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Present Status of Horticulture Development in Himachal Pradesh

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Introduction

The problem of a widening gap between increasing human population and food production has been emphasized by various people and the gravity of the situation in India and other developing countries has been highlighted. The problem is, however, not of quantitative shortage alone. The quality of available food has been causing equally great anxiety to planners, scientists, and administrators alike and it is in this context that the cultivation of horticultural crops, particularly fruits, has gained much importance.

In India, the possibilities of horizontal expansion of agriculture are small. In fact, India has almost reached the physical frontiers of possible cultivation. In this country, there is already about 47 per cent cropping of the total reported area (1977/78). The total culturable wasteland is hardly 17 million hectares, which is 5.6 per cent of the total area. The extension of agriculture to this area is costly and of low economic feasibility, as it requires expensive soil and water conservation measures. However, with the fast-expanding development of horticulture in the Himalayas, it has been observed that such areas can be treated more economically by planting perennial horticultural crops which will not only help soil and water conservation, but also provide economic returns to the farmers. Thus the only prospective of increasing food production and meeting the need for food and cash crops in the country lies in increasing the yield per unit of land with suitable diversification of area under high-yielding varieties of cereals and bringing culturable wastelands under perennial plantations.

Horticulture is an important sector of Indian agriculture. The country is endowed with a wide range of agroclimatic conditions suitable for growing a variety of fruits, vegetables, and flowers, ranging from temperate to tropical. Statistics on area and production of horticultural crops in India are not as accurate as of the major field and plantation crops. However, it is estimated that fruits and vegetables account for 6.7 per cent of the total cropped area in the country and that about 70 million tons of various types of fruits and vegetables are produced. Out of a total estimated area of 11.6 million hectares under horticultural crops, the area under fruits in 1986/87 was around 2.94 million hectares, with a total production of 25.5 million tons. Mango leads with a 40 per cent share, followed by banana, with an 18 per cent share, citrus fruits occupy the third place, and guava and apple take the fourth and fifth positions respectively.

Keeping in view the importance of fruits and vegetables in the Indian diet and the fact that our per caput consumption of fruits and vegetables in one of the lowest, the National Commission on Agriculture proposed that the area under fruits should by the turn of the century be raised to 4 million hectares with a production of 40 million tons and vegetable production should plan for 80 million tons from an area of 4 million hectares. If this goal set by the National Commission on Agriculture is to be achieved, strenuous efforts will have to be made. All our efforts in the past have been to attain self-sufficiency in cereals, i.e., food security. The time has now come to pay special attention to nutritional security. With the population explosion, efforts in this direction need to be intensified.

Horticultural crops have also big export potentials. The emerging trend in the dietary habits of affluent populations in the developing countries is to reduce the consumption of cereals, whereas the consumption of fruits and vegetables is increasing. Fruit and vegetable development has a bright future specially in the developing countries.

Himachal Pradesh—An Overview

Geography

Himachal Pradesh is situated in the nothwestern Himalayan region bordering Uttar Pradesh in the east, Jammu and Kashmir in the northwest, Tibet and China in the northeast and Punjab and Haryana in the south. The state has a geographical area of about 55, 673 sq. km. It has 12 districts and 4,280,818 people living in 16,807 villages and a score of towns. The physiography of the state consists wholly of mountainous tracts, with elevations ranging from 350 to 6975 m above mean sea level.

Climate

The climate varies from hot to severe cold, depending upon elevation. The state has relatively hot summers and mild winters in the south, mild summers and cold winters in the interior and severe winters and pleasant summers in the inner parts of the north. In the inner zone, summers are experienced late in the months of July and August and the temperature drops rapidly after October. The state has the highest and the lowest average of annual rainfall, about 300 cm at Dharamsala (District Kangra) and 35 cm at Pooh (District Kinnaur), which is further reduced to 18 cm in the interior of Spiti. For the whole of Himachal Pradesh, the average annual rainfall is 150 cm. While a large proportion of it is concentrated in the monsoon season in the outer zone, the monsoon comes only in the form of a misty drizzle in parts of the inner zone, which gets most of its moisture in winter in the form of snow.

Early winter fogs are characteristic of the outer valleys of Manali and Bilaspur. The occurrence of fog provides some insurance against delay of winter showers required for the sowing of winter crops. In the higher valleys of the interior, frost occurs in areas where the temperature drops very low during winter. The greatest intensity of hail has been marked within 15 km of the main ranges, particularly along Dhauladhar in Kangra-Mandi and Kullu-Seraj tracts.

Taking both temperature and rainfall into consideration, the climatic types in the state range from outer zone wet sub-tropical areas of Kangra-Mandi, Bilaspur, and lower Sirmour to cool humid temperature areas in the interior and at higher elevations of the outer Himalayas, of which Chamba, Dalhousie, Kullu, Karsog, Solan, Shimla, and Jubbal are representative.

Cold moist temperature areas are marked in the inner parts of the lesser Himalayas, as in Tissa-Bhandal, Bharmour-Pangi, Mandi, and Rampur-Kalpa tracts. To the north of Pir Panjal and the central axis of the great Himalayas, a cool dry temperature verging on a Tibetan climate is found in Lahaul Spiti and Kinnaur districts.

Horticultural Zones

The state can broadly be divided into four horticultural zones, details of which are given in Table 3.1.

Soils and Terrain

In a mountainous tract such as Himachal Pradesh, the percentage of area under cultivation is very low. There are small valleys, stretches of river banks and the banks of rivulets and streams, hill tops and ridge

TABLE 3.1
Horticultural zones of Himachal Pradesh

Particulars	Elevation (m)	Rainfall (mm)	Important fruits grown
Low hills and valley areas near the plains (Hamirpur, Una, parts of Kangra, Bilaspur, Mandi, Shimla, Solan, Kullu, and Sirmour districts)	350–950	1250–1750	Mango, litchi loquat, guava, citrus, papaya, fig, sand pear, early variety of grape
Mid-hills, Sub-temperate (parts of Solan, Sirmour, Shimla, Kullu, Bilaspur, Mandi, Chamba, and Kangra district)	950–1500	1250–2500	Stone fruits, peach, plum, apricot, almond, persimmon, pear, pomegranate, pecan nut
High hills and valleys in the interior (parts of Shimla, Solan, Kullu, Mandi, Sirmour, Chamba, and Kangra District)	1500–2500	850–1750	Apple, pear, cherry, walnut, almond, chestnut
Cold and dry zone (Kinnaur, Lahaul and Spiti, Pangi, and Bharmour areas of Chamba district)	1500–3200	180–400	Grapes, prunes, drying type of apricot, almond, chilgoza, Sarda melon, pistachio

tops, where the land is more or less flat and level. Barring these areas, cultivation is carried out on terraces. Entire hillsides are found dotted with villages set amidst terraced fields.

The soil in the state varies greatly within small areas. Its profile, depth, and characteristics change according to gradient of slopes. These differences are caused by climate, vegetation, parent material topography, drainage, and time. Soil on nearly level areas may be imperfectly drained and soil on depressed areas is usually poorly drained, but soil on steeper slopes is usually well drained. On ecological basis the state can be divided into five zones: low hill mid-hill, high hill, mountain, and cold arid zone.

LOW HILL

The low hill area covers the southern margins of the state in the Shiwalik zone, is distributed between 450 and 750 m altitude, experiences 125–175 cm of yearly rainfall, and has a humid, hot tropical climate. Most of the area is found on the banks of rivers and streams. The soil reaction

is mostly neutral. The C:N ratio is around 10:1. The zone comprises the entire districts of Una and Hamirpur and parts of Bilaspur, Kangra, Mandi and Sirmour. Solan and Chamba districts are suitable for sub-tropical fruits such as citrus, mango, litchi, and guava.

Mid-Hill

The mid-hills cover the next altitudinal belt extending up to 1500 m. This area receives 125 to 250 cm annual rainfall under sub-tropical conditions. The soil is mostly sandy loam, loamy sand, snowed clay, and silt loam. The soil has a varying percentage of pebbles and stones and is susceptible to severe drought. The soil reaction is neutral to slightly acidic. The C:N ratio is greater than in the low hill soil. This zone comprises parts of lower Shimla, Solan, Kangra and adjoining parts of Chamba, Mandi, and the lower area of Sirmour districts. This area is suitable for stone fruits, peach, plum, apricot, almond, persimmon, pear (hard varieties) and pomegranate.

High Hill

This zone is distributed between 1500–2100 m above mean sea level. The area receives an average annual rainfall of 85 to 175 cm. The soil is deep and fine-textured, varying from silt loam to clay loam, and is of a light to dark brown colour. With a good reserve of humus and a limited quantity of mineral and plant food, the soil is fairly productive. The soil reaction is slightly acidic. Because of high fertility, the soil is excellent for the cultivation of temperate fruit crops, apple, pear, cherry, walnut, and chestnut. The zone covers Shimla, Kullu, and some parts of Mandi and Kangra districts.

Mountain

This zone is distributed in elevations ranging from 2100 to 3050 m and found on high mountain ranges where precipitation occurs largely in the form of snow. The precipitation amounts to about 85 cm a year. The process of soil formation is slow. The soil varies from silty loam to loam in texture and is dark brown in colour. The area is mainly under forest. The soil reaction is slightly acidic to moderately acidic and has great moisture-holding capacity. The zone comprises parts of Shimla, Kangra, and Kullu districts. In some parts, apple is grown successfully.

Cold Arid Zone

This zone covers elevations above 2500 m in the inner valleys of Lahaul Spiti, Kinnaur, Pangi Bharmour of Chamba district, and Bara Bhangal of Kangra district. The climate is cold moist temperate to cold

arid type. The soil is mostly sandy loam to loam and slightly alkaline in reaction. The productivity of the soil in this zone is very low, however, it is suited for growing fruits such as almond, walnut, grapes, apricots, Sarda melon, and hops, some of which are dried to produce raisins, prunes, dried apricots, etc.

Land-use Pattern and Size of Holding

Agriculture is the mainstay of about 76 per cent of the total rural population. Out of 614,000 hectares cultivated area 23 per cent is under horticultural crops. The total number of operational holdings are 6,38,081, out of which 78 per cent are 2 hectares or less (i.e. small and marginal farmers). The average size of a holding is 1.62 hectares, but a large number of holdings are less than one hectare. The availability of land for agriculture is limited as is evident from the fact that per caput cultivated land is only 0.15 hectare as against 0.34 hectare in the country as a whole and the minimum required is 0.48 hectare to support and provide livelihood for an individual.

Importance of Horticulture

Due to the inherent problems of low land to man ratio, undulating physiography, a cold humid climate, and limited availability of solar energy, farmers cannot depend solely on cereal production as a means of livelihood in Himachal Pradesh. On the other hand, the cold climate and well-drained soil provide ideal conditions for the production of a wide range of fruits crops, from sub-tropical to temperate, besides a number of plantation crops, plants of ornamental value, off-season vegetables and other horticultural crops for markets on the plains. Temperate fruits such as apple, peach, pear, plum, apricot, cherry, almond, and walnut, and sub-tropical fruits such as mango, citrus, litchi, guava, fig, pomegranate, and olive, hops, and a number of temperate zone ornamental plants and vegetables are grown. These are mainly high pay-off crops with the capacity to yield the highest returns per unit area even under the low productivity conditions of Himachal Pradesh soil.

Productivity can be increased by increasing either the yield or the value of the product per unit area. Since it is not possible to substantially increase the yield of traditional crops, the only alternative is to select a pattern of agriculture that will give maximum returns per unit area. In recent years, it has been proved that the productivity of land can be dramatically increased by raising cash crops such as fruits and vegetables. Horticulture thus plays an important role in the economic upliftment of the poor and small farmers of Himachal Pradesh.

Horticultural Development in Himachal Pradesh

Before Independence, hardly any attention was paid to the development of horticulture in the hilly areas of Himachal Pradesh, which was ruled by minor royalty who had neither the resources nor the urge to develop horticulture along scientific lines. Commendable pioneering efforts were, however, made by a few Christian missionaries and European settlers who planted orchards in pockets like Kotgarh area in Shimla Hills and in the Kullu valley. These plantations later served as a nucleus for the development of the horticulture industry in the state.

After Independence, when Himachal Pradesh was formed in 1948, horticulture was started from scratch by the Department of Agriculture and it was soon realized that it could play a vital role in improving the economy of the state. A separate horticulture section in the Department of Agriculture was created in 1953 which played a commendable part in the proliferation of orchards in the temperate regions of the state. Horticulture was given top priority in the state plans and a separate Department of Horticulture came into existence in September, 1970. Since then horticulture has been gaining momentum very fast throughout the state.

Present Status

The fruit industry of Himachal Pradesh, the sole avocation for the economic upliftment of the mainly agricultural population of Himachal Pradesh, has made remarkable progress during the last four decades. The area under various kinds of fruits increased from 793 hectares in 1950 to 142,000 hectares in 1987/88, an increase of 178 times over the period of 37 years. This area under fruits accounts for about 23 per cent of the total cultivable area of the state (see Table 3.2).

The area under temperate fruits during the year 1987/88 was 93,266 hectares, making up about 65 per cent of the total area under fruits. Apple has been the major temperate fruit crop of the state, accounting for 38.5 per cent of the total area under fruits. The trend towards fruit plantations during the past three decades reveals that whereas at the end of the Second Plan, i.e. in 1960, out of the total area of 6004 hectares under fruit crops in the state, 50.38 per cent was under apple alone, it increased to 56.85 per cent in 1965/66 and 57.85 per cent of the total area in 1973/74. However, after this, there has been a steady decline in the proportion of apple grown in the total area, which dropped to 48.81 per cent at the end of the Fifth Plan; 41.34 per cent at the end of the Sixth Plan, and finally to 38.6 per cent in the year 1987/88. The reverse is true in the case of all the other fruits, which is perhaps due to the

TABLE 3.2

Progress made in bringing additional area under fruits (hectares)

Fruit	1950/51*	1960/61**	1965/66***	1984/85****	1986/87	1987/88
Apple	400	3,025	12,711	49,840	52,399	54,912
Other temperate fruits		900	4,147	23,649	25,964	26,728
Nuts, dry fruits	393	231	708	9,804	10,930	11,628
Citrus		1,125	2,780	23,802	29,546	31,226
Other sub-tropical fruits		623	6,020	13,485	16,146	17,559
Total	793	6,004	9,804	120,580	134,985	142,051

Data for the average area under fruits is available only after 1960/61.

* Advent of First Five-year Plan.

** End of Second Five-year Plan

*** End of Third Five-year Plan; also the year of merger of hilly areas of Punjab with Himachal Pradesh at the time of reorganization of the states.

**** End of Sixth Five-year Plan.

Source: Department of Horticulture, Himachal Pradesh, 1988.

increased emphasis given by the state to the development of sub-tropical fruits in the low hill regions of Himachal Pradesh.

The production of fruits has made significant strides during the last four decades, increasing from 1200 tons in 1950/51 to 400,508 tons in 1986/87, a 333-fold increase over a period of 37 years (see Table 3.3). The production of the temperate fruits accounted for about 93 per cent of the total fruit production during the years 1986/87 and 1987/88, while sub-tropical fruits had a share of only 7 per cent. Among the temperate fruits, apples dominated production, constituting about 90 per cent of the total fruit during the peak production year of 1986/87. This is due to the fact that apple growing is the oldest horticultural activity in the state and a large proportion of the plants are in full bearing while the other fruits are only of recent origin. The production of these fruits is also likely to increase in coming years, as more and more plantations enter bearing age.

Productivity

The production figures of various kinds of fruit in Himachal Pradesh reveal considerable variation in yields over the years. The factors which affect the yield are the genetic potential of the varieties planted, the effect of climate and environment, and management practices. The data on the highest average yields obtained by the major fruits grown in the state are given in Table 3.4.

TABLE 3.3
Progress made in fruit production

Fruits	1950/51	1960/61	1965/66	1984/85	1986/87	1987/88
Apple	1,000	12,000	24,000	170,629	359,321	259,277
Other temperate fruits			4,400	26,406	12,432	26,861
Nuts, dry fruits	200	6,719	500	2,224	2,800	2,716
Citrus			6,010	3,947	11,915	10,875
Sub-tropical fruits other than citrus			2,000	12,714	14,040	8,904
Total	1,200	18,710	36,910	215,920	400,508	308,693

Source: Department of Horticulture, Himachal Pradesh.

TABLE 3.4
Peak average yields of fruits in Himachal Pradesh since 1960/61

Fruits	Yield/hectare (tons)
Apple	23.9 (1969/70)
Temperate fruits other than apple	11.00 (1971/72)
Nuts and dry fruits	4.4 (1970/71)
Citrus	9.2 (1968/69)
Sub-tropical fruits other than citrus	9.00 (1968/69)

Source: Department of Horticulture, Himachal Pradesh.

Time series data indicate wide fluctuations in productivity from year to year. For example, taking the average for the state as a whole, the productivity of apple ranged from a low of 4.06 tons (1988/89) to a high of 15.73 tons (1975/76) per hectare over the period 1975/76 to 1988/89, as indicated in Table 3.5.

The variations in yield from year to year were due to the alternate bearing habit of the varieties and unfavourable environmental conditions prevailing in different years. These yield levels are, however, below the international of 30–40 tons per hectare. The Agro-Economic Centre of the Himachal Pradesh University has undertaken several studies on apple yields in Himachal Pradesh and one of these studies found that the average yield of an apple orchard over 15 years of age was 23.43 tons per hectare, the average yield of orchards of all age groups being 14.23 tons per hectare. The results of 15-year trials held at the Regional Fruit Research Station, Mashobra (Shimla), regarding the performance of different apple cultivars, indicated that Red Delicious and Golden Delicious cultivars give an annual yield of 25.5 tons and 15 tons per hectare respectively.

In some efficiently run private orchards it is not uncommon to find

TABLE 3.5
Apple production and productivity in Himachal Pradesh

Year	Production ('000 tons)	Productivity (tons/hectare)
1975/76	200	15.73
1976/77	119	7.83
1977/78	131	7.48
1978/79	121	6.03
1979/80	135	5.77
1980/81	118	4.41
1981/82	307	10.84
1982/83	139	4.48
1983/84	258	8.03
1984/85	171	5.07
1985/86	175	4.98
1986/87	359	9.78
1987/88	259	6.66
1988/89	165	4.06

Plants below 10 years are assumed to be non-bearing

Source: Department of Horticulture, Himachal Pradesh, 1989.

holdings obtaining a yield of 30–60 tons per hectare. These facts illustrate the potential that exists to improve productivity using only currently available technology.

Varieties

Apple

In the case of apples the Delicious group dominates production. It is estimated that 83 per cent of the total planting of apple comprise the Delicious group, namely Red Delicious (25 per cent), Starking (Royal) Delicious (44 per cent), and Rich-a-Red Delicious (14 per cent). Golden Delicious, which is the main pollinizer variety, constitutes 11 per cent of the total planting, while the rest (6 per cent) is made up of miscellaneous varieties, such as Tydeman's Early Worcester, Black Ben Davis, Red Gold, Red June, Cox's Orange Pippin, Rust Pippin, and Granny Smith. Almost the entire plantings are mid-season cultivars and are the progeny of stock which was imported in the first quarter of this century, almost at the time when they were first developed in the United States, and they now require to be enriched by new cultivars.

Pear

Pears are also being grown successfully in Himachal Pradesh, the main varieties being Babugosha, Williams, and Red Bartlett under high hill conditions, Sand Pear and Keiffer in low hill areas. The main thrust achieved in pear cultivation all over the state has, however, been through the improvement of the wild pear (Kainth) trees by the technology of top-working.

Stone Fruits

The mid-hill zone of Himachal Pradesh is suited for the cultivation of stone fruits such as peach, plum, and apricot. Although a large number of varieties have been recommended for peach cultivation, the cultivar Elberta still remains the favourite peach in Himachal Pradesh. An improved strain of Elberta, known as July Elberta, occupies the maximum area. In the case of plums, the salicina group (Japanese plum) has proved successful and cultivars such as Santa Rosa Mariposa, Beauty, Climax and Formosa are recommended, of which the first dominates in the mid-hill region. The cultivar Beauty has been found to act as a good pollinizer for Santa Rosa and these cultivars are generally interplanted in commercial plantations.

The cultivation of apricot is confined to the mid-hill regions and the cold and dry regions, and suitable varieties have been identified for these areas. In the mid-hill regions, the cultivars Early Shipley, Newcastle, Kaise, and St. Ambrose have been recommended. The cultivars Saffaida, Charmagz, and Shakarpara are doing well in the high hills and cold and dry regions.

Almonds were earlier grown only in cold, dry regions but of late cultivation is being extended even to the mid-hill and low hill areas, mainly for use as green almonds. Cultivars such as Nonpareil, Texas (Mission), Ne Plus Ultra, and Peerless, are recommended for cultivation in the low hill and valley areas. Almond cultivars being self-incompatible, it has been the experience in Himachal Pradesh that at least two pollinizer varieties should be planted to obtain maximum yields.

Sub-tropical Fruits

Among the sub-tropical fruits, citrus and mango are by far the most dominant. In the case of citrus fruits, more emphasis has been given to the plantation of Kinnow Oranges and blood red Malta in the sweet orange group and to locally developed Kagzi lime strains in the lime and lemon group. So far as the mango is concerned, Dasehri is the most

favoured cultivar. The introduction of regular bearing varieties such as Amrapali is still in the experimental stage.

Orchard Management Practices

Taking into consideration the physiographic and agroclimatic conditions prevailing in Himachal Pradesh, the main objective of the orchard soil management programme to be followed is to increase the humus content of the soil, conserve soil moisture and prevent soil erosion, maintain soil fertility, and improve soil structure for better aeration and water availability. It has been found that sod culture with clean basins is the most suitable system of orchard management followed in most orchards. The sod should, however, be continuously mowed and added to the basin to act as mulch and also as a source of organic matter in the soil. The mulching of tree basins during dry periods has been found to be the best method for soil moisture conservation.

For orchard nutrition management, Himachal Pradesh has adopted the latest technology of leaf analysis both as an analytical tool to understand nutritional problems and as a means of estimating the fertilizer needs of fruits crops. In fact, Himachal Pradesh was the first state in the country to initiate a fruit plant nutrition advisory service based upon the leaf analysis technique, in 1974. So far, three plant nutrition laboratories equipped with sophisticated equipment have been established at Shimla, Dharmsala, and Kullu. Every year over 15,000 leaf samples are collected and analysed in these laboratories.

Post-harvest Managements

The provision of efficient post-harvest management is a necessary adjunct to any fruit production programme. A sound beginning was made for the creation of post-harvest management infrastructure in the state in 1974 with the implementation of a World Bank-assisted apple processing and marketing project. At present the state has developed an infrastructure with a capacity to grade and pack 30,000 tons of fruit, to store 5000 tons of fruit in the production areas and 8250 tons in the terminal markets (Delhi, Bombay, and Madras), and to process 26,000 tons of fruit within the state. The apple juice concentrate plant established at Parwanoo in Himachal Pradesh ranks as one of the largest in the country. A specialized organisation, the Himachal Pradesh Horticultural Produce Marketing and Processing Corporation, has been created with the sole objective of providing marketing and processing facilities to Himachal fruit growers. The HPMC operates fruit shops in all the major fruit markets of the country and has developed an extensive network for the sale of fruit products all over India. In addition, efforts have also

been made to collect and disseminate market intelligence by the use of modern communication technology under a centrally sponsored scheme operated by the National Horticulture Board.

Horticultural Infrastructure

Apart from an extension set-up to village level, there are a number of centres of horticultural activity in the state under the Department of Horticulture: 92 progeny-cum-demonstration orchards and nurseries, 21 fruit nurseries, 6 olive development stations, one walnut development station, 7 floriculture nurseries, 9 fruit canning units, 45 beekeeping stations, 64 plant protection centres and sub-centres and 3 plant nutrition laboratories.

Government Policy for Horticulture Development

Horticulture development in general involves permanent investment for the development of long-gestation enterprise producing high-value commodities, most of which are perishable by nature; hence the desirability of an appropriate government policy for production, planning, and ultimate utilization of the produce. The involvement of the State Government of Himachal Pradesh in horticultural production and marketing has been by way of:

- Creation of suitable organizations for the supply of various inputs, services, and technical know-how;
- Provision of technological support to the state's horticultural industry by promoting local research and development efforts and the introduction of advanced technology from abroad;
- Legislation measures to ensure increased production of quality fruits and the regulation of marketing activities;
- Provision of price support;
- Provision of incentives to involve the weaker sections of society in the fruit plantation programme and increased adoption of improved methods of horticultural production by the large number of fruit growers.

The approaches adopted by the Himachal Pradesh Government for the development of horticulture in accordance with the above policies are described in the following paragraph.

Growth Centre Approach

For the development of horticulture as a new area in the agricultural economy of Himachal Pradesh, the State government has established progeny-cum-demonstration orchards for different fruits in suitable ar-

eas. These orchards were set up with the objectives of (1) stocking fruit trees of outstanding merit for the supply of bud-wood; (2) multiplying pedigree and disease-free plants for supply to prospective fruit growers; (3) acting as model and demonstration orchards; (4) conducting adaptability trials for various-fruit varieties and cultural practices; and (5) acting as centres for the field training of orchardists, and supplying inputs and technical advice. Each orchard with an area of impact of about 10 km served as a horticultural service centre in which all technical inputs for horticulture development were available under one roof. These horticultural growth centres served as a nucleus for the proliferation of horticulture in the area of impact. In fact, convinced of the efficacy of such units, the other state governments have emulated this scheme.

Today there are 336 centres of horticultural activities established all over the state which serve as a nucleus for the development of various specialized horticultural activities in the areas around them.

Exploitation of Regional Potential

The policy of the State government relating to horticultural development is to promote fruit production in all areas, depending upon their potential. Areas have been delineated for different kinds of fruits, depending upon their agroclimatic conditions. The success of horticulture is, however, at present most pronounced in the temperate zone of the state. The lower hills and valley areas in the state were earlier considered horticulturally marginal but appropriate horticultural planning for these areas in recent years has proved this erroneous. Besides Kinnow (a mandarin variety), other sub-tropical fruits, such as mango, litchi, and sand pear have been grown with great success. Hill lemon and Kagzi lime are the other potential fruits specific to lower areas, especially in frost-prone areas.

The mid-hill region (950–1500 masl) in the state is suitable for stone fruits, particularly the canning varieties of peach, and other fruit crops such as pecans, olives, and figs are being promoted in this region. The mid-hill region of the state has abundant wealth in the form of millions of wild species of fruit trees like Kainth (*Pyrus pashia*), Kahu (wild olive *Olea cuspidata*), Jardaloo (wild apricot, *Prunus armeniaca*), and fig (*Ficus carica*), which are being converted into superior varieties of economic importance by the technique of top-working. Such top-worked plantations are, however, confined to village common lands in the form of community gardens for the benefit of the entire local population.

At higher altitudes, where apple and other temperate fruits are grown extensively, there are still large unexploited areas with vast potential particularly in the cold and dry regions of the state. Efforts made in recent years indicate that the Lahaul valley in the tribal regions of the state is most suitable for the production of best quality hops. The State Depart-

ment of Horticulture has successfully grown on a trial basis the Sarda melon and pistachio in Kinnaur District. In addition to these, almond, walnut, hazel nut, drying types of apricot, prunes, and raisins are some of the fruit crops which have great promise in the cold and dry climatic region of the state.

Diversification

Efforts are being made to bring diversification into the state's fruit industry by developing ancillary horticultural activities such as floriculture, apiculture, and mushroom production in suitable areas. Himachal Pradesh was the first state in the country to introduce the modern technology of bulk pasteurization for the production of compost for growing mushroom. At present, Himachal Pradesh produces about 500 tons of mushroom annually.

The olive has been identified as another promising fruit crop and is being developed in the state to provide a sound base for the olive oil industry. The olive has a wide range of adaptability and climatic conditions in some areas of Chamba, Kullu, Mandi, Sirmour, and Solan districts. A large number of improved olive varieties have been introduced from Italy and are under experimentation. Besides the olive, improved plant material of other temperate climate fruit crops such as cherry, almond, walnut, hazelnut, fig, apple, and peach have also been introduced.

The varied climatic conditions available in Himachal Pradesh offer vast potential for the development of floriculture. The Himalayas are a rich source of flora but, unfortunately, no concerted efforts for the identification and commercial exploitation of resources have been made so far. There are only a dozen private floriculture enterprises in the state, located in Kangra, Shimla, and Solan districts. As already indicated, a wide range of floriculture plant material can be propagated in Himachal Pradesh as a specialty of the hills, provided suitable infrastructure for germplasm collection, multiplication, floriculture extension, and marketing is developed. Floriculture based upon the production of bulbous plants are an especially good economic venture for temperate hilly areas like Himachal Pradesh. There is also much potential for the development of an industry in ornamental and foliage plants and cut flowers with the objective of supplying these to the plains.

The vast floral wealth of the state can provide a sound base for apiculture. Besides developing apiculture as a cottage industry to provide an additional source of income to farm families, beekeeping has vital importance in orchards for the effective pollination essential to obtaining good fruit yields. For the guidance of prospective growers, the State Department of Horticulture runs 45 beekeeping stations at various places, serving as a nucleus for beekeeping development in the surrounding areas.

Research and Development

The research needs of biological industries such as horticulture are of great importance because the intensive system of cultivation creates new problems, like spread of pests and diseases, especially viruses and scab disease of apple. Furthermore, there is nothing static in science. New methods and technologies must be developed to keep the industry in business.

Being aware of the importance of horticulture to the economy of the state and of the need to strengthen the research base of the industry, the Himachal Pradesh government has established a University of Horticulture and Forestry which is the first institution of its kind in Asia devoted to research and education in this vital field of our economy. The university imparts horticultural education up to the doctorate level and has regional research stations in all the agroclimatic regions to take care of the location-specific research needs of various horticultural crops. In addition, besides establishing a National Institute for Mushroom Research devoted to the research and training needs of the mushroom industry, the Indian Council of Agricultural Research has also established horticultural research stations in Himachal Pradesh at several locations.

Introduction of New Technology

To give a new orientation to horticulture development programmes through application of modern science and technology, efforts are also being made to introduce new technology relevant to the situation in Himachal Pradesh from horticulturally advanced countries. In order to benefit from new cultivars of fruit trees developed abroad, the state government has recently imported a large consignment of improved cultivars and rootstocks of apple, pear, cherry, and walnut from the United States of America, in order to study their adaptability under local conditions and subsequently to develop bud-wood banks of the most suited cultivars. Efforts are also under way to import improved germplasm of floricultural plant material.

For the development of specific horticultural commodities such as mushroom, olive, fig, and pistachio, special projects for the introduction of technology have been implemented with bilateral assistance from advanced countries. Special mention may be made of the project for the development of mushroom implemented with assistance from the United National Development Programme and the Netherlands Government at Solan and Palampur respectively and the project for the development of olive and other temperate fruit implemented with the assistance of the Italian government. Improved technology in the field of marketing and

processing was also earlier introduced under the purview of an apple marketing and processing project assisted by the International Development Agency. In addition, horticultural development forms an important component of the Rs. 800 million Hill Area Land and Water Development Project currently under implementation with the assistance of the United States Aid for International Development (USAID). Other externally aided projects currently in the pipeline are the proposed Chamba Valley Cash Crop Development Project, to be implemented with the assistance of the Federal Republic of Germany and a World Bank-assisted Integrated Horticultural Development Project to be implemented at a cost of Rs. 700 million.

Department of Horticulture

Transfer of Technology

Research and development or the efforts made to introduce new technology are of no use unless the new knowledge so generated reaches the actual users. Over the last few years, efforts have been made to develop a well-knit horticultural extension organization in Himachal Pradesh under the control of a separate Department of Horticulture with its headquarters at Shimla. It had over 1800 employees on its payroll in 1988.

For the efficient execution of development programmes, the state has been divided into two zones; the department for the temperate zone has its headquarters at Shimla and the department for the sub-tropical zone has its headquarters at Dharmsala in district Kangra. The development of horticulture in the sub-tropical zone is under the control of the Additional Director of Horticulture, while horticulture development in the temperate zone is looked after by the Director of Horticulture, in addition to his responsibilities as head of the department. The temperate zone comprises the districts of Shimla, Mandi, Kullu, Kinnaur, Chamba, and Lahaul and Spiti, substantial parts of which fall under the temperate/cold and dry zones. The remaining six districts, Bilaspur, Kangra, Una, Hamirpur, Solan, and Sirmour, fall broadly under the sub-tropical zone.

At the directorate level, there are Senior Subject Matter Specialists in the field of plant protection, marketing, fruit technology, plant nutrition, and planning and also experts on horticultural economics and information to provide technical support to the Director of Horticulture, besides heading their respective divisions.

For the efficient transfer of technology to the growers, the state government has reorganized the horticultural extension organization on the training and visit system under the auspices of a special IDA-assisted project. Under this scheme, village horticultural extension officers have

been provided up to the field level and each such worker has been employed to provide extension service to about 600 farm families. Messages regarding different fruit crops are developed by the scientists of the State Horticultural University and the Subject Matter Specialists of the Department and are transferred to contact farmers through the village extension officers on time-bound fortnightly schedules of visits. Subject Matter Specialists in fields such as pomology, floriculture, plant protection, post-harvest physiology, and agronomy have been provided at district level and Senior Subject Matter Specialists in the field of pomology, floriculture, and plant protection have been posted at state level to provide technical support to the extension service.

Input Supply

The nursery plant is the most vital input for any fruit production programme. Government policy with regard to the supply of this input is to develop fruit plant multiplication facilities, in both public and private sectors, backed by nursery certification regulations under state legislation to keep a check on the quality of material being supplied. So far, 89 fruit nurseries in the government sector and 733 nurseries in the private sector with a capacity of production of over 3 million fruit plants annually have been established. The state is not only self-sufficient in the production of temperate fruit plants but is also exporting a considerable quantity of such plants to other temperate zone states. However, the supply of some species of sub-tropical fruit plants, mango, litchi and kinnow, is met by way of imports from nurseries in the adjoining states. Such imports account for only about 15 per cent of the total demand for all kinds of fruit plants and 25.6 per cent of the total demand for sub-tropical fruit plants.

The distribution of other horticultural inputs such as pesticides, fertilizers, micro-nutrients, and horticultural tools and implements is done in the private, cooperative and public sectors, of which the latter predominates. The Department of Horticulture, Himachal Pradesh, has now set up horticultural sales centres even in the remote interior. The supply of inputs is also arranged through block agencies and by the progeny-cum-demonstration orchards and nurseries. Recently, steps have been initiated to open up more distribution points by giving incentives to unemployed youths to set up input supply centres in the interior under the Government of India's sponsored employment programme.

Incentives and Credit Facilities

A wide range of economic incentives in the form of liberal subsidies on production inputs from the government and credit facilities from finan-

cial institutions is available for the development of horticulture. The economic incentives consist of subsidies for weaker sections and subsidies for plant protection.

Subsidies for weaker sections are available at the rates of 25 per cent to 50 per cent of the cost of various inputs, depending upon the category of farmers involved. Thus, for the small farmers, the subsidy is 25 per cent, for the marginal farmers 33.3 per cent, and for the scheduled castes, scheduled tribes, and the farmers of notified backward areas 50 per cent of the total cost of inputs supplied.

Inputs for plant protection, such as apple scab fungicides, micronutrients, plant equipment, and anti-hail nets under special centrally sponsored schemes are available at 50 per cent of their cost.

Credit support, both short- and long-term, is easily available from commercial and financial institutions for the development and maintenance of horticultural enterprises such as fruit cultivation, mushroom cultivation, beekeeping, and floriculture through special schemes refinanced by the National Bank for Agriculture and Rural Development.

Marketing and Fruit Utilization

The policy of the government with regard to the marketing of fruits is to encourage the establishment of marketing and processing facilities in the public, cooperative, and private sectors to ensure economic disposal of marketable and processing grade fruits. In this regard, the state government has intervened to the extent of inviting foreign collaboration to set up such facilities. Under an IDA-assisted project, a chain of packing and grading houses, processing plants; transhipment centres, and cold stores has been developed in Himachal Pradesh. The HPMC has been established to look after the marketing of horticultural produce in Himachal Pradesh.

Price Support

Himachal Pradesh gives price support for horticultural commodities so as to stabilize market prices. This scheme of price support was implemented in 1986. Fruits at these prices are procured by state agencies to be stored, processed, or marketed as fresh fruit through the state's marketing system. Table 3.6 gives the details of the prices fixed for different fruits during the years 1986 to 1988 and the fruit procured by state agencies against these prices. In addition to fruit crops, a support price is also fixed for potato, ginger, and honey from year to year.

TABLE 3.6
Support price for different fruits and the quantity of fruits procured from 1986 to 1989

	1986/87	1987/88		1988/89
		Farmers having up to 25 bighas of orchard	Farmers having more than 25 bighas of orchard	
Support price (Rs./kg)				
Apple	1.30	2.00	1.50	2.25
Galgal	1.00	1.10	1.00	1.10
Kinnow/orange	2.20	2.80	2.40	3.15
Guava				
(winter season)	—	1.60	1.50	—
(rainy season)	—	0.80	0.75	—
Ginger	—	3.50	3.20	—
Procurement of Fruits (tons)				
Apple	252.26	221.00		183.57
Galgal	12.74	32.14		N.A.
Orange	70.52	88.96		N.A.

Source: Department of Horticulture, Himachal Pradesh, 1989.

General Problems of the State Horticultural Industry

Notwithstanding the spectacular achievements in the production of different kinds of fruits in Himachal Pradesh, problems needing urgent remedial measures have also become more acute. Low productivity is one of the most important constraints preventing the accelerated development of the fruit industry. There is a large gap between current and potential yields which needs to be narrowed to keep the industry in the line of business. Some of the factors affecting productivity which need improvement are discussed in the following paragraphs.

Genetic Potential of Cultivars

Most of the present strains of different fruit crops, particularly those of apple, have become outdated and have degenerated. This is one of the contributing factors to low productivity and low quality production. Steps have to be taken to introduce new strains from abroad, besides earmarking trees of outstanding merit locally. Besides using the resources of the state, efforts are also under way to reorient the horticultural industry of the state under an Integrated Horticultural Development Project wherein, besides the introduction of improved plant material, facilities for rapid multiplication of plants will also be established so that the fu-

ture horticultural industry of the state is based upon new plant material. This project is likely to be financed by the World Bank.

Plantation Density

The latest concept throughout the world is optimum utilization of available space—both horizontal and vertical—to achieve the maximum level of production per unit space by accommodating a maximum number of plants in a given area and obtaining maximum solar energy for photosynthesis. With the existing extensive system of plantation, not only is the yield per unit area very low, but the gestation period of the plantation is very long and the plants being vigorous they pose problems of management. For overcoming these problems, high-density plantation as followed in Europe and the United States will have to be taken up on a large scale in future planting programmes. The idea in high-density plantation is to raise only fruit varieties that have yield potential; to dwarf rootstocks in order to get high productivity per unit area; to maintain the size of trees which is most convenient for handling, besides reducing cost of cultivation. It is possible to accommodate 2000 to 3000 trees per hectare under this system as against 250 to 300 trees per hectare under the extensive system presently being followed in Himachal Pradesh. The high-density plantation system not only ensures precocity in production, but also substantially increases yield and also enhances quality.

The proposed density to be followed in any fruit plantation depends upon topography, soil fertility, climatic conditions, pest and disease problems, irrigation facilities, and other factors. Since orchards in Himachal Pradesh are generally located on steep lands, the high- and ultra-high-density plantations being followed in other countries involving very high capital investment will not be practicable for these conditions. Other constraints under which the fruit producers in Himachal Pradesh operate are poor soil fertility, non-availability of assured irrigation, heavy precipitation during the monsoon, heavy snowfall during the winter and hail during the spring in several areas. Diseases and pests like woolly aphid, root rot, and apple scab are also major problems. Therefore, very dwarfed rootstocks requiring fertile soil, flat land, assured irrigation, and provision of support in the form of stakes or trellis will not be suitable, except in valley areas. In steep areas, the rootstock itself should be able to provide support to the main tree. Under these conditions, rootstocks are required which are semi-vigorous, with good anchorage so as to support heavy crop loads and the weight of snow during the winter. Drought resistance and resistance to such pests and diseases as woolly aphid and collar rot, in the case of apple, is also required. Semi-intensive plantation densities involving a plantation of 800 to 1000 trees per hectare with free-standing trees should be the goal when developing future plan-

tations. Besides using semi-dwarf rootstocks, the naturally dwarf mutant and suitable pruning practices would also be helpful. Besides apple, high-density plantations using suitable rootstock and pruning practices could be used for crops such as peach and cherry. The use of varieties such as Kinnow for mandarins and Amrapali for mango offer promise in the development of intensive plantations.

Moisture Stress

Horticulture in Himachal Pradesh is mainly practised under rainfed conditions and serious moisture stress is commonly experienced at the critical periods of plant growth and development. Though rainfall is sufficient, it is not well distributed. The rain water generally flows down with high velocity because of the slopes and hilly terrain. This does not allow water absorption through infiltration into the soil to its optimum capacity. Most of the precipitation runs off through the drainage system. Technology for moisture conservation *in situ* is available and should be applied. First, future plantations must be made on contours because plantations should follow the natural lie of the land. Second, vegetative barriers (in the form of vegetative bunds) will have to be created as dense hedges or fences along contours at suitable intervals. These fences will stop the water flow and force it to filter through these barriers, leaving the soil behind. The velocity of water will thus be reduced and consequently also its solid erosion capability. Such a practice will allow maximum possible infiltration of water into the soil and will also help to recharge the soil profile with water.

To provide artificial irrigation during the moisture stress period, the only possibility in many orchard areas is to use rain water in a high-efficiency irrigation system. Among the traditional yet sophisticated methods of irrigation, drip irrigation has high potential to increase fruit production through conservation and management of scarce water resources in rainfed areas. Research and commercial experiments in the country have established the suitability of the drip system for raising fruit crops and this system of irrigation is already in operation in many states. However, the high installation cost may limit its large-scale and fast adoption by orchardists. Provision of financial support in the form of liberal subsidies and cheap credit facilities from the government or financial institutions could go a long way toward the adoption of this efficient method of irrigation by growers.

Natural Calamities

Unfavourable climatic conditions such as hail, drought, excessive rainfall, and frost also play an important role in reducing fruit production in some

years. Of these the occurrence of hail in some areas is an important natural calamity which considerably damages fruit crops and renders them unmarketable. The use of anti-hail nets can help in saving the crop from this, but at present, suitable anti-hail nets are not available in the country. The material available at present is meant only for fishing and has a short life. The development of some suitable material with a longer life of at least 10 years is, therefore, an urgent necessity.

At present, no insurance against the risk of natural calamity is available to the horticultural industry. Suitable crop insurance programmes are required to be devised by insurance organizations so that the risk factor does not act as a disincentive to investment in the horticultural sector.

Marketing and Processing

Substitute Packing Cases

With increased production of fruits, the demand for packing cases for packing and marketing of fruits has also increased considerably. Since a large proportion of fruit is still marketed in conventional wooden packing cases, the demand for wood has resulted in tremendous pressure on forests. The annual requirement of wood for the manufacture of packing cases at the current level of production has been estimated at 200,000 to 300,000 cubic metres, which will increase proportionately as production increases. There is thus no alternative except to switch over to an internationally accepted mode of packing, i.e. corrugated fibre board (CFB) cartons with trays. Keeping this in view, the state government has decided to implement a project for the manufacture of craft paper corrugated cartons within the state at a total cost of Rs. 200 million in the first phase. The project is in an advanced stage of implementation and is expected to be commissioned in 1990 when it will be possible to meet the entire demand for CFB cartons for the packing of fruits within the state itself. The state government is also promoting the use of CFB cartons for the packing of fruits by supplying the same at subsidized rates. During the last 10 years, a total of 404,470 cartons were supplied to the growers.

Marketing Infrastructure

The development of marketing facilities in the state have not been commensurate with fruit production. It has been realized that the facilities for post-harvest handling of fruits, grading and packing houses, cold storage etc. are far below the actual requirements of the fruit industry. There is an urgent need to introduce mechanized grading and packing facilities

down to the village level and also to increase storage facilities in the production areas.

State Fruit Markets

About 90 per cent of the fruit produce of Himachal Pradesh is marketed in the terminal markets located in other states and 80 per cent of the apple produced is consigned first to the Delhi fruit and vegetable market, from where it is redistributed to other markets. However, the state government has no control over these terminal markets to safeguard the interests of the fruit growers. It has, therefore, been realized that there is a necessity to establish a fruit market within the state itself to avoid dependence on Delhi and other markets. One such market with modern amenities and infrastructural facilities is being established at Parwanoo, a township on the national highway at the Haryana-Himachal border, to act as a state fruit market. Financial assistance from the World Bank under an IDA-assisted Integrated Horticultural Development Project is also expected to be available for the development of this market.

Transportation

Although many orchards in Himachal Pradesh are serviced by a well-developed road network, difficulties are generally experienced by fruit growers in the interiors, who have to carry their produce up to the road head, resulting in heavy transport costs and delay in transport of the produce which ultimately affects quality and price. It is not possible to link all the villages and orchards with roads; the only alternative would seem to be to link remote villages and orchards with road-heads by means of a gravity cableway. The experience of some entrepreneurs in the installation of such cableways in Shimla district have been encouraging. The programme requires to be extended on a mass scale with the assistance of the government and financial institutions.

Diversification in Processing

At present fruit culls are being used by processing units for the preparation of juices and other fruit products. During bumper crop years, or when widespread damage has occurred to fruit crops in the state due to natural calamities, the processing industries are not in a position to use all the unmarketed fruit. Therefore, for maximum utilization of culled fruit, there is a need to diversify the processing industry. In fact, there is an urgent need to install a wine industry in the state.

Fragmented Land Holdings

The small and fragmented land holdings held by a majority of the farmers are also an important constraint to the further development of the fruit industry. Horticulture requires permanent investment and would benefit from government policy on land reform and consolidation of holdings. This would act as an incentive to investment in fruit production. Alternatively, this problem could be conveniently handled by establishing consolidated plantations in the form of garden colonies by pooling the lands of small farmers within a common fence. Such a programme would, however, require liberal assistance from the government. The results of such plantations in Himachal Pradesh have been encouraging.

Future Prospects of Horticulture Development in Himachal Pradesh

Although there has been tremendous development of horticulture in Himachal Pradesh during the last four decades, we are still far from reaching the actual potential given Himachal Pradesh's agroclimatic and vegetative resources. In Himachal Pradesh, about 98.6 million hectares are under grasslands, 224,000 hectares under culturable wasteland and land put to non-agricultural use, and 54,000 hectares are fallow (currently or permanently). Therefore, there is still a large untapped area for horticultural development if proper use is made of the available land resources. An ambitious plan for the development of horticulture up to the end of the century has, accordingly, been formulated. The data presented in Tables 3.7 and 3.8 give an idea of the perspectives of area and production of fruit up to the end of the century.

Horticulture As an Afforestation Activity

The environmental degradation of the mountain regions of the Himalayas due to excessive use of forest resources has made the development of tree plantations, especially plantations of fruit trees, an important economic measure for the environmental conservation of the hills. Fruit trees provide permanent green cover to the soil and act as soil binders, preventing solid erosion and retaining nutrients which would otherwise be lost as a result of erosion. Fruit trees thus offer higher productivity, environmental conservation, and optimum and economical use of resources, compared with any other economic activity, in the most ecologically acceptable manner. The vast stretches of fruit plantations developed on our hills thus fit very well into the campaign to 'Save the Himalayas'.

There is an erroneous impression that horticulture in general and

TABLE 3.7

Projections of area under fruit in Himachal Pradesh up to 2000 A.D. (hectares)

Year	Apple	Other temperate fruits	Nuts and dry fruits	Citrus	Other sub-tropical fruits	Total
1989/90	58,112	29,326	12,628	35,226	19,759	155,051
1990/91	59,612	30,626	13,328	37,426	21,059	162,051
1991/92	61,112	31,926	14,028	39,626	22,359	169,051
1992/93	62,612	33,226	14,728	41,826	23,659	176,051
1993/94	64,112	34,526	15,428	44,026	24,959	183,051
1994/95	65,612	35,826	16,128	46,226	26,259	190,051
1995/96	67,112	37,126	16,828	48,426	27,559	197,051
1996/97	68,612	38,426	17,528	50,626	28,859	204,051
1997/98	70,112	39,726	18,228	52,826	30,159	211,051
1998/99	71,612	41,026	18,928	55,026	31,459	218,051
1999/2000	73,112	42,326	19,628	57,226	32,759	225,051

TABLE 3.8

Projection of production of fruits in Himachal Pradesh up to 2000 A.D. (tons)

Year	Apple	Other temperate fruits	Nuts and dry fruits	Citrus	Other sub-tropical fruits	Total
1988/89	377,298	38,772	6,892	28,942	20,534	472,438
1989/90	389,979	42,490	7,671	33,644	21,656	495,440
1990/91	408,015	44,368	8,487	39,438	23,742	524,050
1991/92	426,186	47,298	9,009	43,852	25,280	551,625
1992/93	434,628	4,988	9,804	47,604	26,970	568,894
1993/94	448,560	51,918	10,455	54,730	29,806	595,469
1994/95	459,927	53,452	10,930	59,178	32,215	615,703
1995/96	471,591	56,052	11,628	62,452	35,118	636,841
1996/97	494,208	58,652	12,128	66,452	37,318	668,758
1997/98	508,608	61,252	12,628	70,452	39,518	692,458
1998/99	523,008	63,852	13,128	74,452	41,718	716,158
1999/2000	537,408	66,452	13,628	78,452	43,918	739,858

the apple industry in particular is solely responsible for the depletion of forest resources because of the demand for wooden packing cases. The industry has, therefore, been considered counterproductive and an indirect threat to the ecology of the Himalayan mountain region. This view is not based upon facts. According to the records maintained by the Department of Horticulture during the last four decades (1950/51 to 1988/89), a total of 138.3 million apple boxes have been exported from the state for marketing in other states. The packing requirements of this fruit were met by using 4.047 million CFB cartons and the balance of

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132.26 million apples were packed in wooden boxes. Since it is possible to manufacture at least 50 standard apple boxes from a standing volume of one cubic metre of wood and about 200 cubic metres of wood (standing volume) can be extracted from a hectare of forest area, it should be apparent that during the last 39 years, about 2,645,261 cubic metres of wood derived from 13,226 hectares of forest area has been used for packing fruit. Against this depletion of forest cover, the apple industry in Himachal Pradesh has helped to provide vegetative cover for about 54,500 hectares. During the same period, the horticultural industry as a whole contributed to provide green cover to about 142,000 hectares, thus supplementing the afforestation programme and improving the ecology of the hills of Himachal Pradesh.

Conclusion

Horticulture in Himachal Pradesh has witnessed significant progress during the last 40 years and is steadily poised to move towards a multi-dimensional phase when the present heavy pressure on traditional farming will be reduced to a great extent. This will not only liberate the state from economic inertia in the agricultural sector, but will also supplement the state's efforts to provide green cover to the hills, promoting environmental conservation. It is expected that by the end of the century, horticulture in Himachal will develop into an industry with a turnover of 5000 million rupees per annum in the rural sector. It will be next only to the public sector power industry in total investment and turnover, and the biggest industry of the state in the private sector employment potential, Himachal Pradesh synonymous with horticulture and power.