

# Horticultural Development in Bhutan

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## **Introduction**

Physiographically, the Kingdom of Bhutan can be divided into three broad agroclimatic zones, all running from east to west. The northern zone is about 30 km wide, with altitudes above 4000 m. It is covered by perpetual snow, glaciers, and barren rock. The central zone is about 70 km wide, and lies between 2000 and 4000 m in altitude. This zone contains the major forest areas of the country, and enjoys temperate climate and vegetation. The southern zone, about 50 km in width, comprises the foothills of the Himalayas, rising to an altitude of around 2000 m. The climate and natural vegetation in this zone are sub-tropical to tropical.

Due to the wide variation in altitude, the mean monthly maximum and minimum temperatures and annual rainfall are very different in each of the agroclimatic zones (Figure 7.1).

The population of Bhutan is estimated at about 1.4 million. About 90 per cent of the people live in rural areas and are directly engaged in agricultural activities. The population is concentrated in the broader river valleys of the central zone and in the lowlands of the foothills in the southern zone.

Agriculture and animal husbandry account for about 50 per cent of the gross domestic product. At present, about 91 per cent of the total land area is under forest, alpine pasture, and snow cover. Only about 410,000 hectares, or 9 per cent of the land area, is considered suitable for agriculture; out of this, about 129,000 hectares of land area is under crops, about 32 per cent of the potential agricultural land area. Out of the total cropped area, 28,380 hectares, or 22 per cent, is irrigated land, synonymous with paddy cultivation.

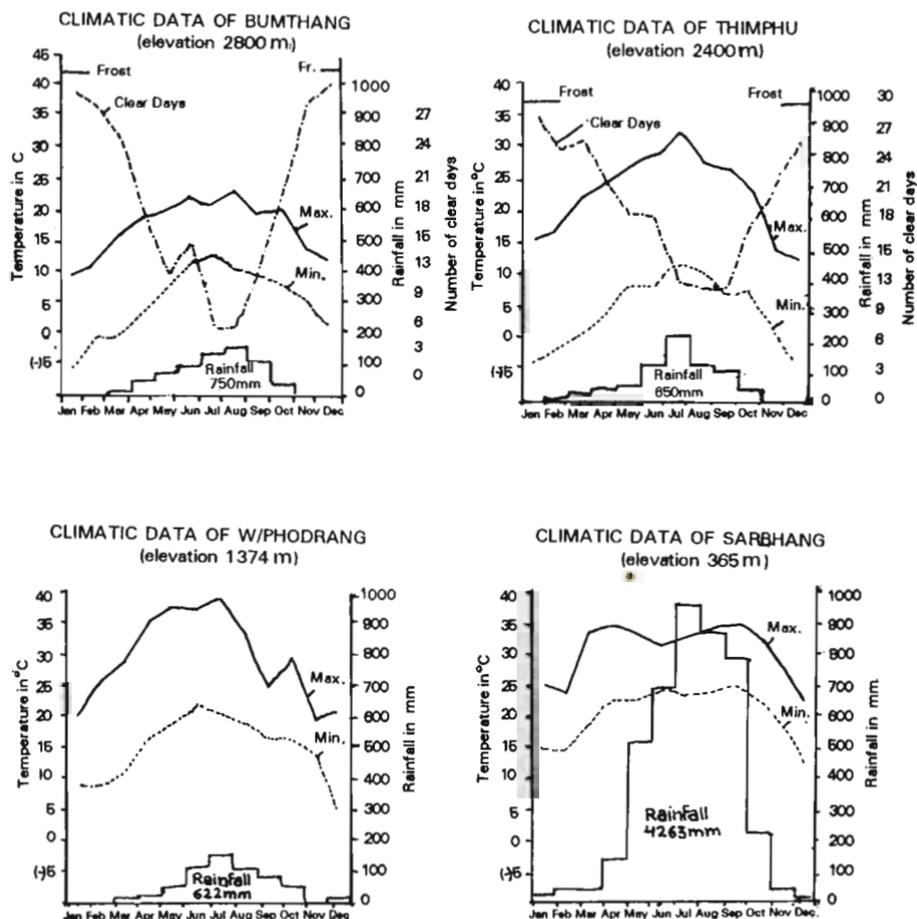


Figure 7.1: Climatic data of different regions of Bhutan

The rest of the cropped area, i.e. 78 per cent, is rainfed, and is variously classified as dry land, 'tsheri' (or shifting cultivation) land, and orchards. Orchards occupy 14,000 hectares, or 11 per cent of the total cropped area. Vegetables are mostly grown in kitchen gardens and comprise about 1000 hectares, or 1 per cent of the total cropped area.

## Review of Policy and Strategies

### *Policy Directions and Strategies for Agriculture*

The long-term goal for the formulation, implementation, monitoring, and evaluation of agricultural development is stated in the Sixth Plan as

follows: To maximize the contribution of agricultural development to national self-reliance and overall economic growth, while safe-guarding the agro-ecology from undue degradation.'

Agricultural development objectives lay strong emphasis on achieving self-sufficiency in food grain production, increasing the per caput income, the nutritional level of the rural population, and the productivity per unit of farm labour and agriculture land. Another objective is to increase the contribution of agriculture to the gross domestic product and to export. Also of concern to the government is the need to improve soil and water conservation.

The basic agricultural strategy emphasizes the intensification of agricultural production in all possible arable areas. The government's strategy to intensify the production of crops is based on a rice-based cropping pattern in the irrigated wetland areas, a maize-based cropping pattern in the low to medium altitude rainfed dryland areas, and a potato-based cropping pattern in the high altitude rainfed dryland areas.

Tied to these three cropping patterns is a recently initiated National Horticultural Programme which will emphasize the production of trees and other horticultural cash crops in those parts of the rainfed areas where environmental considerations preclude the production of field crops. Under this programme, vegetables will be grown as part of the wet and dryland farming system and in kitchen gardens.

### *The Role of Horticultural Crops*

Many horticultural crops are already popular with Bhutanese farmers as their main source of cash income (Table 7.1). The increased production of existing and appropriate new horticultural crops can make a major contribution towards achieving the sectoral objectives. They can increase rural incomes and national export earnings, as well as improve the nutritional level of rural communities. A characteristic of horticultural crops is that a significant proportion of those suited to Bhutan's varied soil and climate conditions have a high, or very high, value-to-weight ratio. As such, they can sustain relatively high road transport costs, or justify air freight. In economic terms, the crops constitute an optimum use of Bhutan's scarce resources of land and labour.

The implementation of a programme to develop horticultural production need not conflict with the nation's food self-sufficiency objectives for the following reasons:

- Increasing the output of cereals is intended to be yield increase by greater use of high-yielding varieties and optimum use of inputs and appropriate crop rotation.

TABLE 7.1  
Acreage, yield and export of major cash crops (1986)

Crop	Area (acres)	Fruit-bearing trees (per cent)	Yield (tons/acre)	Export	
				Quantity (tons)	Value (Nu '000)
Apple	3,656	53	2.4	4,600	5,087.1
Orange	19,395	63	4.0	15,500	17,634.7
Other temperate fruit	67	93	N/A	9	73.0
Sub-tropical fruit	243	—	N/A	N/A	N/A
Ginger	1,147	—	1.9	1,223	1,824.3
Chilli	2,408	—	1.5	34	290.2
Asparagus	20	—	—	N/A	N/A
Other vegetables	1,820	—	—	39	70.1
Cardamom	21,699	51	—	939	38,546.8
Lemon grass oil	—	—	—	3.7	3,222.9
Potatoes	5,100	—	9.8	9,965	21,070.0

- Vegetables, especially those with nitrogen-fixing properties, have a place in the crop rotations of rice, maize and potato-based farming systems.
- Many horticultural crops, particularly tree and shrub species, can be grown satisfactorily on hill slopes unsuited to rice or maize; in fact, current Department of Agriculture recommendations for apple and orange stress the avoidance of planting on rice terraces.

### *Historical Overview of Horticultural Development*

In the early years, horticultural development was done on a piecemeal basis, focusing on individual crops. Most attention was given to the distribution of seeds and seedlings, as well as marketing aspects.

Recent efforts to develop horticultural crops have focused primarily on processing and marketing aspects, as evidenced by the UNCDF-funded Horticulture Produce, Processing and Storage Project, and marketing intervention by the Food Corporation of Bhutan (FCB) through support price purchasing of various horticultural products, and running of auction yards.

The UNCDF project, and related technical assistance, is funding the construction of three auction yards at Phuntsholing, Gaylephug, and Samdrupjongkhar, and equipment for the apple-processing plants at Bumthang and Bondey Farm. It also provided a lump sum for a Horticultural Revolving Fund for small and medium scale investment in production and processing facilities. But relatively little work has been done to tackle production-related problems of the horticulture industry due to resource constraints.

There is now a need to address the imbalance by refocusing on these problems, and to recognize the need for integration between production and marketing.

Taking a farming system approach, the government is now initiating a horticultural development programme that emphasizes the role of horticultural crops as a sub-sector of the whole agricultural industry.

## **Horticultural Crops in Bhutan**

### *Currently Significant Crops*

#### **APPLE**

The major apple-growing zone lies in the temperature climate districts of Thimphu, Paro, and Bumthang. Production systems in Bhutan are extensive, with tree populations of around 100/acre. This factor, combined with often inappropriate rootstocks and cultivars and low levels of management, is responsible for the low average yields (2.4 mt/acre). Even with such yields, it is expected that apple production in the next five years will double as the substantial plantings of recent years come into bearing. At current price levels, apple growing can be extremely profitable for above average growers (4–10 mt/acre).

#### **ORANGE**

The majority of oranges (mandarin type) grown in Bhutan are planted in the southern belt in marginal soils of low fertility and are poorly maintained. Orange growing is largely a part-time activity to generate cash income for both subsistence farmers and the few relatively wealthy farmers. Subsistence food crops, such as maize, millet, and beans, are grown on more level and fertile soil. In many of the orange-growing areas, oranges are the only cash crop which can be assured of an expanding demand with a reasonably rewarding income for minimal inputs. However, as a consequence of the lack of even basic management practices, yields are extremely low.

With significant new plantings in the drier areas of Chirang, Samchi, and Samdrupjongkhar, production is expected to increase to 26,000–27,000 mt by 1989/90 and 37,500–38,500 mt by 1992/93. Expectations are that the Indian market is probably capable of absorbing a substantial increase in volume of this order, with only slight price reductions. Export to Bangladesh commenced in 1988 and is expected to expand.

## POTATO

Potato is the principal cash crop of Bhutan. It is widely grown all over the country, mainly in the hilly regions where the climate remains cold. It is commonly classified into red and white. Although the production of white potato is greater, the red potato commands a premium price in the market. The harvest and marketing season runs from June to December.

The marketing of potatoes is done through auction yards of the FCB.

## VEGETABLES

Significant market potential exists in India during the summer monsoon period for a range of vegetables. These include cabbage, cauliflower, eggplant, spinach, onion, peas, beans, and tomato.

With modern production systems, the climatic conditions exist in some areas of Bhutan for high-volume production of these crops, yielding incomes higher than from most other existing cash crops. There is also scope to produce and export dried peas, beans, and pulses.

While legume production can be readily integrated into maize-based farming systems, summer-grown vegetables tend to conflict with rice growing. However, the area required for commercial vegetable growing would be relatively small.

There is also scope for import substitution. In 1986, recorded onion and garlic imports totalled 235 mt (Nu. 585,715) at an average price of Nu. 2.5 kg. Japanese varieties have been grown successfully. Provided these would be acceptable to consumers, or the more pungent Indian red-skinned which can also be successfully raised, there are a number of areas where commercial onion growing should be feasible. Tomato imports were 174.4 mt (Nu. 432,523) and chilli imports 69.3 mt (Nu. 255,530); these crops would also appear to offer import-substitution opportunities. A wide range of vegetables can be grown during winter on irrigated paddy terraces at low altitudes to replace imports from India.

A limited amount of asparagus has been grown in the Thimphu, Haa, and Paro areas for more than 10 years. In the past year the area has more than doubled to around 10 acres. Output is either sold fresh in the local market or brought by Bhutan Fruit Products for canning at a fixed contract price. In addition to a substantial increase in purchases by the Bhutan Food Products factory at Samchi, there is some potential for export.

## CARDAMOM

Cardamom is the most important export crop with recorded exports in 1986 of 939 mt valued at Nu. 38.45 million, plus some unrecorded export. The 1984 Department of Agriculture crop survey reported 21,699

acres under cardamom, of which around 50 per cent were bearing, indicating prospects of a significant increase in production.

World production of the large brown Himalayan cardamom is concentrated in India, Nepal, and Bhutan, with Pakistan and the Middle East as the main consuming areas. Opportunities may well exist for Bhutan to expand export.

### *Crops with Significant Future Potential*

#### TEMPERATE TREE FRUITS

There have been a number of trial plantings of apricot, peach, plum, cherry, and pear which suggest that these crops would be grown successfully in many parts of Bhutan.

Several growers in Paro district are already supplying peaches to a processing outlet in Siliguri, and Bhutan Food Products factory has also expressed interest in the crop. Because peaches come into bearing rapidly, they offer prospects of quicker returns than apples. Given the interest of processors, there is scope to expand the acreage grown, particularly on irrigated valley slopes. It would, however, be advisable before embarking on large-scale plantings to assess the scope for long-term supply contracts with the canners.

#### TEMPERATE SOFT FRUITS

Favourable climatic conditions exist in the drier, central areas between altitudes of 1800 and 3000 m for currants, gooseberry, blackberry, raspberry, and loganberry production. These crops are all highly perishable and while there is scope for limited planting for domestic consumption and local demand, commercial-scale production would have to be linked to a local processing outlet. A limited amount of strawberry has been grown at Bondey farm for some 14 years, indicating that high yields can be achieved. Marketing trials also confirm that there is a high-priced demand for fresh strawberries in Calcutta.

#### TROPICAL AND SUB-TROPICAL FRUITS

A wide range of tropical and sub-tropical fruits (mango, guava, litchi, banana, kiwi, and fig) can be grown successfully at lower altitudes. For mango in particular, there are export opportunities if the crop can be harvested to follow the main crop in other parts of the region. In the same off-season period, there may also be opportunities for litchi. In addition, there is scope for limited plantings of a wider range of tropical fruits to meet domestic consumption and local market demand.

## GINGER

Ginger is grown in all the southern districts of Bhutan but there is an absence of reliable production and market information for this crop. Officially recorded export of fresh ginger was 1223 tons valued at Nu. 1.8 million in 1986. If, in addition, there are unrecorded exports, ginger may be a more important cash crop than has been supposed. Market prices show significant seasonal and annual fluctuations. Reported yields are low (2–4 mt/acre), suggesting scope for increasing yield by a factor of at least two.

## OTHER SPICES

In addition to chilli, ginger, and cardamom, a wide range of spices could be grown in low-altitude areas. Black pepper, in particular, is a prospective commodity for isolated areas with poor road access, given its high value-to-weight ratio.

## LEMON GRASS AND OTHER OILS

Essential oil production from occurring lemon grass and its distillation by small holders in domestic scale units has become established as a major source of cash income in Mongar, Lhuntshi, and Tashigang districts. Success has been due to limited alternative sources of cash income (since the actual rates of return appear relatively low), and to the provision of technical expertise and market outlets by Bhutan Aromatics and Phyto-chemicals Company of Tashi Commercial Corporation.

There appears to be good potential for increasing lemon grass oil production from collected natural grasses. Under the current FAO Essential Oils Project, adaptive research and trials will be carried out on other essential oil plants such as palmarosa, eucalyptus, citronella, cinnamon, and geranium, all of which currently command high prices in the world market. There may also be scope to exploit other naturally occurring plants such as artemesia. Because of serious risks of deforestation under the existing collection system, any expansion needs to be based on a new production system—which appears to be entirely feasible—which will integrate timber production (for still fuel), grazing improvement, and erosion control, including use of nitrogen-fixing plants.

## MUSHROOM

A beginning has been made in the establishment of mushroom cultivation, especially of varieties such as oak or shiitake, which use locally available oak logs and sawdust.

Specialized drying equipment is required if export quality production is to be achieved. This favours a concentration of the industry around cen-

tral drying facilities. The capital investment required is relatively high, both to the farmer and in terms of the support services (mycelium bank) provided by the government. Mushroom growing requires a high level of expertise and attention to detail.

## NUTS

Walnuts grow well under a wide range of climatic conditions and at varying altitudes. The nut is popular with the Bhutanese and the small amount currently available reportedly commands high prices at gateway towns. There is, in addition, a substantial world trade in all nut species. Subject to confirmation of local and export market opportunities, extensive planting on non-arable slopes would offer a long-term cash crop opportunity and a timber resource, as well as providing some protection from erosion.

The potential for other nut species, chestnut, hazel, pecan and macadamia, all of which can be grown, is yet to be assessed.

## Constraints to Horticultural Development

### *Macro-economic and Market Considerations*

Rural wage levels have risen rapidly over the last year due to the increase in the official minimum wage combined with the increased opportunity for wage employment in non-rural sectors and general buoyancy of the economy. This trend, which can be expected to continue for some time, underscores the need to secure improved crop yields and labour productivity if the existing horticultural export is to remain competitive and the new opportunities outlined above are to be realized.

It is also evident that fruit and vegetable production in the region is undergoing commercialization, with certain areas becoming major producers of particular crops that do well in Bhutan. Improvements in the quality of packing and presentation and in yield are usually associated with emerging specialization. This trend adds urgency to the need both for improvements in the quality of Bhutanese produce and for lower unit costs.

There is only a limited demand for added marketable surplus in the domestic market of Bhutan, particularly for fruits and vegetables. Thus, any expansion in output must find marketing outlets in the neighbouring countries. So far, India provides the largest and most convenient outlet. The prospect of export to Bangladesh is being explored, and consignments of apples and oranges were exported to this market in 1988.

A survey of Bhutanese agricultural products in India was completed in 1988. The study identified the following products as having the highest potential for sales and market expansion in India: apple, orange, potato

(seed and table), dry chilli, soybean, beans, and cowpeas. Off-season green vegetables, namely, peas, cabbage, cauliflower, tomato, capsicum, and squash, also have large potential. Vegetable seeds, flower seeds, walnuts, and almonds are considered to have substantial potential as new items in the market.

The study concluded that although the large cardamom and green ginger are some of the most economically significant produce of Bhutan presently sold in India, there is no immediate prospect of further increasing sales in this market. Similarly, radish, green beans, chilli, mushroom, asparagus and other temperate fruits such as pear, peach, and plum did not have much potential for increased sales.

The small size of Bhutanese markets limits the domestic base from which expansion in the output of most horticultural products would be initiated. For many commodities, inlets into neighbouring country markets are also limited. Horticultural development will, therefore, have to be supplemented by well-organized planning and market development activities.

#### *Planting Materials and Rootstocks*

Many orchards suffer from low tree vigour and poor tree shape, which decrease yields. In the case of apples, this often arises from the indiscriminate planting of trees, grafted on seedlings or unsuitable rootstock. In the case of oranges, most planting materials are farmer-grown, not standardized, and are low-yielding. For other temperate fruits there has, to date, been only a limited systematic evaluation of varieties and rootstocks and few demonstration trials.

Generally, kitchen gardens supply their own vegetable seed or obtain it from neighbours. The National Agricultural Seed and Plant Production Programme (NASEPP) is the sole supplier of improved vegetable seeds intended for commercial production. The NASEPP has limited sources, often leading to low germination rates and high variability of its vegetables seeds. In order to develop an efficient vegetable export trade, these constraints have to be resolved.

#### *Planting Systems and Crop Management*

Sometimes orchards have been planted on marginal soils and on steep slopes. Where such areas lack the possibility of irrigation, there may be little scope to increase yields. On some windy sites, poor pollination often contributes to low yields. This could be overcome by wind breaks or more pollinizers.

The majority of orchards are planted at lower than recommended density. Greater fruit yield could be achieved by increasing plant density.

Often, trees are not trained and pruned properly and this too affects yield.

Many orchards, especially in the case of cardamom, are located some distance from the owner's house, and consequently receive little management. Often farmers are unaware of recommended fertilizers or the means of identifying and controlling trace elements (especially in vegetables).

### *Harvesting*

Rough treatment during harvesting and transport to markets can have a detrimental effect on the price of produce. In the case of oranges, harvesting is sometimes done by twisting fruit off the bearing branches, which results in removal of the calyx from the fruit, leading to exposure to fungal infection and rotting. Additionally, branches may be injured, adversely affecting output in future years. In the case of vegetables, farmers are sometimes unaware of the optimum time to harvest.

### *Grading and Packing*

Inadequate grading, presentation, and packing lowers the market value of produce, especially in external markets. Poor handling methods also contribute to low quality with high waste. Farmers often do not attempt to reject poor quality produce or to improve packaging. Such practices may have little effect on local sales, but they are major constraints to the development of export sales.

The development constraints are further elaborated in Table 7.2.

## **Current Status of Services and Facilities**

### *Research and Extension*

The centre for Agricultural Research and Development was established in 1982 with its headquarters at Wangdiphodrang and sub-stations at Bhur (Gaylephug) and Khangma (Tashigang). It has its main focus on grain and oilseeds. Some work is now being done on vegetables as a component of a rice-based farming system; work on mushroom, asparagus, other vegetables and flowers, has continued at Simtokha (Thimphu). At Bondey Farm (Paro) work on new cultivars was started in the early 1980s as a back-up to the rice-based extension service to farmers of Paro district. This has continued as part of NASEPP, particularly on vegetables, including asparagus, soft fruits, especially strawberries, kiwi fruit, and pome. At the same time, it has provided ad hoc but useful technical advice to growers of apples and other experimental crops. Yusipang in Thimphu district was established in 1964 and designated as the temperate zone horticultural research station.

**TABLE 7.2**  
**Development constraints to be addressed by Integrated Horticultural Development Programme**

Problems	Causes	Evidence
<i>Sectoral or Sub-sectoral level</i>		
Insufficient food to meet country's needs	Mainly subsistence-level farming, limited surplus for sale	Food and horticulture imports.
Low cash incomes	Traditional preference for food crops for farm self-sufficiency, rather than cash	High-value cash crops not being cultivated in areas suited to such crops
	Insufficient income-generation opportunities and knowledge (e.g., of cash crops)	Lack of farm management/budget data to demonstrate feasibility of alternatives.
Insufficient foreign exchange to meet country's requirements	Insufficient quantity and variety of export products	Balance of payments deficit
<i>Project level (technological, cultural, institutional)</i>		
Low horticulture crop yields and poor product quality	Poor root and genetic stocks	Inadequate research programme, non-availability of suitable planting materials
	Inadequate irrigation	Irrigation canals not built
	Insufficient manure/ fertilizer and other inputs	Manure/fertilizer not being applied according to recommended practices
		Limited credit facilities for input purchase
		Limited knowledge of planting and harvesting techniques, irrigation, etc.
	Improper/outdated planting and cultural techniques	Poorly trained farm workers with limited knowledge of planting techniques
	Low manpower productivity	Absence of horticultural section in Department of Agriculture
	Limited institutional framework and extension activities for development	

Contd.

Table 7.2: Contd.

Problems	Causes	Evidence
		Lack of horticulture professionals and training facilities/programme
		Inadequately trained extension workers
		Limited extension service
	Poor packaging and rough handling during transportation	Bruised and damaged produce reducing market value and lowering farm incomes
	Poor export value for horticultural produce	Poor presentation and marketing of produce.
		Lack of export market studies

The main emphasis of extension work is on the principal crops, (rice, wheat, maize, and potato) and the cropping patterns associated with these crops. Extension personnel have limited training in horticultural crops and most are able to offer the farming community only limited support. Nevertheless, advice on production, post-harvest aspects, and a pest control service have been provided to farmers in the main apple, orange, and cardamom growing areas.

The Department of Agriculture has recently established a Horticultural Unit within the Research and Extension Division. This unit will be the focal point of operation for the Integrated Horticultural Development Programme.

### *Supply of Planting Materials*

The NASEPP was formed in 1984 with headquarters at Bondey Farm and activities at eight other farms. It is the government agency responsible for the production and procurement of all government-approved planting materials. Other Department of Agriculture farms, not under the administrative control of NASEPP, are providing some vegetable seeds and fruit plants, but Bondey and its satellite farms are the main source of vegetable seeds. Apple saplings are supplied by Bondey farm, which imports the country's needs from India pending the development of its own supplies. Most orange growers raise their own seedlings.

Through Japanese aid NASEPP is currently being provided with new, fully equipped headquarters at Chungdu-Dinkha near Bondey Farm comprising seed store, seed processing unit, seed treatment, seed packaging, specialist in seed storage facilities, and a complete range of facilities

for tissue culture. These facilities should greatly enhance NASEPP's ability to produce and supply genetically pure, disease-free planting material. The programme plans to continue producing seed at its Bondey production farm and its satellites at Chiufu, Lapsetanka, and Panbesa, at branch farms at Nasphyel, Chenary, Tashiyangtshi, and Bhur, at a leased farm at Changyulthang near Punakha, and through registered growers in various areas.

### *Marketing Mechanisms*

The Royal Government of Bhutan has established infrastructure and various institutions for agriculture crop marketing. For the internal market, the urban marketplaces have been constructed and managed where Sunday markets are held, where farmers and traders sell produce directly to the public. The use of these markets is growing fairly rapidly as both farmers and consumers recognize their value. The markets at Thimphu and Phuntsholing have already become twice-weekly events.

For export to India, the FCB operates auction yards at Phuntsholing, Gaylephug, Samdrupjongkhar, and Samchi. At present, these auctions handle potatoes, apples, oranges, vegetables, and pulses, and operate daily during the harvest season. The auction yards and the auctions conducted by FCB officials have been accepted as the best form of marketing support. Action to upgrade the infrastructure at the auction yards is being initiated.

All transactions are conducted by the FCB on behalf of the farmer. After collection of payment, the FCB takes 2 per cent of the transaction value, i.e. 1 per cent each from farmer and trader.

The FCB provides free storage to farmers for three days. Although there are no funds allocated for transportation, such facilities exist that once produce is at the yard, a farmer may take up to 50 per cent of the estimated value of his produce to pay the transporter.

The FCB also provides training to farmers in the handling of produce. Past training programmes have included instruction in plucking, grading, sorting, packing, and transportation. Stock from the training programme goes on special sale in the auction yards as a way to demonstrate post-harvest operations to a wider range of farmers.

The FCB has recently a godown in the market at Siliguri, which has the largest agricultural produce market in northeast India. It holds auctions for Bhutanese growers who prefer to take their produce to Siliguri and also for produce which FCB sells on behalf of the growers when prices offered at auctions in the gateway towns are too low. The Siliguri auction was well used in the 1988/89 season.

### *Processing*

Seasonality of production, the smallness of internal markets, and the need to salvage produce that is not fit for the fresh table market give rise to the need for processing facilities. The biggest commercial processing outlet for horticultural produce in Bhutan is the Bhutan Fruit Products factory in Samchi, which is run by the privately owned Tashi Commercial Corporation. The corporation also owns the Bhutan Aromatics and Phyto-chemical factory at Mongar, which is the main outlet for lemon grass and other essential oil products. In addition, there are three government-owned food processing units in Bumthang, Paro, and Simtokha (near Thimphu).

For the produce required by its processing factories, Tashi Commercial Corporation offers guaranteed purchasing prices. So far this has applied to oranges, asparagus, and lemon grass oil and fresh, cut lemon grass. Although as a general rule government policy is not to offer guaranteed prices, the Department of Agriculture plans to develop similar arrangements with Tashi Commercial Corporation for the purchase of shiitake mushrooms grown by farmers who have spawn and assistance from the National Mushroom Centre. The present mechanisms are, in general, working satisfactorily although there is scope for improvement of physical facilities, auction procedures, and market information to farmers.

### **Future Plans**

Climate, soil, market and other conditions favour the development of a versatile horticulture industry in Bhutan. The government has decided to implement the Integrated Horticultural Development Master Plan in order to take advantage of this favourable situation. The plan, which will initially involve substantial external technical assistance, is summarized in Tables 7.2 and 7.3.

It is envisaged that the IHDP will operate over a 10-year period divided into two phases each of five years. Financing for the first phase is sought by the Government of Bhutan from UNDP.

TABLE 7.3  
Project output and activities

Output	Activities	Responsibility	Success criteria
A cadre of Bhutanese horticulturists within the government	<p>Preparation of long-term training/manpower development plan, involving:</p> <ul style="list-style-type: none"> <li>• selection of candidates for overseas training</li> <li>• identification of suitable training institutions</li> <li>• planning and implementation of practical workshops</li> <li>• on-the-job training of national staff</li> </ul>	Horticulture section and Department of Agriculture personnel Officer	<p>Those selected for overseas training attend and successfully complete courses</p> <p>Horticulture Section fully staffed and functioning effectively</p>
A comprehensive and up-to-date base on all aspects of horticultural crops and production systems	<p>Desk study of reports Collection of data from field surveys</p> <p>Preparation of crop budget for specific crops</p> <p>Report with latest data on horticultural crop area, yields, profitability, cropping patterns, and constraints</p>	<p>Experts and national staff in Horticulture Section</p> <p>Consultants commissioned to execute specific studies. Reports produced in time and together with the data base used in the detailed planning of IHDP activities</p>	

Contd.

Table 7.3: Contd.

Output	Activities	Responsibility	Success criteria
A completed programme on adaptive trials on research stations, NASEPP farms and farmer's land	Regular collection of market information on the main horticultural crops		
	Studies of domestic and regional markets for specific crops		
	Planning and design of trials	Horticulture Section, NASEPP and CARD staff	All target trials established, well maintained, used as demonstrations and yielding useful results
Advisory leaflets in extension manual form and practical workshops for extension staff and farmers about recommended production and post-harvest management practices for existing crops grown under varying conditions, new varieties of existing crops, and new classes of crop	Preparation and issue of trial kits	Horticultural specialists at Dzongkhag level	
	Establishment of trials		
	Measurement and analysis of results		
	Monitoring and supervision of trials		
	Collection of information from horticultural data base and from results of adaptive research trials	Horticulture in Horticulture Section, in association with Extension Sub-Division, Dzongkhag agricultural staff, and DCSD	Leaflets used by agents Effective message in leaflets successfully conveyed at workshops to farmers
	Preparation of texts of advisory leaflets		
	Preparation and running of workshops		

Contd.

Table 7.3: Contd.

Output	Activities	Responsibility	Success criteria
Integrated development plans for new varieties of crop and new classes of crop	Execution of production trials Conducting of marketing studies  Conducting of test marketing surveys Preparation of plans	Horticulture Section staff, consultants and FCB	Development plans successfully implemented
Advice to input supply agencies on horticultural crops	Quantitative and qualitative assessment of farmer's needs for planting material, fertilizers, plant protection chemicals, tools, equipment, and credit  Formal provision of advice through workshops, correspondence, and attendance at meetings Reviewing plans of the input supply agencies Informal provision of advice through day-to-day working relationships	Horticulture Section staff in collaboration with NASEPP, Procurement Officer of Department of Agriculture, AMC, Bhutan Development Finance Corporation, and Royal Monetary Authority	Growers able to make timely purchase of high quality inputs appropriate to their needs.
Advice to extension agents and farmers on product grading, presentation, and packaging	Observation and identification of farmers' practices and problems	Horticulture Section staff in collaboration with FCB.	Growers adopt practices and gain income benefits

Contd.

Table 7.3: Contd.

Output	Activities	Responsibility	Success criteria
	Assessment of market and customer requirements for horticultural crops		
	Drafting of specification for regulations		Bhutan's horticulture exports improve in reputation and increase in volume
	Preparation of texts for advisory leaflets		
	Preparation for and running of workshops		

that is most suited to small landowners and producers. Generally, the mountain areas of Pakistan offer unlimited development opportunity for selected horticultural crops which have excellent cash potential. Critics of subsistence farming must acknowledge that mountain farming, even in remote areas, does have the cash potential necessary for the survival and sustainability of small farms, provided this potential is properly harnessed and the present-day subsistence farming based on cereal crops is transformed into commercial farming.

The mountain areas examined in this report cover the following administrative sub-divisions:

- The federally administered Northern areas comprising the districts of Gilgit, Baltistan, and Diamer;
- the Malakand and Hazara divisions of the North West Frontier Province (NWFP); Hazara Division consists of Kohistan, Marakhor, and Peshawar districts and the Malakand Division includes the