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Baseline Data on Horticultural Crops in Uttarakhand

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PREFACE

The present study sponsored by the Ministry of Agriculture, Government of India aims to collect data on area, production and yield of horticultural crops and compare with the baseline data collected from secondary sources. The study also presents problems encountered by grass root officials in data collection. In order to fulfill these objectives, primary as well as secondary sources of data have been used. Primary data were collected through a field survey of horticultural crops growers in the selected three districts (Dehradun, Haridwar, and Tehri Garhwal) of Uttarakhand.

The results of this study reveal (i) area, production and yield of horticultural crops grew at the rate of 3.11, 4.41 and 1.27 per cent per annum in India between 1991-92 and 2011-12, (ii) banana, mango and citrus among fruits, potato, tomato and onion among vegetables, garlic, turmeric and ginger among spices contributed 66, 57 and 53 per cent respectively in total production of these crops in India during 2011-12, (iii) the contribution of Uttarakhand was 0.96 in fruits and 0.7 per cent in vegetables. This contribution is low looking at the potential in the state, (iv) the share of fruits, vegetables, spices and flowers in total production of horticultural crops in Uttarakhand was around 54, 41, 5 and 0.39 per cent during 2010-11, (v) mango, apple and citrus in fruits , potato, vegetable pea and tomato in vegetables contributed more than 50 per cent in total production of fruits and vegetables in the state, (vi) Dehradun, Nainital and Almora are leading districts in production of horticultural crops in the state. the yield of horticultural crops was 5.45 MT./ha which is lower in comparison to all India, (vii) The Horticultural Mission for North-East and Himalayan states is being implemented in Uttarakhand. It addresses entire spectrum from production to consumption. The impact of the Mission is limited on horticulture in the state because important components like seed show poor performance, (viii) respondents in selected villages cultivated mango, litchi, potato, vegetable pea, french bean, ginger, turmeric, marigold and rose in different seasons. The respondents reported good price as the main motivating factor, (ix) a comparison of yield estimates of various horticultural crops obtained through survey data with the secondary data revealed some positive and negative gaps, (x) the main source of horticultural data in Uttarakhand is the Directorate of Horticulture, Uttarakhand which publishes data for 11 fruits, 10 vegetables, 7 spices and some flowers. However, data are not being collected for some important crops of commercial value. The Mobile Horticulture Teams collect data on horticultural crops on the basis of their record and information from farmers, (xi) grass root officials involved in data collection faced variety of problems in data collection due to scattered holdings, difficult terrain and inadequate staff.

As a policy measure it is suggested that there is an urgent need of clear cut guidelines from horticulture department regarding data collection. These strictly need to be adhered to while collecting information on horticultural crops. This would reduce location and person specific bias. Furthermore, this would greatly help to make data collection a scientific practice by reducing subjectivity. Infrastructure, easy availability of region specific improved varieties and planting material assume special significance in order to improve the prospects of horticulture in Uttarakhand.

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July, 2013 **Usha Tuteja**

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Contents

LIST OF TABLES

LIST OF FIGURES

Chapter – 1

Introduction

1.1 Importance of Horticultural Crops

Horticultural crops play an important role in human nutrition, preventing diseases and contributing to the nation's development and prosperity. Fruits and vegetables are rich source of vitamins, minerals, proteins and carbohydrates that are essential in human diet. Flowers and ornamental crops enhance aesthetic value of our environment while medicinal crops yield pharmaceutical constituents. Thus, horticulture assumes great importance in food and nutritional security, general health and well -being of our population.

Horticulture crops form a vital part of the Indian agricultural production. India is the second largest producer of fruits and vegetables in the world. Cultivation and processing of these crops generate significant employment opportunities for the rural and peri-urban population. In addition, marketing creates employment prospects for the urban poor which in turn ensure better livelihood security.

Horticultural sector including fruits, vegetables, spices and flowers with a share of about 6 per cent in total cropped area contributed maximum (32 per cent) to the total value of crop production in TE 2004-05. Moreover, gross value of fruits and vegetables grew at an annual rate of 5.6 per cent that was higher than growth of any other crop between 1995-96 and 2004-05. This achievement is commendable since growth in their contribution was one of the lowest (2.9 per cent) between 1981-82 and 1995-96 (Birthal *et al*., 2008). It would be useful to point out that production of horticultural crops in India has increased from 97 million tonnes in 1991-92 to 250 million tonnes in 2011-12. Area expansion and growth in yield are responsible for this success.

1.2 Scope for the Study

Food security, nutritional security, sustainability and profitability are the main focus of present and future agricultural development. The high value agriculture, particularly horticultural crops are the catalysts for the next wave of growth in the farm

sector. The statistical evidences point out that share of cereals and pulses in the per capita food expenditure in India has reduced from 40 to 28 per cent between 2000 and 2010 while that of high value products including fruits and vegetables rose from 36 per cent to 42 per cent during the same period. Therefore, future of agriculture and food sector will rest on crop diversification towards high value crops and higher value addition. In addition, increase in agriculture sector's share in the export pie will also come from this sector. Despite the overwhelming importance of horticultural sector and India being the leading producer of fruits and vegetables, available statistical evidences are scant.

The available statistics point out that area and production of horticultural crops improved significantly during the past two decades. This is the result of concerted efforts through policy initiatives and investment. Nonetheless, country is far behind in productivity of most of the horticultural crops in comparison to international standards. The non-availability of comprehensive statistics even on basic parameters such as area, production and yield of horticultural crops at disaggregate level puts a serious limit in designing and planning for improved productivity through extension, input supply and efficient marketing logistics. With this realization, the Ministry of Agriculture, Government of India has allotted a coordinated study to examine the availability of data and problems encountered in data collection. The secondary evidences in horticultural crops will be substantiated with primary data collected from producers in the hilly states of the country. The Agricultural Economics Research Centre, University of Delhi is a participating institution in the coordinated study and has conducted this study for the hilly state of Uttarakhand.

1.3 Review of Literature

Indian agriculture is dominated by small and marginal farmers. According to the *Agricultural Census*, 2001, 81.9 per cent of holdings were less than or equal to 2 ha and had an average size of 0.59 ha. Although, horticulture has potential of higher returns from land, it is often debated that farmers cultivating tiny pieces of land may not diversify towards these crops due to numerous constraints in production and marketing as well as

higher production and price risks associated with these crops. Among horticultural crops, vegetables are more pronounced on small farms, while fruits and spices occupy a larger share on large farms. These differences are expected. Vegetables generate quick returns, require low capital and relatively higher labour input, which match resource endowments of the small farmers. Since fruits and spices require higher initial capital and have a long gestation period; these do not suit to small farmers who are capital constrained. Therefore, small farmers generally diversify towards vegetables because of surplus labor and liquidity constraint (Birthal *et al*., 2008). Horticulture can be promoted as a means of agro-diversification for the second green revolution in India, providing the much-needed impetus to the growth of agricultural sector, through increase in trade, income and employment. The Indian agriculture is diversifying towards production of high value commodities along with increasing role of small farmers (Surabhi Mittal, 2009). The horticultural crops constituting fruits, nuts, and vegetables including potato, tuber and mushroom, ornamental plants including cut flowers, spices, and plantation crops have become a key driver for economic development in many states of the country and contribute significantly to the GDP of agriculture. In literature, importance of horticulture in improving productivity of land, economic conditions of the farmers and entrepreneurs, enhancing exports and above all, providing nutritional security to common masses is widely acknowledged.

The value productivity per hectare of horticultural crops has been estimated higher than cereals, pulses, oilseeds, sugarcane and cotton. The differential in per hectare value of output was more than 50 thousand rupees. Next two decades witnessed increase in productivity of all crop groups but absolute gains were much larger for horticultural crops. Horticultural crops covered 20.7 million hectares of area and produced 214.71 million tonnes of output in 2008-09, accounting for 8.5 per cent of gross cropped area of the country. The targeted growth rate for horticultural sector during the XI Five Year Plan was envisaged 7-8 per cent. With fruit production at 47.5 million tonnes in 2003-04, India accounted for about 10 per cent of the global production of fruits from an area of 4.0 million hectares. With 90 million tonnes of vegetables production in 2003-04, India ranked as the highest producer of vegetables. In the world,

India occupied first position in the production of cauliflower, second in onion and third in cabbage. (Ramesh Chand *et al*. 2008)

The per hectare share of output of horticultural crops is more than 6 times that of cereals. As such, horticultural industry should focus on targeted commodities and raise output to trigger agricultural productivity in leading sub-sectors, which show potential. Most of horticultural commodities are sold in raw form at low prices, especially when there is a glut. Higher income could be generated through value addition by processing which reduces post-harvest losses and lengthens shelf life. Solution to overcoming challenges and unlocking potential of the horticultural sector lies in forming strong producer groups, producer-marketing alliances and producer–researcher working groups. There is a need for substantive investment in irrigation, biotechnology, plant breeding, post harvest technology, fertilization, pest and disease management and food safety to enhance growth. The horticulture production per unit of area is significantly higher as compared to cereals. Since one or other crop will always remain in field or at maturity, manpower can be judiciously used in the field and even crop failure will not be a serious setback to the growers. The yield of rice or wheat is 3 to 4 tonnes per hectare as compared to 15-20 tonnes yield of cabbage or potato.

The period of horticulture development in India can be divided into five phases. The first phase comprises a period prior to independence of the country, second phase covers a period from 1948 to1980, third phase from 1980 to1991 and fourth phase from1991 to 2000 and fifth phase from 2000 to 2010. During pre-independence period, horticultural crops were mostly grown around the house that comprised fruits and flowers. Higher technology was not used in growing horticultural crops. In particular, kings, *Jamindars* and *Jagirdars* grew these crops at household level. Specifically, these enterprises were adopted as status symbol during this period. Second phase of horticultural development covered the period, which was influenced by indigenous thinking for sectoral growth of commodities in the regions of importance, which mostly included coconut, areca nut and spices. This phase emphasized on development of fruits in tropical and subtropical regions through establishment of centres. This period also witnessed establishment of research institutions devoted to horticulture. Third phase

may be considered as a period of consolidation both for research and development. At centre level, higher-level positions in development and research such as Horticulture Commissioner (Deputy Director General) were created and efforts for development were triggered. Many states paid special attention to horticulture, recognizing its role in nutritional security, employment generation and enhancing farm income. In Central institutes, Directorates of horticulture were established which benefited farmers in adoption of improved technology. Fourth phase marked technological change and growth. It recorded quantum jump in plan allocation, formation of association by farmers, unprecedented increase in production and enhanced availability of the produce. During this period, there has been a quantum jump in production and exports of flowers and introduction of new crops. This period was termed as transition from traditional horticulture to hi-tech horticulture and precision farming approach. Organic horticulture, quality management and safety assumed special significance. In fifth phase of horticulture development, research and development were characterized by large-scale adoption of innovations like micro-propagation, protected cultivation, use of *in vitro* propagated plants and diagnostics. This enhanced investment through launching of various mission mode programmes. Research results supported by investment and extension helped in achieving quantum jump in production, productivity, availability and exports. In addition, many new crops were introduced. This trend of horticultural development has been marked as “Golden Revolution” recording a growth rate of 6 per cent per annum and its enhanced contribution to GDP of agriculture.

During the past two decades, area, production, productivity, availability and exports of horticultural crops have increased manifolds, which provided ample opportunities for utilization of wasteland, employment generation and effective land use planning. Diversification through horticultural crops has been recognized as one of the options for improving land use planning. Results of the paper by (Ramesh Chand et.al, 2008) on share of horticultural crops and other important crops in total value of crop production at five points of time show that share of horticultural crops has grown much faster than other important crops in India between 1970-71 and 2005-06. Cereals, pulses, oilseeds, sugarcane and cotton constituted 43.14, 5.35, 9.62, 3.91 and 4.01 per cent of total crop production at current prices during 1970-71. In addition, horticultural

crops such as fruits, vegetables, condiments and spices together formed 17.11 per cent share of all India production. After almost three decades in the year 2005-06, share of cereals and pulses declined where as horticultural crops showed a clear-cut improvement of 12 per cent. Thus, increase in share of horticultural crops in the value of crop production was appreciable between 1970-71 and 2005-06 (around 12 per cent). Further, contribution of horticultural crops to GDP of agriculture, which was only 0.58 per cent during 1952-53, increased to 18.0 per cent in 1991-92 and subsequently to 30.4 per cent in 2007-2008. It implies that crop diversification through horticulture crops has improved income of farm households, which increased sharply between 2000 and 2010.

An examination of results presented in Appendix-1 reveals that area under horticultural crops grew at the rate of 3.11 per cent per annum between 1991-92 and 2011-12. The growth of productivity however, was slow (1.27 per cent per annum) and therefore, production grew at a rate of 4.41 per cent per year during this period. The year to year variations in area and yield were found common and these affected total production.

India emerged as second largest producer of fruits (74.9 million tonnes) by contributing 11.2 per cent share in global fruit production during this millennium. India occupied first place in production of mango, banana, papaya, pomegranate, sapota and aonla. It is essential to mention that production and productivity of banana and sapota is the highest in the world. Information presented in Appendix-2 reveals importance of major fruits and vegetables grown in India in terms of area and production during 2006-07 and 2011-12. Clearly, banana, mango and citrus together dominated the scenario in acreage (around 64 percent) during 2006-07. But, in terms of production banana with around 35 per cent share was ahead of mango and citrus. Almost same pattern was observed during 2011-12. The average productivity of fruits was around 107 qtls./ha in 2006-07 while it improved by 6.84 per cent in 5 years. Among fruits, papaya followed by banana indicated higher productivity in comparison to other fruit crops.

Among vegetables, potato followed by onion dominated the scenario in terms of area as well as production in India during 2006-07. Other important crops were tomato and brinjal which occupied around 16 per cent of area and contributed almost same

share in production during 2006-07. In 2011-12, potato and onion maintained their position in area but onion lost its position to tomato in terms of production. Share of potato in total production of vegetables in India increased from 24.87 per cent to 32.02 per cent. Among other vegetables, tomato, brinjal, cabbage and cauliflower have shown some improvement in area and production during the year 2011-12 over 2006-07. The average yield of vegetables in India was 152 qtls/ha during 2006-07. The productivity of tapioca, potato and cabbage was much higher in comparison to other crops.

Spices, an important component of horticultural crops from the point of view of domestic consumption and exports occupied 2462 thousand hectares and yielded 3982 thousand tonnes of production during 2006-07. Chillies, turmeric and garlic together contributed around 69 per cent of total production of spices. Garlic recorded an average yield of around 47 qtls/ha in 2006-07. It is discouraging to note that productivity of chillies and pepper has declined between 2006-07 and 2011-12. On the other hand, yield of ginger has improved by 39.66 per cent during the same period.

Floriculture, although in the process of development, had 146 thousand hectares of area in 2006-07 which has more than doubled in 5 years due to improvement in productivity. The production and yield have also improved significantly during these years.

After analyzing macro scenario of growth of horticultural crops in India, it would be appropriate to gauge their status at the state level. An examination of recent data presented in Appendix-3 exhibit that Maharashtra and Andhra Pradesh together shared as high as 34 per cent of all India area under fruits and 25 per cent of production of fruits during 2011-12. The achievement of Tamil Nadu is commendable. It attained first position in production due to high level of productivity. Notwithstanding the large gap, Gujarat, Karnataka and Uttar Pradesh indicated more than 5 per cent contribution at the country level. In case of vegetables, West Bengal followed by Uttar Pradesh and Bihar dominated the scenario and together contributed around 37 per cent to all India area and 40 per cent to production. All other states indicated less than 5 per cent contribution in area as well as in production at all-India level. Apart from fruits and vegetables, India is known for other horticultural crops such as spices. It may be observed that Rajasthan,

Gujarat, Andhra Pradesh, Madhya Pradesh and Karnataka were the most important states in this regard. The achievement of Andhra Pradesh was worth celebrating since its contribution in all-India production was more than double of its contribution in all-India area under spices. It may be pointed out that Rajasthan contributed 12.48 per cent share in production against around 20 per cent proportion in area while Andhra Pradesh and Tamil Nadu showed better productivity in case of spices.

Floriculture appears to be catching up in southern states of Tamil Nadu, Karnataka and Andhra Pradesh. These states together contributed 57 per cent to all India production. After aggregating all the horticultural crops, Maharashtra, Andhra Pradesh, Karnataka and West Bengal attained first four positions in terms of area. The contribution of West Bengal in production was found to be impressive due to higher productivity. Results regarding productivity of horticultural crops show that West Bengal followed by Tamil Nadu and Uttar Pradesh attained higher levels in comparison to other states.

An Overview of Agriculture in Uttarakhand

Uttarakhand, the 27th State of the Union of India was carved out of the 13 north Western districts of Uttar Pradesh on 9th November 2000. The state comprising of the Central Himalayas is spread over 53,483 square kms. and inhabits 101.1 lakh population (Census, 2011). The state is known for its scenic beauty and is also known as “Devbhoomi” due to its shrines, temples & places of worship and meditation. Uttarakhand is included in the National Agro-climatic zone No.9 and 14. The plain region of the state known as Tarai-Bhabar region comprises of Udham Singh Nagar, Haridwar and parts of Dehradun and Nainital districts. The hilly region of the state consists of Uttarkashi, Tehri Garhwal, Pauri Garhwal, Chamoli, Rudraprayag, Almora, Bageshwar, Champawat, Pithoragarh and parts of Dehradun and Nainital districts.

The entire state is rugged mountainous terrain except Udham Singh Nagar, Haridwar, Doon Valley and part of Nainital districts. Administratively, it comprises of the divisions of Kumaon and Garhwal, which are further composed of thirteen districts. Kumaon division comprises of districts of Almora, Nainital, Pithoragarh, Champawat,

Bageshwar and Udham Singh Nagar while the Garhwal division consists of districts of Uttarkashi, Chamoli, Tehri Garhwal, Pauri Garhwal, Dehradun, Haridwar and Rudraprayag. The state has 95 development blocks and 48 tehsils. Hilly areas inhabit 65.41 lakh people whereas plain areas have a population of 35.75 lakh persons. Thus, Uttarakhand accounts for 1.61 per cent of the total geographical area and 1 per cent of the total population of the country

Agricultural advancement is the most important challenge in Uttarakhand due to natural constraints. This is urgent since agriculture sector employs more than 55 per cent of workers and provides livelihood security to the major proportion of population in the rural areas.

The land use pattern, which is manifestation of combined effect of various physio-climatic conditions in the region, is an important factor. Appendix-4 indicates that forests occupy dominant proportion of land and cover around 61 percent of the reported area in the state. There are plans to promote cultivation of Jatropha and bamboo on significant proportion of area under degraded forests. This will help to remove rural poverty in these areas. In addition, 5.47 and 1.50 percent of reported area was under cultivable wasteland and fallow land other than current fallows, respectively in 2010-11. These lands can be brought under cultivation through proper planning and execution. These areas can also be utilized for plantation of fruits, medicinal and aromatic plants. Current fallows comprised less than 1 per cent of the reported area.

The net sown area formed only 12.75 per cent of the geographical area. Out of this area, 61.74 per cent was sown more than once during 2010-11. It is found low in comparison to agriculturally developed regions like Punjab and Haryana. The progress on this front in the state is low and cropping intensity declined from 164.9 in 2008-09 to 161.74 in 2010-11. The percentage of net irrigated area to net sown area in Uttarakhand was around 46 per cent and it has increased by almost 2 per cent during the referred years. Further, share of gross irrigated area in gross cropped area also has risen marginally by around 4 per cent during the past decade. In a nutshell, land use pattern does not show any perceptible change in Uttarakhand between 2000-01 and 2010-11.

The variations in altitude and climate offer natural advantage for crop diversification. As such, alternative strategies for agriculture related enterprises viz., horticulture, forestry, floriculture, medicinal plants needs to be strengthened. Besides, less remunerative crops can be replaced with more profitable crops on a rotational basis. Utilization of fallow lands may also provide additional gains.

Considering the structure of hill agriculture and the constraints it faces, the strategies should be formulated based on ground realities. The variations in altitude and climate may be utilized for gains through diversification. The traditional and scientific resources/know-how should be blended and disseminated to improve the agricultural economy of hills. It is essential to integrate the available natural resource, tap the untapped potential of crops/varieties and technical know-how in an eco-friendly manner to enhance agricultural productivity for food and nutritional security as well. Introduction of vegetable crops in the crop sequence is capable of enhancing profitability by 2-3 times. Therefore, serious attempts should be made in this direction.

Uttarakhand is known for its horticultural crops, which include fruits, vegetables, off-season vegetables, floricultural crops, medicinal and aromatic plants. In temperate zone of the state, only kharif crop is taken due to very cold climate. Thus, agriculture in this part of Uttarakhand is characterized by subsistence farming. The policy should focus on improving food, nutrition and livelihood security. Given the climatic conditions, mixed farming seems a practical approach that should include dairying, horticulture, agro-forestry and organic farming.

Horticulture is one of critical sectors in the economy of the hill state of Uttarakhand. It provides much needed opportunity for diversification and increased employment in the state where the scope of high rate of growth in conventional agriculture is rather limited due to peculiar topography and majority of scattered and marginal holdings.

Horticulture development can become an effective tool for accelerating development in the hill areas as well as boosting the income of farmers beyond the subsistence level that they manage from traditional agricultural crops. Area under

horticultural crops can be increased particularly if cultivable wasteland and farms belonging to absentee landlords are utilized to grow these crops.

The status of Uttarakhand in all India area, production and yield of horticultural crops can be assessed from Appendix-3. Uttarakhand shared 2.81 per cent of all India area under fruits. A wide gap could be noticed in share of area and production. The proportion in production was around one third. It was due to poor level of productivity in the state. Uttarakhand registered low level of yield (below national average) of fruits. The gap in the yield between first ranking state of Tamil Nadu (30966 kgs/ha) and Uttarakhand (4009 kgs./ ha) was high and equal to around 26000 kgs./ha during 2010-11.

The share of Uttarakhand in all India area of vegetables was negligible and around 1 per cent during 2010-11 while proportion in production was less than 1 per cent. It was again due to poor level of productivity (12015 kgs./ha) that was below the all India average of 17253 kgs./ha it may be pointed out that level of productivity of vegetables in Tamil Nadu was 29859 kgs./ha which was more than double of the productivity of vegetables in Uttarakhand.

The scenario of area, production and yield of spices in Uttarakhand appeared to be encouraging and contrary to fruits and vegetables. The share of Uttarakhand in all India area under spices was as low as 0.25 per cent but contribution in production was triple due to higher productivity of 5776 kgs./ha against all India average of 1819 kgs./ ha during 2010-11. The state emerged as a second ranking state in terms of yield rate of spices. Arunachal Pradesh was the only state which registered productivity of spices higher than that of Uttarakhand. A robust policy implication can be drawn from this result that area expansion under spices should be encouraged in the state through proper incentives to the producers.

Floriculture is emerging as a potential sub-sector of horticulture in the state of Uttarakhand. It shared 0.63 per cent of all India area under flowers while contributed only one-third of this to the production.

After aggregating all the sub-groups of horticultural sector, we observed that Uttarakhand shared 1.25 per cent of all India area under horticultural crops and contributed only 0.74 per cent in production. This resulted from low productivity of these crops. The yield level of horticultural crops in Uttarakhand was 6560 kgs./ha against the all India average of 11017 kgs./ha during 2010-11. This level is abysmally low and efforts should be made to improve productivity of horticultural crops in Uttarakhand to make this sector a success story.

1.4 Objectives of the study

The study seeks to examine the following objectives:

- To collect data on area, production and yield of horticultural crops and compare with the baseline data collected by the Department of Horticulture and Directorate of Economics and Statistics, Uttarakhand.
- To identify the horticultural crops on which proper statistics are not being complied in the state of Uttarakhand.
- To study the problems encountered by the grass-root officials while collecting data on the horticultural crops.
- To identify the problems in estimation of horticultural crops and to suggest policy measures.

1.5 Research Methodology and Sources of Data

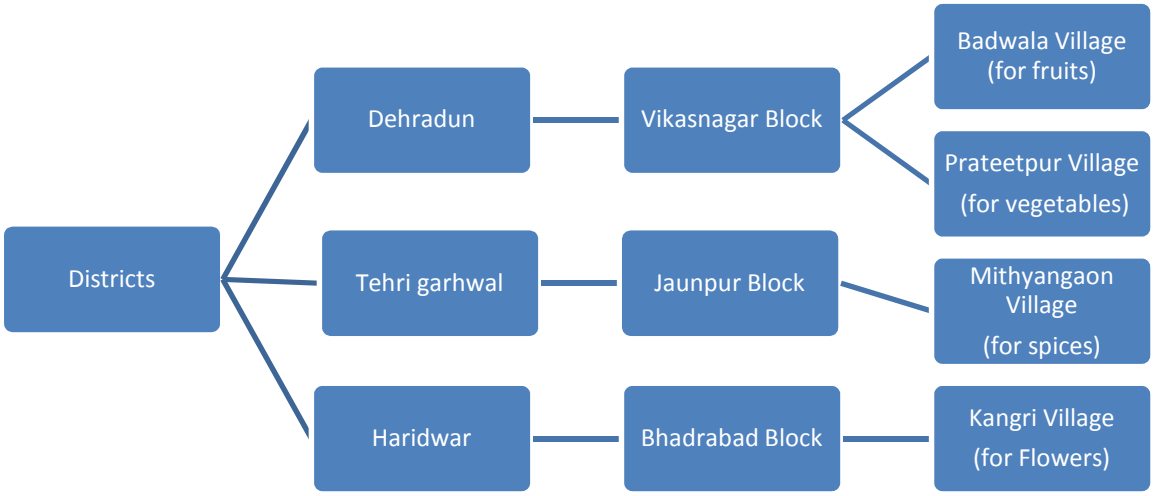
This study is based on macro and micro level data collected from secondary and primary sources. The data on area, production and yield of horticultural crops grown in Uttarakhand were collected from the Directorate of Horticulture, Uttarakhand. We have also obtained some data which are collected under the land use statistics from the Directorate of Economics and Statistics, Uttarakhand but these data are limited to few crops such as potato and onion. General information on selected districts and other aspects was obtained from various issues of the Statistical Diary of Uttarakhand published by the Directorate of Economics and Statistics of the state.

The scope of the study is confined to fruits, vegetables, spices and flowers. The districts for field survey were selected on the basis of criterion provided by the coordinator. Accordingly, districts with highest area under the above mentioned group of horticultural crops were selected. Dehradun has highest share in area of the state under fruits and vegetables. Tehri Garhwal with highest share of area under spices and Haridwar with highest share of area under flowers were selected for in-depth study. Further, one block with highest area and one village in each block based on the same criteria were chosen for detail study. In order to collect data, two questionnaires were canvassed – one for the producers of the horticultural crops and the second one for the officials involved in the data collection of horticultural crops at the village/ Block/ district level.

After collecting information from the secondary sources, all the farmers growing horticultural crops in selected villages were canvassed a household level schedule to collect detailed information about the various aspects related to the horticultural crops grown by them. The village Badawala for fruits, Prateetpur for vegetables in Vikas Nagar block of Dehradun district, village Mithyangaon for spices in Jaunpur block of Tehri Garhwal district and village Kangri of Bhadrabad block for flowers in Haridwar were selected for in depth study. The information on methodology adopted and verification process carried out in collection of horticulture related data and problems encountered by the officials in compilation of horticultural statistics were discussed and a schedule was filled. The field survey was carried out during 2012. The list of the households growing horticultural crops was provided by the office of the District Horticulture Officer of the respective districts and we have followed the same for the survey. The details of the selected districts, blocks and villages are given below.

Item	District	Block	Village	No. of Households
Fruits	Dehradun	Vikasnagar	Badawala	14
Vegetables	Dehradun	Vikasnagar	Prateetpur	15
Spices	Tehri Garhwal	Jaunpur	Mithyangaon	50
Flowers	Haridwar	Bhadrabad	Kangri	14

Flow Chart of the Sample Design



Now, we present general background of the selected districts in Uttarakhand.

Dehradun

Dehradun is the capital city of the state of Uttarakhand. It is located in Garhwal region in Doon Valley on the foothills of the Himalayas nestled between two of India's mightiest rivers- the Ganges on the east and the Yamuna on the west. Dehradun district shares its boundary with the districts of Uttarkashi and Tehri Garhwal in the north-east, Pauri Garhwal on the south east, Haridwar and Saharanpur (UP) in the north-west. The district has two valleys. First one slopes down to the Yamuna on the north-west and the other towards river Ganga on the south east. The north eastern and the south western boundaries are the Himalayan Mountains and the Shivalik hills respectively. As per the 2001 Census, total population of Dehradun district was 12.82 lakh of which increased to 16.98 lakh in 2011. Out of this population, 47.06 per cent was rural in 2001 which reduced to 44.10 per cent in 2011. However, density of population increased in this period from 415 to 550 persons per square kilometer. The sex ratio has increased from 887 to 902 during this decade. The literacy rate in 2011 was 85.24 per cent that is above the level of the state.

According to Agricultural Census, the number of marginal and small holdings in the district was 65668 with an area of 30582 (ha). Of these, 7962 were in hilly region and 57706 in the plains of the district. The average size of holdings in hills was 0.47 ha. The district had a total of 73198 holdings with an area of 59711 ha The average size of the operational holdings in the district was 0.66 ha

The net sown area in Dehradun district was 12.46 per cent in the year 2010-11.The share of irrigated area was 47.32 per cent. Owing to less than 50 per cent of cropped area under irrigation but good rainfall, cropping intensity was 146. The agricultural economy of Dehradun district is horticulture based since 53.99 per cent of GCA is devoted to these crops. The strength of personnel engaged in transfer of technology and implementation of developmental schemes in Horticulture Development is about 200. The department has programmes like mushroom cultivation, bee keeping, floriculture and fruits processing and marketing. Mango, litchi, ginger and potato are major crops in horticulture in Dehradun district. In Chakrata block, temperate fruits like apple and pomegranate are grown. There is a lot of potential for cultivation of temperate fruits in Chakrata block and sub-tropical fruits in Kalsi and Raipur Blocks. Other fruits grown in the district are plum, peach, mango, apricot and walnut. Food grain crops occupied 32.74 per cent of GCA. In particular, pulses, although an important source of protein occupied around 1 per cent of GCA. The area devoted to oilseeds was also around 1 per cent.

The yield rates of cereals, pulses and food-grains in Dehradun district were below the national level. However, in case of cereals, it was above the state level. Hence, there is an urgent need to improve the levels of productivity in the district (Table 1.1).

Tehri Garhwal

Tehri Garhwal is one of the largest districts among the hilly districts of Uttarakhand. Its administrative headquarter is at New Tehri Garhwal. It is surrounded by Rudraprayag district in the east, Dehradun district in the west, Uttarkashi district in the north and Pauri Garhwal district in the south.

According to 2011 Census, total population of district Tehri Garhwal was 6.16 lakh persons (6.09 % of state). Out of this, urban population formed a small fraction and was around 11 per cent. The district is primarily rural in nature and agriculture is the main stay of people. The rural population of the district was around 89 per cent. The sex ratio was 1078 that is above the state level. The population was sparse and therefore, density of population was very low, only 151 persons per square kilometer. It may be noted that total main workers in Tehri Garhwal comprised of 62.93 per cent cultivators, 0.83 per cent agricultural labors and remaining 36.24 per cent were non-agricultural workers. The literacy rate of the population was 75.10 per cent that is around 5 per cent below the state.

It is indicated in Table 1.1 that around 12 per cent of geographical area is cultivated in Tehri Garhwal. The average size of holding is however, marginally higher (0.72 ha) than the state level. This district has poor irrigation facilities. The share of net irrigated area in net sown area is as low as 12 per cent which is 34 per cent below the state level. As a result of poor irrigational facilities, cropping intensity was 138. Food grains followed by horticultural crops are the main crops grown in the district. These crops covered around 73 per cent of GCA. The yield rates of cereals were extremely poor and much below the national and state average. It is encouraging to note that productivity of pulses and oilseeds was above the state level. The major reasons for the success could be consumption of fertilizers by the farmers for these crops.

Horticultural crops including fruits and vegetables form a significant part of the crop system in Tehri Garhwal district. The preferred vegetables grown in this district are vegetable pea, radish, french bean, cauliflower, cabbage, onion, carrot, methi, capsicum, ladyfinger, tomato and brinjal. There has been an upward growth in production of spices (turmeric, chilli, coriander, garlic, ginger) production for the last three years in Tehri Garhwal. The main flowers cultivated in this district are gladiolus and marigold. There has been a significant increase in the production of spices and flowers in the district during the recent period.

Haridwar

Haridwar is an important pilgrimage city in Uttarakhand. The river Ganges, after flowing for 253 kilometers from its source at Gaumukh at the edge of the Gangotri Glacier, enters the Indo-Gangetic Plains of North India for the first time at Haridwar, which gave the city its ancient name, Gangadwara.

According to 2011 Census, total population of district Haridwar was 19.27 lakh persons (19.05 % of state). The density of population was 817 persons per square kilometer. Out of this, urban population formed a small fraction and was around 38 per cent. The district is primarily rural in nature and agriculture is the main stay of people. The rural population of the district was around 62 per cent. The sex ratio was 879. Total main workers in Haridwar comprised of 24.95 per cent cultivators, 15.04 per cent agricultural labors and remaining 59.65 per cent were non-agricultural workers.

It is indicated in Table 1.1 that around 48.92 per cent of geographical area is cultivated in Haridwar. The average size of holding is however, marginally higher (0.96 ha) than the state level. This district has commendable irrigation facilities. The share of gross irrigated area in gross cropped area is as high as 91 per cent which is 45 per cent above the state level. However, cropping intensity was 144 despite excellent irrigational facilities.

The crop pattern of the district was found diversified. The cereals and pulses covered 26.76 and 0.27 per cent of GCA. Oil seeds were grown on 11.40 per cent of GCA. Sugarcane is one of the important crops grown in the district and occupied more than 10 per cent of GCA. Foodgrains followed by sugarcane are the main crops grown in the district Haridwar. The yield rates of cereals were higher than the state level. The major reasons for the success could be availability of irrigation and higher consumption of fertilizers. The productivity of pulses and oilseeds was found lower than the state level.

Table 1.1

Major Indicators Related to Population and Agriculture in the selected Districts in Uttarakhand

Sl. No.	Particulars	Dehradun	Haridwar	Tehri Garhwal	Uttarakhand
I	**Population (In lakh)**				
	2001	12.82 (15.10)	14.47 (17.04)	6.04 (7.12)	84.89 (100)
	2011	16.98 (16.78)	19.27 (19.05)	6.16 (6.09	101.17 (100)
	% of Rural Population				
	2001	47.06	69.16	90.10	74.33
	2011	44.10	62.23	88.63	69.45
	Density of Population (per sq. km)				
	2001	415	613	148	159
	2011	550	817	151	189
	Sex Ratio				
	2001	887	865	1049	962
	2011	902	879	1078	963
	Literacy Rate (percent)				
	2001	78.98	63.75	66.73	71.62
	2011	85.24	74.62	75.10	79.63
II	**Main Workers (% share)***				
	A. Agricultural Workers	21.81	40.35	63.76	52.11
	(i) Cultivators	18.31	24.95	62.93	45.97
	(ii) Agricultural Labourers	3.50	15.40	0.83	6.14
	B. Non-Agricultural Workers	78.19	59.65	36.24	47.89
	(i) Household industrial workers	2.23	3.67	1.01	2.12
	(ii) others	75.96	55.98	35.23	45.77
III	**Area Details**				
	% of Net Area Sown to Geographical Area	12.46	48.92	12.06	12.75
	Average size of Holdings	0.66	0.96	0.72	0.91
	Percentage of Gross Area Irrigated to Total Cropped Area	48.21	90.84	16.95	48.03
	Percent of Net Irrigated Area to Net Area Sown	47.32	91.66	12.22	46.47
	Cropping Intensity (%)	146	144	138	161
IV	**Percentage of GCA (2010-11)**				
	Total Cereals	31.66	26.76	37.33	34.59
	Total Pulses	1.08	0.27	1.54	1.99
	Total Food grains	32.74	27.03	38.87	36.58
	Total Oilseeds	1.31	0.47	1.26	1.29
	All Horticultural Crops**	53.99	11.40	35.91	23.23
	Fruits	38.66	8.40	24.83	16.99
	Vegetables	13.74	2.15	8.69	5.26
V	**Yield (qtls/ha)**				
	Total Cereals	23.63	25.11	15.33	22.52
	Total Pulses	7.35	8.07	9.46	8.80
	Total Food grains	23.09	24.94	15.10	21.77
	Total Oilseeds	5.65	7.26	5.31	7.85
	Horticultural Crops**	5.11	8.59	3.34	5.54
	Fruits	2.60	7.21	1.30	4.00
	Vegetables	11.76	15.04	8.26	9.88

Source: Statistical Diary of Uttarakhand, 2010-11 and Provisional Tables on Population, Census, 2011, *data related to census 2001since Census 2011 data are not yet available, ** Directorate of Horticulture, Uttarakhand, figure in parentheses give percentage

The horticultural crops occupied around 12 per cent of GCA. These crops including fruits, vegetables, spices and flowers are important crops under farming system. There is ample scope for medicinal and aromatic plants which have an important place in export of Agri-products. The district has favorable climate for cultivation of mango, guava, litchi, etc. among fruits and some of the areas are suitable for growing vegetables, flowers and spices. The area under fruit crops, flowers and spices is increasing. The trend of increasing production of mango, flowers and spices indicates that farmers are interested and aware of the production technology of crops. The district has two fruits and vegetable processing units and two community canning and training centres, one departmental nursery of 5 ha at Sikandarpur and 15 private nurseries. The horticulture department has eleven mobile teams and 5 cold storages with installed capacity of 8000 MT.

1.6 Organization of the study

In this report, we have examined status of baseline data on horticultural crops in Uttarakhand. Before turning to the details, a general perspective is provided to place this study in context. Therefore, Chapter-1 of the study is introductory in nature and presents background information, literature survey, objectives, research methodology and plan of the study. Chapter-2 is devoted to the status of horticultural crops in the selected state and districts. In Chapters 3, we have discussed socio-economic conditions of the horticultural crops growers. Chapters 4, 5 and 6 present empirical results obtained from the analysis of primary data collected by us. We have also addressed problems in available secondary data on horticultural crops and methodologies adopted in data collection of these crops in Uttarakhand. Final Chapter presents main findings of the study and conclusions.

Chapter-2

Growth and Development of Horticulture in Uttarakhand

Introduction

Horticulture is one of the critical sectors in the economy of the hilly state of Uttarakhand. Horticulture provides the much needed opportunity for diversification in agriculture especially in the context of peculiar topography and agro-climatic conditions of the hill states where the scope for production of conventional field crops is limited. Horticulture development is an effective tool for accelerating development in hilly areas due to limited land available for cultivation, availability of cultivable waste lands and necessity of supplementary job and income opportunities. However, large scale policy interventions are required to promote this sector. As regards financial input, lending to plantation & horticulture sector is a challenging task as most of these crops are having long gestation period, perishable in nature, labour and capital intensive with comparatively higher level of technical inputs. Considering the agro-climatic and socio economic scenario prevalent in Uttarakhand, it would be pertinent to concentrate on some important horticultural aspects in the state.

2.1 Composition of Horticultural Crops

Horticultural crops comprise a large variety of crops including fruits, vegetables, spices, and flowers, medicinal and aromatic plants. In view of the large genetic base available, crops adapt to diverse conditions of soil and climate. Table 2.1 presents share of individual crops in total area and production of horticultural crops in Uttarakhand. The scenario is dominated by fruits. The share of fruits in area and production of horticultural crops was as high as 73.12 and 53.61 per cent respectively. Vegetables occupied second rank with 22.65 per cent share in area and 41.04 per cent share in production. A higher contribution in production indicates better productivity of vegetable crops in the state. A gap was observed in the share in production and area in case of fruits.

Therefore, there is an urgent need to augment productivity of fruit crops in the state. Increase in productivity has to come from improvement in technology.

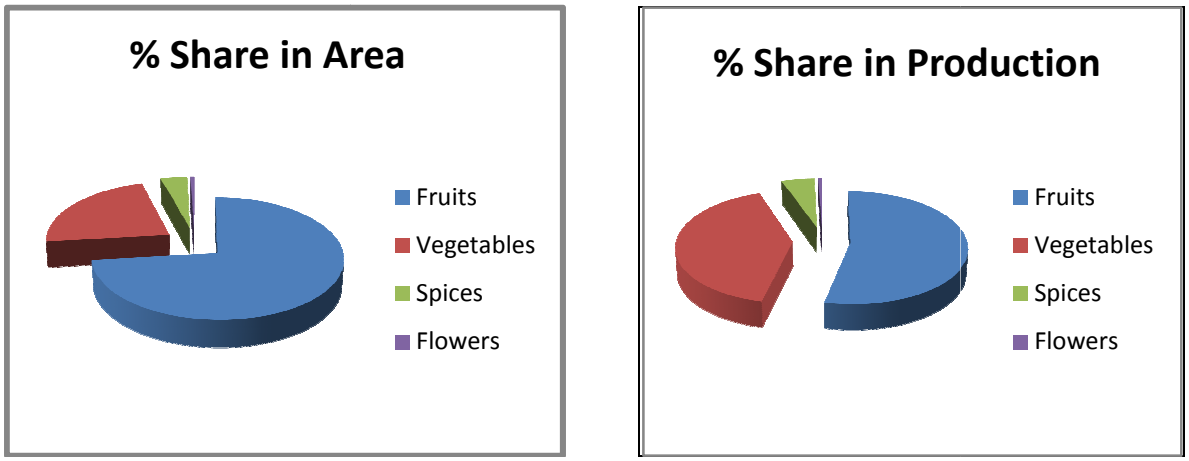
Spices are well known as appetizers. These are also considered essential in the culinary art all over the world. Some of the spices possess anti-oxidant properties and others are used as preservatives. India is the largest producer as well as consumer of spices in the world. Even in Uttarakhand, there is no cuisine without addition of one or more spices. Spices formed around 3.73 per cent of area under horticultural crops and contributed 4.95 per cent to total production. The higher contribution in production could be due to good yield.

Table 2.1
Share of Fruits, Vegetables, Spices and Flowers in Total Area, Production & Yield of Horticultural Crops in Uttarakhand during 2010-11

S.No.	Item	Area (ha)	% Share	Production (MT)	% Share	Yield (MT/ha)
1	Fruits	198160	73.12	792077	53.61	3.99
2	Vegetables	61392	22.65	606508	41.04	9.88
3	Spices	10107	03.73	73101	04.95	7.23
4	Flowers	1346	00.50	5869	00.40	4.36
	Total	271005	100.00	1477555	100.00	5.45

Source: Horticulture Production Data (From 2002-03 to 2010-11), Department of Horticulture & Food Processing, Uttarakhand

Fig. 1
Share of Fruits, Vegetables, Spices and Flowers in Total Area, Production & Yield of Horticultural Crops in Uttarakhand during 2010-11



In Uttarakhand, floriculture is getting popular among the farmers. These are being grown near the places of pilgrimage and peri-urban areas. Around, 0.50 per cent of area under horticultural crops was devoted to flowers and thus, a marginal share of total area under horticultural crops was devoted to them. The floriculture contributed 0.40 per cent in production of horticultural crops. The yield of flowers in Uttarakhand was 4.36 MT/ha during 2010-11 which is below the national average.

2.2 Year to year percentage change in Area, Production and Yield of Horticultural Crops

So far, we have analyzed area, production and yield of horticultural crops at one point of time in Uttarakhand. The importance of year to year percentage change in area, production and yield of horticultural crops has over whelming importance for analyzing development of these crops. Table 2.2, illustrates year to year to year percentage change in area, production and yield of fruits, vegetables spices, flowers and horticultural crops from 2002-2003 to 2010-11.

The acreage under fruits shows wide variations in percentage change from year to year in Uttarakhand during this period. It was as high as around 135 per cent in 2004-05 over 2003-04 while, it was observed negative in 2003-04 over 2002-03. The lowest change was observed in 2009-10 over 2008-09. The year to year percentage change in production of fruits in Uttarakhand also indicates significant variations. It was found highest, around 32 per cent in 2005-06 over 2004-05 while, it was recorded negative in 2009-10. The year to year percentage change in yield of fruit crops in Uttarakhand during 2002-2003 to 2010-11 was found mixed. The maximum increase in yield was observed in 2005-06 over 2004-05 whereas, it was found negative in 2009-10 over 2008-09 and in 2004-05 over 2003-04. The decline in yield of fruits during the second year was around 50 per cent. It could be due to severe change in climate related factors.

Table 2.2 also depicts year to year percentage change in area, production and yield of vegetable crops in the state during the above stated period. Like fruits, year to year percentage change in these parameters in case of vegetables is significant. The highest positive change in area was observed in 2004-05 over 2003-04. This year also recorded significant increase in production of vegetables due to acreage expansion but

yield declined by of more than 10 per cent. A negative change in area, production and yield was recorded during 2005-06 over 2004-05 and 2003-04 over 2002-03. The yield increased at differential rates in these years and the highest positive change was observed during 2003-04 over 2002-03.

Having analyzed year to year percentage change in area, production and yield of fruits and vegetables in Uttarakhand, we analyze the same for spices which indicate wide variations in these indicators. The percentage change in acreage under this group was as high as around 841 per cent in 2009-10 over 2008-09 while; it was recorded negative in 2003-04, 2004-05 and 2010-11. The yield also indicated huge year to year variations. The maximum positive change was observed during 2010-11 while it was negative during the previous year.

The cultivation of flowers has picked up well in Uttarakhand after the new millennium. As a result, area has increased from 618 ha in 2004-05 to 1346 ha in 2010-11. The highest percentage change in area could be noticed in 2005-06 over 2004-05. The rising trend in production since 2006-07 was due to area expansion and yield increase. The maximum increase in yield of flowers was recorded in 2006-07 while, it was found negative in 2005-06.

An examination of year to year percentage change in area, production and yield of horticultural crops in Uttarakhand between 2002-03 and 2010-11 indicates wide variations like individual groups. The highest change in acreage could be noticed in 2004-05 over 2003-04 and negative in 2010-11 over 2009-10. The yield has also shown negative as well as positive variations which affected production. The highest positive change in production of horticultural crops was observed during 2004-05 over 2003-04. However, it was recorded negative in some years.

Table 2.2

Year to Year Percentage Change in Area, Production and Yield of Horticultural Crops in Uttarakhand during 2002-03 to 2010-11

Year	Fruits			Vegetables			Spices			Flowers			Total		
	Area (ha)	Production (MT)	Yield (MT/ha)	Area (ha)	Production (MT)	Yield (MT/ha)	Area (ha)	Production (MT)	Yield (MT/ha)	Area (ha)	Production (MT)	Yield (MT/ha)	Area (ha)	Production (MT)	Yield (MT/ha)
2002-03	69875	443193	6.34	38282	392384	10.25	8551	54246	6.34	NA	NA	NA	116708	889823	7.62
2003-04	66588 (-4.70)	449451 (1.41)	6.75 (6.46)	29940 (-21.79)	348430 (-11.20)	11.64 (13.56)	6822 (-20.21)	49220 (-9.26)	7.22 (13.88)	NA (-)	NA (-)	NA (-)	103350 (-11.44)	847101 (-4.80)	8.2 (7.61)
2004-05	156277 (134.69)	525677 (16.95)	3.36 (-50.22)	50845 (69.82)	521850 (49.77)	10.26 (-11.85)	5605 (-17.83)	44382 (-9.82)	7.92 (9.69)	618 (-)	698 (-)	1.13 (-)	213345 (106.42)	1092607 (28.98)	5.12 (-37.56)
2005-06	180145 (15.27)	692650 (31.76)	3.84 (14.28)	50723 (-0.23)	461073 (-11.64)	9.09 (-11.40)	6091 (8.67)	46852 (5.56)	7.69 (-2.90)	3553 (474.91)	576 (-17.48)	1.16 (2.65)	240512 (12.73)	1201151 (9.93)	4.99 (-2.53)
2006-07	186060 (3.28)	716527 (3.44)	3.85 (0.26)	53969 (6.39)	524244 (13.70)	9.71 (6.82)	6552 (7.56)	50462 (7.70)	7.7 (0.13)	671 (-81.11)	1670 (189.93)	2.49 (114.65)	247252 (2.80)	1292903 (7.63)	5.23 (4.80)
2007-08	190688 (2.48)	735161 (2.60)	3.86 (0.25)	56239 (4.20)	560742 (6.96)	9.97 (2.67)	7302 (11.44)	56407 (11.78)	7.73 (0.38)	783 (16.69)	2423 (45.09)	3.09 (24.09)	255012 (3.13)	1354733 (4.78)	5.31 (1.53)
2008-09	193047 (1.23)	747009 (1.61)	3.87 (0.25)	57547 (2.32)	575040 (2.54)	9.99 (0.20)	7425 (1.68)	53637 (-4.91)	7.22 (-6.59)	886 (13.15)	3796 (56.66)	4.28 (38.51)	258905 (1.53)	1379482 (1.83)	5.33 (0.38)
2009-10	193785 (0.38)	723504 (-3.14)	3.73 (-3.61)	58449 (1.56)	564281 (-1.87)	9.65 (-3.40)	69833 (840.51)	65941 (22.93)	0.94 (-86.98)	1274 (43.79)	4421 (16.46)	3.47 (-18.93)	323341 (24.88)	1358147 (-1.55)	4.2 (-21.20)
2010-11	198160 (2.25)	792077 (9.47)	3.99 (7.24)	61392 (5.03)	606508 (7.48)	9.88 (2.38)	10107 (-85.53)	73101 (10.86)	7.23 (669.15)	1345.52 (5.61)	5869.27 (32.76)	4.36 (25.65)	271004.5 (-16.19)	1477555.27 (8.79)	5.45 (29.76)

Source: Horticulture Production Data (From 2002-03 to 2010-11), Department of Horticulture & Food Processing, Uttarakhand
NA: Not Available, Figure in parentheses depict year to year percentage change.

2.3 Share of Individual Horticultural Crops in Area, Production and Yield

Since vegetable and fruit crops together constituted around 96 per cent of area and production of horticultural crops in Uttarakhand, it would be useful to examine share of individual crops in total area allocation. Table 2.3 reveals that mango (19.68 per cent), apple (16.66 per cent) and citrus together occupied around 50 per cent of area under fruit crops in the state during 2010-11. The major citrus fruits of Uttarakhand are malta, orange, lime, etc. This group of fruits has good potential in the state on account of share in production, longer availability and amenability for processing. However, the data on different citrus fruits are not available which are required in order to evolve strategies for further development of these species. Next ranking fruits are walnut, pear and litchi. The fruits such as guava and aonla do not appear to be popular among farmers and therefore, proportion of area under these crops is less than one per cent.

A perusal of share of the individual crops in production of fruit crops indicates that mango, apple and citrus contributed around 51 per cent of total production. It would be useful to mention that contribution of pear was almost double in comparison to area. Peach also showed a higher share in production. The yield of fruit crops in Uttarakhand was 3.99 MT/ha during 2010-11. Pear followed by guava and peach indicated higher yield rates in comparison of other crops. It is discouraging to note that yield rates of fruits in Uttarakhand are much below the national level. Hence, all efforts should be made to improve the yield of various fruit crops in Uttarakhand.

Table 2.3 also provides information about variety wise area, production and yield of vegetable crops in Uttarakhand during 2010-11. Vegetable pea, tomato and cabbage are the major vegetable crops of Uttarakhand and constituted around 42 per cent of total area under vegetables in the state. A significant gap was observed in the share in area and production in case of beans, okra and capsicum. The productivity of vegetables was 9.88 MT/ha in Uttarakhand during 2010-11.

In view of agro-climatic suitability of vegetable crops cultivation in Uttarakhand, urgent steps are needed to increase productivity to potential levels through research and

development in area specific varieties of vegetable crops. The productivity of cauliflower, radish, cabbage, brinjal, tomato and onion was more than 10 MT/ha The overall scenario of yield rates was not found encouraging in the state.

In the hills of Uttarakhand, there is a lot of potential for growing off season/organic vegetables. More than 57 per cent of the total vegetable production in the state is from the hilly districts of the state, which can be termed as off-season vegetables for the plain regions.

An examination of Table 2.3 indicates that major spices of Uttarakhand are ginger, chilli and coriander. These crops occupied around 77 per cent of total area under spices and contributed almost the same share in production. Turmeric and garlic are also cultivated by farmers. These contributed 21 per cent of total spice production in the state. Ginger followed by turmeric recorded the highest yield.

Among flowers, marigold, gladiolus and rose are popular with around 84 per cent of total area under flowers in the state. Nevertheless, these varieties contributed only 29 per cent in production due to low yield. Among flowers, gerbera followed by carnation registered higher productivity in comparison to other varieties.

Table 2.3

Area, Production and Yield of Horticultural Crops in Uttarakhand during 2010-11

I. Fruits

S. No.	Fruits	Area (ha)	% Share	Production (MT)	%(Share)	Yield (MT/ha)
1	Mango	38994	19.68	135320	17.08	3.47
2	Apple	33023	16.66	135894	17.16	4.12
3	Citrus	27400	13.83	134463	16.98	4.91
4	Walnut	19483	9.83	21706	2.74	1.11
5	Pear	14916	7.53	108582	13.71	7.28
6	Litchi	9585	4.84	18732	2.36	1.95
7	Peach	8843	4.46	48530	6.13	5.49
8	Plum	9581	4.83	41155	5.19	4.29
9	Aonla	399	0.20	653	0.08	1.64
10	Apricot	9008	4.55	32064	4.05	3.56
11	Guava	1472	0.74	8926	1.13	6.06
12	Others	25456	12.85	106052	13.39	4.17
	Total	**198160**	**100**	**792077**	**100**	3.99

II. Vegetables:

S. No.	Vegetables	Area (ha)	% Share	Production (MT)	%(Share)	Yield (MT/ha)
1	Vegetable pea	11187	18.22	86937	14.33	7.77
2	Radish	4614	7.52	56931	9.39	12.34
3	French Bean	5176	8.43	38112	6.28	7.63
4	Cabbage	5609	9.14	70461	11.61	12.56
5	Cauliflower	2550	4.15	33966	5.6	13.32
6	Onion	3779	6.15	37993	6.26	10.05
7	Capsicum	2319	3.78	12739	2.11	5.49
8	Okra	3251	5.30	27085	4.47	8.33
9	Tomato	8783	14.31	97077	16.01	11.05
10	Brinjal	2138	3.48	25870	4.26	12.1
11	Others	11986	19.52	119337	19.68	9.96
	Total	**61392**	**100.00**	**606508**	**100.00**	9.88

III. Spices:

S. No.	Spices	Area (ha)	% Share	Production (MT)	% (Share)	Yield (MT/ha)
1	Turmeric	798	07.90	6651	09.10	8.33
2	Chili	2092	20.70	7626	10.43	3.65
3	Coriander	1476	14.60	7148	09.78	4.84
4	Garlic	1267	12.54	8457	11.57	6.67
5	Ginger	4153	41.09	41944	57.38	10.1
6	Others	321	03.17	1275	01.74	3.97
	Total	**10107**	**100.00**	**73101**	**100.00**	**7.23**

IV. Flowers:

S. No.	Flowers	Area (ha)	% Share	Production (MT)	% (Share)	Yield (MT/ha)
1	Gerbera	75.37	05.60	3480.3	59.30	46.18
2	Rose	146.84	10.91	141.19	02.40	0.96
3	Gladiolus	390.79	29.05	695.36	11.85	1.78
4	Marigold	586.54	43.59	883.37	15.05	1.51
5	Carnation	29.48	02.19	561.03	09.56	19.03
6	Others	116.5	08.66	108.02	01.84	0.93
7	**Total**	**1345.52**	**100.00**	**5869.27**	**100.00**	4.36

Source: Ibid

2.4 District-Wise Scenario of Area, Production and Yield of Horticultural Crops.

Having analyzed area, production and yield of vegetable and fruit crops at the state level, it would be prudent to analyze the scenario of horticultural crops at the district level. Table 2.4 indicates that Dehradun, Nainital, Almora, Pauri Garhwal and Tehri Garhwal were the major districts where fruits are cultivated. These districts together accounted for 58 per cent of total cultivated area. Pithoragarh, Haridwar, Uttarkashi, Chamoli and Champawat showed more than 5 per cent share in over all area under fruit crops in Uttarakhand during 2010-11. As far as, share of these leading districts in production of fruits is concerned, a significant gap could be noticed. The results for Almora are commendable since this district contributed around 22 per cent in production against 12 per cent in total area under fruits in the state. Haridwar and Chamoli also fall under the same category. Tehri Garhwal has contributed one third in production in comparison to its share in area. The yield of fruit crops in Uttarakhand was 3.60 MT/ha which is much below the all India level. However, four districts, namely Haridwar, Chamoli, Almora and Udham Singh Nagar achieved an yield rate above the state level during 2010-11.

Table 2.4
District-wise Area, Production and Yield of Fruits, Vegetables, Spices and Flowers during 2010-11

S. No.	Districts	Fruits					Vegetables					Spices					Flowers				
		Area	% Share	Production	% Share	Yield	Area	% Share	Production	% Share	Yield	Area	% Share	Production	% Share	Yield	Area	% Share	Production	% Share	Yield
1	Nainital	25,454	12.85	102,214	12.90	4.02	8,683	14.14	82,711	13.64	9.53	481	4.76	4,415	6.04	9.18	100.61	7.48	1,266.06	21.57	12.58
2	Udham Singh Nagar	6,685	3.37	39,450	4.98	5.9	6,105	9.94	65,172	10.75	10.68	850	8.41	7,005	9.58	8.24	227.20	16.89	1,700.42	28.97	7.48
3	Almora	24,018	12.12	175,101	22.11	7.29	4,131	6.73	43,006	7.09	10.41	1,150	11.38	8,839	12.09	7.69	15.86	1.18	47.20	0.80	2.98
4	Bageshwar	3,540	1.79	15,467	1.95	4.37	1,451	2.36	11,540	1.90	7.95	497	4.92	2,668	3.65	5.37	19.00	1.41	29.60	0.50	1.56
5	Phithoragarh	15,939	8.04	46,715	5.90	2.93	5,296	8.63	71,400	11.77	13.48	465	4.60	4,305	5.89	9.26	4.20	0.31	7.61	0.13	1.81
6	Champawat	11,067	5.58	15,962	2.02	1.44	3,707	6.04	15,836	2.61	4.27	703	6.96	5,303	7.25	7.54	9.18	0.68	13.97	0.24	1.52
7	Dehradun	25,609	12.92	66,566	8.40	2.6	9,104	14.83	107,093	17.66	11.76	885	8.76	7,551	10.33	8.53	167.00	12.41	1,535.60	26.16	9.2
8	Pauri Garhwal	20,159	10.17	28,662	3.62	1.42	5,329	8.68	27,295	4.50	5.12	682	6.75	2,595	3.55	3.8	37.00	2.75	68.74	1.17	1.86
9	Tehri Garhwal	20,128	10.16	26,146	3.30	1.3	7,044	11.47	58,201	9.60	8.26	1,928	19.08	12,781	17.48	6.63	8.00	0.59	64.00	1.09	8
10	Chamoli	14,966	7.55	99,795	12.6	6.67	2,889	4.71	25,644	4.23	8.88	659	6.52	4,563	6.24	6.92	99.80	7.42	112.55	1.92	1.13
11	Rudraprayag	2,826	1.43	5,542	0.70	1.96	918	1.50	4,696	0.77	5.12	488	4.83	1,862	2.55	3.82	20.25	1.50	21.32	0.37	1.05
12	Uttarkashi	13,401	6.76	66,834	8.44	4.99	3,058	4.98	38,595	6.36	12.62	484	4.79	3,508	4.80	7.25	14.22	1.06	105.00	1.79	7.38
13	Haridwar	14,368	7.25	103,623	13.08	7.21	3,677	5.99	55,319	9.12	15.04	835	8.26	7,706	10.54	9.23	623.20	46.32	897.20	15.29	1.44
	Total	**198,160**	**100**	**792,077**	**100**	**4**	**61,392**	**100**	**606,508**	**100**	**9.88**	**10,107**	**100**	**73,101**	**100**	**7.23**	**1,345.52**	**100**	**5,869.27**	**100**	**4.36**

Source: Directorate of Horticulture, Uttarakhand

After discussing the district wise scenario of fruit crops in terms of area, production and yield, we will examine the same for vegetable crops. Vegetables form an important segment of horticulture in Uttarakhand. The cultivation of vegetables is found concentrated in Dehradun, Nainital and Tehri Garhwal districts. These districts together constituted around 40 per cent of total area under vegetables in the state during 2010-11. In addition, six districts i.e. Udham Singh Nagar, Pithoragarh, Champawat, Almora, Haridwar and Pauri Garhwal recorded more than 5 per cent share in total area under vegetable crops in the state. A positive and negative gap could be observed under the share in area and production. Haridwar, Dehradun and Pithoragarh registered a positive gap between 2 to 3 per cent due to higher levels of productivity. The yield of vegetable crops in Uttarakhand was 9.88 MT/ha during 2010-11. Haridwar followed by Pithoragarh registered higher productivity of vegetables in comparison to other districts.

Like fruits and vegetables, spices are also grown in almost all districts in Uttarakhand. Tehri Garhwal, Almora, Dehradun and Udham Singh Nagar emerged as the leading districts and together constituted around 39 per cent of total area cultivated in the state during 2010-11. In addition, Haridwar, Pauri Garhwal and Champawat contributed around 14 per cent in area. The positive and negative gap in contribution of individual districts in area and production could be noticed. The leading district of Tehri Garhwal has contributed relatively lower share in production in comparison to area. The yield of spices in Uttarakhand was 7.23 MT/ha during 2010-11. Haridwar and Nainital were the front runners in the productivity of spices in comparison to the remaining districts of Uttarakhand. An examination of area under flowers indicates that Haridwar, Udham Singh Nagar and Dehradun together constituted around 76 per cent of total area under flowers in the state. In particular, Haridwar constituted around 46 per cent of total area and thus, showed concentration of floriculture due to being a popular place of pilgrimage in the state. A large gap could be noticed in contribution of individual district in area and production. The leading district of Haridwar contributed around 15 per cent in production against 46 per cent in area. This is largely due to poor productivity which was found much below the state. Nainital with a yield of 12.58 MT/ha emerged as a model that should be replicated in other flowers growing districts of the state.

Table 2.5

District-wise Area, Production and Yield of Horticultural Crops in Uttarakhand during 2010-11

S. No.	District	Area (ha)	% Share	Production (MT)	% Share	Yield (MT/ ha)
1	Nainital	34,719	12.81	190,606	12.90	5.49
2	Udham Singh Nagar	13,867	05.12	113,327	07.67	8.17
3	Almora	29,315	10.82	226,993	15.36	7.74
4	Bageshwar	5,507	02.03	29,705	02.01	5.39
5	Pithoragarh	21,704	08.01	122,428	08.29	5.64
6	Champawat	15,486	05.71	37,115	02.51	2.40
7	Dehradun	35,765	13.19	182,746	12.37	5.11
8	Pauri Garhwal	26,207	09.67	58,621	03.97	2.24
9	Tehri Garhwal	29,108	10.74	97,192	06.58	3.34
10	Chamoli	18,614	06.86	130,115	08.81	6.99
11	Rudraprayag	4,252	01.57	12,121	0.82	2.85
12	Uttarkashi	16,957	06.27	109,042	7.37	6.43
13	Haridwar	19,503	07.20	167,545	11.34	8.59
	Total	271,005	**100.00**	1,477,555	**100.00**	5.45

Source: Ibid

Table 2.5 presents overall scenario of horticultural crops during 2010-11. Dehradun, Nainital, Almora and Tehri Garhwal are the major districts growing horticultural crops in Uttarakhand during 2010-11. These districts together shared 48 per cent of total cultivated area of horticultural crops in the state. The contribution of these districts in production was almost the same. In addition, Pauri Garhwal accounted 9.67 per cent share in total area but its contribution in production was only 3.97 per cent due to dismal level of productivity. The per hectare productivity of horticultural crops in Uttarakhand was 5.45 MT./ha Haridwar, Udham Singh Nagar, Almora, Chamoli and Uttarkashi registered yield level above the state. Rudraprayag, Champawat and Pauri Garhwal showed extremely poor yield and hence, all efforts are needed to improve productivity in these districts.

2.5 Area, Production and Yield of Fruits, Vegetables, Spices and Flowers in Selected Districts

So far, we have analyzed area, production and yield of horticultural crops at the state and district levels. The details of area, production and yield of fruits and vegetables in Dehradun district, spices in Tehri Garhwal and flowers in Haridwar has over whelming importance for analyzing development of these crops.

Table 2.6

Area, Production and Yield of Fruits in Dehradun district during 2010-11

S. No.	Item	Area (ha)	% Share	Production (MT)	% Share	Yield
1.	Apple	4,717.00	18.42	12,619.00	18.96	2.68
2.	Pear	1,335.00	05.21	5,036.00	07.57	3.77
3.	Peach	474.00	01.85	1,980.00	02.97	4.18
4.	Plum	958.00	03.74	2,969.00	04.46	3.10
5.	Apricot	1,124.00	04.39	3,027.00	04.55	2.69
6.	Walnut	2,683.00	10.48	3,005.00	04.51	1.12
7.	Citrus varieties	2,480.00	09.68	7,377.00	11.08	2.97
8.	Mango	5,944.00	23.21	17,681.00	26.56	2.97
9.	Litchi	3,723.00	14.54	8,413.00	12.64	2.26
10.	Aonla	130.00	00.51	287.00	00.43	2.21
11.	Guava	143.00	00.56	485.00	00.73	3.39
12.	Other Fruits	1,898.00	07.41	3,687.00	05.54	1.94
Total		**25,609.00**	**100.00**	**66,566.00**	**100.00**	**2.60**

Source: Ibid

Table 2.6 reveals that mango, apple, litchi and walnut are the major fruit crops being cultivated in Dehradun district. These together contributed around 67 per cent in total area under fruits in this district. The citrus varieties and pear constituted between 5-10 per cent of area under fruit crops. The share of area under apricot, plum, peach, Aonla and guava was found below 5 per cent. The contribution in production in general was lower than area except for mango, citrus varieties and apple. The yield per hectare of fruit crops in the district was 2.60 MT/ha peach registered higher productivity in comparison to other fruit crops.

Table 2.7

Area, Production and Yield of Vegetables in Dehradun district during 2010-11

S. N0.	Item	Area (ha)	% Share	Production (MT)	% Share	Yield
1.	Vegetable pea	1,567.00	17.21	21,198.00	19.79	13.53
2.	Radish	276.00	03.03	3,225.00	03.01	11.68
3.	French Bean	962.00	10.57	5,751.00	05.37	5.98
4.	Cabbage	583.00	06.40	6,791.00	06.34	11.65
5.	Cauliflower	782.00	08.59	14,636.00	13.67	18.72
6.	Onion	425.00	04.67	4,870.00	04.55	11.46
7.	Capsicum	77.00	00.85	667.00	00.62	8.66
8.	Okra	754.00	08.28	5,352.00	05.00	7.10
9.	Tomato	1,061.00	11.65	18,327.00	17.11	17.27
10.	Brinjal	365.00	04.01	4,733.00	04.42	12.97
11.	Other Vegetables	2,252.00	24.74	21,543.00	20.12	9.57
Total		**9,104.00**	**100.00**	**107,093.00**	**100.00**	**11.76**

Source: Ibid

After analyzing the status of area, production and yield of individual fruit crops in Dehradun district, we present the same results for vegetable crops. Vegetable pea, tomato and french bean were found the major vegetables grown in the district and constituted around 40 per cent of total area under vegetables in Dehradun district during 2010-11 (Table 2.7). But, contribution of these crops was 42 per cent in the overall production of the district. The contribution of cauliflower in production was almost one and a half times its share in area. The yield of vegetables in Dehradun district was 11.76 MT./ha during 2010-11. Cauliflower followed by tomato and vegetable pea showed higher productivity in comparison to other vegetables.

After presenting an overview of horticultural crops in Dehradun district at one point of time, we look into year to year percentage change in area, production and yield of horticultural crops during 2002-03 to 2010-11. Table 2.8 indicates that acreage under fruit crops in this district has increased from 4337 ha in 2002-03 to 25602 ha in 2010-11 (490.32 per cent). The year to year percentage change after 2004-05 lies between 0.17 per cent and 1.87 per cent during the referred years. The production of fruits in this district has shown maximum percentage change of 70.85 per cent in 2010-11 over 2009-10. The year to year percentage change in yield of fruit crops was also recorded highest in this year.

The acreage under vegetables in Dehradun has become more than thrice between 2002-03 and 2010-11. The percentage change in area during the year 2004-05 was abrupt and as high as 188.9 per cent over previous year i.e. 2003-04. In the remaining years, it was below 4 per cent. The productivity of vegetables has increased from 5.99 MT/ha in 2002-03 to 11.76 MT/ha in 2010-11. The year to year percentage change in yield varied significantly and it was observed much higher in the year 2004-05 in comparison to rest of the years.

Spices occupied third portion in terms of area allocation under the horticultural crops in Dehradun district. Surprisingly, area under spices has declined significantly over the years in this district. The production has also declined. Nonetheless, yield has shown an increase 0.63 MT/ha between 2002-03 and 2010-11. The overall scenario of changes in area, production and yield of spices in this district during the referred period was not found encouraging.

Like Uttarakhand, cultivation of flowers has picked up in Dehradun district. The acreage has become three fold between 2004-05 and 2010-11. The production has increased several folds due to significant enhancement in the productivity which has increased from 1.02 MT/ha in 2004-05 to 9.19 MT/ha in 2010-11 (800.98 per cent).

The overall scenario of horticultural crops has improved significantly in Dehradun district after the new millennium. The area has increased several folds but it has shown negative change in 2003-04 over the year 2002-03. The production of horticultural crops has improved by 337.97 per cent in 2004-05 over the year 2003-04. It is essential to point out that yield of these crops has declined over the years. It has come down from 6.08 MT/ha in 2002-03 to 5.11 MT./ha in 2010-11. Hence, enhancement of yield through appropriate policies is an urgent need.

Table 2.8

Year to Year Percentage Change in Area, Production and Yield of Horticultural Crops in Dehradun during 2002-03 to 2010-11

Year	Fruits			Vegetables			Spices			Flowers			Total		
	Area (ha)	Production (MT)	Yield (MT/ha)	Area (ha)	Production (MT)	Yield (MT/ha)	Area (ha)	Production (MT)	Yield (MT/ha)	Area (ha)	Production (MT)	Yield (MT/ha)	Area (ha)	Production (MT)	Yield (MT/ha)
2002-03	4337	24463	5.64	2887	17281	5.99	1206	9523	7.90	NA	NA	NA	8430	51267	6.08
2003-04	NA	NA	NA	2887 (0.00)	17279 (-0.01)	5.98 (-0.17)	1209 (0.25)	9721 (2.08)	8.04 (1.77)	NA	NA	NA	4096 (-51.41)	27000 (-47.33)	6.59 (8.39)
2004-05	24270	35000	1.44	8341 (188.92)	79580 (360.56)	9.54 (59.53)	531 (-56.08)	3615 (-62.81)	6.81 (-15.30)	54.14	55.42	1.02	33196 (710.45)	118250 (337.96)	3.56 (-45.98)
2005-06	24572 (1.24)	35686 (1.96)	1.45 (0.69)	8516 (2.10)	83412 (4.81)	9.79 (2.62)	552 (3.95)	3785 (4.70)	6.86 (0.73)	60 (10.82)	61.00 (10.07)	1.02 (0.00)	33700 (1.52)	122944 (3.97)	3.65 (2.53)
2006-07	25032 (1.87)	37665 (5.55)	1.50 (3.45)	8553 (0.43)	83778 (0.44)	9.80 (0.10)	626 (13.41)	4906 (29.62)	7.84 (14.28)	71 (18.33)	223.38 (266.19)	3.15 (208.82)	34282 (1.73)	126572 (2.95)	3.69 (1.09)
2007-08	25178 (0.58)	38601 (2.48)	1.53 (2.00)	8563 (0.12)	84842 (1.27)	9.91 (1.12)	626 (0.00)	4909 (0.06)	7.84 (0.00)	93 (30.98)	229.16 (2.59)	2.46 (-21.90)	34460 (0.52)	128581 (1.59)	3.73 (1.08)
2008-09	25222 (0.17)	38765 (0.42)	1.54 (0.65)	8600 (0.43)	87131 (2.70)	10.13 (2.22)	686 (9.58)	5344 (8.86)	7.79 (-0.64)	113.6 (22.15)	640.09 (179.32)	5.63 (128.86)	34622 (0.47)	131880 (2.56)	3.80 (1.88)
2009-10	25336 (0.45)	38962 (0.51)	1.54 (0.00)	8791 (2.22)	88295 (1.34)	10.04 (-0.89)	755 (10.06)	5451 (2.00)	7.22 (-7.32)	137.5 (21.04)	678.63 (6.02)	4.94 (-12.25)	35019 (1.15)	133386 (1.14)	3.81 (0.26)
2010-11	25609 (1.05)	66566 (70.85)	2.60 (68.83)	9104 (3.56)	107093 (21.29)	11.76 (17.13)	885 (17.22)	7551 (38.53)	8.53 (18.14)	167 (21.45)	1535.60 (126.28)	9.19 (86.03)	35758 (2.11)	182746 (37.00)	5.11 (34.12)

Source: Horticulture Production Data (From 2002-03 to 2010-11), Department of Horticulture & Food Processing, Uttarakhand
NA: Not Available, Figure in parentheses depict year to year percentage change.

We had selected district of Tehri Garhwal for spices. The information on variety wise share of spices is presented in Table 2.9 It could be noted that ginger is the main spice of the district and covered 82.31 per cent of total area under spices. In addition, garlic and chillies each are also grown on 7 per cent of the area. Coriander is the marginal spice with less than 1 per cent of area coverage. Like area, ginger contributed around 92 per cent in production. The productivity of spices in Tehri Garhwal was 6.63 MT/ha during 2010-11. It was found much higher for ginger and turmeric in comparison to other spices grown in the district.

Table 2.9

Area, Production and Yield of Spices in Tehri Garhwal district during 2010-11

S. No.	Item	Area (ha)	% Share	Production (MT)	% Share	Yield
1.	Turmeric	55.00	02.85	329.00	02.57	5.98
2.	Chilli	135.00	07.00	250.00	01.96	1.85
3.	Coriander	16.00	00.83	32.00	00.25	2.00
4.	Garlic	135.00	07.00	463.00	03.62	3.43
5.	Ginger	1,587.00	82.31	11,707.00	91.60	7.38
6.	Other Spices	-	-	-	-	-
Total		**1,928.00**	**100.00**	**12,781.00**	**100.00**	**6.63**

Source: Ibid

Next, we analyze year to year percentage change in area, production and yield of horticultural crops in Tehri Garhwal district between 2002-03 and 2010-11. It may be noticed that area under fruits cultivation in this district increased by 472.79 per cent in this period but production increased by a lower percentage (174.96 per cent) due to decline in productivity which dropped by 52.40 per cent over these years. The year to year percentage change in area, production and yield was positive as well as negative. The highest change in area around (484 per cent) occurred in 2004-05 over the previous year.

The acreage under cultivation of vegetables in Tehri Garhwal district increased by 25.47 per cent during the referred period but production rose by 41.50 per cent due to improvement in yield that was 12.08 per cent. The year to year percentage change in the

mentioned indicators was mixed and the maximum change in production could be noticed in 2010-11 over 2009-10.

Like fruits and vegetables, area under spices in Tehri Garhwal district increased by a significant percentage that is 276.56 per cent in this period. It is surprising to note that area under spices has indicated an exceptional increase of 185.56 per cent in 2009-10 over 2008-09. However, production rose by 249 per cent due to good performance of productivity. In contrast to fruits and vegetables, year to year percentage change was largely positive in this case. Table 2.10 also provides information on area, production and yield of flowers in Tehri Garhwal district over the referred years. The acreage under flower cultivation has increased by 33.33 per cent between 2004-05 and 2010-11. It is worth mentioning that production improved by 966.67 per cent over this period due to eight fold increase in yield. The year to year percentage change could be noticed to be positive as well as negative like earlier groups of vegetables and fruits. A look at the performance of area and production of horticultural crops as a whole in Tehri Garhwal district between 2002-03 and 2010-11 reveals that area increased by 201.95 per cent while production increased by lower percentage of 84.06 per cent over the mentioned years. The performance of yield was found dismal since it declined by 39.05 per cent during this period. The year to year percentage change in area, production and yield was positive as well as negative. The highest percentage change in area and production could be noticed in 2004-05 over 2003-04 but unfortunately, productivity recorded a decline of 52.68 per cent in this year.

Table 2.10

Year to Year Percentage Change in Area, Production and Yield of Horticultural Crops in Tehri Garhwal during 2002-03 to 2010-11

Year	Fruits			Vegetables			Spices			Flowers			Total		
	Area (ha)	Production (MT)	Yield (MT/ha)	Area (ha)	Production (MT)	Yield (MT/ha)	Area (ha)	Production (MT)	Yield (MT/ha)	Area (ha)	Production (MT)	Yield (MT/ha)	Area (ha)	Production (MT)	Yield (MT/ha)
2002-03	3514	9509	2.71	5614	41130	7.33	512	2166	4.23	NA	NA	NA	9640	52805	5.48
2003-04	3198	10550	3.30	5614	41130	7.33	515	2171	4.22	NA	NA	NA	9327	53851.00	5.77
	(-8.99)	(10.94)	(21.77)	(0.00)	(0.00)	(0.00)	(0.58)	(0.23)	(-0.24)				(-3.25)	(1.98)	(5.29)
2004-05	18693	19028	1.02	5595	45831	8.19	525	2927	5.58	6.00	6.00	1.00	24819	67792.00	2.73
	(484.52)	(80.36)	(-69.09)	(-0.33)	(11.43)	(11.73)	(1.94)	(34.82)	(32.23)				(166.09)	(25.89)	(-52.68)
2005-06	18588	24977	1.34	5840	47812	8.19	565	3172	5.61	6.65	6.65	1.00	24999	75967.65	3.04
	(-0.56)	(31.26)	(31.37)	(4.38)	(4.32)	(0.00)	(7.62)	(8.37)	(0.54)	(10.83)	(10.83)	(0.00)	(0.73)	(12.06)	(11.36)
2006-07	18588	24985	1.34	5844	47825	8.18	565	3172	5.61	5.80	9.89	1.71	25003	75991.89	3.04
	(0.00)	(0.03)	(0.00)	(0.07)	(0.02)	(-0.12)	(0.00)	(0.00)	(0.00)	(-12.78)	(48.72)	(71)	(0.01)	(0.03)	(0.00)
2007-08	19513	25299	1.30	6276	50120	7.99	629	3411	5.42	7.61	15.50	2.04	26425	78845.50	2.98
	(4.98)	(1.26)	(-2.98)	(7.39)	(4.80)	(-2.32)	(11.32)	(7.53)	(-3.39)	(31.21)	(56.7)	(19.3)	(5.69)	(3.76)	(-1.97)
2008-09	19620	25518	1.30	6286	50278	7.99	644	3492	5.42	7.53	16.86	2.24	26557	79304.86	2.99
	(0.55)	(0.86)	(0.00)	(0.16)	(0.31)	(0.00)	(2.38)	(2.37)	(0.00)	(-1.05)	(8.77)	(9.8)	(0.50)	(0.58)	(0.33)
2009-10	19894	25878	1.30	6393	51931	8.12	1839	12199	6.63	4.00	4.00	1.00	28130	90012.00	3.20
	(1.40)	(1.41)	(0.00)	(1.70)	(3.29)	(1.63)	(185.56)	(249.34)	(22.32)	(-46.88)	(-76.27)	(-55.35)	(5.92)	(13.05)	(7.02)
2010-11	20128	26146	1.29	7044	58201	8.26	1928	12781	6.63	8.00	64.00	8.00	29108	97192.00	3.34
	(1.18)	(1.03)	(-0.77)	(10.18)	(12.07)	(1.72)	(4.84)	(4.77)	(0.00)	(100)	(1500)	(700)	(3.48)	(7.98)	(4.36)

Source: Horticulture Production Data (From 2002-03 to 2010-11), Department of Horticulture & Food Processing, Uttarakhand
NA: Not Available, Figure in parentheses depict year to year percentage change.

The data on Haridwar, a hub for flower cultivation in Uttarakhand indicate that marigold is the main flower crop of the district with coverage of 70 per cent of total area under flower cultivation in the district during 2010-11. The gladiolus and rose are also grown on around 22 per cent of area. All these important varieties grown in the district made lower contribution in production when compared to their share in area. However, carnation contributed around three times in production than its share in area due to higher yield. An effort should be made to raise the yield of popular flowers in the district by making all efforts.

Table 2.11

Area, Production and Yield of Flowers in Haridwar district during 2010-11

S. No.	Item	Area (ha)	% Share	Production (MT)	% Share	Yield
1.	Gerbera	-	-	-	-	-
2.	Rose	52.00	08.34	44.72	05.30	0.86
3.	Gladiolus	85.00	13.64	106.06	12.58	1.25
4.	Marigold	439.00	70.44	551.38	65.39	1.26
5.	Carnation	4.20	00.67	106.10	12.58	25.26
6.	Other flowers	43.00	06.90	34.94	04.14	-
Total		**623.20**	**100.00**	**843.20**	**100.00**	**1.35**

Source: Ibid

Table 2.12 depicts year wise percentage change in area, production and yield of fruits, vegetables, spices, flowers and all horticultural crops in Haridwar district from 2002-03 to 2010-11. It may be noticed that acreage under fruits has increased from 10757 in 2002-03 to 14368 ha in 2010-11 (33.56 per cent).The year to year percentage change in area was recorded the maximum during 2005-06 over 2004-05. It is pertinent to mention that production of fruits has almost doubled in the district over this period. The yield scenario was found commendable in 2004-05 by indicating a percentage change of 109.83 per cent. The year to year percentage change in yield was found negative in five years out of 8 years.

Like fruits, acreage under vegetables in Haridwar district increased significantly between 2002-03 and 2010-11. The year to year percentage change was positive all through except in the year 2003-04. The yield scenario was found depressing since

productivity of vegetables has declined from 19.19 MT/ha in 2002-03 to 15.04 MT/ha in 2010-11. In view of limited expansion in area and increase in productivity of vegetables in Haridwar during the referred period, year to year percentage change in production was also found low except the year 2007-08.

Spices were cultivated on 563 ha in Haridwar during 2002-03. The acreage has shown an increase of 48.31 per cent between 2002-03 and 2010-11. The year to year percentage change was found mixed. The maximum positive change in area under spices was observed around 97 percentage points in 2007-08 over 2006-07. It is depressing to note that productivity of spices has declined significantly during this period. It came down from 14.25 MT/ha in 2002-03 to 7.82 MT/ha in 2010-11 by showing a decline of 45.12 percentage points. This affected production of spices which also declined from 8016 to 6528 over this period. The year to year percentage change in production of spices was observed negative as well as positive in the district.

The cultivation of flowers in Haridwar district received impetus being a place of pilgrimage where flowers are used as offerings. Therefore, area under flowers increased from around 205 ha in 2004-05 to 623 ha in 2010-11. The productivity of flowers in Haridwar has almost doubled during the referred period. The area expansion and increase in productivity has positively affected the production which has increased by almost 384.24 percentage points between 2002-03 and 2010-11.

The overall scenario of horticultural crops in Haridwar district during the new millennium was found encouraging since acreage and productivity of these crops increased significantly. The area expanded by 51.59 per cent whereas yield increased by 26.18 per cent during the referred period. As a result, production registered an increase of 91.38 per cent. The year to year percentage change in area, production and yield of horticultural crops in Haridwar district were observed negative as well as positive. It could to be attributed to climatic factors in the state.

Table 2.12

Year to Year Percentage Change in Area, Production and Yield of Horticultural Crops in Haridwar during 2002-03 to 2010-11

Year	Fruits			Vegetables			Spices			Flowers			Total		
	Area (ha)	Production (MT)	Yield (MT/ha)	Area (ha)	Production (MT)	Yield (MT/ha)	Area (ha)	Production (MT)	Yield (MT/ha)	Area (ha)	Production (MT)	Yield (MT/ha)	Area (ha)	Production (MT)	Yield (MT/ha)
2002-03	10757	49239	4.58	1546	29674	19.19	563	8016	14.25	NA	NA	NA	12865.60	86929.40	6.76
2003-04	10757	49239	4.58	1277	29673	23.24	563	8016	14.25	NA	NA	NA	12596.60	86928.40	6.90
	(0.00)	(0.00)	(0.00)	(-17.40)	(-0.001)	(21.04)	(0.00)	(0.00)	(0.00)				(-2.09)	(-0.001)	(2.07)
2004-05	10779	103583	9.61	2177	32655	15.00	359	3355	9.35	205.30	183.78	0.89	13520.30	139776.80	10.34
	(0.20)	(110.37)	(109.83)	(70.48)	(10.05)	(-35.45)	(-36.19)	(-58.41)	(-34.39)				(7.33)	(60.79)	(49.85)
2005-06	12515	116154	9.28	2429	36489	15.02	190	1806	9.50	196.40	206.64	1.05	15330.40	154655.60	10.09
	(16.10)	(12.14)	(-3.43)	(11.58)	(11.74)	(0.13)	(-47.07)	(-46.17)	(1.60)	(-4.33)	(12.44)	(17.98)	(13.39)	(10.64)	(-2.42)
2006-07	12725	103287	8.12	2530	37981	15.01	211	2007	9.51	218.40	308.91	1.41	15684.40	143583.90	9.15
	(1.68)	(-11.08)	(-12.50)	(4.15)	(4.09)	(-0.06)	(11.05)	(11.13)	(0.11)	(11.20)	(49.49)	(34.28)	(2.31)	(-7.15)	(-9.32)
2007-08	13415	96463	7.19	3244	49696	15.32	415	3913	9.43	245.00	369.50	1.51	17319.00	150441.50	8.69
	(5.42)	(-6.06)	(-11.45)	(28.22)	(30.84)	(2.06)	(96.86)	(94.96)	(-0.84)	(12.18)	(19.61)	(7.09)	(10.42)	(4.78)	(-5.02)
2008-09	13706	98386	7.18	3461	51790	14.96	651	5666	8.70	278.10	416.21	1.50	18096.10	156258.20	8.64
	(2.17)	(1.99)	(-0.13)	(6.69)	(4.21)	(-2.34)	(56.86)	(44.80)	(-7.74)	(13.51)	(12.64)	(-0.66)	(4.49)	(3.87)	(-0.58)
2009-10	14038	98300	7	3516	52603	14.96	686	5943	8.66	596.80	832.47	1.39	18836.80	157678.50	8.37
	(2.42)	(-0.08)	(-2.50)	(1.59)	(1.57)	(0.00)	(5.38)	(4.89)	(-0.46)	(114.60)	(100.01)	(-7.33)	(4.09)	(0.91)	(-3.13)
2010-11	14368	103623	7.21	3677	55319	15.04	835	6528	7.82	623.20	843.20	1.44	19503.20	166367.20	8.53
	(2.35)	(5.42)	(3.00)	(4.58)	(5.16)	(0.53)	(21.72)	(9.84)	(-9.69)	(4.42)	(1.30)	(3.40)	(3.53)	(5.51)	(1.91)

Source: Horticulture Production Data (From 2002-03 to 2010-11), Department of Horticulture & Food Processing, Uttarakhand

NA: Not Available, Figure in parentheses depict year to year percentage change.

2.6 Schemes for Horticulture Development in Uttarakhand

The government of India, Ministry of Agriculture is implementing a centrally sponsored scheme, Horticulture Mission for North-East and Himalayan (HMNEH) States for overall development of horticulture. The Mission covers states including Uttarakhand and three Himalayan states namely, Jammu and Kashmir, Himachal Pradesh and Sikkim. The Mission addresses entire spectrum of horticulture right from production to consumption through backward and forward linkages.

The objectives of the Mission are:

- To improve the production and productivity of horticultural crops by harnessing the potential of the region.
- Special emphasis on "Low Volume, High Value, Less Perishable Horticulture Crops":
- Horticulture based farming system to be developed, thereby providing viable and ample opportunities for employment, especially for women, besides improving the productivity of land.
- The programmes under the HMNEH have been evolved in consultation with all the stakeholders, including the state governments; The HMNEH strives to address the following issues.
    - Technology & technological development
    - Demonstration of technologies
    - Production of quality planting material
    - Organic farming
    - Efficient water management
    - Plant health

The government has envisaged following goals to fulfill these objectives:

1. To establish convergence and synergy among numerous ongoing governmental programmes in the field of horticulture development. In order to achieve horizontal and vertical integration of these programmes, it is necessary to ensure adequate, appropriate, timely and concurrent attention towards all the links in the production, post harvest and consumption chain.

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

Uttarakhand has been considered as a treasure house of horticultural crops. The Government has introduced several schemes to promote these crops in the state in order to meet the growing demand in the country and abroad. The policy makers have been focusing on promotion of horticultural crops as a means of increasing income of farmers and for crop diversification. Some important schemes are currently in operation for horticultural development in Uttarakhand.

The schemes for development of horticultural sector in Uttarakhand comprise district and state sector schemes. The information on allocation of funds to important schemes for horticultural development in Uttarakhand suggests (Table 2.13) that the highest share of expenditure was allocated to the scheme for tea and medicinal plant development (44.85 per cent) followed by share of the state to provide 20 per cent financial support through the National Horticultural Board (NHB) and APEDA (18.23 per cent). The important components such as production of improved variety material/nursery development and maintenance of state orchards received 12.72 and 7.87 per cent respectively. For commercialization, dehydration of fruits and vegetables is essential and therefore, some expenditure was incurred on these items. In addition, post harvest management is crucial for perishable fruits and vegetables, this programme received Rs. 626 thousand in the allotted funds. There are several other schemes in operation for horticultural development in the state.

Table-2.13
Investment on Horticulture related Schemes in Uttarakhand during 2011-12

(in thousands)

Sl. No.	Name of Scheme	Provision	Expenditure	Utilization (%)
1.	Horticulture development in SC dominated areas	2215 (0.99)	2215 (0.99)	100.00
2.	Processing plan for drying fruits/ vegetables	5850 (2.62)	5850 (2.62)	100.00
3.	Production of improved variety material/ nursery development	28359 (12.72)	28359 (12.72)	100.00
	Total –district sector	36724 (16.47)	36724 (16.47)	100.00
	State Sector			100.00
1.	20 % share in financial support through NHB, APEDA, etc.	40650 (18.23)	40650 (18.23)	100.00
2.	MIS/PSS plan activity	186 (0.08)	186 (0.08)	100.00
3.	10 % share of state in National Micro Irrigation Mission Plan	615 (0.28)	615 (0.28)	100.00
4.	Establishments	3471 (1.56)	3471 (1.56)	100.00
5.	Maintenance of state orchards	17540 (7.87)	17540 (7.87)	100.00
6.	Post- Crop management	626 (0.28)	626 (0.28)	100.00
7.	Uttarakhand Apple Insurance Project	7000 (3.14)	7000 (3.14)	100.00
8.	Establishment of Food Processing Industry in Uttarakhand	96 (0.04)	96 (0.04)	100.00
9.	Bee keeping project	4170 (1.87)	4170 (1.87)	100.00
10.	Import of Nursery Material for Intensive Transplanting	-	-	100.00
11.	Hedging of old Orchard	7000 (3.14)	7000 (3.14)	100.00
12.	Intensive Off-Season Vegetable Production Development	500 (0.22)	500 (0.22)	100.00
13.	Mushroom Production and Marketing Project	2355 (1.06)	2355 (1.06)	100.00
14.	Horticulture Development for Individual Development in ST Dominated Areas in Uttarakhand	1000 (0.45)	1000 (0.45)	100.00
15.	Training Centre Jaremoli (Uttarakhand)	1016 (0.46)	1016 (0.46)	100.00
	Total (State Sector)	86225 (38.67)	86225 (38.67)	100.00
	Total (District and State Sector)	122949 (55.15)	122949 (55.15)	100.00
16.	Tea Development Project	60000 (26.91)	60000 (26.91)	100.00
17.	Subsidies to Medicinal Plant Research Institute	40000 (17.94)	40000 (17.94)	100.00
	Total (Tea and Medicinal plants)	100000 (44.85)	100000 (44.85)	100.00
	Total (Orchards, Tea and Medicinal Plants)	222949 (100.00)	222949 (100.00)	100.00

Figures in brackets show percentage
Source: Directorate of Horticulture, Uttarakhand

For the insurance of apple, an important fruit of Uttarakhand, 3.14 per cent was incurred. Bee-keeping received 1.87 per cent. Off-season vegetables, despite their importance received only 0.22 per cent. Training of the farmers cultivating horticultural crops is crucial for adoption of technology but it was allotted merely 0.46 per cent of total expenditure. The entire provisional budget for different schemes related to horticultural

development was fully utilized. There is none of the components which remained lagging in the utilization of funds.

The impact of above schemes is less visible on the horticultural economy of the state. It could be due to inadequate infrastructure. Systematic and realistic planning for sustainable development of these crops requires detailed information on economics of cultivation of these crops vis-à-vis traditional crops to establish advantages. Unfortunately, this information is scant.

The purpose of fund allocation for horticulture related components is to increase production and productivity. Table-2.14 presents component wise achievement of the physical targets in Uttarakhand during 2012-13.

Seed is a vital input in production. It has therefore, been considered necessary to provide special attention to the production and distribution of seeds of fruits and vegetables. The achievement of set targets was found poor in terms of production of seedling. It was as poor as 0.22 per cent in case of potato. The targets of distribution of seedling were better achieved. The target of area coverage under orchards was achieved by less than 50 per cent however, in case of vegetables, 91.18 per cent of set target was met during 2012-13. The target of the distribution of turmeric seeds was over achieved.

In order to promote technology transfer in case of horticultural crops, training programmes had been envisaged for bee keeping, fruit production and mushroom production. The achievement of targets was found poor in case of bee keeping and mushroom. However, 56.51 per cent of target was achieved in case of fruit production.
In order to assist farmers in the use of technology and related inputs, demonstrations of spices and vegetables were required to be arranged. It would be useful to point out that achievement of targets in case of vegetables was found excellent. On the contrary, it was as poor as 8 per cent in case of spices.

Table-2.14

Achievement of Physical Targets of Schemes in Uttarakhand during 2012-13

Sl. No.	Item	Unit	Target	Achievements	% of achieved
1	**Fruits:**				
	1. Distribution of Seedling	lakh	3580	12.80	35.75
	2. Production of Seedling	lakh	27.00	3.11	11.52
	3. Area coverage under orchards	ha	35.43	1734	48.94
	4. Fruit production	lakh MT	7.00	5.50	78.57
2.	**Vegetables:**				
	1. Distribution of seeds	Quintal	2600	1650	63.46
	2. Production of seeds	Quintal	2000	14.68	0.73
	3. Area coverage under Vegetables	ha	68000	62000	91.18
	4. Production of Vegetables	lakh MT	9.50	6.10	64.21
	5. Production of Potato Seeds	Quintal	10300	22.94	0.22
	6. Distribution of Potato Seeds	Quintal	8800	2084	23.68
3.	**Distribution of Investment:**				
	1. Distribution of Equipment	No.	6614	3680	55.64
	2. Distribution of Ginger Seeds	No.	1700	1239	72.88
	3. Distribution of Turmeric Seeds	No.	1000	1310	131.00
4	**Training:**				
	1. Training to Women in selected Centres	No.	1828	1038	57.78
	2. Training of Bee-keeping	No.	3714	381	10.26
	3. Training of Fruit production	No.	12745	7202	56.51
	4. Training of Mushroom	No.	1500	331	22.07
5	**Demonstration**				
	1. Demonstrations of Spices	No.	500	40	8.00
	2. Demonstrations for Vegetables	No.	1500	3706	247.07
6	**Other Components:**				
	1. Fruit/vegetable Processing in Govt. Preservation Centres	Quintal	3500	1600	45.71
	2. Production of Pasteurized Compost	MT	2285	40.50	1.77
	3. Distribution of Horticulture Cards	No.	50000	8075	16.15
	4. Protection of Plants	ha	12928	14741	114.02
	5. Distribution of Corrugated Boxes	No.	500000	398	0.08
	6. MIS/PSS				
	Purchase of Apple	MT	925	-	0.00
	Purchase of Malta	MT	925	-	0.00
	7. Hedging of Orchards	ha	169	33	19.52
	8. Distribution of Bee-keeping Equipment	No.	15565	1700	10.92
	9. Transportation of Bee-keeping Boxes for Pollination	No.	10825	-	0.00

Source: Directorate of Horticulture, Uttarakhand

The other components included fruit/vegetable processing in the preservation Centres of the government, production of compost, distribution of horticulture cards, protection of plants, hedging of orchards, distribution of corrugated boxes and equipment for bee keeping and transportation of boxes for pollination. It could be noticed that

performance of set targets of these components was recorded dismal except for protection of plants. The achievement of the target of purchase of apple and malta under MIS/PSS was found nil.

The analysis of the performance of different components related to horticulture in Uttarakhand during 2012-13 reveals that achievements of crucial components such as production and distribution of seeds, training, production of compost, purchase of apple and malta under MIS/PSS was not up to the mark. Therefore, urgent attention should be provided to these important components in order to achieve success in horticultural development in the state.

2.7 Plan Investment in Horticulture in Uttarakhand

Attaining regional balance in economic development has been one of the important objectives of the Five Year Plans in India. Therefore, a significant proportion of the total expenditure of the Central Government is incurred as plan outlays/expenditures. Thus, plan expenditure is the annual fund allocated by the Central Government to the State Governments for development schemes outlined in the on-going Five Year Plan, while the expenditure incurred on maintenance of the projects already created is accounted under the non-plan expenditure. The devolution of resources from the centre to the states is designed to bridge regional inequality in services and developmental activity.

With the active intervention of the Central Government in the economic development of the states, plan outlay has become a major instrument of policy. It is therefore, necessary to gauge the pattern of plan expenditure for horticultural development in Uttarakhand.

Table 2.15 depicts expenditure on horticulture development in the Eleventh Five Year Plan (2007-12) to Annual Plan 2011-12, 2012-13 and 2013-14. It could be noticed that horticulture received more than 25 per cent total expenditure of crop husbandry. The highest could be observed during the Eleventh Five Year Plan that was around 37 per cent of total expenditure on crop husbandry in Uttarakhand. In brief, horticulture has emerged as an important component of plan expenditure in Uttarakhand.

Table 2.15

Expenditure on Horticulture during Five Year Plans in Uttarakhand

Plan	Expenditure (Crop Husbandry)	Horticulture	% of Crop Husbandry
11th Plan	79355.99	29416.52	37.07
12th Plan	137102.16	45114.96	32.91
Annual Plan 2011-12	28479.01	8026.36	28.18
Annual Plan 2012-13	20666.98	7405.23	35.83
Annual Plan 2013-14	24794.65	7294.07	29.42

Source; Planning Division, Uttarakhand

2.8 Problems and Prospects of Horticulture Development in Uttarakhand

We have already discussed that horticulture is an important sub-sector of agriculture in the hilly areas of Uttarakhand. It provides much needed opportunities for diversification towards high value crops which yield higher income in comparison to traditional crops and thereby improve livelihood security of the farmers in hilly areas where non-farm sources of income are extremely limited.

The availability of infrastructure is the backbone of agricultural growth in Uttarakhand dominated by hilly areas. Normally, production and distribution bottlenecks created by deficiencies in roads, telecom, etc., create a drag on growth in the long run. What is less appreciated though is that infrastructure investment itself is a source of growth through stimulating demand, particularly, for inputs such as labour. However, infrastructure development in Uttarakhand in terms of connectivity of roads, telecom, etc., is inadequate. This has influenced availability of technology related inputs, marketing and storage facilities for horticultural crops which are mostly perishable in nature. These factors together affect productivity negatively and reduce returns from cultivation of these crops which in turn influence farmer's decisions in area allocation. However, recent policy measures for development of horticultural crops in Uttarakhand helped in area expansion but productivity of most of the horticultural crops still remains low in the state in comparison to the all India level.

Indeed, Uttarakhand has great advantage of agro-climatic diversity for growing a large variety of horticultural crops. This natural advantage should be exploited to the benefit of farmers. Hence, improving infrastructure and removing bottlenecks hindering growth of

productivity of horticultural crops hold prime importance for achieving the desired level of horticulture development in the state. The easy availability of planting material including region specific improved variety of seedlings needs urgent attention in policy.

Fortunately, solutions are at hand. The availability of bank credit for infrastructure related projects can bridge the gap in much needed finance. Often, projects get stuck at various levels of implementation due to regulatory hurdles such as delay in environment clearance and associated problems. These problems fall under the policy and administrative realm and therefore, it is the responsibility of the government to resolve them. In fact, these should be taken up by the government on project to project basis. Resolving the inputs and infrastructure conundrum will definitely make the difference to horticultural development not only for the future but even the present.

Chapter-3

Socio Economic Conditions of Horticulture Crops Growers

In the earlier chapters, we have discussed status of horticultural crops in Uttarakhand and main features of agriculture in the state and selected districts. This chapter is devoted to the socio- economic characteristics of respondent farmers, based on the results of field survey carried out by us during 2012.

The issues related to horticulture in Uttarakhand at the micro level considered for analysis in this study are complex and cannot be taken up for investigation in isolation without regard for some of the basic characteristics of the households growing these crops. We have included those characteristics that have a definite bearing on prospects of these crops. At first, we look into demographic details such as caste, family size, level of education, religion, age group of family members. The other major characteristics such as land owned, leased-in, leased-out, irrigation status, year of starting the horticultural crops by the farmers, motivating factors for growing horticultural crops are covered as important correlates of the main theme.

3.1 Background of the Respondents and Households

Before discussing the important aspects related to cultivation of horticultural crops by the farmers, it would be imperative to provide basic information about age and education of the respondents in the study area since success in agriculture and family income from non-agricultural activities would be influenced by these characteristics. In addition, number of economically active family members would also impact family income.

Distribution of Respondents by Age Group

Age of the household head and other family members is an important determinant of taking initiatives to cultivate horticultural crops as young farmers can generally take more risk while the elder farmers are largely risk averters and prefer to follow traditional technologies and crops.

Table 3.1
Distribution of Respondents by Age Group

(Years)

District	Block	Village	Below 14	15-25	26-50	51-60	61 & above	Total
Tehri Garhwal	Jaunpur	Mithyangaon	0 (0.00)	1 (2.00)	25 (50.00)	15 (30.00)	9 (18.00)	50 (100.00)
Dehradun	Vikasnagar	Badawala	0 (0.00)	0 (0.00)	4 (28.57)	6 (42.86)	4 (28.57)	14 (100.00)
Dehradun	Vikasnagar	Prateetpur	0 (0.00)	0 (0.00)	13 (86.67)	2 (13.33)	0 (0.00)	15 (100.00)
Haridwar	Bhadrabad	Kangri	0 (0.00)	2 (14.29)	11 (78.57)	1 (7.14)	0 (0.00)	14 (100.00)
Total			0 (0.00)	3 (3.23)	53 (56.99)	24 (25.81)	13 (13.98)	93 (100.00)

Figures in Parentheses give percentage.
Source: Field survey

A perusal of Table 3.1 indicates that 56.99 per cent respondents were in the age group of 26-50 years at the overall level. It was found highest in village Prateetpur of Dehradun district where share of respondents in this age group was as high as 86.67 per cent while in Badawala village of Dehradun district, it was found less than one third. Results indicate that more than 50 per cent of the respondents in all the four villages were between 26-50 years.

Education of Respondents

It is generally believed that, if a respondent is more educated, his decision for sowing a particular crop would be governed by the sound economic estimates of costs and benefits of that enterprise. In addition, an educated farmer is more enlightened about the existing options of demand and supply and is more attuned to advanced techniques than an illiterate traditional farmer. Therefore, role of education a priori is positive in taking up cultivation of horticultural crops.

Table 3.2
Distribution of Respondents by Educational Levels

District	Block	Village	Primary	Secondary	High School	Intermediate	Degree	Diploma	Post Graduate	Degree in Engineering /Medical	Illiterate	Total
Tehri Garhwal	Jaunpur	Mithyangaon	8 (16.00)	25 (50.00)	8 (16.00)	2 (4.00)	2 (4.00)	0 (0.00)	0 (0.00)	0 (0.00)	5 (10.00)	50 (100.00)
Dehradun	Vikasnagar	Badawala	0 0.00	0 0.00	4 (28.57)	4 (28.57)	6 (42.86)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	14 (100.00)
Dehradun	Vikasnagar	Prateetpur	0 0.00	1 (6.67)	8 (53.33)	5 (33.33)	1 (6.67)	0 0.00	0 0.00	0 0.00	0 0.00	15 (100.00)
Haridwar	Bhadrabad	Kangri	1 (7.14)	2 (14.29)	5 (35.71)	1 (7.14)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	5 (35.71)	14 (100.00)
Total			9 (9.68)	28 (30.11)	25 (26.88)	12 (12.90)	9 (9.68)	0 (0.00)	0 (0.00)	0 (0.00)	10 (10.75)	93 (100.00)

Source: Ibid

Table 3.2 indicates that 30.11 per cent of total respondents attained education upto secondary school and around 27 per cent passed high school. None of them had diploma, post graduate degree or specialized degree in engineering and medical. Wide variations were observed across the selected villages in educational attainment of respondents. It is discouraging to note that 35.71 per cent of the respondents in Kangri village of Haridwar district were found illiterate.

Distribution of Highest Educated Person in Sampled Households

After examining the educational level of the respondents, we have tried to assess the educational status of the family. For this purpose, an enquiry was made about highest education attained by a family member in case of each household.

In Mithyangaon village of Tehri Garhwal district, 8 per cent of family members graduated from the University. In addition, 2 per cent of family members acquired technical education. Dehradun is the capital of Uttarakhand and hence, access to higher education is much superior in terms of availability of the institutions. Therefore, 71.43 per cent of family members of the respondents in village Badawala attained education up to graduation and above. The results for Prateetpur village in Dehradun were however, different since 26.67 per cent of family members were found educated up to this level, but 60 per cent of family members studied up to higher secondary.

The scenario of educational attainment of family members in Kangri village of Haridwar district deviated from first three villages. None of the family members of respondents attended the university. Only 7.14 per cent of family members were higher secondary. But, a significant proportion (42.86%) studied upto secondary school. At the overall level, it could be observed that status of education of the family members of respondents was mostly confined to school level; still around 20 per cent of them attained education up to the university and technical level.

Table 3.3
Distribution of Highest Educated Person in the Households

District	Block	Village	Below Primary	Primary	Middle	Secondary	Higher Secondary	Graduate & above	Technical	Illiterate	Total
Tehri Garhwal	Jaunpur	Mithyangaon	0 (0.00)	4 (8.00)	7 (14.00)	11 (22.00)	19 (38.00)	4 (8.00)	1 (2.00)	4 (8.00)	50 (100.00)
Dehradun	Vikasnagar	Badawala	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	4 (28.57)	10 (71.43)	0 0.00	0 0.00	14 (100.00)
Dehradun	Vikasnagar	Prateetpur	0 (0.00)	0 (0.00)	0 (0.00)	2 (13.33)	9 (60.00)	4 (26.67)	0 0.00	0 0.00	15 (100.00)
Haridwar	Bhadrabad	Kangri	0 (0.00)	1 (7.14)	5 (35.71)	6 (42.86)	1 (7.14)	0 (0.00)	0 (0.00)	1 (7.14)	14 (100.00)
Total			0 (0.00)	5 (5.38)	12 (12.90)	19 (20.43)	33 (35.48)	18 (19.35)	1 (1.08)	5 (5.38)	93 (100.00)

Figures in Parentheses give percentage.
Source: Ibid

Distribution of Respondents by Caste

Caste factors can influence the farmers' decision to grow specific crops. Some castes may be specialized in undertaking specific activities while traditions in some castes may preclude farmers from undertaking a specific enterprise. In the questionnaire, we had enquired about the caste of respondents. Table 3.4 presents details of the caste of respondents in four selected villages in 2012. Most of the respondents belonged to OBC category and general category at the aggregate level. In Mithyangaon village of Tehri Garhwal, all of them belonged to OBC category while in Badawala village of Dehradun district, majority of respondents belonged to general category.

Table 3.4
Distribution of Respondents by Caste

District	Block	Village	SC	ST	OBC	General	Others	Total
Tehri Garhwal	Jaunpur	Mithyangaon	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)
Dehradun	Vikasnagar	Badawala	0 (0.00)	1 (7.14)	0 (0.00)	13 (92.86)	0 (0.00)	14 (100.00)
Dehradun	Vikasnagar	Prateetpur	0 (0.00)	0 (0.00)	15 (100.00)	0 (0.00)	0 (0.00)	15 (100.00)
Haridwar	Bhadrabad	Kangri	0 (0.00)	0 (0.00)	3 (21.43)	11 (78.57)	0 (0.00)	14 (100.00)
Total			0 (0.00)	1 (1.08)	68 (73.12)	24 (25.80)	0 (0.00)	93 (100.00)

Figures in Parentheses give percentage.
Source: Ibid

Once again, OBC dominated the scenario in Prateetpur village of Dehradun district but in Kangri village of Haridwar district, 78.57 per cent of respondents belonged to general category. It may be pointed out that none of respondents growing horticultural crops were SC and only a marginal 1.08 per cent were from ST category.

Distribution of Respondents by Religion

If we look at the religion of the respondents, it may be observed that all of them were Hindu. This is true despite variation in location of these villages and horticultural crops grown by them. Even in the villages of Badawala and Prateetpur in the capital city of Dehradun in Uttarakhand, all the respondents were Hindu (Table 3.5).

Table 3.5
Distribution of Respondents by Religion

District	Block	Village	Hindu	Muslim	Chirst	Buddhist	Jain	Total
Tehri Garhwal	Jaunpur	Mithyangaon	50 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	50 (100.00)
Dehradun	Vikasnagar	Badawala	14 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	14 (100.00)
Dehradun	Vikasnagar	Prateetpur	15 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	15 (100.00)
Haridwar	Bhadrabad	Kangri	14 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	14 (100.00)
Total			93 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	93 (100.00)

Source: Ibid

Distribution of Family Members by Age Group

Age of the family members is an important determinant of crop diversification and adoption of horticultural crops. The young members of family can persuade head of family to take more risk while the elder members are largely risk averters and prefer to follow traditional crops and technologies. The proportion of male and female members above the age of 15 years was 35 and 30 per cent respectively in Mithyangaon village of Tehri Garhwal district. In Badawala village of Dehradun district, 68 per cent of male and female members were found in this age group while in Prateetpur, this proportion was lower by 6 per cent.

Also, in Kangri village of Haridwar more than 60 per cent of male and female family members were above 15 years in age. After aggregating all the four villages, this proportion was around 65 and rest of 35 per cent family members were found below the age of 15 years including girls and boys. The average size of family of respondents was between 6 and 8 persons in the selected districts.

Table 3.6
Distribution of Family Members by Age Group

(Age in years)

District	Block	Village	Male	Female	Children below 15 Years (Boys and girls)	Total	Average size of family
Tehri Garhwal	Jaunpur	Mithyangaon	144 (34.62)	126 (30.29)	146 (35.10)	416 (100.00)	8.32
Dehradun	Vikasnagar	Badawala	29 (37.18)	24 (30.77)	25 (32.05)	78 (100.00)	5.57
Dehradun	Vikasnagar	Prateetpur	41 (32.8)	36 (28.80)	48 (38.4)	125 (100.00)	8.33
Haridwar	Bhadrabad	Kangri	36 (36.00)	28 (28.00)	36 (36.00)	100 (100.00)	7.14
Total			250 (34.77)	214 (29.76)	255 (35.47)	719 (100.00)	7.73

Source: Ibid

Distribution of Respondents by Land Size Classification

The land details of the respondents are important because they indicate the economic and social status of the household. The details of land size of the respondents are presented in Table 3.7. Generally, size of land affects crop pattern, agricultural income, disposable output and adoption of improved technology and other initiatives. In Mithyangaon village of Tehri Garhwal district, 88 per cent respondents were marginal and 12 per cent were small farmers, reason being that it is hilly village and therefore, land holdings are very small. On the other hand, sizeable proportion of respondents in village Badawala of Dehradun district are orchardists and therefore, 64 per cent of them are medium and large farmers. None of them was a marginal farmer.

In Prateetpur village of Dehradun district, proportion of marginal, small, medium and large farmers was different but the scenario was dominated by small and medium categories. On the other hand, 71 and 29 per cent of respondents in Kangri village of Haridwar district were marginal and small farmers. At the overall level, 82 per cent of the respondents were small and marginal farmers and rest of them was medium and large farmers.

Table 3.7
Distribution of Respondents by Land Size Classification

District	Block	Village	Marginal	Small	Medium	Large	Total
Tehri Garhwal	Jaunpur	Mithyangaon	44 (88.00)	6 (12.00)	0 0.00	0 0.00	50 (100.00)
Dehradun	Vikasnagar	Badawala	0 (0.00)	5 (35.71)	4 (28.57)	5 (35.71)	14 (100.00)
Dehradun	Vikasnagar	Prateetpur	1 (6.67)	6 (40.00)	6 (40.00)	2 (13.33)	15 (100.00)
Haridwar	Bhadrabad	Kangri	10 (71.43)	4 (28.57)	0 (0.00)	0 (0.00)	14 (100.00)
Total			55 (59.14)	21 (22.58)	10 (10.75)	7 (7.53)	93 (100.00)

Figures in Parentheses give percentage.
Source: Ibid

3.2 Land Owned by the Respondents

The type of ownership of land often influences crop pattern and adoption of technology. Therefore, it is essential to look into the nature of ownership of land before analyzing its use. We have classified land details into four categories i.e. land owned, land leased-in, leased-out and land operated.

The land holding position of the respondents of various size classes is presented in Table 3.8. Accordingly, respondents owned 130.56 hectares of land at the overall level. Out of this land, 112.20 hectares was irrigated and rest was un-irrigated. The respondents in Badawala and Prateetpur villages of Dehradun district owned relatively higher share of land. In Mithyangaon village of Tehri Garhwal and Kangri village of Haridwar district, respondents owned around 25 and 8 hectares of land. The respondents in Prateetpur village and Kangri village leased-in land. The practice of leasing out land was not found among respondents. The average size of holding of respondents was 1.52 ha. The lowest size could be observed in Mithyangaon village of Tehri Garhwal district due to hilly terrain. On the other hand, respondents in Badawala village of Dehradun district operated 4.64 ha during 2012.

Table 3.8
Land Owned by the Households

(Hectares)

District	Block	Village	Owned Land			Leased in			Leased out	Uncultivated Land	Total (Owned and Leased in Land)	Net Operated Area	Average size of holding
			Irrigated	Unirrigated or Dry Land	Total Land	Irrigated	Unirrigated or Dry Land	Total Land					
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Tehri Garhwal	Jaunpur	Mithyangaon	11.96	12.76	24.72	0	0	0	0	0.82	24.72	23.9	0.48
Dehradun	Vikasnagar	Badawala	63.60	2.00	65.6	0	0	0	0	0.7	65.6	64.9	4.64
Dehradun	Vikasnagar	Prateetpur	28.72	3.6	32.32	9.04	0	9.04	0	0	41.36	41.36	2.78
Haridwar	Bhadrabad	Kangri	7.92	0	7.92	2.80	0	2.80	0	0	10.72	10.72	0.78
		Total	112.20	18.36	130.56	11.84	0	11.84	0	1.52	142.4	140.88	1.52

Source: Ibid

Terms of leased in Land

The tenancy status of land operated by the respondents is an important factor in determining their involvement in farming. The analysis of land holding structure of respondents revealed that the practice of leasing in land was found prevalent but leasing out of land was non-existent. Among the respondents, none of them leased-out land. Table 3.9 is self explanatory. It could be noticed that 9.04 hectares of land in Prateetpur village of Dehradun district and 2.8 hectares of land in Kangri village of Haridwar district was leased in by the respondents. All of them reported that terms of leasing in land were fixed rent. The same was found true at the aggregate level. It may be pointed out that mode of leasing in land on crop sharing and crop and cost sharing basis or both was not adopted by respondents in selected villages for the study in Uttarakhand.

Table 3.9
Distribution of Leased in and Leased out Land by Terms and Conditions

District	Block	Village	Leased in Land					Leased out Land				
			Crop Sharing	Crop and Cost Sharing	Both 1 &2	Fixed Rent	Total	Crop Sharing	Crop and Cost Sharing	Both 1 &2	Fixed Rent	Total
Tehri Garhwal	Jaunpur	Mithyangaon	0	0	0	0	0	0	0	0	0	0
Dehradun	Vikasnagar	Badawala	0	0	0	0	0	0	0	0	0	0
Dehradun	Vikasnagar	Prateetpur	0	0	0	9.04	9.04	0	0	0	0	0
Haridwar	Bhadrabad	Kangri	0	0	0	2.8	2.8	0	0	0	0	0
Total			0	0	0	11.84	11.84	0	0	0	0	0

Source: Ibid

Distribution of Irrigated Area by Source

Availability of irrigational facilities is critical for adoption of improved technology in farming. The status of irrigation of farmers plays an important role in productivity per unit of land. We had sought information about source of irrigation during our survey. It may be observed that land of respondents was irrigated by canal, diesel and electric tube wells and Canal (gul) in selected villages. In hilly village of Mithyangaon in Tehri Garhwal district, canal (gul) was the only source of irrigation while in Badawala village of Dehradun district, canal and tube wells were the major sources of irrigation while tube-well was recorded as a source of irrigation in Prateetpur village of this district. In Kangri village of Haridwar district, electric tube-wells were reported as the source of irrigation.

Table 3.10
Distribution of Irrigated Area by Source

(Hectare)

District	Block	Village	Canal	Tube well Diesel	Tube well Electric	Tank	Open well	T+C*	Total
Tehri Garhwal	Jaunpur	Mithyangaon	11.96	0.00	0.00	0.00	0.00	0.00	11.96
Dehradun	Vikasnagar	Badawala	46.75	9.80	0.00	0.00	0.00	7.05	63.60
Dehradun	Vikasnagar	Prateetpur	0.00	0.00	4.10	0.00	0.00	33.66	37.76
Haridwar	Bhadrabad	Kangri	0.00	0.00	10.72	0.00	0.00	0.00	10.72
		Total	58.71	9.80	14.82	0.00	0.00	40.71	124.04

Source: Ibid
*Tube well + Canal

In a nutshell, canal and tube-wells were the major sources of irrigation in plain villages while gul was extremely important in hilly village of Mithyangaon in Tehri Garhwal district.

3.3 Year of Starting the Cultivation of Horticultural Crops

After the introduction of the Horticultural Mission in Uttarakhand, it has emerged as an important sector in agricultural passing through the various phases of development by encompassing a wide variety of crops, fruits, vegetables, spices, flowers, aromatic and medicinal plants. This achievement is due to involvement of farmers who are progressive and innovative. During the course of survey, all the respondents in each village were asked about motivation for their involvement in cultivation of horticultural crops.

Results presented in Table 3.11 indicate that 52 per cent of the respondents in Mithyangaon village in Tehri Garhwal district reported that they have been cultivating these crops since 10 years. Another 38 per cent respondents informed that their involvement is less than 10 years old. Around 64 per cent respondents in Badawala village of Dehradun district mentioned that they have been taking up cultivation of horticultural crops for less than a decade. However, around 21 per cent of respondents in the same village informed that they have been involved in horticultural related activity since childhood. In Prateetpur village of Dehradun district, around 47 per cent of respondents were involved in cultivation of horticultural crops since 10 years, while around 27 per cent have been cultivating these crops since 5 years. None of them

reported their involvement since childhood. When we analyse involvement of respondents in cultivation of horticultural crops in Kangri village of Haridwar district, it is found that different groups of respondents started cultivating horticultural crops since childhood , 4 years, 3 years, 2 years and one year but two third of respondents started growing horticultural crops since 10 years or less than 10 years. At the overall level, around 73 per cent respondents reported their involvement in cultivation of horticultural crops since 10 years or less than 10 years. Around 10 per cent have been growing these crops since 5 years.

Table 3.11

Year of Starting the Horticultural Crops by the Farmers (Number of Households)

District	Block	Village	Since our Childhood	Since long >10 years	Since 10 Years	Since 5 Years	Since 4 Years	Since 3 years	Since 2 years	Since 1 Years	Total
Tehri Garhwal	Jaunpur	Mithyangaon (No.)	0	19	26	1	1	0	1	2	50
		%	0.0	38.0	52.0	2.0	2.0	0.0	2.0	4.0	100.0
Dehradun	Vikasnagar	Badawala (No.)	3	9	2	0	0	0	0	0	14
		%	21.4	64.3	14.3	0.0	0.0	0.0	0.0	0.0	100.0
Dehradun	Vikasnagar	Prateetpur (No.)	0	3	7	4	1	0	0	0	15
		%	0.0	20.0	46.7	26.7	6.7	0.0	0.0	0.0	100.0
Haridwar	Bhadrabad	Kangri (No.)	0	1	1	4	0	3	5	0	14
		%	3.2	34.4	38.7	9.7	2.2	3.2	6.5	2.2	100.0
		Total (No.)	3	32	36	9	2	3	6	2	93
		%	3.2	34.4	38.7	9.7	2.2	3.2	6.5	2.2	100.0

Source: Ibid

It may be inferred from above findings that respondents have been involved in cultivation of horticultural crops since long and in particular, prior to this field survey. The higher profitability of horticultural crops in comparison to traditional crops could be the main reason for shifting from traditional crops to these high value crops.

3.4 Motivating Factors in Cultivation of Horticultural Crops

The access to government facilities under the Mission can have a positive effect on crop diversification towards horticultural crops. The availability of support can induce farmers to cultivate more diversified crops, including high value crops for which relative profitability is higher. We have included seven important motivational factors in our analysis i.e. close to market, good price, easy to grow, low cultivation cost, government

support, easy availability of planting material and influence of neighbors. The existence of infrastructure such as access to market, road connectivity, availability of communication facilities, etc, facilitate a better post harvest management of the produce and help the farmers in receiving a better price for their produce. Therefore, cultivation of horticultural crops should increase with provision of better marketing facilities or market being close. But, only 3 per cent respondents in Mithyangaon village of Tehri Garhwal district considered it an important motivating factor. Profitability through good price of the produce is the basic factor for taking up the cultivation of any crop. In Mithyangaon village of Tehri Garhwal district, around 46 per cent respondents reported good price and government support (13.3 per cent) as the motivating factors. Influence of neighbors and easy to grow were the correlated factors in motivation.

In Badawala village of Dehradun district, around 86 per cent respondents reported good price, easy to grow, low cultivation cost and influence of neighbors as motivating factors. But, in Prateetpur village of the same district, proportion of respondents in citing motivating factors to grow horticultural crops was found different except that around 39 per cent respondents reported good price along with proximity to market, government support and influence of neighbors as the motivating factors. Once again in Kangri village of Haridwar district, good price followed by government support, influence of neighbors and close to market were mentioned as the important factors. The results at the aggregate level were on similar pattern since highest proportion of respondents reported good price, government support and influence of neighbors as the key factors in motivating respondents to take up cultivation of horticultural crops in the selected villages.

Table 3.12
Motivating Factors for Taking up Horticultural Crops

(Per cent)

District	Block	Village	Total Farmers	Close to Market	Good Price	Easy to Grow	Less Cultivation Cost	Govt. Support	Neighbor Grows	Easy Seed/ Nursery Availability	Any other	Total
Tehri Garhwal	Jaunpur	Mithyangaon	50	3.1	45.9	9.2	3.1	13.3	10.2	1.0	14.3	100.0
Dehradun	Vikasnagar	Badawala	14	0.0	32.1	17.9	17.9	0.0	17.9	0.0	14.3	100.0
Dehradun	Vikasnagar	Prateetpur	15	28.1	46.9	0.0	0.0	12.5	6.3	0.0	6.3	100.0
Haridwar	Bhadrabad	Kangri	14	16.7	38.9	5.6	5.6	13.9	13.9	0.0	5.6	100.0
		Total	93	9.3	42.8	8.2	5.2	11.3	11.3	0.5	11.3	100.0

Source: Ibid

Preference wise motivating factors for taking up cultivation of Horticultural crops

Earlier, we have discussed proportion of respondents according to motivating factors included in the analysis. For a deeper understanding of this phenomenon, preference of farmers for each motivating factor at the grass root level should be known and understood. In order to capture this aspect, some questions were included as opinion survey in the questionnaire and related queries have been answered on this basis.

Table 3.13
Preferences-wise motivating Factors for Taking up Horticulture Crops

Motivating factors	Tehri Garhwal/ Mithyangaon	Dehradun /Badawala	Dehradun/Prateetpur	Haridwar/Kangri
Close to Market	6		2	2
Good Price	1	1	1	1
Easy to Grow	5	2		
Less Cultivation Cost	6	2		
Govt. Support	3		3	3
Neighbor Grows	4	2	4	3
Easy Seed/Nursery Availability	7			4
Any other	2*	3**	4**	4**
Total household				

Source: Ibid
*climatic condition suitable for production, **cash crop

Table 3.13 suggests that good price followed by favorable climatic conditions received first and second rank in Mithyangaon village of Tehri Garhwal district. On the

other hand, low cultivation cost and easy availability of seeds obtained sixth and seventh rank. Once again, good price received first rank in Badawala village of Dehradun district. Easy to grow, low cultivation cost and influence of neighbours received second rank. In Prateetpur village of Dehradun district, good price, proximity to market and government support received first three ranks. In Kangri village of Haridwar district, good price, proximity to market, government support and influence of neighbors were found important in order of ranking. In brief, good price which is indicator of profitability of the crop emerged as the most important factor by obtaining first rank in all the four selected villages. This is possible by creating marketing facilities so that farmers could get remunerative price for their produce.

Chapter-4
Maintenance of Horticulture Crops

After presenting the socio-economic characteristics and motivational factors for taking up cultivation of horticultural crops by respondents in previous chapter, we analyze maintenance of horticultural crops grown by the farmers in this chapter.

4.1 Rejuvenation of Horticulture Crops:

Demand for fruits have been increasing due to population growth and rise in income. Prices of fruits are relatively attractive and hence, there is sufficient incentive to grow these crops. It has been cited in literature that productivity of orchards declines, over the years, which needs to be restored. In order to increase productivity of old orchards, there is an urgent need to replace low productive trees by high yielding disease resistant varieties. Rejuvenation of old orchards was not popular among the respondents. The main reason cited was low rate of subsidy for rejuvenation. Only one respondent in Mithyangaon village of Tehri Garhwal district rejuvenated 60 plants of lemon under the National Horticulture Mission (Table 4.1).

Table 4.1

Horticulture Crops Rejuvenated by the Farmers in the Last 5 Years

District/Village	Individual Crop Rejuvenated	Number of Plants rejuvenated	Reason for Rejuvenation	Area Rejuvenation
Tehri Garhwal/Mithyangaon	Lemon	60	NHM scheme	60 Plants
Dehradun/Badawala				
Dehradun/ Prateetpur				
Haridwar/Kangri				

Source: Ibid

It is urgent to rejuvenate unproductive gardens by replanting and adopting scientific cultivation methods. Farmers with old orchards need to be motivated to follow improved cultivation methods. Along with this, farmers may be encouraged to adopt latest available technology. It is felt that level of subsidy for rejuvenation of old orchards may be reconsidered and revised without losing time.

4.2 Kitchen Garden/Bund/Rooftop:

We have tried to get an idea of kitchen garden/rooftop/backyard garden maintained by the respondents in the four surveyed villages. Table 4.2 discloses this information. Only one of the respondents in Prateetpur village of Dehradun district maintained kitchen garden to grow vegetable crops for home consumption on 0.08 hectare of land and reported the approximate value of these crops around Rs. 800 during 2011-12.

Table 4.2
Number of Households Having Kitchen Garden/Rooftop/Backyard

District/Village	Crop	No. of Households		If Yes or Having			
		Having	Not Having	Area (ha)	No. of Plants	Production (qtl)	Annual Value (Rs.)
Tehri Garhwal/Mithyangaon			50				
Dehradun/Badawala			14				
Dehradun/ Prateetpur	Vegetables	1	14	0.08			800.00
Haridwar/Kangri			14				

Source: Ibid

4.3 Adoption of Technologies by the Farmers

Technology will drive future growth of agriculture in India by pushing the levels of productivity of various crops grown by the farmers. Producers try to increase production through extensive and intensive methods by adopting improved technology. Since, scope of area expansion is limited in Uttarakhand; increase in production will have to be achieved by raising productivity. The productivity largely depends on adoption of high yielding varieties, availability of irrigation and use of fertilizer/pesticides.

During the survey, it was observed that most of the respondents used improved varieties of seeds. Some of them also used fertilizer. In plain areas, farming is gradually getting mechanized while it remains largely traditional in hilly areas. In the questionnaire canvassed to farmers during the course of survey, we had enquired about adoption of better technology by respondents for cultivation of horticultural crops. In particular, we enquired about use of poly house, green house, protected cultivation like shade net, Integrated Nutrient Management (INM) and Integrated Pest management (IPM). Respondents in all the four surveyed villages reported that none of them used these

technologies. The major reasons cited were lack of adequate support from the government in terms of finance and extension services.

4.4 Benefits/Extension Received by the Farmers:

Benefits through agricultural subsidies or other government sources played an important role in the growth of horticultural sector in Uttarakhand. Moreover, subsidies have been an integral part of government programmes launched from time to time to increase productivity of the crops and for the development of emerging agricultural sectors such as horticulture. An examination of Table 4.3 reveals that growers of horticultural crops in Mithyangaon of Tehri Garhwal district received assistance for seed and plant protection from the Horticulture Department of Uttarakhand during 2011-12. Similarly, respondents in Prateetpur village of Dehradun district received seeds of vegetables through the National Horticulture Mission (NHM), HTM and Krishi Vigyan Kendra (KVK). The respondents growing flowers in Kangri village of Haridwar district received seed and financial support under the NHM and Self Help Group (SHG).

Table 4.3
Benefits/Extension Services Received by the Farmers in 2012

District/Village	Name of the schema	No. of HH benefited	Year of Benefit	Nature of Assistance	Value of Assistance (Rs)	Details of Assistance
Tehri Garhwal/Mithyangaon	Horticulture Deptt of Uttarakhand	48	2011-2012	Seed, Plant Protection, subsidy		Diseases free HYV of seed , impart knowledge of Plant protection, etc.
Dehradun/Badawala	-	-	-	-	-	-
Dehradun/ Prateetpur	NHM, HTM, KVK	10	2011-2012	Seed (cucumber, vegetable vegetable pea)		Farmers Training on Package and practices of scientific crop cultivation.
Haridwar/Kangri	NHM ,SHG	2	2011-2012	Seed		Seed subsidy and Financial support

Source: Ibid

We have noticed that performance of different respondents in selected villages varied in terms of yield rates of horticultural crops. Although, several factors determine yield rates, extension through training plays an important role. Information provided in

Table 4.3 reveals that training was imparted to respondents through NHM in Prateetpur village of Dehradun district. Respondents in other villages did not report any training received by them through any agency.

4.5 Suggestions by Respondents

We have observed that area and production of horticultural crops, specially, vegetable and fruit crops have expanded at a healthy rate in Uttarakhand during the recent period. Producers of these crops however, face a number of problems and constraints. Moreover, dispersed production and poor infrastructure make it expensive to market these crops. This is an extremely important aspect in marketing of perishable produce. Further, shortage of specialized marketing structure and horticultural experts also pose serious constraints in the development of horticultural crops in Uttarakhand. On the basis of discussion with farmers following suggestions are offered for horticultural development in the state. Timely availability of quality seed, regulated market facility and information, irrigation facility in the form of government tube-wells, assistance for drip irrigation, easy availability of chemical fertilizers. In addition, respondents growing fruit crops in Badawala village of Dehradun district suggested urgency of crop insurance (Table 4.4).

Table 4.4
Three Most Important Suggestions given by the Farmers for the Improvement of Horticulture

Suggestions	District/Village					
	Tehri Garhwal /Mithyangaon	Dehradun /Badawala	Dehradun /Prateetpur	Haridwar /Kangri	Total	Rank
Total Farmers	50	14	15	14	93	
Timely availability of quality seed	43		12	13	68 (73.12)	1st
Regulated market facility and information	14	9		7	30 (32.26)	2nd
Irrigation facility (Govt. Tube well)			13		13 (13.98)	
Drip Irrigation		9			9 (9.68)	
Availability of chemical fertilizers	7		8	10	25 (26.88)	3rd
Crop insurance		12			12 (12.90)	

Source: Ibid

4.6 Prospects of Horticulture Development in Uttarakhand:

During the course of survey, we had discussed with respondents about improving the future prospects of horticulture crops in Uttarakhand. A variety of opinions were offered but the major points emerged were the following:

1. Availability of infrastructure including markets, storage and roads.
2. Availability of region specific improved varieties.
3. Timely availability of planting/input material.

There is a felt need to promote shorter gestation vegetable and fruit crops, medicinal and aromatic plants and commercial flower crops through research and development. Timely availability of good quality planting material, mushroom spawn and pasteurized compost/ vermi-compost is one of the major bottlenecks. It was suggested that unemployed agricultural graduates may be duly encouraged to set up agri-clinics and agri-business centres for providing quality planting material and other extension services (table 4.5).

Table 4.5
Three Most Important Future Prospects of Horticulture Expressed by Farmers

District/village	Total Farmers	No. of Farmers responded			
		Availability of infrastructure including markets, storage and roads	Availability of region specific improved varieties	Timely availability of planting/input material	No Response
Tehri Garhwal /Mithyangaon	50	22 (44.00)	12 (24.00)	6 (12.00)	10 (20.00)
Dehradun /Badawala	14	6 (42.85)	3 (21.43)	5 (35.72)	0 (0.00)
Dehradun / Prateetpur	15	4 (26.67)	5 (33.33)	4 (26.67)	2 (13.33)
Haridwar /Kangri	14	4 (28.57)	7 (50.00)	3 (21.43)	0 (0.00)
Total	93	36 (38.71)	27 (29.03)	18 (19.35)	12 (10.90)

Source: Ibid

Farmers should be motivated to adopt latest technology for growing horticultural crops by arranging demonstrations, Field days, Seminars, Trainings and Exhibitions should be organized on regular basis to up- date knowledge of the farmers about available technology. Post-harvest facilities like packaging, efficient transportation, cold storage, processing, canning, etc, need to be developed through public private partnership in

rural areas of the potential districts on priority basis and gradually extending to the entire state. Identifying horticultural crops having export potential and declaring those districts as Agri-export Zones (AEZs) could be immediately taken up by state government to help the farmers in enhancing their income levels through cultivation of horticultural crops.

Chapter-5

Methodology Adopted for Estimation of Horticultural Crops, Non-inclusion of Local Crops and Training Conducted for Horticulture Crops

Introduction:

This chapter aims to present methodology adopted by various agencies for data collection of horticultural crops in Uttarakhand. In addition, an attempt is made to identify local crops which are not included in the data collection by the agencies in their estimation. We also analyse status of training programs conducted for horticulture crops. For better understanding, we have divided this chapter into three sections and one section is devoted to each aspect.

Section-I

Methodology Adopted for Estimation of Horticultural Crops

We have already mentioned that horticulture encompasses study of large group of fruits, vegetables, mushroom, flowers, plantation crops, spices, medicinal and aromatic plants. Uttarakhand is rich in the diversity of these crops due to agro-climatic variations. Horticulture is one of the important sectors of the economy in the state. In Uttarakhand, production of horticultural crops was 1935513 MT. as compared to 18515 MT. for food grain crops during 2011-12. The support for collection of statistical data on the basic indicators such as area and production of horticultural crops is however, inadequate. The Directorate of Economics and Statistics of Uttarakhand covers only a few horticultural crops in particular, potato and onion and thus, provides incomplete scenario which affects planning and development of this sector in a holistic manner.

The major source of horticulture related data on area, production and yield is the Directorate of Horticulture, Uttarakhand, which publishes these data each year.

5.1 Methodology for Collection of Horticultural Crops related Data in Uttarakhand

In Uttarakhand, two major sets of data are available for horticultural crops (1) data collected by the Directorate of Horticulture (2) data collected by the Directorate of

Economics and Statistics, Uttarakhand. The method of data collection and procedure followed by these Departments in collecting data on horticultural crops are indicated below.

I. Directorate of Horticulture

The Directorate of Horticulture is an apex body of the state dealing with matters related to development of horticulture. The director looks after its activities. At district level, District Horticulture Officer is the senior most officer appointed and is responsible for preparation of district level data for area, production and yield of horticultural crops each year in his jurisdiction. Further, one Horticulture Inspector is deputed at the block level who is responsible for data collection at the village level through Horticulture Mobile teams. Currently, 285 teams in Uttarakhand are collecting data on horticultural crops. The Horticulture Inspector consolidates the information collected by mobile teams from villages and forwards this information to District Horticulture Officer. After receiving information from all the blocks in the district, it is finalized by Horticulture Officer. Normally, a meeting of the associated officers is convened before finalizing the report. In case of any shortcoming, it is corrected before submitting the report to the Directorate of Horticulture, Uttarakhand.

The mobile team maintains a register with particulars of horticultural crops grown in the village with area allocation on the basis of information from farmers for the reference year. The production and yield rates are calculated on the basis of information from the farmers and eye estimates. The data on area, production and yield are available for the following crops.

Table 5.1

Horticulture Crops Covered by Directorate of Horticulture, Uttarakhand

Fruits	Vegetables	Spices	Flowers
Apple	Vegetable pea	Turmeric	Gerbera
Pear	French bean	Chilli	Rose
Peach	Cabbage	Coriander	Gladiolus
Plum	Cauliflower	Garlic	Marigold
Apricot	Onion	Ginger	Carnation
Walnut	Capsicum	Methi	Rajnigandha
Citrus varieties	Okra	Cardamom (large)	Dehlia
Mango	Tomato	Other spices	Lillium
Litchi	Brinjal		Other flowers
Aonla	Other vegetables		
Guava			
Other fruits			

Source: Directorate of Horticulture, Uttarakhand.

II. Directorate of Economics and Statistics (DES)

The Directorate of Economics and Statistics (DES) has present strength of 200 persons spread over 13 district units, two divisional units and a head office. At the village level, there is one Patwari working under the aegis of the Department of Revenue. He collects village wise data on area under various crops including horticultural crops based on land records and submits it to the ADO at block level. These statistics are further submitted to the Statistics and Economics Officers of the districts and annual report is prepared and forwarded to the Deputy Directors heading divisional offices. The Deputy Director in turn consolidates the report for the division and forwards it to the Directorate of Economics and Statistics of the State.

Crop estimates are carried by DES for a large variety of crops including cereals, pulses, oilseeds, sugarcane, etc. but only a few horticultural crops such as potato and onion. The data on production are collected through field observations. These data have severe limitations in terms of coverage of horticultural crops. It does not cover fruits, most of the vegetables, plantation crops, flowers, spices, medicinal and aromatic plants.

The horticulture data collected by the Directorate of Economics and Statistics are not widely used due to its extremely limited coverage of horticultural crops.

Uttarakhand is focusing on agriculture as one of the thrust areas for development of the state. The state has potential in producing horticulture crops such as fruits, vegetables, flowers, herbs, spices, medicinal plants, aromatic plants and organic farming. The proactive approach of the farmers and various incentive schemes resulted in a gradual shifting away from conventional crop production to high value crops, especially horticultural crops. Development of horticulture & floriculture, herbs & medicines, spices and tea production is of considerable importance to the state. Uttarakhand has immense potential in the field of organic crop production. The government has taken the initiatives to draw traditional farmers into organic farming by setting up the Uttarakhand Organic Commodity Board.

Uttarakhand needs a forward looking attitude on reforms and improvements in the agriculture sector. Various fiscal and non-fiscal incentives have formed a part of the support provided by the government. There has also been a shift from emphasis on increasing the area and production of fruits and vegetables to creation of adequate forward linkages. The government is making necessary efforts to meet the challenges of globalization, liberalization and quality improvement. The success in these endeavors depends on availability of information on basic indicators related to horticultural crops for creating policy to improve yield levels which is a major casualty in case of most of the horticultural crops in the state.

In addition, some data are collected by Krishi Vigyan Kendra, Watershed Department and some NGOs interested in horticulture development but these data are extremely limited (Table 5.2).

Table 5.2

Agencies involved in collection of Horticulture Data, 2011-12

District /Village	Horticulture Deptt.	DES	NSSO	NGOs	Others
Tehri Garhwal /Mithyangaon	Yes	Yes			NABARD ,SHG
Dehradun /Badawala	Yes				
Dehradun / Prateetpur	Yes	Yes			
Haridwar/Kangri	Yes	Yes			

Source: Ibid

The information provided by the agency on method of data collection and forwarding of collected data to the Directorate of Horticulture, Uttarakhand for verification is summarized in Table 5.3 and Table 5.4. These tables are self explanatory.

Table 5.3
Method Adopted for Data collection on Horticulture Crops in 2011-12

District /Village	Fruits[1]	Vegetables[2]	Spices[3]	Flowers[4]
Tehri Garhwal /Mithyangaon	Information from farmers and eye estimates	Information from farmers and eye estimates	Information from farmers and eye estimates	Information from farmers and eye estimates
Dehradun /Badawala	-do-	-do-	-do-	-do-
Dehradun / Prateetpur	-do-	-do-	-do-	-do-
Haridwar /Kangri	-do-	-do-	-do-	-do-

1: Mango, Litchi, Peach, Plum, Citrus Varieties, Apricot, etc.
2: Vegetable pea, Radish, French bean, Cabbage, Cauliflower, Okra, Capsicum, Tomato, Brinjal, Onion, etc.
3: Ginger, Chili, Garlic, Turmeric, Coriander, etc.
4: Marigold, Gladiolus, Rose, Gerbera, Carnation, etc.
Source: Ibid

Table 5.4

Forwarding of Data Collected and Verification of Horticulture Crops (Department of Horticulture, Uttarakhand)

District /Village	Village to Block	Block to District	District to State	Verification at village level	Verification at District Level	Verification at State level
Fruits	Yes	Yes	Yes	Yes	Yes	No
Vegetables	Yes	Yes	Yes	Yes	Yes	No
Flowers	Yes	Yes	Yes	Yes	Yes	No
Spices	Yes	Yes	Yes	Yes	Yes	No
Medicinal	Yes	Yes	Yes	Yes	Yes	No
Aromatic	Yes	Yes	Yes	Yes	Yes	No

Source: Ibid

Section II

Local Crops not included in the Data Collection

During the course of survey, we have identified some local crops on which separate data on area, production and yield are not collected by the Directorate of Horticulture, Uttarakhand. Some of these crops, however, are included in other fruits and vegetables.

(i) Fruits

Citrus fruits occupy third position in the total production of fruits in the state. The data on individual varieties such as malta, lime, mandarin and sweet lime are not available. Further, there is no data base for minor fruits such as banana, Kafal, strawberry, jamun, kiwi, almond and chestnut despite their commercial value.

(ii) Vegetables

Among vegetables, off season vegetables such as vegetable pea, tomato, cauliflower, cabbage, etc. form a significant part of horticulture in Uttarakhand but data base is not available. There is no information about area under cultivation of leafy vegetables, cucurbits, arvi, etc. and their production.

In hills/foot hills of Uttarakhand, exotic vegetables such as colored Chinese cabbage, Shimla capsicum, parsley, broccoli, and brussels sprout have good potential for income generating in tiny holdings. However, no data are recorded for these crops.

(iii) Spices

In Uttarakhand, a wide variety of spices is grown. Looking at the export potential, rising prices and threat of global warming, a holistic approach covering all aspects of spices is an urgent need to maintain the present status.

(iv) Medicinal and Aromatic Plants

A large number of species of medicinal and aromatic plants are grown in Uttarakhand. Data base on area, production and yield of at least most popular ones need to be urgently encouraged. Some of the items with high demand like Stevia, Rosemary, Snakeroot, Gloriosa, Shatavari, Lemon Grass, Chamomile, etc need special attention so that their cultivation could be popularized in order to generate employment and income.

(v) Flowers

Among flowers, orchids and calla lily are being cultivated on a limited scale in Uttarakhand. In order to incentivize farmers to grow these flowers, data base must be created.

The above mentioned crops are not included by any agency in collection of data on horticultural crops in Uttarakhand. The main reason for non-inclusion is low coverage and minor importance given to these crops by the farmers. It was observed during the survey that most of the farmers grow these crops at small scale and sell a very small quantity in the market that does not have much impact on horticulture in Uttarakhand.

Section III

Training Programme for Horticulture Crops

Further, we had sought information about the training of agency conducted for estimation of area, production and yield data. It was reported that the Indian Council of Agriculture Research (ICAR) conducted one day training and it helped in understanding latest technology (Table 5.5)

Table 5.5
Training Conducted for Estimating of Area, Production and Yield 2011-12

District/Village	Name of Training	Duration	Place	Yes/No		If Yes, Mention advantage
				Yes	No	
Tehri Garhwal /Mithyangaon					No	
Dehradun /Badawala						
Dehradun / Prateetpur						
Haridwar /Kangri	Training, Conducted by ICAR, Krishi Bhawan	One day	Farmers field	Yes		Helped in understanding latest technology

Source: Ibid

It was also felt by the agency that there is an urgent need to depute agency for checking and verification of collected data. The involvement of knowledgeable persons from the village would further improve the scenario and help in collection of accurate data. The information on suggestions made by different agencies is summarized in Table 5.6.

Table 5.6
Suggestions made by Different Agencies for the Improvement of Horticulture Crops

District/Village	1	2
Horticulture	Depute any agency for checking and verifying of collected data	Recruitment of knowledgeable persons from the village level for relevant picture
Agriculture	Yes	Yes
DES	Yes	Yes
NSSO	Yes	Yes
Forest	Yes	Yes
Revenue	Yes	Yes
NGOs	Yes	Yes

Source: Ibid

Chapter 6

Survey Results of Horticultural Crops

We have already pointed out that development of horticulture has good potential in Uttarakhand due to favorable agro-climatic conditions. Diversification from traditional crops to horticultural crops is the best option for farmers due to several advantages. First, horticultural crops produce higher biomass than field crops per unit of area resulting in efficient utilization of natural resources. Second, horticulture has potential of area expansion by utilizing waste lands through proper policy. Third, horticultural crops require less water than several field crops. Fourth, these are high value crops with higher potential of value addition. Fifth, horticultural crops are relatively remunerative and thus, can help in increasing income, employment and nutritional security of the farmers in hill dominated state of Uttarakhand. Sixth, some of the horticultural products are in great demand in domestic and international markets. The country can earn foreign exchange through exports of these products.

In view of above advantages and government support, a visible shift from traditional crops to these crops could be noticed in many regions of India including Uttarakhand. As a result of the above efforts, significant progress has been made in area expansion resulting in higher production. Besides, gradual adoption of improved technology has not brought improvement in productivity of horticultural crops in Uttarakhand during the past one decade.

6.1 Area, production and Yield of Horticultural Crops

Area, Production and Yield of Kharif Crops

A perusal of area, production and yield of horticultural crops grown by farmers during kharif 2011 presented in Table 6.1 indicates that farmers in Kangri village of the Haridwar district grew marigold on 5.12 hectares and reaped a production of 319 qtls. When it is converted into per hectare, it is estimated around 62.21 qtls/ha. It was also grown in Prateetpur on marginal area of 0.16 hectare that yielded 6 qtls and the estimated yield was 37.50 qtls/ha during 2011. It may be pointed out that marigold was cultivated by respondents on irrigated land. The marigold among flowers occupied special position and therefore, it was allocated a significant share of area. It could be

due to popularity of marigold often used as offering in pilgrimage places such as Haridwar.

Table 6.1
Area, Production and Yield of Horticultural Crops (Kharif, 2011)

District	Name of the Crop	Irrigated			Unirrigated			Total		
		Area (ha)	Production (qtl)	Yield (qtl/ha)	Area (ha)	Production (qtl)	Yield (qtl/ha)	Area (ha)	Production (qtl)	Yield (qtl/ha)
Tehri Garhwal /Mithyangaon										
Dehradun/ Badawala										
Dehradun/ Prateetpur	Marigold	0.16	6	37.50	0	0	0	0.16	6	37.50
Haridwar/ Kangri	Marigold	5.12	318.5	62.21				5.12	318.5	62.21

Source: Field Survey

Area, Production and Yield of Rabi Season Crops:

During rabi season, a large variety of vegetable crops was grown by respondents in Prateetpur village of Dehradun district (Table 6.2). Although, okra was allocated highest area (1.32 ha), other vegetables such as vegetable pea, french bean and cucumber were devoted more than 0.44 ha of land. Tomato, ridge gourd and bitter gourd were devoted marginal area. The entire area under these vegetables was found irrigated. Okra, cucumber, vegetable pea, french bean, potato, radish indicated a production of more than 15 qtls. After converting these quantities of production into per hectare productivity, it could be observed that yield of tomato (137.5 qtls/ha) followed by radish (131.6 qtls/ha), cucumber (113.64 qtls/ha) and potato (103.12 qtls/ha) was higher

than other vegetables. The yield of okra with allocation of highest area was 53.79 qtls/ha Thus, okra emerges as the most important vegetable grown by respondents in Prateetpur village of Dehradun district. Vegetable pea, french bean and cucumber are the other major vegetables produced by respondents during the rabi season.

Table 6.2
Area, Production and Yield of Horticultural Crops (Rabi, 2012)

District	Name of the Crop	Irrigated			Unirrigated			Total		
		Area (ha)	Production (qtl)	Yield (qtl/ha)	Area (ha)	Production (qtl)	Yield (qtl/ha)	Area (ha)	Production (qtl)	Yield (qtl/ha)
Tehri Garhwal/ Mithyangaon	Beans	0.03	2.5	83.33	0	0	0	0.03	2.5	83.33
	Potato	0.85	102.75	120.88	0	0	0	0.85	102.75	120.88
Dehradun/ Badawala										
Dehradun/ Prateetpur	Okra	1.32	71.0	53.79	0	0	0	1.32	71.0	53.79
	French bean	0.48	20.0	41.67	0	0	0	0.48	20.0	41.67
	Tomato	0.04	5.5	137.5	0	0	0	0.04	5.5	137.5
	Onion	0.08	3.0	37.50	0	0	0	0.08	3.0	37.50
	Cucumber	0.44	50.0	113.64	0	0	0	0.44	50.0	113.64
	Radish	0.16	21.0	131.6	0	0	0	0.16	21.0	131.6
	Bitter gourd	0.04	1.6	37.5	0	0	0	0.04	1.6	37.5
	Vegetable pea	0.96	47.5	49.58	0	0	0	0.96	47.5	49.58
	Tori	0.04	3.5	87.5	0	0	0	0.04	3.5	87.5
	Potato	0.16	16.5	103.12	0	0	0	0.16	16.5	103.12
Haridwar/ Kangri										

Source: Ibid

In Mithyangaon village of Tehri Garhwal district respondents grew potato and french bean. Potato was allotted an area of 0.85 ha that produced 102.75 qtls. The per hectare yield of potato and french bean was estimated 120.88 and 83.33 qtls/ha

respectively. It may be noticed that yield of these crops in Mithyangaon village in Tehri Garhwal district was higher than Prateetpur village in Dehradun district.

Area, Production and Yield of Summer Season Crops

Table 6.3 suggests that in Mithyangaon village of Tehri Garhwal district, ginger, potato, vegetable pea and french bean are the major vegetable crops grown by respondents during summer season. In addition, respondents allocated a miniscule area to cauliflower, tomato, chilli, onion and turmeric. The production of ginger, potato, vegetable pea and french bean was around 838, 337, 229 and 69 qtls. respectively. When these production levels are converted into per hectare productivity, we obtained an yield of around 174, 108, 90 and 67 qtls/ha, respectively.

Table 6.3
Area, Production and Yield of Horticultural Crops (Summer, 2012)

District	Name of the Crop	Irrigated			Unirrigated			Total		
		Area (ha)	Production (qtl)	Yield (qtl)	Area (ha)	Production (qtl)	Yield (qtl)	Area (ha)	Production (qtl)	Yield (qtl)
Tehri Garhwal/ Mithyangaon	Potato	3.13	337.3	107.76	0	0	0	3.13	337.3	107.76
	Beans	1.07	72.5	67.75	0	0	0	1.07	72.5	67.75
	Vegetable pea	2.53	228.9	90.47	0	0	0	2.53	228.9	90.47
	Turmeric	0.05	1.15	25.56	0	0	0	0.05	1.15	25.56
	Tomato	0.01	0.50	50.0	0	0	0	0.01	0.50	50.0
	Cauliflower	0.02	4.0	200.0	0	0	0	0.02	4.0	200.0
	Chilli	0.30	14.95	49.83	0	0	0	0.30	14.95	49.83
	Ginger	4.81	837.7	174.16	0	0	0	4.81	837.7	174.16
	Onion	0.01	0.6	60.00	0	0	0	0.01	0.6	60.00
Dehradun/ Badawala										
Dehradun/ Prateetpur	Cucumber	0.72	47.5	65.97	0	0	0	0.72	47.5	65.97
	Pumpkin	0.20	18.25	91.25	0	0	0	0.20	18.25	91.25
Haridwar/ Kangri										

Source: Ibid

The respondents in Prateetpur village of Dehradun district grew pumpkin and cucumber in summer season. They devoted 0.72 and 0.20 hectares of area to these crops that produced 47.5 and 18.25 qtls. The yield of these vegetable crops was estimated around 66 and 91 qtls/ha during the summer season of 2012. It is clear from the table that these vegetables were grown on irrigated land and therefore, area under un-irrigated land was nil.

Area, Production and Yield of Annual Crops

An examination of Table 6.4 suggests that respondents in Badawala village of Dehradun district cultivated mango and litchi among major fruits of Uttarakhand. An area of around 41 and 14 hectares was devoted to these fruits by respondents. This area produced 3433 and 353 qtls of fruits. The per hectare yield was estimated around 84 qtls and 30 qtls, respectively. It is useful to point out that yield of mango in Badawala village of Dehradun district is much higher than average in the state because farmers grew varieties (Dushari, langra, chausa and kalmi) that give higher yield. It was further contributed by favorable climatic conditions for the growth of fruits. Apart Badawala, respondents in Prateetpur village of Dehradun district grew mango and lemongrass on 3.16 and 0.80 hectares as annual crops during 2012. The produce was 158 and 120 qtls, respectively. The productivity of mango and lemon grass was estimated around 50 and 150 qtls/ha respectively.

Table 6.4
Area, Production and Yield of Horticultural Crops (Annual, 2012)

District	Name of the Crop	Irrigated			Unirrigated			Total		
		Area (ha)	Production (qtl)	Yield (qtl)	Area (ha)	Production (qtl)	Yield (qtl)	Area (ha)	Production (qtl)	Yield (qtl)
Tehri Garhwal/Mithyangaon	Apple, Lemon Orange, peach	0.40 *	-	-	-	-	-	0.40	-	-
Dehradun/ Badawala	Mango	41.1	3433	83.53				41.1	3433	83.53
	Litchi	13.6	353	29.95				13.6	353	29.95
	Jherbera	0.4	165000/sale					0.4	165000/sale	
Dehradun/ Prateetpur	Mango	3.16	157.8	49.94				3.16	157.8	49.94
	Lemongrass	0.80	120.0	150.0				0.80	120.0	150.0
Haridwar/ Kangri	Rose	0.24	1.5	6.25				0.24	1.5	6.25

*Initial stage of orchards, therefore, no production
Source: Ibid

In addition to above mentioned crops, respondents in Badawala village of Dehradun district cultivated Jherbera as annual crop. Its production was disposed off for Rs. 1,65,000.

The respondents in Kangri village of Haridwar district cultivated traditional flowers such as rose as annual crop. The rose was allocated an area of 0.24 hectares. The production of rose was 1.5 qtls. The estimated yield was 6.25 qtls/ha It may be pointed out that all these fruit and flower crops were grown on irrigated land and hence, share of un-irrigated area was nil.

Source of Irrigation: Kharif Season Crops

As a next step, we look into the source of irrigation for area cultivated under horticultural crops by respondents. Table 6.5 furnishes information regarding source of irrigation for horticultural crops grown during the kharif season.

Table 6.5
Distribution of Irrigated Land Area under Kharif Season by Sources

(Hectares)

District	Major Crop Category	Canal	Tube well	Canal + Tube well	Tank	Open well	Any other	Total
Tehri Garhwal/Mithyangaon	Fruits	0						
	Vegetables							
	Flowers							
	Spices							
	Garden/Plantation							
	Medicinal							
	Aromatic							
Dehradun/Badawala	Fruits	0						
	Vegetables							
	Flowers							
	Spices							
	Garden/Plantation							
	Medicinal							
	Aromatic							
Dehradun/Prateetpur	Fruits							
	Vegetables							
	Flowers			0.16				0.16
	Spices							
	Garden/Plantation							
	Medicinal							
	Aromatic							
Haridwar/Kangri	Fruits							
	Vegetables							
	Flowers		5.36					5.36
	Spices							
	Garden/Plantation							
	Medicinal							
	Aromatic							

Source: Ibid

Flowers were grown in Prateetpur village of Dehradun district on marginal area of 0.16 hectare. Canal plus tube-wells were reported as a source of irrigation by respondents. Flowers were also cultivated in Kangri village of Haridwar district and tube-well was reported as a source of irrigation by respondents.

Source of Irrigation: Rabi Season Crops

We have earlier noticed that it is a normal practice among farmers to grow vegetable crops in rabi season. In Mithyangaon village of Tehri Garhwal district, entire area cultivated under vegetables was irrigated by canal (gul). But in Prateetpur village of Dehradun district, electric tubewells were used as a source of irrigation for 2.76 hectares of area under vegetables. In addition, 0.96 hectare was irrigated by canal + tubewells (Table-4.6).

Table 6.6
Distribution of Irrigated Land Area under Rabi Season by Sources

(Hectares)

District	Major Crop Category	Canal	Tube well Diesel	Canal +Tube well Electric	Tube well Electric	Tank	Open well	Any other	Total
Tehri Garhwal/ Mithyangaon	Fruits								
	Vegetables	0.88							0.88
	Flowers								
	Spices								
	Garden/Plantation								
	Medicinal								
	Aromatic								
Dehradun/ Badawala	Fruits								
	Vegetables								
	Flowers								
	Spices								
	Garden/Plantation								
	Medicinal								
	Aromatic								
Dehradun/ Prateetpur	Fruits								
	Vegetables			0.96	2.76				3.72
	Flowers								
	Spices								
	Garden/Plantation								
	Medicinal								
	Aromatic								
Haridwar/ Kangri	Fruits								
	Vegetables								
	Flowers								
	Spices								
	Garden/Plantation								
	Medicinal								
	Aromatic								

Source: Ibid

Source of Irrigation: Summer Season Crops

Having analyzed source of irrigation for kharif season crops, we look into source of irrigation for summer season crops. Once again, source of irrigation for vegetables grown in summer season in Mithyangaon village of Tehri Garhwal district was canal (gul). The spices were also cultivated by respondents in this hilly village and source of irrigation in this case was also canal (gul). The respondents in Prateetpur village of Dehradun irrigated 0.48 hectare of area under vegetables by tubewells while 0.44 hectare was irrigated by canal + tubewells.

Table 6.7
Distribution of Irrigated Land Area under Summer Season by Sources

(Hectares)

District	Major Crop Category	Canal	Tube well Diesel	Canal + Tube well Electric	Tube well Electric	Tank	Open well	Any other	Total
Tehri Garhwal/Mithyangaon	Fruits								
	Vegetables	6.77							6.77
	Flowers								
	Spices	5.16							5.16
	Garden/Plantation								
	Medicinal								
	Aromatic								
Dehradun/Badawala	Fruits								
	Vegetables								
	Flowers								
	Spices								
	Garden/Plantation								
	Medicinal								
	Aromatic								
Dehradun/Prateetpur	Fruits								
	Vegetables			0.44	0.48				0.92
	Flowers								
	Spices								
	Garden/Plantation								
	Medicinal								
	Aromatic								
Haridwar/Kangri	Fruits								
	Vegetables								
	Flowers								
	Spices								
	Garden/Plantation								
	Medicinal								
	Aromatic								

Source: Ibid

Source of Irrigation: Annual Crops

We further examine source of irrigation for annual crops i.e. fruits and aromatic plants grown by the respondents in selected villages. In Badawala village of Dehradun district, entire area under annual season fruit crops was irrigated by canal. The source of irrigation for annual crops of fruits in Prateetpur village of Dehradun district was found mixed. The major proportion of area under fruits in this village was irrigated by tubewells. A small area of 0.32 hectare under fruits was irrigated by canal + tubewells. Respondents also cultivated aromatic plants on 0.80 hectare and these were irrigated by canal + tubewells.

Table 6.8
Distribution of Irrigated Land Area under Annual Season by Sources

(Hectares)

District	Major Crop Category	Canal	Tube well Diesel	Canal + Tube well Electric	Tube well Electric	Tank	Open well	Any other	Total
Tehri Garhwal/Mithyangaon	Fruits								
	Vegetables								
	Flowers								
	Spices								
	Garden/Plantation								
	Medicinal								
	Aromatic								
Dehradun/Badawala	Fruits	55.10							55.10
	Vegetables								
	Flowers								
	Spices								
	Garden/Plantation								
	Medicinal								
	Aromatic								
Dehradun/Prateetpur	Fruits			0.32	2.84				3.16
	Vegetables								
	Flowers								
	Spices								
	Garden/Plantation								
	Medicinal								
	Aromatic			0.80					0.80
Haridwar/Kangri	Fruits								
	Vegetables								
	Flowers								
	Spices								
	Garden/Plantation								
	Medicinal								
	Aromatic								

Source: Ibid

Number of Trees/Plants

During the survey, we have tried to assess the number of trees/plants in the area under fruit crops and aromatic plants. It may be observed from Table 6.9 that 5105 trees were reported by respondents in orchards of 54.7 hectares in Badawala village of Dehradun district. In Prateetpur village of the same district, 306 trees were reported by respondents on an area of 3.16 hectares under fruit crops.

Table 6.9
Number of Plants in the Area covered During Different seasons, 2012

District	Major Crop Category	Kharif		Rabi		Summer		Annual		Total	
		Area	Plant	Area	Plant	Area	Plant	Area	Plant	Area	Plant
Tehri Garhwal/Mithyangaon	Fruits							0.5	250	0.5	250
	Vegetables										
	Flowers										
	Spices										
	Garden/Plantation										
	Medicinal										
	Aromatic										
Dehradun/Badawala	Fruits							55.1	5105	55.1	5105
	Vegetables										
	Flowers										
	Spices										
	Garden/Plantation										
	Medicinal										
	Aromatic										
Dehradun/Prateetpur	Fruits							3.16	306	3.16	306
	Vegetables										
	Flowers										
	Spices										
	Garden/Plantation										
	Medicinal										
	Aromatic										
Haridwar/Kangri	Fruits										
	Vegetables										
	Flowers										
	Spices										
	Garden/Plantation										
	Medicinal										
	Aromatic										

Source: Ibid

Season-wise Mono and Mixed Cropping:

It is well established that mixed cropping has advantage in terms of yield over mono cropping. It also reduces element of risk in farming through distribution of gains in crops which are grown as mixed. Table 6.10 furnishes information on mono and mixed cropping adopted by respondents in the selected villages. In kharif, entire area under horticultural crops was under mono category in all the selected villages. The same holds true for rabi season crops. In summer season, mixed cropping was reported in Mithyangaon village of Tehri Garhwal district but the proportion of area was low in comparison to mono cropping. Respondents mentioned mono cropping in entire area under annual crops of fruits in Badawala and Prateetpur villages of Dehradun district. To sum up, larger proportion of area allocated to horticultural crops by respondents in selected villages of Uttarakhand was under mono cropping.

Table 6.10
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
Tehri Garhwal/Mithyangaon	Fruits										0	0.40	.40	0	0.40	0.40
	Vegetables				0.88	0	0.88	6.69	0.08	6.77				7.57	0.08	7.65
	Flowers															
	Spices							5.03	0.12	5.15				5.03	0.12	5.15
	Garden /Plantation															
	Medicinal															
	Aromatic															
Dehradun/Badawala	Fruits										54.7	0	54.7	54.7	0	54.7
	Vegetables															
	Flowers							0.40	0	0.40				0.40	0	0.40
	Spices															
	Garden/ Plantation															
	Medicinal															
	Aromatic															
Dehradun/Prateetpur	Fruits										3.16	0	3.16	3.16	0	3.16
	Vegetables				3.72	0	3.72	0.92	0	0.92				4.64	0	4.64
	Flowers	0.16	0	0.16										0.16	0	0.16
	Spices															
	Garden/ Plantation															
	Medicinal															
	Aromatic	0.80	0	0.80										0.80	0	0.80
Haridwar/Kangri	Fruits															
	Vegetables															
	Flowers	5.12	0.40	5.52										5.12	0.40	5.52
	Spices															
	Garden /Plantation															
	Medicinal															
	Aromatic															

Source: Ibid

6.2 Difference in Yield through Field Survey and Estimates of Secondary data for Horticultural Crops:

We have tried to assess difference in the yield of various horticultural crops grown by the respondents based on survey results and secondary data obtained from the Directorate of Horticulture, Uttarakhand.

Table 6.11
Difference in Yield through Field Survey and Estimates of Secondary data for Horticultural Crops

(Qtls./ha)

District &village	**Crop**	Survey Yield	Yield based on Secondary	Differences
Dehradun/Badawala	**Fruits**			
	Mango	83.53	40.81	-42.72
	Litchi	29.95	12.91	-17.04
Dehradun/Prateetpur	**Fruits**			
	Mango	49.94	40.81	-9.13
	Vegetables			
	Okra	53.79	103.03	49.24
	French bean	41.67	94.98	53.31
	Tomato	137.5	137.89	0.39
	Onion	37.5	54	16.50
	Cucumber	113.64	NA	NA
	radish	131.25	157.08	25.83
	Bitter gourd	37.5	NA	NA
	Vegetable pea	49.58	95.1	45.52
	Ridge Gourd	87.5	NA	NA
	Potato	103.12	136	32.88
	Bottle gourd	91.25	NA	NA
	Flowers			
	Marigold	37.5	31.81	-5.69
Tehri Garhwal/ Mithyangaon	**Vegetables**			
	Potato	107.76	136	28.24
	Beans	67.75	94.98	27.23
	Vegetable pea	90.47	95.1	4.63
	Tomato	50	137.89	87.89
	Cauliflower	200	126.5	-73.50
	Onion	60	54	-6.00
	Spices			
	Turmeric	25.56	112.8	87.24
	Chilli	49.83	73.36	23.53
	Ginger	174.16	146	-28.16
Haridwar/Kangri	**Flowers**			
	Marigold	62.20	31.81	-30.40
	Rose	6.25	8.86	2.61

Source: Ibid

A perusal of Table 6.11 indicates that yield of mango and litchi obtained through field survey in Badawala village of Dehradun district was higher than yield provided in secondary data. This difference is due to adoption of high yielding varieties by the respondents and favorable agro-climatic conditions for the growth of fruit crops. In

Prateetpur village of Dehradun district, yield of okra, french bean, onion, radish, vegetable pea obtained through field survey was lower than the estimates of secondary data. This difference was almost negligible in case of tomato. Flowers also indicated a difference of around 6 qtls between yield based on field survey and secondary data. In Mithyangaon village of Tehri Garhwal district, positive and negative differences in yield of vegetables obtained through primary and secondary source could be noticed. The same was true for spices grown in this village. The yield of turmeric and chilli obtained through field survey was found lower in comparison to secondary data while vice-versa could be observed for ginger. Ginger is the major spice crop grown in this village. In Kangri village of Haridwar district, yield of marigold obtained through survey was much higher than estimates available in secondary data. On the other hand, it was found lower in case of rose.

Marketed Quantity and Farm-gate Price by Season:

Marketed surplus and prices received by farmers for agricultural commodities has been a significant concern in India during the recent years. Poor efficiency in the marketing and in adequate marketing infrastructure are the likely causes of not only high and fluctuating consumer prices but also a reason for reaching lower share of the consumers' rupee to the farmers.

Table 6.12 presents quantity of the horticultural crops grown by the respondents and price received by them. In Mithyangaon of Tehri Garhwal district, respondents marketed vegetables during rabi and summer season and the price received was Rs. 13.25 per kg. The respondents also cultivated spices in this village and that were sold at Rs. 25.50 per kg. We have already mentioned that respondents in Badawala village of Dehradun district cultivated fruits and flowers. The farm gate price of fruits was Rs. 18.26 per kg. while flowers valued Rs.1,65,000. In Prateetpur village of the same district respondents grew fruits and vegetables and their price was Rs. 19.39 and Rs.17.99 per kg. The flowers fetched a price of Rs. 30 per kg. Flowers were also grown in the Kangri village of Haridwar district which is an important place of pilgrimage and therefore, demand for flowers is high. The respondents growing flowers could get benefit of this factor and therefore, farm-gate price of flowers in this village was noticed Rs. 46.81 per kg. during 2011-12.

Table 6.12

Area, Production, Marketed quantity and Farm Gate Price by Season

District/ Village	Crop category	Kharif			Rabi			Summer			Annual			Total		
		Area (ha)	Prod. (qtl)	FGP* (Rs/qtl)	Area (ha)	Prod. (qtl)	FGP* (Rs/qtl)	Area (ha)	Prod. (qtl)	FGP* (Rs/qtl)	Area (ha)	Prod. (qtl)	FGP* (Rs/qtl)	Area (ha)	Prod. (qtl)	FGP* (Rs/qtl)
Tehri Garhwal/ Mithyangaon	Fruits															
	Vegetables				0.88	105.25	1329.62	6.77	644.26	3651.71				7.65	749.51	3325.63
	Flowers															
	Spices							5.16	853.80	2550.97				5.16	853.80	2550.97
	Garden															
	Medicinal															
	Aromatic															
Dehradun/ Badawala	Fruits										54.7	3786	1826.39	54.7	3786	1826.39
	Vegetables															
	Flowers										0.4		165000			
	Spices															
	Garden															
	Medicinal															
	Aromatic															
Dehradun/ Prateetpur	Fruits										3.16	157.8	1939	3.16	157.8	1939
	Vegetables				3.72	239.6	1566.06	0.92	65.75	2650.78				4.64	305.35	1799.63
	Flowers	0.16	6	3000										0.16	6	3000
	Spices															
	Garden															
	Medicinal															
	Aromatic													0.80	120	
Haridwar/ Kangri	Fruits															
	Vegetables															
	Flowers	5.12	318.5	4644.0							0.24	1.5	12500	320	320	4680.83
	Spices															
	Garden															
	Medicinal															
	Aromatic															

*FGP: Farm Gate Price

Source: Ibid

Chapter-7

Problems Encountered in Collection of Horticulture Data

Agriculture is the mainstay of the economy of Uttarakhand. Around 58 per cent of the population of the state depends on this sector for food and livelihood security. The main crops grown are rice, wheat, maize among cereals, urad and masoor among pulses, mustard among oilseeds and sugarcane as commercial crop. Now, horticulture is one of the important sub-sector of agriculture and thus, one of the major economic activities of population involved in agriculture. Mango, apple, litchi and citrus are the principal fruit crops while potato, beans, vegetable pea, tomato, cauliflower, etc. are the major vegetables grown in the plain and hilly areas of Uttarakhand. Among vegetables, off season vegetables constitute important component due to favorable climatic conditions.

The tiny size of operational holdings in most of the hilly districts of Uttarakhand puts a severe constraint in development of crop farming. The average size of land holding in the state was 0.70 ha during 2010-11. The land holdings are even smaller in hilly region (0.69 ha) except in one district namely, Udham Singh Nagar (1.33 ha). Bageshwar has smallest size of holdings (0.43 ha). The share of net sown area to geographical area ranges from 3.73 per cent in Uttarkashi to around 50 per cent in Udham Singh Nagar district. Similarly, there are wide variations in percentage of net sown area as irrigated. The net irrigated area as percentage of net area sown is the highest in Dehradun district (48.27 per cent) and lowest in Chamoli district among hilly districts while in plain districts of Udham Singh Nagar and Haridwar, more than 90 per cent of net sown area is irrigated. In the hilly region of the state, farmers devote a large proportion of their land to cereal crops for their subsistence. The horticultural crops are gradually picking up due to advantage in climate, good price and demand from other states.

The yield per hectare in Uttarakhand for cereals, pulses, oilseeds, sugarcane is below all India level. The productivity of two major cereal crops of Uttarakhand i.e. rice and wheat was recorded 19.06 and 23.16 qtls/ha against an all India productivity of 22.39 and 29.89 qtls/ha during 2010-11. The yield for pulses was 8.15 qtls/ha in the

state whereas 6.19 qtls/ha at the country level. This result suggests that efforts should be made to popularize cultivation of pulses in Uttarakhand.

The scenario of productivity of horticultural crops is equally discouraging. The productivity of main fruit crops of Uttarakhand namely, mango, apple and citrus fruits was 34.70, 41.15 and 49.07 qtls/ha in comparison to all India figures of 34.74, 68.29 and 69.31 qtls/ha during 2010-11. Most of the vegetable crops grown in Uttarakhand are also lagging behind in terms of yield. The yield rates of potato, onion and tomato in the state were recorded 136, 100.53 and 110.5 qtls/ha against an all India yield of 220.76, 149, 199.8 qtls/ha during 2010-11.

The productivity of horticultural crops is low due to small and scattered holdings, difficult terrain, unfavorable climatic conditions for some crops, inadequate availability of improved technology related inputs, lack of credit and marketing facilities. As a result, profitability of horticultural crops is lower in comparison to other states. With extremely limited availability of land for cultivation in Uttarakhand, raising productivity and ensuring remunerative prices to growers are essential for sustainability and development of horticulture in the state. This is possible when data base is created and policies are initiated and effectively implemented.

During the course of field survey, a questionnaire was canvassed to grass root officials involved in collection of horticultural data. The following positive points were put forward by them.

1. Uttarakhand has a wide range of agro-climatic conditions which are favorable for growing all varieties of horticultural crops.
2. The hilly districts with temperate climate are especially suitable for growing off-season vegetables, which are in great demand in cosmopolitan cities. There is good opportunity to add value to produce as organic by following organic cultivation.
3. The growth of area under horticultural crops during the past one decade and production indicates good potential of diversification towards these high value crops.
4. Good rainfall spread over several months in the year in most of the locations in the state is a boon for several horticultural crops.

5. Excellent irrigation status in plain districts provides opportunity to cultivate horticultural crops without any risk.

The officials also pointed out shortcomings which are hindering growth of horticultural crops in the state.

1. Lack of adoption of recommended cultivation practices by the horticultural crop growers.
2. Inadequate availability of certified planting material.
3. Rain-fed agriculture in hilly districts brings an element of instability in production and yield of horticultural crops.
4. Although, good rainfall provides ample opportunity for rain harvesting and using the same at critical stages of crop and moisture stress, precious water is being wasted due to lack of proper policy.
5. Efforts of the farmers to adopt improved technology for growing horticultural crops are not adequate since the subsidy provided by the government is low in comparison to cost and risk involved in shifting towards horticultural crops.
6. Lack of adequate marketing facilities and perishable nature of fruits and vegetables dissuades farmers to grow horticultural crops.
7. The natural springs and other water resources are gradually drying up in hills and thereby, creating problems of water availability for irrigation.
8. The menace of wild animals is a serious problem. Many times, a significant part of the produce is destroyed. In order to prevent these losses, protected cultivation should be promoted on wider scale.
9. The unabated migration from hills is leading to a serious problem of availability of labour for horticultural crops which are largely labour intensive.
10. The growth of urbanization is further reducing the limited land available for agriculture growth in the state, contributing to climate change and spoiling the natural environment for the growth of several horticultural crops in Uttarakhand.
11. Identification of clusters for each horticultural crop would help in harnessing the potential of yield and production.

The following problems were faced by the grass root officials involved in collection of horticulture data in Uttarakhand.

1. The mobile team maintains a record of horticultural crops grown with details of area in the villages. But, distribution of horticultural card is limited in the state and hence, most of the horticultural crop growers do not have any written record. This creates variation in information due to subjectivity of the grower and data collector. We need to minimize this taboo through the open mindedness of data collector and responding farmers.
2. There is an urgent need of clear out guidelines from horticulture department regarding data collection. These strictly need to be adhered to while collecting information on horticultural crops. This would reduce location and person specific bias. Furthermore, this would greatly help to make data collection a scientific practice by reducing subjectivity.
3. With the development of science preferred instruments of clear cut methods to be followed during the process. The exact methodology for each crop should be calibrated and the data collectors are required to get training on the similar lines.
4. It is based on oral information from the farmers and eye estimates of collector. If scientific knowledge and traditional wisdom are combined and further information technology is blended, the quality of data would certainly improve.
5. Here lies the main difference in the past approach and suggested new approach. So far, data collection does not have the clear cut methodology and therefore, they are unable to fine tune the data. That is why they had great difficulty to conceive the problems in data collected by them.
6. The data collection in hills is a serious problem due to small, fragmented and scattered holdings. This also leads to low production and productivity since adoption of technology in these holdings is difficult. The low production and yield reported in the data many times creates doubts about the reliability.
7. Many farmers lack awareness about cultivation of suitable varieties. The traditional varieties adopted by them yield low. This creates doubt in collected data on production and yield.
8. Farmers often under report production and exaggerate the cost in the expectation of receiving government subsidies. This affects accuracy of data collected by the mobile teams.

9. The number of collection Centres of horticulture produce is limited in Uttarakhand. The produce sold through these Centres passes through the process of sorting, grading and packaging. These Centres can be a great help in data collection.
10. A good net work of organized markets for horticultural produce can also help in checking up the collected data.
11. Lack of adequate extension staff. The unemployed youth with graduation in agriculture may be involved in data collection of horticultural crops by giving some financial incentive.

In a nutshell, the quality of horticultural data collected in Uttarakhand would greatly improve, if guidelines are prepared for data collection of each horticultural crop and strictly adhered to by data collector and growers so that element of subjectivity could be avoided.

Table 7.1
Problems faced by Grass Root Officials in collection of Data (Department of Horticulture)

District /Village	Problem	Fruits	Vegetables	Flowers	Spices
Tehri Garhwal /Mithyangaon	1	Scattered holdings, difficult terrain, trees on top hills, bunds, etc,	Area no problem, production due to memory bias of farmer	Area no problem ,production due to memory bias of farmer	Area no problem, production due to memory bias of farmer
	2	Difficulty to reach farmers field	Difficulty to reach farmers field		Difficulty to reach the farmers field
	3	Availability of farmers a constraint	Availability of farmers a constraint	Availability of farmers a constraint	Availability of farmers a constraint
Dehradun /Badawala	1	Area: no problem, Estimation of production is difficult due to sale to pre-harvest contractors			
	2				
	3				
Dehradun /Prateetpur	1	Area: no problem Production: due to sale to pre-harvest contractors	Area: no problem, production estimates based on farmers ,information with memory bias		
	2				
	3				
Haridwar /Kangri	1	No problem	No problem		No problem
	2				
	3				

Source: Ibid

Chapter-8

Conclusion and Policy implications

This chapter aims to present main findings of this study and to draw policy implications in order to harness potential of horticulture sector in Uttarakhand. This study is a departure from earlier studies in terms of its focus on issues related to data on horticultural crops at the macro as well as micro levels. The main objective of this research is to compare the field survey data on horticultural crops with baseline data available from secondary sources in Uttarakhand and to point out problems encountered by grass root officials in collection of primary data. The specific objectives of the study are following.

8.1 Objectives:

- To collect data on area, production and yield of horticultural crops and compare with the baseline data collected by the Department of Horticulture/Directorate of Economics and Statistics, Uttarakhand.
- To identify the horticultural crops on which proper statistics are not being complied in the state of Uttarakhand.
- To study the problems encountered by the grass-root officials while collecting data on the horticultural crops.
- To identify the problems in estimation of horticultural crops and to suggest policy measures.

8.2 Research Methodology:

This study is based on macro and micro level data collected from secondary and primary sources. The data on area, production and yield of horticultural crops grown in Uttarakhand were collected from the Directorate of Horticulture, Uttarakhand. We have also obtained data which are collected under the land use statistics by the Directorate of Economics and Statistics, Uttarakhand but these data are limited to a few crops such as potato and onion. General information on selected districts and other aspects was obtained from various issues of the Statistical Diary of Uttarakhand published by the Directorate of Economics and Statistics of the state.

The scope of the study is confined to fruits, vegetables, spices and flowers. Dehradun district with highest share in total area of the state under fruits and vegetables, Tehri Garhwal district with highest share of area under spices and Haridwar with highest share of area under flowers were selected for in-depth study. Further, one block with highest area and one village in each block based on the same criterion were chosen for field survey. In order to collect primary data, two questionnaires were canvassed – one for the producers of the horticultural crops and the second one for the officials involved in the data collection of horticultural crops at the village/ block/ district level.

Now, we summarize main findings of this study

8.3 Main Findings of the Study:

Macro Scenario of Horticulture

All India Level:

Horticulture is emerging as one of the important sub-sector of agriculture in India. The area, production, productivity and exports of horticultural crops increased many folds during the past two decades. The area, production and yield of horticultural crops grew at the rate of 3.11, 4.41 and 1.27 per cent per annum between 1991-92 and 2011-12. As a result, India has emerged as the second largest producer of fruits by contributing 11.2 per cent share in world fruit production. Among fruits, mango, banana and citrus contributed 67 per cent in production during 2011-12.

India grows a large variety of vegetables. Potato, onion, tomato, brinjal, cabbage and cauliflower constitute around 78 per cent of total vegetable production in the country. The productivity of vegetables was around 147 qtls/ha. Tapioca, potato and cabbage indicated a productivity of more than 200 qtls/ha during 2011-12. In spices, garlic, ginger, turmeric and coriander together contributed 62 per cent in total production of spices. The productivity of garlic was found higher than other spices.

At the state level, Maharashtra and Andhra Pradesh contributed 34 per cent in all India fruit production while West Bengal, Uttar Pradesh and Bihar dominated in vegetable production. Rajasthan, Gujarat, Andhra Pradesh, Madhya Pradesh and Karnataka grow most of the spices while Southern states such as Tamil Nadu,

Karnataka and Andhra Pradesh contribute 57 per cent in total flowers production in India. The contribution of Uttarakhand is 0.96 per cent in fruits, 0.7 per cent in vegetables, 0.75 per cent in spices produced in the country. Thus, contribution of Uttarakhand in all India production of horticultural crops is low despite high potential in terms of favorable agro-climatic conditions for the growth of these crops.

State Level:

Vegetables and fruits constituted 73.12 per cent and 22.65 per cent of area under horticultural crops in Uttarakhand during 2010-11. Other crops such as spices, flowers, medicinal and aromatic plants together occupied around 4 per cent of area cultivated under these crops. Among fruits, mango, apple, citrus fruits, walnut, pear and litchi were major crops while potato, vegetable pea, tomato, cabbage, french bean were main crops among vegetables in terms of area allocation at the state level.

A positive and negative gap was noticed in proportion of area and share in production. Among fruits, highest positive gap was recorded for pear and negative gap for walnut. Among vegetables, tomato, cabbage and radish show positive gap. Further, Dehradun, Nainital and Almora were leading districts in area allocation under fruit crops and together accounted for 38 per cent of the total cultivated area in the state. Cultivation of vegetables was found popular in Dehradun, Nainital and Udham Singh Nagar and these districts together produced around 53 per cent of state's total output. The ranking of the districts in area allocation shifts after adding all the horticultural crops. Almora superseded Dehradun and Nainital in share of production due to higher yield. The productivity of horticultural crops in Haridwar district (8.59 tonnes/ha) was found higher in comparison to other districts.

Mango, litchi, apple and walnut were the major fruits in terms of area allocation and their share in production in Dehradun district. The productivity of fruits was found 26 qtls/ha against the all India average of 115 qtls/ha during 2010-11. Vegetable pea, tomato, cauliflower were the major vegetables covering around 51 per cent of area under vegetables in Dehradun. Further, ginger was the main spice crop in Tehri Garhwal district while marigold was the major flower crop in Haridwar district.

An Overview of Agriculture in Uttarakhand

Uttarakhand is the 27th State of Union of India carved out of the 13 North Western districts of Uttar Pradesh in 2000. The state inhabits 101 lakh persons and literacy rate in the state (79.63 per cent) is above the all India level during 2011. The GSDP of Uttarakhand has recorded a rapid growth between 2004-05 and 2010-11. It was contributed by primary, secondary and tertiary sectors. The contribution of these sectors was 12.08, 34.47 and 53.45 per cent respectively during 2010-11. The state economy is shifting from agriculture to secondary and tertiary sector which is a sign of structural change.

Agricultural development in Uttarakhand is a challenge due to natural constraints. Only 12.75 per cent of the geographical area was cultivated in 2010-11. Around 46 per cent of net sown area was irrigated by canals and tubewells. The average size of holdings was 0.91 hectare in the state. Around 89 per cent of holdings are small and marginal.

The crop pattern in Uttarakhand is dominated by food grain crops. Wheat and rice constitute around 35 per cent of GCA. In addition, pulses, oilseeds and sugarcane are cultivated. The yield of these crops is below all India level except for pulses which recorded higher productivity in comparison to India. The low input use could be one of the reasons for low productivity.

Horticulture is one of the important sub-sectors of agriculture in Uttarakhand. Among fruits, mango, apple and citrus occupy first three positions while vegetable pea, tomato, french bean, etc are the major vegetables. The contribution of Uttarakhand in the total area under fruits and vegetables was 2.81 and 1.07 per cent in all India during 2011-12. But, share of the state in production of horticultural crops was much lower due to productivity differentials.

General background of Selected Districts

For better understanding of the horticulture, one has to look into main indicators related to population, workers, net sown area and major crops grown at the district level.

(i) The total population of Dehradun, Haridwar and Tehri Garhwal districts was 16.98, 19.27 and 6.16 lakh persons during 2011. Around 44, 62 and 89 per cent population was rural based in these districts. Education is a catalytic factor in development of agriculture and for initiatives to adopt horticultural crops. The status of education in Dehradun district was found better than Haridwar and Tehri Garhwal districts. The share of agricultural workers in total main workers in selected districts was between 22 per cent in Dehradun and 64 per cent in Tehri Garhwal. It seems that growing work opportunities in Tehri Garhwal district did not benefit population. The composition of workers in farm and non-farm sectors was markedly different. Dehradun exhibited around 78 per cent of main workers in non-agriculture. On the contrary, Tehri Garhwal has exhibited 64 per cent of the main work force involved in agricultural sector.

(i) A comparison of important indicators of agricultural development reveals wide disparities across the selected districts. The irrigation status, yield rates of important crops, input use were analysed to gauge the disparities. Out of the selected districts, Haridwar and Dehradun appeared to be much ahead in agricultural development than Tehri Garhwal district.

(ii) The share of net area sown to geographical area was found different in selected districts. It was around 12 per cent in Dehradun and Tehri Garhwal districts against 48.92 per cent in Haridwar district. The status of irrigation of cultivated area also varied across the districts. The cropping intensity was lowest in Tehri Garhwal district. The share of food-grain crops was less than 40 per cent in the selected districts as well as in the state. A significant share of cultivated area was devoted to horticultural crops including fruits and vegetables.

Socio-Economic Characteristics of Respondents

For looking into issues related to horticulture, we have looked into main indicators related to population, educational status of the head of households, farm size, nature of land ownership, sources of irrigation and motivational factors for taking up cultivation of horticultural crops by respondents. The efficiency and success of farming is influenced to

a significant degree by the socio-economic background of the households. In addition, these characteristics influence adoption of improved technology and diversification towards high value crops. The average size of the family of respondents in four selected villages was between 6 and 8 persons. Most of the respondents were in the age group of 26 to 50 years.

Around 73 per cent of respondents were OBC while 26 per cent were from general category. There was no correlation between farm size and average size of family. The literacy rate of the surveyed families was not found to be impressive; however respondents in Badawala village of Dehradun district indicated higher level of literacy. At the aggregate level, around 57 per cent of respondents attained education upto secondary and high school. Only 9 per cent attended university.

The scenario of land ownership was dominated by small and marginal farmers in particular at Mithyangaon of Tehri Garhwal district. The medium and large farmers constituted 10.75 and 7.53 per cent of total respondents.

The nature of land ownership influences crop pattern, adoption of technology and innovation. At the aggregate level, net operated area was 1.52 hectares per respondent. Further, respondents in Badawala village of Dehradun district operated higher area in comparison to other villages. The practice of leasing-in land was there but none of the respondents leased out land. The main sources of irrigation were canal and electric tube-wells. In kharif season, marigold was grown in Kangri village of Haridwar district while rabi season was dominated by a large variety of vegetables. Okra, french bean, vegetable pea and cucumber were the main vegetables. In Badawala village of Dehradun district, respondents grew mango and litchi while in Mithyangaon of Tehri Garhwal district, spices and vegetables were the major crops. In Kangri village of Haridwar, flowers of marigold and rose were cultivated by respondents. The main motivational factor for taking up cultivation of horticultural crops by respondents was good price in addition to proximity to the market, influence of neighbours and government support.

Area, Production and Yield of Horticultural Crops grown by Respondents

Results show that respondents cultivated a large variety of horticultural crops in selected villages during 2011-12. In kharif season, marigold was grown on 5.12 hectares in Kangri village of Haridwar district. A marginal area was devoted to marigold in Prateetpur village of Dehradun district. This area yielded a production of around 319 and 6 qtls. The productivity of marigold was estimated 62.21 and 37.50 qtls/ha in this village.

Respondents grew a large variety of vegetable crops in Prateetpur village of Dehradun district. Okra, vegetable pea, french bean and cucumber were the major crops while tomato, onion, radish, bitter gourd, potato and tori were also grown. The estimated yield of tomato (137.5 qtls/ha) followed by radish (131.6 qtls/ha), cucumber (113.64 qtls/ha) and potato (103.12 qtls/ha) was higher than other vegetables.

During summer season, respondents in Mithyangaon village of Tehri Garhwal district cultivated ginger, potato, vegetable pea and french bean. A miniscule area was devoted to cauliflower, tomato, chilli, onion and turmeric. The per hectare productivity of ginger, potato, vegetable pea and french bean was around 174, 108, 90 and 68 qtls/ha respectively.

Among annual crops, mango and litchi were cultivated in Badawala and Prateetpur villages of Dehradun district. The per hectare yield of these fruits was estimated 84 qtls and 30 qtls respectively. It is encouraging to state that yield of mango in Badawala village of Dehradun district was much higher than the state level because farmers grew varieties which yield higher. It was further contributed by favourable climatic conditions. The major sources of irrigation for horticultural crops in selected villages were canal, canal + tube-wells and natural spring.

We have assessed the difference between yield of horticultural crops cultivated on the basis of survey data and base line data obtained from Directorate of Horticulture, Uttarakhand. The yield of fruit crops namely, mango and litchi in Badawala village of Dehradun district was higher than yield provided in the secondary data. In Prateetpur village of Dehradun district, yield of okra, french bean, onion, radish and vegetable pea obtained through field survey was lower than estimates of secondary data. The difference in two estimates was negligible in case of tomato. The yield of ginger in

Mithyangaon village of Tehri Garhwal district was higher than secondary source. Similarly, yield of marigold estimated through survey in Kangri village of Haridwar district was higher than secondary data. The positive differences could be due to these areas being hub and specialized in farming of fruits, vegetables and spices.

Methodology for data collection of Horticultural Crops:

In Uttarakhand, two sets of data on horticultural crops are available (i) data collected by the Directorate of Horticulture, Uttarakhand (ii) data collected by the Directorate of Economics and Statistics, Uttarakhand. The Directorate of Horticulture is an apex body of the state dealing with horticulture. The data on area, production and yield of fruits, vegetables, spices and flowers are collected through Horticulture Mobile Teams and published by the Directorate of Horticulture, Uttarakhand.

These data are available for 11 fruit crops, 10 vegetables, 7 spices and 8 varieties of flowers. These are largely based on records of mobile team, oral information from farmers and eye estimates of collectors. Some of the horticultural crops are not covered i.e. kafal, strawberry, jamun, kiwi, almond and chestnut among fruits, off season vegetables, exotic vegetables (Shimla capsicum, parsley and broccoli) among vegetables. In view of rising demand for horticultural products, data base need to be enlarged to popularize cultivation of these crops

The Directorate of Economics and Statistics has data base for potato and onion. The horticulture data collected by this source are not widely used due to extremely limited coverage of horticultural crops.

Problems Encountered in collection of Horticultural Data:

During the course of field survey, grass root officials involved in collection of horticultural data reported positive and negative observations and problems encountered in collection of horticulture data.

The mobile teams maintain record of details regarding horticultural crops along with details of area in the villages. But, distribution of horticultural card is limited in the state and hence, most of the horticultural crop growers do not have written record. This creates variation in information due to subjectivity of the grower and data collector.

There is an urgent need of clear cut guidelines from horticulture department regarding data collection. These strictly need to be adhered to while collecting information on horticultural crops. This would reduce location and person specific bias. Furthermore, this would greatly help to make data collection a scientific practice by reducing subjectivity.

It is based on oral information by the farmers and eye estimates of collector. If scientific knowledge and traditional wisdom are combined and further information technology is blended, the quality of data would certainly improve.

The data collection in hills is a serious problem due to small, fragmented and scattered holdings. This also leads to low production and productivity since adoption of technology in these holdings is difficult. The low production and yield reported in the data many times creates doubts about the reliability.

Farmers often under report production and exaggerate the cost in the expectation of receiving government subsidies. This affects accuracy of data collected by the mobile teams.

There is lack of adequate extension staff. The unemployed youth with graduation in agriculture may be involved in data collection of horticultural crops by giving some financial incentive.

In a nutshell, the quality of horticultural data collected in Uttarakhand would greatly improve, if scientific guidelines are prepared for data collection of each horticultural crop and strictly adhered to by data collector and growers so that element of subjectivity could be avoided.

8.4 Policy Implications

Food security, nutritional security, sustainability and profitability are the main focus of present and future agricultural development. The high value agriculture, particularly horticultural crops are the catalysts for the next wave of growth in the farm sector. Horticulture is one of critical sectors in the economy of the hill state of Uttarakhand. It provides much needed opportunity for diversification and increased employment in the state where the scope of high rate of growth in conventional

agriculture is rather limited due to peculiar topography and majority of scattered and marginal holdings.

Undoubtedly, area, production of horticultural crops has improved during the past one decade in Uttarakhand, but yield performance was observed to be poor. Therefore, serious policy efforts are needed to harness the potential. The non-availability of comprehensive data on basic parameters at the disaggregate level puts a serious limit in designing and planning for improved productivity through extension, input supply and efficient marketing logistics.

The efforts of the Directorate of Horticulture, Uttarakhand are appreciable in publishing the data related to horticulture. During the survey, it was noticed that data are based on oral information of farmers and eye estimates of collector which create subjectivity. Therefore, preparation of guidelines for collection of data for each horticultural crop and implementation at collector and respondent level should be given top priority.

In order to improve prospects of horticulture in Uttarakhand (i) provision of infrastructure (markets, storage and roads), (ii) availability of region specific improved varieties for each horticultural crop, (iii) easy availability of planting material and easy access to extension assume special significance for success.

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Action Taken on Comments of the Coordinator

The author thanks the coordinator for his keen interest in the study and the suggestions made by him. All the comments given by the coordinator on the draft report were considered and have been incorporated at appropriate places in the final report.

Appendix-1

Area, Production and Productivity of Horticultural Crops in India (1991-92 to 2011-12)

Year	Area (million ha)	Production (million MT)	Productivity (MT/ha)
1991-92	12.8	96.6	7.5
1992-93	12.9	107.4	8.3
1993-94	13	114.7	8.8
1994-95	13.1	118.4	9
1995-96	13.7	125.5	9.2
1996-97	14.4	128.5	8.9
1997-98	14.8	128.6	8.7
1998-99	15.1	146.2	9.7
1999-00	15.3	149.2	9.8
2000-01	15.7	150.2	9.6
2001-02	16.6	145.8	8.8
2002-03	16.3	144.4	8.9
2003-04	19.2	153.3	8
2004-05	21.1	170.8	8.1
2005-06	18.7	182.8	9.8
2006-07	19.4	191.8	9.9
2007-08	20.2	211.2	10.5
2008-09	20.7	214.7	10.4
2009-10	20.8	223.1	10.7
2010-11	21.8	240.4	11
2011-12	22.6	249.5	11
Per annum Growth rate	3.11	4.41	1.27
Coefficient of Variation (%)	19.44	27.78	10.7

Note: Crops = Fruits, vegetables, potato &tuber crops, mushrooms, flowers (loose), plantation crops (coconut, cashewnut, arecanut, &coca), spices and honey

Source: NHB, 2012

Appendix-2

Share of Important Fruits, Vegetables, flowers and Spices in all India Area and Production during 2006-07 and 2011-12

	2006-07					2011-12				
Crop	Area ('000 ha)	Per cent	Production ('000 tonnes)	Per cent	Yield (Kgs./ha)	Area ('000 ha)	Per cent	Production ('000 tonnes)	Per cent	Yield (Kgs./ha)
I-Fruits										
Mango	2154	38.78	13734	23.06	6376	2308	35.11	15761	20.93	6829
Apple	252	4.54	1624	2.73	6444	319	4.85	2211	2.94	6931
Banana	604	10.88	20998	35.25	34765	781	11.88	26647	35.39	34119
Citrus	798	14.37	7145	12	8954	895	13.61	8525	11.32	9525
Guava	176	3.17	1831	3.07	10403	212	3.22	2624	3.84	12377
Grapes	65	1.17	1685	2.83	25923	118	1.8	2762	3.67	23407
Papaya	72	1.3	2482	4.17	34472	109	1.66	4389	5.83	40266
Total*	5554	100	59563	100	10724	6572	100	75298	100	11457
II-Vegetables										
Potato	1743	23	28599	24.87	16408	1872	21.26	41328	32.02	22077
Onion	768	10.13	10847	9.43	14124	1033	11.73	15393	11.92	14901
Tomato	596	7.86	10055	8.74	16871	871	9.89	17403	13.48	19980
Brinjal	568	7.49	9453	8.22	16643	661	7.5	11935	9.25	18056
Cabbage	249	3.29	5584	4.86	22426	389	4.41	8456	6.55	21738
Cauliflower	302	3.98	5538	4.82	18338	377	4.28	7057	5.47	18719
Okra	396	5.22	4070	3.54	10278	509	5.78	6020	4.66	11827
Vegetable pea	297	3.92	2402	2.09	8088	385	4.37	3550	2.75	9221
Tapioca	255	3.36	8232	7.16	32282	171	1.94	6359	4.92	37187
Total*	7579	100	114993	100	15173	8807	100	129078	100	14656
III-flowers	146		778		5329	299.8		1714.5		5719
IV-Spices										
Chillies(Dried)	758	30.79	1234.1	30.99	1628	792.1	26.17	1260.1	22	1591
Coriander	320.8	13.03	233.2	5.85	727	562.3	18.58	530.2	9.26	943
Cumin	409	16.61	176.5	4.43	432	512.9	16.94	342.5	5.98	668
Garlic	149.7	6.08	707.4	17.76	4725	218.7	7.22	1163.5	20.31	5320
Ginger	105.9	4.3	370.3	9.3	3497	158.1	5.22	772.2	13.48	4884
Pepper	246	9.99	69	1.73	280	187.9	6.2	42	0.73	224
Turmeric	186	7.55	837	21.02	4500	199	6.57	1062.5	18.55	5339
Total	2462	100	3982	100	1617	3027	100	5726.4	100	1892
Total*	**19241**		**192210**		**9990**	**22589.3**		**249460.5**		**11043**

*Total includes remaining Horticultural Crops

Source: Agricultural Statistics at a Glance, 2012

Appendix-3

Share of Important States in All India Production of Fruits and Vegetables during 2010-11

State	Fruits			Vegetables			Spices			flowers			others			Total		
	Area	Production	Yield	Area	Production	yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
Andhra Pradesh	10.12	12.58	14575	7.67	8.08	18193	9.84	19.98	3697	11.42	12.96	-	8.52	6.79	2636	8.86	9.7	12064
Arunachal Pradesh	1.13	0.14	1499	0.05	0.03	9167	0.34	1.15	6099	0.63	0	-	0	0	-	0.4	0.09	2377
Assam	2.15	2.36	12826	3.06	1.99	11248	3.03	4.15	2490	0	0	-	2.32	1.3	1846	2.63	2.11	8818
Bihar	4.64	5.22	13193	9.95	9.98	17314	0.44	0.23	962	0.1	0.22	-	0	0	0	5.29	7.71	16072
Chhattisgarh	2.77	2.7	8868	4.07	2.89	12287	0.4	0.15	709	3.61	2.63	-	1.17	0.71	2004	2.69	2.47	10139
Gujarat	5.48	9.68	20706	6.07	6.4	18181	16.31	14.81	1653	6.55	4.8	-	0.6	1.02	5622	6.36	7.32	12743
Haryana	0.76	0.48	7702	4.08	3.17	13422	0.51	1.45	5159	3.25	5.85	-	0.02	0	600	1.9	2.14	12397
Himachal Pradesh	3.36	1.38	4800	0.95	1.01	18345	0.22	0.37	2970	0.37	0.06	-	0	0	-	1.39	1.05	8351
Jammu & Kashmir	5.1	2.97	6820	0.82	1.06	22370	0.13	0.02	231	0.05	0.02	-	0	0	-	1.83	1.57	9469
Jharkhand	1.13	1.04	10828	3.06	2.84	15847	0	0	-	0.84	2.13	-	0	0	0	1.53	2.04	14748
Karnataka	5.92	8.38	16606	5.49	6.18	19422	8.81	8.6	1777	14.14	19.77	-	19.28	14.3	2451	8.55	7.4	9538
Kerala	4.72	3.35	8325	1.76	2.31	22694	7.98	2.11	482	0	0	-	25.57	33.15	4290	7.9	4.27	6141
Madhya Pradesh	2.07	4.51	25499	3.34	2.52	13037	9.78	7.73	1439	4.03	0.58	-	0.89	1.6	5944	3.46	3.2	10325
Maharashtra	24.08	12.07	6189	7.19	5.12	12282	3.96	1.88	864	9.17	8.83	-	5.35	2.63	1623	11.39	7.3	7055
Rajasthan	0.8	0.93	13603	1.65	0.6	6308	20.37	12.48	1115	2.83	0.94	-	7.47	1.16	513	4.98	0.99	2224
Tamil Nadu	5.04	13.31	30966	3.26	5.65	29859	4.57	6.38	2541	16.76	23.98	-	14.62	30.36	6864	6.06	9.43	17126
Uttar Pradesh	5.09	7.18	16528	9.76	12.06	21316	1.92	3.75	3546	5.45	1.71	-	3.5	0.13	100	6.21	9.68	17182
Uttarakhand	2.81	0.96	4009	1.01	0.7	12015	0.25	0.75	5776	0.63	0.22	-	0	0	-	1.25	0.74	6560
West Bengal	3.31	3.94	13955	15.89	18.24	19801	3.29	3.61	1991	12.1	5.74	-	1.34	2.2	5435	7.94	12.56	17438
Other States	9.52	6.82	8400	10.87	9.17	14552	7.85	10.4	2411	8.07	9.56	-	9.35	4.65	1645	9.38	8.23	9271
Total	100	100	11732	100	100	17253	100	100	1819	100	100		100	100	3305	100	100	11017

*Others include remaining horticultural crops.

Source: Agricultural Statistics at a Glance, 2012

Appendix-4

Land Use Pattern in Uttarakhand (2000-01 to 2010-11)

('000 ha)

Year	Total Reported Area	Forest	Not Available for Cultivation	Permanent Pastures and other Grazing Land	Land under Misc. Tree, Crops and Grooves	Cultivable Waste Land	Fallow Land Other than Current Fallows	Current Fallows	Net Area Sown	Area Sown More than once	Total Cropped Area	Cropping Intensity	Net Irrg. Area	GIA*
2000-01	5672	3465 (61.09)	462 (8.14)	229 (4.04)	254 (4.48)	385 (6.78)	69 (1.21)	38 (0.67)	770 (13.58)	456	1226	159.22	344 (44.68)	537 (43.80)
2004-05	5670	3465 (61.11)	464 (8.18)	229 (4.04)	249 (4.39)	386 (6.81)	68 (1.20)	42 (0.74)	767 (13.53)	468	1235	160.02	345 (44.98)	549 (44.45)
2008-09	5672	3486 (61.46)	465 (8.20)	229 (4.04)	252 (4.44)	386 (6.81)	71 (1.25)	41 (0.72)	776 (13.68)	504	1280	164.9	372 (47.94)	578 (45.16)
2010-11	5672	3485 (61.44)	442 (7.79)	199 (3.51)	386 (6.81)	310 (5.47)	85 (1.50)	43 (0.75)	723 (12.75)	447	1170	161.74	336 (46.47)	562 (48.03)

**GIA: Gross Irrigated Area*

Figures in brackets show percentage

Source: Directorate of Agriculture, Uttarakhand.