BASELINE DATA ON AREA, PRODUCTION AND PRODUCTIVITY OF HORTICULTURE CROPS IN SIKKIM

STUDY NO. 174

Ranjan Kumar Biswas

Debanshu Majumder

Agro Economic Research Centre
Visva-Bharati
Santiniketan
2013

Study No. 174

Baseline Data on Area, Production and Productivity of Horticulture Crops in Sikkim

Ranjan Kumar Biswas

Debanshu Majumder

Agro-Economic Research Centre

Visva-Bharati

Santiniketan

2013

Preface

The present study entitled "Baseline Data on Area, Production and Yield of Horticulture Crops in Sikkim" has been undertaken at the instance of the Directorate of Economics and Statistics, Ministry of Agriculture, Government of India. The study has been coordinated by the Agricultural Development and Rural Transformation Centre (ADRTC), Institute for Social and Economic Change (ISEC), Bangalore, Karnataka.

The basic purpose of this study is to collect data on area, production and yield of horticultural crops and to make a comparison with the baseline data collected by the Department of Horticulture, Revenue Department and Directorate of Economics and Statistics. The other objective of this study is to identify the horticultural crops on which statistics and information are not being compiled at present in Sikkim.

It has been found that cultivation of horticulture crops under unirrigated condition was predominant during kharif season in Sikkim. Leafy vegetables and oranges were grown by most of the farmers in the study area. The yield figure of each crop expressed clearly that productivity of crops was better under irrigated condition than unirrigated condition. To ascertain the estimate on area, production and yield of horticultural crops, it has been found that crop cutting experiment is being carried out in Sikkim. In the grass root, there is no exact and updated record about the area under various horticultural crops. Though the Village Level Officers under the Department of Revenue have some records of area, but it seems deficient.

In Sikkim, it has been found that there are no other agencies except RKVY and VIUC in South that are collecting horticulture data. So, there is no question of comparing the data collected by different agencies. However, in the South district of Sikkim RKVY and VIUC are working in collaboration with the Department of Horticulture. In the South district, production data collected through crop cutting experiments are cross verified thoroughly by these agencies and the department. But the dearth of exhaustive area estimation remains there too.

It was interesting to find that suggestions in all levels centred on making an arrangement for an exhaustive and thorough estimate for area under different horticultural crops in the state. In a state like Sikkim, where there is wide topographical and morphological diversity of land and a wide variation in climatic conditions, such an estimate is call of the hour. Unless and until such an estimate is done it won't be possible to estimate the prevailing situation and explore the avenues of future development. But unfortunately, the department has no machinery of its own to carry out the exercise. Hence, collaboration between different departments at the government level may be the wisest solution.

The study has been carried out under the leadership of Dr. Ranjan K. Biswas and Sri Debanshu Majumder. The field survey was organized by Dr. Ranjan K. Biswas in collaboration with Sri Debanshu Majumder, Sri Krishna Pada Pal and Sri Sudip Kulkarni. The entire responsibility of preparation of tables, analysis of data and drafting of the report

has been shouldered by Dr. Ranjan K. Biswas in collaboration with Sri Debanshu Majumder. The secretarial assistance has been received from Sri D. Mondal, Sri N. Maji, M. A. Khaleque, Sri D. S. Das, Sri A.Patra and Sri S. Sandhu.

On behalf of the centre, the undersigned likes to express the sincere thanks and gratitude to Dr. P. Kumar, Professor and Head, Agricultural Development and Rural Transformation Centre (ADRTC), Institute for Social and Economic Change (ISEC), Bangalore, Karnataka for his excellent coordination at various stages of the study. Special thanks are also due to the Principal Director, Additional Director, Joint Directors, Deputy Directors, Horticulture Development Officers and Horticulture Inspectors of Horticulture & Cash Crop Development Department, Government of Sikkim for their kind cooperation during the survey. Last but not the least, I wish to place my highest regards to the diligent growers/farmers in Sikkim who have spared their valuable time to share their precious information with our enumerators without which study would have not been completed.

Santiniketan
November, 2013

Saumya Chakrabarti
Hony. Director
AER Centre, Visva-Bharati

CONTENTS

LIST OF TABLES

Executive Summary

I. Introduction:

Sikkim is a hilly State in the Eastern Himalayas. The estimated net cultivable area in Sikkim is to be around 79,000 hectare (11.13%); with irrigated area of 15% of the total operational holdings of 1,10,000 hectare. About 80% of the people are directly or indirectly dependent on scarce land resources for their livelihood. The contribution of horticulture to the state's domestic product will also be of overwhelming importance. The sector, therefore, will have to receive priority attention for higher levels of rural prosperity.

Cash and commercial crops like large cardamom, ginger, orange, seed potato, flowers and off-season vegetables along with other horticultural crops (varieties of fruits, root and tuber crops, mushroom, honey, nuts, spice crops like turmeric, seed spices etc. medicinal and aromatic plants) are dealt by the **Horticulture & Cash Crops Development Department** since its creation in 1996.

The strategy opted for horticulture development in Sikkim is to enhance productivity and to sustain the major production systems through proper management of resources. The Horticulture Sector has established its importance in improving land use, promoting crop diversification, generating employment and above all providing nutritional security to the people. Horticulture also encompasses every aspect of aesthetics, economics and environmental regeneration.

However, in spite of significant contribution of Horticulture Sector to Sikkim state's economy of North Eastern Region, there is dearth of authentic data in this sector. Therefore, collection of proper and accurate data on area, production and productivity of important horticulture crops of the Sikkim state becomes extremely important for further development of the said sector.

II. Need of the Study:

Despite impressive development in horticulture sector in recent years, the situation regarding database is still worse in the case of NE region and Himalayan states (11 states). This poses a serious problem in understanding the real development of horticulture sector in these states. So, it is necessary to identify the methodology followed in collection of horticultural statistics, identify problems faced in data collection of horticultural crops by various agencies and take some remedial measures in order to make data on horticultural sector more scientific and factual. The present study intends to collect base line data on area, production and productivity for some selected villages from the state agencies collecting such data and then do the verification from the concerned households through primary survey. This will help to highlight changes required at the policy level in the process of data collection of horticultural commodities and to improve the data collection process at various levels. This will help policy makers in the Centre and States to chalk out a programme for further development of the sector.

III. Objectives of the Study:

The specific objectives of the study are

- to collect data on area, production and yield of horticultural crops and compare with the baseline data collected by the Department of Horticulture, Revenue Department and Directorate of Economics and Statistics and so on;
- to identify the horticultural crops on which proper statistics is not being compiled at present in the selected state, i.e. Sikkim;
- to study the problems encountered by the grass-root officials while collecting the horticultural data; and
- to identify the problems in estimation of horticultural crops and to suggest policy measures.

IV. Database and Methodology:

Both secondary and primary data have been collected to achieve the objectives specified above. One schedule for the officials is prepared whereby district / block and village level officials of *Horticulture & Cash Crops Development Department*, Government of Sikkim, have been visited to collect information related to area, production and yield for the horticultural crops in Sikkim. Additional information have been collected from the officials on methodology adopted, verification process carried out in collection of horticultural data and problems encountered by them in compilation of horticultural statistics. Information on area, production and yield of horticultural crops has been collected for the village and household level from the above mentioned state agency.

After collecting information from the secondary sources, one village in each district of the state, growing highest area of Large Cardamom and Ginger, Vegetables, Cymbidium Orchid and Orange under the crop category spice, vegetables, flower and fruit, respectively have been selected and complete enumeration has been carried out in the village for those households who are growing horticultural crops. The entire Sikkim state is divided in to four districts. So, five villages for above mentioned five crops have been selected from four districts of Sikkim. In East district Assam Lingzey block for Cymbidium orchid and West Pendam blok for Sikkim Mandarin orange were selected. Similarly, Chawang block in North, Sallybong block in South and Gazing block from north were selected for Large Cardamom, Vegetables and Ginger respectively. Thus, five villages from five blocks have been selected from four districts from the state Sikkim for the primary survey.

In our primary survey, all the households growing horticultural crops have been covered and for a particular household, area, production and yield have been collected for all horticultural crops grown by the household during the reference year.

V. Growth and Development of Horticulture Crops in Sikkim

Area, Production and Yield of Horticulture Crops

According to Horticulture & Cash Crops Development Department, Government of Sikkim, the area under various *fruit* crops was 12.19 thousand hectares in 2009-10 that increase 13.40 thousand hectares in 2011-12. Similarly production was 18.51 thousand tonnes with average productivity of 2476 kilograms per hectare during 2009-2010 that experienced an increase to 22.24 thousand tonnes with yield 3097 kilograms per hectare. Similarly, the total area under *vegetable* crops in Sikkim was 14.59 thousand hectares and production was 77.10 thousand tonnes with the productivity of 5285 kgs per hectare in 2011-12. It was also observed that total area under *root & tuber* crops, *spices* and *flowers* was 10.44 thousand hectares, 25.50 thousand hectares and 0.21 thousand hectares, respectively as recorded in 2011-12. Total production of these crops was 50.55 thousand tones with 4840 kgs per hectare productivity for root & tuber crops, 56.68 thousand tones with 2222 kgs per hectare productivity for spices and 235.0 lakh numbers for flowers.

Infrastructural Facilities Available for Horticulture Crops

The important infrastructural support for horticulture crops in Sikkim are mentioned below:

Ginger Processing Unit – the ginger processing unit has been made operational.

One Centre of Excellence has been established in South Sikkim with a total outlay of 500 lakh. Unlike other centres of the past, this is totally different. This is an exemplary centre with all horticultural crops, operations, programmes and activities concentrated in this centre.

The **Integrated Mushroom Development Unit** has been completed in 2011 and operations started.

Besides, other available infrastructures and its development are as follows;

Research Infrastructure - The ICAR is carrying out horticulture research in the region through NEH Research Complex, National Research Centre for Orchids, Gangtok (Sikkim). In addition, concerted research efforts have been made by research institutions to identify a large number of improved varieties and production technologies of fruits, vegetables and tuber crops including potato and plantation crops suitable for the region.

Scheme for the Development of Horticulture

Department of Agriculture & Cooperation, Ministry of Agriculture, Government of India is implementing a Centrally Sponsored scheme "Horticulture Mission for North East and Himalayan States (HMNEH)" for overall development of Horticulture. The most important activities covered under this scheme are (1) Plantation works, (2) Area expansion and (3) Post harvest management, processing, value addition including that of aromatic plants, marketing and exports.

Other schemes introduced by the Horticulture & Cash Crops Development Department, Government of Sikkim, are as follows:

- Vegetables production scheme
- Promotional activities
- Capital investment subsidy scheme
- Technology development and transfer
- Establishment of nutritional gardens in rural areas
- Market information service for horticulture crops
- Horticulture promotion service

Plan Investment in Horticulture

With the objective of increasing area and production of horticultural crops, the Horticulture & Cash Crop Development Department, Government of Sikkim has invested maximum amount (Rs.1898.25 lakh) for the crops of flower category during the period of 2008-09 to 2010-11. The second highest amount (Rs.1201 lakh) has been spent for developing organic farming area and production in the state. As per the consideration of Horticulture & Cash Crop Development Department of the Sikkim state, the third, fourth, fifth, sixth and seventh ranking important crop sectors were fruits, vegetables, spices, root & tuber crops and bee keeping. The amount of investment under this crop categories were Rs. 1120.56 lakh for fruits, Rs.1026.64 lakh for vegetables, Rs.830.33 lakh for spices, Rs. 70.85 lakh for root & tuber crops and Rs.68.05 lakh for bee keeping during the same period, i.e. 2008-09 to 2010-11.

Again, if we consider crop wise investment of each category for the above mentioned 2008-09 to 2010-11 periods, it will be observed that maximum amount by Rs. 630.50 lakh for Cymbidium orchids and minimum amount by Rs. 28.60 lakh for Carnation have been invested for increasing cultivated area and production of these two flowers. In the fruits category of crops, maximum amount by Rs. 585.00 lakh for rejuvenation of old orchards and minimum amount by Rs. 19.69 lakh for passion fruits have been invested with the objectives of increasing area and production of these fruit crops. The important crop under spices category, for which maximum amount by Rs.418.75 lakh has been spent during 2008-09 to 2010-11 period for increasing its cultivated area and production is large cardamom. The second important spice crop is ginger. An amount of Rs.284.38 lakh has been spent for its cultivated area expansion and production improvement programme during the same period, i.e. 2008-09 to 2010-11. Another important spice crop is turmeric. For increasing the area under turmeric cultivation and its production, the Horticulture & Cash Crop Development Department had decided to spend Rs. 50.70 lakh in 2008-09, Rs. 39.00 lakh in 2009-10 and Rs. 37.50 lakh in 2010-11.

Problems and Prospects of Horticulture Crops

Factors inhibiting horticultural development in the state Sikkim are as follows:

- There is urgent need to create/ strengthen certain basic infrastructures like (i) Soil testing laboratory, (ii) IPM Laboratory, (iii) Organic research farm, (iv) Bio-fertiliser production unit, and (v) Institutionalised capacity building etc. Other major problems are:
    i) Shifting cultivation
    ii) Poor cultivation practices and low yield
    iii) Lack of desirable planting material
    iv) Lack of marketing facilities
    v) Scarcity of trained manpower and extension support
    vi) Problems of processing
    vii) Financial constraints
    viii) Less expenditure on research work
    ix) Absence of insurance facility

Prospects

Considering the excellent climatic conditions, abundant rainfall and fertile soil (high organic content) of the state Sikkim the productivity of different horticultural crops is quite low as compared to national productivity. But horticulture bears the bright future in the state and it has every opportunity to be developed as valuable processed food product and produce export quality fruits, vegetables, flowers and other horticultural products.

VI. Brief findings of the Study

Background of the respondents and the households

The prime age group for farm operation are 26-50 years and 51-60 years. It has been observed from the survey that 43.3%, 52.4%, 27.5%, 18.7% and 19.6% respondents were in the age group of 26-60 years in Assam Lingzey, Saku, Chawang, Sallybong and Tinzerbung village, respectively. It has also been observed that there was no respondent of above 60 years of age in the study area.

Major literate persons obtained education up to 5-7 standard in Chawang (40.0%) and Tinzerbung (74.5%) village. The maximum literate persons were identified in the category of upto 4 standard of education in Sallybong village. The percentage of respondents having degree / graduate level of education was low and they were found in Assam Lingzey, Saku and Sallybong village only. Above 60% of the family members of the respondents in Assam Lingzey and Saku village have taken education from a university. It has been estimated that 90%, 78% and 80.4% of the family members of the respondents of Chawang, Sallybong and Tinzerbung village, respectively have obtained their education (5-12 std) from a school.

The Assam Lingzey, Saku and Sallybong village were dominated by OBC population. Chawang village was predominantly tribal with ST population by 100 percent. On the other hand, more than 50% respondents were of general category in Tinzerbung village.

Total Hindu and Buddhist responded population (100%) had been observed in Saku and Chawang village, respectively. In Assam Lingzey village, more than 50% and 40% respondents were Buddhist and Hindu, respectively. In Sallybong village, 78% of the respondents were Buddhist by religion. The majority (51%) of respondents in Tinzerbung village were Hindu.

Almost all farms (97.5%) in Chawang village were large by size. In Assam Lingzey and Saku village, 79.1% and 69.1% operational holdings were marginal and small, respectively by size jointly. In Sallybong village, 61% and 32.2% operational holdings were marginal and small farms. Only 5.9% operational holdings were under the category of medium farm by size in Tinzerbung village. Rest of the land holdings in the village was either marginal or small by size.

Above 30% of both the male and female population was above 15 years old in all the study villages, except Sallybong village. There were above 40% of both male and female population of above 15 years old. The overall picture indicates that there were around 40% of both male and female population of above 15 years old in the study area. Only 24% of the population was children of below 15 years old.

Earning members in the study area ranged from 32.01% in Tinzerbung village to 44.44% in Chawang village. The percentage of active workers existed in the sample households was almost same with the percentage of either above 15 years old male or 15 years old female population in the study area. However, the overall percentage of earning members across the study area was 37%, which made parity with the percentage of earning members of each village.

The average annual family income in Assam Lingzey of East Sikkim was higher (Rs. 4,00,070.68) than the income per earning member as well as the average annual family income of the Tinzerbung village of West Sikkim (Rs. 97,266.32). The proportion of earning members per family was also higher in Assam Lingzey than Tinzerbung. But, despite almost same proportion of earning member in each family in Saku of East district and Sallybong of South district, the income per earning member of Saku village was too low. On the other hand, though the proportion of earning member per family was highest in Chawang of North district, yet annual income per earning member as well as annual family income was almost same with Tinzerbung village of West district. These two were spice growing area and the spice crop cardamom & ginger were grown in Chawang & Tinzerbung village, respectively.

Land ownership details/cropping pattern

The total area of land holdings of the selected villages across the study area was 173.25, 111.63, 340.75, 66.00 and 56.33 ha for Assam Lingzey, Saku, Chawang, Sallybong and Tinzerbung villages, respectively. The proportion of irrigated area was highest (100%) in Sallybong village. Around 90% of the cultivated area was irrigated in Assam Lingzey and Tinzerbung village. Though, proportion of irrigated area was moderate (60%) in Saku village

but it was very poor (12.5%) in Chawang village. The overall irrigated area across the study area was 52% and unirrigated area was 48%.

Out of 182.30 ha cultivable land, only 9.05 ha (4.96%) and 10.79 ha (5.92%) land were leased in and leased out, respectively in Assam Lingzey village following "crop & cost sharing" condition. Out of 116.13 ha cultivable land in Saku village, only 4.50 ha (3.87%) land was leased in under the condition of "crop sharing". Again, among 9.00 ha (7.75%) leased out land in the same village, 8.50 ha land had been leased out according to "crop sharing" system and the rest 0.50 ha land had been leased out maintaining "crop & cost sharing" decision. Only 0.80 ha (1.20%) and 4.60 ha (7.55%) land were cultivated in Sallybong and Tinzerbung village, respectively under 'crop & cost sharing" condition of leased in type.

Horticulture crops cultivation were being practiced by all the respondents in Saku, Chawang and Tinzerbung villages since more than 5 years long back. Besides, around 50% of the respondents in both Assam Lingzey and Sallybong villages were involved in horticulture sector since more than 5 years long back from the time of reference year. The overall picture indicates that above 80% of the respondents are engaged in horticulture crops cultivation since more than 5 years long back from the reference year in Sikkim state.

Motivating factors for cultivation of horticultural crops

The overall picture shows that the motivating factors according to the importance are government assistance, good price, easy availability of inputs, proximity to market and easy to grow across the study area.

Destruction and rejuvenation of horticulture Crops

Total 17.50 ha area of orchard plantation had been rejuvenated in East Sikkim only. From 17.50 ha area, 1750 plants of mandarin orange had been removed due to old age reason.

Kitchen garden/bund/rooftop plantation

In East Sikkim, only 22% households (39 hh of total 176 hh) were practiced kitchen garden / backyard garden in their homestead area. The land area used for this purpose was also low. It was 0.111 ha. In North Sikkim, almost all family (97.5%) were engaged in practicing kitchen garden / backyard garden. They cultivated a number of vegetable crops in 0.128 ha of their homestead land. In South Sikkim, out of 59 households, 23 households were found to be involved in kitchen garden / backyard garden with 0.035 ha land area. It had been found that no one family had crop land on field bund in Sikkim, except North Sikkim. In

North Sikkim, 20% family (8 families of total 40 families) had crops only on field bund. Total area of field bund lands of these 8 families were 0.009 ha.

Adoption of new technologies by the farmers

It had been observed in survey that only 22.78%, 22.50% and 29.41% respondents in East, North and West Sikkim, respectively adopted poly house cultivation in their horticulture farms. Average size of each farm was 116.30 m^2. Only 20.27%, 27.50% and 7.84% farmers in East, North and West Sikkim, respectively adopted Green house cultivation. The average farm area under Green house was 125.8 m^2. Besides, INM / IPM practices were adopted by 27.45% farmers in West Sikkim only. Maximum area under Poly house and Green house was in East Sikkim and no adoption of these two technologies was found in South Sikkim.

Benefits received from the government for the development of horticulture

It had been reported that 2.27% households under floriculture scheme in East Sikkim, all the farmers under VIUC scheme in South Sikkim and 37.25% respondents under GAEP scheme in West Sikkim got assistance with seed from government side.

Among total farmers, 34.66% under floriculture scheme and 5.11% under ORP scheme in East Sikkim, 70% under CAEP scheme and 30% under SAEP scheme in North Sikkim, 98.31% under VIUC scheme in South Sikkim and 7.84% under GAEP scheme in West Sikkim received seedlings of horticulture plants in last 5 years.

Only 1.14% and 5.11% of total farmers under floriculture and ORP scheme, respectively in East Sikkim, 2.5% under CAEP scheme in North Sikkim and 7.84% under GAEP scheme in West Sikkim got assistance and no one farmers in the study area assisted with credit from an institutional source of finance.

Out of total farmers 35.23% and 5.11% under floriculture and ORP scheme, respectively in East Sikkim, 52.5% and 25% under CAEP scheme and SAEP scheme, respectively in North Sikkim, 100% farmers under VIUC scheme in South Sikkim and 33.33% farmers under GAEP scheme in West Sikkim got assistance with plant protection materials from Govt. side.

Maximum farmers were given assistance with chemicals under CAEP scheme (70%) and SAEP scheme (27.5%) in North Sikkim. This assistance were given to a very few farmer under floriculture scheme (1.70%) in East Sikkim and under GAEP scheme (7.84%) in West Sikkim.

Only 5.11% farmers under ORP scheme got assistance with drip irrigation in East Sikkim only. It is also evident from this table that no one farmer received assistance from Government in respect of sprinkler irrigation.

Total 35.23% and 5.11% farmers under floriculture and ORP scheme, respectively in East Sikkim, 70% and 27.5% farmers under CAEP and SAEP scheme, respectively in North Sikkim, 100% farmers under VIUC scheme in South Sikkim and 37.25% farmers under GAEP scheme in West Sikkim were trained with an objective for improving horticulture crop cultivation in the Sikkim state.

Problems faced by the respondents

The intensity of these problems was measured by the number of farmers who responded to these problems as they had to face in real life. It had been observed that labour availability was a serious problem in production side as it ranked 4th among all the types of problem. On the other hand, lack of storage from marketing side ranked 1st as serious type of problems. Besides, lack of good packaging materials and market facility both were informed as 2nd most important types of problem. Another important problem was related to road infrastructure.

Farmers contracted by the Agencies

It has been found that in the year 2008 and 2009, no information had been collected from the farmers of the study area. Only monitoring was done by the departmental officials. As a result, no information in respect of area, production as well as productivity of horticulture crops were collected in the year 2008 and 2009 from the study area. But from 2010 onwards crop cutting experiment had been conducted, besides collecting information regarding area under horticulture crops in the study area.

Prospects of horticulture expressed by farmers

The Sikkim state is declared as "Organic State". The adoption of organic farming seemed too much prospective to the farmers of the study area by 11.66% (38 farms) in Sikkim. The 2nd most important intervention was provision of export market. In the study area, more than 5% of the respondents believe that introduction of some new varieties, better price and marketing at village level of horticulture crops would play the prospective role in the process of horticulture development in Sikkim. It is also evident from the table that more than 3% of the respondents have an idea that regulated market, more irrigation facility and co-operative marketing will be very prospective in future for development of horticulture sector in the state.

Suggestions for development of horticulture in Sikkim

The opinion from maximum respondents (34.05%) went in favour of providing better storage facility. The proportion of respondents suggested to provide transport facility by

18.40% (2nd highest) and packaging & marketing facility by 14.42% (3rd highest). The respondents of 6.44% in the study area suggested that better marketing facility would hasten the development of horticulture in the state. Only 3.68% farmers of the selected study area opined that regulated market for horticulture crops would facilitated the development process of the horticulture sector in Sikkim state.

Methodologies Adopted for Estimation of Horticulture Data

In the state of Sikkim the methodology that is being practiced is crop cutting experiments conducted by the Horticulture and Cash Crop Development Department. Basically this is a sample estimate to arrive at the productivity estimates for various crops. But for the state as a whole there is no exhaustive estimate as to area under different horticultural crops. So the Department of Horticulture has to depend on an approximate estimate of area under such crops of their own at the cluster or village panchayat unit level.

In the absence of any other agency entrusted for such estimation the Horticulture and Cash Crop Development Department has to shoulder the sole responsibility. The department conducts training programme for giving training to departmental personnel prior to such experiments. Moreover, the methods of estimating productivity differ in accordance with specificities of various crops and cropping practices.

Area, Production and Yield of the sample villages (for each horticulture crops)

The farmers' of Saku village of East Sikkim got mandarin orange from 15.03% irrigated area in the reference year. Total production from this land area was 966.53 qtl in kharif season with a productivity of 2805.60 kg / ha. Under unirrigated condition, farmers' of this study area in East Sikkim district grew 1.70 ha leafy vegetables, 6.85 ha mandarin orange and 0.10 ha ginger. They obtained 15.95 qtl, 209.60 qtl and 4.50 qtl of leafy vegetables, mandarin orange and ginger, respectively from a total of 15.53% unirrigated area. The estimated average productivity was 938.24 kg / ha for leafy vegetables, 3059.86 kg / ha for mandarin orange and 4500 kg / ha for ginger in kharif season. Leafy vegetables are also grown in 1.54% unirrigated area in Chawang village of North Sikkim. In North Sikkim, total production of leafy vegetables was 51 qtl with a productivity of 1108.70 kg / ha. In Tinzerbung village of West Sikkim, only 10.16% unirrigated land was cultivated for horticulture crops with bitter gourd. Total production of bitter gourd was 19.15 qtl with a productivity of 2697.18 kg/ha in this study area.

Turning to rabi seasons, it has been observed that only 2.72% and 4.13% of irrigated and unirrigated land, respectively were cultivated during rabi season in East Sikkim. Radish

and leafy vegetables were cultivated under irrigated condition only. But, cabbage, cauliflower and bean were cultivated under both irrigated and unirrigated condition. The farmers of the study area in North Sikkim districts used their 37.78% unirrigated land for cultivating cabbage and cardamom in rabi season. As the respondents of South Sikkim have no unirrigated land for cultivation, they cultivated 100% of their irrigated land during rabi season for cabbage, cauliflower, bean, tomato and carrot vegetables. The highest productivity was recorded for tomato (5094.49kg/ha) followed by cabbage (5091.38 kg/ha), cauliflower (4843.69 kg/ha), carrot (3307.88 kg/ha), broccoli (307.63 kg/ha) and bean (1409.57 kg/ha). But the farmers of West Sikkim study area have both irrigated and unirrigated area. They cultivated 8.37% and 49.07% of irrigated and unirrigated land, respectively for growing tomato, lady's finger and chilli. Tomato was grown in irrigated land only and chilli was grown in unirrigated land only. But lady's finger was grown in both irrigated and unirrigated land. The productivity of lady's finger was higher in irrigated land (1150kg/ha) than unirrigated land (777.78 kg/ha).

The crop tomato was cultivated during summer as an off-season vegetable in South Sikkim. The productivity of this off-season vegetable under irrigated condition was higher in summer (5210.16 kg/ha) than rabi (5094.49 kg/ha). Ginger and Turmeric are two summer season spice crops in West Sikkim. Ginger and turmeric were cultivated in West Sikkim in 10.62 ha and 0.97 ha land, respectively under unirrigated condition in West Sikkim. Recorded productivity of ginger and turmeric was 5629.94 kg/ha and 3353.61 kg/ha, respectively. These two crops occupied 96.66% of unirrigated land in West Sikkim.

As annual crops, banana, cymbidium orchids and papaya had been cultivated in the study area of Sikkim state. Under irrigated condition, 5.62% land of irrigated area in East Sikkim and 1.05% irrigated and 0.29% unirrigated area in West Sikkim were used for banana cultivation. Productivity of banana was higher under irrigated condition as compared to unirrigated condition. Again, the productivity was higher in the same condition in West Sikkim than the productivity of banana in East Sikkim. Cymbidium orchid was grown in 10.65 ha irrigated area in East Sikkim. The flower gave an average yield of 62784 number sticks per ha. In West Sikkim district, 1.35ha irrigated land was utilized for papaya cultivation. Average yield of papaya was 1914.81 kg/ha in West Sikkim.

During kharif season a total of 34.45ha land was cultivated under irrigated condition in East Sikkim. Out of this 34.45ha land, 8 ha land was irrigated by tank and 26.45 ha was irrigated from other sources. The 52.73 ha irrigated land was splited in different study area as 6.23 ha in East district, 43.97 ha in South district and 2.53 ha in West district. It has been found from the table that total 52.73 ha irrigated land of three districts got water for cultivating crop from other source of irrigation. Total 0.83 ha land in east district and 7.28 ha

land in South district were used for cultivating horticulture crops. The crops of this field during summer season got required water from other source of irrigation.

It was observed that 125 plants had been planted per ha of mandarin orange as fruit crop and 2.34 cymbidium orchids plant per m^2 area as flower in East Sikkim. The density of cardamom plant in North Sikkim was 2068 plants per ha. The plant density/ha of cole crops, i.e., cabbage and cauliflower varied from 11083 in East Sikkim to 11305 in South Sikkim for cabbage and from 11410 in East Sikkim to 11950 in South Sikkim for cauliflower. But the plant density/ha of cabbage in North Sikkim was only 9854. Again, plant density/ha of tomato was8602 and 8950 in rabi and summer season, respectively in South Sikkim. Whereas the density/ha of the same crop in West Sikkim was 7532 in rabi season. So, it is clear that plant density/ha of vegetable crops in South Sikkim was higher than any other district for respective crop. On the other hand, density/ha of banana plantation was higher in West Sikkim (559) than East Sikkim (517).

Mixed cropping system of crop cultivation was predominant in all the three districts, viz. East, South and West districts. But in North district, maximum area under cultivation had been followed mono-cropping pattern.

In East Sikkim, maximum cultivated area had been used for cultivation of mandarin orange and cymbidium orchids. The figure regarding production and price indicates that earning from cultivating one ha area was not attractive for orange fruit, but the earning from one ha flower (cymbidium orchids) was too much attractive. A remunerative profit was earned from banana cultivation and 12.88 ha land had been used for this plantation crop in the study area of East Sikkim district. It has been observed that total 117.30 ha land was used for horticulture crops in North Sikkim. Out of this 117.30 ha land, 104.50 ha (89.09%) had been used for spice crop cardamom cultivation. This spice crop provides a moderate income from unit area of land. Like East Sikkim, cabbage gave an attractive income to its growers in North Sikkim also. Maximum area was used for cabbage cultivation in South Sikkim district, though it was only 17.4 ha (33.56%) out of 51.85 ha. From unit area cultivation, maximum was earned from cabbage followed by carrot, tomato, cauliflower, broccoli and bean. It has been observed in West Sikkim that maximum area had been used for ginger cultivation in this district. The income from ginger cultivation was higher in this district than East district from unit area. Cultivation of papaya and banana gave highest and second-highest income, respectively from one hectare area. Tomato is another attractive profit earning vegetable crop in the district. The area under this crop was 3.93 ha. Turmeric, another spice crop had been cultivated in 0.97 ha land and it gave a moderate income from unit area.

Difference between the Two Estimates (survey and agencies)

As village level data had been collected in survey and district level data had been published by the agency for estimating area, production and productivity, so there was no practical reason for comparing data in respect of area and production between these two estimates. However, it should be noticed first that only 0.76%, 2.06%, 0.52% and 0.31% area in East, North, South and West districts, respectively had been surveyed as compared to the area estimated by the agency across the district. So, a variation in results of productivity between the survey and estimate is quite natural, especially for the group of crops, like, kharif vegetables, rabi vegetables, etc. Though, the productivity of rabi vegetables in North Sikkim was almost same for these two estimates. On the other hand, individual crop like, mandarin orange, ginger and turmeric exhibited parity in result of productivity between survey and estimates. But there was a vast gap in productivity of cymbidium orchids and large cardamom between village and district level estimates.

Local Crops that have not been included

In course of the study it is found that the crops cultivated in the kitchen garden by the households remain outside the horticultural estimate. As the Horticulture department is the only agency that is responsible for collection of horticulture data across the state, it becomes difficult for them to gather information from every household as to the area and production of all the horticultural crop being grown in their kitchen garden.

Difficulties Encountered by the Agencies

The main difficulty for arriving at an estimate turns out to be dearth of exhaustive data on the area under all the horticultural crops across the state. As it appeared from the discussion with the officials at different levels that some other method has to be sought out to cope up with the kind of problem Sikkim is facing.

VII. Policy Implications

Estimation of Area

- To get an exhaustive estimation of area under various crops several government departments such as Department of Revenue, Department of Agriculture and Department of Horticulture can collaborate in collection of such data for major crops particularly for plantation, orchards and major field crops.
- For field vegetables and spices, there are agencies like RKVY, NHM who could collaborate with the Department of Horticulture in collection of area data. Also there

are apex bodies of the Self Help Groups like VIUC who could also share a part of responsibility in this field.

- There are Self Help Groups (SHG) under the Department of Agriculture and Department of Horticulture at the gram panchayat ward (i.e. village) level. These groups can act as an agent in collection of area data under kitchen garden, field bunds and waste land cultivation at the village level.
- The SHGs can also keep a record of area under tree crops of fruits or enumerate the number of fruit plants in the village or cluster that remain scattered and few in number.
- For such activities both theoretical and practical training has to be imparted to the members of these groups at the gram panchayat ward (i.e. cluster) level.

Estimation of Production and Productivity

- Undulated topography of the hilly tract of Sikkim poses certain difficulty in estimation of production and productivity of certain crops. This necessitates review of methodology of crop cutting experiments for crops like large cardamom.
- In case of some of the vegetables marketed quantity over the whole season is added to be used as a proxy for quantity of output. But there exists an approximation in this method because the frequency of marketing may be very high in case of some crops like tomato or chilli and in cases the quantum may not get recorded. Beneficiary groups under various development schemes or the SHGs can take the responsibility to record the quantum of production and the volume marketed and frequency of marketing for the crops.
- With SHGs taking responsibility of such data collection and exhaustive database can be generated at the gram panchayat ward level itself.
- Collaboration between different departments in such estimation would help to augment the authenticity of data through regular cross verification.

CHAPTER-I
Baseline Data on Horticulture Crops

1.1 Introduction

Sikkim is a hilly State in the Eastern Himalayas where agricultural practices and adaptations are highly variable in time and space due to varying altitudes and agro-climatic situations. The surveyed net cultivable area in Sikkim is estimated to be around 79,000 hectare (11.13%); with irrigated area of 15% of the total operational holdings of 1,10,000 hectare. About 80% of the people are directly or indirectly dependent on scarce land resources for their livelihood. The state being hilly has no scope of industrial growth, and hence has not adequately succeeded in decreasing the pressure on agriculture/horticulture as the agrarian population has decreased at minimal since its merger in the Indian Union (1975). The contribution of horticulture to the state's domestic product will also be of overwhelming importance. The sector, therefore, will have to receive priority attention for higher levels of rural prosperity.

Sikkim has entered upon an era of intensive development after the historic constitutional change of April 1975 through which the State joined the mainstream of national life, becoming the 22nd State of Indian Union. The government has decided to adopt the policy of growth with sustainability, making horticulture a priority sector for higher income generation to farming community as well as to concentrate more on securing maximum crop production of agricultural crops and managing primary agro-resources like soil, water and bio-diversity. Integrated farming, an ideally suited system, is commonly followed by farmers in the State, and which fits well in the developmental process of making Sikkim an organic state. Cash and commercial crops like large cardamom, ginger, orange, seed potato, flowers and off-season vegetables along with other horticultural crops (varieties of fruits, root and tuber crops, mushroom, honey, nuts, spice crops like turmeric, seed spices etc. medicinal and aromatic plants) are dealt by the Horticulture Department (**now renamed as Horticulture & Cash Crops Development Department**) since its creation in 1996, whereas the Agriculture Department (**now renamed as Food Security & Agriculture Development Department**) looks after cereals like rice, wheat, maize, finger-millet, barley and buckwheat, pulses like urd, ricebean, rajmash, fieldpea, cowpea and cluster-bean, oilseeds like rapeseed, mustard, soybean and safflower, and agricultural miscellaneous crops.

The strategy opted for agriculture and horticulture development in Sikkim is to enhance productivity and to sustain the major production systems through proper management of resources. The effort is to establish ecologically sustainable, economically profitable and resource efficient cropping systems along with generation of employment to achieve a positive looking transformation. The concern envisages to integrate participation of women in agriculture development and to incorporate components of research, production, post harvest management, processing, value addition and marketing in a holistic manner. Besides the Government support, Food Security & Agriculture Development Department and Horticulture & Cash Crops Development Department now look forward to institutional and

private sector support as well as to mass participation in the growth process of agriculture and horticulture in Sikkim. Different Five-Year Plans envisages to address on the various sectors of strengths and weaknesses pointed out by the two historic documents "Sikkim the People's vision" and "Sikkim Human Development Report" released recently by the Government of Sikkim. The Horticulture Sector has established its importance in improving land use, promoting crop diversification, generating employment and above all providing nutritional security to the people. Horticulture also encompasses every aspect of aesthetics, economics and environmental regeneration.

Keeping all these above points in view, the Horticulture Sector has been prioritized for the XIth Plan. The objectives and horticultural crop production targets of XIth Plan has been envisaged to achieve higher annual growth rate than the previous Xth Plan subject to availability of fund and Horticultural investment to that extent proposed. However, in spite of significant contribution of Horticulture Sector to Sikkim state's economy of North Eastern Region, there is dearth of authentic data in this sector. Therefore, collection of proper and accurate data on area, production and productivity of important horticulture crops of the Sikkim state becomes extremely important for further development of the said sector.

1.2 Profile of the State

1.2.1 Geography and geology

Sikkim is located between 27^{o} 04'46'' and 28^{o} 07' 48" North latitude and between 88^{o} 0' 55" and 89^{o} 55' 25" East longitude in the eastern Himalaya, bounded between three international borders of China, Bhutan and Nepal on the north, east and west sides, respectively and southern boundary by Darjeeling district of West Bengal State. Sikkim with geographical area of 7096 km^{2} is surrounded almost on all sides by Steep Mountain walls except in south it is open by Teesta River and High Mountains of north are always covered under perpetual snow cover. Teesta and Rangeet are the major rivers, which originate from the glaciers and drain the water of the state. The altitudes vary from 300m to 8586m and on the basis of physiography, the whole state can be divided into 6 physiographic zones; summits and ridges; side slope of hills, narrow valley, cliff and precipitous slope, zone of glacial drift and perpetual snow cover.

The entire state is a young mountain system with highly folded and faulted rock strata at many places. The Daling group of rock is found in the central part of Sikkim and composed of phyllites, schists, slates and quartzites. The northern central part of West Sikkim chiefly made up of Darjeeling gneiss. The gneiss of South Sikkim is highly micaceous and frequently passes into mica-schists. The younger Gondwana contains sandstone, shale, and carbonaceous shale with occasional thin coal bands.

1.2.2 Climate and vegetation

Climatically, Sikkim experiences variable temperature with scorching summer at the foothills to freezing chills in winter on high mountains. Rainfall occurs throughout the year and state as a whole gets 80-90% of the annual rainfall (except around 65% in north-east)

during monsoon (May to September). The mean annual rainfall varies from 840 to 5000mm with heavy precipitation of snow on the higher reaches and the Greater Himalayas.

All the botanical zones from tropical to alpine are found in Sikkim due to its geographical position, climate and altitude. The vegetation of Sikkim has been distinguished into 6 forest zones based on altitudes (Khoshoo, 1992). They are (1) Tropical Evergreen Forests (up to 900m), (2) Sub-tropical Forests (900-1800m), (3) Temperate Forests (1800-2700m), (4) Sub-alpine Forests (2700-3500m), (5) Alpine vegetation (3500-4500m) and (6) Alpine deserts (> 4500m). Sikkim is renowned for its Rhododendrons and orchids and for high altitude Primulas, Meconopsis and Blue poppies. This state is veritable storehouse of medicinal and economically important plants.

1.2.3 Land elevation and land use

On the basis of elevation, the different places of Sikkim are roughly divided into four zones. The places lying in the altitudinal ranges between 270 to 1500 metres is categorized as Lower Hills. Places between 1500 to 2000 metres are known as Mid Hills, between 2000 to 3000 metres as Higher Hills and places lying above 3000 metres with sparse vegetation are categorized at Alpine Zone.

The land use pattern of Sikkim is strongly influenced by the elevation, climate and mountainous terrain, especially in the field of agriculture and forestry. Forest is the main land use in the state and nearly 40% (reserve + private) of the geographical area is under varying forest densities cover followed by alpine barren land, snow and glaciers. The cultivated land is approximately 11.13 % of the total geographical area (776.74km^2) and is confined to altitude less than 2000m. Around 70% of the cultivated land (54144ha) is terraced/semi-terraced and remaining is under fallow/scrub.

1.2.4 Soil profile

The soils of Sikkim are generally acidic, pH ranging from 4.3 to 6.4 with mean value of 5.35. The soil texture is silty to clay loam with depth varying from a few inches to several feet. Organic matter content is high with a mean value of 2.74%.

1.2.5 Economic profile

The economy of Sikkim is traditionally agrarian based on agriculture and animal husbandry. However, with the pace of development, opportunities have sprung up in other tertiary sectors, mainly tourism. It is estimated that less than 11% of the total geographical area is under agriculture. The contribution of agriculture sector to the total GSDP is diminishing, currently accounting for 16.30%.

1.2.6 Horticulture profile

Horticulture is one of the major economic activities of the people of Sikkim. Large Cardamom, Ginger and Turmeric are the principal crops while Mandarin Orange, Guava, Mango, Banana and so on are the principal fruits grown in the state. The department of

Horticulture is deeply involved in motivating and providing technical guidance to local farmers. Sikkim is also a paradise for flowers. Gladioli, Anthuriums, Lilliums, Primulas, Rhododendrons, Orchids as well as many other floral species thrive here. The state is home to an amazing 450 species of exotic orchids alone. There is immence potential for developing floriculture on a commercial basis here, and the department of Horticulture is making concerted efforts to turn this sector into an export-oriented industry.

Horticulture crops play a unique role in Sikkim as well as in India's economy by improving the income of the rural people. Cultivation of these crops is labour intensive and as such they generate a number of employment opportunities for the rural population. Fruits and vegetables are also rich source of vitamins, minerals, proteins, carbohydrates, etc. and are essential in human nutrition. Hence, these are referred to as protective foods and assumed great importance as nutritional security of the people. Thus, cultivation of horticultural crops plays a vital role in the prosperity of a nation and is directly linked with the health and happiness of the people.

Fruits and vegetables are not only used for domestic consumption and processing into various products (Pickles, Preserves sauces, Jam, Jelly, etc.) but also substantial quantities are exported in fresh and processed form, bringing much-needed foreign exchange for the country. These groups of crops also provide ample scope for achieving bio-diversity and diversification to maintain ecological balance and to create sustainable agriculture and can make an impact on the state as well as the national economy in the years to come.

It is estimated that India has 240 million acres of cultivable wasteland, which is lying idle, which can be brought under orchard crops without curtailing the area under food crops. The country has abundant sunshine through the year, surplus labour and widely varied agro-climatic conditions, which offer high potential for successful and profitable commercial horticulture.

Having realized the facts the farmers of Sikkim have been encouraged continuously through *Kisan Mela*, etc by the Horticulture and Cash Crop Department of Government of Sikkim towards horticulture sector which is one of the most profitable sectors owing to its market in and outside the state. This type of *Mela* exhibits horticulture products from the farmers of the state. Such *Mela* besides encouraging the farmers in agricultural and allied activities helps in developing cordial relationship between department and the farmers which in the long run helps in the development of agriculture/horticulture in the state. The *Kisan Mela* is being organized to aware the farmers about new technology and technique of farming in easier ways, which is a sustainable profession and never goes in loss.

1.3 Need of the Study

Despite impressive development in horticulture sector in recent years, there is a general feeling that data-base of horticultural crops is not comprehensive and reliable in the country. The situation is still worse in the case of NE region and Himalayan states (11 states). This poses a serious problem in understanding the real development of horticulture sector in these states. Besides, there is no systematic data on some marginal and minor horticultural

crops in these states. To fill this gap, it is necessary to identify the methodology followed in collection of horticultural statistics, identify problems faced in data collection of horticultural crops by various agencies and take some remedial measures in order to make data on horticultural sector more scientific and factual. The present study makes an attempt in this very direction with a focus on North-East and Himalayan states. The study intends to collect base line data on area, production and productivity for some selected villages from the state agencies collecting such data and then do the verification from the concerned households through primary survey. The primary village level survey will verify the discrepancies of the data collected by different agencies of horticulture crops. This will help to highlight changes required at the policy level in the process of data collection of horticultural commodities and to improve the data collection process at various levels. This will help policy makers in the Centre and States to chalk out a programme for further development of the sector.

1.4 Review of Literature

The Himalayan region is comprised of a large variety of wild-growing plants that are used for food and other subsistance needs by the local communities. The Sikkim Himalaya harbours as many as 190 food plants that grow in wild habitats. The six most prominently used fruit species (*i.e. Baccaurea sapida, Diploknema butyracea, Eriolobus indica, Spondias axillaris, Machilus edulis* and *Elaeagnus latifolia*) that bear maximum pressure in natural habitats due to their higher demands by the locals, were investigated in details. Densities of all the species were low in the forest stands and fruit-collection procedure was highly erratic, threatening their survival in near future. The fruits were nutritionally rich and could be utilized for making by-products. The fruit yield per tree could easily compete with commercial fruit-yielding species. Therefore, such fruit trees deserve priority action for conservation in natural forest stands and domestication in farmers' fields (Sundriyal *et al*, 2003).

In the National Workshop on Horticulture on 17th February, 2012, Sikkim was awarded one of the best performing states under the Horticulture Mission for North East and Himalayan States (HMNEH).

In the Citation for the Sikkim government it has been mentioned that the State has demonstrated a large number of success stories on protected cultivation of high value vegetables and flowers, besides promotion of organic farming. The Citation further mentions that besides the success of Sikkim mandarin; the success achieved by the State in crop diversification strategy through plantation of guava and litchi in the lower valleys with banana and papaya as filler crops is highly commendable.

The Citation also mentions that horticulture-led transformation in Sikkim has been the result of special attention of state government for horticulture development. Efforts of the department to bring the state in the forefront by ensuring effective delivery of HMNEH programme in convergence with other programmes of the Government of India such as Rastriya Krishi Vikas Yojana (RKVY), Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGA), etc is noteworthy.

At the end, the Citation reads 'in recognition of the meritorious performance by the state in the field of protected cultivation of high value vegetables & flowers and organic farming, the Ministry of Agriculture, Department of Agriculture & Cooperation places on record its appreciation and recognizes Sikkim as one of the best performing States under Horticulture Mission for North East and Himalayan States (HMNEH)'.

Poudyal *et al*, (2004) described that the State Government has taken a decision to formulate policy for potential Horticulture Development in the State considering the kind of terrain and agro-climates, the needs of rural populace, the possibility of bettering rural economy through horticulture and the availability of potential crops, it is imperative to have a resolute policy to develop Horticulture & Cash Crops in Sikkim. In order to prepare a roadmap towards the set goals of the Government, it has become necessary to identify potential horticulture crops and to draw requisite policy resolutions to effect their development in positive manner;

The potential horticultural crops as visualized in Sikkim at present are Large Cardamom, Ginger, Sikkim Mandarin, Seed Potato, Off-Season Vegetables, Passion Fruit, Cymbidium Orchid, Cherry Pepper and Turmeric. It is through these potential crops, there would be possibility for Sikkim to accomplish the commercial production and marketing of horticulture produce. Now therefore, in order to achieve the above objectives, detailed policy resolutions were taken by the Sikkim Legislative Assembly for consideration and adoption. The policy resolution emphasised on providing technological support to farmers as well as emphasising on infrastructural development for promotion of horticulture. Technological aspect included research support in the area of biotechnology, certified seeds and quality planting materials, organic farming, establishment of Krishi Vigyan Kendras etc. On the other hand the Legislative Assembly envisaged that improved management and production practices, greater credit availability, scientific post harvest management practices, formation of Self Help Groups and Co-operatives would strengthen capacity building of human resource. Market promotion and building up of all-weather road would open up possibilities of export market.

Regarding the marketing of the products, Sapkota (2010) said "It is true that the most of the farmers are facing difficulties in marketing and this problem won't be solved until and unless we, the farmers of Sikkim will be able to produce sufficient and fulfill the demand of the market."Impressed from his progressive work, the State Horticulture Department has constructed Farm Handling Unit under the Technology Mission which has become helpful to market his products. Now he does not need to take the products to market as his products are being sold from this unit.

1.5 Objectives of the Study

The specific objectives of the study are

- to collect data on area, production and yield of horticultural crops and compare with the baseline data collected by the Department of Horticulture, Revenue Department and Directorate of Economics and Statistics and so on;
- to identify the horticultural crops on which proper statistics is not being compiled at present in the selected state, i.e. Sikkim;
- to study the problems encountered by the grass-root officials while collecting the horticultural data; and
- to identify the problems in estimation of horticultural crops and to suggest policy measures.

1.6 Data Base and Methodology

Both secondary and primary data have been collected to achieve the objectives specified above. One schedule for the officials is prepared whereby district / block and village level officials have been visited to collect information related to area, production and yield for the horticultural crops in Sikkim, a Northern-eastern state of India. The state agency that collect data on horticultural crops is belongs to *Horticulture & Cash Crops Development Department*, Government of Sikkim. Additional information have been collected from the officials on methodology adopted, verification process carried out in collection of horticultural data and problems encountered by them in compilation of horticultural statistics. Information on area, production and yield of horticultural crops has been collected for the village and household level from the above mentioned state agency.

Table 1.1: Selected villages, respective crops and number of households in the study area

District	Block	Village	Household No.	Selected Crops
North	Chawang	Chawang	40	Large Cardamom
South	Sallybong	Sallybong	59	Vegetables
East	Assam Lingzey	Assam Lingzey	134	Cymbidium Orchid
East	West Pendam	Sakhu	42	Mandarin Orange
West	Gazing	Tinzerbung	51	Ginger

After collecting information from the secondary sources, one village in each district of the state, growing highest area of Large Cardamom and Ginger, Vegetables, Cymbidium Orchid and Orange under the crop category spice, vegetables, flower and fruit, respectively have been selected and complete enumeration has been carried out in the village for those households who are growing horticultural crops. The entire Sikkim state is divided in to four districts. So, five villages for above mentioned five crops have been selected from four districts of Sikkim. In East district Assam Lingzey block for Cymbidium orchid and West Pendam blok for Sikkim Mandarin orange were selected. Similarly, Chawang block in North, Sallybong block in South and Gazing block from north were selected for Large Cardamom,

Vegetables and Ginger respectively. Thus, five villages from five blocks have been selected from four districts from the state Sikkim for the primary survey.

In Sikkim, as there is a wide diversity in agro-climatic specificities, cropping pattern across the districts demonstrated substantial variation. In the North district there is widespread cultivation of Large Cardamom while West specializes in Ginger. But both of these crops remain important as far as spice cultivation in Sikkim is concerned. Vegetable cultivation in an extensive scale is found in South district and in East Cymbidium orchid and Sikkim Mandarin oranges are found.

In our primary survey, all the households growing horticultural crops have been covered and for a particular household, area, production and yield have been collected for all horticultural crops grown by the household during the reference year (Table 1.1).

CHAPTER-II
Growth and Development of Horticulture Crops in Sikkim

2.1 Area, Production and Yield of Horticulture Crops

Horticulture Mission for North East and Himalayan States (HMNEH) is the back bone of horticulture development initiative in the State with substantial enhancement in subsidy and modifications in pattern of assistance than earlier. The aim of the Mission is to achieve horizontal and vertical integration of horticultural programmes to ensure adequate, appropriate, timely and concurrent attention to all the links in production, post-harvest management and consumption chain to maximize economic, ecological and social benefits.

According to Horticulture & Cash Crops Development Department, Government of Sikkim, the area under various fruit crops was 12.19 thousand hectares in 2009-10 that increase 13.40 thousand hectares in 2011-12. Similarly production was 18.51 thousand tonnes with average productivity of 2476 kilograms per hectare during 2009-2010 that experienced an increase to 22.24 thousand tonnes with yield 3097 kilograms per hectare. Similarly, the total area under vegetable crops in Sikkim was 14.59 thousand hectares and production was 77.10 thousand tonnes with the productivity of 5285 kgs per hectare in 2011-12. It was also observed from this table that total area under root & tuber crops, spices and flowers was 10.44 thousand hectares, 25.50 thousand hectares and 0.21 thousand hectares, respectively as recorded in 2011-12. Total production of these crops was 50.55 thousand tones with 4840 kgs per hectare productivity for root & tuber crops, 56.68 thousand tones with 2222 kgs per hectare productivity for spices and 235.0 lakh numbers for flowers (Table-2.1).

2.1.1 Fruits

The important fruits grown in the State include Sikkim Mandarin Orange, Pear, Guava and other new introductions like Kiwi and Asiatic variety of Pear, Papaya and Banana as filler crops in lower altitudes. Apple cultivation was a traditional practice in some pockets of North Sikkim, which dwindled after decline hit the orchards during the late seventies. Sikkim Mandarin is the traditional fruit of the state which has made major progress in terms of area coverage and production. The new concept of high density orchards in guava is becoming popular amongst farmers. This concept is highly suitable in a hilly state like Sikkim where land is limited and even small and marginal farmers can allocate certain portion of their land for cultivation of guava. Banana and papaya as filler crops in the lower belts is on the rise. The advantage of these two fruits is that they give very quick returns and hence their popularity is ever growing. Litchi and kiwi are other two fruits which have vast potential in lower and upper belts of the state respectively. Delayed ripening of litchi due to climate is a great advantage, fruits coming to market one month after the main litchi season, commanding good price. This provides ample scope for area expansion under litchi in all suitable belts.

Table 2.1: Growth of horticultural crops in Sikkim

C R O P	2009-10			2010-11			2011-12		
	Area	Prodn.	Yield	Area	Prodn.	Yield	Area	Prodn.	Yield
Fruits	12.19	18.505	2476	12.88	20.08	3089	13.40	22.24	3097
Vegetables	13.68	70.858	5180	14.405	75.2	5220	14.59	77.1	5285
Root and tuber crops	9.8	47.608	4858	10.11	49.16	4862	10.44	50.552	4840
Spices	23.361	49.444	2117	24.38	52.37	2148	25.5	56.681	2222
Flowers	0.175	200.0	-	0.188	212.5	-	0.21	235.0	-
Horticulture crop except flowers	59.03	186.415	3432	61.78	196.81	3553	63.93	206.573	

Area in '000 Ha; Production in '000 Tonnes, Flowers in lakh Nos.; Yield in Kg/Ha, Source: Horticulture and Cash Crop Development Department, Govt.of Sikkim

Table 2.2: Crop wise growth of horticulture sector

C R O P	2009-10			2010-11			2011-12		
	Area	Prodn.	Av.yield*	Area	Prodn.	Av.Yield*	Area	Prodn.	Av.yield*
Sikkim Mandarin Orange	7.87	13.136	3013	8.32	14.39	3300	8.6	15.75	3200
Other Fruits	4.32	5.369	3078	4.56	5.69	1247	4.795	6.49	1353
Kharif Vegetables	3.89	20.132	5175	4.033	20.991	5205	4.081	21.494	5266
Rabi Vegetables	4.54	22.271	4905	4.897	24.28	4958	4.965	24.961	5027
Off-season	5.25	28.455	5420	5.475	29.929	5466	5.54	30.645	5531
Vegetables									
Total Potato	9.15	44.292	4840	9.435	45.71	4845	9.768	47.091	4821
Other Root & Tuber Crops	0.65	3.316	5101	0.675	3.45	5111	0.676	3.461	5119
Large Cardamom	14.521	3.396	234	15.02	3.51	233	15.6	3.681	235
Ginger	8.01	43.19	5392	8.51	45.89	5392	8.9	49.5	5561
Turmeric	0.83	2.858	3443	0.85	2.97	3494	1	3.5	3500

Area in '000 Ha; Production in '000 Tonnes, Flowers in lakh Nos.; Yield in Kg/Ha, Source: Horticulture and Cash Crop Development Department, Govt.of Sikkim

Out of the total area under different fruit crops in Sikkim in 2011-12, the maximum area, i.e., about 8.6 thousands hectare is under Sikkim Mandarin Orange only which reveals a steady increase from 7.87 thousand hectares in 2009-10 (Table 2.1). As to production of oranges it increased from 13.14 thousand tonnes to 15.75 thousand tonnes in a period of three years from 2009-10 reflecting rising productivity from 3013 kilogram per hectare to 3200 kilogram per hectare in the same period.

2.1.2 Vegetables

Out of the three vegetable seasons in the State, focus is given to promotion of off-season vegetables which have comparative advantage over pricing. Off-season vegetables include tomato, cabbage and cauliflower. Tomato is grown both as greenhouse and open crop throughout. This successful open cultivation of tomato in the rain shadow belts of South Sikkim is a classic example of converting disadvantage into advantage. South Sikkim ranks number one in vegetable production. Going by the success of off-season vegetables, the department encourages production of vegetables comprising of cabbage, cauliflower, radish, carrot and broccoli in the higher reaches during off-season. In some pockets in the higher reaches, it is common practice to intercrop potato and pea or maize, pea, cabbage and ginger. The department has taken up steps to improve this practice through use of better quality seeds and inputs with stress on timing the production with pick market demand. Efforts are being

intensified to replicate these successful practices in other suitable areas as innovation to enhance vegetable production.

Traditional vegetables like pea and beans have always remained as strength of the State and programmes are being devised to augment seed production of these vegetables. Chayote is another traditional vegetable which can be very successfully grown in many parts of the State. South Sikkim leads in production of chayote as well.

Summer vegetables have added a new chapter to vegetable development programmes by increasing the vegetable basket of the farmer. The summer vegetables popular under cultivation comprise of many types of gourds, cucumber, egg plant and okra.

Out of total area under different vegetable crops, the maximum area of about 5.54 thousand hectares in 2011-12 is under Off-season vegetables only. Total production of off-season vegetables for the year 2011-12 has been recorded as 30.65 thousand tonnes with the productivity of 5531 kg per hectare. Area wise second most important crop is Rabi vegetables, covering about 4.97 thousand hectares in 2011-12, while Kharif vegetables occupies 4.08 thousand hectares. In 2011-12 season, total production of Rabi vegetables and Kharif vegetables was 24.96 thousand tonnes and 21.49 thousand tonnes, with a productivity of 5027 kg per hectare and 5266 kg per hectare, respectively (Table-2.2). It is worth noting that over the years both seasonal and off-season vegetables are increasing both in terms of area and production.

2.1.3 Root and tuber crops

Potato is the most important crop under this section. This crop is considered as very important cash crop of the entire Sikkim. Other minor tuber crops are cassava, sweet potato and yams. Area under Potato shows an increase from 9.15 thousand hectares in 2009-10 to 9.77 thousand hectares in 2011-12.

In a similar manner production of the crop demonstrate a steady rise in a span of three years. However, in terms of productivity data for 2011-12 reveals a marginal decline over preceding year.

2.1.4 Large cardamom

Large cardamom is the traditional spice crop which was in its glory during the mid and late eighties. Decline set in after nineties the cause of which is attributed to some disease complex, nutritional factors and inadequate management. This decline has had wide ranging ramifications disorienting agrarian economy and upsetting cropping patterns. The farmers are still reeling under the impacts of this decline. However, departmental interventions

comprising of scientific technology with inputs in the form of re-plantation, rejuvenation, gap filling and scientific management with support under HMNEH has started to show tangible impacts. In addition to old existing plantation, new areas have been developed bring about large non-traditional cardamom areas under new clusters.

Area under Large Cardamom has been steadily rising over the years. In 2011-12 the total area under the crop was 15.6 thousand hectares while production increased to 3.68 thousand tonnes giving rise to productivity to the tune of 235 kilograms per hectares.

2.1.5 Ginger

Ginger is another important cash crop particularly for small and marginal farmers found in large cultivation in the tropical and sub-tropical belts of the state. It is a major cash crop for the small and marginal farmers. A high value crop, it is grown organically in the State without use of any synthetic fertilizers or pesticides resulting in premium sales. A Ginger Processing Plant has been set up in the State to provide assured market and nullify the negative impacts of price fluctuations. Area under Ginger also registered an increase from 8.0 thousand hectares in 2009-10 to 8.9 thousand hectares in 2011-12. Similarly production and productivity show tangible growth over the three year period.

2.1.6 Turmeric

Turmeric as a spice is gaining importance in the State. Cultivation of this crop is all the more significant for the simple reason that it has far greater tolerance to diseases and pests as compared to ginger. There is a steady rise in area under this crop. However, cultivation practice needs to be improved and standardized under local conditions.

2.1.7 Flowers

Floriculture is an extremely important sub-sector under horticulture for Sikkim. Flowers not only are items having sentimental value to the people of the State but can be developed as products to augment rural economy. The relevance of floriculture in the rural economy has multiplied over the years. Multifarious activities have been launched under HMNEH for development of this sub-sector. The result of all these initiatives is the growth of floriculture to unprecedented heights within a short span of 4 – 5 years. The tangible impacts of floriculture programmes in transforming hobby floriculture into commercial venture are manifested in increased usage of flowers for different local functions, development of floriculture clusters in many corners of the State, increased and sustained supply of flowers to various domestic markets and greater degree of floriculture entrepreneurship amongst educated youths. Some of the important flowers included for commercial purpose include cymbidium orchids, rose, lilium, alstroemeria, gerbera and carnation. In addition to enhanced growth in area and production, there has been great enhancement in quality as well.

2.2 Infrastructural Facilities Available for Horticulture Crops

The importance of infrastructural support for the success of any capital venture has been duly recognized. In order to draw maximum advantage out of the various programmes under implementation and to give a meaningful direction to the development initiatives, efforts have been directed towards strengthening the existing infrastructures and to sustain them through various measures. These are discussed as follows:

Ginger Processing Unit – the ginger processing unit has been made operational.

One Centre of Excellence has been established in South Sikkim with a total outlay of 500 lakh. Unlike other centres of the past, this is totally different. This is an exemplary centre with all horticultural crops, operations, programmes and activities concentrated in this centre.

The **Integrated Mushroom Development Unit** has been completed in 2011 and operations started.

Besides, other available infrastructures and its development are as follows;

Research Infrastructure - The ICAR is carrying out horticulture research in the region through NEH Research Complex, National Research Centre for Orchids, Gangtok (Sikkim). In addition, concerted research efforts have been made by research institutions to identify a large number of improved varieties and production technologies of fruits, vegetables and tuber crops including potato and plantation crops suitable for the region.

2.2.1 Technology Mission for the Integrated Development of Horticulture in Sikkim

In order to improve livelihood opportunities and to bring prosperity to the North Eastern Region (NER) including Sikkim, Government of India launched a Technology Mission for North East for Integrated Development of Horticulture in 2001-02. Considering the potential of horticulture for socio-economic development of Sikkim, Technology Mission was introduced in this state. The Mission is based on the "end-to-end approach" taking into account the entire gamut of horticulture development, with all backward and forward linkages, in a holistic manner. The mission has now been renamed as "Horticulture Mission for North East and Himalayan States (HMNEH)".

Technology Mission as well as Horticulture Mission for Integrated Development of Horticulture in Sikkim was mooted. The Goals of the Mission are:

- To establish convergence and synergy among numerous ongoing governmental programme in the field of horticulture development to achieve horizontal and vertical integration of these programmes
- To **ensure** proper linkage of adequate, appropriate, timely and concurrent attention in the production, post harvest and consumption chain

- To **maximize** economic, ecological and social benefits from the existing investment and infrastructure created for horticulture development
- To **promote** ecologically sustainable intensification, economically desirable diversification and skilled employment
- To **generate** value addition, promote the development and dissemination of eco-technologies based on the blending of the traditional wisdom and technology with frontier knowledge such as bio-technology, information technology and space technology
- To provide the missing links in ongoing horticulture development projects.

The mission is organized in 4 mini missions i.e. **Mini Mission-I (MM-I), Research**: This Mini Mission concentrates on appropriate technology up-gradation and refinement in coordination with Indian Council of Agricultural Research (ICAR) and implemented by ICAR institutions and state scientific organization situated in the Sikkim;

Mini Mission-II (MM–II), Production and Productivity: The Mission aims at increasing the production and productivity of horticulture crops like fruits, vegetables, spices, cashew, medicinal and aromatic plants, floriculture and mushroom through improved technology adoption already available as well as those developed in MM-I and by creating suitable environment and infrastructure for this purpose. This will be coordinated by Department of Agricultural and Cooperation, Government of India to be implemented through SFAC, Central Agencies, Agriculture / Horticulture Departments of the State Governments, NGO's and Co-operative Organizations;

Mini Mission–III (MM-III), Post harvest management, marketing and export: The Mission-III aims at increasing the supply of horticulture produce by concentrating on reducing post harvest losses through efficient post-harvest management, which would include development of cold storage facilities, efficient transport and marketing facilities and dissemination of information to the farmers about the modern post harvest management techniques by establishing market information centre. This mini mission would also aim at providing a special thrust to promote the export of horticulture produce, for which there is potential global market. This mini mission will be coordinated by Department of Agriculture & Cooperation and implemented through National Horticulture Board (NHB), SFAC, TRIFED, Directorate of Marketing and Inspection (DMI), National Cooperative Development Corporation (NCDC) and Agriculture and Processed Food Products Export Development Authority (APEDA), Cooperatives and NGO's;

Mini Mission-IV (MM-IV), Processing: To promote processing industry for value addition of horticulture products in the region to prevent post-harvest losses is the aim of Mini Mission IV. The processing of horticulture produce would also help in promoting

the export of these products from this region to the other states in the country as well as to the contiguous neighbouring countries and other countries. It is proposed to achieve this aim by providing incentives for the setting up of horticulture processing industry in the region and encouragement for the suitable development of the requisite linkages between the market for the horticulture produce and processing industry. This mini mission will be coordinated by Department of Food Processing Industry (DFPI) in the Ministry of Agriculture and implemented through agencies under the administrative control of DFPI and other organizations and the concerned departments of the State Governments.

2.3 Scheme for the Development of Horticulture

Department of Agriculture & Cooperation, Ministry of Agriculture, Government of India is implementing a Centrally Sponsored scheme "Horticulture Mission for North East and Himalayan States (HMNEH)" for overall development of Horticulture. The Mission consists of four Mini Missions which individually address specific goals and cover entire spectrum of horticulture right from production to consumption through backward and forward linkage. The most important activities covered under this scheme are (1) Plantation works, (2) Area expansion and (3) Post harvest management, processing, value addition including that of aromatic plants, marketing and exports.

Other schemes introduced by the Horticulture & Cash Crops Development Department, Government of Sikkim, are as follows:

Table 2.3: Development of commercial horticulture through production and post-harvest management

Name of the Scheme/Project	Components	Pattern of assistance
Production Related	High Quality commercial horticulture crops, Indigenous crops/produce, Herbs, Aromatic & Medicinal Plants, Seed & Nursery, Biotechnology, Tissue culture, Bio-pesticides, Organic Foods, Estt. of Hort. Health Clinics/Laboratory (For Agri/ Horticulture unemployed graduates), Consultancy Services, Bee- Keeping.	Back-ended capital subsidy not exceeding 20% of the project cost with a maximum limit of Rs. 25 lakh per project. For the North-Eastern/ Tribal/Hilly Areas, maximum limit of subsidy would be Rs. 30.00 lakh per project. The subsidy to be released to the participating leading Financial Institution on the completion of project as in the case of cold storage projects approved by the Government
PHM/Processing Related	Grading/Washing/Sorting/Drying/Packing centers, Pre-cooling Unit/Cool store, Refer Van/Containers, Sp. Transport Vehicle, Retail Outlets, Auction Platform, Ripening & curing chamber, Market yard/rope ways, Radiation unit/VHT unit, Primary processing of product, Hort. Ancillary industry e.g. tools, equipment, plastics, packaging etc., Crates, Cartons, Aseptic, Packaging & Nets (50% subsidy)	For projects in the co- operative sector funded by NCDC, the subsidy would be through NCDC

2.3.1 Vegetables production scheme

Foundation seed production obtaining breeder seeds from CPRI, Shimla in Government Farms at Hilley and Rabangla for seed replacement in the Seed Village, Certified seed production in Certified Seed Village, and making available of seeds to Rabi potato growers are the ongoing programmes and will be continued in this scheme. Health coverage, soil management, micro-nutrient are the important activities under this. Providing physical working facilities such as seed godown, farm fencing, are essential. Provision has been made for providing mobility to the districts officers working under this crop one each to the four districts.

Sweet potato, Cassava, Yams, Colocasia, etc are the other root and tuber crops of minor importance. Introduction of Improved / Hybrid varieties, Minikit distribution and demonstration are the various programme under this scheme.

The programme launched under State Plan to provide Minimum Support Price (MSP) for selected vegetables and 50% transport subsidy till Siliguri has worked magic into the overall vegetable development programme.

2.3.2 Promotional activities

Post harvest Management, Marketing and Exports (National Horticulture Board Programmes) of this scheme are (1) Facilitate in establishment of Horticulture Development Boards/ Co-operation in States for promoting post-harvest management and marketing having support of quality management, (2) Integrated project on management of post-harvest infrastructure of horticultural crops and development of marketing, (3) Horticulture promotion services, (4) Technology development, refinement and transfer and (5) On farm handling of horticulture produce.

2.3.3 Capital investment subsidy scheme

Capital investment subsidy scheme for construction/expansion/modernization of cold storages for horticulture produce are (1) Scheme would be implemented by NHB in collaboration with NABARD/NCDC, (2) For wider dispersal, projects upto 5000 MT capacity would be preferred. The cost of 5000 MT capacity new cold storage and expansion of existing capacity should not exceed Rs. 2.00 crore @ Rs. 4000/- per tonne, for modernization and rehabilitation @ Rs. 1000/- per tonne and for storage like onions @ Rs. 2000/- per tonne capacity created /to be created, (3) 25% promoter's contribution, (4) 50% term loan by Commercial/Cooperative Banks/ RRBs/ADFCs/SEBs/SCARDBs at PLR + 1% through NABARD refinance, (5) 25% back-ended capital investment subsidy from National Horticulture Board shall be routed through NABARD/NCDC for opening Borrower-wise Subsidy Reserve Fund Account by lending commercial/cooperative banks. The subsidy is restricted to Rs. 50.00 lakh and for North-Eastern states Rs. 60.00 lakh @ 33.33% per project.

For projects having a capacity of more than 5000 MT, the amount of subsidy would be restricted to the maximum limit, (6) The projects pertaining to controlled/Modified Atmosphere/Pre-Cooling Unit facilities would also be entitled for the subsidy on the same parameters as stipulated for the cold storages, (7) National Cooperative Development Cooperation (NCDC) shall sanction projects under cooperative sector, (8) Scheme will be implemented only in those states/UTs /Areas which do not control rentals for cold storages under any statutory or administrative order, (9) Emphasis shall be laid on (i) Reducing PHM losses with multi-chamber and multi-products facilities, (ii) Modern Design/Technology and Energy Saving Equipment's/Devices to be adopted to avoid obsolescence of machinery etc. (iii) Improvement in technology like shifting from Diffuser system to Gravity Cooling System/ Fincoil System etc., (10) Applications to be submitted to Commercial/Cooperative banks and NCDC (as the case may be) on their format.

2.3.4 Technology development and transfer

- Introduction of New Technologies: 100% financial assistance. Up to Rs 10 lakh/project and Rs. 25.00 lakh to R&D efforts.
- Visit of progressive farmers: 2nd Class Sleeper Rail/Ordinary bus fare and Rs 100/day/farmer for a group of 30 farmers.
- Experts Services from India/ Technology Awareness/ Organization/participation in seminars etc.: Actual basis/Abroad- Up to Rs 50,000/seminar, Up to Rs 3.00 lakh for State, Rs 5.00 lakh for Nation and Rs 10.00 lakh for International event.
- "Udayan Pandit Publicity" Observation-cum-study tours abroad: Rs 1.50 lakh on merit/on actual basis.
- Honorarium to Scientists for effective transfer of technology: Up to Rs 20,000/- for each expert up to 5 experts/project.

2.3.5 Establishment of nutritional gardens in rural areas

- Distribution of fruits plants and vegetable seeds in Minikits -Rs 250/minikit/family
- Zero Energy Cool Chambers - Rs 2500/Zero energy cool chamber per school/village in a panchayat selected for the demonstration
- Demonstration - Up to Rs 5000/- per school/panchayat selected for demonstration

2.3.6 Market information service for horticulture crops

Generate information on whole sale prices, arrivals and trends in various markets for horticulture produce and Dissemination of information through media and publications - To assist farmers, Exporters, dealers, research organization etc.

2.3.7 Horticulture promotion service

- Techno-Economic Feasibility Studies through Studies to review with present status of horticulture development in particular area/state - Professional Consultants
- Identify constraints and suggest remedial measures - 100% financial assistance

- Develop short term & long term strategies - 100% financial assistance
- ¨Provide consultancy services and expert services - 100% financial assistance

2.4 Plan Investment in Horticulture

All the programmes for horticulture development in Sikkim have been undertaken under the scheme of "Horticulture Mission for North-East and Himalayan States". The investment plan for various sectors of horticulture, namely, spices, flowers, fruits, vegetables, root & tuber crops, bee keeping and organic farming has been decided with the objective of increasing area and production of horticultural crops.

With this objective, the Horticulture & Cash Crop Development Department, Government of Sikkim has invested maximum amount (Rs.1898.25 lakh) for the crops of flower category during the period of 2008-09 to 2010-11. The second highest amount (Rs.1201 lakh) has been spent for developing organic farming area and production in the state. As per the consideration of Horticulture & Cash Crop Development Department of the Sikkim state, the third, fourth, fifth, sixth and seventh ranking important crop sectors were fruits, vegetables, spices, root & tuber crops and bee keeping. The amount of investment under this crop categories were Rs. 1120.56 lakh for fruits, Rs.1026.64 lakh for vegetables, Rs.830.33 lakh for spices, Rs. 70.85 lakh for root & tuber crops and Rs.68.05 lakh for bee keeping during the same period, i.e. 2008-09 to 2010-11 (Table-2.4).

Table 2.4: Crop category wise investment in Horticulture sector from 2008-09 to 2010-11 in Sikkim

(Rupees in lakh)

Sl. No.	Crop category	Investment in the year			Total	Rank
		2008-09	2009-10	2010-11		
1	Spices	330.20	247.00	253.13	830.33	5
2	Flowers	598.00	806.00	494.25	1898.25	1
3	Fruits	391.69	381.56	347.31	1120.56	3
4	Vegetables	338.00	443.95	244.69	1026.64	4
5	Root &Tuber crops	31.85	39.00	-	70.85	6
6	Bee keeping	26.40	41.65	-	68.05	7
7	Organic farming	326.00	480.00	395.00	1201.00	2

Source: Horticulture & Cash Crops Development Department, Government of Sikkim

Again, if we consider crop wise investment of each category for the above mentioned 2008-09 to 2010-11 periods, it will be observed that maximum amount by Rs. 630.50 lakh for Cymbidium orchids and minimum amount by Rs. 28.60 lakh for Carnation have been invested for increasing cultivated area and production of these two flowers. In the fruits category of crops, maximum amount by Rs. 585.00 lakh for rejuvenation of old orchards and minimum amount by Rs. 19.69 lakh for passion fruits have been invested with the objectives of increasing area and production of these fruit crops. The important crop under spices category, for which maximum amount by Rs.418.75 lakh has been spent during 2008-09 to 2010-11 period for increasing its cultivated area and production is large cardamom. The second important spice crop is ginger. An amount of Rs.284.38 lakh has been spent for its cultivated area expansion and production improvement programme during the same period, i.e. 2008-09 to 2010-11. Another important spice crop is turmeric. For increasing the area

under turmeric cultivation and its production, the Horticulture & Cash Crop Development Department had decided to spend Rs. 50.70 lakh in 2008-09, Rs. 39.00 lakh in 2009-10 and Rs. 37.50 lakh in 2010-11 (Table-2.5).

Table 2.5: Investment in Horticulture sector from 2008-09 to 2010-11 in Sikkim

(Rupees in lakh)

Crop category	Crop name	Government investment in the year			Total
		2008-09	2009-10	2010-11	
Spice	Large cardamom	195.00	130.00	93.75	418.75
	Ginger	84.50	78.00	121.88	284.38
	Turmeric	50.70	39.00	37.50	127.20
Flower	Cymbidium orchids	273.00	357.50		630.50
	Rose	130.00	104.00		234.00
	Gerbera				
	Lillium	65.00	52.00		117.00
	Anthurium	39.00	58.50	494.25	591.75
	Zantedeschia	39.00	166.40		205.40
	Carnation		28.60		28.60
	Alstromeria	52.00	39.00		91.00
Fruits	Orange	90.00	90.00	99.00	279.00
	Passion Fruit	19.69			19.69
	Litchi		22.50	34.20	56.70
	Kiwi	27.00		56.25	83.25
	Guava		14.06	32.40	46.46
	Apple			28.80	28.80
	Banana			21.66	21.66
	Rejuvenation of old orchards	255.00	255.00	75.00	585.00
Vegetables	Cauliflower	338.00	443.95	244.69	1026.64
	Cabbage				
	Broccoli				
	Peas				
	Beans				
	Tomato				
Root & Tuber crops	Potato	31.85	39.00		70.85
	Cassava				
	Sweet Potato				
Bee Keeping		26.40	41.65		68.05
Organic Farming		326.00	480.00	395.00	1201.00

Source: Horticulture & Cash Crops Development Department, Government of Sikkim

2.5 Problems and Prospects of Horticulture Crops

Though the state Sikkim has high potential for the development of horticultural crops, efforts have not been made to develop it as a commercial venture. Factors inhibiting horticultural development in this state are as follows:

2.5.1 Problems of Infrastructure

Seeds cannot be grown at lower hills and providing potato seeds to the farmers of lower hills at subsidies rate is an important task of the state. Unavailability of red-skin tuber variety breeder seed and replacement of quality seed to the certified seed growers is the greatest constraint in potato production. Besides, there is urgent need to create/ strengthen certain basic infrastructures like (i) Soil testing laboratory, (ii) IPM Laboratory, (iii) Organic

research farm, (iv) Bio-fertiliser production unit, and (v) Institutionalised capacity building etc. Other major problems are:

(i) Shifting cultivation

Shifting cultivation also known as jhuming is widely prevalent in Sikkim as well as North Eastern and Himalayan states of India. This jhuming cycle which extended to 15-20 years earlier has now been shortened to 2-3 years because of increased population pressure on land, decrease in productivity leading to utilization of more area under jhuming. This system has caused large-scale deforestation, soil degradation/erosion (removes nutrient rich top soil) and depletion of resource base.

(ii) Poor cultivation practices and low yield

General neglect and non-adoption of scientific cultivation practices are the major constraints for poor return from most of the horticultural crops in this state. Despite conducive environment, the rate of production and growth of all horticultural crops are far below the all India average.

(iii) Lack of desirable planting material

The disease free, true to type genuine planting material is absolutely lacking in a number of horticultural crops. It is imperative to produce disease free propagules. Screening of planting materials before its distribution is of utmost importance.

(iv) Lack of marketing facilities

Due to lack of organized marketing structure in this state, farmers are getting low return compared to the other parts of India, whereas the middleman gets the profit at their expenses. Except the organized tea industry, almost all the commodities including specialized products like citronella oil the producers face considerable marketing problems. Due to thin primary markets and perishable nature of the products the farmers sell their produce at a throw away prices to the middleman without even getting the opportunity to display them. Transportation of perishable produces is perhaps the most serious constraints in the horticultural development of this state.

(v) Scarcity of trained manpower and extension support

Dearth of trained manpower and low priority to horticulture in the development plans of the state despite high potential are some of the factors responsible for ineffective extension programme. Unlike other states of India like Punjab, Himachal Pradesh, Haryana, etc., where the extension services are very efficient, the North Eastern and Himalayan region on the other hand is lagging far behind in this aspect. To strengthen this wing not only trained manpower but determined extension activities with full government support are most urgently required.

(vi) Problems of processing

The success of fruits and vegetable growing is closely linked with the success of fruit processing units, because of poor marketing and transport facilities. The processing industry can help in sorting out the problem of proper disposal of perishable commodities. Till today, there are hardly any cold storage facilities available; few processing units exist but are not functioning up to the desired capacity. Use of appropriate pre and post harvest practices for horticultural crops is vital for the success of the crops and to provide good return to the growers. Unfortunately this is the weakest spot in the Sikkim state. Value addition should be given top priority for the crops like ginger and turmeric. Production of oleoresin from ginger, turmeric and chilli using improved techniques as developed by CFTRI, Mysore needs to be tested in the region.

(vii) Financial constraints

The high capital cost involved in establishing orchard/plantation and setting up of required infrastructure is a serious constraint in the expansion of area under horticultural crops. The situation becomes all the more difficult in view of the large number of small holdings.

(viii) Less expenditure on research work

Investments for research on horticulture have always remained low when compared to the large number of crops it covers. This results in poor technological support. The extension system is also weak. The Department of Horticulture has been created in many states but, do not have adequate manpower and infrastructure to address the entire problem of horticulture.

(ix) Absence of insurance facility

Risk management in horticultural crops is non-existent although crops like onion and potato are covered under the National Agriculture Insurance Scheme. There is a need to cover the risk in case of other horticultural crops in a different manner, perhaps on the basis of potential production coverage instead of average yield. This would encourage higher investment to achieve high productivity.

The other major bottlenecks are (i) Inadequate thrust on conservation and exploitation of horticultural germplasm, (ii) Lack of funds and financial support from government for purchase of quality seeds/planting materials & other inputs, (iii) Remoteness of the region, (iii) High rainfall, soil erosion and high rate of leaching of nutrients, (iv) Heavy infestation of weeds, insect-pests and diseases, (v) Lack of suitable technology for control of Blast in Paddy, Leaf blight in Maize, Storage of seed etc. (vi) Problem for control of diseases of Apple, Orange, Large Cardamom & Ginger, (vii) Lack of needed information, (viii) Lack of awareness about the potentiality of horticultural crops as commercial crop, (ix) Lack of need based research as sustainable agricultural system/silvi-horti-pastoral system in the need of the hour, (x) Weak data base, (xi) Unavailability of organic seed and (xii) Problem of adoption of Organic technology by Framers for which massive capacity building is necessary.

2.5.2 Prospects

Considering the excellent climatic conditions, abundant rainfall and fertile soil (high organic content) of the state Sikkim the productivity of different horticultural crops is quite low as compared to national productivity. But horticulture bears the bright future in the state and it has every opportunity to be developed as valuable processed food product and produce export quality fruits, vegetables, flowers and other horticultural products.

(i) Organic farming

The rich biodiversity, low initial fertilizer consumption, rich soil organic carbon of the state are some of the potential strength to organic farming. To streamline and increase the pace of organic movement a separate independent body in the form of a board or mission to handle organic farming issues need to be formed.

(ii) Bio-diversity of horticultural crops

The state Sikkim is considered to be one of the richest reservoirs of genetic variability of large number of horticultural and plantation crops. The enormous diversity makes the state a gene pool for the varietal improvement but in spite of potentiality no worth mentioning development in the field of horticulture has taken place. It may be mentioned that in Sikkim horticultural crop cultivation as an alternative to jhuming may prove to be a boon in the regional economy. In Sikkim, farming being the main stay of the people, development of horticulture will markedly improve the economy of the people. Establishment of orchards and planting of plantation crops on hill slopes will prevent soil erosion which may solve the problem of shifting cultivation and out migration of people to towns.

CHAPTER-III
Socio-Economic Conditions of the Horticulture Crops Growers

The socio-economic characteristics of the sample farmers would provide the background information and resource endowment position of the farmers in the selected area. This includes the information about the details of family members, level of education of the family members, caste and religion of the respondents, size of land holding, pattern of land ownership and motivating factors for adoption of high value crops of the sample households. These factors are crucial for bringing about desirable changes in the farm economy. It is therefore essential to get acquainted with these factors.

3.1 Background of the Respondents and the Households

Before we go through the details about other factors, it seems worthwhile to mention first the average age and education of the respondents in the study area. The farm business and farm income of the family would depend mostly on the age and level of education of the respondent as well as the head of the family and number of economically active farm workers in a family. Thus the information regarding average age and level of education of the respondent as well as the head of the family are collected and presented in tabular form for discussion.

3.1.1 Distribution of respondents by age group

It is evident from the enquiry that the average age was 15-25 years for the respondents of around 50% in Assam Lingzey and Saku villages and it was over 70% for the respondents of remaining three villages, viz. Chawang, Sallybong and Tinzerbung. These respondents were in the initial stage of starting farm business. The prime age group for farm operation are 26-50 years and 51-60 years. It has been observed from the survey that 43.3%, 52.4%, 27.5%, 18.7% and 19.6% respondents were in the age group of 26-60 years in Assam Lingzey, Saku, Chawang, Sallybong and Tinzerbung village, respectively.

Table 3.1: Distribution of respondents by age group

District	Block	Village		Distribution by age (in years					Total
				Below 14	15-25	26-50	51-60	61 & above	
1	2	3	4	5	6	7	8	9	10
East Sikkim	Assam Lingzey	Assam Lingzey	Count	4	72	33	25	-	134
			% within Block	3.0%	53.7%	24.6%	18.7%	-	100.0%
	West Pendam	Saku	Count	-	20	15	7	-	42
			% within Block	-	47.6%	35.7%	16.7%	-	100.0%
North Sikkim	Chawang	Chawang	Count	-	29	8	3	-	40
			% within Block	-	72.5%	20.0%	7.5%	-	100.0%
South Sikkim	Sally bong	Sally Bong	Count	1	47	8	3	-	59
			% within Block	1.7%	79.7%	13.6%	5.1%	-	100.0%
West Sikkim	Gazing	Tinzer bung	Count	5	36	9	1	-	51
			% within Block	9.8%	70.6%	17.6%	2.0%	-	100%

Source: Field Survey

So, it may be concluded that the respondents, fit for farm work, were moderate in number in Assam Lingzey and Saku village and it was very poor in number in the remaining Chawang, Sallybong and Tinzerbung village. Interestingly, it has been found that 3% of the respondents from Assam Lingzey village, 1.7% of the respondents from Sallybong village and 9.8% of the respondents from Tinzerbung village were under the age group of below 14 years. It has also been observed that there was no respondent of above 60 years of age in the study area (Table-3.1).

3.1.2 Distribution of respondents by level of education

The data on education level of respondents of selected villages have been presented in Table-3.2. The table reveals that in each village at least 5% villagers were illiterate. Among literate population, majority had education up to 11-12 standard in Assam Lingzey (24.6%) and Saku (38.1%) village.

Table 3.2: Distribution of respondents by level of education

District	Block	Village		Distribution by level of education							Total
				(a)	(b)	(c)	(d)	(e)	(f)	(g)	
1	2	3	4	5	6	7	8	9	10	11	12
East Sikkim	Assam Lingzey	Assam Lingzey	Count	20	9	16	21	33	18	17	134
			% within Block	14.9%	6.7%	11.9%	15.7%	24.6%	13.4%	12.7%	100.0%
	West Pendam	Saku	Count	8	5	4	6	16	3	-	42
			% within Block	19.0%	11.9%	9.5%	14.3%	38.1%	7.1%	-	100.0%
North Sikkim	Chawang	Chawang	Count	2	2	16	14	6	-	-	40
			% within Block	5.0%	5.0%	40.0%	35.0%	15.0%	-	-	100.0%
South Sikkim	Sally bong	Sally Bong	Count	7	20	10	12	5	5	-	59
			% within Block	11.9%	33.9%	16.9%	20.3%	8.5%	8.5%	-	100.0%
West Sikkim	Gazing	Tinzer bung	Count	-	7	38	4	2	-	-	51
			% within Block	-	13.7%	74.5%	7.8%	3.9%	-	-	100.0%

Note: (a) Illiterate, (b) Up to 4 std, (c) 5-7 std, (d) 8-10 std, (e) 11-12 std, (f) Degree, (g) Post graduate
Source: Field Survey

But major literate persons obtained education upto 5-7 standard in Chawang (40.0%) and Tinzerbung (74.5%) village. The maximum literate persons were identified in the category of upto 4 standard of education in Sallybong village. The percentage of respondents having degree / graduate level of education was low and they were found in Assam Lingzey, Saku and Sallybong village only. There were no respondents of post graduate degree holder in the selected villages, except Assam Lingzey village. In Assam Lingzey village, 12.7% respondents had post graduate qualification. Thus, literacy level of the respondents of selected villages was very poor. The low level of literacy is one of the many reasons for slow and very low adoption of new agriculture technology.

3.1.3 Distribution of highest educated person in the sample households

An attempt has been taken next, to understand the status of the family of the respondents in respect of education in the study area. For this purpose, the level of highest education of the members of each family of the respondents has been enquired. The collected information has been furnished in Table-3.3.

Table 3.3: Distribution of highest educated person in the sample households

District	Block	Village		Distribution by level of education							Total
				(a)	(b)	(c)	(d)	(e)	(f)	(g)	
1	2	3	4	5	6	7	8	9	10	11	12
East Sikkim	Assam Lingzey	Assam Lingzey	Count	-	7	6	22	41	41	17	134
			% within Block	-	5.2%	4.5%	16.4%	30.6%	30.6%	12.7%	100.0%
	West Pendam	Saku	Count	2	4	1	7	12	16	-	42
			% within Block	4.8%	9.5%	2.4%	16.7%	28.6%	38.1%	-	100.0%
North Sikkim	Chawang	Chawang	Count	1	11	13	12	3	-	-	40
			% within Block	2.5%	27.5%	32.5%	30.0%	7.5%	-	-	100.0%
South Sikkim	Sally Bong	Sally Bong	Count	-	9	21	16	7	2	4	59
			% within Block	-	15.3%	35.6%	27.1%	11.9%	3.4%	6.8%	100.0%
West Sikkim	Gazing	Tinzer bung	Count	-	11	9	21	4	6	-	51
			% within Block	-	21.6%	17.6%	41.2%	7.8%	11.8%	-	100.0%

Source: Field Survey, Note: (a) Illiterate, (b) Up to 4 std, (c) 5-7 std, (d) 8-10 std, (e) 11-12 std, (f) Degree, (g) Post graduate

The data in the table reveals that above 60% of the family members of the respondents in Assam Lingzey and Saku village have taken education from a university. The state capital *Gangtok* is located in the district of East Sikkim. So, scope for higher education in this district is comparatively higher than the remaining three districts of Sikkim state. Perhaps, this is the reason for obtaining higher education by the inhabitants of this district as compared to other three districts. The information in the table also exhibits that the level of education are confined in the school level, i.e., 5-12 std, for most of the members of the family of respondents of Chawang, Sallybong and Tinzerbung village. It has been estimated that 90%, 78% and 80.4% of the family members of the respondents of Chawang, Sallybong and Tinzerbung village, respectively have obtained their education (5-12 std) from a school.

3.1.4 Distribution of respondents by caste

Table-3.4 gives community-wise details of respondents under selected villages during the study period, i.e., 2010-11. Except Assam Lingzey village, the total respondents in each village ranged between 40 and 59. In Assam Lingzey village, there were 134 respondents. The community-wise examination of data shows that the respondents of selected villages were belonging to SC, ST, OBC and General category. The Assam Lingzey, Saku and Sallybong village were dominated by OBC population. Chawang village was predominantly tribal with ST population by 100 percent. On the other hand, more than 50% respondents were of general category in Tinzerbung village.

Table 3.4: Distribution of respondents by caste

District	Block	Village		Category					Total
				SC	ST	OBC	General	Others	
1	2	3	4	5	6	7	8	9	10
East Sikkim	Assam Lingzey	Assam Lingzey	Count	2	28	93	11	-	134
			% within Block	1.5%	20.9%	69.4%	8.2%	-	100.0%
	West Pendam	Saku	Count	5	-	36	1	-	42
			% within Block	11.9%	-	85.7%	2.4%	-	100.0%
North Sikkim	Chawang	Chawang	Count	-	40	-	-	-	40
			% within Block	-	100.0%	-	-	-	100.0%
South Sikkim	Sally Bong	Sally Bong	Count	12	21	26	-	-	59
			% within Block	20.3%	35.6%	44.1%	-	-	100.0%
West Sikkim	Gazing	Tinzer Bung	Count	-	14	9	28	-	51
			% within Block	-	27.5%	17.6%	54.9%	-	100.0%

Source: Field Survey

3.1.5 Distribution of respondents by religion

Except Saku and Chawang village, the total respondents in each selected village were belonging to more than one religion. Total Hindu and Buddhist responded population (100%) had been observed in Saku and Chawang village, respectively. In Assam Lingzey village, more than 50% and 40% respondents were Buddhist and Hindu, respectively. There were a few percentages of Muslim (8.2%) and Christ (0.7%) respondents in this village also. In Sallybong village, 78% of the respondents were Buddhist by religion. There were 18.6% Hindu and 3.4% Muslim in Sallybong village also. The majority (51%) of respondents in Tinzerbung village were Hindu. Out of 51 respondents, 10 respondents (19.6%) were Muslim and 15 respondents (29.4%) were Buddhist in Tinzerbung village. Thus, predominance of Buddhist and Hindu population by religion was observed in the selected villages of Sikkim state (Table-3.5).

Table 3.5: Distribution of respondents by religion

District	Block	Village		Religion					Total
				Hindu	Muslim	Christ	Buddhist	Jain	
1	2	3	4	5	6	7	8	9	10
East Sikkim	Assam Lingzey	Assam Lingzey	Count	54	11	1	68		134
			% within Block	40.3%	8.2%	0.7%	50.7%	-	100.0%
	West Pendam	Saku	Count	42	-	-	-	-	42
			% within Block	100.0%	-	-	-	-	100.0%
North Sikkim	Chawang	Chawang	Count	-	-	-	40	-	40
			% within Block	-	-	-	100.0%	-	100.0%
South Sikkim	Sally Bong	Sally Bong	Count	11	2	-	46	-	59
			% within Block	18.6%	3.4%	-	78.0%	-	100.0%
West Sikkim	Gazing	Tinzer Bung	Count	26	10	-	15	-	51
			% within Block	51.0%	19.6%	-	29.4%	-	100.0%

Source: Field Survey

3.1.6 Distribution of respondents by land size classification

The category-wise data on land holdings for villages of selected blocks have been presented in Table-3.6.

Table 3.6: Distribution of respondents by land size classification

District	Block	Village		Religion					Total
				Marginal	Small	Medium	Large	Others	
1	2	3	4	5	6	7	8	9	10
East Sikkim	Assam Lingzey	Assam Lingzey	No.	61	45	28	-	-	134
			%	45.5%	33.6%	20.9%	-	-	100.00%
	West Pendam	Saku	No.	18	11	10	3	-	42
			%	42.9%	26.2%	23.8%	7.1%	-	100.00%
North Sikkim	Chawang	Chawang	No.	-	1	-	39	-	40
			%	-	2.5%	-	97.5%	-	100.00%
South Sikkim	Sally Bong	Sally Bong	No.	36	19	4	-	-	59
			%	61.0%	32.2%	6.8%	-	-	100.00%
West Sikkim	Gazing	Tinzer Bung	No.	36	12	3	-	-	51
			%	70.6%	23.5%	5.9%	-	-	100.00%
Total			No.	151	88	45	42	-	326
			%	46.32	27.00	13.80	12.88	-	100.00%

Source: Field Survey

From the table, the domination of marginal and small farmers was evident in all the villages, except Chawang. Almost all farms (97.5%) in Chawang village were large by size. In Assam Lingzey and Saku village, 79.1% and 69.1% operational holdings were marginal

and small, respectively by size jointly. In Sallybong village, 61% and 32.2% operational holdings were marginal and small farms. Only 5.9% operational holdings were under the category of medium farm by size in Tinzerbung village. Rest of the land holdings in the village was either marginal or small by size. Thus, it was evident from the ownership of respondent's land property that the marginal and small farmers were predominant in the study area.

3.1.7 Distribution of family members by age group

Greater availability of economically active workers in the farm family would induce farm holdings to use crop-mixes and / or intensive use of land in the form of multi-cropping (measured by the ratio of gross cropped area to net cropped area i.e. cropping intensity) such that he derives a higher gross yield per unit of his holding. In fact a basic premise underlying the explanation of a higher degree of labour use on small sized holdings refers to the greater availability of family labour relative to land on such holdings (labour is interpreted as worker). Again, family human labour is a major source of labour required for carry out timely all type of farming operations and other allied activities. The extent of availability of family human labour directly impacts the paid out cost of cultivation. The availability of human labour and economically active workers in the family is directly related to the age of the members. So, an attempt has been taken to understand the age group of the members of respondent's family (Table-3.7).

Table 3.7: Distribution of family members by age group

District	Block	Village	Male (years)		Female		Children below 15 (Boys and Girls)	Total Members
			Below 15	Above 15	Below 15	Above 15		
1	2	3	4	5	6	7	8	9
East Sikkim	Assam Lingzey	Assam Lingzey	113	346 (39.82)	108	302 (34.75)	221 (25.43)	869 (100)
	West Pendam	Saku	37	116 (39.86)	35	103 (35.40)	72 (24.74)	291 (100)
North Sikkim	Chawang	Chawang	29	69 (33.33)	32	77 (37.20)	61 (29.47)	207 (100)
South Sikkim	Sally Bong	Sally bong	30	166 (43.80)	31	152 (40.11)	61 (16.09)	379 (100)
West Sikkim	Gazing	Tinzer bung	37	118 (38.94)	38	110 (36.30)	75 (24.75)	303 (100)
Total			246	815 (39.78)	244	744 (36.31)	490 (23.91)	2049 (100)

Source: Field Survey *(Figure in parentheses indicates percent to total members)*

It is evident from Table-3.7 that above 30% of both the male and female population was above 15 years old in all the study villages, except Sallybong village. There were above 40% of both male and female population of above 15 years old. As a result, children of below 15 years old were around 25% in Assam Lingzey, Saku, Chawang and Tinzerbung village. But below 15 years old children were only 16% in Sallybong village. The overall picture indicates that there were around 40% of both male and female population of above 15 years old in the study area. Only 24% of the population was children of below 15 years old. So, it can be assumed that in respect of family labour and earning members of the family, the respondents' family was moderate in number in the study area.

3.1.8 Total number of earning members in the sample households

It is also evident from the investigation that earning members in the study area ranged from 32.01% in Tinzerbung village to 44.44% in Chawang village. The percentage of active workers existed in the sample households was almost same with the percentage of either above 15 years old male or 15 years old female population in the study area. So, it can be assumed that either all adult male or all adult female members of a family were engaged in earning for their family. Another possibility is to earn for the family by half of adult male population and by half of adult female population. The distinguished fact is that some children of below 15 years old in Chawang village were earning for their family, whereas some members of above 15 years old were not considered as earning family member in Sallybong village. However, the overall percentage of earning members across the study area was 37%, which made parity with the percentage of earning members of each village (Table-3.8).

Table 3.8: Total number of earning members in the sample households

District	Block	Village	Total members	Earning members	Avg. annual family income	Avg.Annual income/ member
1	2	3	4	5	6	7
East Sikkim	Assam Lingzey	Assam Lingzey	869	328 (37.74)	367227.91	422.59
	West Pendam	Saku	291	105 (36.08)	74274.93	255.24
North Sikkim	Chawang	Chawang	207	92 (44.44)	268560.50	1297.39
South Sikkim	Sallybong	Sallybong	379	136 (35.88)	43894.84	115.82
West Sikkim	Gazing	Tinzerbung	303	97 (32.01)	37318.55	123.16
Total			2049	758 (36.99)	207250.15	101.15

Source: Field Survey *(Figure in parentheses indicates percent to total members)*

3.1.9 Details of family income

To understand the socio-economic status, i.e. social position and economic condition of the sample families in the study area, an attempt has been undertaken to estimate the annual income of these families. It is well accepted that family income is the absolute scale to measure the economic viability of a family. Again, the source/sources of that income partially focused on the social status of that family. With this view, the average annual family income of the sample farm households in the study area has been worked out.

3.1.10 Average annual family income

The estimated results of average annual family income in the study areas have also been given in Table-3.8. The table has exposed that the income per member as well as the average annual family income in Assam Lingzey of East Sikkim was higher (Rs. 3,67,227.91) than the income per earning member as well as the average annual family income of the Tinzerbung village of West Sikkim (Rs. 74,274.93). The proportion of earning

members per family was also higher in Assam Lingzey than Tinzerbung. But, despite almost same proportion of earning member in each family in Saku of East district and Sallybong of South district, the income per member of Saku village was too low. On the other hand, though the proportion of earning member per family was highest in Chawang of North district, yet annual income per member as well as annual family income was highest. Return per household member was maximum in North Sikkim. Assam lingzey was the area of cymbidium orchids. It was the one of the most profitable horticulture crop in Sikkim, which was reflected on per family as well as per earning member's income. Low income in Saku village may have been due to of removal of old orchard plantation and rejuvenation of young seedlings. These seedlings were not competent for bearing at the time of survey. Vegetable cultivation in Sallybong village also provided a poor income for its grower in South Sikkim and from Ginger cultivation in the West district too. The overall average annual family income of the households in the study area was Rs. 2, 07,250.15. Thus, the estimated income of every member across the study area was Rs. 101.15.

3.2 Land Ownership Details/Cropping Pattern

3.2.1 Land owned by the households

The accepted opinion is that the area of cultivated land holdings and its character (rainfed/irrigated/uncultivated, etc.) mainly influences the rate of adoption of new agricultural technology and capital investment in agriculture sector besides some other economic factors, such as cost of cultivation and net return of farm operation, etc. In this context, the area of land holding and its character of sample households has furnished in Table 3.9 according to the selected villages.

3.2.2 Land area of the sample villages

In course of discussion with land holdings, it appears that the total area of land holdings of the selected villages across the study area was 173.25, 111.63, 340.75, 66.00 and 56.33 ha for Assam Lingzey, Saku, Chawang, Sallybong and Tinzerbung villages, respectively. The proportion of irrigated area was highest (100%) in Sallybong village. Around 90% of the cultivated area was irrigated in Assam Lingzey and Tinzerbung village. Though, proportion of irrigated area was moderate (60%) in Saku village but it was very poor (12.5%) in Chawang village. The overall irrigated area across the study area was 52% and unirrigated area was 48%. That means, the proportion of irrigated and unirrigated area was almost same across the study area. This was due to existence of nearly 90% unirrigated area in Chawang village (Table-3.9).

The indication was that the farmers of the study area were mostly involved in irrigated farming practices. This may also be noted here that the proportion of leased in, leased out and uncultivated land were very low in the each study area, except Saku. As a result, net operated area was ranged from 93% (Assam Lingzey) to 100% (Sallybong) and in Saku, it was only 68%.

Table 3.9: Land owned by the households

(Area in ha)

District	Block	Village	Unirrigated land	Irrigated land	Own land	Leased-in land	Leased-out land	Uncultivated land	Own + Leased-in land	Net operated area
East Sikkim	Assam Lingzey	Assam Lingzey	11.31 (6.53)	161.94 (93.47)	173.25 (100.0)	9.05 (4.96)	10.79 (5.92)	1.85 (1.01)	182.30 (100.0)	169.66 (93.07)
	West Pendam	Saku	44.40 (39.77)	67.23 (60.23)	111.63 (100.0)	4.50 (3.87)	9.00 (7.75)	27.65 (23.81)	116.13 (100.0)	79.48 (68.44)
North Sikkim	Chawang	Chawang	298.27 (87.53)	42.48 (12.47)	340.75 (100.0)	0.00	0.00	1.50 (o.44)	340.75 (100)	339.25 (99.56)
South Sikkim	Sally Bong	Sally bong	0.00	66.00 (100.0)	66.00 (100.0)	0.80 (1.20)	0.00	0.00	66.80 (100.0)	66.80 (100.0)
West Sikkim	Gazing	Tinzer bung	11.99 (19.55)	49.34 (80.45)	61.33 (100.0)	4.60 (7.55)	0.00	3.60 (5.91)	60.93 (100.0)	57.33 (94.09)
Total			365.97 (48.60)	386.99 (51.40)	752.96 (100.0)	18.95 (2.45)	19.79 (2.56)	34.60 (4.48)	771.91 (100.0)	717.52 (92.95)

Source: Field Survey *(Figure in parentheses indicates percent to total members)*

The discussion indicates that the farmers in the study area primarily depend on assured irrigation system for horticultural crop cultivation. But, despite 40% unirrigated land in Saku village, the farmers of that village were also involved seriously in horticultural crop cultivation. This information suggests that irrigation facility or availability did not influence the farmer to adopt horticultural crop cultivation in Sikkim state.

3.2.3 Distribution of leased in and leased out land by terms and conditions

It has been known during primary data survey that two different conditions, as the mode of payment to the land owners, were being followed for rent of leased in and leased out land. The "crop sharing" is one of the conditions. According to this condition, one-third of the total production had to give to the land owner by the cultivator. Another condition was 'crop & cost sharing". According to this condition, the land owner had to pay half of the total cost of cultivation to the cultivator. In this condition, the cultivator also had to give half of the total production to the land owner.

Table-3.10 depicts the land area under leased in and leased out category and the condition applied by the land owner for the cultivation in leased in and leased out land. It has been observed that out of 182.30 ha cultivable land, only 9.05 ha (4.96%) and 10.79 ha (5.92%) land were leased in and leased out, respectively in Assam Lingzey village following "crop & cost sharing" condition. Out of 116.13 ha cultivable land in Saku village, only 4.50 ha (3.87%) land was leased in under the condition of "crop sharing". Again, among 9.00 ha (7.75%) leased out land in the same village, 8.50 ha land had been leased out according to "crop sharing" system and the rest 0.50 ha land had been leased out maintaining "crop & cost sharing" decision. There was no leased in or leased out land in Chawang village. Only 0.80 ha (1.20%) and 4.60 ha (7.55%) land were cultivated in Sallybong and Tinzerbung village, respectively under 'crop & cost sharing" condition of leased in type. Now, on the basis of overall discussion, it may be inferred that "crop & cost sharing" system was more favourable for both leased in and leased out type of cultivation in Sikkim.

Table 3.10: Distribution of leased in and leased out land by terms and conditions

(Area in ha)

District	Block	Village	Land Leased in Type			Land Leased out Type		
1	2	3	Crop sharing	Fixed rent	Total	Crop sharing	Fixed rent	Total
East Sikkim	Assam Lingzey	Assam Lingzey	-	9.05	9.05	-	10.79	10.79
	West Pendam	Saku	4.50	-	4.50	8.50	0.50	9.00
North Sikkim	Chawang	Chawang	-	-	0.00	-	-	0.00
South Sikkim	Sally Bong	Sally bong	-	0.80	0.80	-	-	0.00
West Sikkim	Gazing	Tinzer bung	-	4.60	4.60	-	0.00	0.00
Total			4.50	14.45	18.95	8.50	11.29	19.79

Source: Field Survey

3.2.4 Year of starting the horticultural crops by the farmers

The agro-ecological situations of Sikkim state are diverse in nature. The situations are ranging from sub-tropical in the lower valleys to alpine in very high elevations present an extremely congenial environment for diversifications of horticulture. The horticulture development programmes of Sikkim state are based on the advantages arising out of the state's inherent strengths and disadvantages posed by geography and topography. Nonetheless, the efforts of the Horticulture & Cash Crops Development Department of Sikkim Government directed towards converting disadvantages into advantages have brought about path breaking transformations in horticulture sector in the recent years. So, it is the point of interest, how the growth of horticulture has been impacted due to various interventions undertaken by the respective department of the government.

At the time of field level survey, all the respondents in each village were asked about their involvement by years in horticulture crops cultivation. The collected information has been furnished in Table 3.11. It has been observed from the table that horticulture crops cultivation were being practiced by all the respondents in Saku, Chawang and Tinzerbung villages since more than 5 years long back. Besides, around 50% of the respondents in both Assam Lingzey and Sallybong villages were involved in horticulture sector since more than 5 years long back from the time of reference year. Among these respondents, 80.95%, 100%, 37.29% and 92.16% respondents in Saku, Chawang, Sallybong and Tinzerbung villages, respectively were engaged in horticulture crops cultivation since more than 10 years long back from the time of survey. Not only that, 45.24%, 16.95% and 56.86% respondents of Saku, Sallybong and Tinzerbung villages reported their involvement in horticulture since more than 20 years long back from the survey period. The overall picture indicates that above 80% of the respondents are engaged in horticulture crops cultivation since more than 5 years long back from the reference year in Sikkim state.

Based on the above information, it may be inferred that horticulture crops cultivation is more favourable and profitable to the farmers of Sikkim. They are cultivating these crops spontaneously in their farm since long back. Government assistance has enabled the sector to achieve much in area expansion. Increased productivity, high level of crop diversification and technological inputs are some of the manifestations of departmental interventions.

Table 3.11: Year of starting the horticultural crops by the farmers

(Number of HH)

District	Block	Village	>20 yr	>10 to <=20 yr	>5 to <=10 yr	Since 5 yr	Since 4 yr	Since 3 yr	Since 2 yr	Since 1 yr	Current Yr	Total
1	2	3	4	5	6	7	8	9	10	11	12	13
East Sikkim	Assam Lingzey	Assam Lingzey	0	0	62 (46.27)	13 (9.70)	38 (28.36)	4 (2.98)	2 (1.49)	6 (4.48)	9 (6.72)	134 (100.0)
	West Pendam	Saku	19 (45.24)	15 (35.71)	8 (19.05)	0	0	0	0	0	0	42 (100.0)
North Sikkim	Chawang	Chawang	0	40 (100.0)	0	0	0	0	0	0	0	40 (100.0)
South Sikkim	Sallybong	Sallybong	10 (16.95)	12 (20.34)	29 (49.15)	2 (3.39)	6 (10.17)	0	0	0	0	59 (100.0)
West Sikkim	Gazing	Tinzerbung	29 (56.86)	18 (35.30)	4 (7.84)	0	0	0	0	0	0	51 (100.0)
Total			58 (17.79)	85 (26.07)	103 (31.60)	15 (4.60)	44 (13.50)	4 (1.23)	2 (0.61)	6 (1.84)	9 (2.76)	326 (100.0)

Source: Field Survey *(Figure in parentheses indicates percent to total members)*

3.3 Motivating Factors for Cultivation of Horticultural Crops

In the previous discussion, it has been highlighted that government interventions in the field of horticulture development in Sikkim state started in recent years, but farmers are growing horticulture crops in Sikkim since long back. So, the guessing "besides government assistance, there are some other factors also for motivating farmers to horticulture crops in Sikkim" may not be unjustifiable. So, an attempt has been taken to understand the overall factors that are liable to motivate farmers of Sikkim to adopt horticulture in their farming business. These factors are "proximity to market of horticulture crops", "good price of horticulture crops", "easy to grow horticulture crops", "government assistance available for horticulture crops" and "easy availability of inputs for horticulture crops cultivation". The respondents were asked to express their preference to these factors by ranking (1 to 4) method. The result of this opinion survey has been furnished in Tables-3.12 and 3.13.

3.3.1 Motivating factors for taking up horticulture crops

Table-3.12 depicts that in Assam Lingzey village, all the motivating factors, except proximity to market, have more or less same importance. In Saku village, proximity to market, good price and government assistance have played major role as farmers' motivating factors to horticulture. Again, good price, government assistance and easy availability of inputs are the most influential factors for the same in Chawang village. In Sallybong village, the factors, proximity to market and easy availability of inputs act as moderately influential factors besides most influential factors like good price and government assistance. The three factors, viz., proximity to market, government assistance and easy availability of inputs, are the most important motivating factors in the same field in Tinzerbung village. The overall picture shows that the motivating factors according to the importance are government assistance, good price, easy availability of inputs, proximity to market and easy to grow across the study area (Table 3.12).

Table 3.12: Motivating factors for taking up horticulture crops

District	Block	Village	Total farmers	Proximity to Market	Good Price	Easy to Grow	Govt. Assistance Available	Easy Availability of Inputs	Total responding farmers
1	2	3	4	5	6	7	8	9	10
East Sikkim	Assam Lingzey	Assam Lingzey	134	0	112 (83.58)	103 (76.86)	112 (83.58)	113 (84.33)	134
	West Pendam	Saku	42	38 (90.48)	41 (97.62)	2 (4.76)	42 (100.0)	3 (7.14)	42
North Sikkim	Chawang	Chawang	40	5 (12.50)	40 (100.0)	0	40 (100.0)	31 (77.50)	40
South Sikkim	Sallybong	Sallybong	59	35 (59.32)	43 (72.88)	11 (18.64)	45 (76.27)	28 (47.46)	59
West Sikkim	Gazing	Tinzerbung	51	51 (100.0)	0	0	51 (100.0)	51 (100.0)	51
Total			326	`129 (39.57)	236 (72.39)	116 (35.58)	290 (88.96)	226 (69.33)	326

Source: Field Survey *(Figure in parentheses indicates percent to total members)*

3.3.2 Preference-wise motivating factors for taking up horticulture crops

Now, the task is to identify the block-wise proportion of respondents as per their choice of ranks for a particular motivating factor in the study area. Table-3.13 furnished this information. It has been found from the table that maximum proportion of respondents in West Pendam, Chawang and Gazing preferred "proximity to market" by ranking 3, whereas maximum respondents of Sallybong preferred the same by ranking 2. The factor "good price" has got the rank 1 by maximum respondents in each block, except Gazing, where no one did response for the same. More than 40% of the respondents expressed their choice for the factor "easy to grow" by giving rank 1 in Sallybong block, 3 in Assam Lingzey block and 50% of the respondents responded by each 2 and 3 rank in West Pendam block. The "available government assistance" was appreciated by most of the respondents across the study area. This motivating factor was preferred with rank 2 by most of the respondents in every block. Another motivating factor "easy availability of inputs" got 1st position by preference by most of the respondents in West Pendam and Gazing block and got 2nd position for the same in Sallybong block. The 3rd and 4th position were obtained by the majority of the respondents for the same motivating factor in Chawang and Assam lingzey block, respectively. The overall picture indicates that "good price" and "easy availability of inputs" were the most preferred motivating factors with ranked 1 by most of the respondents in the study area. Thus, the 2nd, 3rd and 4th ranked preference were "government assistance available", "proximity to market" and "easy to grow", respectively across the study area.

Table 3.13: Preference-wise motivating factors for taking up horticulture crops

District		East Sikkim		North Sikkim	South Sikkim	West Sikkim	Total
Block		Assam Lingsay	West Pendam	Chawang	Sallybong	Gazing	
Order of Preference							
Proximity to Market	1	0	0	0	0	0	0
	2	0	3 (7.89)	0	28 (80.00)	0	31 (24.03)
	3	0	35 (92.11)	5 (100.0)	7 (20.00)	51 (100.0)	98 (75.97)
	4	0	0	0	0	0	0
	Total	0	38	5	35	51	129
Good Price	1	70 (62.50)	27 (65.85)	38 (95.0)	17 (39.53)	0	152 (64.41)
	2	27 (24.11)	12 (29.27)	2 (5.0)	14 (32.56)	0	55 (23.31)
	3	14 (12.50)	2 (4.88)	0	12 (27.91)	0	28 (11.86)
	4	1 (0.89)	0	0	0	0	1 (0.42)
	Total	112	41	40	43	0	236
Easy to Grow	1	4 (3.88)	0	0	5 (45.45)	0	9 (7.76)
	2	23 (22.33)	1 (50.0)	0	4 (36.36)	0	28 (24.14)
	3	45 (43.69)	1 (50.0)	0	2 (18.18)	0	48 (41.38)
	4	31 (30.10)	0	0	0	0	31 (26.72)
	Total	103	2	0	11	0	116
Govt. Assistance Available	1	40 (35.71)	13 (30.95)	2 (5.0)	12 (26.67)	0	67 (23.10)
	2	49 (43.75)	25 (59.52)	38 (95.0)	25 (55.56)	51 (100.0)	188 (64.83)
	3	22 (19.64)	4 (9.53)	0	8 (17.77)	0	34 (11.72)
	4	1 (0.90)	0	0	0	0	1 (0.35)
	Total	112	42	40	45	51	290
Easy Availability of Inputs	1	21 (18.58)	2 (66.67)	0	0	51 (100.0)	74 (32.74)
	2	27 (23.89)	1 (33.33)	0	15 (53.57)	0	43 (19.09)
	3	27 (23.89)	0	31 (100.0)	10 (35.71)	0	68 (30.09)
	4	38 (33.64)	0	0	3 (10.72)	0	41 (18.14)
	Total	113	3	31	28	51	226

Source: Field Survey *(Figure in parentheses indicates percent to total members)*

CHAPTER-IV
Maintenance of Horticulture Crops

4.1 Destruction and Rejuvenation of Horticulture Crops

During the survey, an attempt had been undertaken to get an idea about destruction and rejuvenation of horticulture crops in the study area. Related facts for the same are given in Tables-4.1 and 4.2. Table-4.1 discloses that the respondents in the study area did not destruct any plantation garden with horticulture crops. But in South Sikkim only, the respondents kept them away from the cultivation of leafy vegetables. The farmers of the area compelled to take such decision for its lower profit. On the other hand, 17.50 ha area of orchard plantation had been rejuvenated in East Sikkim only. From 17.50 ha area, 1750 plants of mandarin orange had been removed due to old age reason. At the same time, this uncovered land had been covered with rejuvenating young seedlings of mandarin orange (Table-4.2).

Table 4.1: Horticulture crops removed in the last 5 years

Village/Block	Name of the individual crop removed	Number of plants removed	Reason for removing	Area removed (ha)	Number of households
East Sikkim	-	-	-	-	-
a. Sub-total	-	-	-	-	-
North Sikkim	-	-	-	-	-
b. Sub-total	-	-	-	-	-
South Sikkim	Leafy vegetables	140100	Lower profit	9.14	32
c. Sub-total	-	140100	-	9.14	32
West Sikkim	-	-	-	-	-
d. Sub-total	-	-	-	-	-
State Total (a to d)	-	140100	-	9.14	32
Per Household	-	-	-	-	-

Source: Field Survey

Table 4.2: Horticulture crops plants rejuvenated by the farmers in the last 5 years

(Area in ha)

Village/Block	Name of the individual crop rejuvenated	No. of plants rejuvenated	Reason for rejuvenation	Area rejuvenated (ha)	Number of households
East Sikkim	Mandarin Orange	1750	Old Plants	17.50	9
b. Sub-total	-	1750	-	17.50	9
North Sikkim	-	-	-	-	-
b. Sub-total	-	-	-	-	-
South Sikkim	-	-	-	-	-
c. Sub-total	-	-	-	-	-
West Sikkim	-	-	-	-	-
d. Sub-total	-	-	-	-	-
State Total (a to d)	-	1750	-	17.50	9
Per Household	-	-	-	-	-

Source: Field Survey

4.2 Kitchen Garden/Bund/Rooftop Plantation

The observation during survey highlighted on the facts regarding inclination of the family in the study area towards kitchen garden as well as backyard garden. The facts and figures for the same are given in Table-4.3.

It had been observed in East Sikkim that only 22% households (39 hh of total 176 hh) were practiced kitchen garden/backyard garden in their homestead area. The land area used for this purpose was also low. It was 0.111 ha. Total value of production in money-term was Rs.15,350.00 in this area

In North Sikkim, almost all family (97.5%) were engaged in practicing kitchen garden/backyard garden. They cultivated a number of vegetable crops in 0.128 ha of their homestead land. These gardens provided a production of value Rs.17,315.00.

Table 4.3: Number of households having kitchen garden/backyard garden

Village/Dist	Name of the Crop*	No. of Household		If Yes or Having			
		Having	Not Having	Area (ha)	No. of Plants	Production (qtl)	Annual value (Rs.)
East Sikkim			137				
	Leafy veg.	10		.053	1900	3.15	3150.00
	Tomato	29		.058	460	4.72	12200.00
Sub-Total		**39**	**137**	**0.111**	**2360**	**7.87**	**15350.00**
North Sikkim			1				
	Brinjal	2		.010	40	.40	440.00
	Chilli	3		.007	60	.30	600.00
	Chayote	8		.015	62	6.20	5280.00
	Leafy veg.	1		.007	200	.60	600.00
	Mixed veg.	22		.086	1170	5.60	6745.00
	Tree tomato	3		.003	16	.31	3650.00
Sub-Total		**39**	**1**	**0.128**	**1548**	**13.41**	**17315.00**
South Sikkim			36				
	Cabbage	3		.006	50	.41	545.00
	Chilli	14		.021	150	.68	1710.00
	Tomato	6		.008	60	.32	640.00
Sub-Total		**23**	**36**	**0.035**	**260**	**1.41**	**2895.00**
West Sikkim			51				
Sub-Total		**0**	**51**	**0**	**0**	**0**	**0**
Total		**101**	**225**	**0.274**	**4168**	**22.69**	**35560.00**

Source: Field Survey

The numbers of households practicing kitchen garden / backyard garden in South Sikkim were moderate in number. Out of 59 households, 23 households were found to be involved in kitchen garden/backyard garden. It was 63.89 by percentage to the total number of households in the area. In this study area, a production of Rs.2,895.00 was obtained from 0.035 ha land area.

However, the above discussion pointed out that the concept as well as the importance of kitchen garden/backyard garden was known to the farmers' family in Sikkim. The family who were not involved in kitchen garden/backyard garden, they were helpless. Because, these families have no enough land in their homestead area for implementing kitchen garden/backyard garden programme. The income from kitchen garden/backyard garden was too attractive as compared to income from commercially cultivated land. This became possible for efficient and timely management practices by all the adult members of the family.

Table 4.4: Horticultural crops plants in the field bund lands in 2010-11

Village/Dist	Name of the Crop*	No. of Household		If Yes or Having			
		Having	Not Having	Area (ha)	No. of Plants	Production (qtl)	Annual Value (Rs.)
East Sikkim			176				
Sub-Total		**0**	**176**	**0**	**0**	**0**	**0**
North Sikkim	Chayote	8	32	.009	38	3.8	3250.00
Sub-Total		**8**	**32**	**.009**	**38**	**3.8**	**3250.00**
South Sikkim			59				
Sub-Total		**0**	**59**	**0**	**0**	**0**	**0**
West Sikkim			51				
Sub-Total		**0**	**51**	**0**	**0**	**0**	**0**
Total		**8**	**318**	**.009**	**38**	**3.8**	**3250.00**

Source: Field Survey

Another important observation was that the crop cultivation on the field bund lands was not either popular or predominant in Sikkim state. It had been found that no one family had crop land on field bund in Sikkim, except North Sikkim. In North Sikkim, 20% family (8 families of total 40 families) had crops only on field bund. Total area of field bund lands of these 8 families were 0.009 ha. Total earning from this field bund lands crop was Rs.3,250.00. This indicates an extra income of family for their livelihood. So, attempt should be taken to aware the farmers about the economic importance of field bund lands utilization. Another point may be underlined here that plantation on field bund lands are equally important to check soil erosion (Table-4.4).

4.3 Adoption of New Technologies by the Farmers

The balance between government initiatives and farmers' acceptance of new technology indicates the performance of the state as well as awareness of the farmers in respect of implementation of any development scheme. So, an attempt had been undertaken to estimate the number of farmers who adopted high technology, viz., Poly house, Green house, INM/IPM, etc., in their horticulture farms. It had been observed in survey that only 22.78%, 22.50% and 29.41% respondents in East, North and West Sikkim, respectively adopted poly house cultivation in their horticulture farms. Average size of each farm was 116.30 m^2. The adoption of green house cultivation was too poor even as compared to adoption of Poly house cultivation in the state. Only 20.27%, 27.50% and 7.84% farmers in East, North and West Sikkim, respectively adopted Green house cultivation. The average farm area under Green house was 125.8 m^2. Besides, INM/IPM practices were adopted by 27.45% farmers in West Sikkim only. Maximum area under Poly house and Green house was in East Sikkim and no adoption of these two technologies was found in South Sikkim. East Sikkim and South Sikkim were predominant in cymbidium orchids and vegetables cultivation, respectively. High cost and non-availability of various components are the two major limiting factors in the adoption of Green house and Poly house technology for commercial cultivation. On the other side, appropriate training for INM / IPM was not up to the desired level in the state. So, it may be concluded that Poly house and Green house are popular in orchid's cultivation only, whereas these have no impact on vegetable cultivation (Table-4.5).

Table 4.5: Adoption of high technology by the farmers in last five years

Village/Block	Poly House (Area in sq.mt)		Green House (Area in sq.mt)		INM/IPM (Area in Ha)		Other (Specify		Total Farmers	Area
	No. of Farmer	Area	No. of Farmer	Area	No. of Farmer	Area	No. of Farmer	Area		
East Sikkim	40	5000	4	700					47	
North Sikkim	9	1300	11	1360					20	
South Sikkim										
West Sikkim	15	1140	4	330	14	2.16			33	
State Total (1 to 4)	64	7440	19	2390	14	2.16			97	
Per Household		116.3		125.8		0.15				

Source: Field Survey

4.4 Benefits Received from the Government for the Development of Horticulture

The enquiry in respect of benefits as well as extension services that were received by the respondents in last 5 years from the government for the development of horticulture in the Sikkim state disclosed the following information that are depicted in Table 4.6a and Table 4.6b. It had been reported that 2.27% households under floriculture scheme in East Sikkim, all the farmers under VIUC scheme in South Sikkim and 37.25% respondents under GAEP scheme in West Sikkim got assistance with seed from government side.

Among total farmers, 34.66% under floriculture scheme and 5.11% under ORP scheme in East Sikkim, 70% under CAEP scheme and 30% under SAEP scheme in North Sikkim, 98.31% under VIUC scheme in South Sikkim and 7.84% under GAEP scheme in West Sikkim received seedlings of horticulture plants in last 5 years.

Table 4.6a: Benefits/extension services received by the farmers in last five years

District	Name of Scheme	Year	No. of H/H assisted with seed	No. of H/H assisted with plant	No. of H/H assisted with subsidy	No. of H/H assisted with credit	No. of H/H assisted with pp materials
East Sikkim	Floriculture	2006	4	61	2		62
	ORP	2011		9	9		9
	Total	2006	4	61	2		62
		2011		9	9		9
North Sikkim	CAEP	2010		21	1		18
		2011		7			3
	SAEP	2009		3			3
		2010		1			1
		2011		8			6
	Total	2009		3			3
		2010		22	1		19
		2011		15			9
South Sikkim	VIUC	2011	59	58			59
	Total	2011	59	58			59
West Sikkim	GAEP	2007	2				1
		2008	5				4
		2009	4				4
		2010	8	4	4		8
	Total	2007	2				1
		2008	5				4
		2009	4				4
		2010	8	4	4		8

Source: Field Survey, *Note: Assistance comes as package and hence assistance for individual items could not be ascertained at the field level.*

In case of subsidy for facilitating cultivation and development of horticulture, only 1.14% and 5.11% of total farmers under floriculture and ORP scheme, respectively in East Sikkim, 2.5% under CAEP scheme in North Sikkim and 7.84% under GAEP scheme in West

Sikkim got assistance and no one farmers in the study area assisted with credit from an institutional source of finance.

A reverse fact had been observed in case of assistance given with plant protection materials by the Government of Sikkim. Out of total farmers 35.23% and 5.11% under floriculture and ORP scheme, respectively in East Sikkim, 52.5% and 25% under CAEP scheme and SAEP scheme, respectively in North Sikkim, 100% farmers under VIUC scheme in South Sikkim and 33.33% farmers under GAEP scheme in West Sikkim got assistance with plant protection materials from Govt. side.

Maximum farmers were given assistance with chemicals under CAEP scheme (70%) and SAEP scheme (27.5%) in North Sikkim. This assistance were given to a very few farmer under floriculture scheme (1.70%) in East Sikkim and under GAEP scheme (7.84%) in West Sikkim.

It is evident from Table 4.6b that only 5.11% farmers under ORP scheme got assistance with drip irrigation in East Sikkim only. It is also evident from this table that no one farmer received assistance from Government in respect of sprinkler irrigation.

Table 4.6b: Benefits/extension services received by the farmers in last five years

District	Name of Scheme	Year	No. of H/H assisted with chemicals	No. of H/H assisted with drip irrigation	No. of H/H assisted with sprinkler irri.	No. of H/H assisted with training
East Sikkim	Floriculture	2006	3			62
	ORP	2011		9		9
	Total	**2006**	**3**			**62**
		2011		**9**		**9**
North Sikkim	CAEP	2010	21			21
		2011	7			7
	SAEP	2009	2			3
		2010	1			1
		2011	8			7
	Total	**2009**	**2**			**3**
		2010	**22**			**22**
		2011	**15**			**14**
South Sikkim	VIUC	2011				59
	Total	**2011**				**59**
West Sikkim	GAEP	2007				2
		2008				5
		2009				4
		2010	4			8
	Total	**2007**				**2**
		2008				**5**
		2009				**4**
		2010	**4**			**8**

Source: Field Survey, *Note: Assistance comes as package and hence assistance for individual items could not be ascertained at the field level.*

A large number of farmers in the state had been facilitated with the departmental extension services of the Government through training programme of various aspects of horticulture crop cultivation as well as development. The Table 4.6b exhibits that 35.23% and 5.11% farmers under floriculture and ORP scheme, respectively in East Sikkim, 70% and 27.5% farmers under CAEP and SAEP scheme, respectively in North Sikkim, 100% farmers under VIUC scheme in South Sikkim and 37.25% farmers under GAEP scheme in West

Sikkim were trained with an objective for improving horticulture crop cultivation in the Sikkim state.

However, the above discussion highlighted on the fact that Government want to develop the scientific skill regarding horticulture crops cultivation for the farmers. So, maximum numbers of farmers in the study area were assisted with training. The Government also wants to keep in touch the farmers of the state with the use of improved and scientific plant protection materials against pest and diseases losses. The Government motive was also towards increasing horticulture crops production in the state. So, the Government took the programme to distribute seedlings/young plants of HYV to the farmers as many as possible.

On the other hand, it had been observe from the Table 4.6a and 4.6b that all the farmers in the south Sikkim were assisted with seed and seedlings of HYV crops, plant protection materials and training for improved cultivation practices of horticulture crops. This district was selected for survey to understand the status of vegetable crops production in the state. So, it may be concluded that vegetable production with the use of latest technology got top priority in the state. This is perhaps due to lower scope of producing field crops in the state.

4.5 Problems Faced by the Respondents

Opinion survey of the respondents across the study area had been conducted to identify the problems that were being faced by the farmers in respect of production and marketing of horticulture crops in Sikkim. The problems like seeds and labour from production side and road, storage, packaging materials and market centre from marketing side had been considered as different types of problem.

Table 4.7: Nature of problems faced by the farmers of horticulture in 2010-11

District	Road Infrastructure	Seeds	Packaging Material	Labour	Storage	Market	Other (Info)	Total Farmers
East Sikkim	89	25	102	91	135	121	54	617
North Sikkim	29	3	40	9	37	17	4	139
South Sikkim	32	6	36	40	59	30	19	222
West Sikkim	22	6	25	24	51	34	11	173
State Total (1 to 4)	172	40	203	164	282	202	88	1151
Percent	14.9	3.5	17.6	14.3	24.5	17.6	7.7	100.0

Source: Field Survey

The intensity of these problems was measured by the number of farmers who responded to these problems as they had to face in real life. Based on this technique, it had been observed that in the production side, availability of seeds was a problem but not so serious. Rather, labour availability was a serious problem in production side as it ranked 4th among all the types of problem. On the other hand, lack of storage from marketing side

ranked 1st as serious type of problems. Besides, lack of good packaging materials and market facility both were informed as 2nd most important types of problem. Another important problem was related to road infrastructure. A reasonable number of respondents opined that road from field to market centre was not good for transportation. However, except these types of problem, there were no other so serious problems in the study area of Sikkim state (Table-4.7).

4.6 Farmers Contracted by the Agencies

No any agency, except Horticulture & Cash Crops Development Department (H&CCD), Government of Sikkim had conducted base line survey for horticulture crops in respect of area, production and productivity and other related aspects in the state. Even, Horticulture & Cash Crops Development Department of Sikkim did not conduct base line survey, they had conducted periodical monitoring mainly and seasonal crop-cutting experiment in the recent years for estimating area, production and productivity only. During this course of work, all farmers or sometimes few farmers in a village have been contracted by the respective officials of the Horticulture & Cash Crops Development Department. Table 4.8 depicts the status of frequency in respect of monitoring and crop cutting experiment for horticulture crop in the recent years. It has been found from the table that in the year 2008 and 2009, no information had been collected from the farmers of the study area. Only monitoring was done by the departmental officials. As a result, no information in respect of area, production as well as productivity of horticulture crops were collected in the year 2008 and 2009 from the study area.

Table 4.8: No. of farmers contacted by the agencies in recent years*

District	Total Farmers	Farmer contacted	Year of Contacting	Name of the Agency	Information Sought (Two main)		Information Missed by the agencies (as You feel)	
East Sikkim	176	6	2008	H&CCD	Monitoring		Area	Production
		18	2009	H&CCD	Monitoring		Area	Production
		23	2010	H&CCD	Monitoring		Area	Production
		24	2011	H&CCD	Crop cutting		Varietal potentiality	Production problems
North Sikkim	40	20	2010	H&CCD	Area		Production	Productivity
		20	2010	H&CCD	Crop cutting		Varietal potentiality	Production problems
South Sikkim	59	34	2011	H&CCD	Monitoring	Production	Area	Productivity
		25	2011	H&CCD	Crop cutting		Varietal potentiality	Production problems
West Sikkim	51	9	2009	H&CCD	Monitoring		Area	Production
		10	2010	H&CCD	Monitoring		Area	Production
State Total (1 to 4)	326	189						
Percent	100	58						

*No base line survey was conducted by any agency. The data reflect visit by Horticulture &Cash Crop Development Department (H&CCD), Govt. of Sikkim

But from 2010 onwards crop cutting experiment had been conducted, besides collecting information regarding area under horticulture crops in the study area. Though crop cutting experiment was done, yet yield potentiality of different varieties of horticulture crops

and the incidence of different problems in the production process had not been asked to the farmers. Again, when area under different horticulture crops was investigated, production and productivity of the respective crops were not asked. However, the estimated figures from the table 4.8 suggested that only 3.17% (6 farms), 14.29% (27 farms), 17.46% (33 farms) and 17.99% (34 farms) horticulture farms among the total contracted farms (189 farms) were monitored in the year 2008, 2009, 2010 and 2011, respectively. It is an increasing trend no doubt of monitoring horticulture farms. This increasing trend was also founded in crop cutting experiment. This was for 10.58% (20 farms) horticulture farms in 2010 and for 25.93% (49 farms) horticulture farms in 2011. In 2010, 10.58% (20 farms) horticulture farms were also surveyed for estimating the area under horticulture crops in the study area. So, it may be concluded that departmental initiative mainly confined with monitoring activity till the time of this survey.

4.7 Prospects of Horticulture Expressed by Farmers

Farmers' opinion survey in the study area highlighted to some interventions which are correlated and have future prospects with the development of horticulture sector in Sikkim. In other words, if these interventions are considered with due importance, these will facilitate the development of horticulture in the state. These prospective interventions are listed in Table 4.9.

Table 4.9: Three most important future prospects of horticulture expressed by farmers

District	Total Farmers	Organic Marketing	Export Market	New Variety	Better Price	Marketing at Village Level	More Irrigation Facility	Co-operative Marketing	Regulated Market
East Sikkim	176		22	19	17				
North Sikkim	40	16				14	8		
South Sikkim	59	12				5			13
West Sikkim	51	10					5	11	
State Total (1 to 4)	326	38 (11.66%)	22 (6.75%)	19 (5.83%)	17 (5.21%)	19 (5.83%)	13 (3.99%)	11 (3.37%)	13 (3.99%)
		1st	2nd	3rd			4th		

Source: Field Survey, Figures in parenthesis indicate percentage to total farmer

The Sikkim state is declared as "Organic State". The adoption of organic farming seemed too much prospective to the farmers of the study area by 11.66% (38 farms) in Sikkim. The 2nd most important intervention was provision of export market. It is fact that not only organic vegetable crops but organic cymbidium orchids also have a good market in the European countries. In the study area, more than 5% of the respondents believe that introduction of some new varieties, better price and marketing at village level of horticulture crops would play the prospective role in the process of horticulture development in Sikkim. It

is also evident from the table that more than 3% of the respondents have an idea that regulated market, more irrigation facility and co-operative marketing will be very prospective in future for development of horticulture sector in the state.

4.8 Suggestions for Development of Horticulture in Sikkim

Having known the problems that were responsible for hindering the development process of horticulture sector in Sikkim, the respondents of the study area were asked to suggest their feeling for development of this sector. The respondent's reply for the same has been depicted in Table 4.10. The facts and figures of the table indicate that opinion from maximum respondents (34.05%) went in favour of providing better storage facility. The proportion of respondents suggested to provide transport facility by 18.40% (2^{nd} highest) and packaging & marketing facility by 14.42% (3^{rd} highest). The respondents of 6.44% in the study area suggested that better marketing facility would hasten the development of horticulture in the state. Only 3.68% farmers of the selected study area opined that regulated market for horticulture crops would facilitated the development process of the horticulture sector in Sikkim state.

Table 4.10: Three most important suggestions given by the farmers for the iprovement of horticulture

District	Total farmers	Number of farmers responded in favour of provision for better								
		Storage facility	Packaging & Marketing facility		Regulated Market facility		Better Marketing facility		Transport facility	
		1^{st} choice	2^{nd} choice	3^{rd} choice	2^{nd} choice	3^{rd} choice	2^{nd} choice	3^{rd} choice	2^{nd} choice	3^{rd} choice
East Sikkim	176	58	47							35
North Sikkim	40	15						8	9	
South Sikkim	59	21			12					8
West Sikkim	51	17					13			8
State Total (1 to 4)	326	111 (34.05)	47 (14.42)		12 (3.68)		21 (6.44)		60 (18.40)	

Source: Field Survey

CHAPTER-V
Methodologies Adopted and Training Programme Conducted for Estimating Horticultural Crops

We have already discussed that Sikkim has a wide possibility for horticultural crops. The Department of Horticulture and Cash Crops Development along with National Horticultural Mission is taking initiative for development of such crops. The department carries out crop cutting experiments to estimate the productivity of major horticultural crops in the state. However, there remains dearth of an exhaustive estimate as regards to area and production of different horticultural crops. The only estimate that is available is the one done by the horticulture department. Village Level Officers (VLOs) under Department of Land Revenue are supposed to keep a record of such estimates and update at regular intervals. But at the village level one finds such estimates as regards to area under few crops at an aggregative level. It thus becomes difficult to have an idea as to the extent of yearly change of area under a wide range of horticultural crops that are being cultivated in villages of Sikkim. Moreover, the land record is kept with village as the accounting unit while horticultural data are estimated at cluster level whose jurisdiction is different from that of village. Often a cluster is agglomeration of several villages or part of several villages. Hence, the area data collected by the revenue department do not correspond to horticultural cluster. However, the horticulture and cash crop development department has a approxiate estimate of area under different horticultural crops at the cluster level. Over and above, it is true that the hilly terrain poses hindrance for exact estimation of area under various horticultural crops.

5.1 Horticulture and Cash Crop Development Department

The Horticulture and Cash Crop Development Department (DHCCD) under Government of Sikkim shoulders the responsibility of estimating the productivity of horticultural crops in the state and publish the report annually (Table-5.1).

Table 5.1: Agencies involved in collection of horticulture data 2010-11

District	Horticulture	Agriculture	DES	NSSO	Forest	Revenue	Others
East Sikkim	Dept. of Hort.& Cash Crop Dev. only Collects data	-	-	-	-	-	-
North Sikkim	Dept. of Hort.& Cash Crop Dev. Only Collects data	-	-	-	-	-	-
South Sikkim	Dept. of Hort.& Cash Crop Dev collects data in collaboration with RKVY & VIUC	-	-	-	-	-	RKVY* & VIUC** jointly collects data
West Sikkim	Dept. of Hort.& Cash Crop Dev. only Collects data	-	-	-	-	-	-

*Rashtriya Krishi Vikas Yojna; ** Vegitable Initiative Urban Cluster

The department carries out exhaustive crop cutting experiment throughout the state for major horticultural crops in different clusters. For horticultural crops the estimation is done at the cluster level. Fruits like Sikkim Mandarin Oranges, Banana or spices like Large Cardamom or Ginger come under such experiments. Apart from fruits or spices crop cutting

experiment is also done for major vegetables like Cabbage, Cauliflower, and Radish etc. But in such exercises, it often becomes difficult to estimate the area under the crop. In many cases the area estimates are carried out in a roundabout manner – estimating the number of plants and spacing between them first to arrive at the area estimates.

5.1.1 Sikkim mandarin orange

Crop Cutting Experiment is carried out for Sikkim Mandarin Oranges (Table 5.2a). An area of ten metre square is selected and the trees therein as the first step. Plucking of oranges is done from these selected trees and weighed to arrive at the sample estimate of production and productivity. The department also has the approximate estimate of the total area in the cluster under Sikkim Mandarin Orange for the year in question. Productivity estimated through crop cutting experiments are checked and verified at the cluster level. However, estimates for area and production for Orange is done at the district level on the basis of productivity estimates done at the cluster.

5.1.2 Cymbidium orchid

The methodology adopted for estimating productivity of Cymbidium Orchid is different from that of other field crops. As the plants are grown in pot under coverage of green house or poly sheds, the pots are taken as the unit of measurement. One plant per pot is the method of plantation. Productivity estimates are basically an average eye estimate of production in this case. Four spikes per plant is taken as the average production per plant. Five such plants within an area of one metre square is the standard spacing for plantation of Cymbidium Orchid. As the method of cultivation is essentially a captive one, the area estimates can be arrived at with greater ease. But it appears from the methodology of estimating production that it remains an average estimate of the Cymbidium spikes (Table-5.2a).

Table 5.2a: Method adopted for collection of data on horticulture crops in 2010-11 (Department of Horticulture and Cash Crop Development)

District	Fruits	Vegetables	Flowers	Spices
East Sikkim	Crop Cutting Experiment for Sikkim Mandarin Orange.		An eye estimate of spikes per pot in which there is only one plant. Four spikes per pot is taken as an average production level and 5 plants in an area of 1 metre square.	
North Sikkim				Crop Cutting Experiment for Large Cardamom.
South Sikkim		Production Estimation Experiment for major Vegetables.		
West Sikkim				Crop Cutting Experiment for Ginger

5.1.3 Large cardamom

Large Cardamom is cultivated mainly in the North district of the state. It is one of the main cash crops that are cultivated in Sikkim. Plantation of Cardamom is done in the hilly and undulated terrains, particularly in the slopes of the hills. Hence, it becomes difficult to arrive at an exact area estimate for such plantation. However, from the standard plant spacing

norms and number of plants the area is estimated approximately. In crop cutting experiments also such method is adopted. Generally 55-60 plants of Large Cardamom cover an area of 5 metre square. In crop cutting experiment output from plants are gathered and weighed to arrive at the estimated productivity of the crop.

5.1.4 Vegetables

Vegetables are cultivated generally in the main land owned by the household though the surface of the land is hilly. Cultivation of most of the vegetables requires substantial irrigation. In cases the vegetables are grown in a system of mixed cropping, of which we shall be discussing later on. Annual production estimation experiments are carried out for most of the vegetables by Horticulture and Cash Crop Development Department. There are other agencies too. The department collaborates with other agencies in such experiments. In cases the production is estimated from the quantity of crop being marketed. But in such cases it becomes an approximation of exact production for the fact that the nature of crop necessitates multiple cropping and hence multiple marketing throughout the whole season. On the other hand, in area and production estimation at the field level, however, the total number of plants of a specific crop is counted to arrive at the area under the crop depending upon the standard spacing norms. In such cases average weight of crop is to estimate the volume of production.

5.1.5 Ginger

Productivity estimates for Ginger is being done through crop cutting experiment. For such an experiment 5 meter sq. area is selected and the total weight of the crop is measured to arrive at the estimated productivity. In some cases sample area is taken as 1 metre square instead of 5 metre square. With the help of total area under Ginger within a cluster, which is an approximate estimate, total quantum of production is determined. However, there remains a problem with such estimation. Once Ginger is cropped it loses weight as it gets dry and the quantum of output changes. But no provision is there to make adjustments for the loss.

Table 5.2b: Method adopted for collection of data on horticulture crops in 2010-11 (Rashtriya Krishi Vikas Yojna, Vegetable Initiative Urban Cluster)

District	Fruits	Vegetables	Flowers	Spices
East Sikkim				
North Sikkim				
South Sikkim		Production estimates are done in terms of weight for the beneficiary households for major Vegetables. The area under crop is kept almost unaltered incorporating the crop rotations.		
West Sikkim				

5.2 Other Agencies

Rashtriya Krishi Vikas Yojna (RKVY) and Vegetable Initiative Urban Cluster (VIUC) are the agencies that collect and collaborate with government department for estimating productivity. RKVY is a national level scheme that works under the jurisdiction of government department. VIUC is a sort of apex body of self help groups that are promoting and providing assistance to vegetable growers. Both of these bodies were working

in collaboration with Horticulture and Cash Crop Development Department in South Sikkim. Main objective of these agencies is promotion of vegetable cultivation through making provision of technological and other assistance. They regularly carry out crop cutting experiment for estimating the production and productivity (Table 5.2b). Data collected by these agencies and the government department are cross verified at the cluster as well as district level.

5.3 Mixed Cropping Practices and Estimation Procedure

We discussed the methodologies adopted by the Horticulture and Cash Crop Development Department, RKVY and VIUC for estimation of productivity for various crops. These are methods that are adopted to estimate productivity under sole cropping system.

But in a state like Sikkim where tillable land is scarce due to undulation of hilly tract we find areas where mixed cropping practice is in abundance. Particularly in vegetable cultivation there exists wide practice of mixed cropping system. In such practices area and production is estimated from the number of plants. Number of plants and the weight for each crop is recorded. From number of plants one gets the required area for plantation. And the total area under all crops under mixed cropping practice is then allocated proportionally to respective crop (Table- 5.3). This practice is evident in case of some of the spices also.

Table 5.3: Method adopted for collection of mixed and intercropping in 2010-11 (Department of Horticulture and Cash Crop Development and RKVY&VIUC)

Disrict	Fruits	Vegetables	Flowers	Spices
East Sikkim		Number of plants and the weight for each crop is recorded. From number of plants one gets the required area for plantation. And the total area under all crops is then allocated proportionally to respective crop.		
North Sikkim		Number of plants and the weight for each crop is recorded. From number of plants one gets the required area for plantation. And the total area under all crops is then allocated proportionally to respective crop.		
South Sikkim		Number of plants and the weight for each crop is recorded. From number of plants one gets the required area for plantation. And the total area under all crops is then allocated proportionally to respective crop.		
West Sikkim		Number of plants and the weight for each crop is recorded. From number of plants one gets the required area for plantation. And the total area under all crops is then allocated proportionally to respective crop.		

5.4 Training Programme

Training programme for Crop Cutting Experiment is done every year by the Horticulture and Cash Crop Development Department. Horticulture Inspectors, who are the personnel at the Gram Panchayat Unit level are given training for carrying out such experiments. Gram Panchayat Unit is a cluster of few Gram Panchayat Wards that corresponds to village in jurisdiction. Garm Panchayat Units are the operational unit at the lowest level under the Department of Horticulture. Every Gram Panchayat Unit is catered by Horticulture Inspector who is responsible for all developmental activities regarding horticulture at the grass root level. Horticulture Inspectors are supposed to report to Horticulture Development Officer at the district level. Crop Cutting Experiments are carried out by the Horticulture Inspectors.

Training is held at the District Head Quarters of the respective districts prior to such data collection. For reference year 2010-11 two-day training was conducted to train the personnel (Table 5.4). In South district personnel from RKVY and VIUC also joined the training. The training imparted both theoretical as well as empirical exercise regarding Crop Cutting Experiment. Horticulture Inspectors found the training very useful and supportive in collection of productivity data at the field level.

Table 5.4: Training conducted for estimating of area, production and yield (2010-11)

District	Name of Training	Duration$	Place*	Yes/No		If yes, Mention advantages
				Yes (1)	No (2)	
East Sikkim	Training for Crop Cutting Experiment	Two days	3	1		Understanding the methods used in Crop Cutting Experiment.
North Sikkim	Training for Crop Cutting Experiment	Two days	3	1		It was advantageous to have the training and know the method.
South Sikkim	Training for Crop Cutting Experiment	Two days	3	1		It as very useful particularly for mixed cropping.
West Sikkim	Training for Crop Cutting Experiment	Two days	3	1		Empirical exercise of Crop Cutting was conducted.

$ Duration in Days; * Village (1), Block (2), District HQ (3), State Capital (4), Outside the State (5)
Note: No training was conducted for collecting data on Area, Production & productivity except for training for Crop Cutting Experiment

CHAPTER-VI
Survey Results of Horticulture Crops

6.1 Area, Production and Yield of the Sample Villages (for each horticulture crops)

Horticulture in Sikkim includes varieties of fruits, vegetables, root and tuber crops, spice crops like large cardamom, ginger, etc. among flowers, cymbidium orchids is most popular in this hill. The sector has established its importance in improving land use, promoting crop diversification, generating employment and above all providing nutritional security to the people. Horticulture also encompasses every aspect of aesthetics, economics and environmental regeneration.

The achievements depends on availability of budget to justify and address the strength, weakness and hi-tech available and also to justify such a large numbers of horticulture crops to deal with in this sector.

However, estimation has been done in respect of area, production and productivity of horticulture crops in Sikkim state for the period of 2010-11. The collected information was based on the budget allocation by the Government and farmer's investment according to their preference to various types of horticulture crops in Sikkim state for the same period.

The farmers' of Saku village of East Sikkim got mandarin orange from 15.03% irrigated area in the reference year. Total production from this land area was 966.53 qtl in kharif season with a productivity of 2805.60 kg / ha. Under unirrigated condition, farmers' of this study area in East Sikkim district grew 1.70 ha leafy vegetables, 6.85 ha mandarin orange and 0.10 ha ginger. They obtained 15.95 qtl, 209.60 qtl and 4.50 qtl of leafy vegetables, mandarin orange and ginger, respectively from a total of 15.53% unirrigated area. The estimated average productivity was 938.24 kg / ha for leafy vegetables, 3059.86 kg / ha for mandarin orange and 4500 kg / ha for ginger in kharif season. Leafy vegetables are also grown in 1.54% unirrigated area in Chawang village of North Sikkim. In North Sikkim, total production of leafy vegetables was 51 qtl with a productivity of 1108.70 kg / ha. In Tinzerbung village of West Sikkim, only 10.16% unirrigated land was cultivated for horticulture crops with bitter gourd. Total production of bitter gourd was 19.15 qtl with a productivity of 2697.18 kg / ha in this study area (Table: 6.1).

It has been evident from the Table 6.1, that cultivation of horticulture crops under unirrigated condition was predominant during kharif season. Leafy vegetables and oranges were preferred by most of the farmers in the study area as vegetables and plantation crop, respectively in Sikkim.

Table 6.1: Area, production and yield of horticultural crops (Kharif -2010-11)

District	Name of the Crop*	Irrigated			Unirrigated/Dry			Total		
		Area (ha)	Production (qtl)	Yield (kg/ha)	Area (ha)	Production (qtl)	Yield (kg/ha)	Area (ha)	Production (qtl)	Yield (kg/ha)
East Sikkim	Leafy Veg				1.70	15.95	938.24	**1.70**	**15.95**	**938.24**
	Orange	34.45	966.53	2805.60	6.85	209.60	3059.86	**41.30**	**1176.13**	**2847.77**
	Ginger				0.10	4.50	4500.00	0.10	**4.50**	**4500.00**
Total farmers										
North Sikkim	Leafy Veg				4.60	51.00	1108.7	4.60	**51.00**	**1108.7**
Total farmers										
South Sikkim										
Total farmers										
West Sikkim	Bittergard				.71	19.15	2697.18	.71	**19.15**	**2697.18**
Total farmers										
Total										

Source: Field Survey

Turning to rabi seasons, it has been observed that only 2.72% and 4.13% of irrigated and unirrigated land, respectively were cultivated during rabi season in East Sikkim. Radish and leafy vegetables were cultivated under irrigated condition only. But, cabbage, cauliflower and bean were cultivated under both irrigated and unirrigated condition.

Table 6.2: Area, production and yield of horticultural crops (Rabi -2010-11)

District	Name of the Crop*	Irrigated			Unirrigated/Dry			Total		
		Area (ha)	Production (qtl)	Yield (kg/ha)	Area (ha)	Production (qtl)	Yield (kg/ha)	Area (ha)	Production (qtl)	Yield (kg/ha)
East Sikkim	Radish	3.70	123.14	3328.11				**3.70**	**123.14**	**3328.11**
	Leafy veg.	0.40	4.20	1050.00				**0.40**	**4.20**	**1050.00**
	Cabbage	0.77	38.50	5000.00	0.80	39.50	4937.50	**1.57**	**78.00**	**4968.15**
	Cauliflower	1.12	43.25	3861.61	1.10	39.50	3590.91	**2.22**	**82.75**	**3727.48**
	Bean	0.24	1.80	750.00	0.40	2.20	550.00	**0.64**	**4.00**	**625.00**
Total farmers										
North Sikkim	Radish									
	Leafy veg.									
	Cabbage				8.20	390.50	4762.20	**8.20**	**390.50**	**4762.20**
	Cauliflower									
	Bean									
	cardamom				104.50	126.53	121.08	**104.50**	**126.53**	**121.08**
Total farmers										
South Sikkim	Radish									
	Leafy veg.									
	Cabbage	17.4	885.90	5091.38				**17.4**	**885.90**	**5091.38**
	Cauliflower	10.3	498.90	4843.69				**10.3**	**498.90**	**4843.69**
	Bean	9.40	132.50	1409.57				**9.40**	**132.50**	**1409.57**
	Tomato	2.54	129.40	5094.49				**2.54**	**129.40**	**5094.49**
	Carrot	2.41	79.72	3307.88				**2.41**	**79.72**	**3307.88**
	broccoli	2.52	77.38	3070.63				**2.52**	**77.38**	**3070.63**
Total farmers										
West Sikkim	Radish									
	Leafy veg.									
	Cabbage									
	Cauliflower									
	Tomato	3.93	186.25	4739.19				**3.93**	**186.25**	**4739.19**
	Lady's finger	0.20	2.30	1150.00	0.90	7.00	777.78	**1.10**	**9.30**	**845.45**
	chilli				2.53	35.75	1413.04	**2.53**	**35.75**	**1413.04**
Total farmers										
Total										

Source: Field Survey

The yield figure of each crop expressed clearly that productivity of these crops was better under irrigated condition than unirrigated condition. The farmers of the study area in North Sikkim districts used their 37.78% unirrigated land for cultivating cabbage and cardamom in rabi season. As the respondents of South Sikkim have no unirrigated land for cultivation, they cultivated 100% of their irrigated land during rabi season for cabbage, cauliflower, bean, tomato and carrot vegetables. The highest productivity was recorded for tomato (5094.49kg/ha) followed by cabbage (5091.38 kg/ha), cauliflower (4843.69 kg/ha), carrot (3307.88 kg/ha), broccoli (307.63 kg/ha) and bean (1409.57 kg/ha). But the farmers of West Sikkim study area have both irrigated and unirrigated area. They cultivated 8.37% and 49.07% of irrigated and unirrigated land, respectively for growing tomato, lady's finger and chilli. Tomato was grown in irrigated land only and chilli was grown in unirrigated land only. But lady's finger was grown in both irrigated and unirrigated land. The productivity of lady's finger was higher in irrigated land (1150 kg/ha) than unirrigated land (777.78 kg/ha) (Table. 6.2).

During summer season, ginger was cultivated in both irrigated and unirrigated land in East Sikkim. Ginger occupied 0.36% and 10.81% land of irrigated and unirrigated condition, respectively. Though, utilization of unirrigated land for ginger cultivation was higher, but the productivity was higher in cultivation under irrigated condition. The crop tomato was cultivated during summer as an off-season vegetable in South Sikkim. The productivity of this off-season vegetable under irrigated condition was higher in summer (5210.16 kg/ha) than rabi (5094.49 kg/ha). Ginger and Turmeric are two summer season spice crops in West Sikkim. Ginger and turmeric were cultivated in West Sikkim in 10.62 ha and 0.97 ha land, respectively under unirrigated condition in West Sikkim. Recorded productivity of ginger and turmeric was 5629.94 kg/ha and 3353.61 kg/ha, respectively. These two crops occupied 96.66% of unirrigated land in West Sikkim (Table 6.3).

Table 6.3: Area, production and yield of horticultural crops (Summer: 2010-11)

District	Name of the Crop*	Irrigated			Unirrigated/Dry			Total		
		Area (ha)	Production (qtl)	Yield (kg/ha)	Area (ha)	Production (qtl)	Yield (kg/ha)	Area (ha)	Production (qtl)	Yield (kg/ha)
East Sikkim	Ginger	0.83	43.00	5180.72	6.02	310.20	5152.82	**6.85**	**353.20**	**5156.20**
Total farmers										
North Sikkim										
Total farmers										
South Sikkim	Tomato	7.28	379.30	5210.16				**7.28**	**379.30**	**5210.16**
Total farmers										
West Sikkim	Ginger				10.62	597.90	5629.94	**10.62**	**597.90**	**5629.94**
	Turmeric				0.97	32.53	3353.61	**0.97**	**32.53**	**3353.61**
Total farmers										
Total										

Source: Field Survey,

It is evident from the above discussion that out of this three vegetables season in the Sikkim state, rabi season was preferred most for cultivation of horticulture crops.

As annual crops, banana, cymbidium orchids and papaya had been cultivated in the study area of Sikkim state. Under irrigated condition, 5.62% land of irrigated area in East Sikkim and 1.05% irrigated and 0.29% unirrigated area in West Sikkim were used for banana cultivation. Productivity of banana was higher under irrigated condition as compared to unirrigated condition. Again, the productivity was higher in the same condition in West Sikkim than the productivity of banana in East Sikkim. Cymbidium orchid was grown in 10.65 ha irrigated area in East Sikkim. The flower gave an average yield of 62784 number sticks per ha. In West Sikkim district, 1.35ha irrigated land was utilized for papaya cultivation. Average yield of papaya was 1914.81 kg/ha in West Sikkim (Table-6.4).

Table 6.4: Area, production and yield of horticultural crops (Annual -2010-11)

District	Name of the Crop*	Irrigated			Unirrigated/Dry			Total		
		Area (ha)	Production (qtl)	Yield (kg/ha)	Area (ha)	Production (qtl)	Yield (kg/ha)	Area (ha)	Production (qtl)	Yield (kg/ha)
East Sikkim	Banana	12.88	170.92	1327.02				**12.88**	**170.92**	**1327.02**
	Orchid**	10.65	668650	62784				**10.65**	**668650**	**62784**
Total farmers										
North Sikkim										
Total farmers										
South Sikkim										
Total farmers										
West Sikkim	Papaya	1.35	25.85	1914.81				**1.35**	**25.85**	**1914.81**
	Banana	0.52	7.60	1461.54	0.02	0.24	1200.00	**0.54**	**7.84**	**1451.85**
Total farmers										
Total										

Source: Field Survey, ** Production in No. of Sticks and Yield in No. of Sticks/ha

In the next stage of survey and attempt has been taken to estimate the area of cultivated irrigated land as per the source of irrigation. Survey result indicated that during kharif season a total of 34.45ha land was cultivated under irrigated condition in East Sikkim. Out of this 34.45ha land, 8 ha land was irrigated by tank and 26.45 ha was irrigated from other sources (Table 6.5a).

Table 6.5b exhibited that 52.73ha land was cultivated under irrigated condition during rabi season in the study area of Sikkim State. The 52.73 ha irrigated land was splited in different study area as 6.23 ha in East district, 43.97 ha in South district and 2.53 ha in West district. It has been found from the table that total 52.73 ha irrigated land of three districts got water for cultivating crop from other source of irrigation.

Similar picture in respect of source of irrigation has been observed in East and South district during the summer cultivation of horticulture crops. Total 0.83 ha land in east district and 7.28 ha land in South district were used for cultivating horticulture crops. The crops of this field during summer season got required water from other source of irrigation (Table 6.5c).

Table 6.5a: Distribution of irrigated land area under kharif season by source (in ha)

District	Major Crop Category	Canal	Tube well Diesel	Tube Well Electric	Tank	Open well	Any other	total
East Sikkim	Fruits				8		26.45	34.45
	Vegetables							
	Flowers							
	Spices							
	Garden/plantation							
	Medicinal							
	Aromatic							
Sub-total					8		26.45	34.45
North Sikkim	Fruits							
	Vegetables							
	Flowers							
	Spices							
	Garden/plantation							
	Medicinal							
	Aromatic							
Sub-total								
South Sikkim	Fruits							
	Vegetables							
	Flowers							
	Spices							
	Garden/plantation							
	Medicinal							
	Aromatic							
Sub-total								
West Sikkim	Fruits							
	Vegetables							
	Flowers							
	Spices							
	Garden/plantation							
	Medicinal							
	Aromatic							
Sub-total								
Total					8		26.45	34.45

Source: Field Survey

Table 6.5b: Distribution of irrigated land area under rabi season by source (in ha)

District	Major Crop Category	Canal	Tube well Diesel	Tube Well Electric	Tank	Open well	Any other	total
East Sikkim	Fruits							
	Vegetables						6.23	6.23
	Flowers							
	Spices							
	Garden/plantation							
	Medicinal							
	Aromatic							
Sub-total							6.23	6.23
North Sikkim	Fruits							
	Vegetables							
	Flowers							
	Spices							
	Garden/plantation							
	Medicinal							
	Aromatic							
Sub-total								
South Sikkim	Fruits							
	Vegetables						44.57	44.57
	Flowers							
	Spices							
	Garden/plantation							
	Medicinal							
	Aromatic							
Sub-total							44.57	44.57
West Sikkim	Fruits							
	Vegetables							
	Flowers							
	Spices						2.53	2.53
	Garden/plantation							
	Medicinal							
	Aromatic							
Sub-total							2.53	2.53
Total							53.33	53.33

Source: Field Survey

Table 6.5c: Distribution of irrigated land area under summer season by source (in ha)

District	Major Crop Category	Canal	Tube well Diesel	Tube Well Electric	Tank	Open well	Any other	total
East Sikkim	Fruits							
	Vegetables							
	Flowers							
	Spices						0.83	0.83
	Garden/plantation							
	Medicinal							
	Aromatic							
Sub-total							0.83	0.83
North Sikkim	Fruits							
	Vegetables							
	Flowers							
	Spices							
	Garden/plantation							
	Medicinal							
	Aromatic							
Sub-total								
South Sikkim	Fruits							
	Vegetables						7.28	7.28
	Flowers							
	Spices							
	Garden/plantation							
	Medicinal							
	Aromatic							
Sub-total							7.28	7.28
West Sikkim	Fruits							
	Vegetables							
	Flowers							
	Spices							
	Garden/plantation							
	Medicinal							
	Aromatic							
Sub-total								
Total							8.11	8.11

Source: Field Survey

Annual as well as perennial crops of 12.88 ha and 107692 m^2 area in East Sikkim and 1.87 ha area in West Sikkim were also irrigated from other source of irrigation (Table 6.5d).

Table 6.5d: Distribution of irrigated land area under annual crop season by source (in ha)

District	Major Crop Category	Canal	Tube well Diesel	Tube Well Electric	Tank	Open well	Any other	total
East Sikkim	Fruits						12.88	12.88
	Vegetables							
	Flowers						107692*	107692*
	Spices							
	Garden/plantation							
	Medicinal							
	Aromatic							
Sub-total**							12.88	12.88
North Sikkim	Fruits							
	Vegetables							
	Flowers							
	Spices							
	Garden/plantation							
	Medicinal							
	Aromatic							
Sub-total								
South Sikkim	Fruits							
	Vegetables							
	Flowers							
	Spices							
	Garden/plantation							
	Medicinal							
	Aromatic							
Sub-total								
West Sikkim	Fruits						1.87	1.87
	Vegetables							
	Flowers							
	Spices							
	Garden/plantation							
	Medicinal							
	Aromatic							
Sub-total							1.87	1.87
Total**							14.75	14.75

Source: Field Survey, * Area in m^2 **except orchid (flower)

So, from the above discussion, it may be concluded that the sources of irrigation other than canal, tube well of either diesel or electric operated, tank and open well were predominant for irrigating horticulture crops in the study area of Sikkim state.

During the survey, it was observed that 125 plants had been planted per ha of mandarin orange as fruit crop and 2.34 cymbidium orchids plant per m^2 area as flower in East Sikkim. The density of cardamom plant in North Sikkim was 2068 plants per ha. This is a

Table 6.6: Number of plants in the area covered during different seasons 2010-2011

(Area in ha)

District	Major Crop Category	Kharif		Rabi		Summer		Annual		Total	
	Fruits	Area	Plant	Area	Plant	Area	Plant	Area	Plant	Area	Plant
	Orange	41.3	5185							41.3	5185
	Banana							12.88	6665	12.88	6665
	Vegetables										
	Radish			3.70	6060					3.70	6060
	Leafy Vegetable	1.70	4350	0.40	1000					2.10	5350
East Sikkim	Cabbage			1.57	17400					1.57	17400
	Cauliflower			2.22	25330					2.22	25330
	Bean			0.64	*					0.64	*
	Flowers										
	Cimbedium							107692*	251750	107692*	251750
	Spices										
	Ginger	0.10				6.85				6.95	
Total Farmers											
	Fruits										
	Vegetables										
	Leafy Vegetable	4.60	11500							4.60	11500
North Sikkim	Cabbage			8.20	80800					8.20	80800
	Flowers										
	Spices										
	Cardamom			104.5	216070					104.5	216070
Total Farmers											
Sub-Total											
	Fruits	Area	Plant	Area	Plant	Area	Plant	Area	Plant	Area	Plant
	Vegetables										
	Cabbage			17.40	196700					17.40	196700
	Cauliflower			10.30	123080					10.30	123080
South Sikkim	Bean			9.40	*					9.40	*
	Tomato			2.54	21850	7.28	65160			9.82	87010
	Carrot			2.41	*					2.41	*
	Brocolli			2.52	26780					2.52	26780
	Flowers										
	Spices										
Total Farmers											
	Fruits										
	Papaya							1.35	1325	1.35	1325
	Banana							0.54	302	0.54	302
	Vegetables										
	Tomato			3.93	29600					3.93	29600
West Sikkim	Lady's Finger			1.10	8100					1.10	8100
	Biter guard	0.71	1255							0.71	1255
	Flowers										
	Spices										
	Ginger					10.62	*			10.62	*
Total Farmers	Turmeric					0.97	537			0.97	537
Sub-Total	Chilli			2.53	23252					2.53	23252
Total											

Source: Field Survey,

- *No. of plant cannot be specified in case of Ginger, Bean and Carrot
- ** Area in m^2

spice crop and another one spice crop is ginger. But the density of ginger plantation could not be estimated due to lack of information. The plantation time was kharif season for mandarin orange, both kharif and summer season for ginger and rabi season for cardamom. But, cymbidium orchids had been planted as perennial flower plant. The prominent vegetable crops in the state were leafy vegetables, cabbage, cauliflower, tomato, etc. Leafy vegetables were grown both in khjarif and rabi season. The plant density/ha were almost same in both

the season in different districts, namely, East and north Sikkim. The plant density/ha of cole crops, i.e., cabbage and cauliflower varied from 11083 in East Sikkim to 11305 in South Sikkim for cabbage and from 11410 in East Sikkim to 11950 in South Sikkim for cauliflower. But the plant density/ha of cabbage in North Sikkim was only 9854. Again, plant density/ha of tomato was8602 and 8950 in rabi and summer season, respectively in South Sikkim. Whereas the density/ha of the same crop in West Sikkim was 7532 in rabi season. So, it is clear that plant density/ha of vegetable crops in South Sikkim was higher than any other district for respective crop. Perhaps, this was happened due to higher availability of plant nutrients in the soil of South Sikkim. On the other hand, density/ha of banana plantation was higher in West Sikkim (559) than East Sikkim (517). This was an indication that the soil of West Sikkim was more favourable for banana cultivation in Sikkim state (Table-6.6).

Table 6.7: Distribution of area under mono and mixed cropping in different seasons

(Area in Ha)

District	Major Crop Category	Kharif			Rabi			Summer			Annual			Total		
		Mono	Mixed	Total	Mono	Mixed	Total	Mono	Mixed	Total	Mono	Mixed	Total	Mono	Mixed	Total
East Sikkim	Fruits		41.30	41.30							12.88		12.88	12.88	41.30	54.18
	Vegetables		1.7	1.7	2.67	5.86	8.53							2.67	7.56	10.23
	Flowers										107692*		107692*	107692*		107692*
	Spices		0.10	0.10					6.85	6.85					6.95	6.95
Total Farmers																
North Sikkim	Fruits															
	Vegetables		4.6	4.6	6.6	1.6	8.2							6.6	6.2	12.8
	Flowers															
	Spices				104.5		104.5							104.5		104.5
Total Farmers																
South Sikkim	Fruits															
	Vegetables				18.84	25.73	44.57	4.38	2.9	7.28				23.22	28.63	51.85
	Flowers															
	Spices															
Total Farmers																
West Sikkim	Fruits										0.19	1.70	1.89	0.19	1.70	1.89
	Vegetables	0.71		0.71	4.83	0.2	5.03							5.54	0.2	5.74
	Flowers															
	Spices					2.53	2.53	2.09	9.5	11.59				2.9	12.3	14.12
Total Farmers																
State Total																

Source: Field Survey

Table-6.7 depicts that mixed cropping system of crop cultivation was predominant in all the three districts, viz. East, South and West districts. But in North district, maximum area under cultivation had been followed mono-cropping pattern. In East Sikkim, maximum proportion of mixed cropping was followed in orange field, the fruit crop. But interestingly, the flower field with cymbidium orchids was totally under mono-cropping system. The spice crop (ginger) in this district was cultivated as a crop mixture, whereas the spice crop (cardamom) in North district was cultivated following mono-cropping system. Both mono-cropping and mixed cropping system had been given almost equal importance for vegetable crops in South Sikkim. Again, in West Sikkim, though mono-cropping system was predominant in vegetable garden, but mixed-cropping system attended more importance for spice crops (ginger, turmeric and chilli).

However the overall figure across the study area indicates that mono-cropping system was predominant in respect of area in Sikkim horticulture. This happened due to cultivation of cymbidium orchid and cardamom in a large area following mono-cropping system in the state (Table-6.7).

Table- 6.8 exhibits district wise area, production and farm gate price of horticulture crops in different crop growing seasons including annual as well as perennial plantation crops. It has been observed in East Sikkim that maximum cultivated area had been used for cultivation of mandarin orange and cymbidium orchids. The figure regarding production and price indicates that earning from cultivating one ha area was not attractive for orange fruit, but the earning from one ha flower (cymbidium orchids) was too much attractive, though the area used for flower cultivation was much lower than the area under mandarin orange. The lower income might be the cause of old plantation of orange garden. On the other hand, export opportunity of cymbidium orchids facilitates higher income for the growers. Among vegetables, cabbage gave higher profit followed by cauliflower and radish from one hectare area. But interestingly, lower area for cultivation of cabbage had been used as compared to the area used for cauliflower and radish. The spice crop ginger provided a moderate income from one hectare area in this district. The area used for this crop was also moderate. Besides, a remunerative profit was earned from banana cultivation and 12.88 ha land had been used for this plantation crop in the study area of East Sikkim district.

Turning to North Sikkim, it has been observed that total 117.30 ha land was used for horticulture crops, more specifically for vegetable and spice cultivation. Out of this 117.30 ha land, 104.50 ha (89.09%) had been used for spice crop cardamom cultivation. This spice crop provides a moderate income from unit area of land. Like East Sikkim, cabbage gave an attractive income to its growers in North Sikkim, yet area under cabbage cultivation was lower in this district also.

Among vegetables, maximum area was used for cabbage cultivation in South Sikkim district, though it was only 17.4 ha (33.56%) out of 51.85 ha. From unit area cultivation, maximum was earned from cabbage followed by carrot, tomato, cauliflower, broccoli and bean. The important point may be noted here that allotment of land for cultivating different vegetable crops had not been considered the income from that crop of a unit area.

On the basis of facts and figures regarding area, production and farm gate price of cultivated horticulture crops in West Sikkim, it has been observed that maximum area had been used for ginger cultivation in this district. The income from ginger cultivation was higher in this district than East district from unit area.

Table 6.8: Area, production, marketed qty and farm gate price by season in 2010-11

(Area in Ha; Quantity in qtl, Price in Rs/qtl)

District	Major Crop Category	Kharif			Rabi			Summer			Annual			Total		
		Area	Prod.#	FGP*	Area	Prod.#	FGP*	Area	Prod.#	FGP*	Area	Prod.#	FGP*	Area	Prod.#	FGP*
East Sikkim	Fruits															
	Orange	41.30	1176.13	1782.10										41.30	1176.13	1782.10
	Banana										12.88	170.92	1097.80	12.88	170.92	1097.80
	Vegetables															
	Radish				3.70	123.14	242.00							3.70	123.14	242.00
	Leafy veg.	1.70	15.95	606.80	0.40	4.20	606.80							2.10	20.15	606.80
	Cabbage				1.57	78.00	2485.70							1.57	78.00	2485.70
	C.flower				2.22	82.75	1016.70							2.22	82.75	1016.70
	Bean				0.64	4.00	1500.00							0.64	4.00	1500.00
	Flowers															
	Cymbidium										10.65	668650	56.40***	10.65	668650	56.40***
	Spices															
	Ginger	0.10	4.50	1500.00				6.85	353.20	1775.80				6.95	357.70	1772.30
Total Farmers																
North Sikkim	Fruits															
	Vegetables															
	Leafy veg.	4.60	51.00	573.20										4.60	51.00	573.20
	Cabbage				8.20	390.50	2786.20							8.20	390.50	2786.20
	Flowers															
	Spices															
	Cardamom				104.50	126.53	82250.0							104.50	126.53	82250.0
Total Farmers																
South Sikkim	Fruits															
	Vegetables															
	Cabbage				17.40	885.90	3333.90							17.40	885.90	3333.90
	C.flower				10.30	498.90	1008.80							10.30	498.90	1008.80
	Bean				9.40	132.50	1517.90							9.40	132.50	1517.90
	Tomato				2.54	129.40	1591.20	7.28	379.30	1548.10				9.82	508.70	1559.10
	Carrot				2.41	79.72	3736.00							2.41	79.72	3736.00
	Brocoli				2.52	77.38	899.80							2.52	77.38	899.80
	Flowers															
	Spices															
Total Farmers																
West Sikkim	Fruits															
	Papaya										1.35	25.85	9520.70	1.35	25.85	9520.70
	Banana										0.54	7.84	1097.80	0.54	7.84	1097.80
	Vegetables															
	Tomato				3.93	186.25	1520.60							3.93	186.25	1520.60
	Ladysfinger				1.10	9.30	956.10							1.10	9.30	956.10
	Bittergourd	0.71	19.15	1711.50										0.71	19.15	1711.50
	Flowers															
	Spices															
	Ginger							10.62	597.90	1823.50				10.62	597.90	1823.50
	Turmeric							0.97	32.53	1500.00				0.97	32.53	1500.00
	Chilli				2.53	35.75	3479.50							2.53	35.75	3479.50
Total Farmers																
State Total																

Source: Field Survey, #Production, * Farm Gate Price and Total Marketed Qty, and the latter (FGP) should be given in Parenthesis, *** Price per Stick

It is evident from Table- 6.8, that cultivation of papaya and banana gave highest and second-highest income, respectively from one hectare area, yet the area under these crops were lower as compare to some other crops in this study area. Tomato is another attractive profit earning vegetable crop in the district. The area under this crop was 3.93 ha, which is not as less as compare to other crops. A new crop, bitter gourd, had been cultivated in this study area. This crop provided an income almost same with the income from a spice crop chilli. But the area under bitter gourd was three and half times less than the area under chilli. Turmeric, another spice crop had been cultivated in 0.97 ha land and it gave a moderate income from unit area (Table-6.8).

However, from the above discussion, it is evident that maximum profit earning crops in Sikkim were papaya, banana, cabbage, tomato, etc. But the land under these crops was not as per expectation. Perhaps, there were no much lands that are suitable for papaya and banana cultivation. The state has lack of cold storage and wire house. Probably this the reason for cultivation of cabbage, tomato, etc. profit maximizing but perishable crops in a limited area of cultivating land.

6.2 Area, Production and Yield estimated by the above Agencies

No any agency, except the Horticulture & Cash Crop Development Department (H&CCDD) of Sikkim government, took initiative for collecting data in respect of area, production and productivity of horticulture crops in the state. However, the estimated district level data by the Horticulture & Cash Crop Development Department and the collected village level data from the selected villages of each district under this survey have been furnished in Table 6.9. It has been found from the table that no any particular vegetable crops had been mentioned by its name. Vegetable crops were mentioned by its growing season, i.e., kharif, rabi, summer or off-season vegetables. Some crops were also mentioned as fruits, root & tuber crops, etc. Only the estimation of cymbidium orchids, mandarin orange and spice crops, like, large cardamom, ginger and turmeric were done by its name.

Table 6.9: Data collecting agency and the crops covered with area, production and yield in 2010-11

District	Name of the Crop*	Agency	Area ('000Ha)	Production ('000qtl)	Yield (kg/ha)
East Sikkim	Cymbidium Orchid	H&CCDD	0.039	49.960*	128102**
	Sikkim Mandarin	H&CCDD	3.430	5.250	3035
	Rabi Vegetables	H&CCDD	1.593	7.798	4895
	Ginger	H&CCDD	2.730	14.312	5242
	Fruits other than Orange	H&CCDD	1.410	1.778	1260
Sub-Total			9.163***	29.138***	3179***
North Sikkim	Large Cardamom	H&CCDD	4.783	1.042	218
	Kharif Vegetables	H&CCDD	0.553	2.444	4419
	Rabi Vegetables	H&CCDD	0.343	1.637	4772
Sub-Total			5.697	5.123	899
South Sikkim	Rabi Vegetables	H&CCDD	1.693	8.515	5029
	Kharif Vegetables	H&CCDD	1.173	6.503	5543
	Off Season Vegetables	H&CCDD	1.965	11.318	5760
	Root & Tuber Crops other than Potato	H&CCDD	0.227	1.179	5194
Sub-Total			10.033	26.563	2648
West Sikkim	Ginger	H&CCDD	2.546	13.648	5360
	Turmeric	H&CCDD	0.277	0.951	3433
	Kharif Vegetables	H&CCDD	1.140	5.795	5543
	Rabi Vegetables	H&CCDD	1.268	6.330	4992
	Fruits other than Orange	H&CCDD	1.775	2.369	1334
Sub-Total			7.006	29.093	4153
Total			31.899***	89.917***	2819***

Source: Annual Report, Department of Horticulture and Cash Crop Development, Govt.of Sikkim.
*In lakh number, ** Number per hectare, *** Except Cymbidium Orchid

6.3 Difference between the Two Estimates (Survey and Agencies)

To estimates the difference of productivity between two estimates (survey and agency), the survey data have been grouped as per agency-procedure and presented in Table-6.10. As village level data had been collected in survey and district level data had been published by the agency for estimating area, production and productivity, so there was no practical reason for comparing data in respect of area and production between these two

estimates. However, it should be noticed first that only 0.76%, 2.06%, 0.52% and 0.31% area in East, North, South and West districts, respectively had been surveyed as compared to the area estimated by the agency across the district. So, a variation in results of productivity between the survey and estimate is quite natural, especially for the group of crops, like, kharif vegetables, rabi vegetables, etc. Though, the productivity of rabi vegetables in North Sikkim was almost

Table 6.10: Difference between the estimates (A, P, Y) of survey and agency

District	Name of the Crop*	Estimates of Survey			Estimates of Agency			Difference
		Area (Ha)	Production (qtl)	Yield (kg/ha)	Area ('000Ha)	Production ('000qtl)	Yield (kg/ha)	Yield (kg/ha)
East Sikkim	Cymbidium Orchid	10.65	6.687*	62789**	0.039	49.960*	128102**	-65313
	Sikkim Mandarin	41.3	1176.13	2847.77	3.430	5.250	3035	-187.23
	Rabi Vegetables	8.53	292.09	3424.27	1.593	7.798	4895	-1470.73
	Ginger	6.95	357.70	5146.76	2.730	14.312	5242	-95.24
	Fruits other than orange	12.88	170.92	1327.02	1.410	1.778	1260	67.02
Sub-Total		69.66***	1996.84***	2866.55***	9.163***	29.138***	3179***	-312.45
North Sikkim	Large Cardamom	104.50	126.53	121.08	4.783	1.042	218	-96.92
	Kharif Vegetables	4.60	51.00	1108.70	0.553	2.444	4419	-3310.30
	Rabi Vegetables	8.20	390.50	4762.20	0.343	1.637	4772	-9.8
Sub-Total		117.30	568.03	484.25	5.697	5.123	899	-414.75
South Sikkim	Rabi Vegetables	42.16	1724.08	4089.37	1.693	8.515	5029	-939.63
	Kharif Vegetables				1.173	6.503	5543	
	Off Season vegetables	7.28	379.30	5210.16	1.965	11.318	5760	-549.84
	Root & Tuber Crops other than Potato	2.41	79.72	3307.88	0.227	1.179	5194	-1886.12
Sub-Total		51.85	2183.10	4210.41	10.033	26.563	2648	1562.41
West Sikkim	Ginger	10.62	597.90	5629.94	2.546	13.648	5360	269.94
	Turmeric	0.97	32.53	3353.61	0.277	0.951	3433	-79.39
	Kharif Vegetables	0.71	19.15	2697.18	1.140	5.795	5543	-2845.82
	Rabi Vegetables	7.56	231.30	3059.52	1.268	6.330	4992	-1932.48
	Fruits other than Orange	1.89	33.69	1782.54	1.775	2.369	1334	448.54
Sub-Total		21.75	914.57	4204.92	7.006	29.093	4153	51.92
Total		260.56***	5662.54***	2173.22***	31.899***	89.917***	2819** *	-645.78***

Source: Field Survey & Annual Report, Department of Horticulture and Cash Crop Development, Govt.of Sikkim.
*In lakh number, ** Number per hectare, *** Except Cymbidium Orchid

same for these two estimates. This result was perhaps the reflection of considering almost same number of crops under survey and estimates in rabi season in North Sikkim. On the other hand, individual crop like, mandarin orange, ginger and turmeric exhibited parity in result of productivity between survey and estimates. But there was a vast gap in productivity of cymbidium orchids and large cardamom between village and district level estimates. It was happened because orchids flower and large cardamom were not in fully matured stage in the village level estimates. Despite some disparity in results of some horticulture crops, fruits other than orange exhibited almost equal productivity in village and district level estimates in East Sikkim. But, the productivity of fruits other than orange was not even almost equal between village and district level data in West Sikkim. However, it may be concluded on the basis of this result that only 260.56 ha area in four districts of Sikkim was surveyed for this study. It was only 0.82% of the area that was estimated by the agency across the districts. This small area of course showed a compatible result of productivity as compared to district level estimates in a number of horticulture crops in Sikkim state.

CHAPTER-VII
Local Crops that have not been included while estimating of Horticultural Crops

The state of Sikkim has a wide diversity in the variety of horticultural that is grown across the state. There are flowers, fruits, vegetables, spices of different kinds. Among the fruits there is Oranges, Papaya, Banana, cabbage, cauliflower, broccoli, tomato among vegetables, cardamom, ginger, turmeric among spices and wide variety of flowers including Cimbidium Orchid. The Horticulture and Cash Crop Development Department under Government of Sikkim looks after the development of horticulture in the state. Improving the land use, enhancing crop diversification and generating employment has been the focal point for the department in course of development of the horticultural sector. We discussed earlier that over last three years from 2009-10 the area, production and productivity have increased substantially across the state.

Estimation of productivity of various horticultural crops is one of the major tasks of the department. For the purpose crop cutting experiments are carried out at cluster or Gram Panchayat Unit level, which are co-terminus, every year. Most of the field crops including vegetables, fruits, spices and flowers get accounted in the process.

But one of the main problems in such estimation is that the process does not incorporate the area and production in the kitchen garden or field bunds. Also in some areas the plants of some fruits like Guava, Local Peach is stray and scattered, production from which does not get reflected in the estimation. Also the area under such crops is not recorded. Though total area under and output from such crops are meager as compared to the field crops, nonetheless they contribute to consumption and income of the family. Hence, it has impact on household's consumption basket and livelihood.

In course of the study we found crops like leafy and off season vegetables, beans, Cherry Pepper, Chayote are often being left out of accounting. This is mainly because of the fact that these are grown in the kitchen garden. Among leafy vegetables Spinach and Lettuce are important. Area and production of Beans, Pumpkin etc. also do not get reflected. Had these crops been cultivated in the main land of the households, they would have their contributions to the area and productivity accounts. Cherry Pepper is an indigenous variety of chilli that is quite popular in Sikkim for its flavour and pungency. The horticulture department is promoting its cultivation in a larger scale. Chayote, though originally a vegetable of Mexican origin, is very popular in these parts. Especially in North district households having one or two Chayote tree in the kitchen garden is a common phenomenon. In most of the cases output from these plants is not marketed. These are generally consumed by the family and do not get their contribution recorded in the state's accounting process.

7.1 Crops not covered in the estimation

We came across a number of crops that could not register their share in the horticulture estimate. In East Sikkim were crops like Leafy vegetables and Tomato, while in North were Leafy and Mixed vegetables, Brinjal, Tree Tomato, Chayote, Chilli and in South were Cabbage, Chilli and Tomato (Table 7.1). Main reason, as it appear from the survey, is shortage of trained personnel for accounting the output of kitchen garden. Moreover, the Horticulture department does not incorporate the production from kitchen garden in their estimate. For some of the crops the department has to depend on the productivity estimates of the demonstration plots.

Table 7.1: Crops not covered in the estimations and reasons in 2010-11

Name of the Village/Block	Name of the Crops	Reason 1	Reason 2	Remarks
East Sikkim	Leafy Vegetables Tomato	Shortage of personnel for estimating production under Kitchen Garden	The Department has no policy to incorporate the crops grown in kitchen garden	These are basically eye estimates depending on approximate area.
North Sikkim	Leafy Vegetables Mixed Vegetables Brinjal Tree Tomato Cilli Chayote	Only the field crops are taken into account. Production under Kitchen Garden is left out	For Other Vegetables The Department has to depend on the productivity estimates in demonstration plots.	
South Sikkim	Cabbage Chilli Tomato	Production of crops under main land is accounted for. But estimation of production under Kitchen Garden is left out.		

7.2 Area, Production and Productivity of Left-Out Crops

In course of the study we came across crops like Leafy vegetables and Tomato that are being cultivated in the kitchen garden by the households in East Sikkim (Table-7.2). The food habit in Sikkim is such that people use these crops quite abundantly. Apart from these two, another crop that is quite popular among people in these parts is Cherry Pepper. This is a local variety of Chilli which has a good market potential of its own.

In the northern part, however, there are crops like Brinjal, Tree Tomato, mix of vegetables like Bean, Lady's Finger that have their demand for domestic consumption of the

households. Another crop, though of foreign origin, is very popular in these parts is Chayote. Productivity of the crop is also substantially high.

In South Sikkim, once again, there are varieties of vegetables that are being grown by the households. In South, however, cultivation of a wide range of vegetables is very popular.

Table 7.2: Households having crops that have not been included

District	Crop*	Area (in ha)	Production (qtl)	Yield (Kg/Ha)
East Sikkim	Leafy vegetables	.053	3.15	5943
	Tomato	.058	4.72	8138
North Sikkim	Leafy vegetable	.007	.60	8571
	Brinjal	.010	.40	4000
	Mixed vegetable	.086	5.60	6512
	Tree tomato	.003	.31	10333
	Chilli	.007	.30	4286
	Chayote	.024	10.0	41666
South Sikkim	Cabbage	.006	.41	6833
	Chilli	.021	.66	3143
	Tomato	.008	.32	4000
West Sikkim	-	-	-	-
	-	-	-	-
	-	-	-	-
Total		**0.274**	**26.47**	**9661**

7.3 Comparative Performance of Crops

We have tried to make a comparison between the yields of crops that are being grown both in the main land of the household in the cropping fields vis-à-vis the kitchen garden.

Table 7.3: Comparative yield rates

Name of Crop	Yield (Main Land) Kg/Ha	Yield (Kitchen Garden) Kg/Ha
Leafy vegetables	1031	6250
Tomato	5054	7636
Cabbage	4985	6833
Chilli	1413	3429

It was interesting to observe that in all cases the productivity of crops grown in the kitchen garden were higher than those cultivated in the main land (Table-7.3). Crops like Leafy vegetables, Tomato, Cabbage and Chilli registered substantially higher productivity in comparison with their main land counterpart. The reason may lie in the fact that the kitchen gardens are nurtured mainly by the female members of the family. It is a fact that women are more caring. And under their caring eyes the plants give more output.

7.4 Economics of Indigenous Crops

It appears from the study that the area under the crops in the kitchen garden that are not included in course of the estimation process account for a small fraction of the area under similar field crops. And hence their share to the family income, with imputed farm gate price for similar crops, is only meagre. Addition to annual family income from these crops is to the

tune of only Rs.352.08 per household (Table-7.4). We said earlier that the productions from these crops do not generally enter the market, but are consumed at the family level. But when looked upon in terms of their productivity, they register their impression as being highly productive.

Table 7.4: Value of output that have not been included

District	Crop*	Number of Households	Value (in Rs.)	Value per House-hold (in Rs)
	Leafy vegetables	10	3150.00	315.00
	Tomato	29	12200.00	420.69
East Sikkim				
	Leafy vegetable	1	600.00	600.00
	Brinjal	2	440.00	220.00
	Mixed vegetable	22	6745.00	306.59
North Sikkim	Tree tomato	3	3650.00	1216.67
	Chilli	3	600.00	200.00
	Chayote	8	5280.00	660.00
	Cabbage	3	545.00	181.67
South Sikkim	Chilli	14	1710.00	122.14
	Tomato	6	640.00	106.67
	-	-	-	-
West Sikkim	-	-	-	-
	-	-	-	-
Total		**101**	**35560**	**352.08**

It is found that Tree Tomato, Chayote and Leafy Vegetables in North district are more remunerative than the other crops. In particular, Chayote which have a sizeable demand and Tree Tomato which has much higher productivity may be nurtured for increasing the income of the households. But over and above it is the motherly love and care of the small bit of land in the kitchen garden by women, that assumes importance in increasing the productivity.

In Sikkim, however, the Horticulture department is taking initiative to improve land utilization, increasing productivity and extending crop diversification. Rich biodiversity and wide ranging topographical variations give Sikkim enormous possibility of horticultural crops.

CHAPTER-VIII
Difficulties Encountered by the Agencies while Compiling Horticulture Data

In our earlier chapter we discussed about the method of data collection by the Horticulture department and other agencies in Sikkim. We also discussed that only the crop cutting experiment is being carried by this department to ascertain the annual productivity of horticultural crops across the state. Data are collected at cluster or Gram Panchayat Unit level which is an agglomeration of few Gram Panchayat Wards or villages. Trained personnel of the Horticulture department carry out the data collection selecting samples across the cluster. The Horticulture Inspectors at the cluster level are the ones responsible for such data collection.

Once the data is collected at the field level it is cross examined and verified at the cluster level itself (Figure-8.1, Table-8.1). Any anomalies, if registered, get corrected in this process. After finalization of the crop cutting estimates these are forwarded to the district head quarters.

Figure 8.1
Flowchart for the Horticulture Data

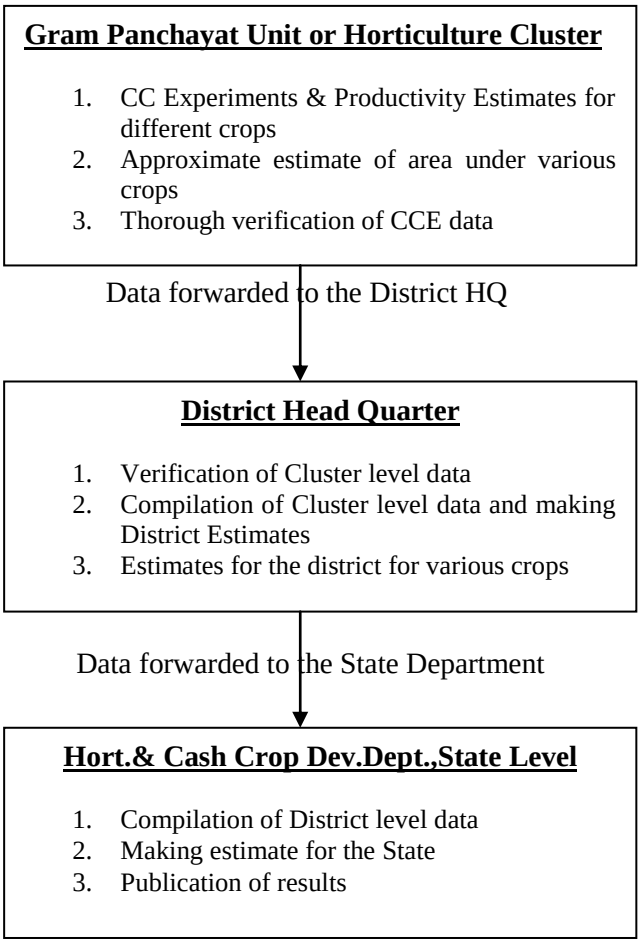

Table 8.1a: Forwarding collected data and verification of horticulture crops (Horticulture and Cash Crop Development Department)

Crops	Cluster to District	District to State	Verification		
			At cluster level	At district level	At state level
Fruits	Yes	Yes	Yes	Yes	No
Vegetables	Yes	Yes	Yes	Yes	No
Flowers	Yes	Yes	Yes	Yes	No
Spices	Yes	Yes	Yes	Yes	No

At the district head quarters the data received from various clusters are checked and verified prior to compilation. The district level estimates for different crops are calculated on the basis of cluster estimates. For all the field crops considered in the present the data are being thoroughly verified at the district level by the Horticulture Development Officer and Deputy Director, Horticulture. The data collected by agencies like RKVY and VIUC also get verified both at cluster as well as district level (Table 8.1b). After estimating the area, production and productivity of various crops for the district, the estimates are forwarded to the state level.

In the state directorate, the district level data are used to arrive at the estimate for the state as a whole. No detailed verification is carried out at this level as regards to the information supplied by the district level departments. The Horticulture and Cash Crop Department publishes the results annually.

Table 8.1b: Forwarding collected data and verification of horticulture crops (Rashtriya Krishi Vikas Yojna, Vegetable Initiative Urban Cluster)

Crops	Cluster to District	District to State	Verification		
			At cluster level	At district level	At state level
Fruits					
Vegetables	Yes	Yes	Yes	Yes	No
Flowers					
Spices					

8.1 Problems Faced while collecting Horticulture Data

The government of Sikkim collects horticulture data with their own machinery. Departmental personnel are involved in such an exercise. In course of the study we had discussions and interviewed government officials at various levels.

In the grass root, the Horticulture Inspectors did opined having no exact and updated record about the area under various horticultural crops. Though the Village Level Officers under the Department of Revenue have some records of area, but it seems deficient. The record there is kept for major field crops. But horticultural statistics necessitates a more detailed account across different regions and varieties of crops that are not available with the department of revenue. Moreover, as we discussed earlier, that accounting jurisdiction between the two departments are different. Hence, no comprehensive estimate of the area is available with the horticulture department (Table 8.2a,b,c & d). The horticulture department

does not have any machinery of their own to collect such data. The fact is corroborated by district and state level officials too.

Secondly, there is no agency other than the horticulture department, except for RKVY and VIUC in South district, which is collecting these data. So, no cross verification of the estimates could be made to ascertain authenticity.

Table 8.2a: Problems faced by different agencies while collecting data (Department of Horticulture and Cash Crop Development)

District	Problem	Fruits	Vegetables	Flowers	Spices
East Sikkim	1	No machinery to keep detailed record of area under the crop		Spikes vary in size and number per plant. So it is difficult to get an exact estimate of production	
	2	Shortage of trained personnel to carryout crop cutting experiments		The plants start flowering after 3-4 years and production increases till 10^{th} year. After that production declines. So there remains difference in productivity across younger-older plants in one hand and fully grown-up plants on the other	
	3	There is no other agency or department that collect such data. Hence, it is not possible for the Department to cross verify collected data.			

In the East district Cymbidium orchid present separate problems. Cymbidium orchids are planted in pots – one pot for one plant. The plants starts flowering after 3-4 years of plantation. From 5-6^{th} year onwards production increases till about 10^{th} year. After 10^{th} year production once again declines. Fully grown plant give 5-6 spikes per plant but for the older and younger plant productivity is low. Moreover, the spikes vary in size across the plants. So, it becomes difficult to estimate the exact productivity. Hence, four spikes per plant on an average is assumed to estimate productivity of Cymbidium orchid.

Table 8.2b: Problems faced by Different Agencies while collecting Data (Department of Horticulture and Cash Crop Development)

District	Problem	Fruits	Vegetables	Flowers	Spices
North Sikkim	1				No machinery to keep detailed record of area under the crop. Though area under Large Cardamom is kept by local level official of Dept. of Land Revenue, but the record is not updated at regular interval
	2				As Large Cardamom is planted in hilly tract the area estimates are done in a roundabout method. About 55-60 plants covering an area of 5 metre square is taken as an estimate for area.
	3				Though training for Crop Cutting Experiment is being done, there remains shortage of trained personnel.

Large Cardamom, cultivated extensively in the North District, has different specificities and problem of its own in the process of estimation. Large Cardamom plantation is done in the undulated terrains of the hills. It is difficult in such a tract to estimate the area under cultivation. Hence, in crop cutting experiments an indirect method is applied. Taking the standard spacing norm for Large Cardamom about 55-60 plants are selected that are supposed to cover an area of 5 metre square. Productions from those plants are measured and productivity thus estimated. But under such circumstances the level of exact productivity cannot be estimated. Though record of area under Cardamom plantation is kept by the revenue officials, the information is not updated at regular interval.

Table 8.2c: Problems faced by different agencies while collecting data (Department of Horticulture and Cash Crop Development)

District	Problem	Fruits	Vegetables	Flowers	Spices
South District	1		No detailed estimate of area being done by the Department. The Department carries out Crop Cutting Experiments for major vegetables like Cabbage, Cauliflower, Tomato, Broccoli, Carrot etc.		
	2		Due to shortage of personnel, Crop Cutting Experiments for Leafy Vegetable crops such as Spinach, Lettuce etc are left out of such experiments.		
	3		Vegetables grown in the Kitchen Garden are left out of Crop Cutting Experiments		

In South and West Sikkim, however, the basic problem remains the same – dearth of reliable area estimate. In Southern district there is abundance of different kinds of vegetables both under sole and mixed cropping practices. Under such circumstances, with no reliable estimate of area under crops, it becomes difficult for the horticulture department to estimate area, production and productivity (Table 8.2c). The West district, however, presents shortage of trained personnel as one of the main problems (Table 8.2d). Another important problem for Ginger lies in the fact that during crop cutting experiments the weight of Ginger that is recorded gets reduced with passage of time as it becomes dry. This results in a difference in productivity estimates which does not get its reflection.

Table 8.2d: Problems faced by different agencies while collecting data (Department of Horticulture and Cash Crop Development)

District	Problem	Fruits	Vegetables	Flowers	Spices
West Sikkim	1				Crop Cutting experiment is carried out for ginger for estimating the productivity. Output per 5 metre square area is estimated
	2				More trained personnel is required for estimating area and production of crops
	3				No agency or department other than the Dept. of Agriculture and Horticulture presently collecting such data. Hence, it is not possible to compare two sets of results.

Table 8.2e: Problems faced by different agencies while collecting data (Rashtriya Krishi Vikas Yojna, Vegetable Initiative Urban Cluster)

District	Problem	Fruits	Vegetables	Flowers	Spices
South Sikkim	1		No detailed estimate of area being done by RKVY or VIUC. They carry out Crop Measurement for major vegetables like Cabbage, Cauliflower, Tomato, Broccoli, Carrot etc and estimate the area.		
	2		They carry out production estimation for vegetables in collaboration with the Dept. of Horticulture.		
	3		Absence of reliable area estimates.		

8.2 Comparison of Data on Horticultural Crops with other Agencies

In Sikkim, as we have said earlier, there are no other agencies except RKVY and VIUC in South that are collecting horticulture data. So, there is no question of comparing the data collected by different agencies. However, in the South district RKVY and VIUC are working in collaboration with the Department of Horticulture. In the South district, production data collected through crop cutting experiments are cross verified thoroughly by these agencies and the department (Table 8.3). But the dearth of exhaustive area estimation remains there too.

8.3 Suggestion made by Different Agencies

We had the opportunity of having discussions with personnel involved with horticulture data collection at different level. In the grass root there are Horticulture Inspectors, at the district level there are Horticulture Development Officers and Deputy Director, Horticulture and at the state level is Additional Director and Principal Director, Horticulture and Cash Crop

Table 8.3: Comparison of data on horticultural crops with other agencies in 2010-11

District	Crops	Comparison		If yes, Give details
		Yes (1)	No (2)	
East Sikkim	**Fruits**		2	
	Vegetables			
	Flowers		2	
	Spices			
North Sikkim	**Fruits**			
	Vegetables			
	Flowers			
	Spices		2	
South Sikkim	**Fruits**			
	Vegetables	1		Production data for vegetables are collected by the Department as well as RKVY & VIUC in a collaborative way and compared.
	Flowers			
	Spices			
West Sikkim	**Fruits**			
	Vegetables			
	Flowers			
	Spices		2	

Table 8.4: Suggestions made by different agencies for the improvement of horticulture crops

Departments	1	2	3
Horticulture and Cash Crop Development	A dependable and updated source of data on Area under different horticultural crops is essential in order to have a thorough estimate of Area, Production and Productivity for such crops.		
DES			
NSSO			
Forest			
Revenue			
RKVY and VIUC	The method of collection is satisfactory and collaboration with the Department of Agriculture and Horticulture seems to be very helpful.		

Development Department. It was interesting to find that suggestions in all levels centred around making an arrangement for a exhaustive and thorough estimate for area under different horticultural crops in the state (Table-8.4). In a state like Sikkim, where there is wide topographical and morphological diversity of land and a wide variation in climatic conditions, such an estimate is call of the hour. Unless and until such an estimate is done it won't be possible to estimate the prevailing situation and explore the avenues of future development. But unfortunately, the department has no machinery of its own to carry out the exercise. Hence, collaboration between different departments at the government level may be the wisest solution.

CHAPTER-IX
Conclusion and Policy Implications

9.1 Brief findings of the Study

9.1.1 Background of the respondents and the households

The prime age group for farm operation are 26-50 years and 51-60 years. It has been observed from the survey that 43.3%, 52.4%, 27.5%, 18.7% and 19.6% respondents were in the age group of 26-60 years in Assam Lingzey, Saku, Chawang, Sallybong and Tinzerbung village, respectively. It has also been observed that there was no respondent of above 60 years of age in the study area.

Major literate persons obtained education up to 5-7 standard in Chawang (40.0%) and Tinzerbung (74.5%) village. The maximum literate persons were identified in the category of upto 4 standard of education in Sallybong village. The percentage of respondents having degree / graduate level of education was low and they were found in Assam Lingzey, Saku and Sallybong village only. Above 60% of the family members of the respondents in Assam Lingzey and Saku village have taken education from a university. It has been estimated that 90%, 78% and 80.4% of the family members of the respondents of Chawang, Sallybong and Tinzerbung village, respectively have obtained their education (5-12 std) from a school.

The Assam Lingzey, Saku and Sallybong village were dominated by OBC population. Chawang village was predominantly tribal with ST population by 100 percent. On the other hand, more than 50% respondents were of general category in Tinzerbung village.

Total Hindu and Buddhist responded population (100%) had been observed in Saku and Chawang village, respectively. In Assam Lingzey village, more than 50% and 40% respondents were Buddhist and Hindu, respectively. In Sallybong village, 78% of the respondents were Buddhist by religion. The majority (51%) of respondents in Tinzerbung village were Hindu.

Almost all farms (97.5%) in Chawang village were large by size. In Assam Lingzey and Saku village, 79.1% and 69.1% operational holdings were marginal and small, respectively by size jointly. In Sallybong village, 61% and 32.2% operational holdings were marginal and small farms. Only 5.9% operational holdings were under the category of medium farm by size in Tinzerbung village. Rest of the land holdings in the village was either marginal or small by size.

Above 30% of both the male and female population was above 15 years old in all the study villages, except Sallybong village. There were above 40% of both male and female population of above 15 years old. The overall picture indicates that there were around 40% of both male and female population of above 15 years old in the study area. Only 24% of the population was children of below 15 years old.

Earning members in the study area ranged from 32.01% in Tinzerbung village to 44.44% in Chawang village. The percentage of active workers existed in the sample

households was almost same with the percentage of either above 15 years old male or 15 years old female population in the study area. However, the overall percentage of earning members across the study area was 37%, which made parity with the percentage of earning members of each village.

The average annual family income in Assam Lingzey of East Sikkim was higher (Rs. 4,00,070.68) than the income per earning member as well as the average annual family income of the Tinzerbung village of West Sikkim (Rs. 97,266.32). The proportion of earning members per family was also higher in Assam Lingzey than Tinzerbung. But, despite almost same proportion of earning member in each family in Saku of East district and Sallybong of South district, the income per earning member of Saku village was too low. On the other hand, though the proportion of earning member per family was highest in Chawang of North district, yet annual income per earning member as well as annual family income was almost same with Tinzerbung village of West district. These two were spice growing area and the spice crop cardamom & ginger were grown in Chawang & Tinzerbung village, respectively.

9.1.2 Land ownership details/cropping pattern

The total area of land holdings of the selected villages across the study area was 173.25, 111.63, 340.75, 66.00 and 56.33 ha for Assam Lingzey, Saku, Chawang, Sallybong and Tinzerbung villages, respectively. The proportion of irrigated area was highest (100%) in Sallybong village. Around 90% of the cultivated area was irrigated in Assam Lingzey and Tinzerbung village. Though, proportion of irrigated area was moderate (60%) in Saku village but it was very poor (12.5%) in Chawang village. The overall irrigated area across the study area was 52% and unirrigated area was 48%.

Out of 182.30 ha cultivable land, only 9.05 ha (4.96%) and 10.79 ha (5.92%) land were leased in and leased out, respectively in Assam Lingzey village following “crop & cost sharing” condition. Out of 116.13 ha cultivable land in Saku village, only 4.50 ha (3.87%) land was leased in under the condition of “crop sharing”. Again, among 9.00 ha (7.75%) leased out land in the same village, 8.50 ha land had been leased out according to “crop sharing” system and the rest 0.50 ha land had been leased out maintaining “crop & cost sharing” decision. Only 0.80 ha (1.20%) and 4.60 ha (7.55%) land were cultivated in Sallybong and Tinzerbung village, respectively under ‘crop & cost sharing” condition of leased in type.

Horticulture crops cultivation were being practiced by all the respondents in Saku, Chawang and Tinzerbung villages since more than 5 years long back. Besides, around 50% of the respondents in both Assam Lingzey and Sallybong villages were involved in horticulture sector since more than 5 years long back from the time of reference year. The overall picture indicates that above 80% of the respondents are engaged in horticulture crops cultivation since more than 5 years long back from the reference year in Sikkim state.

9.1.3 Motivating factors for cultivation of horticultural crops

The overall picture shows that the motivating factors according to the importance are government assistance, good price, easy availability of inputs, proximity to market and easy to grow across the study area.

9.1.4 Destruction and rejuvenation of horticulture Crops

Total 17.50 ha area of orchard plantation had been rejuvenated in East Sikkim only. From 17.50 ha area, 1750 plants of mandarin orange had been removed due to old age reason.

9.1.5 Kitchen garden/bund/rooftop plantation

In East Sikkim, only 22% households (39 hh of total 176 hh) were practiced kitchen garden / backyard garden in their homestead area. The land area used for this purpose was also low. It was 0.111 ha. In North Sikkim, almost all family (97.5%) were engaged in practicing kitchen garden / backyard garden. They cultivated a number of vegetable crops in 0.128 ha of their homestead land. In South Sikkim, out of 59 households, 23 households were found to be involved in kitchen garden / backyard garden with 0.035 ha land area. It had been found that no one family had crop land on field bund in Sikkim, except North Sikkim. In North Sikkim, 20% family (8 families of total 40 families) had crops only on field bund. Total area of field bund lands of these 8 families were 0.009 ha.

9.1.6 Adoption of new technologies by the farmers

It had been observed in survey that only 22.78%, 22.50% and 29.41% respondents in East, North and West Sikkim, respectively adopted poly house cultivation in their horticulture farms. Average size of each farm was 116.30 m^2. Only 20.27%, 27.50% and 7.84% farmers in East, North and West Sikkim, respectively adopted Green house cultivation. The average farm area under Green house was 125.8 m^2. Besides, INM / IPM practices were adopted by 27.45% farmers in West Sikkim only. Maximum area under Poly house and Green house was in East Sikkim and no adoption of these two technologies was found in South Sikkim.

9.1.7 Benefits received from the government for the development of horticulture

It had been reported that 2.27% households under floriculture scheme in East Sikkim, all the farmers under VIUC scheme in South Sikkim and 37.25% respondents under GAEP scheme in West Sikkim got assistance with seed from government side.

Among total farmers, 34.66% under floriculture scheme and 5.11% under ORP scheme in East Sikkim, 70% under CAEP scheme and 30% under SAEP scheme in North Sikkim, 98.31% under VIUC scheme in South Sikkim and 7.84% under GAEP scheme in West Sikkim received seedlings of horticulture plants in last 5 years.

Only 1.14% and 5.11% of total farmers under floriculture and ORP scheme, respectively in East Sikkim, 2.5% under CAEP scheme in North Sikkim and 7.84% under

GAEP scheme in West Sikkim got assistance and no one farmers in the study area assisted with credit from an institutional source of finance.

Out of total farmers 35.23% and 5.11% under floriculture and ORP scheme, respectively in East Sikkim, 52.5% and 25% under CAEP scheme and SAEP scheme, respectively in North Sikkim, 100% farmers under VIUC scheme in South Sikkim and 33.33% farmers under GAEP scheme in West Sikkim got assistance with plant protection materials from Govt. side.

Maximum farmers were given assistance with chemicals under CAEP scheme (70%) and SAEP scheme (27.5%) in North Sikkim. This assistance were given to a very few farmer under floriculture scheme (1.70%) in East Sikkim and under GAEP scheme (7.84%) in West Sikkim.

Only 5.11% farmers under ORP scheme got assistance with drip irrigation in East Sikkim only. It is also evident from this table that no one farmer received assistance from Government in respect of sprinkler irrigation.

Total 35.23% and 5.11% farmers under floriculture and ORP scheme, respectively in East Sikkim, 70% and 27.5% farmers under CAEP and SAEP scheme, respectively in North Sikkim, 100% farmers under VIUC scheme in South Sikkim and 37.25% farmers under GAEP scheme in West Sikkim were trained with an objective for improving horticulture crop cultivation in the Sikkim state.

9.1.8 Problems faced by the respondents

The intensity of these problems was measured by the number of farmers who responded to these problems as they had to face in real life. It had been observed that labour availability was a serious problem in production side as it ranked 4th among all the types of problem. On the other hand, lack of storage from marketing side ranked 1st as serious type of problems. Besides, lack of good packaging materials and market facility both were informed as 2nd most important types of problem. Another important problem was related to road infrastructure.

9.1.10 Farmers contracted by the Agencies

It has been found that in the year 2008 and 2009, no information had been collected from the farmers of the study area. Only monitoring was done by the departmental officials. As a result, no information in respect of area, production as well as productivity of horticulture crops were collected in the year 2008 and 2009 from the study area. But from 2010 onwards crop cutting experiment had been conducted, besides collecting information regarding area under horticulture crops in the study area.

9.1.11 Prospects of horticulture expressed by farmers

The Sikkim state is declared as "Organic State". The adoption of organic farming seemed too much prospective to the farmers of the study area by 11.66% (38 farms) in Sikkim. The 2nd most important intervention was provision of export market. In the study area, more than 5% of the respondents believe that introduction of some new varieties, better price and marketing at village level of horticulture crops would play the prospective role in the process of horticulture development in Sikkim. It is also evident from the table that more than 3% of the respondents have an idea that regulated market, more irrigation facility and co-operative marketing will be very prospective in future for development of horticulture sector in the state.

9.1.12 Suggestions for development of horticulture in Sikkim

The opinion from maximum respondents (34.05%) went in favour of providing better storage facility. The proportion of respondents suggested to provide transport facility by 18.40% (2nd highest) and packaging & marketing facility by 14.42% (3rd highest). The respondents of 6.44% in the study area suggested that better marketing facility would hasten the development of horticulture in the state. Only 3.68% farmers of the selected study area opined that regulated market for horticulture crops would facilitated the development process of the horticulture sector in Sikkim state.

9.2 Methodologies Adopted for Estimation of Horticulture Data

In the state of Sikkim the methodology that is being practiced is crop cutting experiments conducted by the Horticulture and Cash Crop Development Department. Basically this is a sample estimate to arrive at the productivity estimates for various crops. But for the state as a whole there is no exhaustive estimate as to area under different horticultural crops. So the Department of Horticulture has to depend on an approximate estimate of area under such crops of their own at the cluster or village panchayat unit level.

In the absence of any other agency entrusted for such estimation the Horticulture and Cash Crop Development Department has to shoulder the sole responsibility. The department conducts training programme for giving training to departmental personnel prior to such experiments. Moreover, the methods of estimating productivity differ in accordance with specificities of various crops and cropping practices.

9.3 Area, Production and Yield of the sample villages (for each horticulture crops)

The farmers' of Saku village of East Sikkim got mandarin orange from 15.03% irrigated area in the reference year. Total production from this land area was 966.53 qtl in kharif season with a productivity of 2805.60 kg / ha. Under unirrigated condition, farmers' of this study area in East Sikkim district grew 1.70 ha leafy vegetables, 6.85 ha mandarin orange and 0.10 ha ginger. They obtained 15.95 qtl, 209.60 qtl and 4.50 qtl of leafy vegetables,

mandarin orange and ginger, respectively from a total of 15.53% unirrigated area. The estimated average productivity was 938.24 kg / ha for leafy vegetables, 3059.86 kg / ha for mandarin orange and 4500 kg / ha for ginger in kharif season. Leafy vegetables are also grown in 1.54% unirrigated area in Chawang village of North Sikkim. In North Sikkim, total production of leafy vegetables was 51 qtl with a productivity of 1108.70 kg / ha. In Tinzerbung village of West Sikkim, only 10.16% unirrigated land was cultivated for horticulture crops with bitter gourd. Total production of bitter gourd was 19.15 qtl with a productivity of 2697.18 kg/ha in this study area.

Turning to rabi seasons, it has been observed that only 2.72% and 4.13% of irrigated and unirrigated land, respectively were cultivated during rabi season in East Sikkim. Radish and leafy vegetables were cultivated under irrigated condition only. But, cabbage, cauliflower and bean were cultivated under both irrigated and unirrigated condition. The farmers of the study area in North Sikkim districts used their 37.78% unirrigated land for cultivating cabbage and cardamom in rabi season. As the respondents of South Sikkim have no unirrigated land for cultivation, they cultivated 100% of their irrigated land during rabi season for cabbage, cauliflower, bean, tomato and carrot vegetables. The highest productivity was recorded for tomato (5094.49kg/ha) followed by cabbage (5091.38 kg/ha), cauliflower (4843.69 kg/ha), carrot (3307.88 kg/ha), broccoli (307.63 kg/ha) and bean (1409.57 kg/ha). But the farmers of West Sikkim study area have both irrigated and unirrigated area. They cultivated 8.37% and 49.07% of irrigated and unirrigated land, respectively for growing tomato, lady's finger and chilli. Tomato was grown in irrigated land only and chilli was grown in unirrigated land only. But lady's finger was grown in both irrigated and unirrigated land. The productivity of lady's finger was higher in irrigated land (1150kg/ha) than unirrigated land (777.78 kg/ha).

The crop tomato was cultivated during summer as an off-season vegetable in South Sikkim. The productivity of this off-season vegetable under irrigated condition was higher in summer (5210.16 kg/ha) than rabi (5094.49 kg/ha). Ginger and Turmeric are two summer season spice crops in West Sikkim. Ginger and turmeric were cultivated in West Sikkim in 10.62 ha and 0.97 ha land, respectively under unirrigated condition in West Sikkim. Recorded productivity of ginger and turmeric was 5629.94 kg/ha and 3353.61 kg/ha, respectively. These two crops occupied 96.66% of unirrigated land in West Sikkim.

As annual crops, banana, cymbidium orchids and papaya had been cultivated in the study area of Sikkim state. Under irrigated condition, 5.62% land of irrigated area in East Sikkim and 1.05% irrigated and 0.29% unirrigated area in West Sikkim were used for banana cultivation. Productivity of banana was higher under irrigated condition as compared to

unirrigated condition. Again, the productivity was higher in the same condition in West Sikkim than the productivity of banana in East Sikkim. Cymbidium orchid was grown in 10.65 ha irrigated area in East Sikkim. The flower gave an average yield of 62784 number sticks per ha. In West Sikkim district, 1.35ha irrigated land was utilized for papaya cultivation. Average yield of papaya was 1914.81 kg/ha in West Sikkim.

During kharif season a total of 34.45ha land was cultivated under irrigated condition in East Sikkim. Out of this 34.45ha land, 8 ha land was irrigated by tank and 26.45 ha was irrigated from other sources. The 52.73 ha irrigated land was splited in different study area as 6.23 ha in East district, 43.97 ha in South district and 2.53 ha in West district. It has been found from the table that total 52.73 ha irrigated land of three districts got water for cultivating crop from other source of irrigation. Total 0.83 ha land in east district and 7.28 ha land in South district were used for cultivating horticulture crops. The crops of this field during summer season got required water from other source of irrigation.

It was observed that 125 plants had been planted per ha of mandarin orange as fruit crop and 2.34 cymbidium orchids plant per m^2 area as flower in East Sikkim. The density of cardamom plant in North Sikkim was 2068 plants per ha. The plant density/ha of cole crops, i.e., cabbage and cauliflower varied from 11083 in East Sikkim to 11305 in South Sikkim for cabbage and from 11410 in East Sikkim to 11950 in South Sikkim for cauliflower. But the plant density/ha of cabbage in North Sikkim was only 9854. Again, plant density/ha of tomato was8602 and 8950 in rabi and summer season, respectively in South Sikkim. Whereas the density/ha of the same crop in West Sikkim was 7532 in rabi season. So, it is clear that plant density/ha of vegetable crops in South Sikkim was higher than any other district for respective crop. On the other hand, density/ha of banana plantation was higher in West Sikkim (559) than East Sikkim (517).

Mixed cropping system of crop cultivation was predominant in all the three districts, viz. East, South and West districts. But in North district, maximum area under cultivation had been followed mono-cropping pattern.

In East Sikkim, maximum cultivated area had been used for cultivation of mandarin orange and cymbidium orchids. The figure regarding production and price indicates that earning from cultivating one ha area was not attractive for orange fruit, but the earning from one ha flower (cymbidium orchids) was too much attractive. A remunerative profit was earned from banana cultivation and 12.88 ha land had been used for this plantation crop in the study area of East Sikkim district. It has been observed that total 117.30 ha land was used for horticulture crops in North Sikkim. Out of this 117.30 ha land, 104.50 ha (89.09%) had

been used for spice crop cardamom cultivation. This spice crop provides a moderate income from unit area of land. Like East Sikkim, cabbage gave an attractive income to its growers in North Sikkim also. Maximum area was used for cabbage cultivation in South Sikkim district, though it was only 17.4 ha (33.56%) out of 51.85 ha. From unit area cultivation, maximum was earned from cabbage followed by carrot, tomato, cauliflower, broccoli and bean. It has been observed in West Sikkim that maximum area had been used for ginger cultivation in this district. The income from ginger cultivation was higher in this district than East district from unit area. Cultivation of papaya and banana gave highest and second-highest income, respectively from one hectare area. Tomato is another attractive profit earning vegetable crop in the district. The area under this crop was 3.93 ha. Turmeric, another spice crop had been cultivated in 0.97 ha land and it gave a moderate income from unit area.

9.4 Difference between the Two Estimates (survey and agencies)

As village level data had been collected in survey and district level data had been published by the agency for estimating area, production and productivity, so there was no practical reason for comparing data in respect of area and production between these two estimates. However, it should be noticed first that only 0.76%, 2.06%, 0.52% and 0.31% area in East, North, South and West districts, respectively had been surveyed as compared to the area estimated by the agency across the district. So, a variation in results of productivity between the survey and estimate is quite natural, especially for the group of crops, like, kharif vegetables, rabi vegetables, etc. Though, the productivity of rabi vegetables in North Sikkim was almost same for these two estimates. On the other hand, individual crop like, mandarin orange, ginger and turmeric exhibited parity in result of productivity between survey and estimates. But there was a vast gap in productivity of cymbidium orchids and large cardamom between village and district level estimates.

9.5 Local Crops that have not been included

In course of the study it is found that the crops cultivated in the kitchen garden by the households remain outside the horticultural estimate. As the Horticulture department is the only agency that is responsible for collection of horticulture data across the state, it becomes difficult for them to gather information from every household as to the area and production of all the horticultural crop being grown in their kitchen garden.

9.6 Difficulties Encountered by the Agencies

The main difficulty for arriving at an estimate turns out to be dearth of exhaustive data on the area under all the horticultural crops across the state. As it appeared from the discussion with the officials at different levels that some other method has to be sought out to cope up with the kind of problem Sikkim is facing.

9.7 Conclusion and Policy Implications

9.7.1 Conclusion

In the light of above discussions it becomes clear that the Horticulture Department in Sikkim is carrying out crop cutting experiments to estimate productivity of various horticultural crops at regular intervals. Still there are avenues where it is not being possible for the department to collect the information. This is an area where all the households growing horticultural crops as a means of their livelihood, be it in the main land or kitchen garden or even in waste lands, in the state are concerned. Especially, a thorough estimate of area under a wide range of horticultural crops is essential to get an overview of the state of such crops and its progress in the state. So far as planning for development is concerned such information such information are crucial.

There are vegetables like bean, bitter guard or leafy vegetables like spinach and lettuce that have ample potential in Sikkim and being cultivated by the households. But there is no reliable estimate as to area under and production of these crops. Also there are fruits like guava, banana and papaya being grown by the families in their homestead land. In those cases the number of plant is fewer and remains scattered across the village territory and output from these never get estimated.

At all India level the Department of Revenue shoulders the responsibility of gathering such information. In Sikkim also the revenue department does collect some of the information about land under various crops. But it is not exhaustive at disaggregative level that is necessary for estimation of horticultural production and productivity.

There are various schemes and self help groups which are working in the field of horticultural development. Over and above, National Horticultural Mission is working for promoting horticulture in North East and Himalayan regions. Despite these interventions no reliable statistics as regards to different aspects of horticulture is available in the state. It becomes difficult for a sole department like Horticulture to acquire all the information that is required across a state like Sikkim where there exists wide variation in agro-climatic and topographical specificities.

The operational methods of crop cutting experiments and productivity estimation may be reviewed to get a more reliable estimate of productivity for various crops. This concerns particularly the areas where it is not being possible for the Horticulture Department to get an estimate.

9.7.1 Policy Implications

Estimation of Area

- To get an exhaustive estimation of area under various crops several government departments such as Department of Revenue, Department of Agriculture and Department of Horticulture can collaborate in collection of such data for major crops particularly for plantation, orchards and major field crops.
- For field vegetables and spices, there are agencies like RKVY, NHM who could collaborate with the Department of Horticulture in collection of area data. Also there are apex bodies of the Self Help Groups like VIUC who could also share a part of responsibility in this field.
- There are Self Help Groups (SHG) under the Department of Agriculture and Department of Horticulture at the gram panchayat ward (i.e. village) level. These groups can act as an agent in collection of area data under kitchen garden, field bunds and waste land cultivation at the village level.
- The SHGs can also keep a record of area under tree crops of fruits or enumerate the number of fruit plants in the village or cluster that remain scattered and few in number.
- For such activities both theoretical and practical training has to be imparted to the members of these groups at the gram panchayat ward (i.e. cluster) level.

Estimation of Production and Productivity

- Undulated topography of the hilly tract of Sikkim poses certain difficulty in estimation of production and productivity of certain crops. This necessitates review of methodology of crop cutting experiments for crops like large cardamom.
- In case of some of the vegetables marketed quantity over the whole season is added to be used as a proxy for quantity of output. But there exists an approximation in this method because the frequency of marketing may be very high in case of some crops like tomato or chilli and in cases the quantum may not get recorded. Beneficiary groups under various development schemes or the SHGs can take the responsibility to record the quantum of production and the volume marketed and frequency of marketing for the crops.
- With SHGs taking responsibility of such data collection and exhaustive database can be generated at the gram panchayat ward level itself.
- Collaboration between different departments in such estimation would help to augment the authenticity of data through regular cross verification.

Reference

1. Government of Sikkim, Gangtok, (2012), Sikkim bags National Award under Horticulture Mission, Sikkim Reporter, February 23

2. Dhanpati Sapkota, 2010. Award winning farmer from Sikkim, *http://isikkim.com*/dhanpati-sapkota-award-winning-farmer-from-sikkim/:

3. The Tribune, (2004), Rs 15.71 crore for afforestation : September 3.

4. Poudyal, S and Subba, R.B., (2004), Policy Resolution for potential Horticulture and Cash Crops Development in Sikkim, Sikkim Legislative Assembly

5. Rai, N; Nath, A; Yadav, D.S. and Patel, K.K., 2004. Effect of polyhouse on shelf-life of bell pepper grown in Meghalaya. National Seminar on Diversification of Agriculture through Horticultural Crops, held at IARI Regional Station, Karnal, from 21-23rd February, pp. S.P.22.

6. Singh, K.K.; Kumar, S.; Rai, L.K. and Krishna, A.P., (2003), Rhododendrons conservation in the Sikkim Himalaya. *Current Science*, 85(5): 602-606. G.B. Pant Institute of Himalayan Environment and Development, Sikkim Unit, P.O. Tadong, Gangtok 737102, India.

7. Sundriyal, Manju and Sundriyal, R.C., (2003), Underutilized edible plants of the Sikkim Himalaya: Need for domestication. *Current Science*, 85(6): 731-736. G.B. Pant Institute of Himalayan Environment and Development, North East Unit, Vivek Vihar, Itanagar 791113, India.

8. Ganesh, N., (2003), Fruit bowl shrinks in Himachal, INDIAN EXPRESS: August 8.

9. Sharma, R., R.S. Parasher, K.D. Sharma, M.H. Wani, M.L. Sharma, N.R. Singh and R.K. Singh, 2003. System Orinted Socio- Economic Assessment of Transitions in Hill Agriculture, Dr YS Parmar University of Horticulture and Forestry Nauni, Solan (Himachal Pradesh), *A NATP Research Report*.

10. Phookan, D.B. and Saikia, S., 2003. Vegetable production under naturally ventilated plastic house cum rain shelter. Plasticulture Inervantion for Agriculture Development in North Eastern Region, Edt. by K.K. Satapathy and Ashwani Kumar, pp. 127-141.

11. Annonymous, 2002. Indian Council of Agricultural Research 2002. Agricultural Research Data Book, ICAR, 2004.

12. Mehta, P., K.D. Sharma, V. Kumar and D.C. Thakur, 2001. Economics of Tomato and Capsicum in Himachal Pradesh, *Department of Agriculture Economics* CSKHPKVV, Palampur, Research Report No. 18.

13. Wasim, M.P., 2001. Agricultural Growth and instability in major crop production: A Province–wise analysis in Pakistan, *Asian Economic Review,* 43: 294–314

14. Singh, Narender; Diwedi, S.K. and Paljor, Elli, 1999. *Ladakh Mein Sabjion Kei Sanrakshit Kheti*. Regional Research Laboratory of DRDO, Leh. Pub. By D.R.D.O., Leh. Pub. By D.R.D.O. 56 A.P.O.

15. Singh, Brahma, 1998. Vegetable production under protected conditions: Problems and Prospects. Indian Soc. Veg. Sci. Souvenir: Silver Jubilee, National Symposium Dec. 12-14, 1998, Varanasi, U.P. India pp. 90.

16. Sani, A.S., D.R. Thakur and T.V. Moorti, 1991. Export Potential of Himachal Potato Seed, *Indian J. Agri. Marketing*, 5: 34–41

Annexure I

Action Taken on Comments

Title of the study: – "Baseline Data on Area, Production and Productivity of Horticulture Crops in Sikkim"

Chapter-wise comments & Action taken

Comment: We are finding difficult to decide your sample size, in Table 1.1 the household No. is 327; in Table 3.1 it is 275; in Table 3.2 it is 325; in Table 3.3 it is 326; in Table 3.4 it is 324 and Table 3.5 it is 326. Please clear us.

Action taken: Actual size of the sample was 326. Correction has been made in final report.

Chapter I

Comment: On page No. 16, Table 1.1 that shows sample size of East Sikkim (Assam Lingzey) is to be read as 134 instead of 135.

Action taken: Correction has been made in the final report.

Chapter-2

Comment: It would be good if you could provide us the data regarding Area, Production and Yield of Horticultural Crops under the category of Fruits, Vegetables, Spices, and Plantation crops, Flowers and Medicinal Plants, from the year 2001-02 depending on the availability of the same (for Sikkim, secondary data).

Action taken: Secondary data regarding Area, Production and Yield of Fruits, Vegetables, Root & Tuber Crops, Spices, Flowers, Horticulture crops except flowers have been given in Table 2.1 & Table 2.2 in the draft report from 2009-10 to 2011-12.

Secondary data for all the above mentioned crops in respect of Area, Production and Yield from 2001-02 are not available.

Comment: Also kindly provide us the data for plan investment based on different Five Year Plans, under Horticulture Sector of Sikkim.

Action taken: No data for plan investment based on different Five Year Plans under Horticulture Sector of Sikkim is available.

Chapter-3

Comment: The households figures presented in the Table 3.1 cannot be tallied with the total sample size of 326 households. Kindly check the table and provide necessary details.

Action taken: Table 3.1 has been tallied with the total sample size of 326 households.

Comment: Kindly provide the 1st row title (which gives as 1……8) for the Table 3.10 and Table 3.11

Action taken: Necessary corrections have been made.

Comment: Also please provide the data regarding Distribution of Area under irrigation by various sources i.e. Canal, Diesel Tube well, Electric Tube well, Tank, and Open well.

Action taken: Data for irrigation by sources is provided in Table 6.5a, Table 6.5b, Table 6.5c, Table 6.5d.

Comment: The figures presented in Table 3.14 reflecting the Motivating factors for taking up horticulture crops is exceeding the total sample size of 326. Kindly check the same and provide us with the details, or add one more column at the end as "Total" and the total HHs should match with 326.

Action taken: Necessary corrections have been made.

Comment: Please provide the absolute figures i.e. the number of households for Table 3.15 showing Preference-wise motivating factors for taking up horticulture crops.

Action taken: Absolute figures regarding the number of households had been mentioned in the draft report.

Chapter-4

Comment: Kindly give the number of households for Table 4.1 and 4.2.

Action taken: Necessary corrections have been made.

Comment: Please fill the gaps for Table 4.3 and Table 4.4. Give the name of the crop in Table 4.4.

Action taken: Necessary corrections have been made.

Comment: Please provide the details regarding problems faced by the Farmers in application of Improved Technology (Poly House, Green House, and INM/IPM).

Action taken: Problems faced by the Farmers in application of Improved Technology (Poly House, Green House, and INM/IPM has been mentioned in the final report.

Chapter-5

Comment: It would be nice if you provide the details regarding the methodologies adopted by various agencies for estimating Horticulture Crops, as mentioned in the chapter scheme of the project.

Action taken: Methodology under taken by the Horticulture and Cash Crop Development Department (H&CCDD) under Government of Sikkim, the only estimating agency, has been mentioned in the draft report.

Comment: Is that only the Horticulture and Cash Crop Development Department of Horticulture (Govt. of Sikkim) collecting official data?

Action taken: Yes, that has also been mentioned in the draft report.

Chapter-6

Comment: Kindly provide the data on Area, Production and Yield of each Horticulture Crop by different agencies as specified in Chapter – 5 of the chapter scheme.

Action taken: H&CCDD is the only department that estimates area and production of horticultural crops in Sikkim. RKVY & VIUC collaborate with this department in such estimation. Hence, no separate database for area, production and yield of horticultural crops are available with RKVY & VIUC. The data collected by these collaborating experiments are published by the state department, which has already been given in the draft report.

Chapter-7

Comment: Are these crops provided in Table 7.1 and Table 7.2 not covered by the official estimates? We are interested to know the local/indigenous crops that have not been included in the survey/official data. Please confirm in these crops as they are found in Table 6.1 to 6.3.

Action taken: These are the crops (as mentioned in Table 7.1 & table 7.2) which are grown in the kitchen garden of the households. These crops, though very small in respect of area and production as compared to the field crops of same varieties are left out of the official estimates.

Comment: Please provide us with the details of economics of local crops that are not included in the official survey. However, the crops provided in your Table 7.4 is also found in other estimated official surveys Table 6.1 to 6.3

Action taken: Yield rates, total value of production and value of production per household for the left out crops (grown in kitchen garden) have been given in Table 7.2, Table 7.3, and Table 7.4.

Chapter-8

Comment: If agencies other than H&CCDD have collected any information, please provide their difficulties as well (if any)

Action taken: H&CCDD is the only department that estimates area and production of horticultural crops in Sikkim.