Chapter 11

Agriculture

Himachal Pradesh, described by the ancients as 'Dev Bhoomi' (abode to the Gods), is situated in the heart of the Himalayas in the northern part of India. It has a geographical area of 55.67 lakh hectares by professional surveys (42.67 lakh hectares by village papers), most of which is under forests, pastures and grazing lands. Less than ten per cent (5.6 lakh hectares) of the state's net area is under cultivation. The state has a large range of mountains and valleys rising from 350 meters to 7000 meters above mean sea level. Its climate ranges from sub-tropical to sub-arctic cold with an annual rainfall of 350 millimeters to 3800 millimeters. Its temperatures vary from –25 C to 42 C. The state has snow-fed perennial rivers and rivulets flowing in almost all its parts. In addition, there are some natural lakes. The topography, soil, climate, rainfall and temperature provide the state with wide opportunities and potential for agriculture and horticulture.

Due to its hilly terrain, the economy of the state is predominantly mixed farming, agro-pastoral, silvi-pastoral and agro-horticultural. Most of the group based farming systems, engaging a majority of the farmers, are found in the valleys of Yamuna, Satluj, Beas, Ravi, Chandera Bhaga and their tributaries. Agriculture accounts for over 30 per cent of the state's net domestic product and provides employment to about 71 per cent of its residents. The annual growth rate of the State during 1999-2000 was 5.8 per cent against India's 6.4 per cent. Earlier, during the Eighth Plan the annual growth rate of the State was 6.3 per cent. The state enjoys the special category status and thus gets special funds from the center for its development activities. Per capita income at the current prices is over Rs. 18000 (1999-2000).

Important crops grown in the state are cereals – maize, wheat, rice and barley; pulses; oilseed; buckwheat; and minor millets; cash crops – potato, ginger, tea, peas, kuth, hops; and a variety of vegetables including out-of-season and exotic vegetables; and fruits, particularly pome, stone and dry fruits like *chilgoza*, walnut, pecan nut, pistachio, etc. Although the state is deficient in foodgrains, it has gained importance in the production of vegetables and fruits such as seed potato, vegetables, ginger, chicory seed, hops, olives, figs, apples and mushrooms, besides certain medicinal and aromatic plants.

Agriculture in the state suffers from certain limitations. Most of the farming is rainfed as only about one lakh hectares of its net sown area has assured irrigation. Operational land-holdings are small and scattered. Fruit cultivation is thriving on old plantations whose bearing is low. Farm mechanisation is scanty. Awareness level of farmers is low and technologies are out of date. A concerted approach has to be made by injecting reforms and designing policy measures which can give a boost to crops and horticulture in the state.

Profile of Agriculture

Himachal Pradesh has 16,997 inhabited villages and over 90 per cent of the state's population lives in rural areas. Some important parameters of its agriculture are given in Table 11.1. Considering the precipitation, altitude and irrigation, the state has been divided into four agro-ecological zones whose characteristics are given in Table 11.2. The texture of the soil, climate and rainfall vary in the four zones and so does the cropping pattern. More than 70 per cent of the rainfall occurs during the monsoon season and for the rest of the year there is water shortage in areas where irrigation is scarce. Most of the crop area lies in Zone II where rainfall and irrigation are the maximum and the least is in Zone IV. Crop intensity is over 177 per cent.

TABLE 11.1

Profile of Agriculture in H.P. (1996-97)

(Area in Lakh ha)

Indicators	*H.P.*	*India*
Reporting area	33.96	3048.80
Net area sown	5.58	1428.19
Area sown more than once	3.59	467.24
Gross cropped area (GCA)	9.47	1895.43
Cropping intensity (%) 1997	176	133
Net irrigated area	1.05	551.43
Gross irrigated area (GIR) (GIR as % of GCA)	1.76 (18.58)	732.75 (38.65)
Average size of operational holding (ha)	1.21	1.55
Fertiliser consumption (kg/ha)	39.43	95.33
No. of Inhabited villages	16997	557137
Poverty		
Total (%)	7.63	26.1
Rural (%)	7.94	27.09
Urban (%)	4.63	23.62

Source: Statistical Outline of H.P., 2001, DTE of E&S.

Operational Land Holdings

More than eight lakh farmers of Himachal Pradesh cultivate about 10 lakh hectares of land with an average operational landholding of 1.2 hectares (Table 11.3). About 84 per cent of the farmers have less than two hectares of land while 16 per cent own between 2 and 10 hectares. In the case of the Scheduled Castes, 93 per cent of the farmers own less than two hectares, and cultivate 70 per cent of the total area. They have an average land-holding of 0.73 hectare. The Scheduled Tribes own an average of 1.16 hectares of land. According to the 1991 census, over 22 per cent of the farmers belong to the Scheduled Castes and four per cent to the Scheduled Tribes. Together, the Scheduled Castes and the Scheduled Tribes own 17.6 per cent of the cultivated area.

TABLE 11.3

Distribution of Operational Land Holdings (1990-91)

Category	*No. of Farmer (lakh)*	*Per cent*	*Area (lakh ha)*	*Per cent*	*Operational Holdings (ha)*
Marginal (1 ha)	5.32	63.8	2.25	21.3	0.40
Small (1-2 ha)	1.66	19.9	2.35	23.3	1.42
Medium (2-4 ha)	0.94	11.3	2.58	25.5	2.74
Large (4-10 ha)	0.36	4.3	2.05	20.3	5.69
Extra large (> 10 ha)	0.06	0.7	0.97	9.6	16.17
Total	**8.34**	**100**	**10.10**	**100**	**1.21**

Source: Annual Administration Report, Department of Agriculture, and H.P., 2001-02.

Due to sub-division and fragmentation, land holdings are becoming uneconomic. Besides, due to the lack of land consolidation, the holdings are scattered and are often unmanageable and are a limiting factor for crop production. Land lease and tenancy regulations do not allow farming on large areas.

Agricultural Production

The Agro Climatic Regional Planning (ACRP) scheme was launched in the state in June 1998. Himachal Pradesh comes under Western Himalayan Agro Climatic Zone No. I, which consists of three distinct sub-zones, namely, Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh. Himachal Pradesh falls under the second sub-zone and is further divided into four zones under the ACRP programme as

TABLE 11.2

Characteristics of Agro-ecological Zones

Character	*Zone I*	*Zone II*	*Zone III*	*Zone IV*
Ecology	Low Hill Sub-tropical	Mid Hill Sub-humid	High Hill Temperate Wet	High Hill Temperate Dry
Geographical Area (0%)	35	32	25	8
Cropped Area (0%)	33	53	11	3
Irrigated Area (0%)	17	18	8	5
Altitude (MASL)	Upto 914	915-1523	1524-2472	2476-7000
Rainfall (cm)	100-150	150-300	100-200	20-50
Area (Districts)	Kangra, Hamirpur, Solan, Sirmaur,	Kangra, Mandi, Solan, Shimla, Sirmaur, Chamba	Kangra, Mandi, Sirmaur, Shimla, Kullu Bilaspur, & Chamba	Lahaul & Spiti, Kinnaur,Chamba, Kullu

Source: Agricultural Statistics at a Glance, H.P., 2001.

described earlier. Rapid strides in agricultural production were planned and various programmes were initiated to increase productivity of foodgrain and other crops.

Since 1998-99, foodgrain production and productivity have been fluctuating over the years whereas the total area under cultivation has remained almost the same (Table 11.4). The year 2000-01 recorded exceptionally low production and productivity because of drought conditions in both *Kharif* and *Rabi* seasons. Production was the highest in 2001-02. The Tenth Plan target aims at an increase of about 10 per cent in production as well as productivity.

TABLE 11.4

Foodgrain Production

Year	*Production (lakh mt tonne)*	*Area ('000 Ha)*	*Productivity (Kg/Ha)*
1998-1999	13.13	8.37	1569
1999-2000	14.46	8.22	1760
2000-2001	11.04	8.12	1360
2001-2002 (Exp.)	17.60	8.43	2080
10th Plan Target	18.75	8.22	2281

Source: Annual Administrative Report, Department of Agriculture H.P., 2001-2002.

TABLE 11.5

Growth Rate in Area, Production and Productivity of Some Crops During VIth to VIIIth Plan

Crop	*Growth Rate (%) Over VIth Plan*		
	Area	*Production*	*Productivity*
Maize	6.44	25.82	18.18
Rice	-14.12	4.25	21.46
Wheat	3.19	40.15	35.33
Pulses	-22.93	-3.82	24.80
Oilseeds	0.33	49.18	48.81
Potato	-5.26	17.36	23.89
Vegetables	74.82	113.05	21.87

Source: Work Plan for Accelerated Growth of Agriculture and Horticulture in H.P., (2002-2003).

Growth rate in area, production and productivity of some important crops of the state during the Sixth Plan to the Eighth Plan are shown in Table 11.5. The area under rice, pulses and potato has decreased during this period, while the maximum increase has been in the area under vegetables. The rate of productivity of different crops has also been increasing, maximum being in oilseeds and wheat and the least in maize. As far as productivity of different crops is concerned, only maize yield has been higher than the all-India average while that of wheat is low - about 46 per cent less. Productivity of rice and barley is also less than the all-India average (Table 11.6). The state, however, has surplus maize and little wheat but is deficient in rice, oilseeds and pulses.

TABLE 11.6

Production Scenario (lakh mt) and Yield (kg/ha) in H.P. and India (1999-2000)

Crop	*Production*		*Yield*		*Surplus/Deficit*	
	H.P.	*India*	*H.P.*	*India*	*1987-88*	*2000-2001*
Foodgrains	13.13	0.64	1597	1697	-	-
Rice (1998-99)	1.25	0.10	1423	1928	-166	-149
Wheat	2.51	0.64	1266	2755	-81	+19
Maize	6.84	5.93	2272	1785	+48	+100

Source: Statistical Outline, H.P., 2001 DTE & E & C.

Since 1997-98, the productivity of rice, maize, millets, pulses and oilseeds (*Kharif*), and chickpea has shown a rising trend but the productivity of wheat, barley, *rabi* pulses and oilseeds has been going down (Table 11.7). The total area under these crops has been decreasing and has yielded place to vegetable crops.

There is a great variation in foodgrain production and productivity in different districts of the state (Table 11.8). During 1997-98, the productivity of foodgrains was the maximum in Bilaspur district followed by the districts of Una and Sirmaur. It was the least in Kinnaur district. However, during 1999-2000, foodgrain productivity was the highest in Sirmaur district. Productivity, in general, showed an increasing trend in almost all districts, though 1998-99 and 2000-01 recorded a poor performance due to drought conditions. Nevertheless, the variation of productivity between different districts is wide.

In the drought prone areas of Zone IV, only rainfed crops such as barley, oats, rapeseed and mustard, etc., are grown while vegetable production is common wherever irrigation is available.

Horticulture

Himachal Pradesh has the advantage of climate and topography in the cultivation of a variety of fruits. Sub-tropical fruits such as mango, litchi, guava, citrus, etc., mature about one month later than in the plains thus fetching better prices.

Temperate fruits cover about 64 per cent of the total cultivated area of the state of which more than 40 per

TABLE 11.7

Crop Production (1997 to 2001)

Crop	1997-98			1998-99			1999-2000			2000-01		
	Area	Production	Productivity	Area	Production	Productivity	Area	Production	Productivity	Area	Production	Productivity
Kharif												
Corn	311.86	620.68	1990	300.98	662.82	2202	299.91	681.42	2272	298.05	683.64	2222
Paddy	86.18	120.44	1398	82.13	117.00	1425	80.22	120.37	1500	81.52	124.90	1532
Millets	11.67	7.38	632	10.53	7.23	686	11.11	7.41	667	10.78	7.07	656
Ragi	4.06	4.29	1056	3.67	4.16	1134	3.96	4.44	1121	4.13	4.16	1007
Pulses & Oilseed	27.85	8.67	315	26.65	10.02	376	24.21	9.67	399	23.22	7.97	343
Total	**441.63**	**761.42**	**1724**	**423.95**	**800.68**	**1889**	**419.40**	**823.32**	**1963**	**417.70**	**827.73**	**1982**
Rabi												
Wheat	377.34	641.31	1700	379.72	481.27	1267	370.59	583.30	1574	362.68	251.32	693
Barley	27.69	41.34	1493	26.75	27.76	1038	25.90	32.50	1255	25.64	21.41	835
Chickpea	2.34	2.50	1068	1.91	1.29	675	1.70	1.53	900	1.35	1.49	1104
Pulses & Oilseed	4.59	1.55	338	4.64	2.02	435	4.84	5.50	1136	4.87	1.62	333
Total	**411.96**	**686.69**	**1667**	**413.02**	**512.33**	**1240**	**103.02**	**622.82**	**1545**	**394.54**	**275.54**	**699**
Grand Total	**853.58**	**1448.11**	**1696**	**836.97**	**1313.02**	**1569**	**827.42**	**1416.14**	**1722**	**812.23**	**1103.58**	**1359**

Source: *Annual Administrative Report, Department of Agriculture, and H.P.,* 2001-02.

Note: Area ('000 ha); Production ('000 mt); Productivity (kg/ha).

TABLE 11.8

District-wise Foodgrain, Area, Production and Productivity

District	1997-98			1998-99			1999-2000		
	Area	Production	Productivity	Area	Production	Productivity	Area	Production	Productivity
Bilaspur	57.23	115.45	2017	54.08	77.55	1434	55.72	101.68	1825
Chamba	59.60	115.96	1946	56.28	103.55	1840	58.02	102.28	1763
Hamirpur	70.82	102.97	1454	73.88	109.23	1478	69.89	106.00	1517
Kangra	196.70	267.36	1359	199.35	266.24	1336	197.42	303.86	1539
Kinnaur	6.75	6.09	902	6.31	6.48	1027	6.09	5.08	834
Kullu	53.48	95.59	1787	48.74	81.82	1679	45.25	87.83	1941
Lahaul & Spiti	0.79	1.20	1519	0.90	1.08	1200	0.80	1.17	1462
Mandi	148.59	282.28	1900	146.58	238.51	1627	145.90	286.86	1966
Shimla	65.82	82.07	1247	62.04	79.15	1276	55.95	78.14	1396
Sirmaur	67.13	131.99	1966	66.70	120.72	1810	65.46	138.93	2122
Solan	57.68	105.32	1826	57.44	111.66	1944	56.76	102.57	1807
Una	68.99	135.82	1969	64.68	117.08	1810	65.17	131.82	2023
Total	**853.58**	**1448.11**	**1697**	**836.97**	**1313.02**	**1569**	**822.42**	**1446.24**	**1759**

Source: *Annual Administrative Report, Department of Agriculture, and H.P.,* 2001-2002.

Note: Area: '000 ha; Production = '000 mt; Productivity = kg/ha.

cent is under apple cultivation. The area under fruits more than doubled in the last two decades. Similarly, the productivity of apples almost doubled to 4500 kg per hectare during 2000-2001, but the productivity of nuts and dry fruits, citrus and other sub-tropical fruits decreased even though the area under these crops increased (Table 11.9). Production of apples was the maximum during 1988-1990.

The districts of Shimla and Kullu are the dominant areas of apple production while in Sirmaur peach is the main fruit crop. Kullu district grows plums and pears. Citrus, mango and litchi are main fruits grown in the district of Kangra (Table 11.10). The area under mango is about 39 per cent of the total area under sub-tropical fruits in the lower hill region and about 6 per cent of the total area under all fruits in the state as compared to 19 per cent under citrus fruits.

TABLE 11.9

Fruit Production

Fruit	*1980-81*			*1990-91*			*2000-01*		
	Area	*Production*	*Productivity*	*Area*	*Production*	*Productivity*	*Area*	*Production*	*Productivity*
Apple	43.3	118.1	2727	62.8	342.1	5447	83.7	376.7	4500
Other Temperate Fruits	17.5	9.3	531	28.5	14.9	523	32.4	20.5	633
Nuts and Dry Fruits	6.9	1.8	261	13.2	3.1	235	16.4	2.7	165
Citrus	14.5	4.4	303	36.0	12.6	350	39.1	11.1	284
Other Sub-Tropical Fruits	10.3	6.4	621	22.9	13.6	594	36.3	17.0	468
Total	**92.5**	**140**	**1574**	**163.4**	**386.3**	**2364**	**207.9**	**428.0**	**2059**

Source: Work Plan for Accelerated Growth of Agriculture and Horticulture in H.P., 2002-2003.

Note: **(**Area**:** 00 *ha; Production mt ; Productivity: kg/ha).*

TABLE 11.10

District-wise Area under Different Fruit Crops Bearing Trees (1998-99)

(Hectares)

District	*Apple*	*Peaches*	*Plum*	*Pears*	*Kinnow & Orange*	*Litchi*	*Mango*
Bilaspur	—	—	2	7	28	80	178
Chamba	—	—	—	—	—	—	—
Hamirpur	—	—	—	—	—	—	79
Kangra	—	—	8	—	2139	107	2141
Kinnaur	1591	—	—	—	—	—	—
Kullu	7958	—	740	44	—	2	—
Lahaul & Spiti	19	—	—	—	—	—	—
Mandi	916	—	190	—	—	—	—
Shimla	20028	10	226	—	24	45	4
Sirmaur	649	323	59	24	33	41	286
Solan	80	5	63	30	30	55	49
Una	—	—	—	—	—	—	—
Himachal Pradesh	**31241**	**342**	**1288**	**105**	**2254**	**330**	**2737**

Source: Annual Season and Crop Report (1998-99), Commissioner Revenue, H.P.

About one-seventh of the fresh fruit trees are non-bearing while in case of dry fruits the proportion of non-bearing trees is about one-eighth of the total plantation covering about 16 per cent of the area under fruits. The districts of Shimla and Kinnaur have the largest number of non-bearing trees of fresh as well as dry fruits (Table 11.11). Fruit production, which was 1200 metric tons in 1950-51, increased to 4.3 lakh metric tons in 2000-2001 (about 360-fold increase), but the yields are about 10-12 times below what is produced in the European countries (*H.P. State Plan, 2001-02*).

According to the time series data, the average productivity of apple (kilogram per hectare) has been 5830, other temperate fruits 990, nuts and dry fruits 450, citrus 510 and other sub-tropical fruits 1370 (*Work Plan for Accelerated Growth of Agriculture and Horticulture in H.P. 2002-03*). Punjab produces 10 to 15 tonnes of citrus fruits per hectare whereas the yield of these fruits in Israel is between 43 to 65 tonnes per hectare. In Kashmir, apple production is about seven to eight thousand kg per hectare.

Experiments are under way in the state to grow fruits like strawberry, pomegranate, olive, kiwi, hazelnut, etc., which have been identified as the potential crops of the future. Some high-bearing clones of these fruits have been imported and are being tested for commercial cultivation. Planting material imported during 2001-02 includes apples (six cultivars) 5000, cherry (two cultivars) 3500 and plum (three cultivars) 1500.

TABLE 11.11

District-wise Bearing and Non-bearing Area under Fresh Fruits, Dry Fruits and Vegetables (1998-99)

(Hectares)

District	*Fresh Fruits*		*Dry Fruits*		*Vegetables*		
	Bearing	*Non-bearing*	*Bearing*	*Non-bearing*	*Potato*		*Others*
					Kharif	*Rabi*	
Bilaspur	338	75	2	—	—	13	498
Chamba	2147	—	—	—	533	26	698
Hamirpur	84	—	—	—	—	13	199
Kangra	6092	—	9	—	122	1246	2229
Kinnaur	1597	318	552	57	244	—	921
Kullu	8744	272	58	3	850	139	2308
Lahaul & Spiti	19	40	—	—	874	—	900
Mandi	5757	—	—	—	1635	195	4904
Shimla	20337	6815	308	93	5130	817	13062
Sirmaur	1489	100	33	5	1082	384	3395
Solan	745	137	4	—	18	125	3197
Una	538	—	—	—	89	293	927
Himachal Pradesh	**47887**	**7757**	**966**	**158**	**10577**	**3251**	**33238**

Source: Annual Season and Crop Report 1998-99. Commissioner (Revenue) Himachal Pradesh.

The work plan for the development of horticulture aims at complementing and supplementing the efforts of the state government to bridge the gap between the low level of productivity and the quality of fruit crops resulting from:

- Lack of availability of elite planting material
- Lack of modern production and protection technologies and facilities
- Lack of rapid and efficient transfer of technology
- Poor communication due to hilly terrain
- Inadequate irrigation
- Lack of post-harvest management
- Losses due to the vagaries of nature, etc.
- Inadequate marketing infrastructure and intelligence

Modernisation of horticulture is necessary to improve production and quality in competitive environment. Horticulture industry at present contributes about Rs. 584 crore per annum to the GDP. Gross income from fruits has increased from Rs. 45.74 crore in 1990-91 to about Rs. 584.35 crore in 1998-99.

Vegetables

Like fruits, cultivation of vegetables too covers a wide variety, thanks to varied seasons and topography. Almost all vegetables can be grown. In recent years more area has come under vegetable crops due to availability of irrigation facility and also because of high returns from these crops. Over the last decades, the area under vegetables as well as their production has increased more than 40 per cent. This is exclusive of potato and ginger crops (Table 11.12).

TABLE 11.12

Area, Production and Productivity of Vegetables, Potato and Ginger

Crop	*Index*	*1990-91*	*1995-96*	*2000-01*	*2001-02*
Vegetables	Area	22	25	32	36
	Production	370	425	580	655
	Productivity	16818	17000	18125	18194
Potato	Area	16	14	16	15
	Production	115	135	160	160
	Productivity	7188	9642	1000	1066
Ginger	Area	1.5	3.0	3.1	3.5
	Production	2.9	3.2	3.7	4.2
	Productivity	1933	1066	1194	1200

Source: Annual Plan, H.P., 2001-02.

Note: Area = '000 hectare; production = '000 mt: productivity = kg/ha.

Himachal Pradesh was considered to be the highest producer of quality seed potato during the 70s and 80s but since the end of 1980, a declining trend has been noticed. It is because other states of India have also started producing good quality seed potato besides true potato seed is also being used for cultivation. Potato production has increased nearly by 40 per cent (Annual Plan H.P., 2001-02). The crop is grown both in *Rabi* and *Kharif* seasons. Most of the potato is grown during

Kharif in Shimla district followed by the districts of Mandi and Sirmaur. In the *Rabi* season it is grown mostly in the districts of Kangra, Shimla and Sirmaur (Table 11.11).

Ginger is another commercial crop that has received considerable priority over the years. An area of 1,500 hectares was brought under ginger in 1990-91, which more than doubled by the end of 2001-02. Production saw an upswing all through the 1990s. It was 2.9 thousand metric tonnes in 1990-91 and reached 4.2 thousand metric tonnes by the end of 2001-02 (Table 11.12).

The maximum area under vegetables, apart from potato and ginger, accounts for peas and tomato. Productivity of tomatoes is quite high i.e., 34,645 kg per hectare as against an average of 24,000 kg in Punjab and 15,000 kg in India. Productivity of cauliflower is about the same as the all-India average while Punjab produces about 24,000 kg per hectare (Table 11.13). Fresh peas of the state are of premium quality and fetch a higher price particularly in the plains where it is an off-season variety. Vegetable seed production is a dominant feature of vegetable cultivation in the state as the climate of the central region is very conducive to seed production. Cultivation of exotic vegetables like broccoli, asparagus, leek, parsley, Brussels sprout, and others is catching up because these vegetables are in demand in hotels and by foreign tourists. The advantage of topography enables vegetable cultivators to grow out-of-season crops.

TABLE 11.13

Production of Vegetables (1998-99)

Crop	*Area (ha)*	*Production (mt)*	*Productivity (kg/ha)*
Peas (green)	9400	90000	9574
Tomato	6000	207870	34645
Beans	2170	21310	9912
Cabbage	2150	61820	28753
Cauliflower	1340	24340	14933
Capsicum & chillies	1630	15250	9355
Others Vegetables (Potato excluded)	9310	159410	17122
Total	**32000**	**500000**	**18125**

Source: Administrative Report, Department of Horticulture, and H.P. 2001.

Note: Area = '000 hectare; Production = '000 mt: Productivity = kg/ha.

Other Horticultural Activities

a) Flower cultivation – Commercial cultivation of flowers in Himachal Pradesh started in 1980 under the guidance of the Department of Horticulture. It was declared a thrust area for economic development. The District Rural Development Agencies (DRDA) in the districts of Kangra, Mandi, Shimla and Solan are engaged in this activity. Several small nurseries have been established for the propagation of floriculture planting material for distribution to the growers. The main crops are gladiolus, carnation, chrysanthemum, tulips, daffodils, etc. The cultivation of some traditional flowers, such as marigold, has also caught up in certain areas like Rajgarh. The area under floriculture in the state has increased from five hectares in 1991 to more than 188 hectares in 2002 and flowers worth about Rs. 6 crore are being produced every year (Table 11.14). These are being exported to Chandigarh, Amritsar, Delhi, Haridwar, Hrishikesh and other places. The floriculture industry of the state is still in a nascent stage and requires to be organised properly so that it becomes a remunerative enterprise.

b) Mushroom cultivation – Mushroom cultivation technology was first introduced in the state in 1961 on a trial basis under the Technological Co-operation Programme of FAO. Later, commercial application of technology was introduced under FAO and UNDP assisted projects at Chamba Ghat in Solan district during 1977-82. During 1986-1992, a project under Indo-Dutch programme for mushroom production was introduced at Palampur, Kangra district. All these establishments helped in popularising button mushroom (Agaricus bisporus) cultivation and its productivity increased from six kg per square metre in 1992 to 10 to 15 kg per square metre now. During 2001-02 over 3260 metric tonnes of mushrooms were produced in the state (Table 11.14). This is showing an increasing trend. Production of pasteurised compost for distribution to mushroom growers has been taken up by the government at Dharbaggi in Kangra district, and Bajaura in Kullu district, under centrally sponsored scheme.

These units will supply pasteurised compost to about 400 new production units in the districts of Kangra, Kullu, Mandi and Bilaspur. About 20 small units are operating in the private sector in Solan district which produce pasteurised compost. The present capacity to produce

pasteurised compost is about 11170 metric tonnes annually. There are nine spawn production laboratories in the state of which six are in the private sector and three are with research institutions. A production of 2495 metric tonnes of mushrooms was recorded in 2000-2001 in the state. An export-oriented mushroom unit, namely, M/s Himalayan International Private Limited, has been set up at Paonta Sahib, Sirmaur district, to export 150 metric tonnes of mushroom and its products in various forms.

TABLE 11.14

Trend and Targets of Horticulture

Item and Unit	*Annual Plan*	*Annual Plan 2001-2002*		
		Target	*Achievement*	*Annual Plan*
Fruit production area ('000 ha)	217.2	225.2	223.2	228.3
Production ('000 mt)	428.1	539.6	263.4	561.0
Floriculture area (ha)	154	155	188	175
Mushroom production (MT)	2945	2500	3261	4000
Bee keeping (maintenance of colonies (No.)	1586	1800	1830	2000
Distribution of bee colonies (No.)	1729	1800	1038	500
Plant nutrition Plant analysed (No.)	11994	12000	13821	15000
Plant protection area apple scab control (ha)	88649	55000	89454	85000
Area other fruit diseases control (ha)	45893	35000	43837	35000
Total area under plant protection (ha)	260782	185000	271092	183000

Source: Work Plan for Accelerated Growth of Agriculture and Horticulture in H.P. 2002-03.

c) Bee-keeping - The state has a wide diversity in agro-climatic conditions and flora, which provide enormous potential for the development of bee keeping. The British first introduced it in Kullu valley in 1934 and in Kangra valley in 1936. The migratory system of bee keeping was introduced in 1952 when bee flora from the high hills was brought down to lower altitudes during winter months. The state took a lead in the introduction of exotic honey bee, *Apis mellifera* (Italian honey bee) for the first time in 1962-63. Before this honey was produced in the state from *A.acerana* and production was ten metric tons per annum from 2,500 bee colonies maintained by 150 beekeepers. Now there are about 26,000 bee colonies with more than 939 beekeepers producing over 650 metric tonnes of honey of diverse flora every year. Private entrepreneurs have established breeding and multiplication centres under centrally sponsored schemes, which have become quite popular with new beekeepers. Fruit growers also indulge in honey production during the flowering season on rental basis as this facilitates pollination of the fruit trees, which increases fruit productivity, besides yielding honey. Over 1000 bee colonies were distributed by government agencies in 2001-02. One honey processing unit with a capacity to process 120 metric tonnes of honey every year is working at Kandrori in Kangra district, and is managed by the Agro Industry Corporation Limited.

d) Medicinal and aromatic plants – Himachal Pradesh is a rich repository of medicinal and aromatic plants because of its situational advantage. It is unfortunate that no compendium or systematic inventory about the medicinal and aromatic plants is available. During the last several years the flora of Himachal Pradesh has been under scrutiny and exploitation by various national and multinational pharmaceutical organisations. It is estimated that about 500 medicinal, 150 aromatic and a large number of potent alternative and substitute drug plant species are available in this area. The demand for medicinal and aromatic plants is increasing day by day. There are 70 units/pharmacies in the state, which manufacture Ayurvedic medicines. Two bigger units set up at Joginder Nagar and Majra procure raw material from the market, process them and supply the ingredients to outside agencies. Not many medicinal or aromatic plants have been brought under cultivation. Collection by outside agencies of wild medicinal plants at a rapid rate has threatened some species with extinction. The state government and the universities are attempting to develop package of practices for growing some of the medicinal plants commercially for use both in India and abroad. Table 11.15 shows a few important medicinal and aromatic plants and wild species, which are cultivated in the state for export. To these, many more can be added.

The Department of Ayurveda, Government of Himachal Pradesh, has set up one herbal garden in each

of the four agro-climatic zones of the state to raise germplasm nurseries, and has perfected conservation and other agro-techniques for the sustenance and multiplication of such plants in the respective zones. An *Ayurvedic* herbarium has also been set up at Joginder Nagar to keep specimens of medicinal plants in a systematic manner. A lot more needs to be done to preserve the wealth of the Himalayas in the form of medicinal and aromatic plants.

TABLE 11.15

Major Medicinal Herbs Exported from Himachal Pradesh

(Quintal)

Name	*1988-89*	*1989-90*	*1991-92*	*1994-95*
Jurinea sp.	5,884	4,064	4,939	3,260
Dioscorea sp.	1,672	180	380	4
Gentiana kurroo	1,468	199	2,899	343
Valeriana sp.	1,954	1,247	2,014	1,642
Cinnomomum camphora	1,430	849	-	675
Centella asiatica	417	166	335	921
Saussurea lappa	3	648	667	321
Morchella sp.	402	137	2,800	490
Viola sp.	26	195	-	71
Pistacia integerima	129	437	278	17
Aconitum violoceum	60	12	48	-
Aconitum heterophyllum	189	1	2	25
Bunium persicum	70	5	5	-
Berberis sp.	2,981	11,195	12,824	-
Pinus gerardiana	656	568	600	403
Agaricus bisporus	37	15	-	-
Other sp.	4,239	4,913	10,328	684

Source: Biotechnology Policy of Himachal Pradesh, Department of Biotechnology, and Govt. of H.P. Brochures, 2001.

Among the cultivated medicinal plants, *Saussurea lappa* (Kuth), *Bunium persicum* (Kala Zira), *Cichorium itybus* (Chicory), *Crocus sativus* (Kesar) and *Humulus lupulus* (Hops) are important. However, some of the medicinal plants have become endangered. These include *Podophyllum hxandrum* (Bankakri), *Nardostachys grandiflora* (Jatamansi), *Gentiana kurroo* (Indian Gentian), *Aconitum heterophyllum* (Patees), *Onosma bracteatum* (Ratanjot), *Ephedra gerardiana* (Somlata), *Swertia chirata* (Chirayata), *Taxus baccata* (Talispatra), *Atropa acuminata* (Indian belladonna), bamboo, Jatropha etc. It is high time agro-technologies were developed for the domestication of these plants. This will not only help in the diversification of farming and improving the economic condition of the farming community but also help in conserving these endangered species.

Irrigation

Himachal Pradesh has high ranges of the Himalayas some of which contain perennial glaciers and snow-capped peaks. These supply water throughout the year to various rivers that pass through the state. A number of tributaries close to the snow-capped mountains join one another to form these rivers. While there is plenty of water in the hills yet water use for irrigation is limited to over 1.05 lakh hectares out of nearly 6 lakh hectare of cultivated land. More than 50,000 hectares of cultivated land can be brought under irrigation through major and medium irrigation projects, which are underway, and the remaining area can be provided with irrigation through minor and other irrigation schemes. By the end of March 2001, about two lakh hectare of cultivated land is expected to come under irrigation. This accounts for nearly 33 per cent of the cultivable area of the state (Table 11.16). Minor irrigation projects including kuhls and others cover over 1.8 lakh hectares for irrigation. It is evident that the progress of irrigation has been dependent mostly on private organisations as the number of kuhls and tube wells operated and developed by the farmers at their own level are more in number than those provided by government agencies (Table 11.17).

TABLE 11.16

Irrigation in Himachal Pradesh

(hectares)

Item	*End of Eight Plan*	*Achievement*				
		1997-98	*1998-99*	*1999-2000*	*2000-01*	*Cumulative*
Major and Medium irrigation	10936	300	150	150	200	11736
Minor irrigation	82595	2000	2000	2120	1800	90515
Kuhls and Others	92796	NA	NA	NA	NA	92796
Total	**186327**	**2300**	**2150**	**2270**	**2000**	**195047**

Source: Tenth Five-Year Plan, Himachal Pradesh.

Traditional irrigation practices include pond irrigation, terrace bunding and development of *kuhls*. The latter are perennial source of water provided the hill cover has adequate forest cover. Some of the *kuhls* have become seasonal giving water during rainy season or little after because the forest cover has ceased to accumulate water for long. Terrace bunding and continuous flow from one field to another is practiced where the terraces are contiguous and are particularly

on flat land. On sloppy lands, ordinary bunding can retain rainwater for short time.

Since irrigation is a crucial input for increasing productivity of crops, many major, medium and minor irrigation projects have been set up after conducting feasibility studies. Some important irrigation projects are:

Major Irrigation Projects

A major irrigation project, with a cultivable command area (CCA) of more than 10,000 hectare is Shah Nahar Project on the Beas in Kangra district. This project ran into problems with the Punjab Government after it was conceived in 1983. It was cleared in April 1996, with the help of the Central Government. This project aims at irrigating 15,287 hectares of CCA benefiting 93 villages. It is likely to become operational by the end of 2003.

Medium Irrigation Projects

Medium irrigation projects cover a CCA of more than 2,000 but less than 10,000 hectares. An area of 11.38 thousand hectares stood irrigated till March 1999. Four projects have been completed and work on two is in progress. The completed projects at a total cost of Rs. 325.71 lakh are:

a) Giri Irrigation project (5263 hectares)

b) Bhabour Sahib Project-Phase I (923 hectares)

c) Bhabour Sahib Project-Phase II (2640 hectares)

d) Balh Valley Project (2410 hectares)

Schemes in hand are Sidhata Project with a CCA of 3,150 hectares, and LIP in Changer area with a CCA of 2,350 hectares. These projects are likely to be completed in five to seven years. Eighteen other medium irrigation projects are under feasibility study and hopefully these will be taken up soon. It is estimated that about 32 thousand hectare of land shall be irrigated by these projects by the end of next Plan period.

Minor Irrigation

Minor irrigation with a CCA of 2,000 hectare or less is operated both by government and privately in the form of tubewells, kuhls and lift irrigation, which are shown in Table 11.17. Several government projects are subsidised and subsidy is also available to farmers to develop their own *kuhls* or to put up tubewells to augment the existing irrigation facilities. Till March 2001, an area of 195 thousand hectares was brought under irrigation by these methods.

TABLE 11.17

Sources of Water Supply and Area Irrigated

(Hectares)

Water Source		*1994-95*	*1996-97*	*1998-99*
Tube wells	Govt.	1275	1629	432
	Private	179	179	1629
	Total	1454	1808	2061
No. of *Kuhls*	Govt.	6420	6420	6412
	Private	10475	10475	10475
	Total	16895	16895	16887
Lift irrigation	Govt.	243	243	243
	Private	246	246	246
	Total	489	489	489

Source: Annual Season and Crop Report 1998-99. Commissioner (Revenue), H.P.

Under the Micro Management of Agriculture projects, there are several schemes, which encourage farmers to develop their own irrigation facilities. These include Irrigation tank scheme, wherein a nine square meter tank can be provided with a subsidy of Rs. 8,000 to a farmer having a minimum of one *bigha* of land. During 2001-2002, 1785 irrigation tanks were set up to irrigate about 143 hectares. Another scheme is the Shallow Well Irrigation Scheme, which carries a subsidy of Rs. 12,000 per well to a farmer who has a minimum of two *bighas* of land. During 2001-02, 267 shallow wells were constructed to irrigate about 43 hectares. The Command Area Project is operative in the catchment areas of the Sutluj, Beas and Ravi covering the districts of Mandi, Kullu, Kangra and Chamba. This aims at reducing soil erosion through planting of grass and trees, construction of bunds, stonewalls, etc. During 2001-02, 204 hectares was saved for cultivation and irrigated.

Despite projected schemes and proposals that are in hand or are under consideration several factors create impediments wherein the targeted approach is jeopardised. Among these, financial crunch, unavailability of funds at required time and quantity and disbursing state's share in Central Government allocation are the major bottlenecks. Besides, land acquisition, deployment of trained staff and terrain factors also govern the progress and implementation.

Watershed Development

Nearly 70 to 75 per cent of the rain occurs during the monsoon season, which flows as run-off without much use or conservation. As a consequence, all areas, which are without assured irrigation, suffer from water stress and low productivity. Development of watersheds has been emphasised for the conservation of water.

TABLE 11.18

List of Watershed Identified for Tenth Five Year Plan

District	*No. Watershed*	*Arable Land (ha)*	*Non-arable (ha)*	*Total (ha)*
Bilaspur	6	2062	1410	3472
Hamirpur	3	1113	840	1953
Kangra	14	5178	5401	10579
Kullu	7	2129	401	2530
Mandi	20	5456	7651	13107
Shimla	2	346	687	1033
Sirmaur	8	2188	3261	5449
Solan	10	2592	3370	5962
Total	**70**	**21064**	**23021**	**44085**

Source: Work Plan for Accelerated Growth; Himachal Pradesh, 2002-03.

During the Ninth Plan, 61 watersheds were proposed to be constructed and for the Tenth Five Year Plan, 70 watersheds have been identified in eight districts of Himachal Pradesh (Table 11.18). These watersheds, when commissioned, will irrigate about 44,000 hectares of cultivated land in the dry season. Watershed projects can become effective and sustainable only when participation of the local community is ensured right from the beginning of planning to execution and maintenance. Panchayati Raj Institutions can play a major role in this and other irrigation programmes. The local communities should be involved in working out immediate plans to manage the scarce water resources in a collective way till proper irrigation systems are developed.

Agricultural Inputs

Seed

Seed is the most important determinant of agricultural potential on which the efficiency of other agricultural inputs depends. Seeds of appropriate character, variety, quality and certification is required to meet the demand of diverse agro-climatic conditions and cropping pattern. The state has no well-defined seed production programmes as there is no Seed Corporation. Further, the private seed organisations are not coming forward to help the state in seed production/distribution programmes. The state government relies greatly on the seed production/ multiplication of the important crop varieties by the farmers within the state, which is rather insufficient, and without any quality determinants.

The Department of Agriculture procures about 60,000 quintals of wheat seed every year from registered growers of the state, out of which 15,000 to 18,000 quintals of seed is procured from the farmers of Una district alone. In this district, however, there is an acute shortage of seed-grader-cum-seed-cleaners. The seed is procured immediately after the harvest in May and properly stored. Similarly, the seed of other crops is produced by designated farmers and procured.

Certified seeds of high-yielding varieties procured for different crops, including vegetables, are distributed among the farmers (Table 11.19). The area under high-yielding varieties of maize, rice and wheat is shown in Tables 11.7 and 11.20. During the Tenth Plan period the estimated coverage with HYV seed will be 280,000 hectare under maize, 79,000 hectare under paddy and 3,61,000 hectares under wheat. There has been considerable increase in the area (about 50%) under corn since 1998-99, while the area under paddy has remained static and there has been some reduction in the area under wheat. Production and use of high quality seed of composite or hybrid maize by the state agencies can have a direct impact on productivity of this crop.

TABLE 11.19

Consumption of Fertilisers, Certified Seed and Pesticides

(mt.)

Year	*Fertilisers*	*Certified Seed*	*Pesticides*
1998-1999	38557	378	150
1999-2000	37343	367	196
2000-2001	35552	353	232
2001-2002 (P)	40165	367	222
2002-2007	42500	366	210
(Yearly, P)	**46000**	**361**	**200**

Source: Annual Administrative Report, Department of Agriculture, and Himachal Pradesh, 2001-02.

Note: P = Provisional

Since irrigation is a constraint in the cultivation of food grain crops, the area under high yielding varieties is small (235,000 hectare) as only about 20 per cent of the area is irrigated. The area under rice with assured irrigation is 78.15 per cent, and for other varieties about 50 per cent of the area is irrigated. For wheat, irrigated area under HYV and other varieties is about 18.5 per cent whereas in the case of maize it is 11.7 per cent under HYV and 6.5 per cent under other varieties (Table 11.20). Seeds of food grains and other crops distributed by the Department of Agriculture are supplied with a subsidy of 50 per cent to the SCs, STs, IRDP and other backward areas.

Lot of opportunity exists in developing sound technologies for production of quality seed of vegetables, potato, ginger, some food crops, medicinal plants and herbs for export to other states and even abroad. For this, linkages and cooperation will have to be developed between two state universities, state department of agriculture, floriculture, horticulture and biotechnology, farmers and the government.

TABLE 11.20

Irrigated Area Covered under High Yielding Varieties (HYVs) and Other Cereal Varieties (1995-99)

('000 ha)

Crop	*HYV*			*Others*		
	Area	*Irrigated*	*Per cent*	*Area*	*Irrigated*	*Per cent*
Rice	13.96	10.91	78.15	68.17	39.58	58.12
Maize	88.68	10.34	11.66	221.30	14.44	6.53
Wheat	129.49	23.92	18.47	250.23	46.38	18.53
Barley	3.06	0.85	27.71	23.70	3.34	14.09
Total	235.19	46.02	19.57	563.40	103.74	18.41

Source: Annual Administrative Report, Department of Agriculture, H.P. (2001-02).

Every year about 10,000 quintals of maize, 600 quintals of sorghum, 300 kg of vegetable (tomato, cabbage, cauliflower and cucumber) hybrid seeds are procured from private companies and supplied to farmers. Private seed companies are also allowed to market non-certified seeds directly to the farmers.

Fertilisers

Traditionally, the small farmers of Himachal Pradesh have been using farmyard manure (FYM) as the main fertiliser. For this, cattle, sheep, goats and other animals find place in their farmhouses, even though some of these animals are unproductive. The state government, while trying to popularise the use of chemical fertilisers in crop production, has introduced the element of subsidy on the use of fertilisers by the farmers. The subsidy varies with the type of fertilisers. For instance CAN, urea and ammonium sulphate have a subsidy of Rs. 20.25 per bag of 50 kg while on NPK (12:32:16) it is Rs. 37 per bag and on NPK (15:15:15) it is Rs. 31 per bag. This subsidy is given on three bags per farmer per season. In the case of tea farmers, a subsidy of 50 per cent is given on ammonium sulphate, super phosphate and murate of potash for eight hectares per year. The consumption of fertilizers is estimated to be 42,500 metric tonnes during 2002-03 (Table 11.21).

TABLE 11.21

Consumption of Nitrogen (N), Phosphorus (P) and Potassic (K) Fertilisers

(mt)

Year	*N*	*P*	*K*	*Total NPK*
1998-1999	29140	5219	4198	38557
1999-2000	27593	5762	3988	37343
2000-2001	24418	6540	4594	35552
2001-2002	27615	7320	5230	40165
2002-03 (Target)	29800	7400	5300	42500
Tenth Plan Target	32300	8000	5700	46000

Source: Annual Administrative Report. Dept. of Agriculture, H.P. 2001-02.

The Department of Agriculture is experimenting with bio-fertilisers produced by the bio-fertiliser laboratory at Shimla, which has a capacity of 50 metric tonnes per year. During 2001-02, the department promoted the use of bio-fertilisers in 1,600 acres. However, quality control measures are necessary for which testing facilities should be made available.

Pesticides

The consumption of pesticides has been rather low, i.e., 225 grams per hectare per year. The consumption pattern (Table 11.19) shows that during 2001-2002, 222 metric tonnes of pesticides (technical grade) were used in the state covering about 405,000 hectares. Fruit and vegetable growers use most of the pesticides.

The state is laying great emphasis on strengthening bio-control technology. A state bio-control laboratory has been set up at Palampur with grants-in-aid received from the Government of India. Integrated Pest Management (IPM) has also been adopted at the state level with great enthusiasm with the help of the universities of the state. The area covered under IPM activities like augmentation and conservation of bio-control agents by CIPMC, Solan, is 23,331 hectares till January, 2002 and the crops covered are paddy, tomato, cabbage, peas, cauliflower, beans, apple, plum, pear, etc. The bio-control laboratory has also promoted IPM activities by conservation of bio-control agents in 449 hectares and augmentation in 493 hectares till January 2002, mainly in crops like paddy, cole crops, onion, potato, tomato, etc. Major pests and diseases for which IPM packages have been developed are given in Table 11.22.

Bio-pesticides and *neem*-based pesticides are not readily available in the market. Therefore, their usefulness and application procedures are not known to most of the farmers. Efforts are being made through

various extension agencies to make the farmers aware of the benefits of bio-control agents and IPM. Pesticide testing laboratories should be efficient to check the samples quickly and catch the culprits indulging in malpractices before it is too late. Presently, there are limited number of quality control test laboratories for checking fertilisers and pesticides. Their number should be increased.

TABLE 11.22

Integrated Pest Management Packages Used in the State

Crop	*Pest/Disease*
Rice	Rice Sterm Borer, Leaf Folder,
Potato	Tuber Moth
Rapeseed and Mustard	Aphid
Ginger	Rhizome Rot
Brinjal	Fruit and Shoot borer, Hodda Beetle, Jassids, Mites, Bacterial blight, Wilt, Phomopsis blight, Fruit rot and Nematodes
Pea	Leaf minor, Pod borer, White rot, Powdery mildew, *Ascochyta blight*, Bacterial blight, Rust, Root rot and Wilt
Tomato	Bacterial wilt, Fruit rot, Blight, Leaf spot, Damping-off, Fruit Borer, Cut worm, Fruit flies
	Package for White Grub, Cut Worm and *Heliothis armigera*

Source: National Conference on Agriculture (H.P), 2002.

Farm Implements

Farm mechanisation is limited to the southwest submontane region where land is mostly flat and less undulated. In the hilly terrain, small tractors, power tillers and power sprayers are made available to the farmers on subsidy but mechanisation is rather marginal and only some big orchardists use these implements. There is great scope for giving farm equipment on hire. Special small instruments to meet the needs of hill farming have to be developed and popularised.

Developmental Potential, Prospects and Constraints

Crop Production

The increase in the population of Himachal Pradesh from 45 lakh to 61 lakh in the 1980-2000 decades has naturally led to an increasing demand for food. Since the inception of the state, cultivation of foodgrains has been a priority with the farmers as well as with the state. It is a matter of concern that food production has not been able to keep pace with the demand even though there has been a massive increase in the technology input and money for the development of agriculture in the state.

At present, there is a deficit in the state's production of foodgrains, except maize. Despite having missions for increase in the production of pulses and oilseeds the yields are still low. In fact, the average production of wheat, rice, pulses and oilseeds, besides many other crops, is lower than the Indian average.

The main reasons attributed to low production are:

- Cultivation is on the slopes
- The soils are shallow
- Irrigation is limited
- Land holdings are small and scattered
- Use of inputs is limited
- Farm mechanisation is scarce
- Absence of quality and certified seed

However, nowhere management of production and dissemination of technology have been considered as factors responsible for low productivity. In fact, these are the two key reasons of low productivity because the basic physical situation that exists in Himachal Pradesh has a parallel in some hilly South-East Asian and European regions where productivity is much higher. There is tremendous scope for improving the land-use pattern and minor irrigation schemes for giving a boost to production. Dissemination of suitable and practical technologies which are available have not received due emphasis.

The state is trying to improve agricultural production through various policies, projects and schemes. Quality seed production is a great determinant for increase in production. The state depends upon local farmers for its seed production programmes. A large number of private seed growers are also allowed to sell their seed, hybrid or otherwise, to the growers directly. Though it is claimed that the private seed dealers get their seed approved from the designated agencies, yet very often the farmers are cheated because of the poor quality of the seed. Nevertheless, quality certified HYV seed of different crops has yet to reach a large number of farmers. The state agricultural university and state department of agriculture can join hands in developing programmes for seed production and distribution. Private sector can also be encouraged to participate in the programme under proper guidelines so that farmers are not cheated.

The consumption of chemical fertilisers in the state is hardly 40 kg per hectare per year as compared to the Indian average of 95 kg per hectare per year. Chemical fertilisers are available to small and marginal farmers and the Scheduled Castes and Scheduled Tribes on 50 per cent subsidy. Even then fertiliser consumption is very low, indicating that the usefulness of chemical fertilisers is not known to most of the farmers. Farmyard manure obtained from domesticated animals remains the most favoured fertiliser.

The demographic structure of the villages reveal that 2613 villages have more than 50 per cent concentration of the Scheduled Castes and Scheduled Tribes who have an average operational landholding of 0.7 to 1.2 hectares per household. Nearly 64 per cent of the total landholdings are less than one hectare. In the hilly terrain, landholdings are small and scattered and thus unmanageable. This is one of the biggest bottlenecks hampering the development of agriculture. Furthermore, the land lease and tenancy laws are conservative and orthodox with the result that leasing out of farmland becomes difficult. On account of this, the farmers prefer to keep their land fallow than to lease it out to other farmers.

Eighty per cent of the farming in the state is rainfed and about 70 per cent of the rainfall occurs in the three months of the rainy season. Most of the rainwater is lost through *nallah*, streams, and rivulets and as run-off. Although construction of water harvesting structures for conserving rainwater has been taken up by the farmers, yet this process is slow and has not been adopted on a mass scale for want of awareness and appropriate technology.

Similarly, though incentives have been offered to farmers to construct water tanks and shallow wells as subsidy, even these schemes have met with limited success in augmenting irrigation. A state with ample water resources should not have agriculture dependent on rain. At present only one per cent of the cultivated area has assured irrigation, whereas a large potential exists to augment irrigation through major and minor schemes. Watershed development is another convenient method to conserve rainwater, the technology for which has to be disseminated and used extensively to make these support the main irrigation programme.

Soil conservation has to be considered with all seriousness as rapid felling of forest trees and clearing of bushes by rampant grazing is leading to erosion of hills on large scale. Besides, during rains, flash floods also cause enormous damage to the soil. While bringing more land under cultivation is very expensive and difficult, it is necessary that the existing soil resources are well protected and guarded. Besides soil erosion, mineral starvation and disturbances in soil physico-chemical characteristics have to be kept under check. Soil management thus assume great importance.

It is encouraging to note that the state is putting emphasis on the use of bio-fertilisers, bio-pesticides, integrated pest management and integrated nutrient management programmes. In addition the state has set up testing laboratories for pesticides and fertilizers to minimize adulteration. There are very few soil testing laboratories in the state with facilities for micronutrient tests and these need to be augmented.

Apparently, there are a number of projects and schemes for the development of agriculture, yet the action programmes do not seem to have reached the stakeholders because of relatively less emphasis on communication technology and dissemination practices. Emphasis is laid on training of agricultural development officers and a few farmers through a number of courses. However, personal contacts with the farmers and demonstration and adoption of modern cultivation technologies have been the backbenchers. The universities at Palampur and Solan need to have strong and modernised agricultural extension and training programmes for each district and the state Agriculture Department should have mobile teams to train and visit the farmers frequently and lay extensive demonstrations in the farmers' fields. Such an exercise will go a long way in improving the productivity level. Technology, information and communication are the keys to agricultural progress by increasing the receptivity and awareness of the farmers. Added to this, if farmers are organised into farmer interest groups, community groups, using Panchayati Raj Institution as a tool along with NGO's and private sector, a lot can be achieved in short time.

Horticulture

Horticulture is the strength of Himachal Pradesh. Its topography allows the production of all kinds of fruit crops ranging from temperate to sub-tropical species. The gross annual turnover of the state's horticulture industry is over Rs. 600 crore from less than five lakh farming families. Normally 75 to 80 per cent of the horticultural produce is marketable surplus, which can either be processed or exported.

Taking advantage of the variation in climate, the state is producing fruits as well as vegetables, which

mature early, or late in the season and this fetches a better price in the markets of the neighbouring states. This competitive advantage has not been fully exploited for want of adequate infrastructure. Similarly, the surplus marketable horticultural produce often languishes in remote markets for want of infrastructure, transport, cold storage, processing facilities and above all suitable marketing outlets and intelligence for disposal of the produce.

Most of the apple orchards are old and have become less productive while the replacement rate of newer hybrid/dwarf cultivars of apples and pears is slow. The urgency of developing planting material is great and the University at Solan should develop technologies for mass production and the horticulture department should energise its resources to distribute and ensure their planting rapidly. In the meantime, suitable package of practices be evolved for the aging orchards where replacement of plant is not immediately due. Increasing productivity of aging orchards is dependent upon proper management and technical input. Proper linkages be established between horticultural scientists of the universities, government and the farmers so that declining trend in productivity is arrested and if possible reversed till new planting material blooms for high production.

The population of non-bearing fruit trees occupies a large, occupying area, which could be used profitably. Encouraging cultivation of olives, kiwi fruit, saffron and similar crops can only have ornamental value since their cultivation has become very professional in other countries and some states of India. In contrast, flower cultivation; exotic vegetables, off-season vegetables and organic farming have tremendous potential and competitive advantage to the state with very little extra effort on the development of infrastructure. Comparatively the best crop productivity average of the state is lower than the best in the world (Table 11.23) thereby showing the productivity gaps, which could be filled with the use of modern technologies. The two state universities can play a significant role in this.

Biotechnology in Agriculture

The state government in 2001 with the objective of harnessing biotech developments for increasing agricultural and industrial production established a Department of Bio-technology. The Department of Biotechnology has a mission for promoting diversified farming of high value cash crops, conservation and commercial exploitation of bio-resources and promoting entrepreneurships in biotechnology based industries in the state. Three state universities at Palampur, Solan and Shimla, the Institute of Himalayan Bio-resource Technology, Palampur, and the Central Potato Research Institute, Shimla, are responsible for research and development besides developing the human resource. Biotechnology parks are also being set up in association with the private sector at Solan and Shahpur. The main emphasis is on improving agriculture through biotechnology and the use of micro-propagation through tissue culture, mass micro-propagation of fruit trees and forestry material, somatic embyogenesis, meristem culture for disease-free material, cell/ protoplast culture, somaclonal variations, genetic transformation, gene manipulations and genetic engineering etc. The biotechnology laboratories require large funding for research and ultimate application of the developed technologies and human resource development for which the state government and other agencies are contributing. It is expected that the lead taken by the state in giving importance to biotechnology will enrich its programmes in agriculture including horticulture, floriculture and other related areas.

TABLE 11.23

Productivity of Different Crops in Himachal Pradesh, India and Best in the World (2000-01)

(Kg/ha)

Crop	*H.P*	*India*	*World's Best*	
Foodgrains				
Rice	1423	2914	12090	Australia
Wheat	1266	2756	8656	Ireland
Maize	2272	1769	10226	New Zealand
Vegetables				
Tomato	34645	15068	377667	Ukraine
Beans (Green)	9921	9600	12471	Israel
Pea (Green)	9574	10000	16010	France
Cabbage	28663	18085	57641	Germany
Cauliflower	18164	15000	45134	New Zealand
Capsicum	9355	9074	49639	Kuwait
Potato	23890	18657	46662	Bosnia

Source: FAO Abstract, 2002.

Statistical Outline of Himachal Pradesh, 2001.

Thrust for Development Initiative

Land Use

Small, scattered and unconsolidated landholdings are a limiting factor for intensive agriculture. Land lease and tenancy regulations do not allow the farmers to acquire cultivable land for commercial cultivation. Even

farm mechanisation becomes difficult with small holdings. All these result in low productivity of crops. Land reforms, therefore, assume great importance in the context of low productivity of the crops in the state.

Input-use Efficiency

Among the vital inputs, the use of fertilizers and pesticides is very restricted and limited to a few crops. Even irrigation is scanty and appears to be somewhat misused. Distribution of the seed of high yielding varieties is faulty as it is not being supplied in full in areas where there is assured irrigation (see Table 11.20). There is need for bringing more areas under irrigation at a rapid pace. Programmes of major, medium and minor irrigation projects are moving at a slow speed. Minor irrigation needs to be encouraged in all areas along with watershed development wherever possible. The state policy to develop power through micro hydel projects should be integrated with its major or minor irrigation projects so that its irrigation potential is increased rapidly and the drought prone areas are well served. Conservation of water by the use of drip and sprinkler irrigation for vegetable and fruit crops and rainwater harvesting will add to the irrigation potential. Participation of local communities is essential in appropriate execution of water conservation and management.

Certified seeds of high yielding varieties of vegetables, flowers and other important crops or hybrids with assured germination should either be produced within the state or procured from authorised agencies for distribution in the state. Private seed dealers may be allowed to sell seeds of known and certified varieties only, for which checking agencies need to be installed.

Cropping Pattern

The State has the advantage of its topography and climate where all kinds of crops can be grown. The present scenario of the cropping pattern reveals that most of the foodgrain crops, oilseeds, pulses, millets, etc., are grown by a large number of farmers, even when their productivity is low and economically these do not yield good returns.

Should all crops be grown in the state? Instead, the focus should be on crops like maize, potato, ginger and some high yielding, exotic, off-season and temperate vegetables and other crops which have high productivity and give good economic returns to the farmers. This policy can help the farmers and the state in improving agriculture.

Horticulture

Apple has made the state popular while for other fruits it is yet to gain ground. Productivity of all the fruits is lower than the Indian average. Apple orchards are old, becoming unproductive and the replacement rate with newer and high yielding varieties is three per cent per year. Similarly, no cultivars of mango, citrus and litchi are making any headway in production and productivity. Nearly 16 per cent of the area under temperate and dry fruit trees are non-bearing. Technology for production of fruits, including the use of inputs and farm machinery, is very old and needs to be replaced. At the present rate of introduction of high yielding dwarf cultivars of temperate fruits, it will take about 20 years to gain advantage in their production. While there is marketable surplus of apple in the state, there is no adequate backing for utilising the produce for processing purposes and marketing infrastructure is inadequate.

Introduction of kiwi fruit, olives, hazel nut, pecan nut is attractive, yet these demand an extra degree of technical input to achieve economic productivity. Instead of venturing on newer introductions, it would be worthwhile to pay extra attention to improving the quality and productivity of the existing fruits by developing professional management and through the injection of newer technologies and infrastructure back-up.

Flowers

Economic gains from flower cultivation come with strong infrastructural support for marketing. The state neither has an international airport nor extensive cold storage and road network for this perishable produce. Nevertheless, taking advantage of climatic factors, professional flower cultivation, leading to production of seed and bulbs/rhizomes, can be profitable and safe. Production of cut flowers for nearby markets give of temporary advantage.

Vegetables

The state has the distinct advantage of climate in the production of vegetables, including potato and ginger, as productivity is higher than the national average in many cases. Additional inputs of modern technology, like out-of-season cultivation, cultivation in glass houses and poly houses; research and other modern management inputs can make a serious contribution to boosting the production of vegetables. The state can earn additional revenue by concentrating

on growing exotic vegetables like Broccoli, Brussels sprouts, asparagus, leek, horseradish, out-of-season vegetables and vegetable seeds. Tremendous potential exists in these areas when the extension agencies and universities support the cultivators in their efforts for modernisation and upgradation. Value addition to surplus vegetables will be an added economic activity.

Other Crops

Cultivation of tea in Kangra district needs full encouragement. The produce has an acceptable national and international market as the Chinese hybrid tea has both flavour and strength of the brew. Currently, the tea gardens are small, scattered and improperly managed. Concerted effort is required to organise tea plantations on a commercial basis and support the system developed for extensive cultivation of tea and its processing on modern lines.

Medicinal and aromatic plants need special attention as these are not only valuable from the health or cosmetic point of view but are also great foreign exchange earners. Extensive surveys leading to the creation of an exhaustive inventory is required. A full package of practices for the cultivation of commonly used medicinal and aromatic plants should be developed and popularised among the farmers who have assured marketing by government or private agencies. Leaving valuable plants to be exploited by commercial organisations can result in over exploitation and ultimate extinction which must be avoided at all costs.

Commercial and Contract Farming

Commercial and contract farming require relatively large farms. Because of the low yields from small holdings or terraces, contract farming seems a remote possibility. Land reforms and relaxation in land-lease regulations can encourage both contract and commercial farming and give an opportunity to the corporate sector to enter the field of agriculture by providing services and thereby increasing productivity.

Organic Farming

Most of the small and marginal farmers are not using chemical fertilisers or pesticides due to economic reasons. Some such farmers can be lured into organic farming by the technical experts of the agricultural universities and the department of agriculture by providing adequate training and incentives. This can be very profitable particularly in vegetable and fruit cultivation besides tea. Technological and management inputs are necessary for introducing this activity.

Technology and Information Boost

The Agricultural University at Palampur and the Horticulture and Forestry University at Nauni (Solan) are the two organisations mandated to generate technologies for improving crop and horticultural production. While the state has ventured into the cultivation of all kinds of crops, fruits and vegetables, it has lagged in utilising the modern cultivation technologies evolved by local and other leading organisations in the country. Above all, the extension network of the universities and the state Departments of Agriculture and Horticulture have not been able to reach the farmers with modern technology, appropriate seed and other inputs. Technology development and dissemination appears to be a weak link, which should receive full attention for boosting production. Modern training programmes can be introduced at village level for crop cultivation.

Infrastructure

Infrastructure for agriculture is particularly deficient in terms of roads, cold stores, power and irrigation. Valuable agricultural produce does not fetch appropriate returns. Quality control laws are inadequate. Augmenting the infrastructure in the hilly regions in particular will greatly boost agricultural and horticultural productivity as well as profitability to the cultivators. Facilities for quick marketing of perishable produce, supported by market intelligence, a chain of cold stores and processing industry, are necessary to encourage the farmers to accelerate their production capabilities. Procurement of quality and graded produce and direct marketing without the involvement of middlemen will greatly improve the economy of farmers.

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