

# Strategies for Doubling Farmers Income in Himachal Pradesh



**YSP University of Horticulture and Forestry**  
**Naini, Solan 173230, Himachal Pradesh**



# Strategies for Doubling Farmers Income in Himachal Pradesh

Report Prepared

by

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## Preface

Sustainability of agricultural production systems, and food and nutritional security are the major challenges due to global warming and climate change, increasing population pressure and over exploitation of natural resources. The farmers are heavily burdened through high cost of inputs, frequent droughts, increased severity of insect-pests and diseases, natural vagaries and uncertain market prices for the agricultural produce. Because of availability of food grains in the public distribution system at cheaper prices, craze among the youth for white collar jobs, crop damage by the stray cattle, monkeys and other wild animals, the farmers are giving up crop cultivation, and nearly 50% of the arable land in some parts of Himachal Pradesh is lying vacant, which is being increasingly infested by weeds or covered with bushes. Therefore, there is an urgent need to develop cost-effective alternative farming systems to increase farmers' income in Himachal Pradesh.

Because of fragmentation of land holdings, there is a need to focus on cooperative/ contract farming, reduce dependence on agriculture, and place greater emphasis on value chain systems, infrastructure development, and undertake policy reforms. Equally important is the need for a focussed approach by the centre and state governments to achieve the goal of doubling the farmers' income. The presentation made by Dr. Ramesh Chand, Member NITI Aayog, in the State Agricultural Universities (SAUs) Vice Chancellors and ICAR Directors Conference, 14-15 Feb 2017, and by Dr. M.S. Swaminathan before the Hon'ble Prime Minister on doubling the farmers' income led to creation of state strategic planning committees to develop the action plan for doubling the farmers' income by 2022.

Due to lack of irrigation and hilly terrain, most of the farmers are not able to take up protected cultivation and/ or precision farming of high value cash crops on a large scale. Except sheep and goats, which are largely owned by the nomads, animal husbandry and poultry have not been taken up commercially in Himachal Pradesh. Limited transport and marketing facilities, and lack of storage and processing facilities are the other bottlenecks in turning farming into an economically viable enterprise. Cultivation of temperate fruits has made a huge impact in the mid- and high-hill regions of Himachal Pradesh, but the fruit cultivation has not been taken up on a commercial scale in the lower Shivalik Hills, which needs greater attention in the near future. One of the major steps to be undertaken for doubling farmers' income in Himachal Pradesh is to increase the area under irrigation to improve crop productivity. Protected cultivation of off season vegetables, precision farming, hydroponics and high-density plantings of different fruit crops should be undertaken on a large scale to increase farm incomes. Large scale production of flowers in niche areas, agro-forestry, mushroom cultivation, beekeeping, sericulture and medicinal plants can be used for diversifying the sources of farm income.

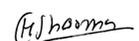
Extension services are equally important in spreading the knowledge to the farmers, and this can be most effectively achieved through the Krishi Vigyan Kendras (KVKs) located in each district. This document provides a blueprint and covers the technologies that could be adopted for increasing farm productivity, adoption of effective marketing reforms, value addition and processing, developing entrepreneurial skills and effective marketing policies. We are sure that this document will serve as a useful source of information for developing an action plan for doubling farmers' income in Himachal Pradesh.

We thank the scientists from YSP-UHF, Nauni; CSK-HPKV, Palampur; CPRI, Shimla; DMR, Solan; and Directorates of Agriculture, Horticulture, Animal Husbandry and Fisheries for their inputs in preparing this document. We also thank the coordinators of Krishi Vigyan Kendras for providing information on major farming practices in different districts of Himachal Pradesh. Our special thanks are to Dr Sudhir Verma, Mr Suchet Attri and the staff of the VCs office for their help in preparing this document.

Place: Nauni, Solan

Date: 05/01/2018

  
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### Details of the Meetings of the SCC

- Formulation of strategy to double farmers' income in Himachal Pradesh, 17 March 2017. Central Potato Research Institute, Shimla, HP.
  - Formulation of strategy to double farmers' income in Himachal Pradesh, 14<sup>th</sup> April 2017. YSP University of Horticulture and Forestry, Nauni, Solan, HP.
  - Formulation of strategy to double farmers' income in Himachal Pradesh, 16 Dec 2017. Central Potato Research Institute, Shimla, HP.
- Participants:** Scientists from YSP-UHF, CSK HPKV, CPRI, DMR, Departments of Agriculture, Horticulture, Animal Husbandry and Fisheries, Environment and Forests, Govt of Himachal Pradesh.

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## Strategies for Doubling Farmers' Income in Himachal Pradesh

### Introduction

To ensure food and nutritional security for the growing population and to increase farmers' income, there is an urgent need to enhance resource use efficiency, reduce input costs and improve crop yields. According to the International Food Policy Research Institute, the world needs to double food production per unit area/day. This calls for an urgent need to identify potential alternative farming strategies to achieve long-term sustainable food production and food security. The Finance Minister in his Budget 2016 Speech mentioned about doubling farm incomes. Later, the Prime Minister of India gave a call to the nation for doubling farm incomes by 2022 by spelling out a six point strategy. To double the income of farmers by 2022, which does not take into account the rate of inflation, would require 15% growth rate, that would only be a marginal increase over the increase achieved from 2003 to 2013. To increase the farmers' income in real terms would entail restructuring the agricultural processes and policy interventions. Re-orienting conventional agriculture to more productive alternative farming systems has now been viewed as the need of the hour, as has been enunciated by Dr. MS Swaminathan, "If agriculture goes wrong nothing else goes right" and "Younger people will only join agriculture if it is technologically driven". This will require new approaches and innovations, as well as increasing collaboration between various stakeholders in the food system.

### General Profile of Himachal Pradesh

Himachal Pradesh is located in the foot hills of the Western Himalayas and lies between 30° 22' 40" to 33° 12' 20" N latitude and 75° 45' 55" to 79° 04' 20" E longitude. It shares boundaries with Jammu & Kashmir in North, Punjab in the West, Haryana in the South and Uttarakhand and Uttar Pradesh in South-East. Its altitude ranges from 350 meters to 6,975 meters amsl, and is endowed with a myriad of climatic niches. The state is having an area of 556.7 m ha, the 3D surface area being 863.8 m ha (Fig. 1). However, due to hilly terrain, the area amenable for cultivation is only 10% of the total geographical area. The population of Himachal Pradesh is approximately 6 million and nearly 62% of the population is engaged in agriculture, which accounts for 15% of the Gross State Domestic Product (GSDP) (Table 1). More than 86% of

the farmers are marginal and small landholders with < 2.0 ha. The state is divided into 12 districts, with four major land agro-climatic regions (Fig. 2, Table 2). Maize and rice are the major cereals grown in the rainy season, while wheat and barley are grown in the winter season. Blackgram, green gram, *Phaseolus* beans (*Rajmah*) and cowpeas are the main pulses in the rainy season, while chickpea and pea are grown in the winter season. The pulse crops are often inter-cropped in maize and wheat, although the traditional inter-cropping system is disappearing fast. In recent times, agriculture in Himachal Pradesh has diversified into temperate and subtropical fruits, off-season protected cultivation of vegetables and flowers, and aromatic and medicinal plants. In addition, turmeric, *Calocasia* (*Arbi*), garlic, and spices are being cultivated as cash crops in some pockets (Table 3). An area of 772 thousand hectares is under food grain production, with a total production of 1,537 thousand MT. Vegetable production has increased from 991 thousand MT in 2006-07 to 1466 MT in 2013-14, while apple production rose from 103 thousand MT in 1970-71 to 866 thousand MT in 2014-15. About 800 hectares area is under floriculture, which is only 0.4% of the total area under floriculture in India. The average monthly income per agricultural household in Himachal Pradesh during 2012-13 was higher (Rs 8,777) than the national average (Rs 6,426) (Table 4). The per capita income of people in Himachal Pradesh has increased from Rs 651 in 1970/71 to Rs 1,30,067 in 2016/17 as compared to the all India average of Rs 823 and 93,231 respectively (Fig. 3).

**Table 1: General Profile of Himachal Pradesh.**

Total Geographical Area	55.67 lakh ha
Total Cropped Area	9.56 lakh ha
Net Area Sown	5.49 lakh ha (10%)
Cultivable Waste Lands	1.22 lakh ha
Operational Holdings	9.14 lakhs
Number of Farmers	8.63 lakhs
Average Holding Size	1.1 ha
Net Irrigated Area	18.76% (1,04,027 ha)
Small & Marginal Farmers	85%
Annual Avg. Rainfall	1,150 mm
Per capita income	Rs.1,35,621 in 2015-16

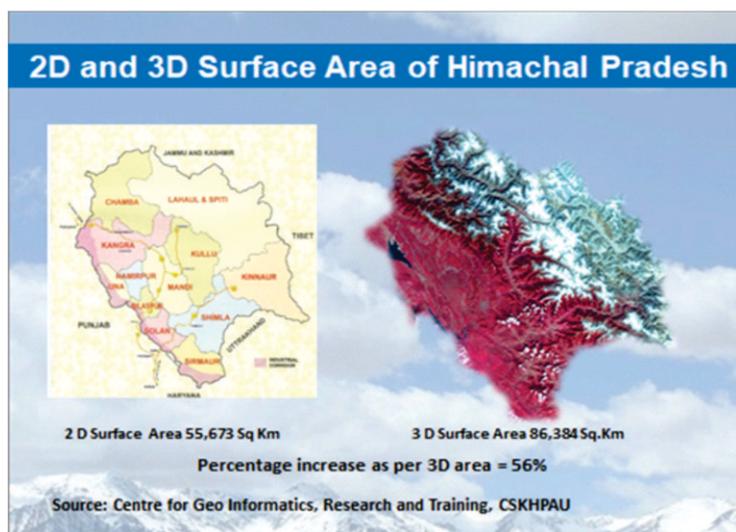


Fig. 1: Surface area (2D and 3D) of Himachal Pradesh



Fig. 2: Agro-climatic zones of Himachal Pradesh

Table 2: Description of Different Agro-climatic Zones of Himachal Pradesh

Particulars	Sub-montane sub tropical low hills zone (Zone-I)	Mid-hills sub humid zone (Zone-II)	High hills temperate wet zone (Zone-III)	High hills temperate dry zone (Zone-IV)
Areas	Una, Bilaspur, Hamirpur, and parts of Sirmaur, Kangra Solan and Chamba	Palampur and Kangra tehsils; Rampur in Shimla, and parts of Mandi, Solan, Kullu, Chamba and Sirmaur	Shimla (except Rampur) parts of Kullu, Solan, Chamba, Mandi, Kangra and Sirmaur	Kinnaur, Lahaul & Spiti and parts of Chamba
Geographical area (000 ha)	913.2 (16.4%)	1,183.2 (21.3%)	1,280.9 (23.0%)	2,190.0(39.0%)
Total cropped area (000 ha)	355.1 (38.0%)	383.4 (41.0%)	171.8 (18.4%)	24.0 (2.6%)
Elevation	Below 650 m amsl	650-1,800 m amsl	1,800-2,200 m amsl	2,200 m amsl
Soil pH	Neutral, coarse texture	Acidic, coarse texture	Acidic, shallow in depth	Neutral, coarse texture
Rainfall	1,000 mm	1,500-3,000 mm	1,000 mm	250 mm
Irrigated area	16.6%	17.5%	7.8%	40.6%

Table 3: Major Crops Grown in Different Agro-Climatic Zones of Himachal Pradesh

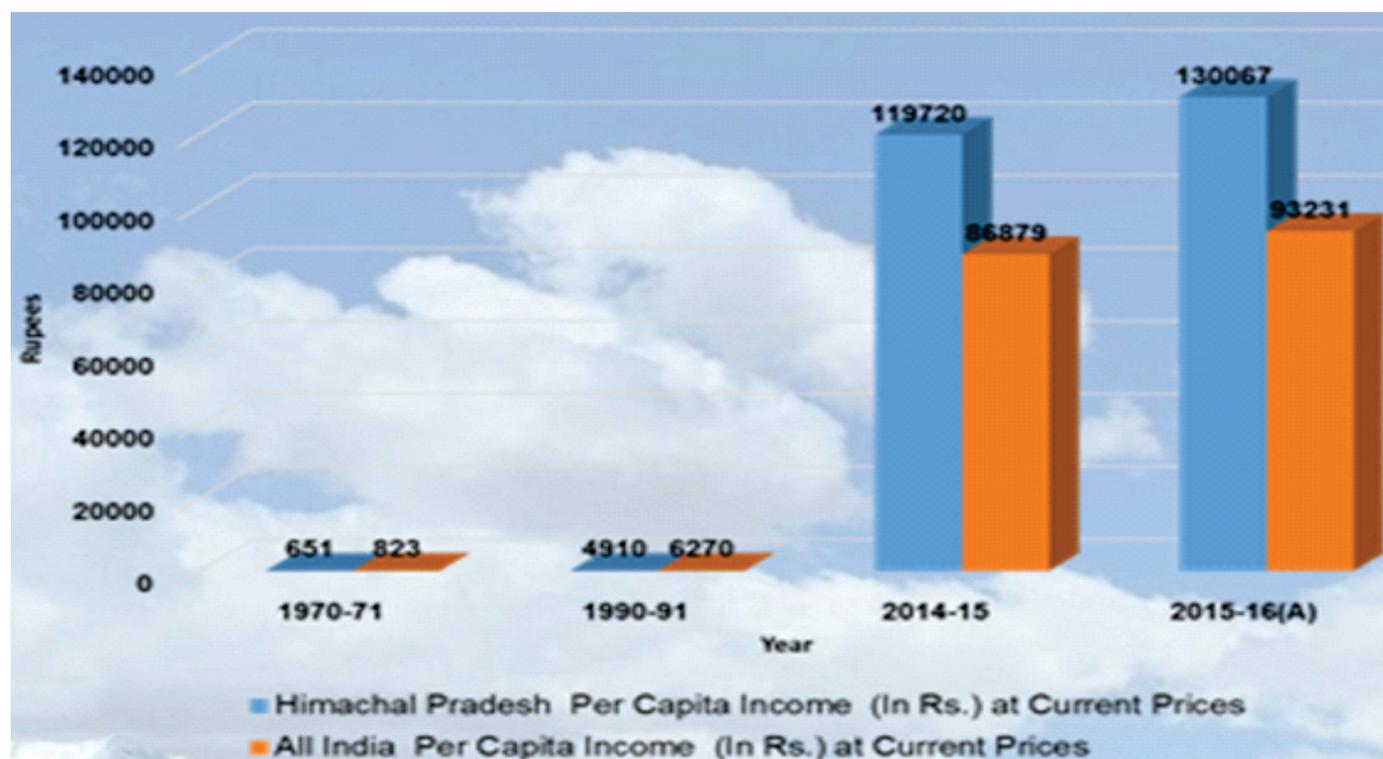
Zones	Crops				
	Field crops	Fruits	Medicinal Plants	Flowers	Spices
I	Wheat, Maize, Paddy, Gram, Sugarcane, Mustard, Potato and Vegetables	Mango, Litchi, Citrus, Aonla, Pomegranate, Low chilling varieties of Peach, Plum, Pear, Apple and Strawberry	Safed Musli, Aloe and Rose	Gladiolus, Lillium, Marigold, Chrysanthemum and Rose	Ginger, Turmeric and Garlic
II	Wheat, Maize, Barley, Black Gram, Beans, Paddy and vegetables	Stone fruits (Peach, Plum, Apricot and Almond), Pear, Pomegranate, Pecan nut, Walnut, Kiwi Fruit and Strawberry	Dil, Thyme, Tulsi, Aloe, Rose and Stevia	Carnation, Gladiolus, Lillium, Marigold, Chrysanthemum and Alstroemeria	Ginger, Garlic and Turmeric



III	Wheat, Barley, Small millets, Pseudo cereals (Buck wheat and Amaranthus), Maize and Potato	Apple, Pear (soft), Cherry, Almond, Walnut, Chestnut, Hazel-nut and Strawberry	Lavender, Rose, <i>Taxus baccata</i> and Kuth	Gladiolus, Lillium, Chrysanthemum and Marigold	Ginger and Garlic
IV	Wheat, Barley, Pseudo cereals (Buck wheat and Amaranthus), Peas and Potato	Apple, Hops, Grape, Prunes Drying type of Apricot, Almond, Chilgoza, Walnut, Pistachio nut and Seabuckthorn	Hops	-	Kuth and Kala Jeera

**Table 4: Average Monthly Income per Agricultural Household During 2012-13 (₹)**

State	Income from wages	Net receipt from cultivation	Net receipt from farming of animals	Net receipt from non-farm business	Total income
Himachal Pradesh	4,030	2,876	1,047	824	8,777
Jammu & Kashmir	7,336	3,063	801	1,483	12,683
Uttarakhand	1,069	2,531	848	253	4,701
All-India	2,071	3,081	763	512	6,426



**Fig. 3: Per-Capita Income of People in Himachal Pradesh**



## Infrastructure and Programmes

Various programmes of the Department of Agriculture are given below:

### Quality Seed Multiplication and Distribution

Department owns 36 Seed Farms where foundation seeds of *Kharif* and *Rabi* crops are produced. Annually, about 3,500 to 4,000 quintals seed of cereals, pulses and vegetables are produced in these farms. At present, 5 grading centres are in operation for various crops. Under this scheme, considerable expenditure is incurred on seed multiplication farms, seed testing and certification, subsidy on cost of seeds and demonstrations.

### Manure and Fertilizers

**Distribution of Fertilizers:** The State Govt. has allowed cost subsidy on complex fertilizers NPK 12:32:16, (NPK 10:26:26 and NPK 15:15:15) @ Rs.1000/-per MT. Apart from this, cost subsidy @25% is also being provided on 100% water soluble complex fertilizers to the farmers (limited to Rs 2500 per farmer). In order to ensure adequate supply of fertilizers, the government has entrusted this responsibility to HIMFED/Cooperative Societies. The farmers are educated about balanced use of fertilizers based on soil testing.

**Soil Testing Centres:** The department is providing free soil testing facilities to the farmers. Department has 11 Soil Testing Laboratories besides four mobile soil testing labs to provide free soil testing facilities to the farmers. About 1,25,000 samples are analysed annually. Besides this, Soil Health Cards are also being provided to the farmers.

### Plant Protection

The Department supplies 150 MT of pesticides through 991 sale centres to the farmers. Pesticide Testing Laboratory at Shimla has been set up with a capacity of 150 to 250 samples per year. One Bio Control Laboratory has been set up at Palampur where conservation, pest augmentation, rearing and multiplication of bio-agents and training to extension staff and farmers are provided on regular basis. Another Bio Control Laboratory has been set up at Mandi. This is a continued scheme and the provision is made for meeting the expenditure on transportation and subsidy provided is on the cost of plant protection material. The plant protection material including equipments are supplied to the SCs / STs / IRDP families at 50% cost.

### Commercial Crops

Under crop diversification, major emphasis is being laid on production of off-season vegetables, quality vegetable seeds, potato and ginger, besides soybean, oilseeds and pulses.

**Development of Seed Potato:** The Department owns 13 Potato Development Stations where foundation seed of potato is produced.

**Development of Vegetable Farms:** Himachal Pradesh has gained reputation for cultivation of off-season vegetables and production of quality vegetable seeds. The ongoing programme on cultivation of off-season vegetables and production of vegetable seeds is proposed to be strengthened and organized on an extensive scale for providing higher income and employment.

**Ginger Development:** For production of disease free ginger, the Department is providing training, demonstrations and quality seed. About 35,000 tonnes of green ginger is produced annually, which is marketed within Himachal and neighbouring states.

### Quality Control

Under this scheme, implementation of various acts on seeds, fertilizers and pesticides is ensured. Quality control functionaries have been notified. The Department has three fertilizer testing labs (Hamirpur, Sundernagar and Shimla), one State Pesticides Testing Lab at Shimla, Biofertilizer and Biopesticide lab at Palampur, and three seed testing labs (Solan, Palampur and Mandi), where 2,000 fertilizer samples, 300 pesticide and 1,200 seed samples are being analysed annually.

### Agricultural Marketing

This is controlled through HP Agricultural and Horticultural Produce Marketing (Development and Regulation) Act, 2005. Under this Act, HP State Agricultural Marketing Board has been set-up. At present, 10 market committees are functioning and 53 markets have been made functional. Market information is being disseminated through AIR, Doordarshan, print media and internet to the farmers. The work on development of marketing infrastructure is carried out under APMCs. Information on daily market rates is also being disseminated through AIR and DD. Market rates of 39 commodities are also disseminated through [agmarknet.nic.in](http://agmarknet.nic.in). The APMC act has been repeated as per the model act, and provision has been made for private markets, single point market fee, contract farming, etc.



### **H.P. Crop Diversification Project (JICA ODA Loan Project)**

Himachal Pradesh Crop Diversification Project is being supported by JICA through ODA loan. The objectives of the project are:

- Increase the area and production of vegetables through crop diversification.
- To raise income of small and marginal farmers.
- To create infrastructures for irrigation, farm access roads, marketing, post harvest, etc.
- To promote organic farming in a big way.
- To organize farmers into groups to takeover operation and maintenance of irrigation systems.
- Training and capacity building of Department of Agriculture field extension staff.
- The project is being implemented through Himachal Pradesh Agriculture Development Society. It has Governing Council, Executive and Finance Committee. For overall management of the project, State Project Management Unit (PMU) has been set up at Hamirpur, and three District PMU's at Palampur, Mandi and Hamirpur.
- Block PMU's at Dehra, Nurpur, Baijnath, Hamirpur, Una, Bilaspur, Mandi and Sarkaghat have also been set up for crop diversification.

### **Project under Rural Infrastructure Development Fund (R.I.D.F)**

#### **Special Project on Diversification of Agriculture through Micro-Irrigation and Other Related Infrastructure in HP**

The project on diversification of agriculture through micro-irrigation and other related infrastructure in HP aims at increasing the area under efficient methods of irrigation viz., drip and sprinkler irrigation. NABARD has sanctioned this project under RIDF- XIV, amounting to Rs.198.09 crores starting from 2009-10. The project components include sprinkler system, drip system, farm tanks, shallow wells, shallow tube wells, deep tube wells, small and medium lifts and pumping machinery. For sprinkler and drip systems, the farmers shall be provided 80% subsidy, and 20% would be beneficiary's contribution. Besides this, the farmers shall also be provided 50% assistance for creation of farm tanks, shallow wells, shallow tube wells, deep tube wells, small and medium lifts and pumping machinery.

#### **Dr YS Parmar Kisan Swarozgar Yojna**

Project components of 'Dr YS Parmar Kisan Swarozgar Yojna' (Poly House and Micro Irrigation) include

creation of need based infrastructure such as location specific models of polyhouses with micro-irrigation facility, and are expected to fulfil the objectives of high productivity, quality, safeguard against adverse weather, efficient input use, etc. For this, 85% project assistance shall be provided to the farmers. For creation of water sources individually and collectively by a group of farmers (low/medium lift, pumping machinery), 50% subsidy shall be provided. The project envisages construction of 4,700 polyhouses and 2,150 micro-irrigation systems of different designs suitable to different agro-ecological situations in the state. Beside this, 60 small lift, 60 medium lift and 750 pumping units shall also be established under this project.

#### **Rajiv Gandhi Micro-irrigation Scheme**

State Government is committed to promote Agriculture in the state by increasing the productivity of crops. For efficient system of irrigation, the government has launched crucial project named 'Rajiv Gandhi Micro-Irrigation Scheme' with an outlay of Rs 154 crores over a period of 4 years. Through this project, 8,500 hectare area will be brought under drip/ sprinkler irrigation system benefitting 14,000 farmers. Farmers will get a subsidy of Rs 113 crores during the project period. The project is under appraisal with NABARD under RIDF funding.

- 80% assistance shall be provided to individual farmers for micro- irrigation systems.
- 50% assistance for construction of shallow wells and shallow bore wells.

#### **Mukhya Mantri Kisaan Evam Khetihar Mazdoor Jeevan Suraksha Yojna**

This scheme provides compensation to the farmers and agricultural labourers in the event of sustaining injury or death during the operation of farm machinery. Farm machinery for this purpose includes tractors registered for agricultural purpose, power tillers, weeders, power plough, reaper cum binder, power thrasher, chaffcutters, implements, tools, equipment installation and operation of tube well/bore well/pumping sets and low lifts. The scheme is limited to the domicile farmers and farm labourers, but not to a worker/employee of any company/contractor.

#### **Establishment of Centers of Excellence for Vegetable Nursery Production**

The State Government has started new scheme named 'Establishment of Centres of Excellence for Vegetable



Nursery Production' by farmers to raise the vegetables seedlings, flowers and the other valuable plants under controlled environment to provide better planting material to the farmers, and to provide gainful employment to the farming youth.

### **Uttam Chारा Utpadan Yojna**

With a view to increase fodder production in the State, The State Government has launched a new scheme; 'Uttam Chारा Utpadan Yojana' for fodder development by bringing an area of 25,000 hectares under fodder production. Quality seed of fodder grasses, cuttings and seedlings of improved fodder varieties will be supplied on subsidised rates to the farmers. Chaff cutters are important input for farmers and subsidy on chaff cutters is available to the SC/ST and BPL farmers.

### **Lift Irrigation and Borewell Scheme**

In most parts of the state, water has to be lifted for irrigation. As an incentive to the farmers, government has decided to grant 50% subsidy for construction of lift irrigation schemes and installation of bore-wells by individual or group of farmers for irrigation.

### **Organic Farming**

The state has diverse agro-climate conditions and due to its favourable positioning in the Himalayan region. Himachal Pradesh has a great scope for promotion of organic farming. The use of chemical fertilizers and pesticides in the state is very low and 80% of the area is rainfed.

### **Soil and Water Conservation**

Due to topographical factors, the soil is subject to splash, sheet and gully erosion resulting into soil degradation. The Department of Agriculture (HP) is executing two soil and water conservation schemes under the state scheme :

- Soil conservation works.
- Water conservation and development.

### **Agriculture Research and Education**

Under this, grant in aid is given to agriculture university for teaching, research and extension. Emphasis is being laid on location specific research for adoption of the same by the farming community of the state.

### **Extension and Farmers Training**

Main function of the Agriculture Department is to

disseminate the technology to the farmers. The department runs two training centres, one at Mashobra and the other at Sundernagar. Besides this, farmers training camps are organised at village, block and district level.

### **Agricultural Economics and Statistics**

Under this programme, three centrally sponsored schemes are operated as indicated below:

- Timely Reporting Scheme (TRS) for estimation of area and production of crops.
- Improvement of Crop Statistics (ICS) for bringing quality in the land record data at grass root level.
- Estimation of Production of Commercial crops like Potato and Ginger.

### **Agricultural Engineering**

Under this scheme, new farm implements/ machines are popularized among the farmers. Testing and demonstration of new machines is also done under this programme.

### **Centrally Sponsored Schemes**

- National Mission on Agricultural Extension and Technology (NMAET): (90:10).
- Mass Media Support to Agriculture Extension (100% CSS).
- Kisan Call Centre.
- National Crop Insurance Schemes.
  - Rashtriya Krishi Bima Yojna (RKBY).
  - Pilot Weather Based Crop Insurance Scheme (WBCIS).
- Biogas Development Programmes (100%).
- Rashtriya Krishi Vikas Yojna (RKVY) (90:10).
- National Food Security Mission (NFSM).
- Paramparagat Krishi Vikas Yojna (Organic Farming).
- National Mission On Sustainable Agriculture (NMSA 90:10).
- Pardhanmantri Krishi Sinchai Yojana.
- AGRISNET Project.
- National e-Governance Plan -Agriculture [NeGP-A].

### **Department of Horticulture**

The State Department of Horticulture has mandate for carrying out activities relating to production and post-harvest management of fruit crops, commercial floriculture, apiculture, mushrooms, hops, herbs and medicinal and aromatic plants. The vegetable cultivation,



though an integral part of horticulture, is however, presently being managed under control of the State Agriculture Department. The schemes/ services of the department are as follows:

**Horticulture Development Scheme:** For supply of fruit plants and elite plant material from registered government and private nurseries, supply of horticulture inputs and establishment of new orchards (individually or as garden colony).

**Plant Protection Services:** For supply of pesticides, bio-agents and plant protection equipments.

**Horticulture Farm & Nurseries Services:** To serve as model demonstration centres for modern horticulture technology and production of elite plant material at government registered nurseries.

**Horticulture Training & Extension Service Services:** For training of farmers through short term training camps and training courses, exposure visits of farmers within and outside the state, and organisation of seminars and workshops.

**Development of Beekeeping Services:** For supply of improved strains of bee colonies with hives and bee colonies for pollination on rental basis.

**Development of Floriculture Services:** For supply of

elite planting material of flowers.

**Development of Mushroom Services:** For practical training in mushroom cultivation, registration of trained farmers as mushroom growers, production and supply of pasteurized mushroom compost from departmental units, availability of quality mushroom spawn and transportation of mushroom compost.

**Fruit Processing Programme Services:** For community canning service and processing of fruits and vegetables .

**Marketing & Quality Programme Services:** For survey of markets under market intelligence scheme, training in post-harvest management/ picking, grading and packing of fruits, and procurement of fair average quality fruit (Apple, Citrus and Mango) under market intervention scheme.

### Infrastructure

Availability of good physical infrastructure is of utmost importance for the growth in agriculture. Easy access to agricultural inputs such as fertilizers, seeds, and nurseries for fruits and vegetables is essential for meeting the farmers requirements. The details of fertilizer sale points, nurseries and other horticultural and animal husbandry infrastructure facilities are given in Tables 5 to 11.

**Table 5: District Wise Number of Fertilizer Wholesale Points and Retail Sale Points in Himachal Pradesh**

District	Whole sale HIM-FED	Retail sale								
		Co-op	HIM-FED	HPMC	HPAgro Ind.	IFFCO	Civil supply	Private	Total	Grand total
Bilaspur	6	107	7	-	-	-	3	13	130	136
Chamba	5	121	-	1	-	-	3	84	207	212
Hamirpur	9	197	7	-	-	-	-	11	215	224
Kangra	9	503	2	-	-	2	8	125	640	649
Kinnaur	2	23	-	1	-	-	6	4	34	36
Kullu	6	134	1	2	-	-	-	96	233	239
Lahaul Spiti	3	43	-	-	-	-	-	2	45	48
Mandi	11	360	9	-	-	1	-	132	502	513
Shimla	27	219	5	5	2	1	-	78	310	337
Solan	6	93	5	-	-	-	12	25	135	141
Sirmaur	10	92	3	-	-	1	-	28	124	134
Una	6	220	2	-	-	2	2	43	269	275
Total	100	2112	41	9	2	7	32	641	2814	2944

Source: www.himfed.com



### Progeny-cum-demonstration Orchards/Nurseries

Progeny-cum-Demonstration Orchards/Nurseries have been established for different fruits to serve as growth centers for the development of horticulture in their impact zone of normally ten kms radius. The objectives of these units are:

- Stocking of fruit trees of outstanding quality.
- Multiplication of pedigree and true to type planting

material.

- To act as model and demonstration orchards.
- Conducting field adaptability trials for new fruit varieties and testing of other horticultural technologies.
- To act as extension and training units for local farmers.

**Table 6: District wise Details of PCDOs**

District	No. of Units	Area (ha)	Fruit plants
Shimla	13	87.18	Apple, stone fruits, pear, cherry, pomegranate
Kinnaur	8	39.71	Apple, stone fruits, almond, apricot, grapes
Solan	8	41.58	Stone fruits, kiwi fruit, hazelnut, persimmon, pear, mango, citrus
Bilaspur	6	16.55	Mango, litchi, citrus, guava, peach, pear
Mandi	11	48.98	Apple, stone fruits, mango, citrus fruits, Kiwi fruit, walnut, strawberry
Sirmaur	16	116.40	Apple, stone fruits, Kiwi fruit, mango, citrus fruits
Kangra	8	35.76	Mango, litchi, citrus fruits, low chilling varieties of stone fruits, guava, pecan nut, aonla, grapes
Una	1	33.88	Mango, pear, citrus, papaya, pomegranate
Hamirpur	4	10.75	Mango, citrus, pear
Chamba	12	55.43	Apple, stone fruits, mango, citrus, walnut, pear, guava
Kullu	5	36.39	Apple, stone fruits, cherry, pomegranate, persimmon, Kiwi fruit, strawberry, clonal rootstocks of apple, cherry, pear, stone fruits
Lahaul & Spiti	2	7.02	Apple, apricot, almond, hops
<b>Total</b>	<b>94</b>	<b>529.63</b>	

Source: www.hphorticulture.nic.in

### Private Registered Nurseries

The propagation of plant material for fruits is regulated under the Himachal Pradesh Fruit Nurseries Registration Act 1973. So far, 614 nurseries have been registered under this Act, out of which 540 nurseries are in the

private sector and the balance 74 in the public sector. About two million fruit plants are propagated in these nurseries per annum.

**Table 7: District Wise Details of Private Registered Nurseries**

District	No. of nurseries	Area (ha)	Fruit plants
Shimla	165	33.00	Apple, pear, cherry, apricot, peach, almond, Kiwi fruit, strawberry, walnut, pomegranate
Kinnaur	35	9.25	Apple, pear, apricot, almond, grapes, Kiwi fruit
Solan	11	4.00	Stone fruits, apple, Kiwi fruit, mango, citrus, guava, pear
Bilaspur	24	9.50	Mango, litchi, guava, aonla, pear, papaya, grapes



Mandi	115	28.00	Apple, stone fruits, mango, guava, litchi, walnut, pomegranate, strawberry, olive, pecanut
Sirmaur	39	20.50	Stone fruits, apple, mango, citrus, Kiwi fruit
Kangra	26	30.60	Mango, citrus, litchi, pecan nut, grapes, stone fruits, aonla, guava, loquat
Una	5	6.25	Mango, pear, papaya, pomegranate, banana, peach, strawberry.
Hamirpur	15	7.50	Mango, pear, citrus
Chamba	68	22.30	Apple, stone fruits, mango, walnut, pear, guava, Kiwi fruit
Kullu	126	32.50	Apple, pear, stone fruits, pomegranate, persimmon, olive, cherry, Kiwi fruit
Lahaul & Spiti	3	0.30	Apple, apricot, almond, hops
<b>Total</b>	<b>632</b>	<b>203.70</b>	

### Plant Tissue Culture Laboratories

For rapid propagation of horticulture and floriculture planting material, the State Department of Horticulture has promoted two plant tissue culture laboratories, one each in the public and private sectors.

**Table 8: Details of Plant Tissue Culture Laboratories**

Name and address of the laboratory	Plant propagation capacity
Agrigene International, Highway Home, Sanjauli, Shimla	2,00,000 plants
Department of Biotechnology, Dr. Y S Parmar University of Horticulture and Forestry, Nauni	50,000 virus free plants per year
Rajat Biotech Ltd, Padyalag, Bilaspur	5,00,000 plants per annum

Source: www.hphorticulture.nic.in

### Olive Stations

For promoting the development of olives in the State, three Olive Stations have been established with the objective of collection of varieties and development of suitable package of practices for its cultivation.

**Table 9: Detail of Olive Stations in Himachal Pradesh**

Station	Area (ha)	No's of olive plants
Panarsa, Mandi.	4.80	1000
Lanji, Chamba,	8.09	1900
Jerva, Sirmaur	6.36	399

Source: www.hphorticulture.nic.in

### Walnut Development Station

A walnut development station has been established at Nohra in district Sirmaur for collection of walnut varieties and to develop and adapt technology for walnut cultivation.

**Table 10: Veterinary Institutions Under Animal Husbandry Department**

Category of Veterinary Institution	Number
State Veterinary Hospital	1
Zonal Veterinary Hospital	1
Veterinary Polyclinic	9
Sub-Division Veterinary Hospital	59
Veterinary Hospital	338
Central Veterinary Dispensary	30
Veterinary Dispensary	1,772
Veterinary Check Post	6
Pool Store	11
Semen Bank	7
Sperm Station	2
Wool Analysis Laboratory	3
Epid. Laboratory	1
Disease Investigation Laboratory	2
Cattle Farm	3
Sheep Farm	5
Sheep and Wool Extn. Centre	9
Rabbit Farm	2
Horse Breeding Farm	1
Poultry Farm	2
Poultry Extn. Centre	11
Quality Control Laboratory	1
Training Centre	2
Gosadan	1
Total	2,279
Mukhya Mantri Pashu Arogya Pashudhan Yojna	1,251
<b>Grand total</b>	<b>3,530</b>

**Plant Protection Centres**

A total of 337 plant protection centres have been established in different fruit growing regions of the State with the objectives of:

- Supply/sale centres for plant protection chemicals and equipments.
- Extension units for the dissemination of technical information to the local farmers.

**Table 11: The District Wise Details Plant Protection Centres**

Districts	No's of units
Shimla	78
Kinnaur	20
Solan	23
Bilaspur	16
Mandi	47
Sirmaur	13
Kangra	16
Una	13
Hamirpur	16
Chamba	47
Kullu	42
Lahaul and Spiti	6
<b>Total</b>	<b>337</b>

Source: [www.hphorticulture.nic.in](http://www.hphorticulture.nic.in).



## Major Constraints and Productivity Gaps

Several abiotic (drought, frost, hailstorms, floods, and insufficient chilling) and biotic (insect pests, diseases, nematodes, monkeys, stray/wild animals, and birds) are the major constraints to increase farm productivity. Because of the monkey menace and crop damage by the wild/ stray animals, many farmers have given up crop cultivation in many parts of Himachal Pradesh. However, availability of food grains in the public distribution system, and the tendency among the youth to look for white collar jobs are also one of the reasons for lack of interest in farming.

The major limitations to increase crop productivity, profitability and diversification are:

- Less than 20% of the total cultivable area is irrigated, while the rest of the area is rainfed along the steep slopes of the mountains.
- Because of lack of irrigation, most of the farmers are not able to take up intensive protected cultivation of high value cash crops (vegetables, fruits and flowers).
- Except sheep and goats, which are largely owned by

the nomads, animal husbandry, poultry and fisheries have not been taken up commercially.

- Lack of transport and marketing facilities, and lack of storage, processing and value addition are the major bottlenecks in turning farming into an economically viable enterprise.
- Cultivation of temperate fruits has made a huge impact in the mid and high-hill regions of Himachal Pradesh. However, fruit cultivation has not been taken up on a commercial scale in the lower Shivalik Hills, which accounts for nearly 60% of the total area and population.

There is a huge gap between the potential and attainable yields of vegetables and fruits (Tables 12 and 13). In case of tomato the farmers' yield is about 50% of the attainable yields, while in capsicum, the farmers' yields are just one-fourth of the attainable yield. There is a huge scope for increasing crop yields and farm incomes. Besides this, harvest and post-harvest losses result in monetary losses of thousand of crores (Tables 14 and 15).

**Table 12: Yield Gap Analysis in Vegetable Crops**

Crop	Yield (q/ha)		Yield Gap (q/ha)		
	Potential (A)	Attainable (B)	Farmers (C)	A-B	B-C
Tomato	600	400	220	200	180
Capsicum	250	200	57	50	143
Peas	200	160	94	40	66
Cauliflower	250	200	191	50	9
Cabbage	435	250	227	185	23

**Table 13: Yield Gap Analysis in Major Fruit Crops**

Crop	Yield (t/ha)			Yield Gap (t/ha)	
	Potential (A)	Attainable (B)	Farmers (C)	A-B	B-C
Apple	40	25	4.18	15	20.82
Pear	22	18	2.45	4	15.55
Plum	12	10	1.65	2	8.35
Apricot	8	6	3.15	2	2.85
Pomegranate	30	18	1.02	12	16.98
Mango	12	7	1.15	5	5.85



Fig. 4: Plant diseases constraining crop production on farmers' fields



Fig. 5: Insect pests constraining crop production on farmers' fields

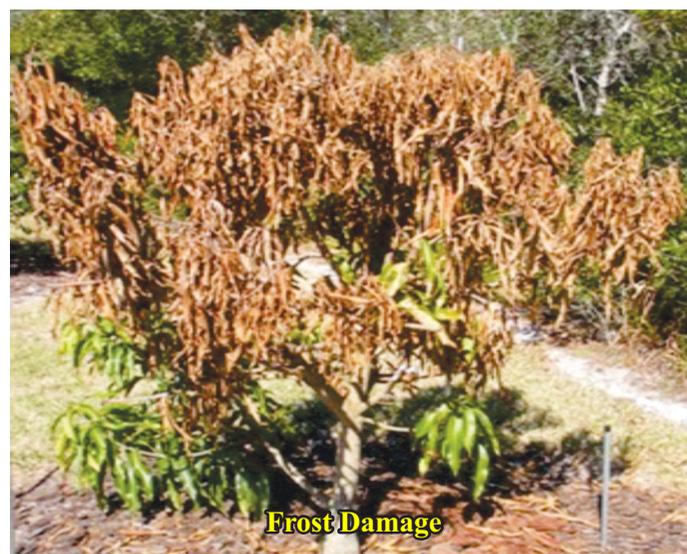


Fig. 6. Abiotic stresses constraining crop production on farmers' fields

**Table 14: Estimate of Monetary Value of Harvest and Post-Harvest Losses in India (2012-13, at 2014 Prices)**

Crops	Production (mt)	Price (₹/t)	Loss (%)	Losses (₹ crores)
Apple	1.90	68,078	10.39	13,341
Citrus	11.47	14,011	9.69	1,557
Grapes	2.52	44,564	8.63	969
Cauliflower	7.79	16,321	9.56	1,214
Mushrooms	0.04	1,19,049	9.51	46
Tomato	17.85	16,510	12.44	3,666

**Table 15: Extent of Post-Harvest Losses Across Commodity Groups**

Crop/commodity	Monetary losses (production of 2012-13 and prices at 2014, ₹ crore)	
Cereals	20,698	Paddy (50), Wheat (38), Others (12)
Pulses	3,877	Chickpea (63), Pigeonpea (25), Others (12)
Oilseeds	8,278	Soybean (65), Mustard (18), Others (16)
Fruits	16,644	Mango (43), Banana (23), Citrus (9), Apple (8), Others (16)
Vegetables	14,842	Potato (34), Tomato (25), Onion (16), Cauliflower (8), Others (18)
Plantation crops	9,325	Sugarcane (60), Coconut (22), Others (18)
Livestock Produce	18,987	Milk (23), Marine fish (23), Poultry meat (21), Inland fish (20), Others (13)

Source: Jha et al. (2015)

### Farmers' Share in Consumer Prices

The farmers' share in consumer prices remains very low, especially in case of horticultural commodities (Singh et al. 2016). Farmers' share in consumer price varied from 25.5% in apple, 39.9% in banana, 41.1% in onion, 41.7% in tomato, 43.2% in mango and 58.6% in potato in 2004 (Table 16). Producers stand to gain with improved marketing, and increased demand for their products.

**Table 16: Marketing Margins and Farmers' Share for Major Fruits and Vegetables (in percentage)**

Commodity	Ahmedabad			Chennai		
	Marketing cost	Marketing margin	Farmer's share vegetables	Marketing cost	Marketing margin	Farmer's share
Tomato	8.0	50.3	41.7	17.3	34.5	48.2
Cabbage	11.1	43.2	45.8	42.9	16.7	40.4
Cauliflower	5.5	37.0	68.5	49.3	9.0	41.8
Brinjal	9.1	48.1	42.9	29.7	22.1	48.3
<b>Fruits</b>						
Mango	17.9	38.9	43.2	18.7	13.7	67.6
Apple	5.0	69.4	25.5	37.5	21.8	40.8
Pomegranate	11.7	48.5	39.8	23.2	33.8	43.0

Source: Gandhi and Namboodiri (2004)



## Potential for Development and Role of Technology in Doubling Farmers' Income

The farmers of Himachal Pradesh have been practicing mixed farming systems, and hence, information on contribution of each component of farming including cereals, grain legumes, vegetables, fruit crops, agro-forestry, medicinal plants, fisheries, bee keeping, dairy, poultry, mushroom cultivation, and collection and sale of forest produce, along with non-farm sources of income form part of total farm income. However, there is no comprehensive source of data on the contribution of each of these components to farmers income in Himachal Pradesh.

Farmers of Himachal Pradesh have been diversifying agriculture, and the sources of income to farmers are either through agriculture (farm income 20% in rain fed and 40% in irrigated systems) or non-farm income, which ranges from 60 to 80%. However, there is no comprehensive source of data on the contribution of each of these components to farmers income in Himachal Pradesh.

The goal of doubling the income of the farmers by 2022 cannot be achieved by increasing crop production only, but has to be accompanied by improvement in infrastructure, policy support, marketing and value addition. Efficient and organized supply chain holds the key for providing incentives to farmers to intensify, expand and diversify agricultural production.

Himachal Pradesh is well endowed with congenial conditions for taking up cultivation of fruits, vegetables, flowers, mushrooms and agro-forestry on a commercial scale. In one of the studies conducted under the flagship scheme, *Rashtriya Krishi Vikas Yojna* (RKVY), it has been estimated that the farmers earned fairly high net returns through cultivation of vegetable crops, varying from Rs 2.73 lakhs in capsicum to Rs 43,861 per hectare in tomato. The net returns from green pea cultivation in dry temperate zone of Kinnaur and Lahaul and Spiti districts were Rs 2.49 lakhs and Rs 1.05 lakhs per hectare, respectively.

The farmers' cooperatives can play a catalytic role in boosting the agricultural growth in Himachal Pradesh. The **Mahakali Flowers and Vegetable Growers' Cooperative Marketing Society, Ltd (MFVGS)** was established at Jubbarhatti in district Shimla, in March, 2009. The society has a modern nursery growing polyhouse (5 lakh seedlings), cold storage for vegetables, and a godown for supply of critical inputs to the member

farmers (fertilizers, chemicals, seeds, staking material, packing material, and other usable items for the polyhouse growers).

This system reduced the cost of marketing to one tenth due to large-scale handling and marketing, and the farmers' incomes in the area have increased by 40 to 50%. There are several such success stories that need to be documented and replicated in other areas to double farmers' income in Himachal Pradesh. To increase crop productivity and enhance farm incomes, it is important to increase the productivity of the existing cultivated area, increase cropping intensity, and adopt precision farming, polyhouse culture, diversification of farming systems, storage, processing and value addition.

There is a need for a mission mode approach to double the farm income by focusing on critical inputs for doubling the farmers' income. To achieve this objective, it is imperative that we overcome the major constraints to increasing crop production such as shortage of irrigation facilities and farm roads, improve input use efficiency, adopt integrated crop – livestock farming and develop facilities for marketing the farm produce. To realize a major boost in farmers' income, it is equally important that we invest in developing newer technologies and innovations, as well as increase the collaboration between different departments of the central and state governments, and promote public - private partnerships in agri-food system. The following interventions can be made to double the farmer's income in Himachal Pradesh over the next 5 years.

- Strengthening of water storage structures, and efficient management of rain water harvesting.
- Promoting timely and judicious use of fertilizers based on soil and water testing reports.
- Adoption of cluster approach for holistic development of vegetables, fruits, flowers, and spices.
- Timely availability of quality seeds/ seedlings of vegetables and fruits.
- Promotion of high density plantations in fruits.
- Efficient and timely use of integrated pest management practices.
- Enacting legislative measures for protection of crops from wild animals.

## Technological Interventions

### Water Storage, Conservation and Use

Of the total 5.40 lakh hectares of farmland in the state, only 18-20% is irrigated, which is far below the national average of 49% in India. Since there is plenty of water in Himachal Pradesh, there is an urgent need to improve infrastructure to cover > 50% of the cultivable area under irrigation for increasing the production and productivity of different crops. This can be achieved by tapping the water from rivers and rivulets through water channels and

pipes along the hill slopes; construction of small and medium sized dams and barrages across rivers and rivulets, and check dams and tanks (polythene lined or concrete tanks to store 10,000 to 500,00 liters of water), and use the stored water by lift irrigation and/or gravity flow (Figs. 7 and 8).

Supplement availability of water can be increased through storage of spring water in large tanks, rainwater harvesting, and recharge of the groundwater through check dams and percolation tanks.

#### Water Storage in Barrages and Check-dams Across Rivers and Rivulets, and Storage Ponds and Tanks: Needed Urgently

- Need to increase area under irrigation from 20 - 50% over the next 5 years.
- Develop systems to store rain and snow water in barrages across rivers and rivulets, check dams, and tanks.
- Increased irrigation will be the key to attract youth to farming.
- Implement Participatory Water Conservation Projects, with 80% of the cost to be borne by the state/central Govts.
- Farmers and farmer associations should use irrigation water by lift irrigation or gravity flow, and be responsible for maintenance and distribution of water in the community.
- Urgent Need for a **Movement for Water Conservation.**

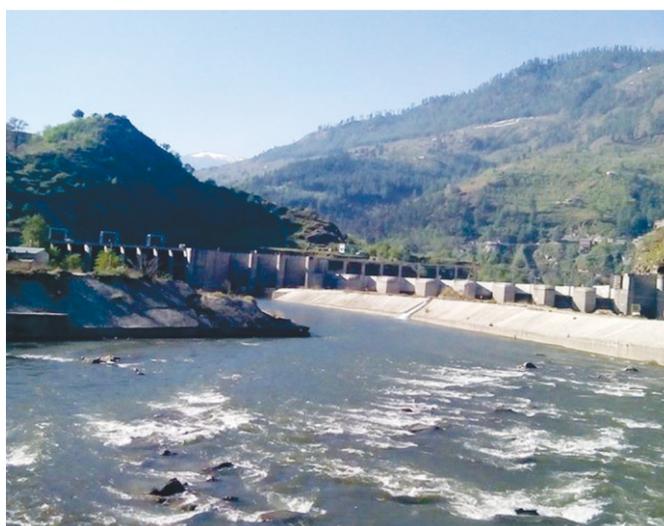


Fig. 7: Water storage in barrages and check dams



'Kaccha' water pond



Polylined water pond

Fig. 8: Use of water harvesting (left) and water storage (right) structures for conservation and utilization of available water for increasing crop productivity

### Waste Land Development to Promote Water Conservation

- Afforestation with perennial grasses/trees in steep slope of more than 40% slope.
- Promotion of mulberry, wild fruit plants and fodder trees.
- Development of soil bunds to save excessive loss of water and nutrients.

- Construction of trenches, check dams and artificial structures to maximize water percolation in marginal and denudated areas.

Water use efficiency needs to be improved through drip and sprinkler irrigation, and moisture conservation through crop residue/polythene mulching, and follow inter cropping for sustainable crop production (Fig 9). Increase in yield and water savings due to drip irrigation and fertigation have been shown in Fig. 10 and Table 17.



Fig. 9: Use of drip irrigation/polythene mulching to improve water use efficiency and increase crop productivity

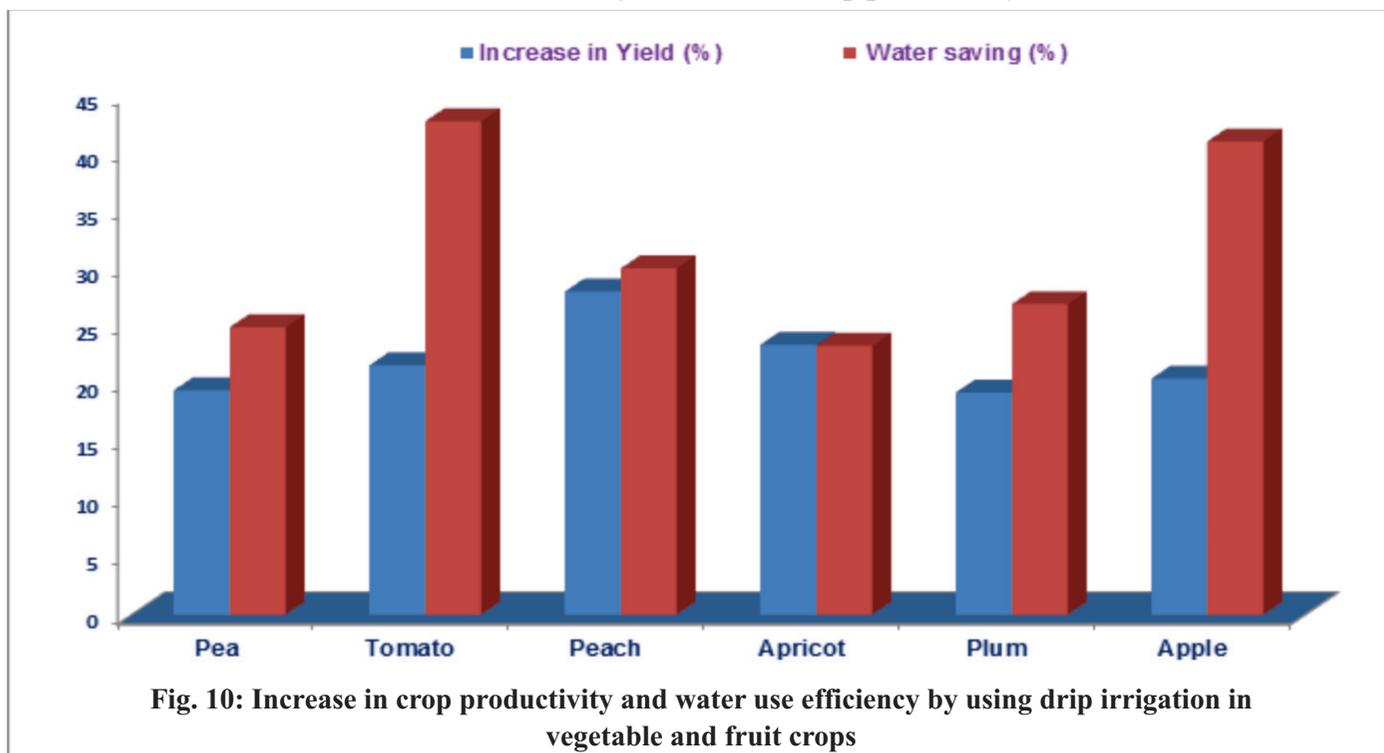


Fig. 10: Increase in crop productivity and water use efficiency by using drip irrigation in vegetable and fruit crops

**Table 17: Increase in Yield and Water Saving Due to Drip Irrigation in Vegetables**

Crop	Yield under drip fertigation (t/ha)	Yield under conventional method (t/ha)	Yield increase (t/ha)	Water saving (%)
Potato	44	29	15	30
Chilli	30	20	10	47
Pea	20	11	9	50
Brinjal	75	44	31	44
Cabbage	32	20	12	40

Source: PAU (2017)

### Diversification

Diversification of agriculture through high value cash crops such as fruits (apple, plum, peach, pear, apricot, pecan nut, Kiwi fruit, pomegranate, mango, litchi, orange, cherry), vegetables (tomato, peas, capsicum, beans, cole crops, cucurbits), flowers (rose, carnation,

chrysanthemum, Gerbera, marigold, gladiolus), agroforestry (*Grevia*, mulberry, poplar, willow), timberwood, mushrooms, beekeeping and medicinal plants (*Valeria najatamansi*, *Viola odorata*, *Picorrhiza kurroa*, Amla, and grafted Harar) (Fig. 11).



**Fig. 11: High value crops for system diversification to increase farm incomes**

### Protected Cultivation

Protected cultivation of vegetables and flowers, hydroponics, and multi-story cropping systems can increase farmers' incomes (Fig. 12, 13 and 14, Tables 18,

19 and 20). Protected cultivation under protective structures shields the crops from insect pests and weather extremes for assured, climate-resilient and increased production of quality produce.



Fig. 12: Protected cultivation of vegetables

**Table 18: Returns from Protected Cultivation of Tomato, Capsicum and Cucumber at Solan, Himachal Pradesh**

Particulars	Protected conditions			Open conditions		
	Tomato	Capsicum	Cucumber	Tomato	Capsicum	Cucumber
Productivity (t/ha)	110.0	75.0	110.0	50.0	30.0	50.0
Input cost (lakhs)	6.3	4.8	3.1	4.0	2.1	3.0
Rate (₹/kg)	20.0	30.0	15.0	20.0	20.0	15.0
Return (lakhs)	22.0	22.5	16.5	10.0	6.0	7.5
Net Profit (lakhs)	15.70	17.65	13.45	6.00	3.95	4.50

**Table 19: Increase in Income Through Protective Cultivation of Vegetables By Using Low Tunnel Technology**

Crop	Yield (q/ha)	Gross income (₹/ha)	Expenditure (₹/ha)	Net income (₹/ha)
<b>With low tunnel technology</b>				
Chilli	312.5	6,25,000	3,46,250	2,78,750
Capsicum	304	7,81,250	3,27,500	4,53,750
<b>Without low tunnel technology</b>				
Chilli	200	4,00,000	3,05,000	95,000
Capsicum	187.5	4,67,500	2,97,500	1,70,000

Source: PAU (2017)

**Table 20: Increasing Farmers' Income through Protected Cultivation of Flowers**

Intervention	Technology	Production cost (₹/500 m <sup>2</sup> )	Gross income (₹)	B: C Ratio
Chrysanthemum Carnation	Year round cultivation	2,51,44149,747.32	9,48,5592,06,801	1: 3.771: 4.16



**Fig. 13: Protected cultivation of lillium and carnation under mid-hill conditions in Himachal Pradesh**



**Fig. 14: Vegetable production under hydroponic system (left), and potato seed production under aeroponic system (right) to increase farmers income**

### Timely Availability of Quality Seed

Improved and timely availability of quality seed of cereals, legumes, vegetables, flowers, and saplings of fruit plants (for example, hybrid seeds of okra, tomato, radish, carrot, cauliflower, bell pepper chilies, cabbage

and beetroot), and appropriate varieties suited for protective cultivation to the farmers are important for increasing productivity and net returns.



**Seed production of onion cv nasik red**



**Seed processing and packaging**

**Fig. 15: Production of quality seed to increase farmers income and crop productivity**



**Fastrack plums. Trees are approximately 1 year old and flower and fruit continuously in the green house**



**'Stoneless' plum (left) normal stone cultivar 'cacanska leptica' (right)**

**Fig. 16: Adoption of biotech derived products for value addition to develop new production systems**

### **Varietal Shift and Use of Improved Management Practices**

- **Potato-** Varietal shift to Kufri Himalini and cultural management practices (potato - French bean system), and effective white grub management can increase the yields by 17%.
- **Maize-** high yielding hybrids and mixed cropping with pulses.
- **Wheat-** Mixed cropping with mustard, chickpea or peas.
- **Mango-** Regular bearing and frost tolerant varieties in lower Shivalik Hills, and cultural management practices to regulate plant growth and fruit bearing for high productivity.
- **Citrus-** Varietal shift and management practices, use of selective insecticides, and use of grass/ polythene

mulching for moisture conservation.

- **Litchi-** Ensured irrigation to avoid fruit cracking.
- **Cherry-** Management practices + use of drip irrigation.
- **Peach, Plum, Apricot and Kiwi-** Varietal shift and management practices with emphasis on training, pruning, and drip irrigation.
- **Apple and Pear-** Shift to clonal rootstock based high density plantations of self-fruiting varieties, supplemented with drip irrigation, proper training and pruning, managed pollination through pollinators and pollinizers. High density planting will result in more than 40% increase in farmers' income under different fruit crops (Tables 10, 11 and 12). Managed pollination has a great potential to enhance farmers' income (Figs. 15,16 and Table 13).

**Increasing Production and Productivity of Fruit Crops  
Use of Dwarf Rootstocks and Inter-Stocks**

Fruit	Rootstock (s)	Salient features
Apple	EMLA111/MM111	Suited to drought prone areas
Pear	BA-29	Standard rootstock, semi-vigorous
Peach	GF 667 and GF-677	Drought tolerance
Plum	PIXY X ST, Julian-K	Dwarfing rootstocks
Cherry	COLT	Semi-dwarf



**Fig. 17: High density planting of apple to increase fruit production**

**Table 21: Returns from High Density Planting in Apple**

Parameter	Low density	High density
Planting density	250 trees	2,500 trees
Productivity	10 t/ha	55 t/ha
Input costs	₹ 3 lakhs	₹ 12 lakhs
Returns	₹ 12 lakhs	₹ 28 lakhs
Net profit	₹ 9 lakhs	₹ 16 lakhs

**Table 22: Returns from High Density Planting of Kinnow (20x10 Feet)**

Activity	Normal spacing (20x20 feet)	High density planting (20x10 feet)
No of plants in per ha	275	550
Cost of cultivation ( ₹/ha )	1,71,325	2,23,325
Yield (q/ha)	255	355
Average price (₹)	3,82,500	5,32,500
Net profit ( ₹/ ha )	2,11,175	3,09,175

**Table 23: Returns from Improved Cultivation of Kiwi Fruit (Zones II & III)**

Age(yrs)	Input/ expenditure (₹ lakhs)	Gross income (₹ lakhs)		Net income (₹ lakhs)	
		Traditional	Improved	Traditional	Improved
1	14.00	00.00	00.00	-14.00	-14.00
2	03.50	00.00	00.00	-03.50	-03.50
3	03.50	03.75(25 q)	07.50(50 q)	+00.25	+04.00 (16 fold)
4	03.50	05.25 (35 q)	11.25 (75 q)	+01.75	+07.75 (4.43 fold)
5	03.50	07.50(50 q)	15.00(100 q)	+04.00	+11.50 (2.88 fold)
6	03.50	11.25(75 q)	22.50 (150 q)	+07.75	+19.00 (2.45 fold)
7	03.50	18.0 (120 q)	40.63 (250 q)	+14.50	+37.13 (2.56 fold)
		<b>Traditional cultivation</b>		<b>Improved cultivation</b>	
Gross income		₹ 18,00,000		₹ 40,62,500	
Net income		₹ 14,50,000		₹ 37,12,500	

### Interventions for improved cultivation of Kiwi

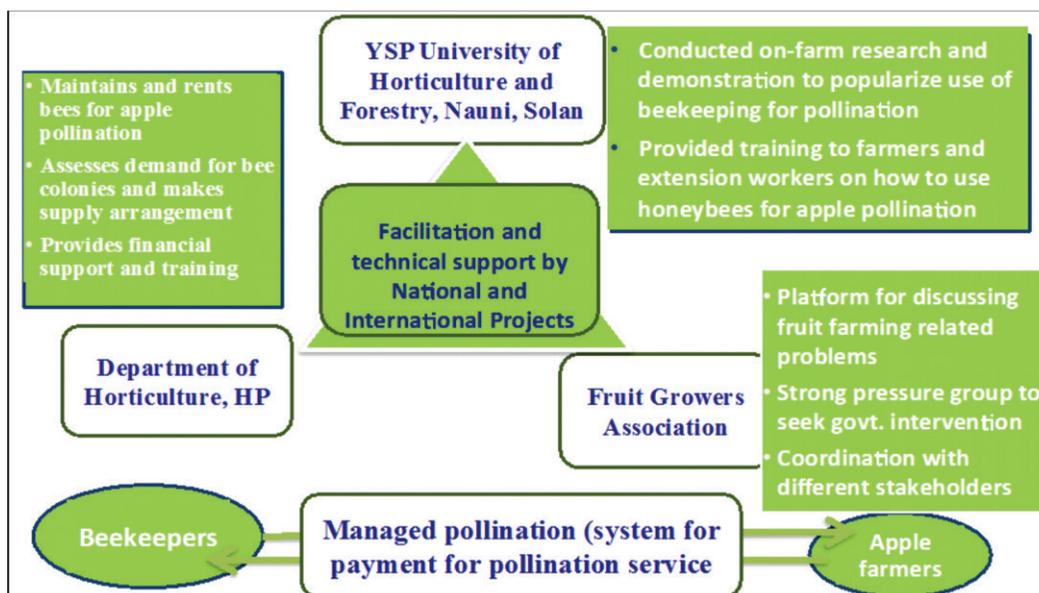
- Summer and winter pruning.
- Application of Cytokinins to improve fruit size and quality.
- Pollination and fruit thinning (6-8 fruits).
- Water management and harvesting at right stage of maturity.

### Honeybee Keeping and Managed Pollination



**Placement of 5 to 6 Bee Hives colonies per ha increases fruit production by 25%**

**Fig. 18: Honeybee keeping for generating additional farm income and managed pollination for increasing fruit set**



**Fig. 19: Institutional mechanism for up-scaling managed pollination by honeybees**

**Table 24: Increasing Farmers' Income Through Integrated Honeybee Keeping**

Technology	Input	Returns
<b>A. Integrated beekeeping</b>		
Managed pollination	₹1 lakh/ 30 ha/100 colonies	₹ 45 lakhs increase in fruit production in apple.
Honey production	₹ 2.15 lakhs/100 colonies	3.15 lakhs
Division, pollen, propolis, bee wax, queen production	₹ 4 lakhs/100 colonies	₹ 6.5 lakhs
<b>B. Long term interventions</b>		
Plantation of bee flora	Plantation program	Increases in carrying capacity
Selective breeding of <i>Apis mellifera</i>	As a coordinated network project	Productive honeybee strains

**Tea/Coffee: The Crops for Diversification of Cropping System**

Tea in Himachal Pradesh is mainly cultivated in Kangra district and cultivates both black tea and green tea, but black tea constitutes around 90% of the production. There are 5,900 tea gardens between Dharamsala to Jogindernagar, with an annual output of 8.99 lakh kg.

Kangra tea is known for its unique color and flavour, attributed to unique climatic conditions in the region. It has been granted Geographical Indicator tag in 2005. Tea cultivation can be expanded in areas with >1,000 mm rainfall, with deep alluvial soils up to 1,000 m amsl in parts of Kangra, Mandi, Hamirpur, Sirmaur, and Bilaspur. Coffee is one of the most potential and ruminative crops

for the Lower Shivalik Hills of Himachal Pradesh. It can be cultivated in areas with high rainfall and deep alluvial soils up to 1,000 m amsl in Bilaspur, Mandi, Kangra, Hamirpur, and Sirmaur districts. Chandragiri and Selection 9 are suitable for cultivation in the temperate regions of the state, and has better flavor due to cold climatic conditions during fruit set and ripening.

Farmers can earn an income of Rs 30,000 to Rs 35,000 per *bigha*. It can be grown along with mango, avocado, papaya, and other fruit crops needed as shade for coffee cultivation. Dwarf and semi-dwarf varieties can be developed for high density plantings for high productivity.



**Fig. 20: Coffee and tea have tremendous scope in Himachal**

**Sericulture**

India is importing huge quantities of silk from China, South Korea, and Japan. To meet the domestic requirements, silkworm rearing can be adopted on a large scale in the lower Shivalik hills, where mulberry is growing aplenty under natural conditions. There are already a large number of silkworm rearing units and spinning mills set up in this area. This can be promoted as

a self-employment scheme for the young entrepreneurs. To give a technological boost to silk production in Himachal Pradesh, we are strengthening silkworm research at the YSP-UHF Campus, Neri, collect and multiply the mulberry varieties suitable for silkworm rearing, distribute the material to the farmers, and develop marketing linkages with the silk industry.



Fig. 21. Sericulture for generating additional farm income

### Mushroom Cultivation

Integration of mushroom cultivation with farming systems (crop-livestock system) under low and mid-hill regions is important for increasing farm incomes (Fig. 21 and Table 25).



Input cost/100 bags = Rs 7,000. Return = Rs 15,000 in 3 months

Fig. 22: Mushroom cultivation as a cooperative or small scale Agro-Industry.

Table 25: Increasing Farmers Income Through Mushroom Cultivation

Area under mushroom cultivation	2 Kanals (1011.71 sq. meter)	1 Kanal (semi-automatic)+ 1 Kanal
		Amount (₹)
Initial cost	AC Unit + Temporary Sheds	₹ 17,00,000
Gross income	From whole sale	₹ 7,30,000/-
	<b>Total</b>	₹ 7,30,000/-
Cost of production (3000 bags)	Initial raw material (Bag + Spawn + Casing)	₹ 3,25,000/-
	Electricity + Packing + Labour charges	₹ 1,10,000/-
	<b>Total</b>	₹ 4,35,000/-
Net income		₹ 2,95,000/-
Net income from paddy-wheat		₹ 46,875/-

Source: PAU (2017)

### Medicinal and Aromatic Plants

Medicinal and aromatic plants can be exploited to boost farmers' income in Himachal Pradesh.

#### Cultivation of *Tagetes minuta* (Wild Marigold) for essential oil production

Yield	35 liters of essential oil/ha
Current market rate	₹ 9,000/litre
Input cost	₹ 45,000/ha.
Total returns	₹ 3,15,000/ha.(total returns from traditional crops like maize < ₹ 1,50,000/ha)
Essential requirement	Essential oil extraction unit (Rs 1,50,000/ for one ha crop, life of unit: 10-12 years).

#### *Gloriosa superba* (Kalihari) seed production

Technology intervention	Pollination management
Yield	400 kg seeds/ha/year
Current market rate	₹ 1,200/kg
Input cost	₹ 2,00,000/ha/year 1 <sup>st</sup> year 5,00,000 (planting material) + ₹ 1,00,000/ year maintenance cost
Total returns	₹ 4,80,000/ha/yr

#### Agroforestry and Pasture Development

Promotion of improved pasture and grassland management, agro-forestry, and cultivation of sweet stalk sorghum, maize and pearl millet to increase milk production through cooperative societies is an important component of animal husbandry (Fig. 23 and Table 26).

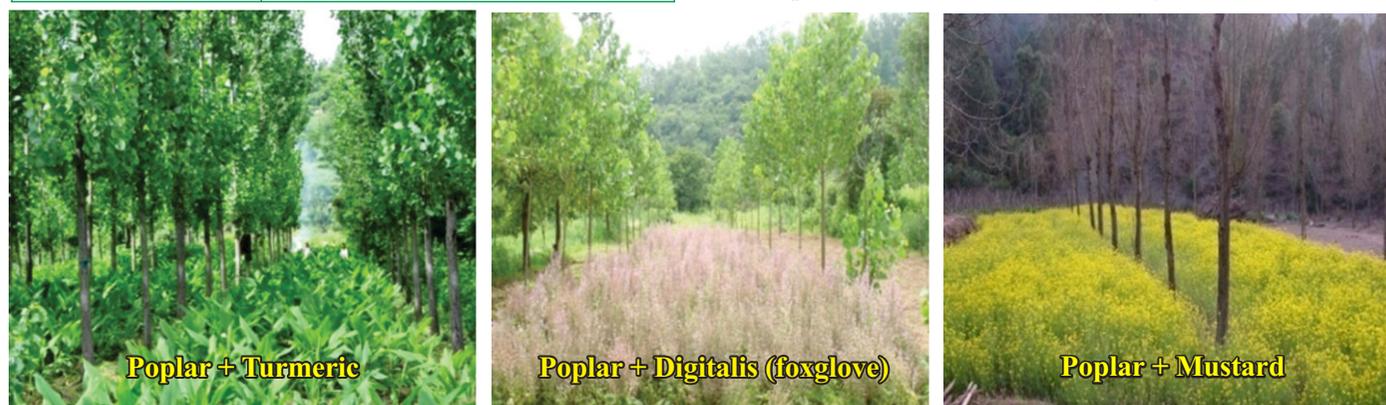


Fig. 23: Integrate crop production with agro-forestry to increase availability of fodder, timber and food crops to meet the household needs of the farmers

Table 26: Returns From *Ocimum* Cultivation Under Peach Based Agro-forestry System

Technology	Objective	Inputs	Cost of cultivation (₹/ha)	Gross return from AGF (₹/ha)	Net return from AGF (₹/ha)	BC Ratio
Stone fruit based Agroforestry system ( <i>Ocimum</i> + Peach)	Effect of organic manure on biomass production of <i>Ocimum sanctum</i> under different fruit tree species	25 t/ha FYM	2,06,027	3,85,800	1,79,772	1:1.87
	Above ground biomass production of different fruit tree species	1,000 litres/ha Jeevamrut	2,33,361	4,17,719	1,84,358	1:1.79
	Economics of the system	No manure	1,88,027	2,88,377	1,00,350	1:1.53

### Remarks

- Agro-forestry system is more beneficial than sole cropping system.
- Integration of medicinal and aromatic plants in orchards/ land-use system with the application of organic manure produced higher biomass and higher net returns.
- Net returns from sole crop of *Oscimum* are Rs 22,850/-

### Livestock/Fisheries

Integrated farming comprising of crossbred, exotic or Indigenous milch breeds of dairy cattle/yak, fisheries, sheep, goats, backyard poultry, pig, emu and rabbits should be promoted for diversifying farm incomes. Advanced fingerlings fish should be used for increasing productivity in fisheries. Economics of various livestock based enterprises is given in Table 27.

**Table 27: Comparative Economics of Livestock Farming**

Enterprise	Unit	Returns/year ( ₹ )
Dairy farming	10 CB cows	1,76,350
Dairy farming	10 Buffaloes	1,34,510
Goat farming	30+2 Males	2,28,000
Pig farming	11 Adults	2,70,000
Fish farming (carp culture)	2.5 acre	93,600

Source: PAU (2017)

### Steps for promotion of livestock: goatry, poultry, fisheries

- Introduction of high yielding milchbreeds of buffaloes and cattle.
- Establishment of service bulls at block level for

improvement of cattle breeds.

- Organisation of timely health check-ups of animals.
- Establishment of milk chilling plants at strategic locations.
- Promotion of pure genetic breeds of sheep/goat and yak.
- Strengthening of traditional water bodies/rivulets for raising mahaseer and carp.

### Processing and Value Addition for Reducing Post-Harvest Losses

Value addition through drying, processing, and product development can be used to increase farmers income (Figs. 24 to 26). Food processing should be adopted on a large scale to avoid post harvest losses, distress sales by the farmers, and to regulate market prices. Given here are some examples of food processing that would promote utilization of the farm produce, and increase the margins of farmers' income. There is a need to reduce post-harvest losses and promote value addition through:

- Promotion of cluster approach for efficient procurement and disposal of surplus fruits and vegetables.
- Establishment of mini-grading, packing and storage units.
- Promotion of Solar Dryers for processing excess vegetables/ fruits/ flowers at the farm/ village/ panchayat level.
- Establishment of small scale and mobile Processing Units for juice and pickle making of limited or heterogeneous stocks.
- Promotion of common resources on custom hire basis viz. Power tiller, mini thresher, etc.








## Value Addition Through Solar Drying

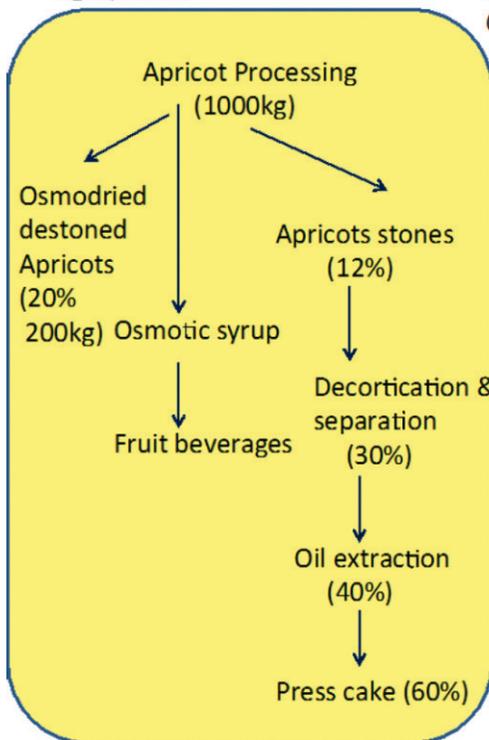
Zones I,II,III & IV

Osmo dried de-stoned apricots = Rs 60,000  
Returns = Rs 100,000/t. Profit = Rs 40,000

**Fig. 24: Drying and processing of vegetables/ fruits for stabilization of prices, minimizing crop loss, and value addition**

**Value Addition of Fruits and Vegetables**

eg: Apricots



Fresh fruit selling price = Rs20,000

@ 20 Rs /kg (1000kg)

**Value addition of Apricots**

Input cost @ 300 Rs/Kg of = 300x200 = Rs60,000

Osmo dried destoned apricots

Return from dried apricots = 500x200= Rs1,00,000

@500Rs/Kg

**Net Return= 1,00,000-60,000= Rs40,000**

Input cost of decortication of stones = Rs120.00

(@ Rs1 for 120 kg)

Input cost for separation of kernels = Rs72.00

(@Rs 2 for 36Kg)

Input cost for extraction of oil =Rs 140.40

from expeller (@Rs 10 for 14.4 lts of oil)

Total input cost for oil extraction = Rs 332.40

Return from oil @ Rs 800/lit = Rs11,520

Return from selling of Press cake = Rs 324.00

@ Rs 15/ kg for 21.6 kg

Total return =11,520+324=11,844

**Net Return = 11,844-332.40= Rs11,511.60**

Utilization of 2500 lts osmotic syrup (45°B) for squash

Pulp @ 25% required 625 lts = Rs 18,750.00

@ Rs 30 /lt

Packaging bottles 4285Nos. @ =Rs 34,280.00

Rs 8/bottle

Total input cost =Rs 18,750+ 34,280= Rs

53,030

Returns from selling of apricot squash =Rs 2,99,950.00

@70/bottles

**Net Return = Rs 2,99,950-53,030 = Rs. 2,46,920.00**

Total input cost for apricot processing (1000kg) = Rs 60,000+ 332.40 +53,030 = Rs1,13,362.40

Returns from apricot processing = Rs1,00,000+ 11,884+2,99,950 = Rs 4,11,834

**Net Return from processing of 1000 kg of apricots = ₹ 4,11,834-1,13,362= ₹ 2,98,47**

**Fig. 25: Value addition in apricots**

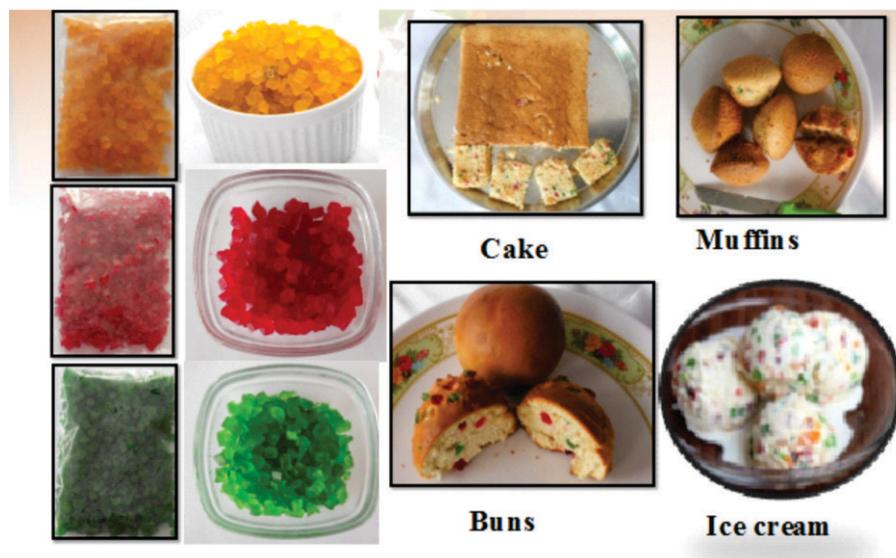


Fig. 26: Utilization of tutti-frutti in different food products

### Reducing Cost of Cultivation

- Promotion of well decomposed FYM, Vermicompost and Bio-fertilizers to minimize the use of chemical fertilizers.
- Avoid broadcasting of seeds and fertilizers.
- Promotion of hand tools in agricultural and horticultural operations.
- Promotion of use of Power Tillers, Power Weeders, Paddy Threshers, Wheat Threshers, Maize Sheller, Wheel Hand Hoe, Manual/ Power operated Wheat/Paddy Reapers.
- Promotion of mulching (bio-degradable plastic) to maintain moisture and reduce intercultural operation cost.
- Promotion of pressurized irrigation techniques in horticultural crops.

### Zero-Budget Natural Farming

Under the current farming scenario, the ever-increasing crop production costs seem to be a major cause of farmer distress. Thus, there is an urgent need to popularize the holistic farming technique of '**Zero Budget Natural Farming (ZBNF)**' based on the use of farm based inputs (Fig. 27), developed by Sh. Subhash Palekar in Maharashtra. This farming system has been adopted successfully by several farmers across the country. This climate resilient, cost effective, ecologically safe and sustainable technique can help in reducing the market dependency of farmers for the farm inputs and finally enhance their self-reliance.

- Adopt holistic natural farming techniques involving

use of cow dung and urine to reduce production costs and enhance farmers' self-reliance.

- Promote generation of inputs at the farm level so as to reduce input costs.
- Branding of natural farming produce.



Fig. 27: Use of Jeevamrit in Zero Budget Natural Farming

### Off-Farm Sources of Income

- Promotion of subsidiary occupations such as poultry, fish farming, beekeeping, sericulture and mushroom production.
- Promotion of cultivation and collection of medicinal plants.
- Encouraging SHG's, NGO's for promotion of agriculture based economy by developing small scale enterprises (Candle making, Pickle making, Jam &

- Jelly making, Woollen knitting and Handicraft).
- Establishment of distillation units for medicinal and aromatic plants.
- Promotion of Agri-clinics.

### Market Interventions

- Promotion of **Cluster approach/Contract farming** for efficient crop management, and linking production centers with markets and value addition through processing.
- Reduction of post-harvest and in-transit losses by developing a chain of cold stores, reefer trucks in strategic alliance with agribusiness cooperatives.
- Strengthening of main and link roads, timely availability of transport vehicles, market intelligence, cold storages, warehouses, processing units, and promotion of grower societies (Co-operative marketing), and auction yards to increase net profits.
- Post-harvest technology for value addition, value added products of ginger, mango, citrus, garlic and vegetables, extraction of pectins, kernel oil of apricot, and value added/dried products of apple, plum, pear, apricot, fig and vegetables (Figs. 22, 23 and 24).

### Online Management and Evaluation

- Development of Mobile apps/ software for online management of introduce at the district level.

- Creation of link between district level committees of state line departments and KVK experts for field as well as online monitoring, evaluation and feedback.
- Development of e-Marketing and kiosk at district level to have information on surplus commodities at the block level.
- Organization of monthly review meetings to solve the problems related to farmers.
- Promotion of use of radio, TV talks and WhatsApp, etc. for effective implementation of programs.

### Strengthening On-Farm and Off Farm Training Services

- Formal trainings (Fig. 28) and use of communication media to enhance farmers' knowledge for undertaking farming on scientific basis and generating employment opportunities during the off season.
- Orientation of farmers towards cashless transactions for purchasing inputs and sale of farm produce.
- Enhancing managerial and marketing skills of the farmers in production of high value cash crops.
- Research and development programs through public and private partnership will lead to doubling the farmers' income for food and national security.



Fig. 28: Training and skill development of farmers

### Policy and Institutional Support

- **Checking migration** by attracting rural youth to agriculture by promoting high-tech precision agriculture as an industry.
- **Land fragmentation** has resulted in disruption of economies of scale, and hence, it should be mandatory

to define the minimum size of holdings that are economically viable.

- **Cultivation of arable lands** should be made mandatory, and the stray cattle and wild animals be controlled through policy/ legislation.
- **Promote public - private partnership.**
- **Define quality standards** for crop produce and link it



- to prices.
- **Minimum support price** and buy back mechanisms to reduce on-farm losses.
  - **Promotion of e-trading**, both for the agricultural inputs and the crop produce.
  - **Reform Import/Export policies** to promote farming.
  - Allotment of 'Nautaur land' out of the ceiling-surplus, and wastelands, especially in the tribal areas, to increase the size of land holding to small farmers.
  - Levy a fee of **Rs 10 per quintal of produce**, and **allocation of an equal amount by the state/ central Governments**, and *use the funds for supporting research and development* in agricultural universities, as is the case in several developed countries in the world.

Institutional Support/Reforms for Doubling Farm Incomes	
<b>Consolidation of land holdings</b>	Define the minimum size of holding
<b>Cooperative/contract farming</b>	Need of the hour
<b>Minimum support price</b>	Buy back mechanism to reduce on farm losses
<b>Farm mechanization</b>	Technological support for reducing labor input
<b>Crop insurance</b>	To mitigate the risk of climate change and crop failures



## Implementation Plan

The objective of doubling farmers' income can be achieved through proper implementation by different agencies involved and convergence of the various agencies. The implementation plan is given in Table 28.

**Table 28: Implementation Plan and Institutional Responsibilities**

Issue	Agency / organization/ stakeholders/' responsibilities
Seed replacement	SAUs, ICAR centers, Departments of Agriculture and Horticulture, Seed Certification agencies and NGOs. Need to develop linkages and partnerships with the private seed companies/ nursery producers for faster dissemination of technologies to the farmers.
Replacement of unsuitable crops and crop cultivars	Line Departments of Agriculture and Horticulture, KVKs and Extension departments of Agricultural Universities and NGOs.
Awareness of scientific seed treatment techniques	Line Departments, KVKs and Extension departments of Agricultural Universities should impart training to farmers on seed treatment.
Exposure of farmers to non-monetary inputs	Line Departments, KVKs and Extension departments of Agricultural Universities need to impart rigorous training on Zero Budget Natural Farming.
Plant population/high density plantings of fruit crops	Line Departments, KVKs and Extension departments of Agricultural Universities to impart training and ensure availability of good quality seeds/ planting materials.
Integrated nutrient management	Line Departments, KVKs and Extension departments of Agricultural Universities should impart training. SAUs and ICAR centres should undertake research on sustainable cropping systems.
Promoting precision agriculture	SAUs, line departments and KVKs should impart training to identified farmers and extension workers. SAUs and ICAR centres should take up focused research on alternative farming systems.
Prioritizing research on R&D	SAUs and ICAR centers.
Integrated weed management	KVKs, line departments and extension departments of Agricultural Universities should impart training on integrated weed management.
Integrated Pest /Disease management	State regulatory authorities need to seize spurious products from market. Strict control on cultivation of varieties recommended by the SAUs. Line Departments should impart training on IPM. SAUs / ICAR centres need to train input dealers and progressive farmers.

**The budget estimates for executing major initiatives are given in Annexure II.**



## Summary and Recommendations

Sustainability of the agricultural production systems, and food and nutritional security are the major challenges due to climate variability and climate change in Himachal Pradesh. Farming systems in Himachal are frequently threatened by floods, prolonged periods of droughts, pest outbreaks, hailstorms, low chilling in high hills and frost damage in the lower Shivalik Hills. Because of availability of food grains at cheaper rates in the public distribution system, and the aspirations of the youth for white collar jobs, crop damage by the stray cattle and wild animals, the people are giving up farming, as result, nearly 50% of the arable land is lying vacant, which is being increasingly infested by weeds. Therefore, there is an urgent need to develop cost-effective alternative farming systems to attract the youth to farming to increase farmers' income in Himachal Pradesh. There is an urgent need to:

- Improve irrigation from 19 to cover >50% of the area under cultivation through check dams-tanks.
- Integrate wheat/maize based cropping system with legumes and agro-forestry/ horticulture.
- Timely availability of quality planting material of vegetables, flowers, fruits.
- Adopt high/ ultra high-density planting of fruit crops to increase productivity.
- Reduce post harvest losses, promote drying and value addition.
- Diversification of farm income through crop-livestock farming, beekeeping, sericulture, fisheries, mushroom cultivation, agro-forestry, floriculture and aromatic and medicinal plants.
- Adoption of protected cultivation, aquaponics and aeroponics.
- Consolidation of land holdings: Define the minimum size of land holdings.
- Cooperative/contract farming: Need of the hour.
- Minimum support price: Buy back mechanism to reduce on-farm losses.
- Farm mechanization: Technological support for reducing labour input.
- Crop insurance: To mitigate the risk of climate change and crop failures.

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## Annexure I: Technology Modules from Krishi Vigyan Kendras (KVKs) of Himachal Pradesh

(Source: Programme Coordinators of Respective KVKs)

### KVK Bilaspur

#### Land Use Pattern

Total geographical area	1,11,776 ha
Cultivated area (net area sown)	29,187 ha
Area sown more than once	27,714 ha
Total cropped area	56,901 ha (195 % cropping intensity)
Area under irrigation	3,819 ha (13.08 %)
Area under forests (pastures and grazing land)	53,596 ha
Other land (under Govind Sagar lake)	2,325 ha
Polyhouses	55 ha

#### Statistics of Major Crops

Crop	Area (ha)	Production (MT)	Productivity (MT)
Maize	26,694	50,629	1.85
Rice 1465	2,508	1.44	
Wheat	23,807	42,212	2.24
Barley	173	300	1.71
Pulses (Chickpea and Blackgram)	500	450	0.90
Total food grains	52,639	96,099	1.82
Oilseeds	305	257	0.87
Potato	120	1,500	12.5
Ginger	215	2,150	8.57
Vegetables	3,040	83,005	27.30
Fruits Mango:3,946, Pomegranate:380, K-lime: 599, Galgal: 251, Orange:249, Litchi: 533,	7,313	2,67	-

### Livestock Population in Bilaspur District

Livestock	Numbers
<b>Cattle:</b> Cross breed	Bulls: 4,928
	Cows: 21,242
Indigenous	Bulls: 19,688
	Cows: 2,034
<b>Total cattle</b>	47,892
<b>Buffaloes</b>	Male: 9,716
	Female: 90,870
<b>Total buffaloes</b>	1,00,586
<b>Sheep</b>	1,423
<b>Goat</b>	59,244
<b>Pigs</b>	2,900
<b>Total livestock</b>	2,10,439 (including horses and ponies, mules, donkeys, dogs)
<b>Poultry</b>	96,017

### Technology Available

- Quality-seed production of pulses.
- Tuber crops production : Very effective in areas prone to monkey menace. KVK has developed the first ever variety of *Zimikand* (Elephant foot yam) variety in the state, 'Palam Zimikand-1'. A demonstration museum of tuber crops (Tapioca, Arrow root, Zimikand, Dioscorea spp. - Tardi, Dragel, Sweet potato, Colocasia) is being maintained. An AICRP on Tuber Crops is in operation at the KVK.
- *Kharif* onion production technology standardized and is being popularized among the farmers. Onion is available during lean period from October-December.
- Protected (Polyhouses) cultivation technology for vegetables standardized.
- Round-the-year vegetable nutrition garden/ demonstration unit established at the KVK.
- Post-harvest value addition technology available for preparation of pickle, jam, jelly, muraba, etc.
- Technology available for low cost organic agriculture.
- Technology for preparation of 'Utility products out of



- waste material' developed.
- A demonstration unit on vermi-compost preparation has been established at KVK.
- A low cost rain water harvesting structure (*kacha*) of >18,00,000/- litre capacity established, and is being demonstrated to the farmers.

**Farmers' income may be increased if the following constraints are addressed in a focussed manner:**

- Increase in area under irrigation: From current 13.8% to at least 50%. This is important for crop

- diversification including quality seed production, protected cultivation, off-season vegetable production and cultivation of cash crops.
- Lowering input cost by educating farmers to adopt low cost natural/organic farming.
- Availability of farmer friendly small/handy farm tools and machinery for small and fragmented land holdings and terraced fields in the district.
- Assured marketing and minimum support price for the produce.

**Possible Income from Various Models**

Enterprise	Proposed model	Cost ( ₹ )	Gross income /annum ( ₹ )	Net income /annum ( ₹ )
<b>Integrated Farming System</b>				
Crop cultivation	Size: 0.50 ha	Variable depending upon cropping system	69,024	35,752
Live stock	Cattle (2) + goats (5) + backyard poultry (50)	2,36,000	3,89,000	98,000
Vegetables	Kitchen garden 250 m <sup>2</sup> + poly house 60m <sup>2</sup>	6,000 + 8,250 (var) =14,250 +1.20 lakhs	16,600 + 21,810 =38,410	10,600 +13,560 =24,160
Vermicompost	Size 12 x 5 x 2.5 cu. ft.	90,000 to 1,80,000 (fixed)+ 22,500 variable	90,000	67,500
Fisheries	-	3,00,000	1,10,000	1,90,000
Seed production (pulses)	Size: 0.50 ha	Cost of cultivation + certification fee	62,000	40,000
Mushroom cultivation	200 bags	53,500/-	60,000 to 70,000	35,000 to 57,000
Pickle preparation	-	2,19,000 fixed + 8,84,000 variable	10,19,000	1,79,000
Jam, jelly and murabba unit	-	2,34,000 +4,89,000 variable	6,32,000	1,43,000
<b>Sericulture</b>	-	15,000-20,000	3,000	3,000
<b>Wages (NREGA)</b>	-	-	60,000	60,000



## KVK Chamba

### Success story from NICRA Village

**A brief statement of the problem:** NICRA village, Lagga in District Chamba is situated at a height of 1500-2,000 m amsl. The annual average rainfall is about 1,100 mm. During winters, this area receives moderate to high snowfall. This zone has a single crop in a year. Maize, cabbage, cauliflower, apple, beans and potato are the major crops grown in this area.

Farmers of this area have very small land holdings, that too without irrigation facilities. Before starting of NICRA project in this village, the farmers were earlier producing small amounts of maize to meet their domestic requirements.

**Natural resources:** The area has a highly rugged hilly terrain, and most of the rain water is lost by surface runoff resulting in very limited ground water storage. At present, 11 water harvesting structures with 60,000-80,000 litres storage capacity have been built to augment irrigation of crops.

### Plan Implementation and Support

**Alternative technologies:** The agro-climatic conditions of this region are suitable for the cultivation of cabbage, cauliflower, beans, potato and apple. Under protected cultivation, the construction of polyhouse in the village started in 2011. The Department of Agriculture along with KVK identified the farmers for financial assistance and KVK provided the necessary inputs to the farmers.

**Extension strategies:** With an increase in the construction of polyhouses in the village, the training needs of extension functionaries and farmers for protected cultivation were identified by the KVK under the project, and organized 200 training programs in 2017 in which 3,000 farmers were trained for protected cultivation.

**Facilitation of critical inputs:** Establishment of one Custom Hiring Centre in the form of machinery and other agricultural inputs helped the farmers for improved production of various vegetable crops under open as well as protected conditions.

**Technical support (consultancy, advisories, training, exposure visits, farmer and scientist interface):** Exposure visits of 60 farmers were conducted at CSK HPKV Palampur and PAU Ludhiana. Off campus training programmes were also conducted in the NICRA village.

### Output

Initially, a group of 20 progressive farmers took up the cultivation of vegetable crops in eight villages of the region. Gradually, more and more farmers took up the cultivation of vegetable crops under protected condition. At present, there are 30 polyhouses of 1,300 sq m and more than 40 farmers are growing vegetables under protected and open field conditions.

Cultivation of vegetable crops in the area has resulted in increased income of Rs 5-6 lakhs per farmer in a single cropping season.

### Shift in Area under Cultivation of Different Crops at Lagga Village after KVK Intervention

Crops	Pre-NICRA	Post-NICRA	% increase/decrease
Maize	57.68	35.00	- 39.30%
Potato	7.40	12.60	+ 70.30%
Apple	5.12	18.00	+ 251%
Cabbage	0.30	8.00	+ 2566%
Cauliflower	0.40	6.00	+ 1,400 %



Protected Cultivation of Vegetable crops in Village Lagga, Chamba District

### KVK Hamripur

#### Main Cultivars of Different Crops Grown in the District

Cereals	Pulses	Vegetables	Fruits
<b>Maize:</b> Hybrids of Kanchan, Proline	<b>Blackgram:</b> Him Mash-1UG -218, Naveen 2,000+	<b>Tomato:</b> Hybrids Abhimanu, Avtar, Suri and Red	<b>Papaya:</b> Arka Prabhat, Arka Dark Red
<b>Wheat:</b> HPW-236, HPW-349HS 507	<b>Chickpea:</b> HC-2 HPG-17	<b>Cauliflower:</b> Hybrids (Megha, Barkha, Fuziyama, Swati, Shweta and Pahuja-71	<b>Mango:</b> Dashehari
<b>Paddy:</b> HPR-2143		<b>Cucumber:</b> Malini and Malav Kian, Pusa-8, Purple cluster <b>Cabbage:</b> Hybrids Pushkar and Bahar <b>Broccoli:</b> Hybrid Palam Smridhi <b>Peas:</b> PB-89, Arkel <b>Radish:</b> Pusa Himani and Japanese White <b>Capsicum:</b> California Wonder, Natasha, Orobille and Indira <b>Bottle gourd:</b> Sharda <b>French bean:</b> Phalguni and Arka Komal <b>Bitter Guard:</b> Palli, <b>Onion:</b> Palam Lohit, Nasik Red and Agrifound	<b>Citrus:</b> Kazgi lime and Galgal



## KVK Kangra

District Kangra has varied agro-climatic conditions from sub-tropical to temperate high hills. Precipitation is received both in the rainy and winter seasons. Over 1,500 mm rainfall is received during the rainy season. The elevation of the district ranges from 300 - 4,000 m amsl.

### Major Farming Systems/Enterprises

Farming systems/enterprises
<b>Cereal based:</b> Maize-Wheat, Paddy-Wheat, Paddy-Potato, Maize-Mustard, Maize-Pulses and Pulses-Wheat
<b>Vegetable based:</b> Rainy, autumn season, winter season and summer season vegetables
<b>Fruit crops:</b> Mango, Citrus and Litchi
Dairy farming, Bee-keeping, mushroom cultivation, sheep and goat rearing

### Description of Agro-Climatic Zones

Agro-climatic zone	Agro-ecological characteristics	Crops/ fruits/ livestock
<b>Sub-tropical zone (Zone-I)</b>	Below 650 m amsl, undulating topography, low rainfall, hot summers, mild winters, light textured well drained soils with partial irrigation facilities.	Maize, Paddy, Wheat, Urdbean, Cole Crops, Mustard, Cucurbits, Mango, Citrus, Pear, Buffaloes and Cows
<b>Mid hills sub-humid zone (Zone-II)</b>	651-1,800 m amsl, steep topography, low to medium rainfall hot summers and mild winters, neutral coarse textured, pebble embedded, poor fertility soils.	Maize, Paddy, Wheat, Potato, Mustard, Urdbean, Vegetables, Mango, Litchi, Buffaloes and Cows
<b>High hills temperate wet zone (Zone-III)</b>	Above 1,800 m amsl, steep topography, high rainfall and snow. Cool summers and severe winters. Leached acidic soils with low fertility.	Potato, Barley, Rajmash, Rapeseed, off-season vegetables (Cabbage, Radish, Peas), Sheep, Goats, Mules

### Area, Production and Productivity of Major Crops

Crop	Area (ha)	Production (t)	Productivity (q/ha)
Maize	58,050	1,45,632	25.08
Rice	34,310	68,612	20.00
Wheat	94,552	1,77,750	18.80
Barley	1,600	3,180	19.90
Millets	200	135	60.75
Kharif pulses	3,902	2,910	7.45
Rabi pulses	2,550	3,740	14.60
Kharif oilseeds	4,340	2,650	6.10
Rabi oilseeds	3,939	1,957	4.96
Vegetables	7,349	1,47,612	200.85
Fruit crops	36,225	86,308	21.00

**Production and Productivity of Livestock, Poultry and Fisheries**

Category	Population	Production (l/Lakh ton)	Productivity (l/ animal)
Crossbred	1,53,000	0.93	5.5 l
Indigenous	2,44,000	0.20	1.6 l
Buffalo	1,56,000	0.65	3.0 l
Sheep	67,000	-	-
Goats	1,96,000	-	-
Poultry	2,63,000	-	-

**Enterprises for Doubling Farmers' Income****Dairy Farming of Indigenous Cows**

District Kangra is the largest producer of milk in Himachal Pradesh. Majority of the farmers are rearing crossbred animals, which have high production potential, but are more susceptible to various parasites and diseases. Additionally, the milk produced by these crossbred animals is more likely to be of A1 type, which is

considered to be less health promoting as compared to A2 milk produced by the indigenous dairy breeds such as Red Sindhi and Sahiwal. If a farmer starts a dairy comprising of indigenous cows and gets the milk certified to be A2 type from established labs, he/she can market the milk at a premium and earn more income. The urine and farmyard manure produced by these animals is also considered more useful for organic farming.

**Fixed costs**

Cost of indigenous animals 5 No.@ ₹ 50,000 each	₹ 2,50,000
Cost of shelter/housing	₹ 1,00,000
Depreciation @ 10%	₹ 35,000/year
<b>Running Cost</b>	
Cost of fodder	Own resources + 1,00,000
Cost of feed @ ₹ 2,000/animal/month	₹ 1,20,000
<b>Income</b>	
Sale of certified A2 milk @ ₹ 60/l	₹ 6,00,000
Average 2,000l/year/animal X 5	
Sale of Urine	
Sale of FYM/Compost/Vermicompost	Use at own farm
<b>Net income per annum</b>	<b>₹ 6,00,000 – 2,55,000 = 3,45,000 per year</b>

**Broiler Poultry Farming for Higher Returns**

District Kangra is bestowed with highest poultry population in Himachal Pradesh. However, most of these birds are of local or improved backyard stocks, with low productivity. These are helpful to augment the farmers income, but not enough as an avenue for self-

employment. Broiler poultry farming comprising of commercial flocks such as Vencobb with a small marketing age of 40 to 45 days needs minimal investment and provides early returns for diversifying farmers' income.

**Investment for 1,000 Broiler Unit****Fixed cost**

Housing 1,000 sq ft @ ₹ 300/1,000 sq ft	3,00,000
Cost of equipment ₹ 50/bird	50,000
Depreciation @ 10 %	35,000

**Running cost**

Cost of chicks @ ₹ 30/chick	30,000
Cost of feed 4 Kg/bird @ ₹ 30/Kg	1,20,000

**Income**

Sale of mature birds @ ₹ 100/kg live bwt	2,00,000
Net Income per flock	₹ 50,000
No. of flocks per annum	6 (minimum)
Income per year	Rs 50,000 X 6 = Rs 3,00,000
<b>Net income per annum</b>	<b>₹ 3,00,000 - 35,000</b> <b>= 2,65,000</b>

**Mushroom Cultivation**

Mushrooms are popular for their delicacy, flavour as well as food value. The agro-climatic conditions prevailing in many parts of the state provide ample scope for cultivation of mushrooms. White button mushroom (*Agaricus bisporus*) and Dhingri (*Pleurotus* spp.) are being cultivated in the state. Modern mushroom culture produces more proteins per unit area of land than any other form of agriculture. This also constitutes an excellent means of recycling the farm wastes. Since mushrooms are grown indoors, no additional land is required for their culture. Mushroom cultivation is labour intensive and can offer self-employment to unemployed educated and illiterate people. Mushrooms can be produced in large quantities within a short time.

**Organic Manures – An Enterprise for Small and Marginal Farmers**

Farmers can prepare organic manures at home with little guidance from experts. These organic manures can replace the requirement of chemical fertilizers, if used properly. Organic manures are good substitutes for chemical fertilizers in organic farming. The use of organic manures reduces the cost of cultivation and decreases the dependency on market. The use of organic inputs in crop

cultivation improves the quality of the produce and fetches higher price for the produce.

**Vermicompost**

Vermicompost production of the composting process uses various species of earthworms, usually red earthworms, to create a mixture of decomposing vegetables or food waste, bedding materials, and vermicast. Vermicompost contains water-soluble nutrients and is an excellent nutrient-rich organic fertilizer and soil conditioner. It is used in farming and small-scale sustainable organic farming. The vermicompost unit can be constructed on any wasteland with an approximate initial investment of Rs 10,000. After the preparation of the vermicompost, it can be packed in one kg well labelled packs and marketed as such at an attractive price of Rs.10-15/- per kg in the cities.

**Ghanjeevamrit**

Like vermi-compost, *Ghanjeevamrit* is a type of organic manure rich in nutrients and beneficial microorganisms. The *Ghanjeevamrit* can be prepared in an open area with little investment. After the preparation of the *Ghanjeevamrit*, it can be packed in one kg well labelled packs and marketed as such at an attractive price of Rs. 15-20/- per kg to the users.

**Jeevamrit**

The *Jeevamrit* or *Jeevamrutham*, is a traditional organic fertilizer. It can be used as a fertilizer for plants every week, which boosts the plant growth and gives good yield. We need to use it within one week of preparation. The *Jeevamrit* unit can also be constructed in any wasteland with little investment. After preparation of *Jeevamrit*, it packed in one litre well labeled containers and marketed as such at an attractive price of Rs. 15-20/- per litre.

**Matka Khad**

*Matka Khad* is prepared from the domestic waste and has no cost or very little cost. The material used to prepare the manure is household or market organic waste. The *Matka Khad* can be packed in one kg well labeled containers and marketed as such at an attractive price of Rs. 15-20/- per kg.

**KVK Kinnaur**

The major crop of district Kinnaur is apple, which is planted on an area of 10,828.05 ha with production of 75,201.86 MT. The other important crops of the district are peas, rajmash, wheat, barley and buckwheat. The action plan for doubling farmers income in Kinnaur



district is discussed below.

### Temperate Fruit Nursery Production

Maximum area under apple plantation in Kinnaur is of Delicious group, which are late, alternate in bearing habit and have low productivity. Nursery production of Spur type varieties, which are early in bearing, regular bearing habit with high productivity will be a major input to increase production and productivity of apple in Kinnaur district.

### Intercropping with Vegetable Crops

Farmers grow rajmash, wheat, barley and buckwheat as an intercrop with apple. These crops are low in productivity. Productivity of vegetable crops is 10 to 25 times higher than pulses and cereal crops. Intercropping with high value off-season vegetables such as pea, cabbage and cauliflower can be exploited to increase

farmers income.

### Mushroom Cultivation

Average landholding of the farmers in the district is very small which is approximately 1.37 ha. Farming of wheat and barley is done on an area of 192 and 1786 ha respectively. Straw of these crops can be used as a raw material for mushroom compost. KVK Kinnaur has started Mushroom Cultivation as an intervention in NICRA village and training is being provided to the farmers for mushroom production to diversify the farm income.

### Bee Keeping

Fruit setting is major problem in apple in district Kinnaur due to inadequate number of pollinizers and pollinator fauna. Bee boxes should be placed in the orchards for effective pollination in apple. Training programmes on bee keeping are being given a top priority in the district.

## KVK Lahaul Spiti and Kinnaur District

### Main Crops

Cereals	Pulses	Vegetables	Fruits
Barley	Rajmash	Pea (Azad Pea-1 and other mid season varieties/hybrids), Potato (Kufri Chandermukhi), Cauliflower (Hybrids) and Cabbage (Hybrids)	Apple Spur types and standard varieties, Apricot (Shakarpara) Almond (thin shelled, Non Pareil)

### Cultivation of off- Season exotic vegetables (lettuce and broccoli)

- High potential due to off season production in Lahaul Valley.
- Good quality that fetches premium price.
- Availability of market in super markets and five star hotels.
- Less use of pesticides.

Net returns to farmers (₹): 3.75 to 5.60 lakh per hectare per year (single cropping season)

Crop	Variety	Farming	Average yield (q/ha)	Gross input (₹ /ha)	Gross returns (₹ /ha)	Net returns (₹ /ha)	B : C ratio (GR/GC)
Broccoli	Hybrid	Irrigated	180	1,59,330	7,20,000	5,60,670	4.51
Lettuce	Hybrid	Irrigated	220	1,74,795	5,50,000	3,75,205	3.14

Sale price of Broccoli: ₹ 40/kg; Sale price of Lettuce: ₹ 25/kg

### KVK Mandi

Mandi is situated in the lap of Western Himalayas between 31°13'20" to 32°04'30" North latitude and 76°37'20" to 77°23'15" East longitude. The climate of the district is mostly sub-tropical in lower reaches and wet temperate in

upper reaches. Precipitation is received both in the rainy and the winter season. The temperature varies from 1° C at higher reaches during winter to 40° C in the valleys during the summer season. Average annual rainfall is



1,200 mm. The elevation of the district ranges from 650 - 4,000 m amsl.

### Land Holdings

Particulars	No. of families	Percentage	Holding size (ha)
Marginal	90,855	67.19	0.43
Small	28,752	21.26	1.40
Medium	15,535	11.49	2.65
Large	84	0.06	5.59
Landless	221	-	-

### Status of Major Crops Grown in Mandi district

Crop	Area (ha)	Production (MT)	Productivity (Kg/ha)
Maize	48,681	1,37,282	2,820
Paddy	20,942	26,344	1,258
Wheat	66,373	1,21,193	1,826
Barley	3,839	7,002	1,824
Pulses	3,280	1,489	454
Oilseeds	1,692	1,261	747
Potato	2,419	34,484	14,300
Peas	5,002	64,026	12,800.1
Tomato	827	25,224	30,500.6
Beans	431	4,181	9,700.7
Onion	459	6,334	13,799.6
Garlic	458	5,862	12,799.1
Cabbage	977	30,482	31,199.6
Cauliflower	686	20,923	30,500.0
Radish	384	5,760	15,000.0
Ladyfinger	479	5,365	11,200.4
Cucurbits	361	6,498	18,000.0
Brinjal	333	7,093	21,300.3
Fruits: (Apple: 16,311, Mango:4,769, Citrus:3,558, Stone fruits: 3800)	28,438	52,288	-

### Land Use Pattern

Geographical area	3,95,000 ha
Population	9,77,999
Population density	228 persons/km <sup>2</sup>
Literacy rate	75.24%
Sex ratio	1012
Development blocks	10
Panchayats	473
Total villages	3,338
Net cultivated area	95,390 ha
Gross cultivated area	1,60,419 ha
Net irrigated area	17,291 ha

### Available Technological Interventions

- Raising quality nursery of fruits and vegetables.
- Quality-seed production of cereals, vegetables and pulses.
- Off-season vegetable production.
- Integrated orchard management.
- Protected (polyhouses) cultivation of vegetables.
- Integrated nutrient management in cereals, pulses and vegetables.
- Vermicompost preparation.
- Soil health management.
- Post-harvest and value addition for preparation of pickles, jam-jelly, muraba, etc.
- Round-the-year production of vegetables.
- Preparation of utility products from waste material.
- Soil moisture conservation with emphasis on rain water harvesting and its efficient use.
- Bio-intensive pest and disease management in vegetable and fruit crops.

### Farmers' income may be increased by taking care of following constraints:

- Increase in area under irrigation: from current 18 % to at least 50 %. This is important for bringing more areas under cash crops, especially the vegetable crops for income generation.
- Lowering input cost by educating farmers to adopt low cost natural/organic farming.
- Availability of farmer friendly small/handy farm tools and machinery for predominantly small and fragmented land holdings and terraced fields.
- Assured marketing of farm produce.
- Assured "profitable rate" of farm produce to the growers.



### Models for Increasing Farmers Income in Mandi District

Enterprise	Proposed model	Cost (Rs)	Gross income /annum (Rs)	Net income /annum (Rs)
<b>Protected cultivation</b>				
<b>Capsicum</b> (March-November)- Garden pea ( November -February)	250 m <sup>2</sup>	27,388 variable cost	47,000	19,612
<b>Tomato</b> ( March-October)- French bean ( November-February)		26,198 variable cost	86,300	60,102
<b>Cucumber</b> (March-August)- Tomato (September -February)		32,849 variable cost	50,000	17,151
<b>Sericulture</b>	-	15,000-20,000	3,000	3,000

### Main Cultivars of Different Crops Grown in the District

Cereals	Pulses	Vegetables	Fruits
<p><b>Maize:</b> Hybrids of Kanchan , Proline and Niju Biju</p> <p><b>Wheat:</b> HPW-236HPW-349 WH1105, HD 1080, HD 3056, HS 507 HD 1080, HD 3056 and HS 507</p> <p><b>Paddy:</b> HPR-2612, Pusa-1509, Arize-6129, HPR-2143, HPR -1068 HPR -1156 and US-312</p>	<p><b>Blackgram:</b> Him Mash-1UG -218PDU-1 and Palampur-93</p> <p><b>Chickpea:</b> HC-2GNG-1581 HPG-17, Swati and Shweta</p>	<p><b>Tomato:</b> Hybrids ( US-981, Crystal 460, Abhimanu, Avtar, Naveen 2000+ )</p> <p><b>Cauliflower:</b> (Megha, Barkha, Fuziyama and Pahuja-71 (Superstar -71)</p> <p><b>Protected Conditions:</b> Claudia, Kian, Hillton, Kingstar and Multistar</p> <p><b>Brinjal:</b> Hybrids (Nisha, Nishant, Pusa Purple cluster, Nav Kiran and Sandhaya)</p> <p><b>Cabbage:</b> Hybrids (Varun, Pushkar, Bahar and Pragati)</p> <p><b>Broccoli:</b> Hybrids (Lucky and Fiesta)</p> <p><b>Peas:</b> PB-89, AP-1, Arkel, GS-10 and AS-10</p> <p><b>Radish:</b> Pusa Himani, Japanese White and Minu Early White</p> <p><b>Capsicum open conditions:</b> Bharat, Mahabharat and California Wonder</p> <p><b>Onion:</b> Palam Lohit, Nasik Red and Agrifound Dark Red</p> <p><b>Garlic:</b> GHC-1, Agrifound</p> <p><b>Protected:</b> Natasha, Swarna, Orobille and Phaladin</p> <p><b>Bottle gourd:</b> Chakra, Shamhu, Mulyam and Ganesh</p> <p><b>French bean:</b> Phalguni, Arka and Komal</p> <p><b>Potato:</b> Kufri Jyoti</p> <p><b>Cucumber:</b> Hybrids Long Green, Juhi, Noori , US 6125 and Sajan</p>	<p><b>Apple:</b> Royal Del. Golden Del., Red Chief, Oregon Spur, Scarlet Spur and Super Chief</p> <p><b>Mango:</b> Dashehari, Chausha, Langra, Amarapalli, Parvati and local varieties</p> <p><b>Citrus:</b> Kazgi lime and Galgal</p> <p><b>Plum:</b> Santa Rosa, Frontier and Mariposa</p> <p><b>Guava:</b> Alhabadi Safeda and Lucknow-49</p> <p><b>Litchi:</b> Calcuttai and Dehradun</p> <p><b>Pear:</b> Bartlett, Conference and Patharnakh</p> <p><b>Pomegranate:</b> Kandhari Kabuli</p>

## KVK Shimla

### Doubling Farmers' Income Through High Density Apple Plantation

The elevation of the Shimla district varies from 600 m to 5,760 m amsl, and the climate varies from cold temperate to sub-tropical depending on the terrain. Apple is the most important fruit crop covering an area of 38,000 ha with a production of 4,99,422 MT. Traditionally, farmers produce delicious apple, but face the problem of low spur formation, poor fruit set, poor coloration at lower elevations and delayed maturity at higher elevations. Because of low density of pollinizing cultivars, production of apple fluctuates across years, despite an increase in area. There is a large diversity in apple varieties with self pollination spur type and coloured strains, which can be adopted according to the agro-



Poor coloration in Starking Delicious apple on seedling root-stock

ecological conditions in different parts of the district.

High density planting of apple is one of the best options to the farmers for doubling their income. This technology is well established and widely adopted in the Europe since 1960s. In this system, we need to establish an apple orchard based on the semi-dwarfing and dwarfing root-stocks and use of spur type and colored cultivars of apple. High density system of planting is increasing in popularity among the farmers. Before switching to the high density planting on the clonal root-stocks, we need to survey the area for feasibility of this system as described below.

- The land must be flat or with little slope.
- Deep soil with no hard pan up to a depth of 1-2 ft.
- High fertility status of the soil.
- Availability of life saving irrigation.



A new spur variety (Oregon Spur II) plant bearing fruits

### Recommended Planting Distances for Apple

Cultivar	Root-stocks	Planting distance (m)	No. of plants/ ha
Non-spur	Seedlings	7.5	178
Spur	Seedlings	5.0	400
Non-spur	MM-111 & MM-109	6.0	278
Spur	MM-111 & MM-109	3.5	816
Non-spur	MM-106 & M-7	4.5	494
Spur	MM-106 & M-7	3.0	1,111
Spur	M-9	1.5	4,444

High density planting exhibits early fruiting and higher yields. The fruit quality improves with low cost on pruning, spraying, harvesting and other cultural operations. In this system, greater stress is placed on development of maximum number of fruiting branching, rather than structural branches. Most widely used root-

stocks are M-27, M-9, M-26, M-4, MM-106, M-7 and MM-111. M-7 is a semi-dwarfing root-stock and it produces trees of 60- 65 % size as compared to that on apple seedlings. M-9 dwarfing root-stock is most widely used across the world, and is most suitable for high density planting.

### Effect of High Density Planting of Apple

With the introduction of suitable spur type varieties and coloured strains of apple which are regular in bearing, the production of apple can be increased tremendously. Presently more than 25% area (around 8,000 ha), has already been shifted to spur types with the intervention of Krishi Vigyan Kendra, Shimla in collaboration with the Horticulture Department. The average yield of apple in Delicious variety, which was around 15-16 t/ha, has now increased to 25-30 t/ha due to introduction of new varieties. With the introduction of high density planting on clonal root-stocks, the fruit yield can be increased up to 50-60 t/ha.



**High Density Apple Plantation**

Variety	No. of plants/ha	Yield (t/ha)	Expenditure (₹)	Gross returns (₹)	Net returns (₹)	B : C Ratio
Starking Delicious on seedling root-stock	180	15	2,50,000	6,00,000	3,50,000	1 : 2.4
Spur type on seedling root -stock	400	30	5,00,000	18,00,000	13,00,000	1 : 3.6
Spur type/coloured strains on clonal root-stock M-9	4,400	50	6,00,000	30,00,000	24,00,000	1 : 5.0

- Yield is calculated on the basis of 20 kg/per apple box.
- Average sale price of Delicious variety of apple- ₹ 800 per box.
- Average sale price of Spur variety of apple (due to early maturity)- ₹ 1,200 per box.

### Interventions Required

- Survey and marking of the areas suitable for high density plantation.
- Awareness among the farmers to adopt high density plantation.
- Availability of quality planting material on suitable root-stocks.
- Assisting farmers with proper spacing to make future orchard management easier.
- Conservation of soil moisture through mulching for production of quality fruits.
- Advising farmers for construction of rain water harvesting storage tanks, and installation of drip irrigation system for the success of high density planting.
- Use of fertigation for reducing labour and other input costs.
- Intercropping of orchards with high value vegetable/pulse crops for additional income and maintaining fertility.
- Integrated nutrient management for sustaining the

soil health.

- Canopy management for maintaining the balance between vegetative and reproductive growth

### KVK Solan

Solan District of the Himachal Pradesh falls under Zones I and II, which include low and mid hill regions. The District is situated between 76° 42' to 77° 20' East Longitude and 30° 30' to 30° 15' North Latitude, with a total geographical area of 1,936 sq km. The District comprises of five developmental blocks of Nalagarh, Dharampur, Solan, Kandaghat and Kunihar. Solan district of Himachal Pradesh is the major supplier of tomato and bell pepper to the plains during summer and rainy seasons. The traditional farming systems in the mid hills comprises of Solanaceous vegetables (tomato and bell pepper) in summer, followed by cabbage, cauliflower and peas in the winters. Over the past few years, glut of tomato and bell pepper in the markets during summer and rainy season has resulted in lower prices, thereby resulting in low profits to the farmers. Moreover, intensive



cultivation of solanaceous crops has resulted in greater incidence of insects pests and diseases, especially soil borne diseases. Therefore, it has become important to diversify the tomato/capsicum production system with the introduction of exotic vegetables to double the farmers income. Cultivation of exotic vegetables has picked up in Himachal Pradesh over the past 4-5 years. Solan district provides the best opportunity for successful cultivation of the exotic vegetables due to prevalence of optimum growing conditions. Small land holdings, increased cost of cultivation with low yields of vegetables is attracting the farmers to adopt exotic vegetables for quality produce and high returns.

### Specific Interventions Needed for Doubling Farmers' Income

- Conduct base line survey to identify major gaps and success indicators for cultivation of exotic vegetables in Nalagarh, Dharampur, Solan, Kandaghat and Kunihar.
- Selection of a cluster of villages suitable for cultivation of exotic vegetables (Lettuce, Celery, Parsley and Broccoli).
- Skill development of farmers by providing trainings in cluster villages for sustainable, remunerative and climate smart agri-enterprise of exotic vegetables.
- Establishment of model demonstration unit at the KVK and YSP-UHF campus at Nauni, as centres of learning.
- Evolving marketing linkages through the formation of grower's groups, and branding for enhanced profitability.
- Regular backstopping through mobile advisory for the timely solution of problems being faced by the farmers for cultivation of exotic vegetables.
- Impact assessment, publication of success stories, and development of farmer friendly literature for the benefit of farmers.

### KVK Una

Una district is a submontane low hills. It has a lot of scope for Agriculture/Horticulture development. Maize is the main Kharif crop which is cultivated on an area of 32,157 ha, with a total production of 6,36,320 quintals. Wheat is the main Rabi crop, cultivated on an area of 34,836 ha, with a production of 6,96,670 quintals (2013-14). Vegetable and potato cultivation is being taken up in a big way by the farmers having assured irrigation, thereby, getting good returns per unit area. Since 85% of the farmers have small and marginal land holdings, therefore, there is a need for farmer centric model instead of

corporate model so as to prevent usurpation of subsidies and resources by the big farmers.

To increase the farmers' income, an integrated approach should include strategies with active participation of farmers as well as the State Government,

- There is a need to increase crop productivity, cropping intensity, diversification (cultivation of high value crops like fruits, vegetables and flowers). With Swan river channelization, thousands of hectares of reclaimed land has been put under vegetable cultivation mainly under potato (for table purpose). There is a lot of scope for cultivation of onion, cucurbits, capsicum and tomato under the Hydroponic system. Production of cucumber and lettuce will be a handy tool for doubling the farmers' income in future .
- Affordable and improved storage facilities.
- Livestock farming as an integrated component of farming system.
- Dissemination of information and adoption of cluster approach.
- Adoption of integrated farming system (dairy, poultry, organic manuring, mushroom cultivation and bee-keeping).
- Farm mechanization.
- Protected cultivation (gerbera, capsicum, tomato and cucumber) is being taken up by the farmers in a big way. Sustaining and strengthening of cultivation of these crops requires utmost attention in future.

**Annexure II: Doubling Farmers Income in Himachal Pradesh: The Fact Sheet****Budget Estimates for Major Inputs Needed to Double Farm Income: Approximately ₹ 50,000 Cr)**

Activity	No.of Units	Unit cost (Crores)	Cost (₹ Crores)	Remarks
Micro-irrigation projects	100	100	10,000	Central Govt
Small scale irrigation/ check dams (every 5 to 10 km along the rivers)	500	25	12,500	State/Central Govt
Barrages/check dams across rivers (Khuds), rivulets (Nalas) and springs	10,000	1	10,000	By State Govt.
Water conservation and storage tanks on each farm	50,000	0.1	5000	By the farmers/State Govt, Banks
Seed production and distribution (annual)	10,000 q/year	0.01	500	By the Univ, Line Depts, Seed industry, Farmers
Production and distribution of nursery plants for 5 years	100 Cr plants	0.05	500	By the Univ., Line Depts, Farmers, Private industry
Establishment of orchards	10,000 cr	...	10,000	Farmers, Banks, Govt.
Beekeeping (focus on genetic diversity)	500 units of 100 colonies	0.01	25.00	Uni, Line Depts, Farmers/ Industry, University to focus on diversification of genetic stocks
Mushrooms	250	0.01	25	Farmers, Industry, Govt agencies (50 composting units) University/ ICAR to supply the spawn
Sericulture	50,000 Farm Units	0.01	500	Central Silk Board, State Govt, Private industry and farmers
Medicinal Plants	5,000 units	0.001	5	Farmers, Private Industries
Food Processing (Small, medium, household units)	100 units	0.1	10	Private Industry, Farmers and Govt. Agencies
Transport and storage	Road connectivity	Storage facility	Processing and drying	Govt., Private Industry
Marketing	e-marketing	Market yards	Direct marketing by the farmers	Remove the middle men on the lines of <b>Ryuthu Bazars</b> in Andhra Pradesh
Training and Development	(5,000)	0.001	500	Uni/Line Depts
*Research and Development for backstop	2 Uni		500	Technological backstopping and address the newer problems

Returns to investment in R&D in Agriculture/Horticulture stores over the next 25 years (5 times the investment, ₹ > 10 billion).

\* Special funding for target areas to be provided by the State Govt to the Universities to provide seeds and seedlings to the farmers for doubling the farm incomes.

