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**ROLE OF OFF-SEASON VEGETABLES IN THE  
DEVELOPMENT OF HILL AGRICULTURE  
IN HIMACHAL PRADESH, INDIA**

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**S. C. Tewari**

This paper was a part of this series of studies commissioned by ICIMOD, and was also presented at the Workshop on 'Agricultural Development in Himachal Pradesh', better organised jointly by ICIMOD in collaboration with the Agro-economic Research Centre (AERC), Himachal Pradesh University, Shimla, in April 1988. The specific issues that are discussed in this paper concern the role of off-season vegetables in the context of agricultural development in the hills of Himachal Pradesh.

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Employment Potential

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## I. INTRODUCTION

With the rapidly rising pressure on the natural resources in the hill and mountain areas both for providing subsistence to the local population and to generate ingredients for the material well-being of the society in general, the associated demands on different resources have not only become more intense but complex also. Pressures have also been naturally felt on the local environment and social patterns of the areas and interactions among these have increasingly become consequential. Such situations, in turn, have generated some of the most vexing aspects of human predicaments in the hills. Population in the hills at present is facing the most challenging situation of all times as the hills are fast losing their ecological balance owing to ever increasing economic and human pressures. Much of this has been the result of the unplanned development programmes initiated in many of the hill areas without taking into account their geographical, ecological, agro-climatic, and socio-cultural structures.

Failure to take into account the special problems and needs of hill areas, in the formulation and implementation of the various programmes, have resulted in a distortion of hill economic profiles. Almost all the hill areas in the sub-continent represent a special case of economic backwardness which requires the immediate attention of the planners. The problems of economic backwardness in the hill areas stem from their peculiar geographical conditions. To achieve the objective of accelerated development it is essential to understand the wide range of factors which are responsible for this backwardness, which include special geographical features, highly dispersed population, the near absence of agricultural and general economic diversification, meagre infrastructural facilities, institutional and other related problems.

Himachal Pradesh, among all the hill areas of the Hindu Kush-Himalayan Region, is looked upon as a model for development, where gains of scientific research have percolated to the scattered fields over a vast and undulating terrain. When the State of Himachal Pradesh came into existence in India in 1948, there was hardly anything to guide the amelioration of the hill farmers. Whatever, planning models and research results were available at that time, were mostly relevant to only the plains. During the last three decades, the scientists and the planners were able to work out a developmental model which laid emphasis on opening up of hitherto inaccessible areas for most productive use of hill lands, mostly horticultural enterprises. This model of development has revolutionised agriculture in the State, the name of which has now become synonymous with apple cultivation. Even before apple cultivation was made a widely practised avocation, seed potato production had been developed as a viable economic activity in the mid/higher hills and by producing disease free seed potato in virus free altitudes, Himachal Pradesh helped the entire nation in diversifying agriculture. Even after the development of seed plot techniques for producing seed potato in the plains, the importance and value of seed potato growing in the State has remained the same.

The third dimension to agricultural development in the State was added when a summer season vegetable programme was introduced two decades ago. The steadfastness with which vegetable production was pursued in the State can be seen from the fact that while hardly 30,000 tons of summer vegetables were produced during 1966, more than 312,000 tons of the vegetables were grown during 1985. About 0.2 million small and marginal farmers were engaged in vegetable growing, and as such, almost 1/4th of the total population is directly or indirectly benefited by it. According to an estimate, Himachal Pradesh farmers supplied fresh vegetables worth Rs 500 million to the rest of the country, generating an economic activity of over Rs 2000 million.



This report in the next section provides a brief profile of the agricultural sector of Himachal Pradesh with emphasis on research and development efforts in the field of off-season vegetables. Based on a sample survey, Section III analyses production aspects of off-season vegetables with focus on cultivation practices, employment potential, and economic and financial returns. Vegetable markets and marketing aspects are examined in Section IV while Section V summarises the major problems facing off-season vegetable growers in respect to both production and marketing. Strategies and recommendations for the future are set out in the concluding section.

## **II. AGRICULTURAL PROFILE OF HIMACHAL PRADESH**

### **Agro-climatic and Economic Factors in Vegetable Growing**

In several parts of Himachal Pradesh, which is an important constituent of the Western Himalayan Region, the agro-climatic conditions are conducive to the production of off-season vegetables. Capsicum, tomatoes, peas, beans, cole crops, and cucumbers are the important vegetable crops being successfully grown in the State in the season when their supply from the plains of Northern India is almost nil. This offers a captive market for these crops in the towns and cities of Punjab, Haryana, Western Uttar Pradesh and Delhi itself. Thus the State of Himachal Pradesh has absolute advantage in vegetable production compared to other crops and to other States during the off-season.

On the basis of varied agro-climatic conditions the State can be divided into four zones: sub-tropical, sub-temperate, temperate, and cold/dry. Associated elevation and rainfall conditions are set out in Table 1 together with area coverage and of off-season vegetables grown.

Vegetables play a unique role in developing countries in the economic and social spheres for enhancing income as well as nutritional status of rural masses. The majority of the population in the hills are vegetarian. The consumption of fruits and vegetables estimated in the hilly areas is far below the recommended nutritional standard requirement of 230 grams per day. The low consumption of vegetables and fruits in the hills clearly indicates that the population is suffering from malnutrition. According to the National Commission on Agriculture, the normal requirement of vegetable on the basis of nutritional standard, is 72 kg per capita per annum but the present per capita consumption of India is hardly 15 kg per annum. The Commission has estimated that by 2,000 AD, the country would require about 80 million tons of vegetables which would be raised from an area of about 4 million hectares. This means that vegetable production has to be increased by 5 times from the existing level.

Besides nutritional advantage, vegetable cultivation plays a crucial role in the production pattern of agriculture due to its higher return and employment generation potential per unit of area. For reasons of high population pressure on land, the farming is labour intensive and is likely to continue so because of high rate of population growth. Scale economies are small in labour intensive agriculture and there is not much pressure towards large scale farms.<sup>1</sup> In the hills due to small size of holdings, availability of labour is in abundance and it can be used over a diverse set of enterprises. Vegetable cultivation is one such enterprise. Subrahmanyam (1983) emphasised that adoption of vegetable cultivation by marginal and small farmers not only increases their income but also offers good potential for additional direct and indirect employment.

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1. Heady, E. D., Economic and Social Conditions Relating to Agriculture and its structuring to year 2000, CARD Miscellaneous report. The Centre for Agricultural and Rural Development, Iowa State University, Ames, Iowa, 50011:2.



**Table 1: Agro-climatic Zonation for Off-season Vegetable Production in Himachal Pradesh**

Zone	Elevation (a.m.s.l. in metres)	Rainfall	Area covered	Important off-season vegetables grown
Sub-tropical	0365-0914	600-1000	Una, Hamirour, adjoining areas of Kangra, Chamba, Solan Sirmaur and the valley areas of Mandi District.	
Sub-temperate	0914-1543	900-1000	Mid-hills of Kangra, Mandi, Kullu, Solan, Sirmaur, adjoining areas of Shimla with Mandi, Kullu, Solan and Sirmaur districts.	Tomato, capsicum, beans, peas.
Temperate	1523-2742	900-1000	More than 90 per cent of Kullu & Shimla districts. Ten to 20 per cent of Sirmaur Kangra, Mandi, and Chamba	Cauliflower, cabbage, beans, peas, radish, turnip and carrot.
Cold & dry	1523-3656	250-400	Lahaul-Spiti, 98 per cent of Kinnaur, Pangi and Bharmaur tehsils of Chamba, Bara & Chata Bangal of Kangra District.	Peas, cabbage, and onion.

### Structure of Agriculture and Role of Vegetables

The Economy of Himachal Pradesh is dominated by the agricultural sector. More than 80 per cent of the population of the State depends upon agriculture for its livelihood. It provides direct employment to 71 per cent of the working population of the State. The share of the agricultural sector in net domestic product is more than 43 per cent, of which the farm sector alone contributes about 27 per cent. Nearly 77 per cent of the farmers in the State have less than 2 ha of holdings, covering 33.62 per cent of total operated area. Holdings above 2 ha contribute more than 66 per cent of the total operated area. The average size of holding comes to 1.6 ha. The net sown area which is an indicator of effective utilization of land, accounted for 18.5 per cent of the total geographical area and it increased at 0.36 per cent annum during the last 17 years. Foodgrains dominate the scene in the cropping pattern followed by fruits and vegetables. The cropping intensity is calculated at 170.6 per cent. The area under vegetables excluding potatoes increased from 4,692 ha in 1976/77 to 11,490 ha in 1985/86 i.e. about 145 per cent (Table 2).

**Table 2: Change in Area Under Vegetables in Himachal Pradesh, 1976/77 to 1985/86**

(Area in hectare)

District	Years		Percentage change over 1976/77
	1976/77	1985/86	
Lahaul-Spiti	10	343	3330
Mandi	355	2559	620
Kinnaur	40	153	282
Solan	916	2975	224
Sirmaur	189	583	208
Kullu	350	731	108
Shimla	1424	2910	104
Una	221	372	68
Bilaspur	123	143	16
Kangra	473	546	15
Chamba	159	52	-67
Hamirpur	432	123	-71
Himachal Pradesh	4692	11490	145

Source: Directorate of Land Records, Shimla.

During the last ten years, the area under vegetables increased in all the districts of Himachal Pradesh except Chamba and Hamirpur. Lahaul-Spiti, which hardly grew any vegetables in the mid-1970s, recorded the highest increase in the area of vegetables in relative terms (more than thirty times) during this period. In the case of Mandi, the increase was more than seven times and five other districts more than doubled or trebled their areas cultivated with vegetables during the reference period. The leading districts in 1985/86 were Solan, Shimla, and Mandi (each having more than 2,500 ha) followed by Kullu, Sirmaur, and Kangra. These very considerable and widespread increases were achieved as a result of concerted efforts by the Government and the university in educating the farmers in off-season vegetable cultivation and supporting these efforts through research and development activities.

### Research and Development in Off-season Vegetables

#### *Historical Overview*

At the time of the formation of Himachal Pradesh in 1952, vegetable crops were grown for domestic and local markets only. Mr. Edward Buck (1984) had chronicled in his book 'Shimla, Past and Present' that only a very few farmers around Shimla grew vegetables then and that, they sold them to the Britishers who lived in Shimla in those days. Even during 1962, only a few hundred tons of fresh vegetables were taken to Shimla for marketing. By 1966, vegetable production had come to be acknowledged as a good cash crop in the mid-hills and about 30,000 tons of fresh vegetables were produced in the State in that year. By 1987/88 vegetable production had increased to 0.35 million tons.



Keeping in view the importance of the European type of vegetables, the Government of India in 1949 started the Central Vegetables' Breeding Station in Kullu Valley which is now known as I.A.R.I. Regional Station, Katrain. This station is located about 25 kms from Kullu Town on the Kullu-Manali road at an altitude of 1500 metres a.m.s.l. Three farms namely, Naggar, Bara gaon, and Sarasi are in the purview of this centre. These three farms are isolated from one another by a distance of about 2-3 kms. The Centre and the farms contributed greatly to the expansion of off-season vegetables' production in Kullu District and solved many of the problems of the vegetable growers in the fields of entomology and pathology. The Centre has also developed a large number of improved varieties of off-season vegetables, either by using traditional breeding techniques or the selection of new strains based on germ plasm collected from various places.

The Himachal Government on its part established a vegetable research station at Parala, Theog Tehsil, Shimla District in 1957. This station was headed by a Vegetable Botanist and its main aim was to evaluate vegetable crops suitable for the agro-climatic zones of Himachal Pradesh. In 1959, another research station was started at Solan with the aim to produce, test, and disseminate suitable varieties of vegetable crops. In 1961, a centrally sponsored scheme entitled, 'Production of Foundation Seeds of Temperate Vegetables at Kalpa' was started. In 1973, the research work was transferred to the Agricultural University and during the last one decade the University Scientists have worked on the various aspects of vegetable production, new varieties, disease and pest control, water management, etc.

#### *Development of New Varieties and Seed Production*

The Vegetable Department of the University has been able to make selections and develop suitable varieties of temperate and sub-temperate vegetables such as peas, tomatoes, cauliflowers, beans, cabbages, carrots, turnips, radishes, etc. The new varieties recommended for cultivation on the basis of the research conducted by the University are as follows:

Peas: Lincoln - is a dwarf, high yielding variety having dark green colour, swork shaped, and well filled grains.

French beans: SVM 1 is resistant to angular leaf spot and high yielding.

Tomatoes: Yashwant is fairly field resistant to Buck eye rot. It resembles Solan Gola in other characters.

Chillies: Pachhad Yellow - is field resistant to Anthracnoss and is high yielding.

Okra: Selection 6-2 - is fairly field resistant to yellow vein mosaic and is high yielding.

Seed production techniques in temperate vegetables have been standardized in cauliflowers, cabbages, carrots, sugarbeet, and chickory. New varieties are replacing the old varieties grown by the vegetable farmers in the State.

Besides this, the Department of Agriculture of the State as well as the University are actively involved in the production of breeder seeds and their multiplication. At present four Government farms in the State are involved in vegetables seed production.



## *Pest and Disease Control and Extension Services*

In the field of pest and disease management, the University has been able to solve many problems of vegetable farmers. Buck-eye-rot (*Phytophthora nicotianse ver pasaitica*) is an important fruit disease of tomatoes. This disease is controlled by adopting cultural methods and spraying with mancoreb (0.25%) + Benzimidazola (0.02%) or Bordeaux mixture at 8 to 10 days interval. Similarly, diseases of capsicums, beans, cauliflowers and peas are being effectively controlled by the farmers based on the research conducted by the University.

Keeping in view the nature of vegetable crops and the cost structure, the Department of Entomology has developed a new system of Integrated Pest Management (IPM) which is becoming popular among the vegetable growers.

To disseminate modern techniques of off-season vegetable production and to solve problems regarding the control of pests and diseases in the vegetable growing areas, the Government of Himachal Pradesh has appointed two Agricultural Inspectors in each block. One of these has the responsibility of providing technical knowledge on agronomic practices and the supply of fertilizers and improved vegetable seeds, the second inspector is wholly and solely responsible for providing guidance to the vegetable growers in the field of plant protection and for the distribution and sale of plant protection materials. Recently, the Government has also started paying more attention to marketing aspects but much remains to be done in this area.

### **III. CULTIVATION OF OFF-SEASON VEGETABLES**

#### **Methodology of Assessment and Main Findings**

This portion of the paper is based on the quick survey of 40 off-season vegetable growers spread over Solan and Shimla districts of the State. Selected off-season vegetable growers have been sub-divided into three categories marginal (having less than 1 ha of operational holding), small (1-2 ha), and farms having more than 2 ha. The land utilization pattern of sampled farmers indicated that marginal farmers are putting more area under vegetables than small farmers and those having more than 2 ha of operational holding. Multiple cropping index and relative vegetable crop index were also found to be higher on marginal farms. Diversification of cropping pattern to avert risk and uncertainty is the main reason for a lower proportion of area under vegetable crops. Marginal farmers are putting more area under vegetables to have more income as well as to provide more employment to the family members [Table 3(a)].

Among the various off-season crops grown by the sampled farmers, tomatoes occupy prime position followed by peas, capsicums, and french beans. Proportionate area under these crops, except capsicums, has not indicated any definite pattern associated with the size of holding (Table 3(b)). Analysis of the cropping patterns followed by the sampled households indicated that farmers are still following the traditional subsistence agriculture by retaining 70 per cent or more of their land under food crops even in the high potential off-season vegetable growing pockets. This means that there is still considerable scope for future expansion of vegetable cultivation (and resulting increases in employment and income) in the future.



**Table 3(a): Land Utilization and Cropping Pattern Followed by Sample Farmers**

Particulars	Marginal Farms	Small Farms	More than 2 ha.
<b>A. <u>Area under (Percentage):</u></b>			
1) Cultivation	68.99	69.07	58.28
2) Orchard	1.55	7.81	6.98
3) Ghasni	28.68	19.78	30.28
4) Fallow	0.78	3.34	4.46
Total Area (in ha.)	1.00	2.00	5.04
<b>B. <u>Irrigated area (%)</u></b>	15.87	21.31	14.21
<b>C. <u>Distribution of cultivated area between arable crops (%)</u>:</b>			
1) Food crops	71.92	75.70	70.67
2) Off-season vegetable crops	20.09	15.25	17.87
3) Other crops	7.99	9.05	11.46
<b>D. <u>Multiple cropping index</u></b>	162.12	158.87	159.31
<b>E. <u>Relative Vegetable Crop Index</u></b>	32.43	24.26	28.69

- (i) Relative Vegetable Crop index =  $\text{MCI} \times \text{percentage area under crop or Total area under off-season vegetable crop.}$   
Net area sown = 100.

**Table 3(b): Share of Vegetable Species in Total Area under Off-season Vegetables**

(In percentage)

Crop/size of farm	Marginal	Small	Medium
1. Tomato	44.74	48.12	51.14
2. Peas	40.44	38.17	40.13
3. Capsicum	12.66	4.17	2.17
4. French beans	2.16	3.68	1.71
5. Cabbage	-	3.73	2.10
6. Cauliflower	-	2.13	2.75

Information on the types and varieties of vegetable crops grown, their sowing and harvesting seasons, and supply position in the terminal market has been summarised in Table 4. Assessment of the table indicates that except for tomatoes, and here too for an only brief period between 15th July to 15th August, there is no competition in the domestic and outside markets. Thus, Himachal farmers are assured of remunerative prices for their off-season vegetables.

### **Cultivation Practices**

Off-season growers in the study area prepared the field according to the requirement of vegetable crops concerned. Generally, they plough the land three to four times by using a traditional plough followed by planking. Before starting the last ploughing they spread well-prepared farm yard manure and basal dose of chemical fertilizers particularly superphosphate and potash. They transplant/sow their vegetables according to the recommended distance. In the case of transplanted crops, they are watered twice a day till the plants are established properly, thereafter irrigation is given according to the need and availability of irrigation water.

*Makhan* Beans (French Beans) are generally grown as an inter-crop with tomatoes (irrigated) to have an additional income. This practice is generally followed in irrigated areas after having 3 to 4 pickings of tomatoes. Beans are sown in between the lines of tomatoes in the month of July to the first week of August and the farmers save labour to be used for staking as well as on field preparation. Besides this, it helps in enhancing soil fertility by nitrogen fixation.

Input use: Farmers of the area are not applying the recommended doses of farm yard manure and chemical fertilizers as is evident from Table 5. The reasons for not adopting the recommended dose of farm yard manure is non-availability of it in the desired quantity and they prefer to apply the available FYM on each and every field they own. Lack of finance is reported to be one of the main constraints for fuller adoption of chemical fertilizers and FYM. Besides this, non-availability and lack of technical knowledge is also responsible for this state of affairs. Although farmers are conscious about the protection of their vegetable crops from pests and diseases, they fail to achieve the desired goal even after spending a good amount of money on it. Lack of technical knowledge about plant protection measures is the main cause of it.

### **Employment Potential**

One of the problems that besets the hill economy is to provide gainful employment to the rural work force. The reasons for rural unemployment in the hills are lack of industrial development, lack of skills, and the absence of proper diversification of farming activities.



Table 4: Off-season Vegetable Crop Species/Varieties Grown Under Irrigated and Un-irrigated Conditions

in Himachal Pradesh

Off-season Vegetable Species	Variety	Irrigated condition		Un-irrigated condition		Market situation in Delhi
		Sowing/ planting	Harvesting	Sowing/ planting	Harvesting	
Tomato	Solangola	Feb-Mar	Jun-Aug	May-June	Aut-Oct	June-mid July no competi- tion - Tomato from Maharashtra & Gujarat mid-July to mid-August competition with Himachal produce. No competition between mid-Aug to Oct.
	Gold Maker	Feb-Mar	Jun-Aug	May-June	Aug-Oct	
	Yaswant (A-2)	Feb-Mar	Jun-Aug	May-June	Aug-Oct	
Capsicum	Californiawonder	Feb-Mar	Jun-Aug	Apr-May	Jul-Oct	No competition
Bean	Contender	Feb-Mar	May-Jul	Jul-Aug	Sep-Oct	No competition
	Kentucky Wonder	Mar-Apr	Jun-Aug	Jun-Jul	Sep-Oct	No competition
	French Bean (Pole)	Feb-Mar	Jun-Aug	Jun-Jul	Sep-Oct	
Peas <u>Mid-hills</u>	Arkal	Aug-Sep	Oct-Nov	Aug-Sep	Oct-Nov	No competition
	Lincoln	Oct-Nov	Mar-May	-	-	No competition
	<u>High-hills</u> Lincoln	November	Jun-Jul	-	-	No competition
	Arkal	Mar-May	Jul-Oct	-	-	No competition
	Arkal	-	-	Jul-Aug	Sep-Oct	
	Kinnauri	Apr-May	Jul-Sep	Apr-May	Jul-Sep	No competition
Cauliflower	<u>Mid-hills</u> Snow king	November	Mar-Apr	-	-	Punjab produce
	Sawan Bhadon	May	Aug-Sep	-	-	No competition
	<u>High-hills</u> Snowball	April	Jul-Sep	-	-	No competition
Cabbage	<u>Mid-hills</u> Pride of India & Golden Acre	Feb-Mar	May-Jun	July	Sep-Nov	No competition
	<u>High-hills</u> Pride of India & Golden Acre	Mar-Apr	Jun-Aug	-	-	No competition
	Large late drum Head	May-Jun	Sep-Oct	Jun-Jul	Aug-Sep	No competition

Source: Survey of the vegetable growing areas in Himachal Pradesh.

**Table 5: Deviation in Actual Use of Farm Yard Manure and Chemical Fertilizer in the Study Area**

Crop	Recommended doses kg/ha				Doses actually applied by farmers (percentage of recommended doses)			
	FYM '000	N	P	K	FYM	N	P	K
Tomato	25	60	30	30	40	67	50	50
Capsicum	25	100	75	50	40	15	13	10
Beans	25	50	100	50	20	-	3	-
Peas	25	25	75	75	20	-	6	-
Cauliflower	20	125	60	30	50	8	17	17
Cabbage	25	125	60	30	40	8	17	17

Source: Packages of Practices for Kharif Crops 1985, Directorate of Extension Education, HPKV, Palampur.

Note: FYM in tons  
N,P,K in kg

Shift in the existing cropping system in agriculture provides ample opportunities for generating employment in rural areas. Expansion of area under off-season vegetables is one of the best propositions in this regard. The labour requirement of off-season vegetables, cereals, and fruit crops grown in the State indicated that on an average human labour requirement for almost all the off-season vegetable crops is higher than that for other crops. Among off-season vegetables, the labour requirement for tomatoes is estimated to be the highest (1016 man-days per ha) and the lowest in case of beans (236 man-days) as against wheat, maize, and paddy which require only 126, 114, and 160 man-days respectively (Fig. 1).

Per hectare requirement of human labour for conducting various farm operations has been estimated and is presented in Fig. 2. Interculture operations provide maximum man-days of employment to the farm families followed by irrigation, plant protection measures, preparatory tillage, and harvesting and sowing in the cultivation of tomatoes. Requirement of human labour has been found to be the highest for performing interculture and harvesting of beans and peas followed by cauliflowers and cabbages. Peas and beans cultivation invariably requires staking and this operation is labour intensive.

This suggests that cultivation of off-season vegetables on commercial scale generates more employment opportunities for the farmers of the hilly areas than the cultivation of cereals and a number of other crops.

**FIGURE: 1**  
**HUMAN LABOUR REQUIREMENT PER HECTARE FOR VEGETABLES AND COMPARATIVE CROPS**

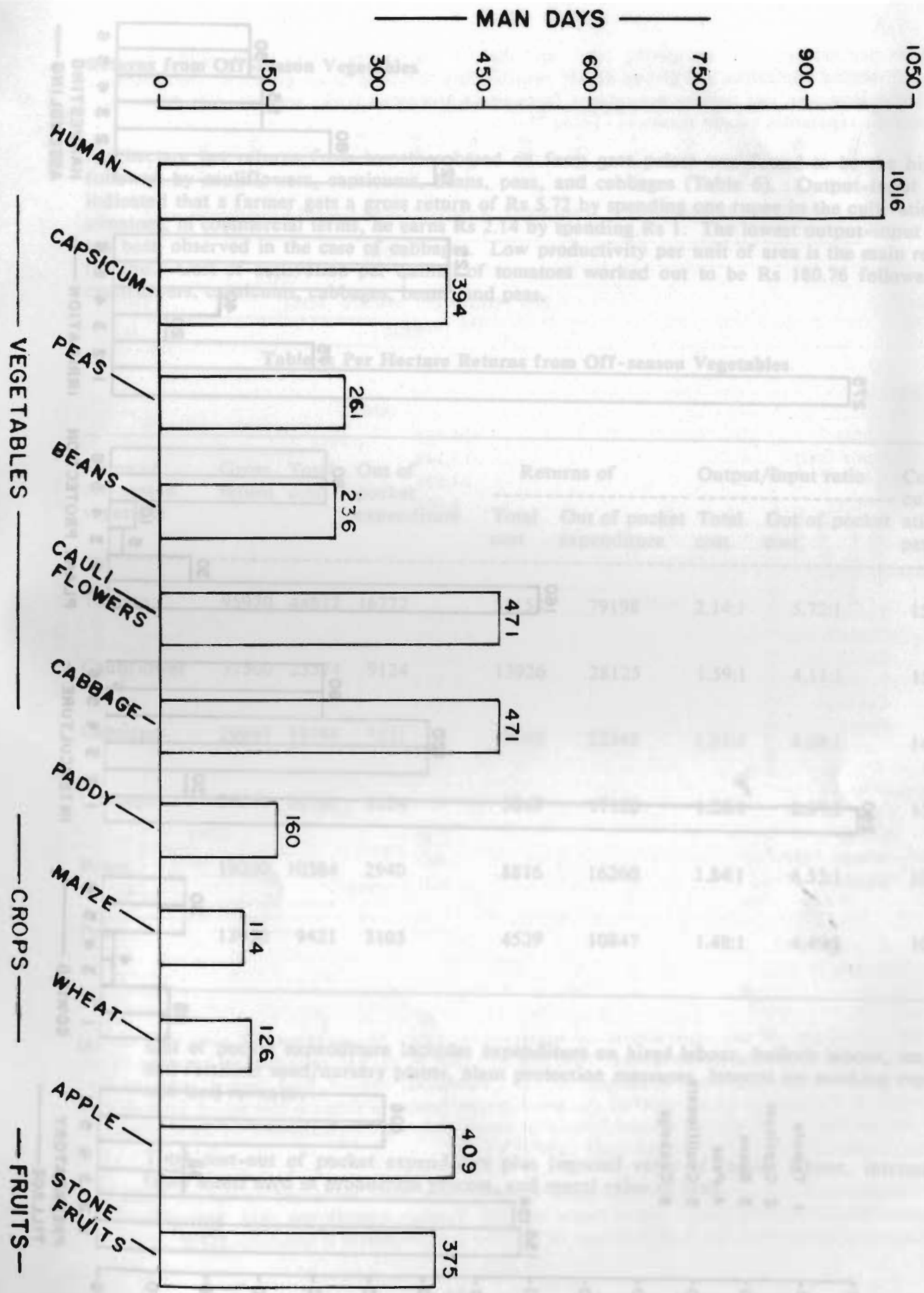
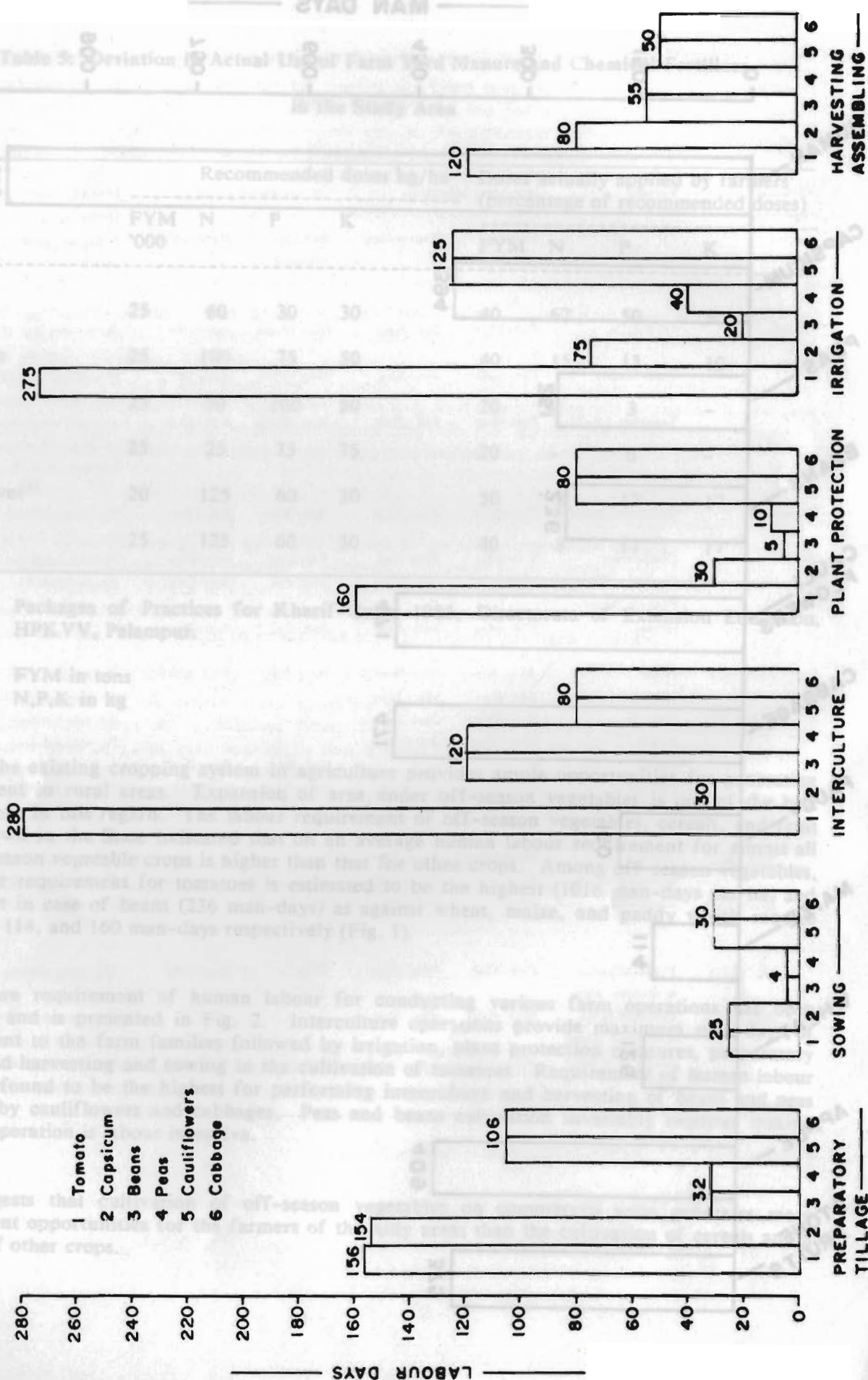




FIGURE: 2 OPERATION-WISE LABOUR REQUIREMENT



## Returns from Off-season Vegetables

Per hectare net returns from tomatoes based on farm gate prices was found to be the highest followed by cauliflowers, capsicums, beans, peas, and cabbages (Table 6). Output-input ratio indicated that a farmer gets a gross return of Rs 5.72 by spending one rupee in the cultivation of tomatoes, in commercial terms, he earns Rs 2.14 by spending Rs 1. The lowest output-input ratio has been observed in the case of cabbages. Low productivity per unit of area is the main reason for this. Cost of cultivation per quintal of tomatoes worked out to be Rs 180.76 followed by cauliflowers, capsicums, cabbages, beans, and peas.

**Table 6: Per Hectare Returns from Off-season Vegetables**

Name of off-season vegetable	Gross return	Total cost	Out of pocket expenditure	Returns of		Output/input ratio		Cost of cultivation per Qtl
				Total cost	Out of pocket expenditure	Total cost	Out of pocket cost	
Tomato	95970	44812	16772	51158	79198	2.14:1	5.72:1	158
Cauliflower	37500	23574	9124	13926	28125	1.59:1	4.11:1	157
Capsicum	29865	19786	7321	10080	22545	1.51:1	4.08:1	146
Cabbage	26250	20761	9124	5849	17126	1.26:1	2.87:1	138
Beans	19200	10384	2940	8816	16260	1.84:1	6.53:1	108
Peas	13950	9421	3103	4529	10847	1.48:1	4.49:1	105

- (a) Out of pocket expenditure includes expenditure on hired labour, bullock labour, manure and fertilizer seed/nursery plants, plant protection measures, interest on working capital, and land revenue.
- (b) Total cost-out of pocket expenditure plus imputed value of family labour, interest on fixed assets used in production process, and rental value of land.

Returns per hectare from competing crops and the off-season vegetables under study indicated that off-season vegetables are giving higher returns than the food crops grown by the farmers of the area. However, per hectare net returns from apple and stone fruits are generally higher than off-season vegetables except tomatoes (Table 7).

**Table 7: Net Returns from Fruit, Vegetable and Cereal Crops**

Crops	Net returns per hectare (in rupees)
<hr/>	
<u>Fruit crops</u>	
Apple	14,586
Stone fruit	13,248
Kinnow	14,056
Orange	8,064
<hr/>	
<u>Vegetable crops</u>	
Tomato	51,157
Cauliflower	13,929
Capsicum	10,079
French beans	8,815
Cabbage	5,489
Peas	4,528
<hr/>	
<u>Cereals</u>	
Maize	230
Wheat	461
Paddy	421

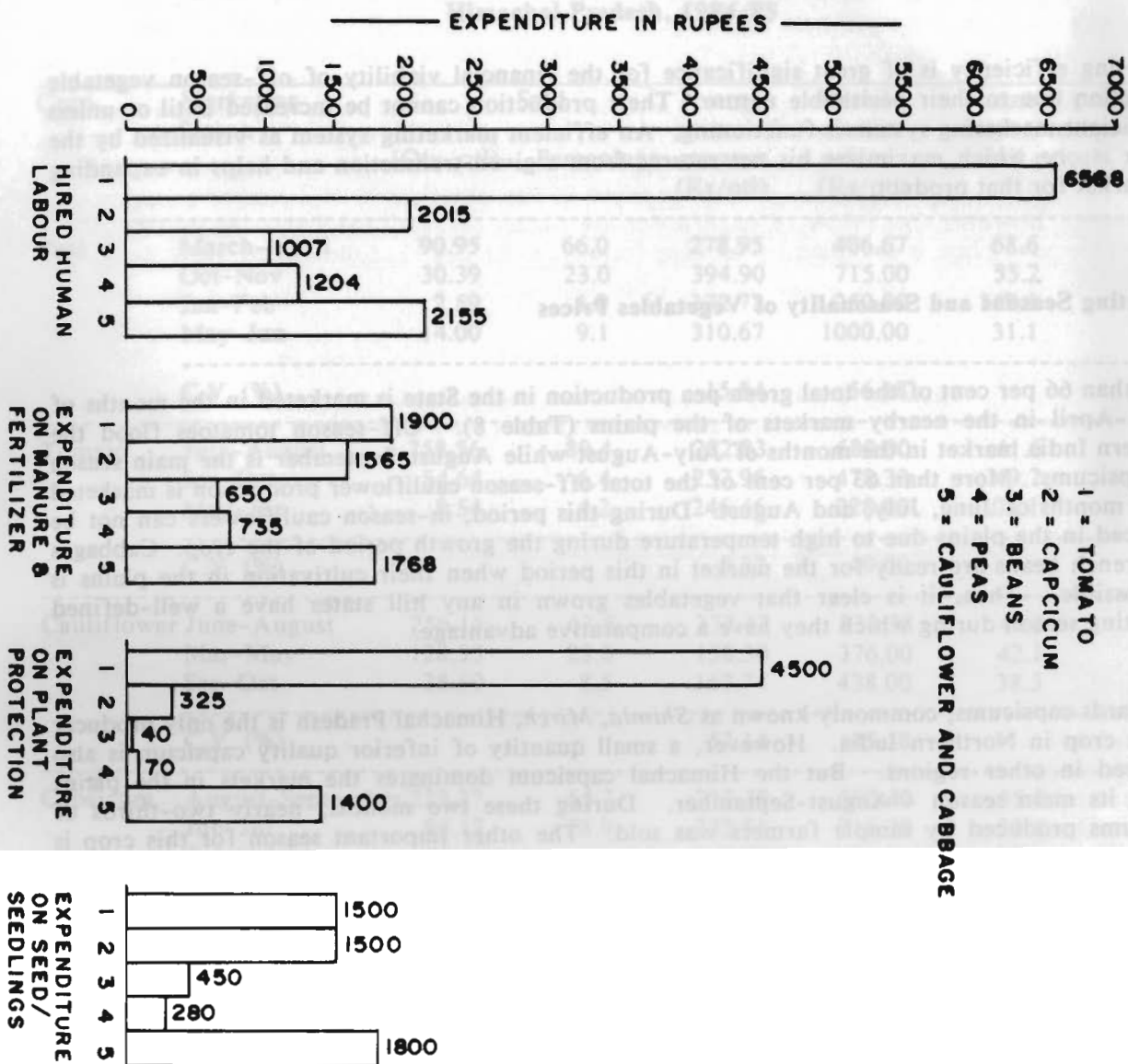
#### *Cost Structure*

In the cultivation of any agricultural or horticultural crop, the quantum of total cost mainly depends on the use of different inputs. Paid out cost (out of pocket cost) ranged between 28 per cent (Beans) and 44 per cent (Cabbage) of the commercial cost of land (rental value of land estimated at the rate of 25 per cent of the gross return from the crop) is the major item of total cost in the case of all the off-season vegetable crops under study, followed by expenditure on labour, material cost, and over head costs (ANNEX).

Per hectare expenditure on plant protection measures has been estimated to be the highest in tomatoes (Rs 4,500) and the lowest in beans (Rs 40). Tomato, cauliflower, and cabbage crops are getting more attention as far as application of manure and fertilizers is concerned (Fig. 3).



FIGURE: 3 OUT OF POCKET EXPENDITURE ON CRITICAL INPUTS



#### IV. MARKETING AND MARKETS OF OFF-SEASON VEGETABLES

Marketing efficiency is of great significance for the financial viability of off-season vegetable production due to their perishable nature. Their production cannot be increased until or unless an efficient marketing system is functioning. An efficient marketing system as visualized by the farmer is one which maximizes his net returns from a given transaction and helps in expanding the market for that product.

##### Marketing Seasons and Seasonality of Vegetables Prices

More than 66 per cent of the total green pea production in the State is marketed in the months of March-April in the nearby markets of the plains (Table 8). Off-season tomatoes flood the Northern India market in the months of July-August while August-September is the main season for capsicums. More than 63 per cent of the total off-season cauliflower production is marketed in the months of June, July, and August. During this period, in-season cauliflowers can not be produced in the plains due to high temperature during the growth period of the crop. Cabbages and French beans are ready for the market in this period when their cultivation in the plains is not possible. Thus, it is clear that vegetables grown in any hill states have a well-defined marketing season during which they have a comparative advantage.

As regards capsicums, commonly known as *Shimla, Mirch*, Himachal Pradesh is the only producer of this crop in Northern India. However, a small quantity of inferior quality capsicum is also produced in other regions. But the Himachal capsicum dominates the markets in the plains during its main season - August-September. During these two months, nearly two-thirds of capsicums produced by sample farmers was sold. The other important season for this crop is reported to be June-July when 29 per cent of the quantity was sold. The third minor season is reported to be October.

##### Seasonality of Vegetables Prices

It is common knowledge that the prices of vegetables change frequently, and no price rules the market for more than a few days. Sometimes, the prices change so abruptly that it causes much discontentment both to the producers and consumers. The demand for vegetables in general is more or less constant and the prices depend largely on the market arrivals. They are lowest when the market arrivals are high and vice versa. This is so because vegetables are highly perishable and cannot be stored for long. However, in the case of off-season vegetables of Himachal Pradesh the prices of different vegetables do not reveal wide variations (Table 8). The coefficient of variation in prices of peas realized by farmers in different seasons is observed to be 15.84 per cent. As regards the other three selected vegetables, the highest variation in prices is observed in cauliflowers (52.14%). The least seasonal variation is observed in capsicum prices (7.02%) followed by 9.32 per cent in tomatoes.

It may be seen from the Table 8 that retail prices i.e. consumer prices for all the vegetables are much higher than the prices received by the farmers. The maximum differences are observed for the May-June season pea crop in which farmers realized only 31 per cent of the market price.

**Table 8: Marketing Seasons and Price Received by Sampled Growers of Himachal Pradesh, 1984/85**

Crop	Marketing Season	Sold		Average prices of growers (Rs/ctl)	Retail market prices (Rs/ctl)	Farmers' price as percentage of retail price
		(Qty. ctl)	Percentage			
Peas	March-April	90.95	66.0	278.95	406.67	68.6
	Oct-Nov	30.39	23.0	394.90	715.00	55.2
	Jan-Feb	2.59	1.9	372.72	250.00	149.1
	May-Jun	14.00	9.1	310.67	1000.00	31.1
	C.V. (%)			15.84	56.18	
Tomato	July-August	758.56	89.4	282.83	680.00	41.6
	Sep-Oct	54.64	6.4	237.96	478.33	49.7
	May-Jun	8.54	4.2	246.46	228.00	108.1
	C.V. (%)			9.32	49.00	
Cauliflower	June-August	256.15	63.5	373.43	833.33	44.8
	Mar-May	128.53	28.0	158.30	376.00	42.1
	Sep-Oct	38.69	8.5	167.74	438.00	38.3
	C.V. (%)			52.14	45.18	
Capsicum	August-September	223.27	65.7	217.39	392.40	55.4
	Jun-Jul	94.17	28.9	222.55	316.30	70.4
	October	18.44	5.4	247.48	409.27	60.5
	C.V. (%)			7.02	13.29	

Source: Prices quoted from Bulletin of Agricultural Prices, New Series, Vol. XXXIV & V (July-June), 1984/85. Directorate of Economics & Statistics, Ministry of Agriculture & Rural Development, Government of India.

C.V. = Coefficient of variation.

However, during the Jan-Feb season the quantity marketed is low (i.e. 1.9%) but growers realized 49 per cent higher prices than the retail market prices. This may be due to the quality of the peas from Himachal Pradesh as compared to those from the plains. During this period the arrival of plains' peas is in full swing. The same picture is also observed in the case of tomatoes in the May-June season. However, the difference in price is only 8 per cent. In the other two seasons i.e. July-August and Sept-Oct the difference in prices is much more than in the May-June season. In the case of cauliflowers, the difference between growers' prices over retail market prices in all the three seasons varies from 38 to 45 per cent. The least variation in prices is observed in the case of the capsicum crop. This may be explained by Himachal Pradesh's monopoly in producing this crop. The highest price variation is observed for peas i.e. 56.18 per cent followed by tomatoes i.e. 49 per cent and 45.18 per cent in cauliflowers. Here, it may be concluded that higher price variations may be due to competition from the plains' vegetables during their harvesting season.



## Target Markets and Price Variability

Prices received by sampled farmers in different vegetable markets are set out in Table 9. As can be seen from the Table, prices realized (or received) by them reveal an inverse trend to the size of farms i.e. as the size increases, prices decline for most of the vegetables. For peas Rs 377.43 were received by sample farmers of marginal farms, Rs 338.75 per Qtl for small farms, and Rs 335.17 per Qtl for medium farms. The same trend is also observed in the case of tomatoes and capsicums. However, the prices of cauliflower are higher on marginal farms i.e. Rs 251.20 per Qtl and the next place is occupied by medium farms (i.e. Rs 228.12) followed by small farms (Rs 218.08/Qtl).

**Table 9: Average Prices of Selected Vegetables of Sampled Growers in Different Markets (1984-85)**

	(Rs/Qtl)			
Size of Farm/Market	Peas	Tomato	Cauliflower	Capsicum
<b>Marginal</b>				
Delhi	487.00	343.46	323.72	227.19
Shimla	427.31	302.49	286.12	339.00
Chandigarh	-	380.77	-	-
Other markets	347.50	325.00	-	165.00
Local sale	247.92	221.94	143.75	225.26
Average	377.43	314.73	251.20	239.11
C.V. (%)	27.43	18.83	37.79	30.35
<b>Small</b>				
Delhi	-	304.81	304.09	239.13
Shimla	361.01	221.18	200.00	220.31
Chandigarh	-	364.00	-	223.00
Other market	400.00	299.00	-	252.00
Local sale	253.76	177.69	150.15	190.86
Average	338.26	273.34	218.08	225.58
C.V. (%)	22.39	26.97	36.02	11.77
<b>More than 2 ha.</b>				
Delhi	-	274.54	286.85	185.80
Shimla	459.52	-	-	-
Chandigarh	300.00	284.93	-	253.63
Other markets	-	-	-	-
Local sale	246.00	260.55	169.38	-
Average	335.17	248.00	228.12	219.72
C.V. (%)	33.12	28.75	36.41	21.83

Note: Weighted prices are given for all the vegetables in different markets realised by sampled farmers.

Regarding the prices realized by sampled farmers in different vegetable markets, Delhi market is paying the highest prices for peas; however, the quantity sold is only 0.69 Qtl. This fact establishes the hypothesis that Delhi is the appropriate market for Himachal peas. For tomatoes, Chandigarh market is paying higher prices followed by Delhi and Shimla markets. This reveals that the tomato crop has three important markets for disposal. The Shimla market is paying higher prices for capsicums which may be due to longer shelf life of capsicums in the cold climate of Shimla, as a result of which sellers have better margins between purchase and sale prices of this commodity. As regards cauliflowers, the Delhi market paid higher prices as compared to other markets. This may be due to the high prices of off-season cauliflowers, which can be afforded only by higher income consumers, who are numerous in a metropolitan city such as Delhi. In local sales, prices of all the vegetables are not much lower as compared to other markets.

### *Point of Vegetable Sale*

The quantity of produce actually marketed depends upon the marketable surplus, immediate need for cash, price trend, nature of crops, and availability of storage facilities. Ninety per cent of the total production of tomatoes, capsicums, cabbages, and cauliflowers is marketed while less than seventy per cent of the beans and peas production enter the market. The seasons for this trend is the higher domestic demand for peas for consumption as well as for seed. Ninety four per cent of the total marketed surplus of capsicum is sold outside the village followed by tomatoes (90%), cauliflowers and cabbages (76%) and peas and beans (56%).

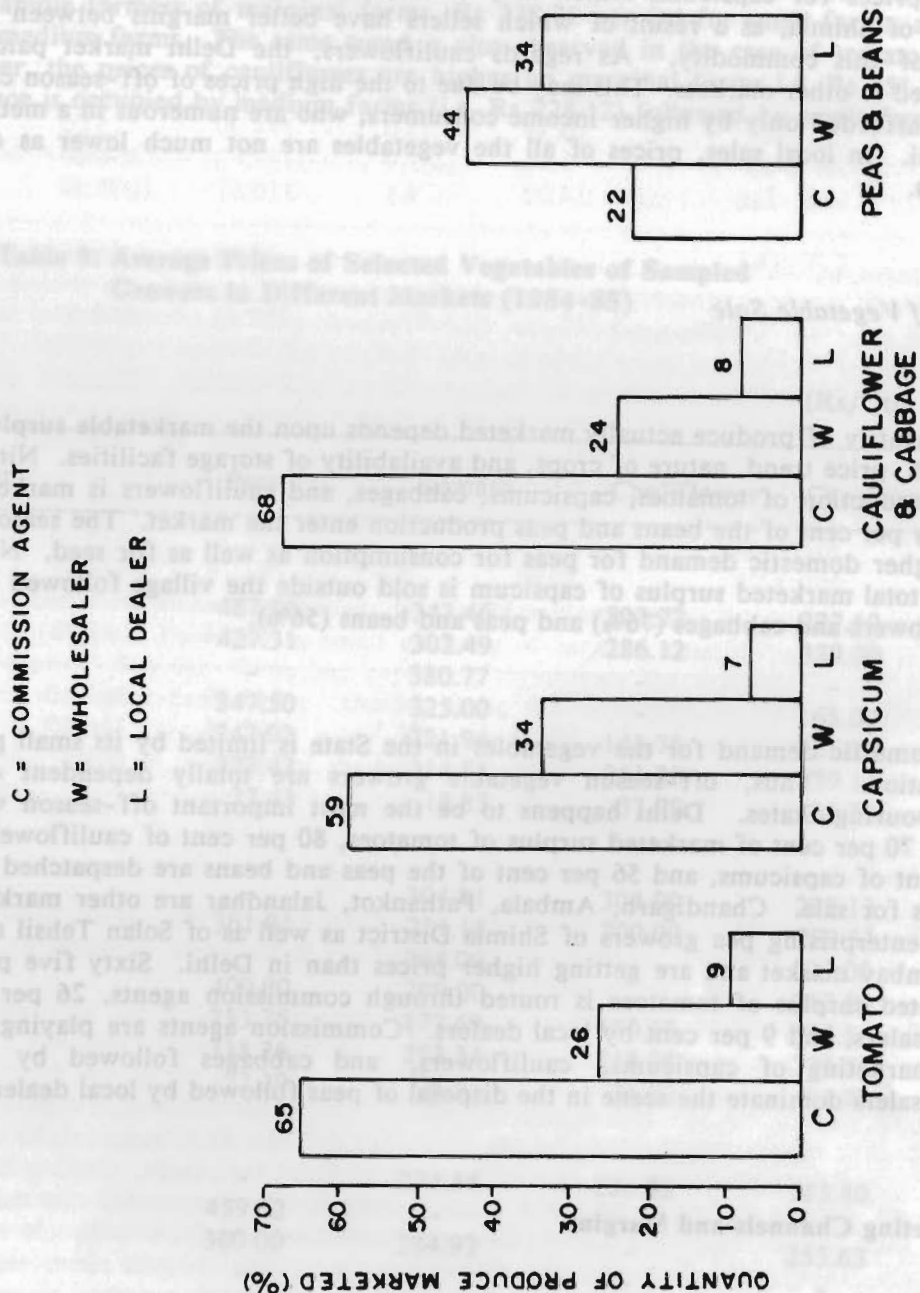
The domestic demand for the vegetables in the State is limited by its small proportion of urban population. Thus, off-season vegetable growers are totally dependent on the markets of neighbouring States. Delhi happens to be the most important off-season vegetable market to which 70 per cent of marketed surplus of tomatoes, 80 per cent of cauliflowers and cabbages, 68 per cent of capsicums, and 56 per cent of the peas and beans are despatched by farmers or local traders for sale. Chandigarh, Ambala, Pathankot, Jalandhar are other markets for these crops. Some enterprising pea growers of Shimla District as well as of Solan Tehsil are dispatching peas to Bombay market and are getting higher prices than in Delhi. Sixty five per cent of the total marketed surplus of tomatoes is routed through commission agents, 26 per cent is handled by wholesalers, and 9 per cent by local dealers. Commission agents are playing a dominant role in the marketing of capsicums, cauliflowers, and cabbages followed by wholesalers, while wholesalers dominate the scene in the disposal of peas followed by local dealers (Fig. 4).

### **Marketing Channels and Margins**

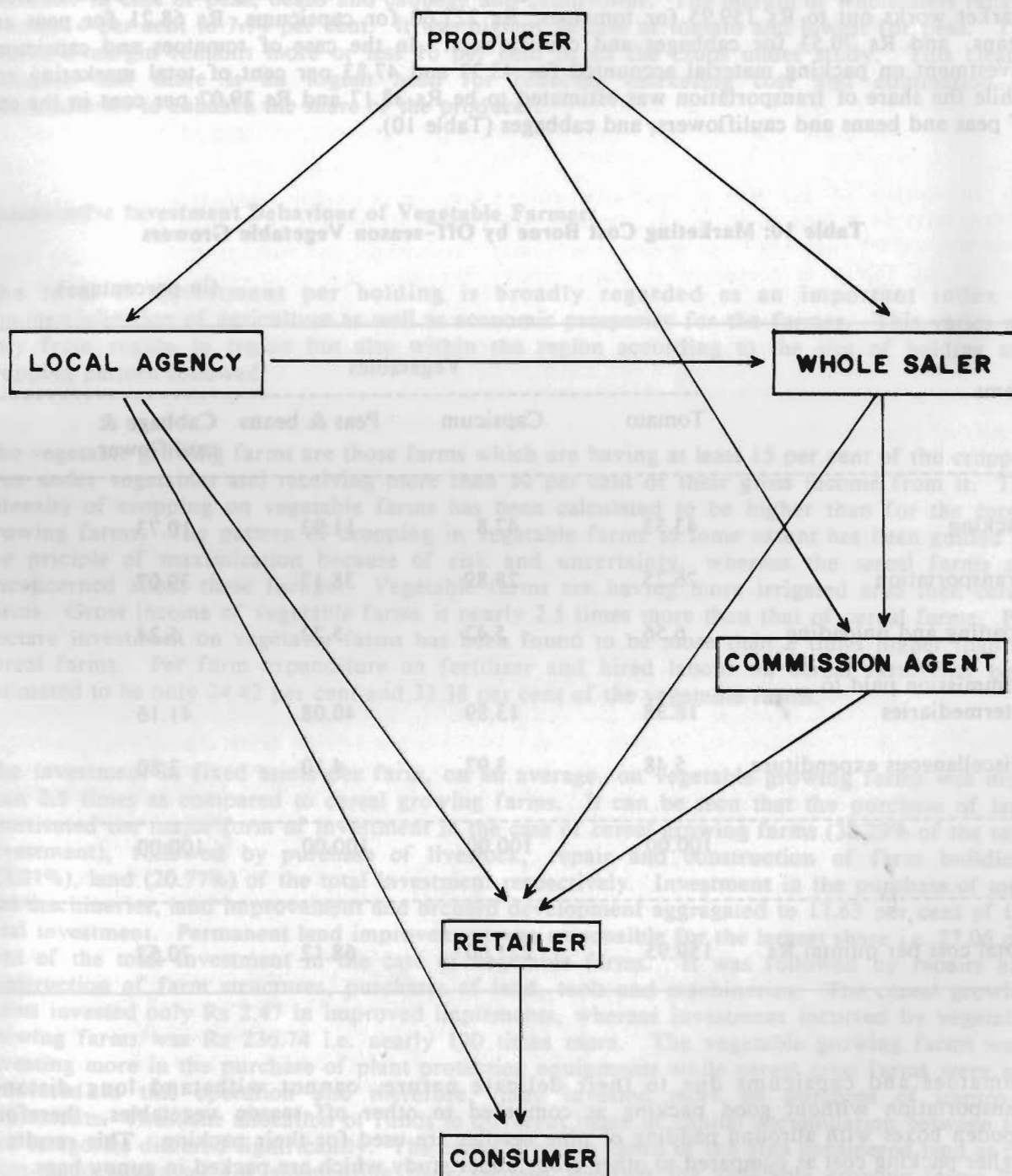
The sequences through which produce reaches the final consumers are termed as marketing channel. The various marketing channels that exist for marketing of off-season vegetables are presented in (Fig. 5).



FIGURE: 4 DISPOSAL BEHAVIOUR OF OFF-SEASON VEGETABLE GROWERS



**FIGURE: 5 MARKETING CHANNEL OF OFF-SEASON VEGETABLES IN HIMACHAL PRADESH**



## Marketing Costs

No matter who performs the functions of marketing or how they are organised, each operation of marketing costs. Main items of marketing costs in the case of off-season vegetables are transportation, commission, loading and unloading and miscellaneous expenditures. Per quintal cost of marketing borne by the off-season vegetable growers for selling their produce in Delhi market works out to Rs 159.95 for tomatoes, Rs 221.60 for capsicums, Rs 68.21 for peas and beans, and Rs 70.53 for cabbages and cauliflowers. In the case of tomatoes and capsicums, investment on packing material accounted for 43.33 and 47.83 per cent of total marketing cost while the share of transportation was estimated to be Rs 38.17 and Rs 39.07 per cent in the case of peas and beans and cauliflowers, and cabbages (Table 10).

**Table 10: Marketing Cost Borne by Off-season Vegetable Growers**

(in percentage)

Items	Vegetables			
	Tomato	Capsicum	Peas & beans	Cabbage & cauliflower
Packing	43.33	47.8	11.93	10.73
Transportation	26.25	28.89	38.17	39.07
Loading and unloading	6.56	5.42	5.72	5.24
Commission paid to intermediaries	18.38	13.89	40.08	41.16
Miscellaneous expenditure	5.48	3.97	4.10	3.80
	100.00	100.00	100.00	100.00
Total cost per quintal Rs	159.95	221.60	68.12	70.53

Tomatoes and capsicums due to their delicate nature, cannot withstand long distance transportation without good packing as compared to other off-season vegetables, therefore, wooden boxes with allround padding of pine needles are used for their packing. This results in higher packing cost as compared to other crops under study which are packed in gunny bags.



## Marketing Margins

The share of the producer in the consumer's rupee was 41 per cent and 31.25 per cent for tomato and capsicum crops respectively. The share was more than fifty per cent of the price paid by consumer in case of peas, beans and cabbage and cauliflower. The margin of wholesalers ranged between 4 per cent to 7.74 per cent. It was highest in case of tomato and lowest for peas. The retailer's margin remains more or less 16 per cent in all the crops under study. This clearly indicates that there is an urgent need for reducing marketing cost and elimination of intermediaries to enhance the share of the producer.

## Comparative Investment Behaviour of Vegetable Farmers

The level of investment per holding is broadly regarded as an important index of commercialization of agriculture as well as economic prosperity for the farmer. This varies not only from region to region but also within the region according to the size of holding and cropping pattern followed.

The vegetable growing farms are those farms which are having at least 15 per cent of the cropped area under vegetables and receiving more than 50 per cent of their gross income from it. The intensity of cropping on vegetable farms has been calculated to be higher than for the cereal growing farms. The pattern of cropping in vegetable farms to some extent has been guided by the principle of maximization because of risk and uncertainty, whereas the cereal farms are unconcerned about these factors. Vegetable farms are having more irrigated area than cereal farms. Gross income of vegetable farms is nearly 2.5 times more than that of cereal farms. Per hectare investment on vegetable farms has been found to be more than 2 times higher than on cereal farms. Per farm expenditure on fertilizer and hired labour on cereal farms has been estimated to be only 24.42 per cent and 33.38 per cent of the vegetable farms.

The investment in fixed assets per farm, on an average, on vegetable growing farms was more than 2.5 times as compared to cereal growing farms. It can be seen that the purchase of land constituted the major form of investment in the case of cereal growing farms (38.29% of the total investment), followed by purchase of livestock, repair and construction of farm buildings (23.21%), land (20.77%) of the total investment respectively. Investment in the purchase of tools and machineries, land improvement and orchard development aggregated to 17.63 per cent of the total investment. Permanent land improvement was responsible for the largest share i.e. 27.06 per cent of the total investment in the case of vegetable farms. It was followed by repairs and construction of farm structures, purchases of land, tools and machineries. The cereal growing farms invested only Rs 2.47 in improved implements, whereas investment incurred by vegetable growing farms was Rs 236.74 i.e. nearly 100 times more. The vegetable growing farms were investing more in the purchase of plant protection equipments while cereal crop farms were not interested in this operation and therefore, they invested more on purchase of improved implements. Thus, the allocation of funds to different items of capital accumulation between the two categories differed significantly. The cereal growing farms of the area considered land as the most important asset for augmenting their income, whereas the vegetable growing farms had given priority to improving the quality of land by adopting different land development measures and installing irrigation works.

## V. MAJOR PROBLEMS OF THE OFF-SEASON VEGETABLE GROWERS

The problems of off-season vegetable growers can be grouped under (i) Production and (ii) Marketing.

### Production Problems

For promotion of off-season vegetable cultivation, it is highly desirable to maintain its productivity at a high level so that farmers are allured to include it in their cropping pattern. Since vegetable crops are more sensitive to climatic conditions and require more irrigation water and critical inputs as compared to other crops, they need special attention in the production process. Off-season vegetable producers are facing the below-mentioned problems in its production:

#### *Supply of critical inputs*

More than 70 per cent of the sampled farmers reported that critical inputs such as fertilizers, pesticides, good quality seeds are not available in time in the government-managed agencies. They informed that they have to depend on private dealers located in towns. The pesticides and fertilizers sold by them are costlier. Therefore, they are not in a position to apply them as per recommendations of package practices. Efficacy of pesticides supplied by the government agencies is reported to be poor as compared to private traders. They suggested that the purchases of critical inputs made by them from private traders may be covered under subsidy programmes.

Off-season vegetable growers showed their frustration about the untimely supply of good quality seed/nursery plants by the government agencies. In the absence of timely and good quality seed, they have to depend on the mercy of private traders. The seeds/nursery plants supplied by private traders, are generally of low genetic quality as well as not properly treated against seed borne diseases. Thus, there is a need for proper and timely distribution of seed/nursery plants.

Non-availability of staking material due to the recent enactment of forest protection legislation to save the eco-balance have posed a threat to the cultivation of tomatoes, peas, and beans. It has been opined by the off-season vegetable growers that in case of non-availability of this from the forest area, they will be compelled to change their cropping system. Keeping in view the importance of staking material, there is a need for scientific studies to find out a suitable substitute. Staking of plastic/synthetic material can be visualised as one of the substitutes for this. The adoption of this will depend upon its comparative advantage over the present system. The second alternative may be plantation of bushes and fast growing short duration forest species having profuse branching system either on ghasnis owned by the cultivators or on the shamlet lands. The lopping of the trees grown under such scheme should be kept outside the purview of forest law.



### *Lack of Technical Know-how*

Lack of technical know-how about the application of fertilizers, pesticides, and weedicides is also responsible for not achieving the desired goal. Farmers reported that they are spending a good amount of money on plant protection measures, but they are not able to save their crops particularly tomatoes. On inspecting crops in the field by experts and laboratory examinations it is revealed that application of pesticides/fungicides by the farmers and the cause of damage are not in conformity with the causal organisms. This clearly indicated the backward state of technical knowledge possessed by the growers. Lack of technical advice to the growers by the field staff trained in plant protection is the main reason for this. Thus, there is an urgent need of strengthening the plant protection wing in the off-season vegetable growing areas.

### *Lack of Finance*

Weak financial condition of the majority of the marginal and small farmers prevented them from adopting the recommended package of practices for off-season vegetable cultivation. This leads to low productivity resulting in poor returns to them. Although the financial institutions are providing crop loans to the small and marginal farmers, the complicated procedures followed by them and their collateral requirement, generally resulted in farmers of these categories, not being able to avail themselves of credit facilities.

### **Marketing Problems**

#### *Exploitation by Private Traders*

Marketing of off-season vegetables in the State is mostly in the hands of the private traders. In spite of governmental efforts, in the form of establishment of the HPMC and encouragement given to marketing cooperatives, the private traders still handle as much as 95 per cent of the produce. Although, these traders are collecting many unauthorised charges from the producers and are not making payments in time, the continued dependence on them calls for scrutiny of the marketing system and the evaluation of cooperative agencies engaged in marketing activities.

#### *Shortage and Costs of Packing Materials*

Packing of off-season vegetables particularly tomatoes and capsicums is done in wooden boxes. Off-season vegetable growers are facing an acute shortage of wood for the last several seasons. The total requirement of wood for the packing of fruits and off-season vegetables is estimated at more than 300 thousand m<sup>3</sup>. Thus, there is an urgent need to find alternative packing case materials. This requires immediate attention of scientists in the field of packing. Use of bamboo baskets may be one of the available alternatives.

#### *Inadequate Transport Facilities*

Better remunerative prices of the off-season vegetables depend upon the quality of the produce under prevailing climatic condition and requires fast refrigerated transportation facilities. The present system of transporting off-season vegetables in the State is inefficient and substantially injurious to the vegetable trade. The roads connecting off-season vegetable growing pockets with



terminal markets are not properly maintained, transport carriers operating on these roads are multi-purpose, and shock absorbers used in these vans do not help in avoiding bruising and other damages to the vegetables. Transporters are charging exorbitant freight rates during peak season of the crop from the growers. Besides this, the transshipment of produce on route also causes delay in transportation of off-season vegetable crops resulting into deterioration of quality. Thus, to have an efficient transportation system, proper all weather link-roads should be developed. The transportation charges should be fixed by the Government and off-season vegetable crops should be given priority at check posts/barriers.

### *Shortage of Cold Storage*

Off-season vegetables, tomatoes in particular, being a highly perishable commodity has poor shelf life. After picking, a considerable part of the produce gets deteriorated during transportation from field to packing place. About 20 per cent of the total produce is estimated to be unfit for sale due to over ripening or damage caused during transit period. In order to prevent this huge loss, it is suggested that small cottage industries for vegetable preservation should be encouraged in the production areas.

## **VI. STRATEGIES AND RECOMMENDATIONS FOR THE FUTURE**

Agro-climatic conditions in the hilly areas of Himachal Pradesh and in many other parts of the Hindu Kush-Himalayan Region are favourable for the production of off-season vegetables. Their returns on land, labour, and capital are substantially higher than for cereals and other field crops. As a result, off-season vegetables offer opportunities for a considerable increase in employment and income earning opportunities in hilly areas and enhancement of their population carrying capacity. However, in order to be successful and sustainable, appropriate strategies and approaches have to be observed. These include the following:

### *The Need for Planning and Research*

Before embarking on a large-scale production programme, a detailed assessment should be undertaken of both production and demand aspects. After technical feasibility and demand prospects have been confirmed the next step should be establishment of vegetable research farms in the different ecological zones. These farms would undertake research and trials for vegetables suitable for the ecological zone concerned and would also arrange for demonstrations in farmers' fields. The farms in the different agro-climatic zones would also serve as centres for the production of foundation seeds.

### *Reliable Supply of Seeds and Other Essential Input*

Pure and healthy seeds and seedlings are essential preconditions for successful vegetable growing. This requires arrangements for multiplication in farmers fields and supervision and certification. Other essential requirements include fertilizer and chemicals for pest and disease control. These should be of confirmed quality and should be available on time when needed. Lastly, farmers should have access to credit at affordable interest to enable them to buy the required goods and services as and when needed. Initially, provision of required inputs may have to be ensured by the Government, but ultimately the private sector and cooperatives should take over those functions.

## *Strengthening of Training and Extension Services*

For disseminating the technical know how on delicate vegetable crops a strong link needs to be established between research and the farmers through an effective extension service. This requires strong organisational structures at State/region, district, and local levels. In case of Himachal Pradesh, it is suggested that at the State level the Additional Director of Agriculture (Vegetables) will act as a co-ordinator for the planning, production, procurement, and distribution of various types of vegetable seeds in the different districts. He will act as a monitoring agency for balancing the production and supply of vegetable seeds for domestic consumption and for export as well.

At the district level the Vegetable Development Officer will be mainly responsible for training and education of farmers through the staff posted in the blocks. Besides this, they will also look after the management of vegetables. There will be one Agricultural Inspector (Vegetable) with supporting staff of three Agricultural Sub-inspectors and four 'Beldars' posted in each block to conduct the training and education programme through the village farm volunteers posted in each *Panchayat*. The latter will establish village vegetable nurseries and operate custom service centres to enable them to become self-employed. Village Farm Volunteers or their equivalent with sufficient skill training and in adequate numbers are needed to pass on to farmers the basic knowledge of "What to grow", "When to grow" and "How to grow"?

## *Improved Marketing Arrangements*

The present marketing structure and arrangements are not satisfactory to either producers and consumers since it is the middlemen who mostly benefit. It is suggested that a cooperative organisational system be established to perform the following functions:

- o to procure vegetable crops;
- o to grade, store, and market the produce on behalf of the members at local and distant markets;
- o to assist grower members financially to cultivate crops;
- o to assist retailer members by giving them produce on credit and meeting their other financial requirements for running their business;
- o to hold produce on behalf of their members by providing storage facilities to enable them to earn good returns;
- o to procure and supply at competitive prices the inputs required for cultivating the crops;
- o to provide its own independent outlets for marketing the crops; and
- o to establish, own, and operate processing units in case of specific crops, and market the finished product directly.

# ANNEX

## Cost of Cultivation of Important Off-season Vegetables

Item of Expenditure	Tomato	Capsicum	Beans	Peas	Cauli-flower	Cabbage
(a) Human labour	15240.00 (34.00)	5910.00 (29.87)	3540.00 (34.09)	3915.00 (41.56)	7065.00 (29.97)	7065.00 (34.00)
i) Family	8671.56 (56.90)	3894.00 (65.90)	2533.00 (71.56)	2701.35 (169.23)	4899.57 (69.35)	4899.57 (69.35)
ii) Hired	6568.44 (43.10)	2015.31 (34.10)	1006.77 (28.44)	1204.65 (30.77)	2165.43 (30.65)	2165.43 (30.65)
(b) Bullock labour	1500.00 (3.35)	1500.00 (7.58)	600.00 (5.78)	600.00 (6.37)	1500.00 (6.36)	1500.00 (7.23)
Total labour cost	16740.00 (37.35)	7410.00 (37.45)	4140.00 (39.87)	4515.00 (47.93)	8565.00 (36.33)	8565.00 (41.26)
(c) Material cost	7900.00 (17.63)	3390.00 (17.13)	1140.00 (10.98)	1085.00 (11.51)	4968.00 (21.08)	4968.00 (23.93)
i) Seed/seedlings	1500.00 (3.35)	1500.00 (7.58)	450.00 (4.33)	280.00 (2.97)	1800.00 (7.64)	1800.00 (8.67)
ii) Farm yard manures	1250.00 (2.79)	1250.00 (6.32)	600.00 (5.78)	625.00 (6.63)	1250.00 (5.30)	1250.00 (6.02)
iii) Fertilizers	650.00 (1.45)	315.00 (1.59)	50.00 (0.48)	110.00 (1.17)	518.00 (2.20)	518.00 (2.50)
iv) Plant protection	4500.00 (10.04)	325.00 (1.64)	40.00 (0.39)	70.00 (0.74)	1400.00 (5.94)	1400.00 (6.74)
(d) Depreciation	55.37 (10.13)	55.37 (0.28)	25.75 (0.25)	35.75 (0.38)	48.55 (0.21)	48.55 (0.23)
(e) Land revenue	9.00 (0.02)	9.00 (0.05)	9.00 (0.08)	9.00 (0.09)	9.00 (0.04)	9.00 (0.04)
(f) Interest on working capital	739.10 (1.65)	351.27 (1.77)	158.64 (1.53)	168.27 (1.78)	433.26 (1.84)	433.26 (2.09)
Sub-total (a)	16771.91	7320.95	2940.17	3102.62	9124.20	9124.20
(g) Rental value of land	19194.00 (42.83)	8437.50 (42.65)	4800.00 (46.22)	3487.50 (37.03)	9375.00 (39.77)	6562.00 (31.61)
(h) Interest on fixed capital	174.75 (0.39)	132.64 (0.67)	110.67 (1.07)	121.01 (.28)	174.75 (0.73)	174.75 (0.84)
Sub-total (b)	36140.66	15891.09	7850.84	6711.13	18673.94	15861.45
Grand-total (c)	44812.22	19785.78	10384.06	9421.48	23573.51	20761.02



ICIMOD is the first international centre in the field of mountain development. Founded out of widespread recognition of environmental degradation of mountain habitats and the increasing poverty of mountain communities, ICIMOD is concerned with the search for more effective development responses to promote the sustained well being of mountain people.

The Centre was established in 1983, and commenced professional activities in 1984. Though international in its concerns, ICIMOD focuses on the specific, complex, and practical problems of the Hindu Kush-Himalayan Region which covers all or part of eight Sovereign States.

ICIMOD serves as a multidisciplinary documentation centre on integrated mountain development; a focal point for the mobilisation, conduct, and coordination of applied and problem-solving research activities; a focal point for training on integrated mountain development, with special emphasis on the assessment of training needs, the development of relevant training materials based directly on field case studies; and a consultative centre providing expert services on mountain development and resource management.

Mountain Farming Systems constitutes one of the four thematic research and development programmes at ICIMOD. The programme deals with agriculture defined broadly to cover all land-based activities (cropping, horticulture, forestry, livestock farming, etc) and their support systems. Currently the major focus of the programme is on the factors and processes contributing to the sustainability/unsustainability of mountain agriculture. This is carried out by examining (through both knowledge reviews and field studies) the sensitivity of public and private interventions to specific mountain conditions. The explicit consideration of the latter conditions can alone assure a mountain perspective to public policies and programmes in the agricultural sector.

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