



Department of Agriculture
Himachal Pradesh

DISTRICT AGRICULTURE PLAN

LAHAUL-SPITI, HIMACHAL PRADESH

Volume - VII



Consulting Agency
CSK, Himachal Pradesh Agricultural University
Palampur, 176 062

Reference citation :

DOA. 2009. District Agriculture Plan: Lahaul-Spiti, H.P., Vol. VII

First Printed: April, 2009

Printed at :

Azad Hind Stores (P) Ltd.,

S.C.O. 34, Sector 17-E, Chandigarh

Ph. : +91 - 172 - 2704511-14

District Agriculture Plans of Himachal Pradesh

1. **Bilaspur**
2. **Chamba**
3. **Hamirpur**
4. **Kangra**
5. **Kinnaur**
6. **Kullu**
7. **Lahaul-Spiti**
8. **Mandi**
9. **Shimla**
10. **Sirmaur**
11. **Solan**

FOREWORD

Reducing hunger and poverty in the country by half by 2015, the first UN millennium development goal, remains a serious concern. The small and marginal farmers constituting 65 per cent of the producers in India face hunger and poverty. Food insecurity among them is both a cause and consequence of poverty. Farmers are also consumers and 70 per cent of the consumers in India are also those who earn their livelihood in farming. Because of continuing poor performance of agriculture in rainfed areas and by these farmers, the growth rates of Indian agriculture witnessed sharp deceleration during the last decade, plummeting to less than 2 per cent for the decade 1995-2005 and then rising slightly above two per cent during 2006-07. However, it is still much less than the expected growth rate of 4 per cent. The Eleventh Five Year Plan (2007-2012) has set a target of 4 per cent for agricultural sector against 9 per cent for the economy as a whole. Therefore, how the nation and states jointly prepare the farmers to learn to live under the new challenges and opportunities will largely determine the success in managing the national food security and poverty scenario.

The uncommon opportunities for launching a new initiative named evergreen revolution, especially to address agricultural concerns of small farmers in rainfed areas, demand innovative policies and strategies, new planning and frontier technologies which can enhance productivity per unit of land and water. For this purpose, the most important strategic programme introduced in the Eleventh Five Year Plan is Rashtriya Krishi Vikas Yojna (RKVY) with an outlay of Rs. 25,000 crores. It gives states more flexibility and incentives to spend more on agricultural sector. The additional assistance is given to the state governments, provided expenditure on agriculture by the state governments is higher than the base period, which is defined as the moving average of the expenditure of the preceding three years. The success of efforts of states in the coming five years will depend on the scale of success of synergies it is able to develop with RKVY and other programmes.

To avail additional assistance under this scheme, a framework has been provided which requires that every district should draw up a district agriculture plan that fully utilises an initial resource envelope from all existing schemes, state or central, including resources at the district level from central schemes such as those of Ministry of Rural Development, Ministry of Panchayati Raj and other Ministries. *“The DISTRICT AGRICULTURE PLANS (DAPs) are aimed at determining the overall resource envelope of each district, its production plan and the associated input plan”*. The DAPs will document the diversity of farming economy and growth patterns within the district, potential micro climatic niches, farming systems and natural resources, cropping patterns and livestock. It has also been emphasised to integrate these district level agricultural plans with the state plan. It has been made mandatory to prepare DAPs in accordance with the guidelines issued by the Planning Commission, so as to benefit from the new central schemes for agricultural development.

It is in this context that the Department of Agriculture, Govt of Himachal Pradesh, entrusted the task of preparing the District Agriculture Plans (DAPs) of eleven districts except Una and State Agriculture Plan (SAP) to the H.P. Agricultural University, Palampur. The university took this gigantic task seriously and constituted a core team of agricultural economists under the leadership of Dr. H. R. Sharma, Professor and Head Department of Agricultural Economics, Extension Education & Rural Sociology. The team developed conceptual framework and evolved methodology for the selection of sample panchayats. Overall, 367 sample panchayats were selected from all the 72 blocks of eleven districts in the state. Two questionnaires, one to collect data at the block level and other to collect data at the panchayat level, were prepared. To accomplish the task of data collection, over 200 scientists of the university were engaged for conducting field survey and secondary data collection from across the state in as many as 72 teams. The scientists remained in the field for about two weeks and collected data from the

selected panchayats and blocks using participatory rural appraisal (PRA). To ensure comprehensiveness in data collection for these plans, each district was assigned to a team(s) of agricultural economists. The agricultural economists incharge of different districts worked to prepare draft agriculture plans for different districts, including state agriculture plan.

The field data were further compiled and analysed by the core team of agricultural economists. The plans have been prepared as per the guidelines laid down by the Planning Commission in Comprehensive District Agriculture Plan Manual (C-DAP). Each DAP document contains a plethora of information on various aspects of agricultural development such as cropping patterns, cropping systems, input use, yield gaps, diseases, constraints and required R&D interventions, projected rates of growth for major agricultural crops and agricultural sector including horticulture and animal husbandry and projected input requirements. DAP documents also contain estimates on rural roads, available irrigation potential including water harvesting, soil conservation, human resource requirement and researchable issues that require attention to boost agricultural production and productivity of agricultural sector.

In accomplishing this task, a large team of scientists, administrative staff of the university and key persons of the state Government played key roles. The team leader, Dr. H. R. Sharma and his core team comprising Dr. S. K. Chauhan, Dr. K. D. Sharma, Dr. Virender Kumar and Dr. Harbans Lal prepared the broad framework for preparing the plans. Dr. Kamlesh Singh, Professor Statistics, Mr. Vaibhav Kalia and Mr. Kapil Sharma computer programmers developed a computer programme to analyse the data. The District Agriculture Plan for Lahaul and Spiti was prepared by Dr. H. R. Sharma Dr. K. D. Sharma. In addition, a large number of scientists and administrative staff of the university were involved in the first ever such state wide field survey for weeks. I wish to place on record my appreciation of the wonderful work done by each one of the above named persons and those I could not mention by name.

Throughout the work on DAPs, the university team received valuable backup advisory support from several officers of the Department of Agriculture, Horticulture and Animal Husbandry in particular from Mr. J. C. Rana, Director, Agriculture, Mr. H. R. Sharma, Additional Director, Agriculture and Mr. Y. P. Thakur, Superintendent Engineer (Soil Conservation) and on behalf of the university I wish to thank them. Lastly, I appreciate and acknowledge the cooperation and help so willingly offered to survey teams and economist incharges by the district level officers of different departments, especially those from the agriculture department, the scientists of UHF, Solan and the Pradhans of Panchayats as well as farmers, during the field surveys and report preparation.



DR TEJ PARTAP
Vice Chancellor

Palampur, March 18, 2009

CONTENTS

Chapter	Title of the Chapter	Page No.
	EXECUTIVE SUMMARY	vii--xxii
Chapter I	INTRODUCTION	1-6
1.1	Background	1
1.2	Data and Methods	3
1.2.1	Sampling Plan	3
1.2.2	Survey Tools	4
1.2.3	Analytical tools	4
1.2.4	Limitations	5
Chapter II	GENERAL DESCRIPTION OF THE DISTRICT	7-26
2.1	Physiography and Location	7
21.1	History and Culture	7
2.1.2	Soil and Climate	8
2.2	Demographic Features	10
2.3	Status of Agriculture	12
2.3.1	Change in Land Holdings	13
2.3.2	Land Utilisation Pattern	14
2.3.3	Cropping Pattern, Crop Production and Crop Yields	15
2.4	Production of Fruits	17
2.5	Performance of Livestock	18
2.6	Input Use	21
2.6.1	Irrigation	21
2.6.2	Area Under HYVs	22
2.6.3	Consumption of Fertilisers	22
2.6.4	Extent of Mechanisation	23
2.7	Infrastructural and Institutional Facilities	24
Chapter-III	SWOT ANALYSIS OF THE DISTRICT	27-30
3.1	SWOT Analysis for Improving Agricultural and Allied Sectors	27
3.1.1	Strengths	27
3.1.2	Weaknesses	28
3.1.3	Opportunities	28
3.1.4	Threats	29
3.2	Issues Emerging out of SWOT Analysis	30
3.3	Sectoral Growth Drivers	30
Chapter IV	DEVELOPMENT OF AGRICULTURE SECTOR	31-58
4.1	Land Use Pattern and Soil Health	31
4.2	Water Resources and Management	34
4.3	Cropping System and Cropping Pattern	37
4.4	Input Use and Gaps	38
4.5	Yield Gap Analysis	42
4.6	Reasons for Gap	43
4.7	Farm Mechanisation	45

4.8	Ongoing Schemes for Agriculture and Rural Development	46
4.9	Interventions for District and Financial Estimates	49
4.10	Research/Extension Gaps	52
4.11	Researchable Issues	55
V	ALLIED AGRICULTURAL SECTORS	59-84
5.1	Horticulture	59
5.2	Animal Husbandry	60
5.3	Fisheries	60
5.4	Poultry	61
5.5	Mushroom	61
5.6	Medicinal Plants	61
5.7	Bee Keeping	63
5.8	Agro Eco Tourism, Organic Farming and Protected Cultivation	63
5.9	Agricultural Marketing	64
5.10	Infrastructure and Institutional Development	67
5.11	Rural Enterprises	69
5.12	Agro-Processing	73
5.13	Drudgery of Women	74
5.14	Input Use and Gaps	76
5.15	Yield Gap Analysis	78
5.16	Reasons for Gap	78
5.17	Interventions for the District and Financial Estimates	79
5.18	Research/Extension Gaps	82
5.19	Researchable Issues	82
VI	DISTRICT PLAN	85-98
6.1	DAP and Sectoral Outlays	85
6.2	New Schemes for Agricultural Development	86
6.3	Input Requirement	89
6.4	Projected Outcome and Growth Rates	91
6.5	Growth Drivers and Expected Outcomes	93
6.6	Innovative Schemes	95
6.7	Vision of Next Plan	95
6.8	Prioritisation of Schemes	96
	APPENDICES	99-104

LIST OF TABLES

Table No.	Title	Page
1.1	Sampling Plan	4
2.1	Rainfall Pattern, 1990-91 to 2002-03	10
2.2	Demographic Features; 1981 to 2001	10
2.3	Block Wise Demographic Features, 2001	11
2.4	Occupational Distribution of Workers	11
2.5	Block-wise Occupational Pattern of Working Population, 2001	12
2.6	Structure of Land Holdings in Lahaul-Spiti District, 1980-81 to 1995-96	13
2.7	Average Size of Holdings, 1980-81 to 1990-91	13
2.8	Changes in the Land Utilization Pattern, 1990-91 to 2004-05	14
2.9	Trends in Area under Different Crops, 1990-91 to 2004-05	15
2.10	Changes in Cropping Pattern; 1990-91 to 2004-05	16
2.11	Extent of Diversification (Herfindahl Index)	16
2.12	Productivity of Major Crops, 1990-91 to 2004-05	17
2.13	Trends in Area and Production of Fruits, 1990-91 to 2004-05	18
2.14	Changes in Livestock Population, 1982 to 2003	19
2.15	Composition of Improved and Indigenous Livestock	20
2.16	Trends in Livestock Production, 1990-91 to 2006-07	20
2.17	Productivity of Livestock, 2006-07	21
2.18	Crop Wise Irrigated Area under Major Crops	22
2.19	Consumption of Fertilizers, 1991-92 to 2005-06	23
2.20	Implements and Machinery in Lahaul & Spiti; 1992 and 2003	23
2.21	Extent of Mechanization, 1992 and 2003	24
2.22	Institutional Infrastructure (as on March 31, 2006)	24
4.1	Land Utilization Pattern	32
4.2	Land Utilization Pattern- Problems	33
4.3	Cropping Pattern in Lahaul-Spiti District	38
4.4	Input Use, Requirement and Gap	40
4.5	Estimated Requirements and Gaps in Manures and Fertilizers	42
4.6	Yield Gap in Different Crops	42
4.7	Reasons for Gap in Crop Yields in Lahaul-Spiti	43
4.8	Major Diseases Limiting Crop Production in Lahaul & Spiti	44
4.9	Priority Wise Weeds Problems in Different Crops	44
4.10	Farm Machinery Use & Gap	45
4.11	Problems and Intervention for Farm Machinery	46
4.12	Existing Schemes for Agriculture and Rural Development	47
4.13	Status of Completed Irrigation Schemes	48
4.14	Status of Functional Irrigation Schemes	48
4.15	Status of Non-Functional Irrigation Schemes	49
4.16	Status of Ongoing Irrigation Schemes	49

4.17	Land Utilization Pattern: Interventions for Land Improvement	50
4.18	Improvements Needed to Increase Productivity of Land	51
4.19	Funds Required for Land Development	51
4.20	Irrigation Schemes: Funds for Repair and Maintenance	52
4.21	Varietal and Technological Problems of Main Crops	53
4.22	Interventions for Improving Production of Crops	54
5.1	Potential for Horticulture Development in Lahaul & Spiti	59
5.2	Estimated Livestock Population	60
5.3	Cultured Fisheries: Existing Status, Potential and Diseases	60
5.4	Constraints/Interventions in Cultured Fisheries	61
5.5	Area under Medicinal and Aromatic Herbs	62
5.6	Important Medicinal and Aromatic Species of Lahaul & Spiti	62
5.7	Places of Interest and Adventure for Agro Tourism	64
5.8	Estimated Marketed Surplus and Marketing Pattern in Lahaul & Spiti	65
5.9	Marketing Infrastructure –Existing and Required (Number)	67
5.10	Agricultural Research and Development Institutions in Lahaul & Spiti	68
5.11	Human Resource for Agricultural Development	69
5.12	Occupation Pattern and Livelihood Options of Farmers in Lahaul & Spiti	70
5.13	Unemployed Educated Persons in Lahaul & Spiti	72
5.14	Potential Enterprises for Employment of Educated Manpower	72
5.15	Status and Potential of Different Rural Enterprises	73
5.16	Extent of Drudgery of Women in Agricultural Operations	74
5.17	Drudgery of Women in Livestock Rearing	75
5.18	Problems and Constraints in Horticultural Development	77
5.19	Gaps in Feed and Fodders	77
5.20	Yield Gaps in Horticultural Crops	78
5.21	Yield Gaps in Livestock Production	78
5.22	Incidence of Livestock Diseases	79
5.23	R & D Interventions for Horticultural Development in Lahaul & Spiti	80
5.24	Interventions for Livestock Improvement	80
5.25	Financial Estimates for Marketing Infrastructure of Livestock Products	81
5.26	Financial Estimates for Human Resources	81
6.1	District Plan: Sectoral Outlays and Yearly Allocation	85
6.2	New Schemes for Agriculture and Rural Development	87
6.3	New Irrigation Schemes	89
6.4	Estimated Requirements of Seeds and Planting Material in Lahaul & Spiti	90
6.5	Projected Fertilizer Requirement in Lahaul & Spiti	90

6.6	Augmentation of Land and Water Resources: Physical Targets	91
6.7	Projected Output and Growth in Agriculture in District Lahaul & Spiti	91
6.8	Existing and Potential Output and Growth in Agricultural Crops in Lahaul & Spiti District	91
6.9	Projected Production and Growth in Horticulture	92
6.10	Livestock Production - Existing and Potential	92
6.11	Projected Value of Output and Sectoral Growth in Lahaul & Spiti District	93
6.12	Prioritisation of Different Schemes	97
	Appendix Tables	99-104
1	Demographic and Institutional Features of Lahaul & Spiti	99
2	Estimated Area under Different Crops in Lahaul & Spiti	101
3	Status of Migratory Labour in Lahaul & Spiti	103
4	Distribution of Workers and Categories of Households	103

EXECUTIVE SUMMARY

I District Agricultural Plan: Funding Proposal for Five Years (Lakh Rs.)

Sr. No.	Schemes	Total Plan Outlay	Yearly Allocation				
			I	II	III	IV	V
I	Interventions to Improve and Enhance Sustainability of Crop Production System	1840	276	368	368	368	460
1	Improvement of productivity of cereals, pulses, oilseeds, vegetables and spices crops through promotion of HYV seeds including hybrids	250	37.50	50	50	50	62.5
2	Improvement of soil health through vermi-composting, bio-fertilizers, micro nutrients, soil testing etc.	150	22.5	30	30	30	37.50
3	Protection of crops against biotic stresses (diseases, pests, weeds) and abiotic stresses (hailstorms, draught, flash floods, etc) and other risk factors	80	12	16	16	16	20
4	Water use efficiency through micro irrigation	900	135	180	180	180	225
	(i) Sprinkler	800	120	160	160	160	200
	(ii) Drip	100	15	20	20	20	25
5	Agricultural mechanization through popularization of improved tools and hill specific machinery like power tillers, tractors, crop planters/ harvesters, sprayers, clod breakers and gender friendly post harvesting equipments etc. to remove women drudgery	150	22.5	30	30	30	37.50
6	Protected (poly house) cultivation to minimize risk factors and enhance quality and productivity	300	45	60	60	60	75
8	Strengthening of seed production farms and promotion of infrastructure to improve seed production and replacement	10	1.5	2	2	2	2.5
II	Need Based Infrastructure Development	967	145.05	193.4	193.4	193.4	241.75
1	Improvement of on-farm water delivery and efficiency of existing irrigation systems	667	100.05	133.4	133.4	133.4	166.75
2	Rural markets	300	45	60	60	60	75
III	Natural Resource Conservation and Management	1137	170.55	227.4	227.4	227.4	284.25
1.	Soil conservation of arable and non-arable land through engineering measures	445	66.75	89	89	89	111.25
2.	Water harvesting check dams, ponds, tanks, etc	207	31.05	41.4	41.4	41.4	51.75
3.	Land improvement	485	72.75	97	97	97	121.25

IV	Niche Based Enterprises for Rural Entrepreneurs	210	31.5	42	42	42	52.5
	(i) Organic farming	145	21.75	29	29	29	36.25
	(iv) Agro-tourism	50	7.5	10	10	10	12.5
	(v) Medicinal and aromatic plants	15	2.25	3	3	3	3.75
V	Fruit Production	767	115.05	153.4	153.4	153.4	191.75
VI	Livestock, Poultry & Fisheries	1482	222.3	296.4	296.4	296.4	370.5
1	Livestock improvement	1420	213	284	284	284	355
2	Fisheries	62	9.3	12.4	12.4	12.4	15.5
VII	Human Resources	345	51.75	69	69	69	86.25
1	Additional man power requirement	335	50.25	67	67	67	83.75
2	Capacity building of extension personnel	10	1.5	2	2	2	2.5
VIII	Research & Extension	128	19.2	25.6	25.6	25.6	32
IX	All Sectors & Schemes	6876	1031.4	1375.2	1375.2	1375.2	1719

Note: The funding proposal for the next five year plan is extracted from the comprehensive District Agriculture Plan. This plan excludes full amount of funds earmarked for development of irrigation and rural roads for connectivity and 50 per cent of the funds estimated for rural markets and water harvesting

II Comprehensive District Agriculture Plan: Sectoral Outlays and Yearly Allocation (Rs. Lakhs)

Sr. No.	Schemes	Total Plan Outlay	Yearly Allocation				
			I	II	III	IV	V
I	Interventions to Improve and Enhance Sustainability of Crop Production System	1840	276	368	368	368	460
1	Improvement of productivity of cereals, pulses, oilseeds, vegetables and spices crops through promotion of HYV seeds including hybrids	250	37.50	50	50	50	62.5
2	Improvement of soil health through vermi-composting, bio-fertilizers, micro nutrients, soil testing etc.	150	22.5	30	30	30	37.50
3	Protection of crops against biotic stresses (diseases, pests, weeds) and abiotic stresses (hailstorms, draught, flash floods, etc) and other risk factors	80	12	16	16	16	20
4	Water use efficiency through micro irrigation	900	135	180	180	180	225
	(i) Sprinkler	800	120	160	160	160	200
	(ii) Drip	100	15	20	20	20	25
5	Agricultural mechanization through popularization of improved tools and hill specific machinery like power tillers, tractors, crop planters/ harvesters, sprayers, clod breakers and gender friendly post harvesting equipments etc. to remove women drudgery	150	22.5	30	30	30	37.50
6	Protected (poly house) cultivation to minimize risk factors and enhance quality and productivity	300	45	60	60	60	75
8	Strengthening of seed production farms and promotion of infrastructure to improve seed production and replacement	10	1.5	2	2	2	2.5
II	Need Based Infrastructure Development	14387	2158.05	2877.4	2877.4	2877.4	3596.75
1	Irrigation	1258	188.7	251.6	251.6	251.6	314.5
2	Improvement of on-farm water delivery and efficiency of existing irrigation systems	667	100.05	133.4	133.4	133.4	166.75
3	Rural markets	600	90	120	120	120	150
4	Rural roads for connectivity	11862	1779.3	2372.4	2372.4	2372.4	2965.5
III	Natural Resource Conservation and Management	1343	201.45	268.6	268.6	268.6	335.75
1.	Soil conservation of arable and non-arable land through engineering measures	445	66.75	89	89	89	111.25
2.	Water harvesting check dams, ponds, tanks, etc	413	61.95	82.6	82.6	82.6	103.25
3.	Land improvement	485	72.75	97	97	97	121.25

IV	Niche Based Enterprises for Rural Entrepreneurs	210	31.5	42	42	42	52.5
	(i) Organic farming	145	21.75	29	29	29	36.25
	(iv) Agro-tourism	50	7.5	10	10	10	12.5
	(v) Medicinal and aromatic plants	15	2.25	3	3	3	3.75
V	Fruit Production	767	115.05	153.4	153.4	153.4	191.75
VI	Livestock, Poultry & Fisheries	1482	222.3	296.4	296.4	296.4	370.5
1	Livestock improvement	1420	213	284	284	284	355
2	Fisheries	62	9.3	12.4	12.4	12.4	15.5
VII	Human Resources	345	51.75	69	69	69	86.25
1	Additional man power requirement	335	50.25	67	67	67	83.75
2	Capacity building of extension personnel	10	1.5	2	2	2	2.5
VIII	Research & Extension	128	19.2	25.6	25.6	25.6	32
IX	All Sectors & Schemes	20502	3075.3	4100.4	4100.4	4100.4	5125.5

III Proposed Interventions and Expected Outcomes

1. Projected Output Growth in Agriculture in District Lahual & Spiti

Crops	Existing			Potential (mt)		Growth (% p.a.)	
	Area (ha)	Production (mt)	Yield (q/ha)	Scenario I	Scenario II	Scenario I	Scenario II
Maize	47	100	21.25	189	185	17.80	17.00
Paddy							
Wheat	107	199	18.64	378	370	17.98	17.19
Barley	636	915	14.39	1734	1696	17.90	17.07
Pulses	149	104	7	198	193	18.08	17.12
Foodgrains	939	1319	61.28	2499	2445	17.89	17.07
Vegetables	2342	40517	173	51183	51450	5.27	5.40

Note: i. Scenario I output growth with increased irrigated area and crop improvement programmes

ii. Scenario II output growth with diversion of 20 % irrigated area to vegetable crops

2 Projected Output Growth in Field Crops in Lahaul & Spiti District (Quintals)

Sectors	Existing	Potential	Growth (% p.a.)
I Agriculture			
Maize	977.50	1840.00	17.65
Wheat	1842.83	3066.37	13.28
Barley	15606.46	23958.72	10.70
Millets (Ogla/hafra)	377.97	921.87	28.78
Rajmash	242.57	343.08	8.29
Lathyrus (Kala matar)	33.00	39.60	4.00
Potato	156153.00	333300.30	22.69
Pea	125071.18	235500.00	17.66

Note : Potential based upon yields of progressive farmers

3 Projected Production and Growth in Horticultural Crops

Crops	Production (tonnes)				Growth (% per annum)*		
	Existing	Potential	50% potential	25% potential	Potential	50% potential	25% potential
Lahaul							
Apple	1303.27	4065.60	2684.43	1993.85	21.20	10.60	5.30
Hop	96.00	924.00	510.00	303.00	86.25	43.13	21.56
Kuth	201.60	500.00	350.80	276.20	14.80	7.40	3.70
Spiti							
Apple	325.84	8958.15	4641.99	2483.92	264.93	132.46	66.23
Hop		168.00	84.00	42.00			
Kuth		100.00	50.00	25.00			
District							
Apple	1629.10	13023.75	7326.43	4477.77	69.94	34.97	9.27
Hop	96.00	1092.00	594.00	345.00	103.75	51.88	10.00
Kuth	201.60	600.00	400.80	301.20	19.76	9.88	10.00

Note: Potential production estimated on the basis of potential area and yields and also at 50% & 25% realisation of production gaps, respectively. The annual growth estimated over ten years

4 Livestock Production - Existing and Potential

Livestock	Existing production	Potential	Annual Growth (%) over existing		
			Full potential	50% potential	25% potential
Lahaul					
Crossbred cow (milk tonnes)	4076.98	12449.06	41.07	20.53	10.27
Local cow (milk tonnes)	2432.30	5121.21	22.11	11.05	5.53
Goat (milk tonnes)	135.75	195.82	8.85	4.42	2.21
Sheep (wool tonnes)	35.63	122.87	48.97	24.48	12.24
Spiti					
Crossbred cow (milk tonnes)	986.88	2679.38	34.3	17.15	8.57
Local cow (milk tonnes)	321.60	967.21	40.15	20.08	10.04
Goat (milk tonnes)	57.29	143.23	30	15	7.5
Sheep (wool tonnes)	7.02	14.75	22.02	11.01	5.5
District					
Crossbred cow (milk tonnes)	5063.86	15128.44	39.75	19.87	9.94
Local cow (milk tonnes)	2753.90	6088.42	24.21	12.11	6.05
Goat (milk tonnes)	193.04	339.05	15.12	7.56	3.78
Sheep (wool tonnes)	42.65	137.62	44.53	11.23	5.62

Note: Potential production estimated on the basis of potential yields of different animals in the area and also at 50% & 25% realisation of yield gaps, respectively. The annual growth estimated over five years

5 Projected Value of Output and Sectoral Growth in Lahaul & Spiti District (Rs. Lakhs)

Sector	Existing	Potential	Growth (% p.a.)
Agriculture	3130.51	6121.29	19.11
Horticulture	406.94	1193.16	38.64
Animal Husbandry	1112.48	2820.67	30.71
All sectors	4649.93	10135.12	23.59

Note: Estimated on the basis of 2007-08 prices. The potential estimated on the basis of yields of progressive farmers

6 Estimated Requirement of Seeds and Planting Material in Lahaul & Spiti

Seed/Plant	Lahaul	Spiti	District
Potato seed (Tonnes)	2075.20	204.00	2279.20
Pea seed (Tonnes)	105.48	40.03	145.51
Apple plants (Number)	21000.00	74800.00	95800.00

Note : Apple plants estimated on the basis of potential

Source: Field Survey, 2007-08

7 Projected Fertilizer Requirement in Lahaul & Spiti for 11th Plan (Tonnes)

Fertilizers	Projected yearly requirement				
	1	2	3	4	5
Lahaul					
Urea	266.17	293.87	321.58	349.28	376.99
CAN	12.23	24.46	36.68	48.91	61.14
IFFCO	110.81	135.17	159.52	183.88	208.23
MOP	24.00	27.64	31.27	34.91	38.54
SSP	97.07	112.63	128.19	143.75	159.31
Spiti					
Urea	61.09	70.49	79.90	89.30	98.71
CAN	44.27	46.68	49.08	51.49	53.89
IFFCO	16.22	18.68	21.15	23.61	26.07
MOP					
SSP					
District					
Urea	327.25	364.36	401.48	438.59	475.70
CAN	56.50	71.13	85.77	100.40	115.03
IFFCO	127.04	153.85	180.67	207.48	234.30
MOP	24.00	27.64	31.27	34.91	38.54
SSP	97.07	112.63	128.19	143.75	159.31

Note : Requirement based upon the augmented operational land and gaps in the fertilizer use

Source: Field Survey, 2007-08

Interventions

- To ensure availability of quality inputs like improved seeds, fertilizers, plant protection material by improving and strengthening delivery system
- Improvement of physical, chemical and biological parameters on the basis of soil health cards proposed to be issued to all farmers
- Promotion of integrated nutrient management through vermi-composting, popularization of bio-fertilisers, and other ameliorants in addition to judicious and balanced nutrients to crops.
- Promotion of micro-irrigation for efficient management and delivery of required quantities of water as per crop needs.
- Promotion of mechanization conducive to hill farming and equipments & implements to reduce labour use and drudgery of women folk.
- Strengthening and improvement of quality control infrastructure (seed, pesticides and fertilizer testing laboratories)
- Promotion of protected cultivation along with supporting infrastructure for quality production of high-value cash crops

- Accelerating the process of replacing indigenous breeds of sheep and goats with improved breeds
- Conservation of rare indigenous animal stock like *Chegu Goats*, *Chamurthi Horse* and *Yak*
- Provision of quality plant material to promote fruit production (apple) and harness available potential
- Strengthening the existing marketing infrastructure for high value cash crops including vegetables and fruit
- Development of model villages for promoting the cultivation of high value cash crops like hops, *kuth*, etc
- To provide technical know how about different processes of value addition of the wild and cultivated apricot oil extraction.

8 Research and Extension Support

- Refinement and validation of technologies
- To speed up research on controlling rapidly spreading wilt root-rot complex disease in pea
- To conduct research on different aspects of seabuckthorn and its products
- *Ex-situ* and *in situ* conservation of minor millets
- Transfer of technologies through extension interventions like trainings, demonstrations, exposure visits, replication of success stories, etc.
- Validation of ITKS
- Use of IT for technology dissemination by creating IT hubs at focal points
- To create a farmers advisory system to address their day - to - day queries
- To promote and strengthen the public- private partnership for ensuring delivery of need based inputs and technologies
- To provide technical know how to farmers about the orchard management techniques like cutting, pruning, grafting and supply of grafting kits and also train farmers about marketing operations like grading, packaging, etc.
- To provide technical know how to the farmers for the promotion of the cultivation of seabuckthorn and about the processing of its produce for value addition
- To develop technologies to harness trout fish production potential and also provide technical know how to the fish farmers
- To spread red clover and white clover through sheep droppings to improve the productivity of alpine pastures and other grazing lands.

9 Researchable Issues

Natural Resources

- Assessment and use of water potential to provide assured irrigation
- Water harvesting to create water potential for irrigation and to augment ground water
- Characterization, classification and preparation of fertility maps of soils of Lahaul & Spiti
- Evaluation of resource conservation technologies (like conservation tillage, deficit water management, pressurized irrigation systems, nutrient-water interaction studies, recycling of waste organic residues etc.) for irrigated and rain fed areas
- Issues related to increasing water productivity of stored water through crop diversification and soil and water management practices
- Development of technologies to harness trout fish production potential and also providing technical know how to the fish farmers
- Base line survey of river catchments and assessment of ground water potential
- Assessment of economics of cash crops and impact on natural resources (soil and water) and livelihoods of people
- Studies on climate change and its impacts on agro-geology and to devise suitable strategies to tackle ill effects of climatic changes

Crop Improvement

- Development of high yielding varieties of various crops having wider adaptability and resistance to various biotic and abiotic stresses, through exploitation of land races, agronomic basis and alien species using conventional as well as non-conventional breeding approaches
- Varietal development in under utilized but highly nutritive crops like amaranths, buckwheat and other millets as well as in high value and low volume crops like kalazira and saffron
- Effective selection, conservation, evaluation, documentation and utilization of genetic resources ensuring wider coverage under improved crop varieties with major emphasis on quality seed production.
- Refinement and validation of technologies for major crops
- *Ex-situ* and *in situ* conservation of minor millets
- Validation of ITKS and use of IT for technology dissemination by creating IT hubs at focal points
- Integrated nutrient management technology demonstration on farm/field and issues in solid waste management and standardization of agro-technology for organic farming

- Development/identification of hybrids and varieties of potential vegetable crops, standardization of production technology of hybrids and development of hybrids and production technology for protected cultivation
- Refinement of green house/poly house technology for temperate region
- Sustainable vegetable production through alternative (exotic) vegetable crops or by avoiding monoculture
- Standardisation of seed production techniques for temperate and exotic vegetable crops
- Studies on economic and marketing aspects of cash crops
- To speed up research on controlling rapidly spreading wilt root-rot complex disease in pea
- Survey and surveillance of major diseases and pests of important crops
- Identification of resistant sources and study of genetics of resistance against pests and diseases
- Marker assisted selection of resistance genes using molecular markers and their use in gene pyramiding for resistance in commercial varieties
- Development of integrated disease and pest management modules suitable for organic and protected agriculture conditions
- Development of detection techniques for pathogens of quarantine importance and certification purposes relating to important seed and soil borne diseases (pea root rot and wilt complex, bacterial wilt, bean mosaic, urd bean leaf crinkle, bacterial blight, potato viruses etc.)
- Formulation of bio-intensive IPM strategies for the management of *Helicoverpa armigera* (tomato, fruit flies (cucurbits and tomatoes), cut worms (vegetables); plant parasitic nematodes (cereals and vegetables), insect pest and nematode management under protected cultivation situations
- Collection and utilization of local strains of entomopathogenic organisms for insect pest management under organic farming situations
- Identification and utilization of native botanicals for eco-friendly pest management:
- Safe management alternatives for the stored grain pests.
- Identification and management of diseases and insect-pests of medicinal, aromatic and ornamental plants:
- Weed management studies in major crops

Horticultural Crops

- Introduction and testing of apple, apricot and pistachio cultivars for determining their suitability under dry temperate conditions. Development of suitable varieties of apple, apricot and dry fruit

- Identification of niche areas and remapping of different fruit growing belts
- Standardisation of nursery practices and alternative propagation techniques for quality planting material in fruit
- Standardisation of cultivation techniques and package of practices for pistachio nuts
- Development of production module and practices for organic fruit farming
- Development of irrigation and fertigation modules for fruit crop
- Nutrient indexing and improvement of soil health in fruit especially apple
- Research on soil and water conservation practices in fruits
- Generation of data base in pollinator diversity and identification of potential pollinators
- Development of suitable IPM capsules and bio control methods for management of pests and diseases of fruit crops
- Research on safe waiting periods of pesticides in horticultural crops
- Research on post harvest management of horticultural crops
- Constraint identification and diagnostic surveys
- Studies on economic and marketing aspects of fruit crops

Animal Husbandry

- Determination of immuno-profiles of Chumurthi horses and establishing the basic immuno-profiles of Yak
- Identification of indigenous livestock health practices and documentation of the prevailing indigenous technical knowledge (ITK) and ethno-veterinary practices among Spiti farmers and their scientific validation
- Identification and nutritional evaluation of the high nutrition fodder grasses in Lahaul & Spiti, the adaptation to alpine pasture in migratory crossbred sheep/goats and development of feed blocks, silage practices and strategic mineral supplements to improve nutrition of animals
- To develop endocrinological tools to augment production and reproduction in dairy animals and to establish complete physiological blood profile of Yak, Spiti pony and Chegu goats.
- Surveillance, monitoring and control of the diseases of animals and birds including wild fauna.
- Development of herbal nutraceuticals for health and production of farm animals and toxicological studies on the poisonous plants and characterization of their toxic principles and anti nutritional factors.
- Investigation on the etiological agents of infectious infertility among bovine, ovine and caprine including male animals with special emphasis on *Brucella*, *Chlamydia*, *Mycobacterium* and fungal agents in H.P. including their molecular diagnosis.

- Preparation and testing of multiserotype vaccine against H.S. Serosurveillance of some important infectious diseases in livestock.
- Investigations on the epidemiology and serodiagnosis of *Mycobacterium bovis* infection in bovines. Molecular diagnosis and genetic diversity analysis of important pathogens responsible for major animal diseases and zoonoses.
- Evaluation of medicinal plants/herbs utilized in soft and hard tissue healing in animals.
- Standardization and further application of endoscopic and laproscopic techniques in clinical cases of abdominal disorders in small and large animals.
- Evaluation of various prosthetics and biomaterials in the management of abdominal trauma/fracture/muscular skeletal disorders in animals.
- To develop state of art in diagnostic and operative facilities including intensive care unit for small and large animals.
- Studies on economics and processing & marketing aspects of livestock products

Other Allied Areas

- Varietal development in hop and kuth crops
- Standardisation of cultivation techniques for medicinal and aromatic plants
- Development of suitable agro forestry models
- Studies on diseases and pests in important tree species particularly willow, poplars and junipers
- Genetic improvement for variety, yield and quality traits in seabuckthorn
- Research on suitable engineering designs for water harvesting and protected cultivation
- Research on development of hill specific suitable models/designs of mechanical tools and equipments for improving efficiency in various farm operations
- Studies on honey bees and rearing practices to popularise garden bee colonies
- Socio demographic and nutritional studies of households
- Scope and potential for household tourism and non-farm enterprises
- Studies on climate change, hydrology and glacial regimes
- Impact assessment of different programmes/schemes and policy implications

10 Augmentation of Land and Water Resources: Physical Targets (Ha)

Blocks	Cultivated land	Potential cultivable land	Productive support land	Potential support land	Existing irrigated area	Potential irrigated land	Irrigation potential through water harvesting
Lahaul	2156	190	25000	37027	2156	588	165
Spiti	887	780	147657	10114	887	150	
District	3043	970	172657	47141	3043	738	165

Interventions

- *In situ* soil and water conservation by employing different measures
- Improvement of support lands (private/public/community grasslands) by employing different measures for the control invasive shrubs, weeds, etc.
- Use of water potential to provide assured irrigation to rain-fed areas
- Water harvesting to create water potential for irrigation and to augment ground water
- Improvement of pastures and restoration and protection of forest grazing rights of shepherd community

11 Potential Enterprises for Gainful Employment

Sector	Enterprises
Farm	Protected cultivation, agro-tourism, medicinal plants, organic farming, seed production, nursery raising
Non-Farm	Vermi-compost, rural craft, fruits and vegetable processing.

12 Human Resource Requirement (No)

Block	Agriculture	Horticulture	Animal Husbandry	Others	Total
Lahaul	-	15	7	8	30
Spiti	-	-	-	-	-
District	-	15	7	8	30

Intervention

- Need based training to the extension personnel within and outside the country
- Exposure to places of success stories where exemplary success has been achieved in the improvement of farming systems

XIV Some Quantitative Outcomes

- Foodgrain production shall increase from 1,319 metric tonnes to 2,499 metric tonnes after the implementation of the plan recording a growth rate of 17.89 per cent per annum in scenario I. Even in scenario II when 20 per cent of irrigated land is shifted to high value cash crops production, the growth rate in foodgrains production shall be very high at 17.07 per cent per annum

- Production of vegetables would increase from 40,517 metric tonnes to 51,183 metric tonnes in scenario I registering a growth rate of 5.27 per cent per annum when the proportion of area under these crops remains same and to 51450 metric tons recording a growth rate of 5.40 per cent per annum in scenario II when 20 per cent of the irrigated area is brought under these crops. This will generate a marketable surplus of 46,305 metric tonnes. The cultivation of high value cash crops shall generate huge employment opportunities for rural unemployed youths through backward and forward linkages.
- Based upon the yield gaps of field crops between average and progressive farmers, the production of cereals and vegetable commodities can be increased substantially. If this gap is abridged, the output of wheat and barley could be increased by 13 and 11 per cent per annum, respectively. Similarly, in the production of potato and pea annual increase of about 23 and 18 per cent, respectively could be achieved.
- Irrigation potential shall be created which will provide irrigation to an additional area of 903 hectares. Since cultivation in Lahaul & Spiti is only possible under irrigation conditions, the exploitation of available irrigation potential shall lead to an increase in the cultivated area from the existing level of 3043 hectares to 3,946 hectares as with the implementation of plan an additional area of 903 hectares shall be brought under cultivation
- Support land (including public and private grasslands) of 2,19,798 hectares shall be treated against invasive weeds and shrubs. This shall improve fodder production to the approximate level of 21,980 metric tonnes.
- The area under fruit would increase from existing 368.25 hectares to 829.25 hectares resulting in total fruit production to the tune of 5,138 tonnes from 1,620 tonnes at present
- The area under medicinal and aromatic plants particularly hop and kuth will increase from existing 40 hectares each to 260 and 120 hectares, respectively there by opening more income and employment opportunities
- The estimated annual demand for seeds in case of potato and pea in the district is 2,279 tonnes of potato seed and 146 tonnes seeds of pea. Demand for apple saplings is about 75,000 in Spiti as against 21,000 in Lahaul block.
- The projected fertilizers requirement in the district would be around 476 tonnes of urea, 234 tonnes of IFFCO (12:32:16), 115 tonnes CAN, 159 tonnes SSP and 38 tonnes MOP.
- With the improvement in livestock breeds, fodder availability and rearing practices, total milk production will increase from 8,009 tonnes to 21,556 tonnes and wool production from about 43 tonnes to 138 tonnes.
- With the implementation of District Agricultural Plan, there shall be increase in the gross value output of all the primary sectors in the district. The value output of agriculture, horticulture and animal husbandry will grow with annual rate of 19%, 39% and 31%, respectively. The gross value of all the primary sectors will increase from existing level of Rs 4649.93 lakhs to Rs 10135.12 lakhs registering the annual growth of about 24 per cent over the plan period.

In brief, the implementation of District Agricultural Plan (DAP) shall strengthen and improve the physical and institutional infrastructure and shall restore, rejuvenate, conserve and enhance the health of the available natural resource base. It shall also give a big boost to the ongoing process of crop diversification towards high value cash crop agriculture including off-season vegetables and other niche based enterprises generating adequate employment opportunities for the rural unemployed youth. In concrete terms, the implementation of the plan shall go a long way in ensuring ecological sustainability and economic viability of the production systems of the district.

Chapter-I

INTRODUCTION

1.1 Background

Planning is an act or process of preparing or carrying out a focussed activity with goals, procedures and policies for economic emancipation of a social or economic unit in a given time frame. The document containing goals, targets and policies to accomplish plan targets is defined as plan. Planning in the context of district agricultural plans is an exercise of preparing an integrated plan considering available resources and encompassing all sectoral activities and schemes being carried out by the government or non-government organisations in a local government area such as panchayat, block/taluka or district. Accordingly, the plan thus prepared is called panchayat or block or district plan. The process of democratic decentralised planning in India dates back to the First Five-Year Plan (1951-1956) which underlined the need to break up the planning exercise into national, state, district and community levels. Two new elements, namely, establishment of District Development Council and drawing up of village plans and people's participation in planning process through democratic decisions were added in the Second Five Year Plan following the recommendations of Balwant Rai Mehta Committee in 1957. Several new elements have been added to strengthen the process of decentralised planning in the subsequent plans. The importance of preparing panchayat/block/district plan lies in involving the people at the grassroots/stakeholders level and those who are responsible for implementing these plans. The Administrative Reforms Commission in 1967 highlighted that planning needed to be focussed in those areas where local variations in pattern and process of development were likely to yield quick results. The Planning Commission issued guidelines to the state governments for formulating district plans in 1969. These guidelines provided details regarding the concept and methodology for drawing up these plans in a framework of annual, medium and perspective plans. The recommendations of several other Committees, namely, Danatwala (1978), Hanumantha Rao (1984) and GVK Rao 1985 were instrumental in the concretisation of the idea and concept of District Plans.

The preparation of these plans assumed special significance in the aftermath of the 73rd and 74th constitutional amendments which conferred constitutional status to panchayats at district and sub-district levels and local self-government in urban areas. Article 243 ZD of the constitution provides procedure for the constitution of District Planning Committee at the district level to consolidate the plans prepared by the panchayats and municipalities and prepare draft development plan for the whole district. The important functions proposed for the district planning committee include, *inter alia*, to (i) consolidate plans prepared by the panchayats at different levels of the rural local and urban bodies; (ii) assess the development disparity that exists between or among village panchayats, block panchayats and municipalities and identify the basic reasons for these disparities; (iii) identify and prioritise the schemes for the development of district conforming to the objectives of the state and central governments; (iv) formulate objectives and strategies for the identification and prioritisation of the schemes for the district. As per the guidelines, the preparation of district level plans have to precede, among others, by the complete assignment of the activities to be undertaken by different levels of local government, formation of District Planning Committees (DPCs).

The current crisis in agricultural sector has once again brought up the importance of preparing district agricultural plans taking into account myriad of agro-climatic niches, problems and potentials in each of the district in the country. As is well known, performance of Indian economy has been a global success story. While it has been growing at a rate of 6 per cent per annum since 1993, the growth rate has been an astonishing 9 per cent during the last four years. This is in stark contrast to the growth rate in Indian agriculture, which has witnessed sharp deceleration during the last decade or so. The growth rate has plummeted from a 3.62 per cent per annum during the period of 1984-85 to 1995-96 to less than 2 per cent in the subsequent period of 1995-96 to 2004-05. Agricultural growth was slightly above two per cent during 2006-07 but much lower than the target growth rate of 4 per cent. In brief, Indian agriculture is in a crisis which is unprecedented. The sordid state of affairs has been attributed, among others, to technology fatigue versus policy fatigue and persistent neglect of agriculture and gradual withdrawal of state from active participation in development activities. It is evident from declining plan outlay, declining public sector capital formation, dwindling credit supply (the growth rate of institutional credit to agriculture has declined from about 6.64 per cent during 1981-91 to 2.16 per cent during 1991-99), decrease in the use of critical inputs, increase in the cost of production, faulty price policy in terms of mismatch between minimum support price (MSP) and coverage of commodities under MSP scheme. Likewise, neglect of agricultural research and extension, technology fatigue manifested in stagnation/deceleration in growth of yields of important crops like wheat (practically no increase in area under irrigation despite launching Accelerated Irrigation Benefit Programme (AIBP) in 1996-97). Between 1995-96 and 2003-04 both central and state governments have spent nearly Rs. 35,000 crores but the net irrigated area has remained static at around 53-55 million hectares, the poor growth in surface irrigation has obliged farmers to depend heavily on ground water exploitation thereby depleting ground water resources and increasing cost of production and fall in the rate of growth of employment opportunities. While the overall employment growth declined from 1.74 per cent between 1983-84 and 1993-94 to 1.08 per cent between 1993-94 and 2003-04, in agriculture it decreased from 1.41 per cent to 0.63 per cent. The net result has been dwindling income of the farmers culminating in increasing number of farmers' suicides.

The Eleventh Five -Year Plan (2007-2012) has set a target of 4 per cent for agricultural sector and 9 per cent for the economy as a whole. To accomplish this rate of growth, centre has emphasised fast and inclusive growth, especially of agricultural sector, so that the benefits of growth percolate down to the most vulnerable sections of the society like landless labour, marginal and small farmers, scheduled caste, scheduled tribes, women, and so on. A number of new initiatives have been launched to revive growth in agriculture. One of such important innovation that has been introduced in the Eleventh Five Year- Plan is Rashtriya Krishi Vikas Yojna (RKVY) with an outlay of Rs. 25,000 crores to give states more flexibility and autonomy in planning and executing programmes for agriculture, achieve goals of bridging the yield gaps in important crops, maximise returns to the farmers, incentivise them to spend more on agricultural sector and address the agriculture and allied sectors in an integrated manner. The funds under this scheme would be provided to the states as 100 per cent grant by the central government. An outlay of Rs. 1500 crores has been approved for 2007-08. The financial assistance provided to the state governments from this centrally sponsored scheme is subject to fulfilment of certain conditions. First, the expenditure on agriculture by the state governments is higher than the base period, which is defined as the moving average of the expenditure of the preceding three years. Second, the preparation of district and state agricultural plans is

mandatory. The areas like integrated development of food crops including coarse cereals, minor millets and pulses, agricultural mechanisations, soil health and productivity, development of rain-fed farming systems, integrated pest management, market infrastructure, horticulture, animal husbandry, dairying and fisheries, completion of projects that have definite time lines, support to institutions that promote agriculture and horticulture, etc; organic and bio-fertilisers are given priority. The District Agricultural Plan (DAP) should determine each district's final resource envelops, its production plan and the associated input plan. It has also been emphasised to integrate these district level agricultural plans with the state plans.

Against above background, the Himachal Pradesh State Department of Agriculture entrusted the task of preparing these plans to Agricultural University, Palampur as per the guidelines issued by the planning commission. The guidelines entails collection and analysis of data on parameters such as land utilisation, farming systems, cropping pattern, horticulture, inputs use, farm machinery, yield and input gaps, issues in livestock management, fisheries, livelihoods of local population, different ongoing irrigation and watershed programmes/schemes, potential for new schemes, women drudgery, post harvest operations, market infrastructure, and so on at the village/panchayats levels. The methodological framework to prepare these plans got evolved in a series of consultations with the officials of the line departments like agriculture and horticulture and the scientists working at different KVKs and regional research stations. The details of the methodological framework have been given in the subsequent section.

1.2 Data and Methods

In the literature on methodologies in social sciences, there are five main approaches, namely, sample surveys, rapid appraisal, participant observation, case studies and participatory learning and action to conduct a research inquiry. The reliability and generalisability of the findings of any study hinges on the methodology followed to conduct the study. The adoption of a particular approach or amalgam of different approaches, however, is contingent on a variety of factors most notably, the objectives of the proposed research inquiry, the proposed use of the findings, the required level of reliability of results, complexity of the research area/programme and, of course, the availability of resources in terms of both money and time. The merits and demerits of different approaches have been described in Hulme, 2000, pp. 79-98¹. The present section is, therefore, devoted to explain methodological framework adopted to prepare district agricultural plans.

1.2.1 Sampling Plan

The state has been divided into 77 developmental blocks. Though all the developmental blocks in the state were taken, sampling approach was adopted to select the panchayats. The sample panchayats were selected in such a way so that variations in micro climatic niches, farming systems and cropping patterns in a particular block are captured. To meet this requirement, it was decided to select 10 per cent of the total panchayats from each of the block with a minimum of four panchayats in those districts, where number of panchayats was more than 200. In other districts, where number of panchayats was less than 200, 15 per cent of the panchayats were selected again with a minimum condition of selecting four panchayats in a block. Wherever 10 per cent or 15 per cent of the total panchayats from a block was not an integer (5.5 say) in those cases the next higher integer (say 6) was taken. There are two blocks in the district and following

this methodology, the number of panchayats selected in district Lahaul & Spiti was 8. The details of the sample panchayats selected from each block are provided in Table 1.1.

Table 1.1 Sampling Plan

Block	Total Panchayats	No. of Selected Panchayats	Name of selected panchayats
Lahaul	28	4	Tindi, Shansha, Tingrit, Darcha
Spiti	13	4	Tabo, Sagnum, Kibber, Kaza
Total District	41	8	

1.2.2 Survey Tools

Guided by the parameters given in guidelines issued by the Planning Commission for the preparation of these plans and discussions held with the officials of department of agriculture, different aspects on which data were to be collected had been divided in two parts. First, those on which data were to be collected at block level. Second, those on which data were to be collected at panchayats level. Accordingly, two questionnaires were developed which were discussed with different stakeholders and officials of line departments before finalising. These questionnaires were administered in all blocks and sample panchayats. The data were collected following participatory rural appraisal (PRA) approach. The officers of the line departments, namely, agriculture, horticulture and animal husbandry and panchayats pradhans including two-three progressive farmers participated in the data collection process.

1.2.3 Analytical Tools

The data were analysed following appropriate statistical tools. Since the data were collected from sample panchayats, the estimates arrived at from sample panchayats were required to be blown up for the block as a whole. For blowing up these estimates, the statistical tools like percentages, simple and weighted averages and standard deviations of different parameters were computed. The averages then were multiplied with the total number of panchayats in a particular block to arrive at the estimates for the whole block. In some cases, depending upon the nature of parameters, one standard deviation was added to the average to arrive at estimates at the block level. The problems, suggestions and interventions suggested by the grass root level functionaries were coded. Based upon these codes, frequency tables were generated and different problems and interventions were prioritised and five most important problems and interventions were considered for preparing plan estimates. The interventions required to solve different problems and to exploit the available potential in different areas were divided into three categories namely, research, extension and development. The funds for these interventions were then worked out in consultation with the stakeholders. The financial requirements for other parameters like irrigation, watershed schemes, infrastructure, markets, and so on were prepared in consultation with the district level officials of the line departments like agriculture, horticulture, animal husbandry and irrigation. The state level plans were prepared on the basis of different district agricultural plans.

1.2.4 Limitations

For the preparation of the district agricultural plans strictly according to the guidelines issued by the Planning Commission, the data on different parameters should have been collected at the village level. This, however, could not be done due to time constraint. Currently, while most of the data are being collected and prepared at tehsil level, the developmental schemes are being implemented at block level whose geographical area seldom coincides with that of tehsil. This led to some problems in generating estimates for the whole block.

.....
1.Hulme, David (2000). Impact Assessment Methodologies for Micro Finance, Theory, Experience and Better Practice. *World Development*, 28 (1): 79-98.

Chapter II

GENERAL DESCRIPTION OF THE DISTRICT

2.1 Physiography and Location

Lahaul & Spiti is the largest district of Himachal Pradesh in terms of geographical area. Total geographical area of the district is 13,693 square Kilometres which accounts nearly for one-fourth of the total geographical area of the state. It has two distinct parts viz., Lahaul and Spiti. Lahaul-Spiti is situated in the North-Western part of Himachal Pradesh and lies between north latitude $31^{\circ} 44' 57''$ and $33^{\circ} 42' 54''$ and east longitude $76^{\circ} 46' 29''$ and $78^{\circ} 41' 34''$. It has international boundary with China (Tibet) on north-eastern side and J & K state on the north-western side. On south-western side, it shares the boundaries with Chamba (Pangi and Bharmour), Kullu and Kinnaur districts. It attained the status of a district in the year 1960. The verdant valleys, majestic mountains, sky line glaciers, gushing rivers, sprawling forests/pastures, ethnic gompas (monasteries) and heritage buildings of the former ruling dynasty are the principal objects of interest in this region. The rugged and awe-inspiring snow clad mountains throw challenge to the hikers, mountaineers and adventurers. The entire district is full of natural scenery exhorting the tourists and visitors to explore and imbibe its hidden grandeur.

2.1.1 History and Culture

The customs, myths, beliefs and conventions of the simple hard working people are the unique features of this border highland. Every village or a hamlet has a temple and a prayer flag fluttering over the Buddhist monastery. These shrines are the centres of the cultural life of the majority of people that have influenced their religious beliefs for centuries. The whole social life revolves around these beliefs. As is clear from the name 'Lahaul & Spiti', the district comprises two different mountains tracts, one known as Lahaul and the other as Spiti. Hence the name of the district came into being with the formation of these two parts into a revenue district. In ancient Buddhist scriptures, 'Padma Thangyang' and 'Mam-Kambum', there is mention of a country named Khasa or Hasha to the south of Ladakh and mighty Zangskar range of Greater Himalaya. It is also possible that existing place 'Garzha' may be the part of ancient Khasa or Hasha. Between the 6th century B.C. and the 5th century A.D., the Saka and Khasa tribes, after having been driven out from Central Asia by the Huns, might have crossed over into India and many of these settled down in the valleys of Mid-Himalayas between Garhwal and Ladakh. This is borne out from the numerous remains of their graves found in these valleys. There is a *nullah* near Keylong known as Shaks, which seems to have taken its name after the Saka tribe settled in the Bhaga valley.

Of course, the two blocks of the district i.e. Lahaul & Spiti, have separate historical backgrounds. In the distant past, Lahaul had been changing hands between the rulers of Ladakh and Kullu. In the second half of the seventeenth century, with the disintegration of Ladakh kingdom, Lahaul passed into the hands of the Kullu chief. In 1840, Maharaja Ranjit Singh took over Lahaul along with Kullu and ruled over it till 1846 when the area came under the rule of the Britishers. From 1846 to 1940, Lahaul formed part of the Kullu sub-division of Kangra district and was administered through the local *Jagirdars/Thakurs*. One of the *Thakurs* was designated as *Wizier*

of Lahaul and was entrusted with judicial and executive powers. Another *Thakur* was given the powers of a Revenue Officer. These functionaries exercised traditional as well as other powers conferred by the contemporary Government. The Assistant Commissioner, Kullu used to visit the area once a year for a month or so with full fanfare of convoy of horse riders. In the late thirties, the unprecedented prosperity of the people through growing *kuth* and their consequent awakening created a formidable challenge to the power and influence of the *Wizier* of Lahaul, which gradually started declining. The inadequacy was soon noticed by the Government which considered the extension of the regular system of administration. Accordingly, in 1941, a separate sub-tehsil comprising Lahaul & Spiti was formed and a *Naib-Tehsildar* was posted at Keylong divesting the *Thakurs* of their powers. The system remained in vogue till June, 1960 when Lahaul & Spiti was given the status of a district.

With regard to Spiti, the East India Company took over the possession of this part in the year 1846 after the cessation of cis-Sutlej part as a result of the Anglo-Sikh War. Before that, it formed a part of Ladakh, a subsidiary of Jammu & Kashmir. Because of its remoteness and paucity of natural resources, the British following the example of the Ladakhi rulers, did not introduce any substantial changes in the administrative set up of Spiti territory. The *Nono* of *Kyuling* was recognized as the hereditary *Wizier* of Spiti (re-affirmed by the Spiti Frontier Regulations of 1883) and was supposed to represent the British India Government. He collected the land revenue for the Government. His judicial jurisdiction included trial of all criminal cases, except murder; and he performed all functions and enjoyed all necessary powers for the fulfilment of his tasks and duties as laid down in the Regulations of 1883. In 1941, Spiti was appended with Lahaul, and constituted into a separate sub-tehsil of Kullu sub-division with its headquarters at Keylong. Later on, after Lahaul & Spiti was conferred the status of a district in 1960, Spiti was made a separate development block as well as a sub-division with its headquarters at Kaza.

2.1.2 Soil and Climate

Lahaul & Spiti district falls in the dry temperate zone of Himachal Pradesh. There is great diversity of climate in the zone due to variation in altitude, topography and geographical location. In general, the climate is extremely cold and heavy snowfall occurs during winter; the temperature at some places remains several degrees below zero level. The winter season spans from November to March and most parts of this zone remain cut off from rest of the world during this period. Spiti in particular becomes the harsh cold desert during winter months.

There is only one cropping season starting from April to September or early October when the mean minimum and maximum temperatures range approximately between 12 to 24° C; though occasionally it ranges from as low as 5° C to 30° C. During winter months, the temperature goes much below the freezing point (-20 to -40° C). Rainfall also varies from one location to another. Though, the average annual rainfall of the zone is 250 mm, yet it ranges from very low at 90 mm to as high as 1,200 mm and most of it is received as snowfall in winter. The rainfall is scanty in Spiti in comparison to Lahaul and due to low rainfall, the humidity remains low throughout the year. Needless to mention, unusual heavy rainfall for the last five years in this belt has caused lot of damage to the economy of the inhabitants.

In general, the soils of the zone are sandy to sandy loam in texture and neutral to alkaline in reaction and low in fertility. While the soils in Lahaul, in some parts, are loam to clay-loam with

abundance of gravel and rich in fertility, in Spiti these are silty loam in texture and neutral to alkaline in reaction with low water holding capacity. These are low in nitrogen and medium to high in P and K. The soil strata are generally loose in both the blocks. The water holding capacity also varies from poor to medium. These soils are prone to erosion due to cultivation on steep slopes, splashing floods, flow irrigation and overgrazing. The forest cover is almost patchy that too in river beds or valley areas while high mountain ranges are naked devoid of any purposeful vegetation except scrubs and bushes. Also, the glaciers and avalanches cascade in abetting and scratching the soil as well as slopes, resulting in enormous soil loss in landslides and/or slips.

There are three famous rivers originating from perennial glaciers. Chandra and Bhaga rivers originate from opposite aspects of mighty Baralacha glacier, former flowing through Lahaul and the latter through Spiti before their confluence at Tandi when the duo form a single river 'Chandra-Bhaga'. It takes the name of 'Chenab' after entering the territory of Chamba (Pangi) and assimilates many turbulent rivulets on its way. This river, as such, is of no economic significance to the area as its water flows uninterruptedly into Pakistan territory as per Indo-Pak Water Commission Treaty. The Spiti river originates from famous 'Kunjam Pass' and flows in south eastern direction bisecting the entire Spiti region through Kaza and Samdhoo and finally merges with Sutlej at Khab in Kinnaur.

Due to low rainfall and coarse texture of soils in Lahaul-Spiti, all crops need frequent irrigation. The main sources of irrigation are Kuhls, in which natural gravitation flow of snow water is harvested. The rainfall pattern in Lahaul & Spiti district during different seasons over the years is shown in Table 2.1.

The entire district almost falls in the rain shadow Himalayan range with average annual rainfall of 619.4 mm with total rainy days of 44.4 in a year. The maximum downpour is received during winter season from February to March and thereafter from June to September but not of the same intensity as in other parts of the state during this period. There is, thus, fair amount of rainfall in the form of snow during winter season forming rich repository of glacial deposits- the progenitors of myriads of perennial streams and rivers in the North western Himalaya. The average annual rainfall showed wide inter-year variations in terms of both total rainfall (mm) as well as number of rainy days. The total annual rainfall in the district varied from as low as 208 mm during the year 1996-97 to as high as 1193.5 mm during 1995-96 that turned out to be the abnormal rainfall year in this district. The variability in rainfall was highest during post monsoon season followed by monsoon season. However, during winter months the variability in rainfall was fairly low in this district.

Table 2.1 Rainfall Pattern, 1990-91 to 2002-03 (MM)

Year	Monsoon (June-Sept.)		Post monsoon (Oct.-Dec.)		Winter (Jan.-Feb.)		Total for the Year	
	June-Sept	Days	Oct-Dec	Days	June- Sept	Days	June-Sept	Days
1990-91	37.0	4.0	150.0	7.0	94.2	15.0	514.2	34.0
1991-92	89.0	5.0	6.0	1.0	127.0	8.5	563.5	36.0
1992-93	230.0	15.0	35.0	2.0	194.2	11.0	941.7	48.5
1993-94	285.0	16.0	40.0	2.0	132.0	8.0	668.0	35.5
1994-95	419.0	24.0	199.0	13.0	132.0	8.0	961.0	55.0
1995-96	611.0	29.0	14.0	2.0	198.5	11.0	1193.5	67.0
1996-97	105.0	2.0	12.0	1.0	75.0	1.5	208.0	5.5
1997-98	11.0	1.0	141.0	19.0	134.5	5.5	535.7	34.4
1998-99	191.5	14.0	84.9	3.0	74.3	6.5	453.5	66.2
1999-00	218.5	14.5	62.0	2.0	96.0	9.5	520.3	38.0
2000-01	191.9	19.0	48.0	8.0	37.5	4.0	442.9	53.0
2001-02	84.6	5.5	58.5	7.0	136.8	9.7	489.7	64.5
2002-03	96.1	10.5	1.8	1.0	173.3	10.5	560.3	40.0

Source: Annual Seasons and Crop Report (Various Issues)

2.2 Demographic Features

The demographic features and changes thereof over the last three decades in Lahaul-Spiti district of Himachal Pradesh have been displayed in Table 2.2. It can be clearly seen from the table that the population of the district was 33,224 during 2001 census. The population increased by just 6.17 per cent during the decade 1991 to 2001. Negative growth of 2.51 per cent was recorded during the period 1981-91 where as during 1971-81 the population growth was 16.31 per cent. This clearly shows that during recent years there has been large scale migration of people from Lahaul mainly to Kullu district as more and more people have settled permanently in Kullu district. This is also testified by very high growth in population in Kullu district (25 to 26 per cent during last two censuses).

Table 2.2 Demographic Features, 1981 to 2001

District/ state	Total population	% to state	Dec. growth	Density/ sq km	Sex ratio	Literacy %		
						Male	Female	Total
Lahaul & Spiti								
1981	32063	0.76	16.31	2	782	42.93	17.12	31.60
1991	31294	0.61	-2.51	2	1013	71.78	38.05	56.82
2001	33224	0.55	6.17	2	804	82.76	60.94	73.17
H. P.								
1981	4237569	100.00	22.46	76	988	52.36	31.39	41.94
1991	5170877	100.00	20.79	93	984	75.36	52.13	63.86
2001	6077248	100.00	17.39	109	970	86.02	68.08	77.13

Source: Census of HP, 1981, 1991 & 2001

Lahaul –Spiti is the most sparsely populated district of the state accounting for merely 0.55 per cent population of the state despite having around 25 per cent of the geographical area. The

density of population is just 2 persons per sq Km as against 109 persons at the state level. The sex ratio is also low (804 females per 1000 males) as compared to state as a whole (970). The number of females per thousand males at the state level has also decreased from 988 in 1981 census to 970 during 2001 census. Taking cue from the state, there has also been considerable progress on literacy fronts in this tribal district. This is evident from the fact that overall literacy rate in the district increased markedly from 31.6 per cent in 1981 to 73.17 per cent in 2001 census. The literacy rate at the state level during 2001 was 77.13 per cent. However, as elsewhere in the state, the literacy level was relatively higher in case of males (82.76 per cent) than females (60.94 per cent).

Among these two blocks, Lahaul alone accounts for about 68 per cent of the total population of the district and has higher population density as compared to Spiti. The decennial growth in population during 1991 to 2001 was quite high in Spiti (11.34 per cent) as against just about 4 per cent in Lahaul (Table 2.3). As mentioned earlier, this could partly be attributed to migration of substantial inhabitants to Kullu district.

Table 2.3 Block Wise Demographic Features, 2001

	Total population	% to district	Dec. growth	Density sq km	Sex ratio	Literacy %		
						Male	Female	Total
Lahaul	22545	67.86	3.86	4	794	81.23	61.7	72.84
Spiti	10679	32.14	11.34	1	818	86.41	58.71	74.14
District	33224	100.00	6.17	2	802	82.82	60.7	73.10

Source: Statistical Abstract (2005), District Statistical Office, Keylong (L & S)

Surprisingly, sex ratio is very low in both the blocks that clearly reveal high mortality among females in this hinterland. There has been marked improvement in the literacy level especially in Spiti which is the most backward tribal area in Himachal Pradesh. Agriculture is the major source of livelihood of people of Lahaul-Spiti district. This is amply clear from the occupational pattern of working population presented in Table 2.4. The table reveals that about 54 per cent of the workers were dependent upon agriculture during 2001. There has been marginal decrease in the proportion of workers dependent

Table 2.4 Occupational Distribution of Workers (Per Cent)

District/state	Cultivators	Agricultural labourer	Workers dependent upon agriculture	Other workers (including household industry)	Total workers
Lahaul & Spiti					
1981	60.27	2.84	63.11	36.89	15587
1991	52.37	5.79	58.15	41.85	16646
2001	52.92	1.57	54.49	45.51	21088
H. P.					
1981	69.44	2.93	72.36	27.64	1436284
1991	65.19	3.52	68.71	31.29	1729089
2001	65.55	3.10	68.65	31.35	2991448

Note: The percentages have been worked on the basis of total working population

Source: Statistical Outline of Himachal Pradesh (Various Issues)

upon agriculture since 1981. The cultivators accounted for around 52.92 per cent while agricultural labourers accounted for 1.57 per cent of working population. The dependence on agriculture was found relatively lower in this district as compared to the state as the proportion of non-agricultural workers was fairly high. At the state level, the cultivators accounted for 65.55 per cent of the total workers while the share of agricultural labourers was 3.10 per cent during 2001 census. The other workers showed increase from 27.64 per cent to 31.35 per cent. The total number of workers increased from about 14.36 lakh during 1981 to 29.91 lakh during 2001. The occupation pattern in the two blocks showed higher dependence on agriculture in Lahaul where around 55 per cent of the workers were dependent upon agriculture majority of whom were cultivators (Table 2.5).

Table 2.5 Block-wise Occupational Pattern of Working Population, 2001

Block	Cultivators	Agricultural labourer	Workers dependent upon agriculture	Other workers	Total main workers	Marginal Workers	Total (Main+marginal)
Lahaul	58.62	1.25	59.87	32.33	92.20	7.80	15187
Spiti	38.25	2.52	40.77	47.45	88.22	11.78	5901
District	52.92	1.61	54.53	36.56	91.09	8.91	21088

Source: Statistical Abstract (2005), District Statistical Office, Keylong (L & S)

In Spiti, the dependence on agriculture was fairly low (38 per cent) inasmuch as most of the workers were engaged in other non-farm works. The proportion of marginal workers was quite high in Spiti (12 per cent) as compared to Lahaul (8 per cent). This clearly shows the need for generating diversified employment opportunities in agriculture.

2.3 Status of Agriculture

The tribal farmers of Lahaul-Spiti district, unlike many other tribesmen in the country have been found to be quite innovative and quick learners. As noted above, there has been marked improvement in the literacy and level of socio-political awareness. A number of tribal people have also acquired top positions in the State and Central administration hierarchy.

Agriculture in tribal area of Lahaul & Spiti has exhibited higher degree of transformation as compared to other areas of the state and has passed through many stages of this transformation process over the years. In 1930's, a man named Dhanwantri Prasad brought seeds of *Kuth* to Lahaul and since then it has been cultivated regularly. Prior to 1962, *Kuth* was the major commercial crop of Lahaul & Spiti and dried *Kuth* roots were exported to China. Thereafter, the area and production of *Kuth* decreased substantially due to severing of trade ties with China. However, the cultivation of seed potato first introduced by Moravian Missionaries in the mid 60's, offered new opportunity for the commercialization. The seed potato production still dominates the cropping pattern and Lahaul & Spiti enjoys comparative advantage in the production of quality seed potato in the country. However, since 1980, the cultivation of off-season peas turned a new leaf in the transformation process that presently has become the most remunerative and leading cash crop of this district. During 1990's, the hops plantation flourished in Lahaul valley which became the sole area for the production of hops in the country due to Kashmir problem. However, hops cultivation was adversely affected by low prices primarily

because of cheap and heavy imports from China and European countries. Nevertheless, pea and potato have continued to remain the major commercial crops and may remain so for long thanks to comparative cost and climatic advantages over other areas.

2.3.1 Changes in Land Holdings

The structure of land holdings shown in Table 2.6 reveals that agriculture in the district is dominated by marginal and small farmers; these two categories together account for about 45 and 28 per cent of the total holdings and 15 per cent and 26 per cent of the operated area, respectively. During 1980-81 to 2000-01, the number of holdings increased by about 23 per cent from 3,308 to 4,068 while the area operated increased by just 7 per cent from 5,976 hectares to 6,386 hectares.

Table 2.6 Structure of Land Holdings in Lahaul-Spiti District, 1980-81 to 2000-01 (Per Cent)

District /state	Marginal <1 Ha		Small 1-2 Ha		Medium 2-4 Ha		Large >4 Ha		Total	
	No	Area	No	Area	No	Area	No	Area	No	Area (Ha)
Lahaul & Spiti										
1980-81	39.78	11.21	26.42	21.60	25.88	40.65	7.92	26.54	3308	5976
1985-86	49.74	15.17	21.95	22.11	21.64	37.97	6.67	24.75	4095	6073
1990-91	43.47	14.01	27.79	25.25	22.79	39.45	5.95	21.29	3980	6403
1995-96	43.86	13.86	26.26	24.33	24.09	41.57	5.78	20.24	3960	6423
2000-01	45.43	15.17	28.07	26.21	26.23	55.81	0.27	2.49	4068	6386
H. P.										
1980-81	55.30	14.92	22.03	20.43	15.16	27.08	7.51	37.57	637081	980425
1985-86	61.55	20.46	20.63	22.71	12.24	25.97	5.58	30.86	752882	980240
1990-91	63.82	21.26	19.96	23.29	11.26	25.51	4.96	29.94	833793	1009766
1995-96	62.85	23.05	19.61	24.07	10.74	25.54	6.80	27.34	884492	999099
2000-01	67.29	25.72	19.06	24.99	13.21	42.83	0.43	6.45	913914	978756

Note: Percentages have been worked out on the basis of total number and area

Source: Agricultural Censuses, Directorate of Land Records, HP.

There was noticeable increase in the number as well as area operated under marginal and small holdings at the state level also whereas number as well as area operated under medium and large categories decreased in the district and in the state as well.

Table 2.7 Average Size of Holdings, 1980-81 to 1990-91 (Hectares)

District /state	Marginal (<1 Ha)	Small (1-2 Ha)	Medium (2-4 Ha)	Large (>4 Ha)	Overall
Lahaul & Spiti					
1980-81	0.51	1.48	2.84	6.05	1.81
1985-86	0.45	1.49	2.60	5.51	1.48
1990-91	0.52	1.46	2.79	5.75	1.61
1995-96	0.51	1.50	2.80	5.68	1.62
2000-01	0.52	1.47	3.34	14.45	1.57

H. P.					
1980-81	0.42	1.43	2.75	7.70	1.54
1985-86	0.43	1.43	2.76	7.20	1.30
1990-91	0.40	1.41	2.74	7.31	1.21
1995-96	0.41	1.39	2.69	4.54	1.13
2000-01	0.41	1.40	3.47	15.91	1.07

Note: Medium includes semi-medium holdings also

Source: Agricultural Censuses, Directorate of Land Records, HP.

As a consequence of higher proportionate increase in the number of holdings in relation to increase in area operated, the average size of holdings decreased (Table 2.7). The overall size of holdings in the district has come down from 1.81 hectares in 1980-81 to 1.57 hectares in 2000-01. At the state level, the size of holdings showed huge decrease from 1.54 hectare in 1980-81 to 1.07 hectares in 2000-01. This clearly shows lower tendency of subdivision of holdings in this district which may be due to joint family culture. The size of marginal holdings has remained almost same while that of small holders increased marginally. However, the holding size of medium and large farmers decreased over the period.

2.3.2 Land Utilization Pattern

Being hilly and mountainous region, most of the geographical area is under snow-clad mountain ranges, passes, river gorges and inhospitable terrains. Consequently, there is limited area available for cultivation. This can be clearly judged from the scenario of land use pattern in this district presented in Table 2.8. The table shows that most of the geographical area (around 98 per cent) is under forests, pastures and barren range lands. The area under forests which was reported to be about 51 per cent earlier has been re-estimated to about 15 per cent while the area under barren lands has been revised to as high as 60 per cent from a mere 2 per cent over the period 1990-91 to 2002-03. The area under pastures reported to be about 44 per cent in 1990-91 came down to 24 per cent in 2002-03. Most striking feature of the district is limited availability of arable land which is even less than 1 per cent of the total reported area of the district. There have been discernible changes in the land utilization statistics in this district in the recent years mainly due to reporting of more geographical area in the revenue records. Most of the recently reported area has been included under the category of barren lands increasing its proportion hugely.

Table 2.8 Changes in the Land Utilization Pattern, 1990-91 to 2004-05 (Per Cent)

District /state	Forest land	Barren land	Non-agri. uses	Culturable waste	Pasture	Misc trees/ groves	Current fallow	Other fallow	Net sown area	Total reported area (000 ³ Ha)
Lahaul-Spiti										
1990-91	51.04	2.10	0.75	0.27	44.24	0.06	0.03	0.06	1.46	215.63
1995-96	51.06	0.71	2.04	0.31	44.27	0.04	0.08	-	1.48	215.64
2000-01	14.86	60.00	0.51	0.06	24.16	0.01	0.01	-	0.38	911.20
2002-03	14.86	60.00	0.53	0.06	24.16	0.01	0.01	-	0.37	911.20
2004-05	14.86	45.64	14.89	0.07	24.16	0.01	0.01	-	0.36	911.10

HP										
1990-91	30.85	5.46	5.74	3.72	33.72	1.43	1.33	0.46	17.31	3367.3
1995-96	31.10	4.07	5.66	3.64	35.44	1.35	1.55	0.76	16.43	3396.10
2000-01	24.05	17.75	6.90	2.74	33.63	1.25	1.19	0.30	12.20	4547.30
2002-03	24.20	17.75	7.03	2.69	33.41	1.28	1.33	0.33	11.99	4543.10
2004-05	24.23	14.78	10.08	2.80	33.02	1.51	1.33	0.31	11.94	4544.70

Source: Annual Season and Crop Reports (Various Issues) and Statistical Abstract (2005), District Statistical Office, Keylong (L & S)

2.3.3 Cropping Pattern, Crop Production and Yields

Cropping pattern in Lahaul-Spiti district is unique and distinct from rest of the districts in the state. The commercial crops, mainly pea and potato, dominate the cropping pattern (Table 2.9). Over time, the area under cereal crops is continuously decreasing. For example, the area under wheat has come down drastically from 275 hectares in 1990-91 to 107 hectares during 2004-05 (Table 2.9). Similar decrease was observed in barley as the area decreased from 741 hectares to 636 hectares during the same period. The area under traditional millet crops also shows drastic decrease. During early 90's, potato was the main crop commanding an area of 1,052 hectares but thereafter shows continuous decrease and the area under the crop declined to 787 hectares in 2004-05. Thereafter, pea has taken over and is presently the main commercial crop of the district. The area under pea has continuously increased from 808 hectares in 1990-91 to as high as 1,555 hectares in 2004-05. There is marginal increase in the total cropped area which increased from 3,219 hectares to 3,430 hectares in 2004-05. The spatial distribution of different crops has also changed over the period (Table 2.10). The share of area under foodgrain crops witnessed a steady decline. The share of wheat has decreased from 8.54 per cent to just 3.12 per cent while that of barley decreased from 23.02 per cent to 18.54 per cent during the period. The share of area under millets (mainly buckwheat), has registered a drastic decrease which is presently just 4.34 per cent of the total cropped area of the district.

Table 2.9 Trends in Area under Different Crops, 1990-91 to 2004-05 (Hectares)

Year	Maize	Wheat	Barley	Millets	Potato	Pea	TCA
1990-91	34	275	741	145	1052	808	3219
1995-96	30	181	590	152	885	1166	3309
2000-01	38	142	616	149	807	1598	3595
2002-02	42	121	576	65	813	1497	3377
2004-05	47	107	636	149	787	1555	3430

Source: Annual Season and Crop Reports (Various Issues) and Statistical Abstract (2005), District Statistical Office, Keylong (L & S)

The share of area under potato has also decreased from 32.68 per cent in 1990-91 to 22.94 per cent during 2004-05. This clearly shows the shift in cropping pattern in favour of peas as the proportion of area under this crop witnessed a remarkable increase from 25.10 per cent to 45.34 per cent in 2004-05. Other crops, mainly hop, registered increase up to 1995-96 but decreased thereafter due to sudden slump in prices of hop owing to import under OGL. There is slight recovery in the recent years which may be due to purchase of hops for processing plant installed at Baddi (Solan).

Table 2.10 Changes in Cropping Pattern; 1990-91 to 2004-05 (Per Cent)

District /state	Maize	Wheat	Barley	Millets	Food-grains	Potato	Pea	TCA
Lahaul & Spiti								
1990-91	1.06	8.54	23.02	4.50	37.12	32.68	25.10	3219
1995-96	0.91	5.47	17.83	4.59	28.80	26.75	35.24	3309
2000-01	1.06	3.95	17.13	4.14	26.28	22.45	44.45	3595
2002-03	1.44	3.46	16.79	1.49	23.18	23.82	43.86	3377
2004-05	1.37	3.12	18.54	4.34	27.37	22.94	45.34	3430
H. P.								
1990-91	32.44	38.26	2.98	1.59	88.59	1.61	0.60	983599
1995-96	32.58	38.04	2.84	1.88	87.43	1.44	0.82	949886
2000-01	31.46	38.27	2.71	1.22	85.98	1.26	0.99	947600
2002-03	30.80	38.03	2.50	1.09	85.67	1.33	1.62	945200
2004-05	31.31	38.78	2.45	0.93	85.26	1.55	1.71	953600

Source: Annual Seasons and Crop Reports (Various Issues) and Statistical Abstract (2005), District Statistical Office, Keylong (L & S)

The extent of crop diversification has decreased over the years in both Lahaul as well as Spiti blocks (Table 2.11). It may be visualized that extent of diversification was higher in the two regions during the past as farmers were taking more number of field crops including foodgrains, pulses, traditional millet crops, kuth, hops, etc.. However, in the recent past, the farmers have specialised in cash crops mainly pea and potato in Lahaul and pea and barley in Spiti. Therefore, there is also a need to diversify the production base as potato-pea monoculture prevalent in the district may not be sustainable. The promotion of organic farming, medicinal herbs, and horticultural crops are the potential crops.

Table 2.11 Extent of Diversification (Herfindahl Index)

Blocks	1993-94	1998-99	2004-05
Lahaul	0.2571	0.2939	0.3398
Spiti	0.3952	0.3653	0.4105

This also shows high degree of specialization and commercialization as major proportion of cropped area is under two major cash crops viz., pea and potato. The farmers too are highly responsive to new technology but farming in this district is certainly 'a race against time' due to very short cropping season. Therefore, input delivery at the doorsteps of the farmers and outright procurement/marketing of cash crops immediately after harvest should remain high on planning agenda.

The yields of major crops grown in Lahaul & Spiti are shown in Table 2.12. As may be seen from the table, the yields of foodgrain crops have remained almost stagnant over a period of time. The yield of barley which is a major crop is hovering around 12 to 13 q/ha over the period. Similarly, the yield of wheat is almost stagnant at 13-14 q/ha. This clearly reveals the scope for technological intervention in these crops to increase yields and in turn production of foodgrains. Maize is not the major crop of this district and is being grown in Udaipur region mainly for fodder purpose. There also exists scope for bringing more area under pulses, especially Rajmash

as the yield has been found much higher than the other regions of the state. In commercial crops, the yield of pea is quite low (55 q/ha) as compared to the potential yield obtained on demonstration-cum research farms in the district (120 to 150 q/ha). In spite of this low yield, the returns from off season pea are quite high due to remunerative prices. The yield of potato is quite high (250 to 300q/ha) but year to year variations are substantial that needs due attention.

Table 2.12 Productivity of Major Crops, 1990-91 to 2004-05 (Q/ha)

District/ state	Maize	Wheat	Barley	Pea	Potato
Lahaul-Spiti					
1990-91	20.59	16.00	14.70	NA	259.67
1995-96	21.33	13.92	11.95	53.99	298.94
2000-01	22.89	13.94	8.34	55.33	240.43
2002-03	16.12	14.05	12.97	54.22	283.74
2004-05	18.35	10.27	11.63	117.46	146.61
H.P.					
1990-91	18.76	15.99	14.70	86.29	66.77
1995-96	19.90	13.89	12.69	94.01	86.21
2000-01	22.94	7.21	8.33	95.74	125.50
2002-03	16.60	13.79	12.97	NA	123.41
2004-05	21.31	17.64	14.41	105.01	120.15

Source: Annual Seasons and Crop Reports (Various Issues) and Statistical Abstract (2005), District Statistical Office, Keylong (L & S)

2.4 Production of Fruit

The area and production of fruit in the district has been shown in Table 2.13. Apple cultivation is gaining momentum in recent years. The area under apple is continuously increasing; it has increased from 131 hectares in 1990-91 to 308 hectares in 2004-05. The production has also increased from 27 metric tonnes to 131 metric tonnes during the same period. However, unlike area, the production shows wider year to year fluctuations which may be partly due to alternate bearing and partly due to fluctuations in weather. Apple plantation is expanding in Spiti also which is a positive sign of development.

Table 2.13 Trends in Area and Production of Fruit, 1990-91 to 2004-05

Year	Apple		Other fruit		Total fruit	
	Area (Ha)	Production (MT)	Area (Ha)	Production (MT)	Area (Ha)	Production (MT)
1990-91	131	27	73	9	204	36
1991-92	145	50	77	8	222	58
1992-93	156	58	77	8	233	66
1993-94	175	119	81	8	256	127
1994-95	216	60	83	12	299	72
1995-96	281	55	87	24	368	79
1996-97	334	50	94	25	428	75
1997-98	202	50	90	26	292	76
1998-99	209	52	103	27	312	79
1999-00	188	73	164	49	352	122
2000-01	261	78	208	52	469	130
2001-02	263	110	91	25	354	135
2002-03	419	68	241	48	660	116
2003-04	210	185	24	50	234	235
2004-05	308	131	25	30	333	161
Growth rate	5.03*	7.42*	-1.50	13.87*	3.40	8.80*
CV (%)	33.65	53.23	58.97	61.11	35.24	47.95

*Significant at 5% level

Source: Directorate of Agriculture, Shimla (HP)

The area under other fruit mainly dry fruit did not reveal consistent pattern both with respect to area as well as production. For example, during 2004-05 the area under other fruits has remained just 24-25 hectares with a production of 30-50 metric tonnes. The area under total fruits which was 204 hectares in 1990-91 increased to 333 hectares in 2004-05 while the production increased from 36 metric tonnes to 161 metric tonnes during the same period. The growth and variability in area and production revealed that area under fruit in the district has increased at the rate of 3.4 per cent per annum while the production recorded a higher growth of 8.8 per cent. This growth in area under fruit was mainly because of significant increase of 5 per cent per annum in area under apple. The production of apple also increased significantly at the rate of 7.42 per cent per annum. Despite this growth, very high variability was recorded in fruit production. The high variability was also observed in the production of other fruits mainly in dry fruit.

Overall variability in fruit production was as high as 48 per cent. This indicates that horticultural development and transfer of technology (extension) should go hand in hand so that farmers take up fruit plantation on scientific lines.

2.5 Performance of Livestock Sector

Livestock rearing is an integral part of farming and holds the distinct complementary relationship with crop production as crop by-products provide fodder for livestock rearing and in turn supply valuable farm yard manure (FYM) for crops and livestock products (milk, meat, wool, etc.) to farm families. The livestock rearing bears greater importance in Lahaul-Spiti inasmuch as there is limited area under cultivation. The livestock production, however, can be increased with the

development of vast forest and grazing/pasture lands in this district. The composition of livestock and changes over the period are displayed in Table 2.14.

During last one decade i.e. between 1992 and 2003 census, the cattle population increased from 8,910 to 13,301. However, the total population of sheep, goats and other animals showed marginal decrease. The total livestock population in the district increased marginally from 68,748 in 1992 to 69,903 in 2003. It is surprising to note that poultry population recorded drastic decrease which may be due to cool climate and low temperature during winter which is not suitable for poultry. At the district level, there was increase in the proportion of cattle population from about 13 per cent in 1992 to 19 per cent in 2003. The sheep population, however, dominates the livestock though there has been proportionate decrease from 62 to 59 per cent. In a similar vein, share of goats in livestock population also decreased from around 17 per cent in 1992 to 15 per cent in 2003. This clearly shows the changes in the composition of livestock in favour of bovine from ovine population. In Lahaul, sheep accounted for 72 per cent of the total livestock in comparison to goats which was just 8 per cent. In Spiti, both sheep and goats accounted for 30 and 33 per cent of livestock, respectively. Other animals mainly Yak/ Mithuns and mules/ ponies were more common in Spiti region.

Table 2.14 Changes in Livestock Population, 1982 to 2003

District/ state	Cattle	Sheep	Goats	Other	Total livestock	Poultry
Lahaul & Spiti						
1982	7652 (11.20)	43233 (63.27)	11422 (16.71)	6027 (8.82)	68334	4115
1992	8910 (12.96)	42788 (62.21)	11445 (16.65)	5627 (8.18)	68748	4923
2003	13301 (19.03)	41449 (59.30)	10568 (15.12)	4585 (6.55)	69903	1034
H.P.						
1982	2173663 (42.42)	1090322 (21.28)	1059862 (20.69)	799924 (15.61)	5123771	461285
1992	2151616 (41.07)	1074345 (20.51)	1115591 (21.30)	897133 (17.13)	5238685	664039
2003	2196538 (43.53)	906027 (17.96)	1115587 (22.11)	826102 (16.37)	5046044	764136

Note: Figures in parentheses are per centages; Source: Livestock Census, 1982, 1992 & 2003

The extent of livestock improvement in the district has been brought in Table 2.15. The livestock surveys conducted by the State Department of Animal Husbandry at two points of time viz., 1997-98 and 2005-07 reveal considerable progress in cattle improvement. The population of crossbred cows increased by about 39 per cent while that of indigenous cows decreased by 18 per cent. Consequently, the proportion of crossbred cows in total milch animals increased from 49 per cent to as high as 60 per cent in 2006-07. Likewise, the proportion of improved sheep also increased from 18 per cent to 23 per cent during this period. However, in poultry, the exotic breeds were not found so successful and *desi* layers were performing better due to more adaptation to harsh climate.

The pattern of livestock production in L & S over the years has been depicted through Table 2.16. The production of milk in the district has increased from 2,167 metric tonnes in 1990-91 to 6,848 metric tonnes in 2006-07. Milch cows contributed almost 99 per cent of milk production while the proportion of goat's milk was negligible. The wool and meat production showed slow growth over the years while the production of eggs recorded drastic decrease due to decreasing number of poultry birds.

Table 2.15 Composition of Improved and Indigenous Livestock

Animal breed	1995-96	1997-98	2006-07	% change over 1997-98
Cows				
Crossbred	2708 (51.50)	3158 (48.75)	4395 (59.86)	39.17
Indigenous	2550 (48.50)	3597 (53.25)	2947 (40.14)	-18.07
Total cows	5258	6755	7342	8.69
Sheep				
Improved	9529 (20.26)	10089 (18.03)	14678 (23.08)	45.49
Indigenous	37504 (79.74)	45865 (81.97)	48916 (76.92)	6.65
Total sheep	47033	55954	63594	13.65
Poultry				
Improved	1777 (33.35)	1402 (43.49)	565 (56.64)	-59.70
Indigenous	3250 (64.65)	1822 (56.51)	469 (43.36)	-74.26
Total poultry	5027	3224	1034	-67.93

Note: Figures in parentheses are percentages; Source: Livestock census, 1982, 1992 & 2003

Table 2.16 Trends in Livestock Production, 1990-91 to 2006-07

Year	Milk (MT)			Wool (MT)	Meat (MT)			Eggs (000 No)
	Cow	Goat	Total		Goat	Sheep	Total	
1990-91	1867	300	2167	54.531	152.2	167.56	319.76	750.00
1995-96	3745	379	4124	51.056	72.823	72.015	144.838	761.90
2000-01	5892	431	6323	71.739	55.579	53.392	108.971	551.20
2006-07	6749	99	6848	82.11	123.86	76.83	200.69	231.10

Source: Integrated Sample Survey for Estimation of Animal Products, Directorate of Animal Husbandry, Pashudhan Bhavan, Shimla, H P. (Different Issues)

The productivity of livestock has been given in Table 2.17. It may be observed from the table that productivity of crossbred cow was remarkably high (3.53 litres/day) as compared to indigenous local cow litres/day. The productivity of sheep wool was recorded as 1.54 and 1.22 kg/year per animal for improved and indigenous breeds, respectively. The average meat production per animal was higher in goat (18.37 kg) as compared to sheep (16.93 kg). It was observed that yield of improved layer was low (202 eggs/bird) as compared to desi breeds (241 eggs). This clearly shows that improved poultry birds would not thrive well in this district.

Efforts may be initiated to popularize desi breeds that thrive well under cool and harsh climatic conditions.

Table 2.17 Productivity of Livestock, 2006-07

Livestock	Productivity per animal
Milch animals (litres/day)	
Crossbred cow	3.52
Indigenous cow	2.14
Overall average	3.05
Goat	0.46
Sheep wool (kg/year)	
Improved	1.54
Indigenous	1.22
Overall average	1.29
Meat (kg)	
Goat	18.37
Sheep	16.93
Overall average	17.79
Poultry (eggs/year)	
Improved	202
Indigenous	241
Overall average	223

Source: Integrated Survey of Livestock Products, Directorate of Animal Husbandry, Shimla (HP)

2.6 Input Use

The use of agricultural technology is quite encouraging as farmers are growing commercial crops particularly potato and pea. There is entire area under irrigation. Area under improved varieties is almost 100 per cent and use of fertilizers is quite high (94 kg/ha). Agriculture development has witnessed significant changes particularly after the sixties when the climate of district was found highly suitable for disease free quality seed potato and thereafter pea and hop.

2.6.1 Irrigation

Irrigation is the life line of agriculture in the district as without irrigation even grass would not survive in grasslands. As shown in Table 2.18 the entire sown area in the district is irrigated. Therefore, Lahaul-Spiti is the only district in the country having cent per cent irrigated agriculture and all the crops are grown under irrigated conditions. However, over the period no additional area has been brought under irrigation. This can be seen from the culturable command area (CCA) under irrigation is 5,640 hectares while the actual area irrigated is 3,326 hectares. Thus, the additional irrigation potential to be harnessed in this district is around 2,300 hectares. The crop-wise irrigated area in the district presented in table shows that maximum irrigated area is under peas followed by potato and barley that are the major crops of this region.

Table 2.18 Crop wise Irrigated Area under Major Crops (Hectares)

Year	Wheat	Barley	Pea	Potato	Net irrigated area	Gross irrigated area
1990-91	273	759	909	946	3152	3245
1995-96	181	590	1166	885	3147	3307
2000-01	142	616	1598	897	3487	3593
2001-02	121	576	1497	813	3296	3377
2002-03	118	573	1497	813	3326	3413

Source: Annual Seasons and Crop Reports

2.6.2 Area under HYVs

The progress in area under high yielding varieties (HYVs) of major crops during the last two decades has been quite impressive. Almost entire area under wheat has been brought under HYVs. However, in barley, most of the area is still under local varieties and there is a need to develop suitable high yielding varieties of barley. In peas and potato, entire area is under improved varieties. In potato, Kufri Jyoti and Kufri Chandermukhi have remained the most important varieties since long. In pea, Azad P-1 is widely grown in all parts of the district. In case of under utilized millet crops like buck wheat, amaranths, finger millets, etc., the entire area was under local varieties of these crops. Likewise, local varieties of kuth/manoo are grown in the region. In hop, hyb-2 and other varieties are commonly grown in the area though area has decreased drastically from around 200 hectares in 1994-95 to just 50 hectares at present.

2.6.3 Consumption of Fertilizers

After irrigation and high yielding varieties of crops, use of fertilizers is the most important input which affects the crop production and productivity. It has been the combined effect of irrigation-seed-fertilizer technology that ushered in the green revolution in the country in the mid-sixties. It can be clearly seen that consumption of fertilizers in the district is quite high viz., 94 kg/ha as against 50 kg/ha at the state level (Table 2.19). There has been a continuous increase in the consumption of fertilizers in this district. The timely supply of fertilizers well in advance is the most critical task because supply can not be made during sowing season owing to blockade of roads through forbidden passes and glaciers.

Table 2.19 Consumption of Fertilizers, 1991-92 to 2005-06

Year	Lahaul-Spiti		Himachal Pradesh	
	Total NPK consumption (MT)	Per hectare (Kg)	Total NPK consumption (MT)	Per hectare (Kg)
1991-92	282	85.17	30605	31.47
1995-96	251	75.90	29678	31.25
2000-01	225	62.62	35552	37.52
2002-03	359	105.19	39721	42.02
2004-05	291	85.26	46253	48.50
2005-06	322	94.35	47973	50.31

Source: Statistical Outline of Himachal Pradesh (Various Issues)

2.6.4 Extent of Mechanization

Farm mechanization has also played an important role in the development of agriculture in the valley area of Lahaul-Spiti district. No doubt, the district has high mountains and undulating topography but most of the habitation and cultivation of crops is in valley areas where there is gentle slope which permits mechanization of farm operations especially tractorisation. The extent of mechanization in the district has been analysed on the basis of number and types of implements and machinery and relative concentration or density per unit of land (Table 2.20).

There is dominance of manually and animal operated implements but there is continuous improvement in the power operated tools and machinery. During 1992, there were just 31 power operated mechanized tools per thousand hectare of cropped area that increased to as high as 1,080 in 2003. Some decrease was noticed in the number of manually and animal operated implements which may be due to increased tractorisation in the valley areas. There is also a need to develop small tools and equipments like potato planter/digger, hop harvester, irrigation equipments, etc., to reduce the drudgery and increase the efficiency in farm operation which is crucial keeping in view the short working/cropping season in this district.

Table 2.20 Implements and Machinery in Lahaul & Spiti, 1992 and 2003

District/ state	1992		2003	
	Number	Number per 1000 ha	Number	Number per 1000 ha
Lahaul & Spiti				
Manually operated implements	18877	5613	16329	4760
Animal operated implements	4660	1386	9793	2855
Power operated implements	103	31	3705	1080
H.P.				
Manually operated implements	2159568	2202	2874660	3015
Animal operated implements	1246651	1271	1141479	1197
Power operated implements	44622	45	120531	126

Source: Livestock Census of H P, 1992, 2003

Table 2.21 Extent of Mechanization, 1992 and 2003

District/ state	Tractors		Wheat thresher		Cultivators/harrows	
	Total number	Per 000 ha of cropped area	Total number	Per 000 ha of cropped area	Total number	Per 000 ha of cropped area
Lahaul & Spiti						
1992	12	3.57	63	18.73	12	3.67
2003	105	30.61	77	22.45	61	17.78
H.P.						
1992	2565	2.61	12700	12.95	19936	20.94
2003	-	-	-	-	-	-

Source: Livestock Census of H P, 1992, 2003

There has been marked increase in the use of farm machinery as is revealed in Table 2.21. There is a marked increase in the number and density of tractors which increased from just 12 tractors in 1992 to 105 in 2003. The density of tractors per thousand hectares of cropped area increased from 3.57 to 30.61 during this period. There is also remarkable increase in the use of livestock equipments like straw reapers and forage harvesters in the recent years.

2.7 Infrastructural and Institutional Facilities

The present scenario of infrastructural facilities and institutions in the district has been depicted through Table 2.19. The road density in the district is still very low i.e. about 8 Km. in 100 sq. Km of geographical area though the district is sparsely populated. Most of the villages are connected with motorable roads. There has been reasonable development in the creation of infrastructure facilities and amenities with liberal grants from Central Government under tribal sub-plan and centrally sponsored schemes. There is hundred per cent electrification and all the villages have been provided with drinking water supply. There is a primary school in every village while there is one middle school for 9 villages. Around 19 and 21 villages are covered under one high and senior secondary school, respectively (Table 2.22).

Table 2.22 Institutional Infrastructure (as on March 31, 2006)

Institution	Number	Institutions per lakh of population	Villages served per institute
Primary schools	205	617	1
Middle schools	33	99	9
High schools	15	45	19
Senior Secondary	14	22	21
Allopathic Institutions	53	159	5
Ayurvedic Institutions	22	66	13
Veterinary Institutions	54	87	5
Banks	14	42	21
Post offices	47	141	6
Fair price shops	67	202	4
Coop Societies	115	346	2
Panchayats	41	123	7
Agricultural markets	Nil	Nil	Nil
Research stations/substations	4	18	72

Source: District Statistical Abstract, Lahaul & Spiti, 2006-07

Recently, one degree college has also been opened in Lahaul (Udaipur) region. There is also appreciable expansion in the medical facilities as there is one allopathic institute for every 5 villages and one ayurvedic institute for every 13 villages. There is also one veterinary institute for every 5 villages that comes to 87 institutions per lakh of livestock population. The density of banks and post offices has also improved over the years. There was one fair price shop for 4 villages, one cooperative society for every two villages and a gram panchayat for every 7 villages. However, as yet there is no regulated market in the entire district. Four agricultural research and development stations are RRS (CSKHPKV) at Kukumseri (Lahaul), Seed Potato Farm (ICAR) Dalang (Lahaul), RHRS (UHF) at Tabo (Spiti) and RSS (CSKHPKV) at Lari (Spiti)

Chapter-III

SWOT ANALYSIS OF THE DISTRICT

Like other districts, agriculture is the backbone of Lahaul-Spiti. However, the peculiar agro-climatic conditions endow the district with certain strengths and opportunities not commonly found in other districts of the state. These natural and physical resource endowments have proved boon for agricultural transformation and it is presently the most advanced district in terms of commercialization of agriculture. As alluded to above, the district has a vast area which constitutes about one-fourth of the total area of the state and there is still huge untapped potential for raising the production of commercial crops. Therefore, the planning strategy should aim at harnessing these untapped resources for the benefit of people by putting in place right kind of infrastructure and institutions. Based on the profile of the district, the main strengths, weaknesses, opportunities and threats (SWOT) are described below.

3.1 SWOT Analysis for Improving Agricultural and Allied Sectors

3.1.1 Strengths.

The main strengths of the district are as follow:

- i. The district is endowed with agro-climatic conditions that are conducive to grow several high value cash crops. There are vast tracts of culturable waste lands amounting to around 600 hectares both in Lahaul as well as in Spiti which, if brought under irrigation, could increase the cropped area by about 20 per cent.
- ii. There are plenty of water resources in the form of glaciers that are the progenitors of numerous streams and rivulets passing through the valley lands. These perennial resources, if harnessed, could substantially augment the irrigated area
- iii. Both the valleys have potential to grow several niche based high value cash crops like off-season vegetables, vegetable seeds, exotic vegetables, seed potato, hops, apple, almond, apricot, etc. Seabuckthorn (*Hippophae*) is yet another useful shrub that can be successfully grown in these areas. The plant has several pharmaceutical, economical and ecological benefits.
- iv. The geographical location of the district nearer to huge markets in neighbouring states of Punjab, Haryana and Azadpur market, New Delhi and off season supply are the important favourable factors in the sustenance of cash crop based economy of the district.
- v. There is also a huge potential to grow high quality medicinal and aromatic plants. The district is a natural habitat of Kalazeera, Shingu, Salampanja, Karhu, Patish, Ratanjot, Somlata and much other useful herbs whose cultivation can be expanded on a large scale even in sprawling pasture and forest lands.
- vi. Both the valleys, especially Spiti valley, use very low amount of inorganic inputs like chemical fertilisers and thus most of the produce is organic by tradition.
- vii. The district has been provided with minimum basic infrastructure like roads, electricity, drinking water, and so on. There is one full-fledged agricultural regional research station

and two Krishi Vigyan Kendras (KVKs) in the district focussing on location specific research.

- viii. The farmers of both the valleys are innovative and are always willing to experiment and adopt new crop technologies. They are willing to take risks provided right kind of infrastructural and institutional support is provided to them. High literacy rates both among male and females speak of high quality human resource in this hinterland.
- ix. The soils of the district are high in potash and respond well to nitrogen application. Further, the day length promoting high rate of photosynthesis and leads to good yields of crops especially pea and potato.
- x. The unique climatic conditions of the district permit the cultivation of both kharif and rabi crops in summer season that provide more opportunities to diversify farming. This strength has also been used for breeding and generation advancement of wheat, barley, pulses, oilseeds and vegetable crops.

3.1.2 Weaknesses

- i. The district is located in high mountain zones and suffers from inaccessibility, marginality and fragility. For example, Lahaul valley remains cut off from the rest of the world for almost six months from November to May.
- ii. Due to mountainous topography of the district, it is difficult and costly to provide basic infrastructural facilities like rural roads.
- iii. The harsh climatic conditions limit the cropping season to one crop season only.
- iv. Due to low rainfall, the cultivation is possible only with irrigation. Therefore, for want of irrigation facilities, a large tract of land remains uncultivated.
- v. The huge fluctuations in day and night temperatures impact adversely the crop productivities.
- vi. The inadequate availability of infrastructural facilities, particularly rural roads, is another important constraint in the successful growing of high value cash crops, especially perishable vegetable crops. Not only that, rural roads and irrigation pipes require regular maintenance owing to loose soil strata and fluctuating temperatures. This escalates the cost of provision and maintenance of these infrastructural facilities.
- vii. The aboriginal climate and harsh cold winter make living difficult for both human beings and animals. The high mountain passes and glaciers are the natural barriers making the district virtually secluded from rest of the world during winter.

3.1.3 Opportunities

- i. There is a huge and ever growing demand for off-season vegetables which are being grown in both the areas of the district thanks to changes in the dietary habits of the people and rising per capita income.
- ii. The ongoing process of globalisation provides excellent opportunities to export vegetables and other high value cash crops including medicinal and aromatic plants.

- iii. Several areas which were not suitable to grow certain crops like apple a few years back are emerging as the potential areas to grow these and many other high value cash crops thanks to rising temperatures as a result of climate change. The apple grown in Spiti valley has been found to be of very superior quality and has long shelf life.
- iv. There are also opportunities to produce one of the best available breeds of *Chhamurti* horses in pin valley of Spiti and rear *Chigo* goat on a large scale which produce high quality pashmina wool.
- v. The two valleys in the district provide excellent opportunities for the development of agro-eco-tourism. Lahaul-Spiti is one of the most attractive destinations for foreign tourists and adventurers and every year thousands of tourists visit the wonderlands of Lahaul & Spiti.
- vi. The remote areas in Lahaul & Spiti are virtually organic by tradition using no fertilizers and chemicals. These areas can easily be brought under organic farming.
- vii. The adoption of poly house technology can help farmers growing two vegetable crops in six months instead of one crop.

3.1.4 Threats

- i. The agrarian economy of both the valleys thrives on the cultivation of high value cash crops, of which pea is the most important one. The rapidly spreading wilt root-rot complex and powdery mildew diseases in pea pose a major threat not only to the sustainability of this crop but for the agricultural economy of the whole district.
- ii. The excessive dependence on Azad Pea-I variety of pea and dearth of other high yielding varieties is yet another impending threat that looms large on the agricultural economy of the district.
- iii. The rapidly developing technologies to produce off-season vegetables in a controlled environment (polyhouse) also pose formidable threat to the crops grown in these areas. For example, the development of seed plot technologies in the plains a few years back dealt a severe blow to seed potato production in the valley.
- iv. The stagnation in the yields of potato and peas is yet another threat to the cultivation of these crops.
- v. The ongoing process of globalisation also poses threat to the cultivation of high value cash crops in the district. For example, cultivation of hops which used to be a highly profitable crop in Lahaul valley suffered a severe blow as a result of cheaper imports from European countries and China in the aftermath of implementation of WTO accord. The proposed lowering of bound tariffs in the ongoing Doha Round poses a huge threat to the cultivation of these crops.
- vi. The ongoing process of commercialisation and mono-cropping pose a threat of genetic erosion of traditional crop biodiversity like minor millets.
- vii. Mono-cropping also poses a threat to soil fertility and health of the natural resource base.
- viii. Limited time period to supply critical inputs.

3.2 Issues Emerging out of SWOT Analysis

The important issues that emerge from the detailed SWOT analysis of the district are given below.

- ✓ To control rapidly spreading wilt root rot complex and powdery mildew diseases in pea and various diseases in potato crop
- ✓ To develop high yielding varieties of pea and other high value cash crops that are being grown in the district
- ✓ To strengthen the extension facilities to educate the farmers about the technical know how in poly house and other technologies
- ✓ The augmentation of irrigation facilities by exploiting perennial sources of water to expand the cultivated area
- ✓ To improve connectivity through providing all weather roads and other infrastructural facilities like markets and collection centres

3.3 Sectoral Growth Drivers

The availability of suitable agro-climatic conditions to grow high value cash crops, especially in a season when these are not grown in other states, rising demand for these crops and huge market for these crops in the neighbouring states including Azadpur market, New Delhi are some of the important growth drivers of the agrarian economy of the district. Besides these factors, the availability of infrastructural facilities like rural roads is yet another important growth driver.

Chapter IV

DEVELOPMENT OF AGRICULTURE SECTOR

The development of agricultural sector of any region is circumscribed by a host of factors including physical, institutional and human resource. An in-depth enquiry into all these aspects is of paramount importance to plan the strategies for development of agriculture. In this section, pertinent aspects that need thorough understanding for developing agricultural plans are described.

4.1 Land Use Pattern and Soil Health

The land use pattern clearly reveals the limited availability of arable land in Lahaul-Spiti district due to mountainous terrains (Table 4.1). Out of the total geographical area of 9,11,198 hectares, the cultivated area is only 3,043 hectares (just 0.33 per cent). The major proportion of the area falls under barren and uncultivable land (60 per cent), forests (15 per cent) and pastures (24 per cent). However, there are 597 hectares of culturable, 373 ha of fallow lands that can be developed and brought under cultivation which would increase the existing cultivated area by about 32 per cent. This may require substantial investment on reclamation, fencing/bunding and development of irrigation. The vast barren/pasture lands require conservation and can be developed into rich repository of temperate grasses and high value medicinal herbs. It needs to be mentioned here that the district harbours vast summer green pastures sustaining large number of migratory shepherds.

The pertinent problems and interventions under different classes of land use have been shown in Tables 4.2. The fragile topography, barren lands, weeds, lack of tree cover and water/wind erosion of top soil are the major impediments preventing productive use of vast geographical area in the district. The lack of irrigation makes it almost impossible to have any type of vegetation except thorny unwanted bushes and weeds. Therefore, land development must form the major intervention in agricultural planning.

The district represents the soils occurring on different landforms of Greater Himalayas (Alpine Humus Mountain Skeletal Soils). However, its area is with rock outcrops or covered with permanent glaciers.

The soils occurring on side slopes and tops of mountains under grasses are shallow to medium, excessively drained, gravelly, sandy –skeletal to loamy skeletal, slightly alkaline, highly calcareous, severely eroded with low available water capacity (AWC). They are classified taxonomically as cryorthents. The forest soils are dominantly deep, well to excessively drained, coarse loamy and loamy skeletal with low to medium available water capacity. They are slightly acidic to neutral and moderately to severely eroded soils with moderate stoniness and have been classified as udorthents and eutrochrepts.

The soils on bench terraces (steeply sloping hills) are medium deep to deep, well to excessively drained with wide range of particle size classes, viz. sandy skeletal, loamy skeletal, fragmental, coarse loamy and fine loamy. They are generally slightly alkaline, calcareous, having relatively high base saturation. The AWC is low to medium. They are classified as cryorthents in cryic temperature regime and udorthents and eutrochrepts in mesic temperature regime.

The gently to moderately steeply sloping glacio-fluvial valleys are occupied by medium to deep, well to excessively drained, loamy skeletal and coarse loamy to fine loamy soils. The soils are slightly to moderately alkaline and highly calcareous with low to medium AWC and are classified as cryorthents, cryochrepts and eutrochrepts. The gently to moderately sloping fluvial valleys have medium to deep, well to somewhat excessively drained, loamy skeletal and coarse loamy, slightly acidic to neutral soils with low AWC. The soils are classified as udorthents and eutrochrepts.

The soils of Lahaul & Spiti are low in available nitrogen, high in available phosphorus and low to medium in available potassium. The organic carbon status of the soils is high. The soils contain adequate amount of micronutrients. The soils of the district are highly susceptible to wind and water erosion.

Table 4.1 Land Utilization Pattern (Ha)

Sr. No	Particulars	Lahaul	Spiti	District
1	Total geographical area	201087	710111	911198
2	Forests	134887	482	135369
	Productive	54887	370	55257
	Degraded	80000	112	80112
3	Barren and uncultivable land	352	549089	549441
	Rocky/ Stony/ Sloppy lands	352	549089	549441
4	Land put to non-agricultural uses	1399	1051	2450
	Buildings	462	662	1124
	Roads/paths/channels	937	389	1326
5	Culturable waste	161	436	597
	Weed/bush infested	0	0	0
	Area prone to animal menace	0	0	0
6	Permanent pastures and other grazing lands	62027	157771	219798
	Productive	25000	147657	172657
	Degraded	37027	10114	47141
7	Land under miscellaneous tree crops and groves	76	51	127
8	Fallow land	29	344	373
	Current fallow	21	344	365
	Other fallow	8	0	8
9	Cultivated land	2156	887	3043

Source: Field Survey, 2007-08

Table 4.2 Land Utilization Pattern- Problems (Per Cent of Panchayats)

Particulars	Problems	Interventions	Lahaul	Spiti
Forests				
Productive	Unwanted grasses	Weeding and planting nutritive grasses	25	
Degraded	Fragile topography	Tree plantation	100	75
	No tree cover	Introducing nutritive grasses	100	75
	Bushes	Breeding suitable tree varieties	100	75
	Unwanted grasses	Watch and ward	50	75
	Undulating	Fencing	25	75
		Planting of willow, deodar and poplar	75	25
		Construction of check dams	50	50
		Planting of seabuckthorn	50	75
Barren and uncultivable land				
Rocky	Undulating	Land levelling, Contour bunding	75	100
	Lack of irrigation		75	100
	Degradation	Developing suitable varieties of trees	75	100
	River bed erosion	Planting seabuckthorn	75	100
Land put to non-agri uses	Diversion of productive land	Formulating land use policy to check conversion of productive land to non-agricultural uses	100	25
Culturable waste				
Weed/bush infested	Weeds	Eradication of weeds		25
		Orchard plantation	25	75
Area difficult to manage	Water logging	Drainage		25
	Stony land	Soil reclamation		25
	Lack of irrigation	Irrigation facilities		25
	Sloppy	Land levelling		25
Permanent pasture and other grazing lands				
Productive	Low production	Introducing improved nutritive grasses	75	100
	Low nutritive grasses	Research on improved grass species	100	100
	Unwanted grasses	Introduction of improved grasses and fodder trees	25	100
Degraded	Bushes/weeds infested	Clearing weeds/bushes	75	25
	Soil erosion	Introducing high yielding grasses	75	
	Low nutritive grasses	Check dams	75	25
	Distance from village	Technical know-how to the farmers for pasture management	25	50
		Research on improved grasses	75	25
		Irrigation facilities	75	50

Land under miscellaneous tree crops and groves	Drying of Salix trees	Treatment for drying trees	50	
Fallow land				
	Undulating land	Check dams	50	
	Low soil fertility	Use of FYM	25	50
Cultivated land	Non functional irrigation schemes	Maintenance of Kuhl	50	100
	Unfenced	Fencing	50	50

Source: Field Survey, 2007-08

4.2 Water Resources and Management

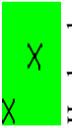
The district has a unique topography and rainfall pattern. Most of the precipitation is in the form of heavy snow in winter months. The monsoon rains, unlike other parts of the state, are scanty. The district is bestowed with wide network of rivers, rivulets and streams emanating from large mass of perennial glaciers lying on high land mountains. There are number of perennial glaciers and snow fields above 5,000 metres above mean sea level remaining covered with snow throughout the year and are the progenitors of major river systems in north India. The major glaciers and lakes are; Baralacha (Chander Tal and Suraj Tal), Bara Shigri, Nilkanth, Kanjar, Rani Nala and many others. The transverse and zig-zag arrangements of mountain ranges direct number of water streams over a wide landscape and verdant valleys. The Chandrabhaga or Chenab (Vedic name Askni), the largest river (in volume of water) is formed after the confluence of two rivers, Chandra and Bhaga at Tandi, in Lahaul and flows 122 kms with a catchments area of 7,500 sq.km. in Himachal, before entering Kashmir. The rivers Bhaga originates from Surajtal and Chandra from Chandertal lakes on opposite sides of Baralacha glaciers and pass through barren lands where there are no signs of life. Spiti River (tributary of Sutlej) originates from Kunjam pass in Spiti and flows eastwardly bisecting Spiti valley and is joined by many streams on the way before it merges into Sutlej at Khab in Kinnaur district. These rivers are fed by large number of *Nallas* and streams that become quite turbulent during summer when glaciers melt on mountains. Fortunately, plenty of irrigation water is available during cropping season in summer.

The springs are widely distributed emanating from snow deposits and form the major source of surface irrigation through gravity Kuhl. Springs are both perennial and ephemeral getting recharged mainly from melting of snow on higher reaches. The discharge of the springs increases enormously during summer. In this way, irrigation and domestic water supply is mainly depending upon these springs. However, no in-depth study on the geomorphological aspects has been conducted so far. Based on the geomorphology and ground details, ground water sources do exist but have not been exploited for irrigation so far. The ground water is distributed in the alluvial terrains as depicted through the ground water map of the district. The depth of soft and hard rock aquifers has been ascertained at 10-20 metres for dug or manual wells. The ground water recharge can be increased with construction of check dams.



Source: Central Ground Water Board, Northern Himalayan Region (NHR), Dharamshala

Ground Water User Map Legend of District Lahaul & Spiti

Legends	Wells feasible	Rigs suitable	Depth of Well (m)	Discharge (lpm)	Suitable artificial Recharge structures
 Soft rock aquifers	Tube well	DTH with Odex	100-150	1200-2500	Check dam, Check dam cum ground water dam, Recharge shaft
 Hard rock aquifers	Dug well	Manual	10-20	300-500	
 Thrust	Dug well Spring development	Manual	10-20	300-500 30-2000	
 Major drainage  Hot water spring(50°C)  Spring					
 Fault/lineament  Tehsil boundary  District boundary  State boundary  International boundary					

Source: Central Ground Water Board, Northern Himalayan Region (NHR), Dharamshala

Pertinent Information of Water Sources in Lahaul & Spiti

Total area	13835 sq.km
No. of Tehsils/Sub tehsils	3
Major drainage	Chenab, Spiti
Rainfall	683 mm
Temperature	-10° C to 35° C
Regional geology	Alluvium, Metamorphics
Ground Water quality	Good, EC <750 μ mhos/cm at 25°C
Utilizable ground water resources	Not estimated (localized aquifers)
Stage of ground water development	Not estimated (localized aquifers)
Water shed/tehsil showing intensive ground water development	Nil

Source: Central Ground Water Board, Northern Himalayan Region (NHR), Dharamshala

4.3 Cropping System and Cropping Pattern

In this district, there is only one cropping season starting from April to September. During this period all the crops (kharif and rabi) are grown in one season. Generally mono-cropping is practiced by the farmers as there is virtually no scope to take two or more crops except in very limited area in Lahaul valley where pea-buckwheat or barley-buckwheat rotations are possible. Consequently, the cropping intensity in this district is little over 100. Therefore, the cropping system as well as cropping pattern is obviously same in this district. The cropping pattern shown in Table 4.3 clearly reveals high degree of commercialisation of farming. Pea and potato are the two major cash crops of the district. Total area under respective crops has been given in Appendix 2.

The extent of commercialisation was considerably higher in Lahaul where pea and potato command about 43 and 29 per cent of the cropped area. The area under hop and kuth grown in Lahaul only is presently quite low (40 hectares each). In Spiti beside barley and pea, apple plantation is gaining momentum in recent years. Therefore, beside agriculture, horticulture also needs to be given due importance in this district. It is also visualised that there are many other vegetable and minor crops grown on a very limited scale for domestic use only. Therefore, pea, potato, apple and, to some extent, hop and kuth in Lahaul and pea, potato, barley and apple in Spiti are the crops of main economic significance. The estimated total cropped area of the district came out to be about 3,891 hectares out of which 2,671 hectares were in Lahaul and 1,220 hectares in Spiti region.

Table 4.3 Cropping Pattern in Lahaul-Spiti District (Per Cent)

Crops	Lahaul	Spiti	District
Cereal	15.84	41.87	24.00
Maize	1.72		1.18
Wheat	2.16	2.87	2.38
Barley	10.04	38.99	19.12
Ogla/Phafra	1.92		1.32
Pulses	0.70	0.64	0.68
Rajmash	0.70	0.53	0.65
Kala matar	0.00	0.11	0.03
Oilseeds (Sarson)	0.00	0.16	0.05
Vegetables	74.21	41.03	63.81
Potato	29.95	8.38	23.19
Peas	43.88	32.62	40.35
Tomato	0.05		0.03
Cabbage	0.20	0.00	0.14
Radish	0.13	0.03	0.09
Fruits	6.24	16.31	9.40
Apple	6.22	16.14	9.33
Apricot	0.03	0.11	0.05
Dry fruits		0.05	0.02
Hop	1.50	0.00	1.03
Kuth	1.51	0.00	1.04
Total cropped area	100.00 (2670.72)	100.00 (1220.20)	100.00 (3890.92)

Note: Figures in parentheses show cropped area

Source: Field Survey, 2007-08

4.4 Input Use and Gaps

In agricultural development and planning, critical inputs play a major role in promoting growth. In the past, the quantum jump in production of foodgrain crops especially rice and wheat was ushered in by the combined interplay of seed, fertilizers, irrigation and improvement in technology. These four components deriving growth in production are most relevant in hilly regions where green revolution has made little impact due to hill specificities and technical bias favouring well endowed plain regions of the country. The critical inputs should be made available in accordance with the need of the area and potential available.

The input use pattern and gap in the input use among average and progressive farmers have been displayed in Table 4.4. It was found that by and large farmers were using higher seed rates in most of the crops both in Lahaul as well as in Spiti blocks. The gap in seed rate was only in case of potato where average use was less than the use by progressive farmers.

However, there was wide gap in manures and fertilizers between the average use and use by the progressive farmers which along with variety and management may be the major reasons for lower average yields than potential yields of crops. The total requirement of Urea, CAN, IFFCO

and SSP has been estimated at 475 tonnes, 115 tonnes, 234 tonnes and 159 tonnes, respectively (Table 4.5). There is also shortage of FYM in both the regions. The use of pesticides and chemicals is quite low in the area. Though the occurrence of diseases and pests is relatively low but in most of the parts, the chemicals are also not available and farmers, in general, are also not aware of the right type of chemicals. The use of weedicide is almost absent in the district.

Table 4.4 Input Use, Requirement and Gap (Kg/Ha)

Inputs	Crops	Lahaul			Spiti			District		
		Used	Required	Gap	Used	Required	Gap	Used	Required	Gap
1 Seed										
	Maize	65.00	30.00							
	Wheat	130.00	100.00		187.50	125.00		140.75	112.50	
	Barley	116.77	120.00	3.50	125.00	125.00		120.89	122.50	2.50
	Kuth									
	Ogla/Phafra	20.87								
	Rajmash	80.00			125.00			102.50		
	Gram									
	Kala matar				187.50					
	Sarson				12.50					
	Potato	26.28	25.94		11.12	20.00	8.88	18.70	22.97	4.44
	Peas	120.00	90.00		145.69	100.58		132.85	95.29	
	Cabbage									
	Kuth	25.00	25							
	Apple	298.12	230.00		239.01	230.00		268.57	230.00	
2. Manure and fertilizers										
	Urea	105.00	166.00	61.00	42.36	80.91	38.55	92.10	154.32	62.22
	CAN		26.92	26.92	34.32	44.17	9.85	21.45	44.43	22.98
	IFFCO	38.07	91.69	53.62	11.28	21.37	10.09	30.84	70.66	39.82
	MOP	8.97	16.97	8.00				5.61	10.61	5.00
	SSP	35.89	70.15	34.26				22.43	43.84	21.41
	Vermi compost	1.16	34.88	33.72				1.16	34.88	33.72

FYM	733.30	892.53	159.23	113.91	242.93	129.02	423.61	567.73	144.13
Biofertilizers					32.43	32.43		32.43	32.43
3. Chemicals used (pesticides/insecticides/weedicides)									
Nuvan	0.43				0.18	0.18	0.22	0.09	
Durmet	0.33						0.17		
DM-45	0.90						0.45		
Bvistan	0.36						0.18		
Kerakhand	0.22						0.11		

A-Average, P-Progressive, G-Gap

Source: Field Survey, 2007-08

Table 4.5 Estimated Requirements and Gaps in Manures and Fertilizers (Tonnes)

Fertilizers	Lahaul			Spiti			District		
	A	R	G	A	R	G	A	R	G
Urea	238.46	376.99	138.53	51.68	98.71	47.03	290.13	475.70	185.56
CAN	0.00	61.14	61.14	41.87	53.89	12.02	41.87	115.02	73.15
IFFCO	86.46	208.23	121.77	13.76	26.07	12.31	100.22	234.30	134.08
MOP	20.37	38.54	18.17	0.00	0.00	0.00	20.37	38.54	18.17
SSP	81.51	159.31	77.80	0.00	0.00	0.00	81.51	159.31	77.80
Vermi compost	2.63	79.21	76.58	0.00	0.00	0.00	2.63	79.21	76.58
FYM	1665.32	2026.94	361.61	138.97	296.37	157.40	1804.29	2323.31	519.02
Biofertilizers					39.56	39.56		39.56	39.56

Note: Estimated on the basis of Panchayat survey A - Actual, R - Required, G - Gap

Source: Field Survey, 2007-08

4.5 Yield Gap Analysis

The yield gap analysis has been presented in Table 4.6. It was found that average yields of the crops in two blocks were considerably lower than yield on progressive farmers. It has been observed that there were narrow gaps in the inputs use but considerable gaps in yields of different crops. This clearly shows that differences in the use of improved technology (variety per se) and management practices contributed towards higher yield gaps of crops rather than gap in inputs use. In most of the crops yield can be doubled from the existing levels. This calls for greater role of R & D institutions to abridge this gap through dissemination of technology and extension advisory services.

Table 4.6 Yield Gaps in Different Crops (Q/Ha)

Crops	Lahaul			Spiti			District		
	A	P	G	A	P	G	A	P	G
Maize	21.25	40.00	18.75				21.25	40.00	18.75
Wheat	22.00	38.00	16.00	16.40	25.00	8.60	19.88	33.08	13.20
Barley	28.54	45.00	17.46	16.72	25.00	8.28	20.98	32.21	11.23
Ogla/hafra	7.38	18.00	10.62				7.38	18.00	10.62
Pulses									
Rajmash	9.50	14.00	4.50	10.00	12.50	2.50	9.63	13.62	3.99
Kala matar				25.00	30.00	5.00	25.00	30.00	5.00
Oilseeds									
Sarson				1.36	2.75	1.39	1.36	2.75	1.39
Vegetables									
Potato	184.08	400.00	215.92	86.88	130.00	43.12	173.13	369.39	196.33
Peas	80.70	150.00	69.30	76.61	150.00	73.39	79.66	150.00	70.34
Fruit									
Apple	78.51	150.00	71.49	16.54	150.00	133.46	44.88	150.00	105.12
Others									
Hop	24.00	42.00	18.00				24.00	42.00	18.00
Kuth	50.00	50.00					50.00	50.00	

Note: A-Average, P-Progressive, G-Gap

Source: Field Survey, 2007-08

4.6 Reasons for Gap

The reasons for gaps in productivity of major crops are displayed in Table 4.7.

The main reasons for yield gaps in different crops were non availability of critical inputs at right time, low and unbalanced use of fertilizers, lack of technical know how about improved practices and disease/pest control, shortage of FYM because of less number of farm animals and shortage of labour in peak cropping season. The severity of these problems, in general, was more pronounced in Spiti. This may be the main reason for low crop yields in Spiti in comparison to Lahaul.

Besides critical inputs and cultural practices, the crop protection also forms the major strategy to improve productivity of crops. The diseases, insect pests and weeds cause substantial reduction in yields. The major diseases of different crops in Lahaul & Spiti are shown in Table 4.8. The major weeds found in different crops and support lands are enlisted in Table 4.9.

Table 4.7 Reasons for Gaps in Crop Yields in Lahaul-Spiti (Per Cent of Panchayats)

Crops	Reasons for gap	Lahaul	Spiti
Maize	Low use of fertilisers	25	
	Less use of FYM	50	
Wheat	Local seed	50	75
	No use of weedicides	100	100
	Low use of FYM	75	75
	Low use of fertilisers	50	100
	Non-availability of HYV seeds	50	75
	Infestation of weeds	50	50
Barley	Lack of irrigation	25	25
	No use of HYY	50	75
	Less use of FYM	100	100
	Poor crop management	50	75
Ogla/Fafra	Low use of FYM	75	75
	Local variety	100	100
	Lodging and late maturity	50	
Rajmash	Non-availability of improved variety seeds	75	75
	Attack of blister beetle	50	
Sarson	Use of local seed		50
	High seed rate		100
	Lack of awareness about improved practices		50
Potato	Unbalanced use of fertilizers	75	100
	Untimely application of inputs	25	50
	Lack of plant protection measures	50	100
	Differences in fertility of soil	25	50
	Low use of FYM	50	75
	Low use of fertilizers	25	100
	Shortage of labour	75	25
	Local seed	25	50

Peas	Unbalanced use of fertilisers	75	100
	Shortage of labour	50	25
	Low use of FYM	75	50
	Powdery mildew disease	50	25
	High seed rate	75	100
	Low germination	25	50
Tomato/Cabbage	Non availability of seeds/seedlings	100	
	Lack of awareness about improved practices	50	

Source: Field Survey, 2007-08

Table 4.8 Major Diseases Limiting Crop Production in Lahaul & Spiti

Crop	Diseases	Insect pests
Cereals		
Maize	Banded leaf and sheath blight	
Wheat	Rusts (yellow & leaf rusts)	Aphid
	Loose smut	Armyworms
Barley	Yellow rust	Aphid
	Barley blight	Armyworms
Vegetable crops		
Pea	Root rot/wilt complex	Sitona weevil
	White rot	Pod borer complex
		Cutworms
		White grubs
Potato	Late blight	Cutworm
	Bacterial wilt	Aphid
Pulse crops		
Rajmash	Anthracnose	Cutworms
		Bean bug
		White grubs
		Blister beetle

Source: Field Survey, 2007-08

Table 4.9 Priority Wise Weed Problems in Different Crops

Crop	Weeds (priority wise)
A Weeds in crop lands	
Barley	<i>Melilotus alba</i> , <i>Chenopodium album</i> , <i>Malva neglecta</i>
Wheat	<i>Polygonum alatum</i> , <i>Chenopodium album</i> , <i>Cirsium arvense</i> , <i>Equisetum typhoides</i>
Buckwheat	<i>Equisetum typhoides</i> , <i>Polygonum alatum</i> , <i>Digitaria sanguinalis</i> , <i>Chenopodium botrys</i>
Frenchbean	<i>Poa annua</i> , <i>Equisetum typhoides</i> , <i>Digitaria sanguinalis</i> , <i>Chenopodium botrys</i>
Peas	<i>Chenopodium album</i> , <i>Equisetum arvense</i> , <i>Chenopodium botrys</i> , <i>Poa annua</i>
Potato	<i>Equisetum typhoides</i> , <i>Polygonum alatum</i> , <i>Chenopodium botrys</i>
B Weeds in support (pasture) lands	<i>Artemisia sp.</i> , <i>Equisetum typhoides</i> , <i>Rumex acetocella</i> , <i>Urtica dioica</i>

Source: Field Survey, 2007-08

4.7 Farm Mechanisation

In spite of being a hilly area, farm mechanisation has been on a steady pace especially in Lahaul block. It is interesting to note that cultivation is generally done in valley areas having plain topography. This has enabled the farmers to use tractors for ploughing operations. The extent of use of machinery and improved tools has been depicted through Table 4.10.

In farm machinery, the use of tractor, thresher and spray equipments is common in Lahaul. However, in Spiti, use of thresher is still quite low though tractor is being used in ploughing operation as well as for transportation purpose. The farmers in Spiti are also using spray pumps to spraying pesticides in pea and potato crops. However, use of power tiller and iron plough is less common in both the blocks. The farmers in the district require more tractors than the existing numbers. There is remarkable preference for chaff cutter and the existing number is far below the requirement. In this way, there is gap in tractor, thresher and chaff cutter in the district and spray pumps in Lahaul.

The major problems in the use of machinery are financial, lack of suitable models, lack of supply and problems relating to repairs/maintenance (Table 4.11). Therefore, there is a need to develop cost effective machinery specific to hilly conditions. Liberal credit facilities and subsidy should be provided to the farmers to purchase machinery and farm tools. There is also a need to open workshops for a cluster of villages for repair and maintenance of farm machinery. The educated youth need to be trained and encouraged to establish such workshops in the area.

Table 4.10 Farm Machinery Use & Gap

Machinery	% users	Number		
		Existing	Required	Gap
Lahaul				
Thresher	70.00	120	135	15
Tractor	48.59	35	119	84
Iron plough	36.48	1960	140	
Spray pump/ power sprayer	89.10	560	420	
Chaff cutter	50.00	800	1913	1113
Power tiller	4.03	56		
Spiti				
Thresher	14.34	63	110	47
Tractor	46.39	104	120	16
Iron plough	73.4	764	478	
Spray pump/ power sprayer	80.97	702	933	231
Chaff cutter			1242	1242
Power tiller	0.43	13		
District				
Thresher	51.52			
Tractor	27.49	183	245	62
Iron plough	54.94	139	239	100
Spray pump/ power sprayer	60.04	2724	618	0
Chaff cutter		1262	1353	231
Power tiller	2.23	800		

Source: Field Survey, 2007-08

Table 4.11 Problems and Intervention for Farm Machinery (Per Cent of Panchayats)

Machinery	Problem	Intervention	Lahaul	Spiti
Thresher	Low efficiency	Improvement in design		75
	High cost	Subsidy	50	50
Tractor	Problem of finance	Credit facility and subsidy	100	
	Repair and maintenance	Agri workshop	75	100
	Less efficient	Hill specific design	25	100
Iron plough	Less efficient	Training and demonstration of use of farm machinery	25	75
	Non availability in local market	Self help groups for timely and smooth availability of farm machinery	25	50
	Heavy	Less weight plough	25	75
Spray pump/Power sprayer	Problem of finance	Credit facility and subsidy	75	75
	Not available	More supply by Agri. Dept.	50	25
Chaff cutter	Problem of finance	Credit facility and subsidy	75	
	Not available	Supply by Govt. agency		100
Power tiller	Less efficient	To enhance power efficiency	25	
	Lack of suitable model	Developing hill specific and cost effective models	50	

Source: Field Survey, 2007-08

4.8 Ongoing Schemes for Agriculture and Rural Development

There are different ongoing schemes in the district launched by the State Government for development of agriculture. Number of these schemes, beneficiary villages/families along with total budget outlay has been displayed in Table 4.12. These schemes include snow/water harvesting, soil conservation measures, agricultural/horticultural schemes, livestock improvement and development of rural infrastructure. In agricultural development, Spiti has remained most backward as compared to Lahaul. Therefore, in recent years liberal funding has been made to develop this region at par with Lahaul. The development of rural roads and bridges has received top priority obviously to connect remote villages of Spiti to facilitate transportation and marketing of cash crops grown in this district. In the past, special central assistance for tribal area and funding under Desert Development (DDP) schemes has made significant impact on infrastructural development.

Table 4.12 Existing Schemes for Agriculture and Rural Development

Block	No. of Schemes	Village covered (No.)	Population covered (No.)	Area covered (ha)	Beneficiary families (No.)	Status		Total budget (Rs. Lakh)	Additional funds required (Rs. Lakh)
						Complete (No.)	Incomplete (No.)		
Snow Harvesting									
Lahaul									
Spiti	18	30	-	540	1230	18		27.56	
Total									
Soil/ Land Conservation									
Lahaul									
Spiti	1	10	-	-	200	1		10.00	
Total									
Fruit Production									
Lahaul	11	271			705	0	11	68.00	
Spiti	7	113	-		1500	7		44.56	
Total	11	384	-		2205	7	11	112.56	
Other Agricultural Schemes									
Lahaul									
Spiti	1	30	-	0	-		1	5.36	
Total	1	30	-	0		0	1	5.36	
Fisheries (Pond)									
Lahaul	12	9			12	12		0.6	
Spiti	3	1			80	3		1.50	
Total	12	10	-	0	92	15		2.1	
Livestock Improvement									
Lahaul	6	290	22545		3238	0	6	9.44	
Spiti	15	113	-	0	2149	15	0	203.72	
Total	15	403	-	0	5387	15	6	213.16	
Roads (Km)									
Lahaul	90	30			392			2700.00	
Spiti	500	73				500		8603.32	
Total	590	103			392	500		11303.32	
Bridges (No.)									
Lahaul	7	10			232		7	21.00	
Spiti	23	50			0		23	24.79	
Total	30	60			232		30	45.79	

Source: Field Survey, 2007-08

Gravity Kuhl is the major source of irrigation in this district and entire cultivated area is irrigated. However, the cost of irrigation development is quite high due to difficult terrain and fragile soil strata. The irrigation channels are required to be renovated almost every year as these are badly damaged by winter snow and land slides. The irrigation schemes are managed mainly by the Department of Irrigation and Public Health. There are also few private schemes maintained by the farmers themselves. The flow irrigation is the major practice in all the crops though the system was found least efficient and not suited to loose soil structure of this district. Therefore, there should be more thrust on sprinkler irrigation system and the farmers should be given incentives to patronise sprinkler system of irrigation. There is ample irrigation potential in

this district which, if exploited, can turn the culturable barren lands into green valleys or apple garden colonies. There are a few such successful models already developed.

The completed irrigation schemes in the district along with villages covered and command/actual-irrigated area have been shown in Table 4.13. There are functional as well as non-functional irrigation schemes in both the blocks as given in Tables 4.14 and 4.15. The non-functional irrigation schemes would require additional funds for their revival/completion.

Besides, there are various ongoing irrigation schemes depicted through Table 4.16 where the developmental work is in progress. Presently, limited area is irrigated, as these schemes would take time for their completion. The irrigation development should be given top priority as without irrigation, even the grass would not grow in this dry temperate region

Table 4.13 Status of Completed Irrigation Schemes

Particular	Lahaul	Spiti	District
1. Lift irrigation			
Number	1	2	3
Amount spent (Rs. Lakh)	2.5	18	21
Villages to be covered	1	2	3
Beneficiaries (No.)	20	35	55
Command area (ha)	40	50	90
Actual irrigated area (ha)	20	50	70
2. Kuhl			
Number	51	81	132
Amount spent (Rs. Lakh)	1875	2170	4045
Villages to be covered	64	81	145
Beneficiaries (No.)	0	2350	2350
Command area (ha)	2387	3766	6152
Actual irrigated area (ha)	2100	1100	3200

Source: Field Survey, 2007-08

Table 4.14 Status of Functional Irrigation Schemes

Particular	Lahaul	Spiti	District
1. Lift irrigation			
Number	1	2	3
Amount spent (Rs. Lakh)	3	18	21
Villages covered. (No.)	1	2	3
Beneficiaries (No.)	20	35	55
Command area (ha)	40	50	90
Actual irrigated area (ha)	20	50	70
2. Kuhl			
Number	51	76	127

Amount spent (Rs. Lakh)	1875	2130	4005
Villages covered. (No.)	64	76	140
Beneficiaries (No.)	2387	2185	4572
Command area (ha)	2387	3766	6152
Actual irrigated area (ha)	2100	1100	3200

Source: Field Survey, 2007-08

Table 4.15 Status of Non-Functional Irrigation Schemes

Particular	Lahaul	Spiti	District
1. Kuhl			
Number	0	5	5
Amount spent (Rs. Lakh)	0	540	540
Villages covered (No.)	0	5	5
Beneficiaries (No.)	0	165	165
Command area (ha)	0	265	265
Actual irrigated area (ha)	0	265	265

Source: Field Survey, 2007-08

Table 4.16 Status of Ongoing Irrigation Schemes

Particular	Lahaul	Spiti	District
1. Lift irrigation	3		3
Number	200	-	200
Amount spent (Rs. Lakh)	7	-	7
Villages to be covered (No.)	100	-	100
Beneficiaries (No.)	111	-	111
Command area (ha)	111	-	111
Actual irrigated area (ha)	3	-	3
2. Kuhl			
Number	67	-	67
Amount spent (Rs. Lakh)	1036	-	1036
Villages to be covered (No.)	70	-	70
Beneficiaries (No.)	-	-	0
Command area (ha)	893	-	893
Actual irrigated area (ha)	893	-	893

Source: Field Survey, 2007-08

4.9 Interventions for District and Financial Estimates

On the basis of extensive survey, it was estimated that as a part of land development/improvement strategy, there is a need to patronise soil conservation measures and other interventions to enhance productive use of lands. The pertinent land development interventions shown in Table 4.17 are; eradication of weeds, planting suitable tree species like willow or seabuckthorn and nutritive grasses, development of irrigation to promote horticulture, *in-situ* or *ex-situ* plantation of medicinal and aromatic plants, fencing, contour bunding/check dams, etc.

The district, as a whole, needs land levelling in about 2,020 hectares, contour bunding in 1,371 hectares and reclamation in 741 hectares mostly in Spiti. The total length of fencing and check dams has been estimated to be 27,304 metres and 18,353 metres, respectively (Table 4.18). All these interventions would require substantial funding amounting to Rs 485 lakhs (excluding forest land development). The major allocation needs to be made for the development of pastures and cultivable land.

To realise higher growth in agriculture, land development, irrigation and transfer of improved technology should be given priority. Based on the felt needs of the people in Lahaul and Spiti blocks, the new schemes proposed for agricultural and rural development along with likely number of beneficiary families, potential area and funds requirement have been documented in Table 4.19. The new emerging avenues are the protected cultivation, organic farming, cold-water fisheries and agro-eco-tourism for which district has natural and ecological advantages. The rural infrastructure and marketing need continuous priority to provide connectivity to secluded villages in some parts of both Lahaul and Spiti regions.

The funds earmarked for repair and maintenance of functional and non-functional schemes are shown in Table 4.20. Needless to mention, irrigation is the lifeline of all agricultural activities because of scanty rainfall during summer and monsoon season. Special emphasis needs to be given to snow harvesting and development of kuhl irrigation in Lahaul & Spiti.

Table 4.17 Land Utilization Pattern: Interventions for Land Improvement (Per Cent of Panchayats)

Sr No	Particulars	Lahaul	Spiti
1	Forests		
	<i>Productive</i>		
	(i) Eradication of weeds	50	50
	(ii) Breeding quick growing tree varieties	75	50
	(iii) Planting forage grasses	75	75
	(iv) In situ conservation of medicinal herbs	75	50
	(v) Plantation of fuel and fodder trees	100	100
	<i>Degraded</i>		
	(i) Tree plantation	50	75
	(ii) Introducing nutritive grasses	75	75
	(iii) Breeding suitable tree varieties	50	50
	(iv) Planting of willow, deodar and poplar	100	50
	(v) Stabilisation of glaciers & construction of check dams	100	100
	(vi) Planting of seabuckthorn	75	100
2	Barren and uncultivable land		
	<i>Rocky/stony/sloppy</i>		
	(i) Land levelling and development	75	100
	(ii) Developing suitable varieties of trees	75	50
	(iii) Planting seabuckthorn	75	100
	(iv) Construction of check dams	50	75

3	Land put to non-agricultural uses		
	<i>Buildings/ Roads/paths/channels</i>		
	(i) Framing of land use policy to check conversion of productive agricultural land to non-agricultural uses	25	
5	Permanent pasture and other grazing lands		
	<i>Productive</i>		
	(i) Improved grass cuttings	75	75
	(ii) Weed eradication	50	75
	(iii) Research on improving/ planting available grass species	100	100
	(iv) Training in pasture management	50	75
	<i>Degraded</i>		
	(i) Clearing weeds/bushes	75	50
	(ii) Introducing high yielding grasses	75	75
	(iii) Check dams	100	75
	(iv) Technical know-how to the farmers for pasture management	50	75
6	Land under miscellaneous tree crops and groves		
	(i) Treatment for drying trees	100	25
	(ii) Checks on land slides/ erosion	100	100
7	Fallow land		
	<i>Current fallow</i>		
	(i) Check dams	25	50
	(ii) Introduction of perennial medicinal plant species	25	50
	(iii) Fruit plantation	75	100

Source: Field Survey, 2007-08

Table 4.18 Improvements Needed to Increase Productivity of Land

Particular	Lahaul	Spiti	District
Land Levelling (ha)	1339.34	680.509	2019.63
Contour bunding (ha)		1370.57	1370.57
Fencing (length meters)	23203.83	4100.66	27304.49
Reclamation (ha)		740.97	740.97
Check dam (length in meters)	17558.26	794.41	18352.67

Source: Field Survey, 2007-08

Table 4.19 Funds Required for Land Development (Rs. Lakh)

Sr. No	Particular	Lahaul	Spiti	District
1	Barren and uncultivable land			
	Rocky/ Stony/ Sloppy	50	100	150
2	Land put to non-agricultural uses			
	Buildings	0		0
	Roads/paths/channels	0		0

3.	Culturable waste	0	75	75
	Weed/bush infested			
	Area prone to animal menace			
4	Permanent pastures and other grazing lands			
	Productive	0	10	10
	Degraded	150	40	190
5	Land under miscellaneous tree crops and groves			
6	Fallow land	0	60	60
	Total	200	285	485

Source: Field Survey, 2007-08

Table 4.20 Irrigation Schemes: Funds for Repair and Maintenance (Rs. Lakh)

Scheme	Lahaul	Spiti	District
Functional			
1. Lift irrigation			
Number	2	2	4
Annual maintenance	14	14	28
Replacement/overhauling in 5 yrs	50	20	70
2. Kuhl			
Number	0	81	81
Annual maintenance	0	13	13
Replacement/overhauling in 5 yrs	0	200	200
Non-functional			
1. Kuhl			
Number	50	5	55
Annual maintenance	81	25	106
Replacement/overhauling in 5 yrs	50	200	250

Source: Field Survey, 2007-08

4.10 Research/Extension Gaps

The research and extension gaps that have emerged from the extensive survey are shown in Table 4.21. The major problems in almost all the crops are: lack of suitable variety, non availability of critical inputs at right time including quality seeds, lack of awareness of improved management practices and attack of diseases and pests, etc. Therefore, there is a need to strengthen research and extension institutions to solve the varietal and technological problems of farmers. The pertinent interventions in this respect are displayed in Table 4.22.

Table 4.21 Varietal and Technological Problems of Main Crops (Per Cent of Panchayats)

Crop	Problem	Lahaul	Spiti
Maize	Local varieties are low yielding and susceptible to diseases	25	
Wheat	Use of local variety seeds	25	50
	Use of bullock labour time consuming	50	75
Barley	Low yielding local variety	50	75
	Late maturity	50	100
Rajmash	Use of local seed	25	50
	Diseases and pests	50	50
Sarson	Local seed		50
Peas	Inadequate supply of seed	25	100
	Poor quality seed	25	50
	Single (Azad P-1) variety	75	25
	Powdery mildew	50	25
	Cut worm	50	
	Root rot	50	75
Potato	Good quality seeds not available	75	25
	Inadequate availability of seeds	50	
	Late blight	50	
	Cut worm	25	25
Tomato	Non availability of seedlings	25	
Cabbage	Cabbage butterfly	25	25
	Cut worm	25	
	No variety of hybrids	25	25
	Grown on limited scale	50	50
	Non availability of seedlings at right time	50	50
Radish	Local variety	25	
Vegetable nursery	Lack of technical know how	50	50

Source: Field Survey, 2007-08

Table 4.22 Interventions for Improving Production of Major Crops (Per Cent of Panchayats)

Crops	Interventions	Lahaul	Spiti
Maize			
	New varieties to be introduced and trainings	50	
	Training & demonstration	25	
	Varieties improvement	25	
Wheat	New variety	100	75
	Mechanisation	50	100
Barley	HYV seeds and new varieties	75	100
	Early maturing varieties	50	100
	Scientific cultivation of barley		75
Rajmash	Improved seeds of new variety	50	100
	Awareness and control measures for diseases and pests	75	100
Sarson	Supply of improved variety seeds	75	75
Peas	Trainings on plant protection measures& IPM	50	25
	Research on varietal development	75	50
	Symptomotogy and management measures	50	75
	Resistent varieties anmd integrated management of root rot and wilt	75	50
	Generate Awarernrss	75	25
	Change of seed	50	
	Training on plant protection measures	75	75
	Ensuring availability of pesticides and spray equipments	75	100
	Integrated management of root rot and other diseases	50	
	Bio control	25	25
	Establishment of plant clinic	50	25
	Awareness for proper diagnosis and timely spray	75	50
Potato	Ensure availability of healthy seeds	50	50
	Frequent change of seed	50	50
	Integrated pest management	75	50
	Availability of pesticides and spray equipments	50	50
	Bio control	25	
	Establishment of plant clinic	25	50
	Awareness for proper diagnosis of blight and timely spray	75	50
Tomato	Timely availability of seeds and seedlings	50	75
	Promote protected cultivation	50	100
Cabbage	IPM module	25	50
	Research on variety and development of suitable hybrids	50	50
	Field demonstration		50

	Identification other suitable varieties	25	100
	Provision of seed of new resistant varieties	25	50
	Protected cultivation and nursery trainings	75	25
Radish	Genetic improvement in local variety (<i>Labuk</i>) for higher yield	50	25
Vegetable nursery	Training in nursery raising	75	25
	Popularisation of poly house nersery	50	75

Source: Field Survey, 2007-08

In nutshell, the major interventions are:

- To ensure availability of quality inputs like improved seeds, fertilizers, plant protection material by improving and strengthening delivery system
- Improvement of physical, chemical and biological parameters on the basis of soil health cards proposed to be issued to all farmers
- Promotion of integrated nutrient management through vermi-composting, popularization of bio-fertilisers, and other ameliorants in addition to judicious and balanced nutrients to crops.
- Promotion of micro-irrigation for efficient management and delivery of required quantities of water as per crop needs.
- Promotion of mechanization conducive to hill farming and equipments & implements to reduce labour and drudgery of women folk.
- Strengthening and improvement of quality control infrastructure (seed, pesticides and fertilizer testing laboratories)
- Promotion of protected cultivation along with supporting infrastructure for quality production of high-value cash crops

4.11 Researchable Issues

The research and development issues that emerged from close perusal of agricultural scenario and potential in the district are given below.

Natural Resource Management

- Assessment and harnessing of water potential to provide assured irrigation to rain-fed areas
- Water harvesting to create water potential for irrigation and to augment ground water
- Improvement of pastures and restoration and protection of forest grazing rights of shepherd community.
- Characterization, classification and preparation of fertility maps of soils

- Evaluation of resource conservation technologies (like conservation tillage, deficit water management, pressurized irrigation systems, nutrient-water interaction studies, recycling of waste organic residues etc.) for irrigated and rain fed areas
- Issues related to increasing water productivity of stored water through crop diversification and soil and water management practices
- Development of technologies to harness trout fish production potential and also providing technical know how to the fish farmers
- To spread red clover and white clover through sheep droppings to improve the productivity of alpine pastures and other grazing lands.
- Base-line survey of river catchments and assessment of ground water potential
- Assessment of economics of commercial crops and impact on natural resources (soil and water) and livelihoods of people
- Studies on climate change and its impacts on agro-geology and devise suitable strategies to emerging problems from climatic change

Crop Improvement

- Development of high yielding varieties of various crops having wider adaptability and resistance to various biotic and abiotic stresses, through exploitation of land races, agronomic basis and alien species using conventional as well as non-conventional breeding approaches
- Varietal development in under utilized but highly nutritive crops like amaranths, buckwheat and other millets as well as in high value and low volume crops like *kalazira* and *saffron*
- Effective selection, conservation, evaluation, documentation and utilization of genetic resources ensuring wider coverage under improved crop varieties with major emphasis on quality seed production.
- Refinement and validation of technologies for major crops
- *Ex-situ* and *in situ* conservation of minor millets cereals
- Transfer of technologies through extension interventions like trainings, demonstrations, exposure visits, replication of success stories, etc. Creation of farmers' advisory system to address their day - to - day queries
- Validation of ITKS and use of IT for technology dissemination by creating IT hubs at focal points
- To promote and strengthen the public- private partnership for ensuring delivery of need based inputs and technologies
- Integrated nutrient management technology demonstration on farm/field and issues in solid waste management and standardization of agro-technology for organic farming

- Development/identification of hybrids and varieties of potential vegetable crops, standardization of production technology of hybrids and development of hybrids and production technology for protected cultivation
- Refinement of green house/poly house technology for temperate region
- Sustainable vegetable production through alternative (exotic) vegetable crops or by avoiding monoculture
- Standardisation of seed production techniques for temperate and exotic vegetable crops
- Studies on economic and marketing aspects of cash crops

Crop Protection

- To speed up research on controlling rapidly spreading wilt root-rot complex disease in pea
- Survey and surveillance of major diseases and pests of important crops
- Identification of resistant sources and study of genetics of resistance against pests and diseases
- Marker assisted selection of resistance genes using molecular markers and their use in gene pyramiding for resistance in commercial varieties
- Development of integrated disease and pest management modules suitable for organic and protected agriculture conditions
- Development of detection techniques for pathogens of quarantine importance and certification purposes relating to important seed and soil borne diseases (pea root rot and wilt complex, bacterial wilt, bean mosaic, urdbean leaf crinkle, bacterial blight, potato viruses, etc.)
- Formulation of bio-intensive IPM strategies for the management of *Helicoverpa armigera* (tomato, fruit flies in cucurbits and tomatoes), cut worms (vegetables); plant parasitic nematodes (cereals and vegetables), insect pest and nematode management under protected cultivation situations
- Collection and utilization of local strains of entomopathogenic organisms for insect pest management under organic farming situations
- Identification and utilization of native botanicals for eco-friendly pest management:
- Safe management alternatives for the stored grain pests.
- Identification and management of diseases and insect-pests of medicinal, aromatic and ornamental plants:
- Weed management studies in major crops

Chapter V

ALLIED AGRICULTURAL SECTORS

The typical farming system in a particular area comprises of various components allied to agriculture. Obviously, these components compete or complement the resource matrix and in a way contribute to the over all development of farm economy. The holistic development of farming system bears special significance for hilly regions having low land base, short working season and limited options of non-farm avenues of employment. At the same time, the agro-climatic specificities offer the scope for niche based farming that can ensure higher incomes to farmers. Therefore, in this section, the scope for development of household income from allied sectors like horticulture, animal husbandry and other ancillary enterprises has been explored.

5.1 Horticulture

Horticultural development bears special significance for this district. With the change in climate, even the harsh cold areas of Spiti are becoming suitable for apple plantation, which is quite evident from the increase in the area under apple in recent years. The area under fruit in this district can be increased from existing 389.25 hectares to 868.25 hectares (Table 5.1). The number of households planting apple orchards would also increase from existing 3,393 to 5,447. There lies more potential in Spiti for apple as compared to Lahaul.

Table 5.1 Potential for Horticulture Development in Lahaul & Spiti

Fruit	Existing status and Potential	Lahaul	Spiti	District
Apple				
Existing	Area (Ha)	166.04	197.21	363.25
	Production (Quintals)	13035.80	3262.48	16298.28
	Households (No.)	2613	780	3393
Potential	Area (Ha)	105.00	309.00	414.00
	Households (No.)	1820	234	2054
Other fruits				
Existing	Area (Ha)		26.00	26.00
	Production (Quintals)		260.00	260.00
	Households (No.)		255	255
Potential	Area (Ha)		65.00	65.00
	Households (No.)		130	130
All Fruits				
Existing	Area (Ha)	166.04	223.21	389.25
	Production (Quintals)	13035.80	3517.48	16553.28
	Households (No.)	2613	845	3458
Potential	Area (Ha)	105.00	374.00	479.00
	Households (No.)	1820	364	2184

Source: Field Survey, 2007-08

5.2 Animal Husbandry

Livestock rearing has remained an integral part of farming particularly in hilly areas due to vast area under forests and pastures and the important role it plays in human nutrition, draft farm power and transportation. The estimated livestock population in Lahaul and Spiti blocks shows the predominance of sheep and goats especially in Lahaul (Table 5.2). During summer, shepherds from other areas (particularly Gaddi) migrate along with their flocks to graze sheep and goats on lush green alpine pastures in Lahaul & Spiti. The population of cross bred cows is increasing over the years. Bullocks and equines also hold important place as a means of draft power and transportation (beasts of burden).

Table 5.2 Estimated Livestock Population (Number)

Type of animal	Lahaul	Spiti	District
Productive			
Crossbred cows	4150	1786	5936
Local cow	5334	1008	6342
Goats	14504	7956	22460
Sheep	61432	5902	67334
Poultry	36680	1200	37880
Young stock	950	650	1600
Bullocks	1624	442	2066
Equines	1344	2561	3905
Yak		2886	2886
Unproductive*	1876	770	2646

Note: * Stray/ old/ diseased/ deformed/ infertile

Source: Field Survey, 2007-08

5.3 Fisheries

There is no special effort to take up fishery enterprise in the district. However, there is a scope to introduce cold-water fish culture at certain places where river flow is mild in the valley area. There is also scope for rearing trout that can be sold at premium price. To harness this potential, the major interventions have been depicted in Tables 5.3 and 5.4.

Table 5.3 Cultured Fisheries: Existing Status, Potential and Diseases

Particular	Households (No.)	Fish production (Qty.)	Ponds (No.)	Ponds Area (ha)	Fish Species				Disease
					Rainbow trout	Brown trout	Silver Carp	Grass Carp	Fungal Disease
Lahaul									
Existing	12	NA	12		√	√			√
Potential	50	NA	50					√	
Gap	38	NA	38						

Spiti									
Existing	0	0	0						√
Potential	10	0	10		√	√	√		
Gap	10	0	10						
District									
Existing	12	0	12		√	√			√
Potential	60	0	60		√	√	√		
Gap	48	0	48						

Source: Field Survey, 2007-08

Table 5.4 Constraints/Interventions in Cultured Fisheries

Constraint	Lahaul	Spiti	District
Quality/quantity of fingerlings	√	√	√
Fish feed	√	√	√
Quality and quantity of water supply			
Training	√	√	√
Technical know-how	√	√	√
Pond structure			
Perishability			
Remunerative price	√	√	√
Markets	√	√	√
Nets, medicines etc.	√	√	√

Source: Field Survey, 2007-08

5.4 Poultry

Due to cold climate, poultry is not so popular. The farmers generally keep few birds for meeting domestic requirement. The population of poultry is higher in Lahaul as compared to Spiti. It has been found that improved breeds of poultry may not thrive well in this cold region but indigenous breeds have been found quite suitable. During summer season, broilers can be taken up successfully for which there is a need to provide broiler chicks from poultry breeding farms from other districts.

5.5 Mushrooms

There is not much scope for mushroom production due to cold climate. However, there are some local nutritious strains that need to be cultured and popularised which may require more research endeavour.

5.6 Medicinal Plants

Hop and *kuth* are grown in Lahaul only and there are 40 hectares of area under each of these two crops (Table 5.5). However, there exists potential to increase area under both hop and *kuth* crops especially in Lahaul. In the past, there were around 200 hectares land under hop plantation and

100 hectares under *kuth*. But low prices and lack of marketing avenues discouraged their cultivation in Lahaul valley. These crops can also be grown successfully in Spiti but no special efforts in the past have been made to introduce these crops in Spiti valley.

Table 5.5 Area under Medicinal and Aromatic Herbs (Hectares)

Medicinal/ aromatic crops	Lahaul	Spiti	District
Hop			
Existing	40.00	-	40.00
Potential	220.00	40.00	260.00
Kuth			
Existing	40.32		40.32
Potential	100.00	20.00	120.00

Source: Field Survey, 2007-08

Besides this, Lahaul and Spiti harbour rich repository of medicinal and aromatic flora growing under natural conditions in forest and pasture lands. The important species of economic importance are: kalazeera, salampanja, karhu, patish, ratanjot, somlata, seabuckthorn and many other species. Many of these species are used by local Vaid (Amchi) in treating different human disorders/diseases. There is a dire need to conserve these high value herbs and to develop and standardise their cultivation techniques. Efforts also need to be directed towards *in situ* conservation as many of these species are facing extinction due to over exploitation. The important species are enlisted in Table 5.6:

Table 5.6 Important Medicinal and Aromatic Species of Lahaul & Spiti

Common Name	Scientific Name
Kalazeera	<i>Bunium persicum</i>
Shingu	<i>Carum carvi</i>
Seabuckthorn	<i>Hippophae rhamnoides</i>
Bhoj patra	<i>Betula utilis</i>
Dhup	<i>Juniperus macropoda</i>
Patrala	<i>Heracleum candican</i>
Somlata	<i>Ephedra gerardiana</i>
Salam panja	<i>Dactylorhiza hatagirea</i>
Atish	<i>Aconitum heterophyllum</i>
Karu	<i>Picrorhiza kurooa</i>
Ratanjot	<i>Arnebia euchroma</i>
Bankakri	<i>Podophyllum hexandrum</i>
Jangli lahsun	<i>Allium carolinianum</i>
Artimisia	<i>Artimisia brevifolia</i>

Source: Field Survey, 2007-08

5.7 Bee Keeping

Presently bee keeping is not common in this district but with the emphasis on horticultural development, the bee keeping may gain importance to harness their complementary benefits in pollination. With the increase in area under fruits, sufficient bee flora can be produced in flowering season. As per recommendation, four to five colonies are required per hectare of fruit plantation for proper and effective pollination. In this way, 4 to 5 thousand bee colonies need to be maintained by the fruit growers in the district particularly in Spiti where apple plantation is increasing. However, like sheep and goats, migratory bee keeping will be more feasible such that during winter bee colonies are shifted to other areas.

5.8 Agro Eco Tourism, Organic Farming and Protected Cultivation

The district harbours verdant valleys, camping sites, majestic mountains, passes, sky line glaciers, gushing rivers, wonderful conglomerates (formed by snow melting and erosion), sprawling forests/pastures, ethnic gompas (monasteries) and heritage buildings of the former ruling dynasty. The unique confluence of Hindu-Budhism religions, repository of ancient culture/costumes and local feasts/festivals are the principal objects of interest in this region. The road to Leh also passes through the district. Some of these important places along with their heights have been presented in Table 5.7. The rugged and awe-inspiring snow clad mountains throw challenge to the hikers, mountaineers and adventurers. The entire district is full of natural scenery exhorting the tourists and visitors to explore and imbibe its hidden grandeur. In the past, there was no special effort to develop tourism due to restriction for security reasons. But now, barring few border villages, the area has been opened for outside tourists. Therefore, development of agro eco tourism may be looked as a major endeavour to provide more livelihood options to people.

Sustainable farming and environment protection are the key concerns in hills and organic farming is the best way to achieve these twin objectives. In most parts of the district, farming is 'organic by tradition' as farmers are not using pesticides and chemicals since ages. There is relatively less incidence of diseases and pests due to natural barriers. All these conditions favour agro eco-tourism and organic farming.

The district harbours about one fourth of the geographical area of the state but at the same time has the limited availability of arable land. The aboriginal and cold climate also makes farming more difficult. Therefore, protected cultivation bears much more importance in this district to increase land use and productivity. The protected cultivation can be promoted in all parts of the district. There is a need to develop a cluster of poly houses in different villages. State Agricultural/Horticultural Universities have already developed the technology for this region which needs to be popularised among the farmers. In this plan, we have made provisions for these innovative schemes as discussed in next chapter.

Table 5.7 Important Places of Interest and Adventure for Agro Tourism

Important Places	Significance	Height (metres msl)
Places		
Keylong	District H Q	3350
Udaipur	Scenic valley and old Mrikula Mata temple	2660
Triloknath	Hindu-Budhist temple	2760
Kaza	H Q of Spiti	3600
Key	Key Monastery	4000
Kibber	High land village with motorable road	4205
Tabo	Tabo Monastery	
Pin valley	National park (land of Ibax and snow leopard)	3800-4800
Lakes		
Neelkanth lake	Beautiful highland lake	5846
Suraj Tal	Lake, origin of river Bhaga (Lahaul)	4600
Chander Tal	Lake, origin of river Chandra (Spiti)	4270
Glaciers		
Neelkanth	Origin of Neelkanth lake and Thiroat Nala	6000
Baralacha	Origin of Chandra-Bhaga and Spiti rivers	4898
Shingri	Tributary of Spiti	5707
Khanjar	Camping site and origin of Myar Nala	4506
Important Passes		
Rohtang pass	Entry gate (by road) to L & S and origin of river Beas	3978
Kunjam pass	Entry from Lahaul (by road) to Spiti	4551
Kugti	Adventurous pass (trecking)	5040
Kali Chho	Adventurous pass (trecking)	4803
Parvati Pass	Trecking to Kullu via Pin Valley	5319
Bhaba	Trecking to Rampur via Spiti	4472

Source: Tourism Map of Lahaul & Spiti, www.hplahaulspiti.gov.in/Map/Map-LS-Tourist

5.9 Agricultural Marketing

Marketing needs to be given special emphasis as major proportion of area is under cash crops. Any delay in marketing of crops mainly pea, potato and hop may cause total economic loss to the farmers. The extent of marketed surplus of different commodities has been estimated and presented in Table 5.8.

Pea and potato are the major commercial crops where in more than 90 per cent of the produce was marketed. The total marketed surplus of potato was estimated at 1,56,153 quintals in which contribution of Lahaul was substantial. Similarly, the marketed surplus of pea came out to be 1,13,357 quintals out of which the contribution of Lahaul was around 76 per cent. Most of the produce was sold in distant markets within as well as outside the state. Among fruits, apple was emerging as the major commercial fruit crop especially in Spiti valley. The total marketed surplus was estimated at 15,950 quintals. In Spiti, most of the area was under new plantations and non-bearing; therefore, marketed surplus would increase substantially in future.

Among other crops, hop and Kuth could emerge as the potential crops especially in Lahaul provided remunerative markets are explored. During 1990s, hop was fetching lucrative prices as a result of which area had increased to more than 200 hectares. With the establishment of hop

processing plant at Baddi (Solan), it is expected that area under hop would increase in near future. However, it needs special mention that in spite of substantial marketed surplus of different commodities, there is not a single regulated market yard in Lahaul as well as in Spiti.

Table 5.8 Estimated Marketed Surplus and Marketing Pattern in Lahaul & Spiti (Qt)

Particular	Lahaul	Spiti	District
Cereals			
Total production	10274.12	8530.63	19969.26
Consumption	10204.12	8496.62	19865.25
Marketed surplus		16.71	16.71
Losses in storage	15.00	5.20	20.20
Losses in transportation			
Post harvest losses	55.00	12.10	67.10
Markets for sale			
<i>Local</i>		16.71	16.71
<i>Distant within State</i>			
<i>Distant outside State</i>			
Pulses			
Total production	178.22	97.35	278.65
Consumption	165.22	89.35	257.65
Marketed surplus		0.00	0.00
Losses in storage	7.50	5.50	13.00
Losses in transportation			0.00
Post harvest losses	5.50	2.50	8.00
Markets for sale			
<i>Local</i>			
<i>Distant within State</i>			
<i>Distant outside State</i>			
Potato			
Total production	147264.00	8888.69	156152.69
Consumption	8871.50	1086.00	9957.50
Marketed surplus	132519.59	7246.34	139765.93
Losses in storage	291.83	86.00	377.83
Losses in transportation	2247.39	280.80	2528.19
Post harvest losses	3333.71	189.56	3523.27
Markets for sale			
<i>Local</i>		362.32	362.32
<i>Distant within State</i>	88350.81		88350.81
<i>Distant outside State</i>	44168.78	6884.02	51052.80

Pea			
Total production	94580.40	30490.78	125071.18
Consumption	1891.61	457.36	2348.97
Marketed surplus	86068.16	27289.25	113357.41
Losses in storage			
Losses in transportation	3783.22	1524.54	5307.76
Post harvest losses	2837.41	1219.63	4057.04
Markets for sale			
<i>Local</i>	18935.00	4093.39	23028.39
<i>Distant within State</i>	12910.22	6822.31	19732.53
<i>Distant outside State</i>	54222.94	16373.55	70596.49
Fruits			
Total production	13032.66	3258.38	16287.81
Consumption	86.29	42.50	128.79
Marketed surplus	12824.37	3128.74	15949.88
Losses in storage	22.00	18.00	40.00
Losses in transportation	62.00	44.38	106.38
Post harvest losses	38.00	24.76	62.76
Markets for sale			
<i>Local</i>	1538.92	1095.06	2633.98
<i>Distant within State</i>	9618.28	1720.81	11339.08
<i>Distant outside State</i>	1667.17	312.87	1980.04
Hop			
Total production	960.00		960.00
Consumption			
Marketed surplus	939.00		939.00
Losses in storage			
Losses in transportation	9.00		9.00
Post harvest losses	12.00		12.00
Markets for sale			
<i>Local</i>			
<i>Distant within State</i>	939.00		939.00
<i>Distant outside State</i>			
Kuth			
Total production	2016.00		2016.00
Consumption	52.00		52.00
Marketed surplus	1942.00		1942.00
Losses in storage	22.00		22.00

Losses in transportation			
Post harvest losses			
Markets for sale			
<i>Local</i>	990.00		990.00
<i>Distant within State</i>			
<i>Distant outside State</i>	952.00		952.00

Source: Field Survey, 2007-08

The marketing infrastructure is very poor despite highly commercial nature of farming in this district. The local traders, itinerants and cooperative societies are main marketing agencies. The most critical aspect of marketing is that produce has to be immediately marketed after harvest as the snowfall could block the roads any time in autumn/winter i.e. post harvest season. Therefore, marketing infrastructure needs to be strengthened in the district. Presently there is not even a single regulated market in the district (Table 5.9). Besides establishing one regulated market yard in each block of the district, the other marketing institutions required are collection centres, sub-yard, information centre, storage/godowns and cooperative marketing/ input supply societies at the panchayat level for overall development of agriculture.

Table 5.9 Marketing Infrastructure –Existing and Required (No.)

Market Infrastructure	Status	Lahaul	Spiti	District
Collection centres)	Existing	0	0	0
	Required	28	10	38
Market sub-yard	Existing	0	0	0
	Required	28	10	38
Storage and godown	Existing	0	0	0
	Required	28	15	43
Market information centre	Existing	0	0	0
	Required	28	13	41
Co-operative marketing society	Existing	3	8	11
	Required	35	12	47
Co-operative input society	Existing	3	12	16
	Required	35	17	52
Banks and other institutions	Existing	16	14	30
	Required	25	19	43

Source: Field Survey, 2007-08

5.10 Infrastructure and Institutional Development

The scientific knowledge/technology-led agri-business framework embodies different crucial components having interlinked and intertwined backward and forward linkages to agriculture as a whole. This framework must operate in congenial economic environment created through the social overheads like R& D institutions, development and extension network, rural infrastructure & public utilities and supporting credit and marketing institutions. Therefore, the growth in agricultural sector also hinges on the institutions and supporting infrastructure.

Past experience lends sufficient support to role of rural connectivity in overall socio-economic development. Therefore, construction of rural roads and bridges would continue to invite major attention in the development planning in hills where road density is still very low. Lahaul Spiti district has the lowest road density in the state. Many remote villages are yet to be connected with motorable roads. The road construction and maintenance cost is exorbitantly high in hills. Therefore, in this plan, the emphasis has been given on rural roads that in turn would usher in agricultural transformation in the remote villages. The physical targets and budget estimates for roads and bridges are given in next chapter.

The demographic and institutional scenario in the district has been depicted through Appendix Table 1 and agricultural development institutions have been given in Table 5.10. Adequate Govt. support is warranted for agricultural R&D, training and extension, irrigation and watersheds, rural roads and electrification, equity participation in cooperative and credit institutions and development of marketing infrastructure. Scientific knowledge-led approach holds the key to accelerate the rate of growth in agriculture. In Lahaul & Spiti, the existing R & D institutions engaged in agricultural research and development are enlisted in Table 5.10.

Table 5.10 Agricultural Research and Development Institutions in Lahaul & Spiti

Name of the institution	R & D mandate
Lahaul	
Regional Research Station (CSKHPKV), Kukumseri, Lahaul	Germplasm collection and evaluation and introduction of HYV of crops
Krishi Vigyal Kendra (CSKHPKV, Kukumseri, Lahaul	Training and extension advisory services
ICAR Wheat Research Station, Dalang Maidan, Lahaul	Research on wheat
State Agriculture Potato Seed Farm, Dalang Maidan, Lahaul	Seed potato multiplication
District Agricultural Office, Keylong	Inputs supply and extension services to farmers Extension
District Horticultural Office, Keylong	Input supply and extension services to farmers
Lahaul Potato Cooperative Society (LPS) at Manali	Marketing of potato and peas and supply of inputs
Lahaul Hop and Chicory Cooperative Society (LHS) at Shansha, Lahaul	Drying/pressing and marketing hops
Seabuckthorn Cooperative Society, Keylong	Promoting plantation and value addition of Seabuckthorn
Spiti	
Research Sub-Station (CSKHPKV), Lari, Spiti	Research on barley, millets and vegetable crops
Regional Horticultural Research Station (UHF), Tabo, Spiti	Research on apple and stone fruits
Agricultural Development Office, Kaza, Spiti	Inputs supply and extension services to farmers
Horticultural Development Office, Kaza, Spiti	Inputs supply and extension services to farmers

Source: Field Survey, 2007-08

It needs a special mention here that especially after 1991, public funding to agricultural R&D has been drastically reduced. Consequently, the state funding to Agricultural and Horticultural Universities has been drastically reduced. Therefore, adequate budgetary support should be

regarded as the future public investment for development of technology and human capital for sustainable agriculture in the state.

The human resource forms the crucial component for executing development plans contemplated in this document. The position of human resource and the requirement under different sectors have been given in Table 5.11. In all, 31 new posts need to be created particularly in the field of horticulture, veterinary and allied sectors to execute different development schemes.

Table 5.11 Human Resource for Agricultural Development (No.)

Position	Lahaul				Spiti				District			
	S	P	R	G	S	P	R	G	S	P	R	G
SMS (Agri)	6	5	1	0	1	0	1	0	7	5	2	0
ADOs				0	2	2	0	0	2	2	0	0
AEOs	7	2	5	0	5	3	2	0	12	5	7	0
SMS (Horti)	0	0	4	4	1	0	1	0	1	0	5	4
HDOs	2	2	3	1	3	0	3	0	5	2	6	1
HEOs	0	0	10	10	3	3	0	0	3	3	10	7
Sr. Veterinary officers	2	0	2	0	1	0	1	0	3	0	3	0
Veterinary doctors	7	5	2	0	6	2	4	0	13	7	6	0
Veterinary pharmacist	0	0	7	7	25	25	25	0	25	25	32	7
Extension Specialists for												
Bee keeping	0	0	4	4	0	0	0	0	0	0	4	4
Mushrooms	0	0	0	0	0	0	2	2	0	0	2	2
Floriculture	0	0	0	0	0	0	2	2	0	0	2	2
Fisheries	0	0	4	4	1	0	1	0	1	0	5	4
Total	24	14	38	30	48	35	42	4	72	49	84	31

Source: Field Survey, 2007-08

5.11 Rural Enterprises

The existing livelihood options of different categories of farmers have been displayed in Table 5.12. It can be visualised that agriculture is the mainstay of majority of households followed by livestock and horticulture. There are few households engaged in rural handicrafts, rural artisans and shops. This clearly shows dearth of non-farm avenues of livelihoods. In Spiti, large number of persons are engaged as daily wage labourers that shows poor economic condition of people in Spiti as compared to Lahaul.

With the increase in education level there are number of educated youths seeking employment outside agriculture. As per our estimates (Table 5.13), there are 10,225 educated youths who are unemployed in the district. Most of the persons are educated up to matriculation and higher secondary levels. The educated manpower can be gainfully employed in different farm avocations and enterprises and thus providing critical support services to improve farm

productivity. The extent of employment of educated persons in different activities has been displayed through Table 5.14. There is a need to train them to take up different professions.

Table 5.12 Occupation Pattern and Livelihood Options of Farmers in Lahaul & Spiti (No.)

Enterprise	Category of farmers				Total
	Landless	Marginal	Small	Large	
Agriculture					
Households		3464	717	27	4208
Persons		7754	2859	170	10783
Fruits					
Households		836	168		1004
Persons		4188	668		4856
Livestock					
Households		1336	609		1945
Persons		4010	2780		6790
Rural handicrafts					
Households		197	118		315
Persons		197	118		315
Masonry work					
Households		134			134
Persons		134			134
Carpentry					
Households		167			167
Persons		167			167
Black smithy					
Households	17				17
Persons	17				17
Rural shops					
Households		142	77		219
Persons		142	77		219
Daily Wage labourers					
Households		101	80		181
Persons		101	80		181
Spiti					
Agriculture					
Households	110	362	2048	365	2885
Persons	418	916	4367	485	6186
Fruits					
Households	2	79	117		198
Persons	7	273	781		1061
Livestock					
Households					
Persons					
Rural handicrafts					
Households	370	105	870	65	1410
Persons	344	131	1009	75	1559

Masonry					
Households	99	89	117	21	326
Persons	104	104	122	21	351
Carpentry					
Households	40	19	93		152
Persons	59	24	108		191
Black smithy					
Households	5	14	72		91
Persons	8	14	18		40
Rural shops					
Households	182	51	26		259
Persons	194	64	34		292
Daily Wage labourers					
Households	332	250	1052	169	1803
Persons	372	361	1286	214	2233
District					
Agriculture					
Households	110	3826	2765	392	7093
Persons	418	8670	7226	655	16969
Fruits					
Households	2	915	285		1202
Persons	7	4461	1449		5917
Livestock					
Households		1336	609		1945
Persons		4010	2780		6790
Rural handicrafts		0			
Households	370	302	988	65	1725
Persons	344	328	1127	75	1874
Masonry					
Households	99	223	117	21	460
Persons	104	238	122	21	485
Carpentry					
Households	40	186	93		319
Persons	59	191	108		358
Black smithy					
Households	22	14	72		108
Persons	25	14	18		57
Rural shops					
Households	182	193	103		478
Persons	194	206	111		511
Daily Wage labourers					
Households	332	351	1132	169	1984
Persons	372	462	1366	214	2414

Source: Field Survey, 2007-08

Table 5.13 Unemployed Educated Persons in Lahaul & Spiti (No.)

Education status	Male	Female	Total
Lahaul			
Matriculate	560	735	1295
Sr. Secondary	714	756	1470
Graduate	840	854	1694
Post Graduate	476	336	812
Tec. Trained	938	602	1540
Sub Total	3528	3283	6811
Spiti			
Matriculate	757	835	1592
Sr. Secondary	676	461	1137
Graduate	169	140	309
Post Graduate	62	29	91
Tec. Trained	162	123	285
Sub Total	1826	1588	3414
District			
Matriculate	1317	1570	2887
Sr. Secondary	1390	1217	2607
Graduate	1009	994	2003
Post Graduate	538	365	903
Tec. Trained	1100	725	1825
Grand Total	5354	4871	10225

Source: Field Survey, 2007-08

Table 5.14 Potential Enterprises for Employment of Educated Man Power (Per Cent Employment)

Enterprises	Matric	Sr Sec	Graduate	Post Graduate	Tech	Total
Lahaul						
Nursery raising			20.05	15.68		7.54
Protected cultivation			13.36	43.04		12.49
Organic farming			25.06	21.52	35.00	14.80
Custom hiring	5.29	18.20				5.18
Marketing and processing	0.00	21.12	25.06	6.46		11.13
Transportation	42.35	22.06			30.00	18.04
Rural industries	47.06	11.03				12.33
Agri clinics/input shops	0.00	0.00	16.47	13.30		6.29
Repair shops	0.00	11.03			35.00	7.40
Agro-tourism	5.29	16.55				4.81
Spiti						
Nursery raising			11.20	22.73		6.53
Protected cultivation			18.40	22.73		8.19
Organic farming			11.20	14.85		5.16
Custom hiring					11.36	1.66
Marketing and processing	20.35	36.20	11.20	9.12	29.55	21.41
Transportation	20.35		18.40			8.55
Rural industries	38.96	18.30				12.61
Agri clinics/input shops		27.40	18.40	30.57	29.55	20.39
Repair shops		18.10			29.55	8.62

Agro-tourism	20.35		11.20			6.89
District						
Nursery raising			15.38	18.64		7.04
Protected cultivation			16.02	34.51		10.39
Organic farming			17.74	18.72	17.59	10.09
Custom hiring	2.69	9.02			5.65	3.46
Marketing and processing	10.00	28.73	17.74	7.58	14.70	16.15
Transportation	31.54	10.93	9.72		15.08	13.40
Rural industries	43.08	14.70				12.47
Agri clinics/input shops		13.83	17.49	20.55	14.70	13.18
Repair shops		14.60			32.29	8.00
Agro-tourism	12.69	8.20	5.91			5.83

Source: Field Survey, 2007-08

5.12 Agro-Processing

Due to single cropping season, there is a dearth of year round employment opportunities in the area. Therefore, agro-processing assumes importance and can also provide additional income and employment avenues to the farmers especially during winter months when there is virtually no farm operation. Table 5.15 presents the potential enterprises that can be developed in the district. Besides primary processing units (flour mill), the other value addition activities like fruit processing, bakeries, weaving/shawls making and handicrafts can be taken up successfully keeping in view the availability of raw material. The entrepreneurs need to be identified, trained and given liberal credit facilities to start cottage industries.

Table 5.15 Status and Potential of Different Rural Enterprises

Block	Existing			Potential			Assistance (Credit)
	No of units	Person employed	Investment (Rs. Lakh)	No of units	Employment No.	Investment (Rs. Lakh)	
Atta Chakki							
Lahaul	70	150	1.5	150	300	1.5	√
Spiti	0	0	0	75	125	1.20	√
Total	70	150	1.5	150	300	1.5	√
Oil expeller							
Lahaul	5	10	2.5	2	4	2.5	√
Spiti	0	0	0	0	0	0	
Total	5	10	2.5	2	4	2.5	√
Bakery							
Lahaul	0	0	0	0	0	0	
Spiti	2	10	0.5	5	35	50	√
Total	2	10	0.5	5	35	50	√
Vermi- Composting							
Lahaul				50	250	5	√
Spiti							
Total				50	250	5	√
Shawls/Woolen Garments							
Lahaul	10	250	4	5	100	25	
Spiti	13	360	6	5	100	30	√
Total	23	610	10	10	200	55	√

Source: Field Survey, 2007-08

5.13 Drudgery of Women

Unlike plains, the women folk are the true givers of food as farming in hills, by and large, is female dominated avocation and in the absence of mechanisation most of the farm operations are carried out manually. The hill topography and geographical conditions further add to the drudgery reducing the labour efficiency. The extent of drudgery of women is clearly visualised through the time spent in accomplishing different activities as shown in Table 5.16. In addition to household chores, the female workers in the family perform most of the farm operations (barring ploughing) manually. The time spent in these farm operations varies as per the type of operation and cropping season. Some of the operations last for 20 to 30 days and the extent of drudgery is further compounded due to short working season when all the farm activities got to be carried out simultaneously.

The livestock rearing is absolutely a female centred avocation in hilly regions. The extent of drudgery in livestock rearing is much more than farm operations as most of the livestock rearing activities are attended to as a part of daily routine (Table 5.17). Fetching fodder from grass lands, fetching water, feeding, milking, shed cleaning, dung disposal and even arranging natural servicing and milk selling are carried out by female members. The lack of cultivated fodder, kucha animal sheds, use of low efficiency tools and harsh cold winter make the tasks even more difficult. The women in the region lead really a tough life toiling hard from dawn to dusk. Therefore, there is a dire need to develop technologies to reduce the extent of drudgery.

The suitable interventions are to design improved tools, mechanical devices and impart trainings for improving work efficiency. The small devices like improved clod breaker, serrated sickles and milk churner, chaff-cutter as well as encouraging bio-gas plants, paved sheds, fodder cultivation, artificial insemination, etc., can reduce the drudgery of women to a great extent.

Table 5.16 Extent of Drudgery of Women in Agricultural Operations

Operations	Mode	Frequency	Extent of drudgery	Lahaul	Spiti	District
Clod breaking	Manually	15-20 days	% Female	100	88.9	94.45
			Hours spent/ day	5.5	4	4.75
Manuring & fertilization	Manually	20-25 days	% Female	98.18	65.48	81.83
			Hours spent/ day	6.38	2	4.19
Intercultural operations	Manually	40 days	% Female	85.92	95.09	90.51
			Hours spent/ day	7.25	6	6.625
Threshing & winnowing	Manually	15-20 days	% Female	73.76	0	36.88
			Hours spent/ day	6.5		
	Power Machinery		% Female	0	69.55	34.77
			Hours spent/ day		5	
Harvesting	Manually		% Female	0	0	0
			Hours spent/ day	5		
Harvesting	2		% Female	10.95	0	5.48
			Hours spent/ day	9		

Source: Field Survey, 2007-08

Table 5.17 Drudgery of Women in Livestock Rearing

Operations	Mode	Frequency	Extent of drudgery	Lahaul	Spiti	District		
Fodder resources	Cultivated	20-25 days	% Female	1.22	74.06	37.64		
			Hours spent/ day	1	2	1.5		
	Ghasni	Daily excluding winter	% Female	98.78	59.98	79.38		
			Hours spent/ day	5.63	3.5	4.565		
Fodder cutting	Traditional tools	Daily	% Female	100	96.19	98.095		
			Hours spent/ day	3.63	3	3.315		
Fodder transportation	On head/back load	Daily	% Female	92.96	49.68	71.32		
			Hours spent/ day	4.75	4	4.375		
Fodder chaffing	Chaff-cutter	Occasional	% Female	15	25	20		
			Without chaff-cutter	Daily	% Female	100	17.93	58.965
					Hours spent/ day	2.25	2	2.125
Feeding system	Inside manger	Daily	% Female	31.94	84.59	58.265		
			Hours spent/ day		1.5			
			On floor	Daily	% Female	68.06	16.14	42.1
Hours spent/ day								
Feeding practices	Stall feeding	Daily	% Female	100	71.11	85.555		
			Hours spent/ day	1.5	1	1.25		
	Grazing	Daily	% Female	80	31.85	55.925		
			Hours spent/ day	4	4	4		
	Both	Daily	% Female	100	3.59	51.795		
			Hours spent/ day	2.5	3	2.75		
Animal waste disposal	Head/back-load to field	Once a week	% Female	100	84.22	92.11		
			Hours spent/ day	1.75	1	1.375		
	FYM	15-20 days	% Female	100	91.56	95.78		
			Hours spent/ day	1	1	1		
Cleaning of animals & sheds	Manually	Once a week	% Female	100	73.97	86.985		
			Hours spent/ day	1	1	1		
Milking operation	Hand milking	Daily	% Female	100	73.53	86.765		
			Hours spent/ day	0.5	0.63	0.565		
Selling of milk	Within village	Daily	% Female	100	12.55	56.275		

			Hours spent/ day	1	2	1.5
Churning of milk	Manually	Daily	% Female	30.21	72.59	51.4
			Hours spent/ day	1	1.25	1.125
	Using machine		% Female	69.79	27.41	48.6
			Hours spent/ day	0.5	0.5	0.5
Breeding methods	Natural service		% Female	84.64	52.99	68.815
	A.I.		% Female	15.36	47.01	31.185
Animal house type	Single story		% Female	71.85	14.42	43.135
	Double story		% Female	28.15	98.13	63.14
Animal shed	Kachha		% Female	98.78	100	99.39
	Pucca		% Female	1.22	0	0.61
Light and ventilation	Sufficient		% Female	59.68	14.44	37.06
	Insufficient		% Female	40.32	85.56	62.94
Animal shed floor	Kacha		% Female	40.32	100	70.16
	Pucca		% Female	-	-	-

Source: Field Survey, 2007-08

5.14 Input Use and Gaps

The problems and constraints in horticultural development displayed in Table 5.18 clearly necessitate the need to strengthen supply of critical inputs and extension services relating to fruit cultivation. Since fruit plantation is a recently emerging phenomenon in Spiti, the farmers are not aware of specialised practices like scientific layouts, training, pruning, proper mix of pollinisers, manuring/fertilisation, disease/pest control, etc. The severity of the input supply constraints was more in Spiti. In other crops like hop, kuth and medicinal herbs, there is a lack of adequate production and marketing support thwarting the realisation of potential of these crops.

In case of livestock, there was huge gap in the feed/fodder and management practices. There is acute shortage of green and dry fodder in Lahaul as well as in Spiti (Table 5.19). The fodder scarcity was so intense during winter that even dry willow twigs are at premium to animals. The quantity of concentrates and minerals fed to animals is meagre leading to low yield. The respondents and veterinary experts also pointed out various disorders, diseases and endo/ecto parasites reducing vigour and yield potential of animals.

Table 5.18 Problems and Constraints in Horticultural Development (Per Cent of Panchayats)

Crop	Problem/constraint	Lahaul	Spiti
Apple	Inadequate supply of healthy plants of good variety	50	50
	Drying of plant	75	
	Attack of rats and animal menace	25	
	Fruit borer	25	50
	Fruit dropping		50
	Irregular bearing	50	50
	Woolly aphid	25	
	Insect attacks	25	
	Marketing problem	50	75
	Apricot	Lack of suitable variety	
Perishability			50
Dry fruits	Lack of suitable variety	25	50
	Lack of supply of planting material	25	50
Floriculture	Seeds, bulbs, cuttings not available	25	
Kuth	Age old local variety and low yield	75	
	Lack of markets	50	
Hop	Non remunerative price	50	
	High investment on structures	50	
	Labour intensive harvesting	50	

Source: Field Survey, 2007-08

Table 5.19 Gaps in Feed and Fodders (Kg/day)

Feed/ fodder	Actual	Required	Gap
Lahaul			
Green fodder	25.84	43.34	17.50
Dry fodder	24.08	34.50	10.42
Concentrate	0.83	2.08	1.25
Minerals (gm)	23.33	60.00	36.67
Spiti			
Green fodder	7.15	18.46	11.31
Dry fodder	12.38	30.54	18.16
Concentrate	1.09	3.15	2.06
Minerals (gm)	0.00	69.23	69.23
District			
Green fodder	16.50	30.90	14.41
Dry fodder	18.23	32.52	14.29
Concentrate	0.96	2.62	1.66
Minerals (gm)	11.67	64.62	52.95

Source: Field Survey, 2007-08

5.15 Yield Gap Analysis

There exists glaring differences in average yields and potential yields obtained by progressive farmers in the district. The yield gap in apple, shown in Table 5.20, is quite high showing that production of fruits can be increased 3 to 4 times from the existing level of production. The yield gap is quite high in Spiti where most of the area is under new plantations. The yield of hop is also much below the potential level. However, there is no gap in the yield of kuth as all the growers are operating at the same level of technology in Lahaul.

There is also yawning gap between actual and potential yield in different livestock species (Table 5.21). In cross bred cows, actual yield in the district is 3.07 litres per animal per day while the potential yield is three times higher at 9 litres per day. Similarly, the yield of local cow is 1.9 litres against the potential yield of 4 litres per animal per day. There is also huge gap in the actual and potential yield of sheep wool showing that with the same number of flock, the wool production can be increased by 2 to 3 times. Therefore, there exists scope for improving livestock production with suitable interventions and livestock improvement programmes.

Table 5.20 Yield Gaps in Horticultural Crops (Q/Ha)

Particulars	Lahaul			Spiti			District		
	A	P	G	A	P	G	A	P	G
Apple	78.51	150.00	71.49	16.54	150.00	133.46	44.87	150.00	105.13
Hop	24	42	18				24	42	18
Kuth	50.00	50.00					50.00	50.00	

A-Average, P-Progressive, G-Gap

Source: Field Survey, 2007-08

Table 5.21 Yield Gaps in Livestock Production (Per Animal)

Type of animal	Lahaul			Spiti			District		
	A	P	G	A	P	G	A	P	G
Crossbred cows (l/day)	3.93	12.00	8.07	2.21	6.00	3.79	3.07	9.00	5.93
Local cow (l/day)	1.90	4.00	2.10	1.33	4.00	2.67	1.62	4.00	2.39
Goats (l/day)	0.52	0.75	0.23	0.40	1.00	0.60	0.89	2.25	1.37
Sheep wool (kg/year)	0.58	2.00	1.42	1.19	2.50	1.31	0.89	2.25	1.37
Poultry (yield, eggs/year/bird)	288.35	324.85					288.35	324.85	36.50

Note: A – Actual yield, P – Potential yield, G – Gap

Source: Field Survey, 2007-08

5.16 Reasons for Gap

The reasons for gaps in productivity of fruit are not far to seek. As already mentioned (Table 5.18), the horticulture development in the district is yet in nascent stage. The farmers lack technical know-how especially in apple plantation. Moreover, major area is under new plantation and is, thus, in non-bearing state in Spiti. As such, research and extension need special consideration and priority.

In livestock, low yielding local breeds, fodder shortage and poor feeding/management practices were major reasons for low yields. The incidence of livestock diseases as shown in Table 5.22 also reduces livestock productivity. The major diseases of cattle are foot and mouth disease (FMD), tympany, diarrhoea and calf scorn. Various internal (endo) and external (ecto) parasites are infecting the livestock, especially cattle. The disease incidence is slightly lower in sheep and goats. In equines, respiratory, colic diseases and certain endo parasites are reported.

Table 5.22 Incidence of Livestock Diseases (Per cent of Panchayats)

Type of animal	Disease	Lahaul	Spiti	District
Cattle	a. FMD	10.14	0.5	5.32
	b. Hemorrhagic Septicaemia	0	0	0
	c. Tympany	9.03	8.28	8.655
	d. Pneumonia	3.06	3.67	3.365
	e. Diarrhoea/Dysentery	10	8.99	9.495
	f. Calf scour	8.61	2.94	5.775
	g. Endoparasites	19.72	8.76	14.24
	h. Ectoparasites	23.33	8.4	15.865
	i. Repeat Breeding	10.14	1.75	5.945
	Sheep & Goats	a. PPR/CCPP	0.55	0.18
b. Mange		1.02	0	0.51
c. Lice and ticks		3.65	5.49	4.57
d. Endoparasites		3.34	5.45	4.395
e. Diarrhoea/Dysentery		1.02	1.72	1.37
Poultry	a. Coccidiosis	5.94		
Equine	a. Respiratory distress	1.66		
	b. Colic	2.81		
	c. Internal parasites	4.57		
	d. Glanders			

Source: Field Survey, 2007-08

5.17 Interventions for the District and Financial Estimates

The interventions for horticultural development in the district are given in Table 5.23. These interventions are relating to supply of healthy planting material, dissemination of technical know how, timely supply of critical inputs and strengthening marketing system.

The interventions for livestock improvements are promoting cultivation of fodder, planting of willow trees and nutritive forage grasses in pasture lands, supply of concentrates/minerals by govt agencies, improving AI and other veterinary services, etc. The creation of fodder banks, preparation of feed blocks and silage are the other innovative interventions to solve fodder shortage (Table 5.24). The funds required for creating required infrastructure for livestock marketing and human resource for agricultural development have been given in Tables 5.25 and 5.26. The detailed budget allocation under different components of agriculture has been given in next chapter.

Table 5.23 R & D Interventions for Horticultural Development in Lahaul & Spiti (Per Cent of Panchayats)

Cropss	Interventions	Lahaul	Spiti
Apple	Ensuring timely supply of planting material and healthy root stock	100	100
	Training on IPM/IDM	50	100
	Timely supply of fertilisers and planting material	75	100
	Suitable variety	50	100
	R & D in varietal development	50	75
	Provisioning of grafting kit and training about orchard management (training/pruning)	50	100
	Provision of subsidy for community fencing	50	100
	Establishment of market yard	100	100
	Apricot	Supply of planting material	50
Dry fruits	Research on variety especially dried apricot		75
	Research on varietal development	25	50
Floriculture	Ensuring supply of seedlings of almonds and walnuts	25	50
	Training in nursery raising	25	50
Kuth	Demonstration	25	
	Research on varietal development	50	
Hop	Thrust on processing essential oils	50	
	Developing linkages with hop processing and brewers	100	
	Subsidy on poles/stakes and wires	100	
	Devising mechanical devices	100	

Source: Field Survey, 2007-08

Table 5.24 Interventions for Livestock Improvement (Per Cent of Panchayats)

Particulars	Management aspects	Intervention	Lahaul	Spiti
Seasons	Feed/fodder		100	100
Summer	Green	Fodder cultivation	50	100
		Improvement and introducing high quality grasses	50	25
		Palleing of grass	25	
		Pasture development	50	50
		Fodder bank	25	50
Rainy	Green	Planting of willow fodder trees	75	
		Enriched grasslands	25	20
		Fodder enrichment -demo	50	75
		Fodder bank	50	
		Planting of willow fodder trees	50	
Winter	Dry	Silage technique in palletic form	75	
		Fodder bank	50	50
		Planting of willow fodder tree	50	

Concentrates		Better transportation	75	100
		Availability through veterinary clinics	75	100
Minerals		Providing mineral mixture on subsidised rates	50	75
		Supply through depot	50	50
Veterinary services		Intervention	75	
AI		Should be made available	100	75
		Training on AI		100
		Radiography and lab facilities	25	100
De-worming		Should be made available	25	
		Training	100	100
Disease control		Should be made available	25	
		Training	100	100
Pest control		Should be made available	25	
		Training	100	100

Source: Field Survey, 2007-08

Table 5.25 Financial Estimates for Marketing Infrastructure of Livestock Products (Rs. Lakh)

Particular	Lahaul		Spiti		District	
	Nos.	Funds	Nos.	Funds	Nos.	Funds
Chilling plants	1	12	1	12	2	24
Refrigerated vans	1	5	1	5	2	10
Total	2	17	2	17	4	34

Table 5.26 Financial Estimates for Human Resources (Rs. Lakh)

Position	Lahaul		Spiti		District	
	Gap	Funds	Gap	Funds	Gap	Funds
SMS (Horti)	4	72	0	0	4	72
HDOs	1	15	0	0	1	15
HEOs	10	90	0	0	10	90
Veterinary pharmacist	7	50.4	0	0	7	50.4
Extension specialist for:						
Mushrooms	0	0	2	36	2	36
Floriculture	0	0	2	24	2	24
Fisheries	4	48	0	0	4	48
Total	26	275.4	4	60	30	335.4

Source: Field Survey, 2007-08

5.18 Research/Extension Gaps

The research and extension gaps visualised in the allied sectors can be abridged through following initiatives:

- Accelerating the process of replacing indigenous breeds of cows, sheep and goats with improved breeds
- Conservation of rare indigenous animal stock like *Chegu Goats*, *Chamurthi Horse* and *Yak*
- Provision of quality plant material to promote fruit production (apple) and harness available potential
- Strengthening the existing marketing infrastructure for high value cash crops including vegetables and fruit
- Development of model villages for promoting the cultivation of high value cash crops like hops, *kuth*, etc
- Providing technical know how about different processes of value addition of the wild and cultivated apricot oil extraction.
- Need based training to the extension personnel
- Exposure to places of success stories where exemplary success has been achieved in the improvement of farming systems

5.19 Researchable Issues

The analysis of data on different parameters throws up the following researchable issues in horticultural crops, animal husbandry and other allied sectors:

Horticultural Crops

- Introduction and testing of apple, apricot and pistachio cultivars for determining their suitability under dry temperate conditions. Development of suitable varieties of apple, apricot and dry fruit
- Identification of niche areas and remapping of different fruit growing belts
- Standardisation of nursery practices and alternative propagation techniques for quality planting material in fruit
- Standardisation of cultivation techniques and package of practices for pistachio nuts
- Development of production module and practices for organic fruit farming
- Development of irrigation and fertigation modules for fruit crops
- Nutrient indexing and improvement of soil health in fruit especially apple
- Research on soil and water conservation practices in fruits
- Generation of data base in pollinator diversity and identification of potential pollinators

- Development of suitable IPM capsules and bio control methods for management of pests and diseases of fruit crops
- Research on safe waiting periods of pesticides in horticultural crops
- Research on post harvest management of horticultural crops
- Constraint identification and diagnostic surveys
- Studies on economic and marketing aspects of fruit crops

Animal Husbandry

- Determination of immuno-profiles of Chumurthi horses and establishing the basic immuno-profiles of Yak
- Identification of indigenous livestock health practices and documentation of the prevailing indigenous technical knowledge (ITK) and ethno-veterinary practices among Spiti farmers and their scientific validation
- Identification and nutritional evaluation of the high nutrition fodder grasses in Lahaul & Spiti, the adaptation to alpine pasture in migratory crossbred sheep/goats and development of feed blocks, silage practices and strategic mineral supplements to improve nutrition of animals
- To develop endocrinological tools to augment production and reproduction in dairy animals and to establish complete physiological blood profile of Yak, Spiti pony and Chegu goats.
- Surveillance, monitoring and control of the diseases of animals and birds including wild fauna.
- Development of herbal nutraceuticals for health and production of farm animals and toxicological studies on the poisonous plants and characterization of their toxic principles and anti nutritional factors.
- Investigation on the etiological agents of infectious infertility among bovine, ovine and caprine including male animals with special emphasis on *Brucella*, *Chlamydia*, *Mycobacterium* and fungal agents in H.P. including their molecular diagnosis.
- Preparation and testing of multiserotype vaccine against H.S. Serosurveillance of some important infectious diseases in livestock of Himachal Pradesh.
- Investigations on the epidemiology and serodiagnosis of *Mycobacterium bovis* infection in bovines. Molecular diagnosis and genetic diversity analysis of important pathogens responsible for major animal diseases and zoonoses.
- Evaluation of medicinal plants/herbs utilized in soft and hard tissue healing in animals.
- Standardization and further application of endoscopic and laproscopic techniques in clinical cases of abdominal disorders in small and large animals.
- Evaluation of various prosthetics and biomaterials in the management of abdominal trauma/fracture/muscular skeletal disorders in animals.

- To develop state of art in diagnostic and operative facilities including intensive care unit for small and large animals.
- Studies on economic, processing and marketing aspects of livestock products

Other Allied Areas

- Varietal development in hop and kuth crops
- Standardisation of cultivation techniques for medicinal and aromatic plants
- Development of suitable agro forestry models
- Studies on diseases and pests in important tree species particularly willow, poplars and junipers
- Genetic improvement for variety, yield and quality traits in seabuckthorn
- Research on suitable engineering designs for water harvesting and protected cultivation
- Research on development of hill specific suitable models/designs of mechanical tools and equipments for improving efficiency in various farm operations
- Studies on honey bees and rearing practices to popularise garden bee colonies
- Socio demographic and nutritional studies of households
- Scope and potential for household tourism and non farm enterprises
- Studies on climate change, hydrology and glacial regimes
- Impact assessment of different programmes/schemes and policy implications

Chapter VI

DISTRICT PLAN

6.1 DAP and Sectoral Outlays

Based upon the potential of agriculture, horticulture, livestock and allied activities, the comprehensive budget outlay and yearly allocation under various schemes/interventions have been given in Table 6.1. The plan envisages budget allocation among VIII major components of agricultural sector comprising crop improvements, infrastructure, natural resource conservation/management, niche based potential enterprises, development of horticulture, livestock improvement, human resource and finally research and extension needs. Each component has been further divided into different sub components/interventions to achieve desirable growth in agriculture, The total plan outlay for the district has been estimated at Rs 20,502 lakhs. The yearly allocation came out to be about Rs 3,075 lakhs in the first year, Rs 4,100 lakhs in the second, third and fourth years of implementation and remaining Rs 5,126 lakhs in the fifth and final year of execution of this plan.

Table 6.1 District Plan, Sectoral Outlays and Yearly Allocation (Rs. Lakhs)

Sr. No.	Schemes	Total Plan Outlay	Yearly Allocation				
			I	II	III	IV	V
I	Interventions to Improve and Enhance Sustainability of Crop Production System	1840	276	368	368	368	460
1	Improvement of productivity of cereals, pulses, oilseeds, vegetables and spices crops through promotion of HYV seeds including hybrids	250	37.50	50	50	50	62.5
2	Improvement of soil health through vermi-composting, bio-fertilizers, micro nutrients, soil testing etc.	150	22.5	30	30	30	37.50
3	Protection of crops against biotic stresses (diseases, pests, weeds) and abiotic stresses (hailstorms, draught, flash floods, etc) and other risk factors	80	12	16	16	16	20
4	Water use efficiency through micro irrigation	900	135	180	180	180	225
	(i) Sprinkler	800	120	160	160	160	200
	(ii) Drip	100	15	20	20	20	25
5	Agricultural mechanization through popularization of improved tools and hill specific machinery like power tillers, tractors, crop planters/ harvesters, sprayers, clod breakers and gender friendly post harvesting equipments etc. to remove women drudgery	150	22.5	30	30	30	37.50
6	Protected (poly house) cultivation to minimize risk factors and enhance quality and productivity	300	45	60	60	60	75

8	Strengthening of seed production farms and promotion of infrastructure to improve seed production and replacement	10	1.5	2	2	2	2.5
II	Need Based Infrastructure Development	14387	2158.05	2877.4	2877.4	2877.4	3596.75
1	Irrigation	1258	188.7	251.6	251.6	251.6	314.5
2	Improvement of on-farm water delivery and efficiency of existing irrigation systems	667	100.05	133.4	133.4	133.4	166.75
3	Rural markets	600	90	120	120	120	150
4	Rural roads for connectivity	11862	1779.3	2372.4	2372.4	2372.4	2965.5
III	Natural Resource Conservation and Management	1343	201.45	268.6	268.6	268.6	335.75
1.	Soil conservation of arable and non-arable land through engineering measures	445	66.75	89	89	89	111.25
2.	Water harvesting check dams, ponds, tanks, etc	413	61.95	82.6	82.6	82.6	103.25
3.	Land improvement	485	72.75	97	97	97	121.25
IV	Niche Based Enterprises for Rural Entrepreneurs	210	31.5	42	42	42	52.5
	(i) Organic farming	145	21.75	29	29	29	36.25
	(iv) Agro-tourism	50	7.5	10	10	10	12.5
	(v) Medicinal and aromatic plants	15	2.25	3	3	3	3.75
V	Fruit Production	767	115.05	153.4	153.4	153.4	191.75
VI	Livestock, Poultry & Fisheries	1482	222.3	296.4	296.4	296.4	370.5
1	Livestock improvement	1420	213	284	284	284	355
2	Fisheries	62	9.3	12.4	12.4	12.4	15.5
VII	Human Resources	345	51.75	69	69	69	86.25
1	Additional man power requirement	335	50.25	67	67	67	83.75
2	Capacity building of extension personnel	10	1.5	2	2	2	2.5
VIII	Research & Extension	128	19.2	25.6	25.6	25.6	32
IX	All Sectors & Schemes	20502	3075.3	4100.4	4100.4	4100.4	5125.5

6.2 New Schemes for Agricultural Development

The new schemes for agricultural development in Lahaul & Spiti are portrayed in Table 6.2. New approach to watershed development and soil conservation would include thrust on snow harvesting, construction of check dams and other civil engineering works to stabilise fragile soil strata so as to make more productive use of land resource. The fruit plantation and livestock improvement schemes would cover maximum number of beneficiaries to diversify income and livelihood opportunities. The entire district has a rich repository of naturally growing medicinal and aromatic herbs that need to be rejuvenated through natural seeding and cultivation to diversify farming. Substantial provision has been made to improve rural connectivity as many of the remote villages are still isolated from the mainstream of economic development. The marketing infrastructure also needs to be strengthened in order to improve marketing efficiency in commercial crops for the benefit of tribal farmers as there is still not even a single regulated market notwithstanding the sizeable marketed surplus of pea, potato and fruit.

Keeping in view the specificities of the district, protected cultivation and organic farming need due attention to increase the profitability and cropping intensity. The entire district has a treasure

of scenic adventures, mountain passes, heritage property, monasteries, ethnic harmony and culture attracting large number of tourists. Therefore, household tourism can play a significant role in enhancing non-farm income as the other non farm avenues are scanty.

Based upon opinion survey and assessment made by officials of agriculture and irrigation department in the district, a number of new irrigation schemes can be taken up to increase the irrigated area (Table 6.3). Four new lift irrigation schemes can be developed with a command area of 68 hectares covering 84 farmers in 7 villages. Similarly 20 snow harvesting schemes may be started in Lahaul benefiting 185 farmers in 18 villages with command area of 210 hectares. About 127 new irrigation kuhls are proposed out of which 77 are in Spiti and 50 in Lahaul. These kuhls would cover 2,650 beneficiaries majority of whom are in Spiti (2,185) in 133 villages creating irrigation potential of 445 hectares. In this way, additional command area of 738 hectares would be created in the district. The budget estimates for different schemes are Rs 212.84 lakhs, Rs 327.60 lakhs, Rs 694.20 lakhs and Rs 23.40 under lift, snow harvesting, kuhl and gravity irrigation schemes, respectively. Irrigation potential shall be created which will provide irrigation to an additional area of 903 hectares. Since cultivation in Lahaul & Spiti is only possible under irrigation conditions, the exploitation of available irrigation potential shall lead to an increase in the cultivated area from the existing level of 3043 hectares to 3946 hectares

Table 6.2 New Schemes for Agriculture and Rural Development

Block	No. of Schemes	Village (No)	Beneficiary families (No)	Potential area (ha)	Funds required (Rs. Lakh)
Watershed development including snow harvesting, ponds, check dams, etc.					
Lahaul	1	150	2000	165	412.5
Spiti	0	0	0	0	0
Total	1	150	2000	165	412.5
Soil/land conservation schemes					
Lahaul	1	60	300	355	95
Spiti	1	30	60	200	50
Total	1	90	360	555	145
Fruit production schemes					
Lahaul	7	200	1000	188	267
Spiti	6	19	1500	250	500
Total	7	219	2500	250188	767
Livestock improvement schemes					
Lahaul	2	290	3238	0	1100
Spiti	8	5	700	0	320
Total	8	295	3938	0	1420
Fisheries (Pond)					
Lahaul	1	40	50	0	12
Spiti	1	10	10		50
Total	1	50	60	0	62
Rural roads (Km)					
Lahaul	571	80	1100	0	9000

Spiti	26	0	1000	0	754
Total	597	80	2100	0	9754
Bridges (No.)					
Lahaul	20	25	400	0	1000
Spiti	8	18	712	0	1108
Total	28	43	1112	0	2108
Rural markets (No.)					
Lahaul	5	290	3800	0	500
Spiti	2	13	275	0	100
Total	7	303	4075	0	600
Protected cultivation					
Lahaul	1	150	400	5.00	200
Spiti	1	60	120	1.20	100
Total	1	210	520	6.20	300
Organic farming					
Lahaul	1	25	250	500	20
Spiti	1	20	20	0.5	25
Total	1	45	270	500.5	45
Vermi Compost					
Lahaul	0	0	0	-	0
Spiti	1	100	500	-	100
Total					
Agro-tourism					
Lahaul	5	100	500	-	50
Spiti	0	0	0	0	0
Total	5	100	500		50
Cultivation of medicinal plants					
Lahaul	1	50	100	50	10
Spiti	1	25	30	20	5
Total	1	75	130	70	15

Source: Field Survey, 2007-08

Table 6.3 New Irrigation Schemes

Particulars	Lahaul	Spiti	District
1. Lift irrigation			
Number	4	0	4
Amount required (Rs. Lakh)	212.84	0	212.84
Villages to be covered (No.)	7	0	7
Beneficiaries (No.)	84	0	84
Command area (ha)	68	0	68
2. Snow Harvesting Schemes			
Number	20	0	20
Amount required (Rs. Lakh)	327.6	0	327.60
Villages to be covered (No.)	18	0	18
Beneficiaries (No.)	185	0	185
Command area (ha)	210	0	210
3. Kuhl			
Number	50	77	127
Amount required (Rs. Lakh)	460.2	234	694.20
Villages to be covered (No.)	57	76	133
Beneficiaries (No.)	465	2185	2650
Command area (ha)	295	150	445
4. Gravity irrigation			
Number	1	0	1
Amount required (Rs. Lakh)	23.40	0	23.40
Villages to be covered (No.)	-	-	-
Beneficiaries (No.)	-	-	-
Command area (ha)	15	-	15

Source: Field Survey, 2007-08

6.3 Input Requirement

The supply of critical inputs well in advance is the utmost need of this tribal district that remains cut off during winter for almost six months in a year. The critical inputs are seeds/planting material of major crops and fertilizers. The demand for these two critical inputs has been estimated. The estimated demand for seeds in case of potato and pea in the district is estimated on the basis of seed rates used by the progressive farmers and the total annual demand is 2,279 tonnes of potato seed and 146 tonnes seeds of pea (Table 6.4). Due to higher area, the demand is more in Lahaul. However, the estimated demand for apple plants is quite high in Spiti due to more potential for horticultural development. The total demand for apple plants is about 75,000 in Spiti as against 21,000 in Lahaul block.

Table 6.4 Estimated Requirements of Seeds and Planting Material in Lahaul & Spiti

Seed/plant	Lahaul	Spiti	District
Potato (Tonnes)	2075.20	204.00	2279.20
Pea (Tonnes)	105.48	40.03	145.51
Apple (No. of plants)	21000.00	74800.00	95800.00

Source: Field Survey, 2007-08

Based upon the augmented arable land and gaps between required and existing use, the projected requirements of different fertilizers over the plan period is shown in Table 6.5.

The gaps in the use of inputs have been linearly abridged over the period of five years. The total fertilizer requirement in the district would be around 476 tonnes of urea, 234 tonnes of IFFCO (12:32:16), 115 tonnes CAN, 159 tonnes SSP and 38 tonnes MOP. Major quantity of fertilizers would be needed in Lahaul due to high degree of commercialisation. In Spiti, fertilizer use is lower and area can also be converted into organic farming. As emphasised earlier, there is also acute shortage of FYM in both the blocks, which needs to be abridged through popularising vermi- compost and bio-fertilizers.

Table 6.5 Projected Fertilizer Requirement in Lahaul& Spiti for 11th Plan (Tonnes)

Fertilizer	Projected Yearly Requirement				
	1	2	3	4	5
Lahaul					
Urea	266.17	293.87	321.58	349.28	376.99
CAN	12.23	24.46	36.68	48.91	61.14
IFFCO	110.81	135.17	159.52	183.88	208.23
MOP	24.00	27.64	31.27	34.91	38.54
SSP	97.07	112.63	128.19	143.75	159.31
Spiti					
Urea	61.09	70.49	79.90	89.30	98.71
CAN	44.27	46.68	49.08	51.49	53.89
IFFCO	16.22	18.68	21.15	23.61	26.07
MOP	0.00	0.00	0.00	0.00	0.00
SSP	0.00	0.00	0.00	0.00	0.00
District					
Urea	327.25	364.36	401.48	438.59	475.70
CAN	56.50	71.13	85.77	100.40	115.03
IFFCO	127.04	153.85	180.67	207.48	234.30
MOP	24.00	27.64	31.27	34.91	38.54
SSP	97.07	112.63	128.19	143.75	159.31

Note : Requirement based upon the augmented operational land and gaps in the fertilizer use in respective blocks

Source: Field Survey, 2007-08

6.4 Projected Outcomes and Growth Rates

With the implementation of the plan, there will be appreciable growth in agriculture, horticulture and livestock production. The expected growth in different sectors has been contemplated hereunder:

The development plans and interventions proposed would lead to overall development of agriculture in the district through resource augmentation (arable land and irrigation), technological interventions and strengthening of multiple backward and forward linkages through creation of social overheads. With the implementation of plan, there will be increase in arable land, irrigated area and support lands to the extent shown in Table 6.6, which, in turn, would provide growth impetus to agriculture as projected in Tables 6.7 and 6.8.

Table 6.6 Augmentation of Land and Water Resources: Physical Targets (Ha)

Blocks	Cultivated land	Potential cultivable land	Productive support land	Potential support land	Existing irrigated area	Potential irrigated land	Irrigation potential through water harvesting
Lahaul	2156	190	25000	37027	2156	588	165
Spiti	887	780	147657	10114	887	150	0
District	3043	970	172657	47141	3043	738	165

Table 6.7 Projected Output and Growth in Agriculture in District Lahaul & Spiti

Crops	Existing			Potential Production (MT)		Growth (% p.a.)	
	Area (ha)	Production (MT)	Yield (q/ha)	Scenario I	Scenario II	Scenario I	Scenario II
Maize	47	100	21.25	189	185	17.80	17.00
Paddy							
Wheat	107	199	18.64	378	370	17.98	17.19
Barley	636	915	14.39	1734	1696	17.90	17.07
Pulses	149	104	7	198	193	18.08	17.12
Foodgrains	939	1319	61.28	2499	2445	17.89	17.07
Vegetables	2342	40517	173	51183	51450	5.27	5.40

Note: i. Scenario I output growth with increased irrigated area and crop improvement programmes
ii. Scenario II output growth with diversion of 20 % irrigated area to vegetable crops

Table 6.8 Existing and Potential Output and Growth in Agricultural Crops in Lahaul & Spiti District (Quintals)

Particulars	Existing	Potential	Growth (% p.a.)
Maize	977.50	1840.00	17.65
Wheat	1842.83	3066.37	13.28
Barley	15606.46	23958.72	10.70
Millets (Ogla/hafra)	377.97	921.87	28.78
Rajmash	242.57	343.08	8.29
Lathyrus (Kala matar)	33.00	39.60	4.00
Potato	156153.00	333300.30	22.69
Peas	125071.18	235500.00	17.66

Note: Potential based upon yield gaps
Source : Field Survey, 2007-08

With the execution of plan, horticulture sector may get a big boost in the district especially in Spiti. After realising full potential, apple production in the district would increase from existing 1,629 tonnes to about 13,024 tonnes showing around 70 per cent growth in which major increase will be in Spiti (Table 6.9). Even by abridging 25 per cent of gap, the annual growth will be well over 9 per cent per annum. The production of hops and kuth can also be increased substantially and even at 25% level the annual growth would be 10 per cent. This clearly shows promising prospects for horticulture development in the district.

Table 6.9 Projected Production and Growth in Horticulture

Crops	Production (tonnes)				Growth (% per annum)*		
	Existing	Potential	50% potential	25% potential	Potential	50% potential	25% potential
Lahaul							
Apple	1303.27	4065.60	2684.43	1993.85	21.20	10.60	5.30
Hop	96.00	924.00	510.00	303.00	86.25	43.13	21.56
Kuth	201.60	500.00	350.80	276.20	14.80	7.40	3.70
Spiti							
Apple	325.84	8958.15	4641.99	2483.92	264.93	132.46	66.23
Hop		168.00	84.00	42.00			
Kuth		100.00	50.00	25.00			
District							
Apple	1629.10	13023.75	7326.43	4477.77	69.94	34.97	9.27
Hop	96.00	1092.00	594.00	345.00	103.75	51.88	10.00
Kuth	201.60	600.00	400.80	301.20	19.76	9.88	10.00

Note: Potential production estimated on the basis of potential area and yields and also at 50% & 25% realisation of production gaps, respectively. The annual growth estimated over ten years pe

The impressive output growth can also be achieved in livestock production as shown in Table 6.10. If full potential output is realised, there will be impressive annual growth of 25 to 40 per cent in milk production and 45 per cent in wool production in the district. Even at 25 per cent technology level, the growth in milk and wool production will be well over 5 per cent per annum over existing level of production.

Table 6.10 Livestock Production - Existing and Potential

Livestock	Existing Production	Annual Growth (%) over existing		
		Full potential	50% potential	25% potential
Lahaul				
Crossbred cows (milk tonnes)	4076.98	41.07	20.53	10.27
Local cow (milk tonnes)	2432.30	22.11	11.05	5.53
Goats (milk tonnes)	135.75	8.85	4.42	2.21
Sheep (wool tonnes)	35.63	48.97	24.48	12.24

Spiti				
Crossbred cows (milk tonnes)	986.88	34.30	17.15	8.57
Local cow (milk tonnes)	321.6	40.15	20.08	10.04
Goats (milk tonnes)	57.29	30.00	15.00	7.50
Sheep (wool tonnes)	7.02	22.02	11.01	5.50
District				
Crossbred cows (milk tonnes)	5063.86	39.75	19.87	9.94
Local cow (milk tonnes)	2753.90	24.21	12.11	6.05
Goats (milk tonnes)	193.04	15.12	7.56	3.78
Sheep (wool tonnes)	42.65	44.53	11.23	5.62

Source: Field Survey, 2007-09

The sectoral growth in different components based upon existing and potential production has been displayed in Table 6.11. The highest growth (47 per cent) can be achieved in horticulture especially apple production which has tremendous potential in Spiti region. Similarly, the milk production will increase by about 34 per cent per annum over the existing production. In this way, the gross value of output originating in different primary sectors in the district will increase at the rate of about 24 per cent per annum.

Table 6.11 Projected Value of Output and Sectoral Growth in Lahaul & Spiti District (Rs. Lakhs)

Sectors	Existing	Potential	Growth (% p.a.)
Agriculture	3130.51	6121.29	19.11
Horticulture	406.94	1193.16	38.64
Animal Husbandry	1112.48	2820.67	30.71
All sectors	4649.93	10135.12	23.59

Note: Estimated on the basis of 2007-08 prices in the district

6.5 Growth Drivers and Expected Outcomes

The district of Lahaul & Spiti harbours unique agro-climatic conditions that are favourable to grow niche based high value and high quality cash crops like pea, potato, fruits, kuth, hop and wide range of medicinal herbs. There is great demand for these commodities as these are either produced in off-season (pea and potato) or can be produced only in this region (hop, kuth, kalazeera, medicinal plants, etc.). Lahaul is also the major producer of quality seed potato in the country. Obviously the huge demand for these crops is one of the important growth drivers for agricultural development of the district.

Irrigation potential shall be created which will provide irrigation to an additional area of 903 hectares (including watershed irrigation schemes). Since cultivation in Lahaul & Spiti is only possible under irrigation conditions, the exploitation of available irrigation potential shall lead to an increase in the cultivated area from the existing level of 3,043 hectares to 3,946 hectares.

The expected (quantitative) achievements of DAP are summarised as under:

- With the implementation of plan an additional area of 903 hectares shall be brought under cultivation

- Support land (including public and private grasslands) of 2,19,798 hectares shall be treated against invasive weeds and shrubs. This shall improve fodder production to the approximate level of 21,980 metric tonnes.
- Foodgrain production shall increase from 1,319 metric tonnes to 2,499 metric tonnes after the implementation of the plan recording a growth rate of 17.90 per cent per annum in scenario I. Even in scenario II when 20 per cent of irrigated land is shifted to high value cash crops production, the growth rate in foodgrains production shall be very high at 17.07 per cent per annum.
- Production of vegetables would increase from 40,517 metric tonnes to 51,183 metric tonnes in scenario I registering a growth rate of 5.27 per cent per annum when the proportion of area under these crops remains same and production increases to 51,450 metric tonnes recording a growth rate of 5.40 per cent per annum in scenario II when 20 per cent of the irrigated area is brought under these crops. This will generate substantial marketable surplus in the district . The cultivation of high value cash crops shall generate huge employment opportunities for rural unemployed youths through backward and forward linkages.
- Based upon the yield gaps of field crops between average and progressive farmers, the production of cereals and vegetable commodities can be increased substantially. If this gap is abridged, the output of wheat and barley could be increased by 13 and 11 per cent per annum, respectively. Similarly, in the production of potato and pea annual increase of about 23 and 18 per cent respectively could be achieved.
- The area under fruit would increase from existing 368.25 hectares to 829.25 hectares resulting in the total fruit production to the tune of 5,138 tonnes from 1,620 tonnes at present
- The area under medicinal and aromatic plants will increase opening more income and employment opportunities
- The supply of critical inputs well in advance is the utmost need of this tribal district that remains cut off during winter for almost six months in a year. The estimated annual demand for seeds in case of potato and pea in the district is 2,279 tonnes of potato seed and 146 tonnes seeds of pea. Demand for apple saplings is about 75,000 in Spiti as against 21,000 in Lahaul block.
- Balanced use of fertilizers needs to be promoted along with increased use of organic manures and bio fertilizers. The projected fertilizers requirement in the district would be around 476 tonnes of urea, 234 tonnes of IFFCO (12:32:16), 115 tonnes CAN, 159 tonnes SSP and 38 tonnes MOP. Major quantity of fertilizers would be needed in Lahaul due to high degree of commercialisation. In Spiti, fertilizer use is lower and area can also be converted into organic farming.
- With the improvement in livestock breeds, fodder availability and rearing practices, total milk production will increase from 8,009 tonnes to 21,556 tonnes and wool production from about 43 tonnes to 138 tonnes.
- With the implementation of District Agricultural Plan, there shall be increase in the gross value output of all the primary sectors in the district. The value output of agriculture,

horticulture and animal husbandry will grow with annual rate of 19%, 39% and 31%, respectively. The gross value of all the primary sectors will increase from existing level of Rs 4649.93 lakhs to Rs 10135.12 lakhs registering the annual growth of about 24 per cent over the plan period.

In brief, the implementation of District Agricultural Plan (DAP) shall strengthen and improve the physical and institutional infrastructure and shall restore, rejuvenate, conserve and enhance the health of the available natural resource base. It shall also give a big boost to the ongoing process of crop diversification towards high value cash crop agriculture including off-season vegetables and other niche based enterprises generating adequate employment opportunities for the rural unemployed youth. In concrete terms, the implementation of the plan shall go a long way in ensuring ecological sustainability and economic viability of the production systems of the district.

6.6 Innovative Schemes

The district agricultural plan envisages the resolve and efforts to achieve sustainable and holistic development of all the components of farming system. The information has been generated at the grass root level so as to express the ambitions and felt needs of people. All possible options have been explored. Some of the innovative schemes included in the draft plan are::

- Creation of water/snow harvesting structures
- Provision of irrigation through development of major and minor kuhls
- Natural resource (soil, land water) conservation and resource use efficiencies
- Protection of crops against biotic and abiotic stresses
- Promotion and development of horticulture
- Livestock development through breed improvement, training, management and veterinary services
- Organic farming and promoting protected cultivation
- Development of rural infrastructure particularly markets, roads and bridges
- Reducing drudgery and coping with labour shortage through mechanisation
- Promoting rural handicrafts and enterprises for providing income and employment opportunities in lean (winter) season

6.7 Vision of Next Plan

The present plan document has presented many new avenues for the development of the district. The present plan would lay the foundation for framing next plan. If the plan would be implemented in entirety, discernible growth can be achieved in agriculture. There will be substantial increase in the land use capability through land development and irrigation. The plan will lead to diversification of agriculture in favour of high value cash crops like pea, potato, fruits, medicinal herbs and livestock products. There will be substantial increase in the marketable surplus for which market infrastructure should be strengthened. With the

development of allied sectors, there is expected to be lot of income and employment diversification in favour of profitable crops, rural enterprises and plethora of non-farm avenues for educated youths. The new innovations like household tourism, organic farming and protected cultivation would add new dimensions to farming and enhance land-man productivity.

Besides these opportunities, agriculture in the future ahead may face new challenges as well. The climate change has already started showing its consequences. There is increase in the summer rainfall that may not be conducive for commercial crops especially peas and may enhance vulnerability of fragile eco-system to land slides and soil erosion. The decrease in the amount of winter snow is also causing great concern as the size of perennial glaciers is shrinking sounding alarm bells for maintaining ecological/hydrological balance in the Himalayas and down plains. The climate change may also necessitate development of new crops/options for sustainable development for which R & D endeavours need continuity and more thrust in future.

The migration of educated youth to other areas needs to be arrested by providing good infrastructure and employment opportunities in the tribal areas. This migration is also causing acute labour shortage. Therefore, in the next plan mechanisation would also need due emphasis. The mechanical devices like potato digger/planter, mechanical grading for pea and potato, hop harvesting, etc., need to be developed and popularised.

6.8 Prioritisation of Schemes

The in-depth survey of the area enables us to prioritise different location specific schemes of agriculture and rural development based of felt needs of people. The prioritisation was done on the basis of PRA conducted at Panchayat level. The development priorities under different components of agriculture have been shown through Table 6.12. In agriculture, irrigation needs to be given top priority in both the blocks. The supply of seeds of disease resistant varieties of pea gets second priority while timely supply of inputs (Lahaul) and organic farming (Spiti) get third priority. In horticulture, irrigation, supply of quality planting material and training get the first, second and third priorities in that order. In livestock sector pasture land development, breed improvement through artificial insemination and cultivation of fodder crops are the major priority areas. The renovation of veterinary institutions and creation of necessary facilities should be given due attention to provide adequate veterinary services to farmers.

Table 6.12 Prioritizations of Different Schemes

Sector	Scheme	Lahaul	Spiti	District
Agriculture				
	Irrigation	1	1	1
	Disease resistant varieties of pea	2	3	2
	Timely supply of seeds/ inputs	3	7	5
	Protected cultivation	4	4	4
	Organic farming	6	2	3
	Promotion of cultivation of medicinal plants	7	5	7
	Maintaining good conditions of road	5	6	6
Horticulture				
	Irrigation	1	1	1
	Quality planting material	2	2	2
	Training to farmers about pruning and other operations	3	3	3
	Development of floriculture	4	4	4
	Regulated market yard	5	5	5
	Planting of seabuckthorn plants	6	6	6
Animal Husbandry				
	Pasture development	1	1	1
	Encouraging artificial insemination for breed improvement	2	2	2
	Encouraging fodder cultivation	3	3	3
	Liquid nitrogen plant	4	4	4
	Renovation of hospitals	5	5	5

Source: Field Survey, 2007-08

Appendix Table 1 Demographic and Institutional Features of Lahaul & Spiti

Sr No	Particulars	Block		District
		Lahaul	Spiti	
1.	Gram panchayats	28	13	41
2.	Villages	290	131	421
3.	Households	3238	2149	5387
4.	Total population	22545	10679	33224
	Male	12567	5874	18441
	Female	9978	4805	14783
	Schedule caste	2005	600	2605
	Schedule tribe	15928	8310	24238
	Rural	22545	10679	33224
	Urban	0	0	0
	Sex ratio	802	818	802
5.	Literacy rate			
	Persons	72.64	74.13	73.10
	Male	81.23	86.41	82.82
	Female	61.60	58.70	60.70
6.	Households economic status			
	Antodaya households	266	769	1035
	BPL households	427	1107	1534
	APL1 households	2545	273	2818
	APL2 households	-	-	-
7.	Village amenities			
	Connected with pucca roads	225	34	259
	Connected with kuchha roads	35	79	114
	Connected with no roads	30	-	30
	Drinking water supply	290	113	403
	Villages electrified	290	81	371
	Tel connection to panchayats	27	5	32
	Post office	27	19	46
	Fair price shops			
	<i>Co-op depots</i>	40	27	67
	<i>Private dealers</i>	0	0	0
8.	Educational and health institutions			
	Primary schools	138	67	205
	High schools	19	13	32
	Technical institutions	19	11	30

	<i>Polytech/Engg</i>	0	0	0
	<i>ITI</i>	0	0	0
	<i>Nurshing TI</i>	1	1	2
	<i>College of Education</i>	0	0	0
	PHC	2	0	2
	Dispensaries	7	4	11
	Sub-health centres	16	8	24
	Community HCs	0	10	10
	Hospitals	4	1	5
	Medical college cum hospitals	1	0	1
	Veterinary hospitals	0	0	0
	Veterinary dispensaries	8	5	13
	Gosadan	24	18	42
	Other health institutions	0	0	0
	Anganwaris/balwaris	0	1	1
9.	Village/community organizations			
	Mahila mandals	118	52	170
	Self help groups	11	41	52
	Youth clubs	28	16	44
	NGOs	3	14	17
	Farmers co-operatives	0	0	0
10	Banking institutions			
	Commercial banks	14	3	17
	RRBs	0	0	0
	Central co-operative banks	0	1	1
	Co-operative credit societies	0	27	27

Appendix Table 2 Estimated Area under Different Crops in Lahaul & Spiti

	Lahaul	Spiti	District
Maize	46	0	46
Wheat	58	35	93
Barley	268	476	744
Ogla/Phafra	51	0	51
Rajmash	19	6	25
Kala matar		1	1
Oilseeds (Sarson)		2	2
Vegetables			
Potato	800	102	902
Peas	1172	398	1570
Cabbage	5	0	5
Apple	166	197	363
Apricot	1	1	2
Hop	40	0	40
Kuth	40	0	40

Source: Field Survey, 2007-08

Appendix Table 3 Status of Migratory Labour in Lahaul & Spiti (Number)

Domicile Status	Labour	Lahaul	Spiti	District
H.P.	Semi skilled		81	81
	Unskilled	1493	1700	3193
	Sub Total	1493	2002	3495
Other States	Skilled	1120	1079	2199
	Semi skilled	140	471	611
	Unskilled	6067	7475	13542
	Sub Total	7327	9025	16352
Total	Skilled	1120	1300	2420
	Semi skilled	140	553	693
	Unskilled	5600	9149	14749
	Grand Total	6860	11002	17862

Source: Field Survey, 2007-08

Appendix Table 4 Distribution of Workers and Categories of Households

Particulars	Lahaul	Spiti	District
Workers			
Cultivators	8903	2257	11160
Agricultural labour	190	149	339
Household Industries	52	84	136
Others	6042	3411	9453
Total	15187	5901	21088
Main workers	14003	5206	19209
Marginal workers	1184	695	1879
Households			
Landless	0	89	89
Marginal	1972	850	2822
Small	278	535	813
Large	70	775	845
Total	2320	2249	4569

