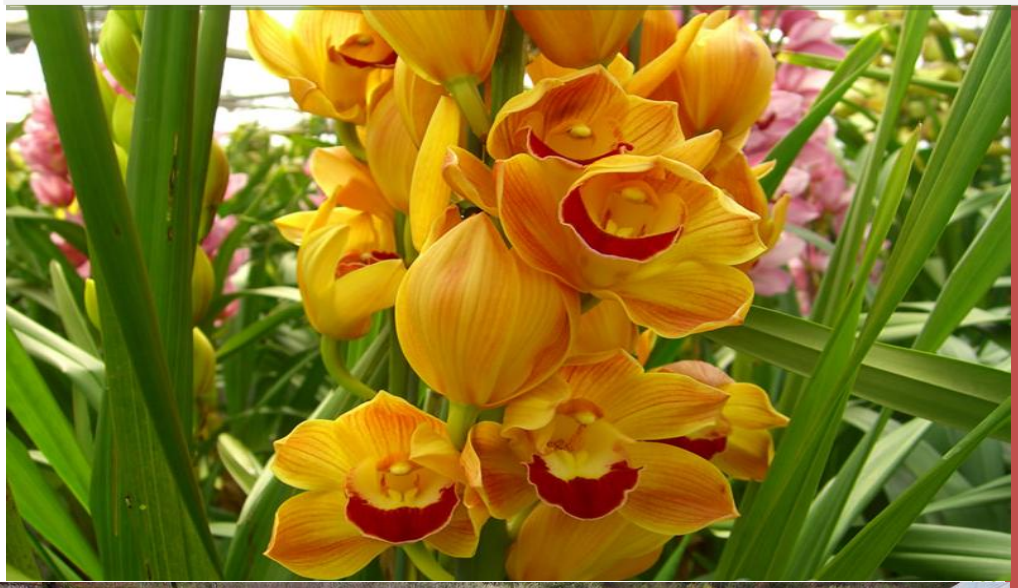
BASELINE DATA ON AREA, PRODUCTION AND PRODUCTIVITY OF HORTICULTURE CROPS IN SIKKIM

Study No. 174









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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

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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.