ECONOMIC ANALYSIS OF EXOTIC VEGETABLE PRODUCTION IN LAHAUL & SPITI DISTRICT OF HIMACHAL PRADESH

THESIS

By

BORISAGAR DHARMIK GAURISHANKAR
(A-2019-30-004)

Submitted to

CHAUDHARY SARWAN KUMAR
HIMACHAL PRADESH KRISHI VISHVAVIDYALAYA
PALAMPUR – 176 062 (H.P.) INDIA

in

partial fulfilment of the requirements for the degree

of

MASTER OF SCIENCE IN AGRICULTURE
(DEPARTMENT OF AGRICULTURAL ECONOMICS, EXTENSION EDUCATION & RURAL SOCIOLOGY)
(AGRICULTURAL ECONOMICS)

2021

Dr. Harbans Lal
Professor

Department of Agricultural Economics,
Extension Education and Rural Sociology,
College of Agriculture,
CSK Himachal Pradesh Krishi Vishvavidyalaya
Palampur-176062 (H.P.) India

CERTIFICATE – I

This is to certify that the thesis entitled **"Economic Analysis of Exotic Vegetable Production in Lahaul & Spiti District of Himachal Pradesh"** submitted in partial fulfillment of the requirements for the award of the degree of **Master of Science (Agriculture)** in the discipline of **Agricultural Economics** of CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur is a bonafide research work carried out by **Mr. Borisagar Dharmik Gaurishankar (A-2019-30-004)** son of Smt. Borisagar Hansaben and Shri Borisagar Gaurishankar under my supervision and that no part of this thesis has been submitted for any other degree or diploma.

The assistance and help received during the course of this investigation have been fully acknowledged.

Place: Palampur
Dated:

(Dr. Harbans Lal)
Major Advisor

CERTIFICATE- II

This is to certify that the thesis entitled**, "Economic Analysis of Exotic Vegetable Production in Lahaul & Spiti District of Himachal Pradesh"** submitted by **Mr. Borisagar Dharmik Gaurishankar (A-2019-30-004)** son of Shri Borisagar Gaurishankar to the CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur in partial fulfilment of the requirements for the degree of **Master of Science (Agriculture)** in the discipline of **Agricultural Economics** has been approved by the Advisory Committee after an oral examination of the student in collaboration with an External Examiner.

(Dr. Harbans Lal)
Chairperson
Advisory Committee

( )
External Examiner

(Dr. Virender Kumar)
Member

(Dr. Viveka Katoch)
Member

(Dr. Radhna Gupta)
Dean's nominee

Head of the Department

Dean, Postgraduate Studies

ACKNOWLEDGEMENTS

Acknowledgment for a few might be just a trifle thing written on a piece of paper. But in its true essence, it gives us an opportunity to remember and express our feelings for those whom we love and revere. Here I get a chance to express my token of gratitude to people who have touched me in one way or the other by their small things. Words are not enough to express my feelings for them yet these lines are not exaggeration but feelings, which come straight from heart.

It has been particularly rewarding to have the privilege of working under the able supervision of my respected major advisor, ***Dr. Harbans Lal,*** *Professor, Department of Agricultural Economics, Extension Education & Rural Sociology for his conscientious guidance and constructive suggestions at every step during the thesis work. I thank him for his creative and valuable suggestions for improving the quality of this work. His patience and support helped me to overcome many testing situations and accomplish this thesis.*

My equal and profound gratitude also goes to the much esteemed members of my advisory committee viz. ***Dr. Virender Kumar,*** *Professor & Head (Agricultural Economics),* ***Dr. Viveka Katoch****, Senior Vegetable Breeder, Dept. of Seed Science and Technology, and Dean's Nominee* ***Dr. Radhna Gupta****, Professor and Dean's Nominee, COHS (Department of Food Science, Nutrition & Technology) for their ever available help and valuable suggestions.*

I am extremely happy to express my deepest sense of gratitude to respected Professor and Head of the Department ***Dr. Virender Kumar****, Department of Agricultural Economics, Extension Education & Rural Sociology for providing excellent suggestions by devoting his precious time in the midst of his busy schedule and for kind sympathetic attitude during the whole degree programme. I also take this opportunity to convey my sincere regards to faculty members of Department of for providing suggestions whenever needed at various stages of my study.*

I express my sincere thanks to ***Dr. H.K. Chaudhary****, Hon'ble Vice Chancellor,* ***Dr. D.K. Vatsa,*** *Director of Research,* ***Dr. Satish Paul,*** *Dean, Post Graduate Studies,* ***Dr. R.K. Kataria,*** *Dean, College of agriculture and other officials of CSKHPKV, Palampur for providing me necessary facilities for timely completion of the study and I would also like to acknowledge* ***Indian Council of Agricultural Research*** *for providing me NTS(PGS) fellowship for period of two years during my degree.*

I also express my sincere thanks to the office staff of Department of Agricultural Economics, Extension Education and Rural Sociology especially ***Ashok Jaryal Sir, Kamini Madam, Suman madam and Dharam Singhji*** *for their ever-willing help in various forms during the course of study in this university.*

With profound sense of gratitude, I wish to record my sincerest appreciation and gratitude to ***Dr. R.L. Shiyani*** *(JAU, Junagadh) for his meticulous suggestions, continuous inspiration, unceasing encouragement and moral support helped me to carve my future.*

I would not have contemplated this work without the love, support and constant encouragement of my parents, ***Shri Borisagar Gaurishanakar and Smt. Borisagar Hansaben.*** *I am indebted to them for their love, support, financial assistance, patience and selfless dedication for my welfare. I also acknowledge the valuable help and support of my beloved sister* ***Smt. Vina Sayagor*** *and brother-in law* ***Shri. Mehul Sayagor.***

A deep sense of appreciation is extended to my worthy seniors ***Ms. Shivalika, Ms. Diksha, Ms. Kanika, Mr. Navjot, Mr. Himashu, Mr. Deekshith and Mr. Praveen*** *for their moral support, timely help and cooperation.*

I feel very lucky to be blessed with my lovely friends ***Sonal, Shiwani, Prashant, Ram, Ankita, Mridula, Chandan, Mayur, Kranti, Bhushan, Sachin, Aayush, Purshottam, Himanshu, Shabnam*** *who were always patient to hear my woes, who kept me in exalted state even during the moments of despondency and for being a helping hand in research work.*

I thankfully acknowledge my ***respondents*** *for providing me the valuable data. At last, my thanks are due to one and all, who helped me directly or indirectly during the course of study.*

Needless to say, all omission and errors are mine.

Place: Palampur ***(Borisagar Dharmik Gaurishanakr)***

Dated:

TABLE OF CONTENTS

LIST OF ABBREVIATIONS USED

Sr. No.	Abbreviation	Meaning
1.	No.	Number
2.	%	per cent
3.	/	Per
4.	et al.	et alii (and others)
5.	ha	Hectare
6.	i.e.	id est (that is to say)
7.	kg	Kilogram
8.	q	Quintal
9.	Fig.	Figure
10.	viz.	videlicet (namely)
11.	Rs.	Rupees
12.	etc.	Etcetera
13.	SE	Standard Error
14.	Qty.	Quantity
15.	FYM	Farm Yard Manure
16.	IFFCO	Indian Farmers Fertiliser Cooperative Limited
17.	w.r.t	With respect to

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

Department of Agricultural Economics, Extension Education & Rural Sociology
College of Agriculture
CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur-176062

Title of thesis	:	Economic Analysis of Exotic Vegetable Production in Lahaul & Spiti District of Himachal Pradesh
Name of the student	:	Borisagar Dharmik Gaurishankar
Admission number	:	A-2019-30-004
Major discipline	:	Agricultural Economics
Minor discipline	:	Vegetable Science
Date of thesis submission	:	
Total pages of the thesis	:	106
Major Advisor	:	Dr. Harbans Lal

ABSTRACT

Exotic vegetable cultivation has gained considerable pace in the state in recent years due to the possibilities of higher returns and considerably shorter growing period. Therefore, the present study was carried out to work out economics of exotic vegetables cultivation in Lahaul valley of Lahaul & Spiti district in the state. The study was based on primary data collected through survey method from 60 farmers selected using proportional allocation technique from 10 randomly selected villages spread in the valley. Among the exotic vegetables, lettuce and broccoli accounted for 46.92 per cent of total cropped area. The cropping intensity in the study area was estimated to be 125 per cent. Among different cultural operations harvesting and weeding collectively accounted for 58 to 59 per cent of total labour employed in production of both these vegetables. The farmers were applying about 1350 kg/ha and 1169 kg/ha of total fertilizers in broccoli and lettuce, respectively. The total cost of production was estimated to be Rs 215315/ha and 299183/ha in lettuce and broccoli, respectively. As per the CACP costs concepts total cost or cost C_3 was found to be Rs 544575/ha and Rs 669885/ha for lettuce and broccoli, respectively. The net returns over total cost were recorded to be Rs 1825811/ha for broccoli and Rs 565935/ha for lettuce. The net returns per farm were maximum from broccoli (Rs 438196) than that from lettuce (Rs 209396). The output-input ratio was found to be 7.10 for broccoli and 3.62 in case of lettuce. The regression analysis showed that area and total labour were the important factors affecting the output of these crops. The total marketed surplus of sample farm households was estimated to be about 6030 q and 2209 q for lettuce and broccoli, respectively. In comparison of lettuce farmers, proportionally more number of farmers were found to be practicing grading in broccoli because of the traders' quality regulation. It was found that in the study area two marketing channels i.e. channel-I consisting of producer-trader-retailer-consumer and channel-II consisting of producer-contractor-cum-trader-retailer-consumer were patronized by the growers for marketing of these vegetables. The results revealed that greater number of farmers followed channel-I, through which about 3145 quintal and 1515 quintal of broccoli and lettuce was marketed. The lack of quality seeds/planting material, availability of hired labour, lack of knowledge about insects and how to control them, not enough support in the form of subsidies, market availability and wild animals threat to the crops were found to be the major production and marketing problems confronted by farmers of study area.

(Borisagar Dharmik Gaurishankar)
Student
Date:

(Dr. Harbans Lal)
Major Advisor
Date:

Head of the Department

1. INTRODUCTION

1.1 The background

Agriculture is the spine of the Indian economy because of its contribution towards livelihood of millions of people even though its proportionate contribution to the nation's economic growth has been plummeting over time. As per the provisional estimates of national income released by CSO in 2020, the share of agriculture and allied sectors in Gross Value Added (GVA) of the country at current prices is 17.80 per cent for the year 2019-20. Agriculture and allied sectors proportion of the country's GVA has declined from 18.20 per cent in 2014-15 to 17.80 per cent in 2019-20. This is an unavoidable result of a development process in which non-agricultural sectors relative performance became more dominant. Even with these falling figures, preliminary advance forecasts for agriculture in 2020-21 showed a growth rate of 3.40 per cent at constant prices, despite the fact that every sector of the economy saw a significant decline in growth rate.

Agriculture is a major source of income for approximately 50 per cent of India's population, making it an important sector for the country's ongoing economic prosperity. Despite major changes in the production techniques and new interventions over the years, agriculture still experiences large fluctuations in output attributed to land fragmentation, meteorological conditions, and market predicaments. Although several allied activities to agriculture also provide some employment to labour force belonging to both farming and rural labour households. The diverse climate of India assures the availability of a wide range of fresh fruits and vegetables. After China, it is the world's second-largest producer of fruits and vegetables. India is the world's largest producer of ginger and okra, as well as potato, onion, cauliflower, brinjal, and cabbage. According to Department of Agriculture, Cooperation and Farmers' Welfare, the production of vegetables is estimated to be 193.61 million tonnes in 2020-21(First advance estimates) compared to 188.91 million tonnes in 2019-20. The vegetables which are referred to as exotic were introduced in India since last few decades from different European countries. These fetch higher returns than conventional vegetables given their demand in places like hotels and their popularity amongst the upper-class society.

1.2 Rationale of the study

The state of Himachal Pradesh has a potential of becoming the country's vegetable bowl because of diverse agro-climatic conditions and greater possibilities for producing off-season vegetables. The vegetables may well be grown in quite difficult climatic conditions thanks to the advent of new hybrid seed varieties. Additionally, the majority of the state's farmers are marginal, and many of them have realized the potential income from producing other cash crops such as vegetables, fruits, etc. The recent technological breakthrough in agriculture has emphasized the need for diversification, which would result in expansion of farmers' and state economy at a faster rate and vegetables production could be the major contributor in this process. The vegetables also have a high nutritional value since these are rich source of proteins, minerals, vitamins, and, to a smaller extent, carbohydrates. Hence, their importance cannot be overlooked. The fresh off-season vegetables produced in the state being marketed at higher prices in the markets of the neighbouring states as these do not face any competition from plains. Thus, vegetable growers have a full advantage in vegetable production as compared to other traditional crops. Moreover, the vegetables have a shorter gestation time (three to four months), produce more marketable surplus, and fetch higher market prices than other crops, thus offer more hope for uplifting farmers out of poverty. The production and marketing of off-season vegetables is the most profitable farm business giving very high production and income to farmers per unit area of land (Thakur,1994). Therefore, vegetable farming is an excellent choice as cash crops. Moreover, the size of land holding on an average is shrinking by further fragmentation of land holdings. In the state, of the total operational holdings 71.40 per cent of farmers are in the marginal (<1 ha) category, whereas 17.45 per cent are in the small farm (1-2 ha) category (Economic Survey 2020-21, Government of Himachal Pradesh). As a result, the state's farmers are making their way towards vegetable cultivation.

The vegetables production suits to all farmers irrespective of size of land holding but especially for marginal and small land parcels it is more suited where the decreasing size and increasing number of operational holdings are the major problems of the cultivators. Over the period from 1991-92 to 2014-15, the acreage under vegetables has observed three-fold increase and the production has increased from 3.68 lakh tonnes to 15.76 lakh tonnes. The area under vegetables has grown at a rate of 6.07 per cent per annum during two and a half decades. However, the growth was slightly higher, 4.93 per

cent per annum during 2003-04 to 2014-15 than compared to 4.15 per cent per annum during 1991-92 to 2002-03. Which indicated more diversification towards vegetables cultivation during recent times (Kumar et al. 2017). According to data from Department of Agriculture, Himachal Pradesh in the year of 2020-21 state had an area of 87.48 thousand ha under various vegetable crops, with a total production of 18.67 lakh tonnes. Presently, over thirty vegetables, including exotic vegetables like as lettuce, asparagus, celery, swiss chard, parsley, kale, brussels sprouts, broccoli, red cabbage, yellow and red capsicum, etc. are being grown successfully in the state and these are in high demand. A sizeable area in the state has started cultivation of these exotic vegetables that are of European and Oriental origins. The area of 798.2 ha area was being cultivated under various exotic vegetables in Himachal Pradesh with a production of 17906.6 MT for the year of 2020-21 (Department of Agriculture, Himachal Pradesh). The climate as well as soil conditions in the state, which is at an altitude of 2000 to 2500 metres above sea level, favour the growing of these vegetables. The potential growing areas are in the districts of Lahaul & Spiti, Shimla, Kullu, Solan, Mandi and Sirmaur where the farmers have taken to growing these vegetables.

The Lahaul & Spiti district is made up of the two formerly separate districts of Lahaul and Spiti. The district was formed in 1960 and is India's fourth least populated district and first in Himachal Pradesh. In the 2020-21 year, the district produced 0.66 lakh tonnes of vegetables from the area of 4.44 thousand ha. In 2020-21 district Lahaul & Spiti had an area of 141 ha under different exotic vegetables with a production of 5724 MT (about 32 % of total production in state during 2020-21). Due to a lack of consumer awareness, the demand for exotic vegetables at vegetable markets is not particularly high. However, there is a high demand for these vegetables among the middle and upper-class urban population, as well as in hotels in big cities in view of foreign tourists. Hence the area under exotic vegetables needs to be increased to match the demand and supply gap. The present study, therefore, was undertaken in Lahaul valley of district Lahaul & Spiti of Himachal Pradesh to examine the economics of production and marketing of exotic vegetables.

1.3 Objectives

The specific objectives of the study are:

1. To examine the extent and importance of exotic vegetables in cropping pattern and to work out the input use, costs and returns from these exotic vegetables in the study area,
2. to study the marketing system and identify the problems in production and marketing of exotic vegetables.

1.4 Significance of the study

The findings of this study will be extremely beneficial to extension workers, researchers, policymakers, marketing organizations and regulation authorities regarding the status of exotic vegetable production. The study will provide a better understanding of their cost of cultivation, efficiency and the structure of existing marketing channels. Also, the implications and suggestions derived from this study will be of great assistance to policymakers in improving the package of practices and deriving solutions to the most serious problems and constraints presently faced in their production and marketing.

1.5 Organization of the study

The entire research has been organized and presented in five chapters. The first chapter (Introduction) explained the study's concept, rationale, and objectives. The second chapter examined a critical review of work done in India and elsewhere that relates to the current investigation. In the third chapter, the systematic techniques used to select the sample, collection of data and analytical tools and methods are presented. The fourth chapter presents findings and in-depth discussions of this study, along with logical conclusions and inferences. The fifth chapter encompasses summary and conclusions. The results of the study have been clarified using pictures, tables, and figures, with extra material provided in different appendices for further clarity and comprehension of interested readers.

2. REVIEW OF LITERATURE

Previous researchers and their experiences provide a strong foundation of information that is helpful in planning and implementation of future research work. The researcher can use a review of past literature to formulate and define desired objectives, create a suitable questionnaire, get insight into the methods and procedures for analyzing the data, interpreting the results, comparing and making deductions, revisions, and suggestions as needed. The review of literature in this study has been divided into three sections, each of which corresponds to the objectives of present investigation.

2.1 Production, cost and returns

2.2 Marketing functions, channels and cost

2.3 Production and marketing constraints

2.1 Production, cost and returns

Raghubanshi et al. (1974) studied the regional specialization in cultivation of commercial crops in Sproon valley of Himachal Pradesh. The study revealed that growing of cauliflower (for seed) was the most profitable followed by hill capsicum, tomato and green hill peas. The hill capsicum earned net income of Rs 15037 per hectare.

Sikka et al. (1977) while analyzing the problems of financing small vegetable growers in Solan district of Himachal Pradesh revealed that the gross returns per hectare for *kharif* season were Rs 23360.16 in tomato and Rs 18153.23 in hill capsicum The returns over variable expenses were Rs 18403.85 and Rs 14531.28 for the same crops. The study revealed that vegetable growers incurred more expenditure on seed, manures and fertilizers and plant protection chemicals. The study also concluded that the vegetable cultivation was more labour intensive than cereals.

Shah (1982) in his study on ecological degradation and future of agriculture in Himalayas revealed that the vegetable production enjoyed comparative seasonal advantage. The study pointed out that several off-season vegetables like capsicum, cabbage, pea, cauliflower, potato, french bean, tomato, etc. were produced during May-October in the hilly areas, whereas, they were not produced during that period in the plains of India. Thus, their season was contracyclical to that in the plains, hence enjoyed an unlimited market as “off-season” vegetables.

Sharma and Thakur (1988) studied economics of different vegetable crops in Lahaul valley of Lahaul & Spiti district and Sproon valley of Solan district of Himachal Pradesh. In case of lahaul valley, cultivation of crops *viz*., potato, hops, *kuth* and *manoo* cost C was Rs 19868/ha, Rs 4092/ha, Rs 79468/ha and Rs 64458/ha while net return over cost C was Rs 10912/ha, Rs 40311/ha, Rs 82068/ha and Rs 82068/ha, respectively. In case of Sproon valley, cultivation of off-season vegetables *viz*., hill Capsicum , tomato, cauliflower(seed) and pea cost C was Rs 13604/ ha, Rs 64655/ha, Rs 53390/ha and Rs 9507/ha while net return over cost C was Rs 15073/ha, Rs 81290/ha, Rs 63066/ha and Rs 1454/ha, respectively.

Singh (1993) estimated the costs and returns of selected off-season vegetable crops grown in Himachal Pradesh. Among the crops included in his study, per farm returns from the cultivation of tomato, capsicum and pea were Rs 21891, Rs 20210 and Rs 6007 respectively. While the per farm cost of cultivation of the crops was Rs 12518 for tomato, Rs 11312 for capsicum and Rs 3682 for pea.

Thakur (1994) carried out research in Kullu and Solan districts of Himachal Pradesh which are famous for off season vegetables and vegetable seed production. The study has found that the variable costs constituted above 56 to 63 per cent of total costs and fixed cost constituted about 37 to 44 per cent of total costs. Tomato gave the highest gross as well as net returns to farmers which were found to be Rs 166002 and Rs 145962, respectively. For tomato, out of total price of Rs 942 paid by consumer, the farmers got only Rs 438.

Kumar (1999) from his study on resource use and marketing of high value crops in Himachal Pradesh showed that cost D was the highest for tomato (Rs 96317 per hectare) followed by cabbage (Rs 91558 per hectare) and pea (Rs.65209 per hectare). Further, the study found that tomato was the most paying high value crop with a net income of Rs 29087/ha with cost-benefit ratio of 1:1.30.

Wilson and Robertson (2001) examined the economic efficiency in main potato crop production in England and Wale. The value of output had been identified as the main determinant of efficiency/profitability in main potato crop production. It was pointed out that to achieve higher output prices, growers need to identify a market, make greater use of contract arrangement and achieve the quality required to meet this contract and market specification. The utilization of labour was identified as the only scale effect to consistently affect economic efficiency. On smaller farms, the most profitable growers achieved savings in materials and labour costs. As farm size increased the most profitable

growers achieved savings in materials, labour and mechanization costs. It was suggested that labour and mechanization requirements must also be considered together in the quest for improved efficiency.

Dileep et al. (2002) conducted study on contract farming of tomato in Ellenabad block of Sirsa district in Haryana as it was the only block in the state in which contract farming of tomato was in continuation since 1989. The cost incurred, yield and gross returns obtained by the contract farmers were almost double compared with non-contract farmers. The average price received by the non-contract farmers was much higher than the contract price for tomato. On an average, the total variable cost in the case of contact and non-contract farmers found to be about Rs 25000 and Rs. 18000 per hectare, respectively. The contract farmers irrespective of their farm size bore very high transportation cost, constituting 48 per cent in total cost on an overall basis.

Kumar et al. (2002) from their study on vegetable farming in Kullu region of Himachal Pradesh reported that average productivity of tomato, cabbage, pea, brinjal and capsicum was highest on large farms. On medium farms productivity of cauliflower and spinach was highest and on small farms ladyfinger and radish showed highest productivity. In case of cost of production peas recorded figure of Rs 159/q, followed by capsicum which was Rs 108/q and Rs 103/q for ladyfinger. Net profit over variable cost was highest in tomato Rs 80878 followed by ladyfinger Rs 79437 and capsicum Rs 73050.

Bala and Sharma (2005) analyzed the cost and return structure of promising enterprise of off-season vegetables in Kullu district of Himachal Pradesh. The study reported a substantial shift in cropping pattern over period 1990 to 2003 in study area. The dominated traditional cereal crops got replaced by vegetable crops. The area under cereals declined from 59 per cent to 49 per cent because of short duration growth habit of vegetables. The cropping intensity increased from 197 to 225 per cent. The vegetable crops generally are highly labour demanding, generated more employment opportunities in the study area. The overall labour employment increased by about 49 per cent. The agricultural income per farm had increased by 332 per cent over the studied period. The per farm annual income increased to Rs 135160 from Rs 31240 that gained more than four times. The cauliflower crop provided the highest level of employment as well as income followed by cabbage and tomato.

A study conducted by Singla (2006) on economics of production of green peas in Punjab revealed that in the rabi season, the main crops were green peas and wheat. The

yield of green peas was found to be the highest on small farms among all the farm-size categories. The total cost incurred was higher in large than small and medium farmers due to more use of inputs by the former. The gross and net returns were found higher on large than small and medium farmers due to realization of higher prices by them and exploring of other markets due to their higher marketable surpluses. The functional analysis revealed that the fertilizers, irrigation, and machinery were identified as impact variables that positively influenced green pea productivity. The returns over variable cost in case of peas were higher by 129 per cent than those in wheat (main competing crop). It was suggested that the farmers be advised by the agricultural extension experts to adopt green pea cultivation for improving the efficiency of the farms through increased income per unit of land.

Lal and Sharma (2006) studied the economics of potato production in Lahaul valley of Himachal Pradesh. The study found that the potato crop was both capital as well as labour intensive due to substantial cost incurred on seed, fertilizers and human labour. Out of total cost of Rs 74461/ha, the human labour alone accounted for around 30 per cent followed by seed (18%). The cost-benefit ratio over all paid out costs was 1:2.51, however it was 1:1.03 over total costs.

Sharma (2007) analyzed time series data on area, production and productivity of vegetables crops for the period 1991 to 2000. The finding of the study revealed that area, production and productivity of vegetable crops recorded a significant growth, however, growth in production (7.51%) and productivity (4.65%) was found higher as compared to area (2.85%). These results highlighted the fact that the state has a comparative advantage of growing vegetable crops on account of its varied agro-climatic conditions. The tomato crop had the highest value productivity both at current as well as constant prices followed by cauliflower and pea. The decomposition analysis revealed that overall increase in vegetable production was mainly due to acreage expansion, however, increase in potato was solely because of productivity enhancement. An increase in tomato production was the cumulative effect of area and yield.

Baba et al. (2010) laid out research in the districts of Srinagar and Budgam in Kashmir valley. A substantial increase in the area and production of vegetables has been observed in study area. The cropping intensity in the study area had become more than 250 per cent due to multiple cropping of vegetable crops.

Akter et al. (2011) examined the economics of winter vegetables (tomato, cauliflower and cabbage) production in some selected areas of Narsingdi district of

Bangladesh. Random sampling technique was used to select 90 farmers (30 from each growing tomato, cauliflower and cabbage). The study indicated that the production of all the selected vegetables was profitable in the study area. The total cost of production in case of tomato, cauliflower and cabbage was estimated at around Tk 118000, 116977 and 120522 /ha , respectively. The net returns were estimated at Tk 97000, 93023 and 99478 /ha, respectively. The gaps in the cultural and management practices were observed in selected vegetables. The study has given suggestions for bridging the gaps in order to enhance farmers' income and employment opportunities from vegetable cultivation.

Badmus and Yekinni (2011) examined the economic importance of exotic vegetable production under Fadama system in Akinyele local government area of Oyo state. The study revealed that exotic vegetable production is a profitable business and it has provided a means of livelihood to the operators of the business. The profit however can be maximized if government intervenes in the area of extension services, import of improved exotic vegetable seeds and provision of adequate incentives to the exotic vegetable growers. This would increase their output level and also contribute significantly to food security in the nation as a whole and the urban areas in particular.

Bala et al. (2011) studied the costs and returns structure of major off-season vegetables, viz. tomato, cabbage cauliflower and peas in two vegetable-dominated developmental blocks of the district Kullu in Himachal Pradesh. The study has revealed that tomato had the highest per hectare cost A_1, followed by cabbage, cauliflower, and peas. Peas, on the other hand, had the highest per quintal cost of production, followed by cauliflower, tomato, and cabbage. The costs on plant protection measures has been the major constituent of cost A_1 in all the crops, followed by expenditure on seed and fertilizers. The vegetables being the labour-intensive crops, have incurred significantly high costs on human labour, Rs 13200-15600/ha. The gross returns as well as net returns per hectare have been observed to be highest for tomato, followed by cauliflower, cabbage and peas.

Ho et al. (2011) examined the costs of producing and processing snap beans and garden peas in New York State. Data were collected from vegetable growers in New York State and used to calculate costs and net returns of producing snap beans and garden peas. The results indicated that the average cost of producing snap beans in New York state was $ 568 per acre and was $ 563 per acre for green peas. The actual producer costs dropped to $402 and $361 for beans and peas if the producer paid for expenses related to seeds, pesticides, and harvesting.

Sharma and Kumar (2012) carried out study on improving economic viability of small and marginal landholders through vegetable cultivation in Himachal Pradesh. This study revealed that average size of land holding in the state has decreased from 1.53 hectare per farmer in 1970-71 to 1.04 hectare per farmer in 2005-06. The study has found that fragmentated and scattered pattern of both small and marginal holding rendered them uneconomical especially when only traditional crops were grown on these holdings and more lucrative option of growing cash crops such as off-season vegetables needed to be promoted especially in mid to high hills districts of the state.

Lokapur et al. (2014) analyzed resource use efficiency of vegetables in Belgaum district in Karnataka. The regression results of cobb-douglas production revealed that seeds were found to be significant in case of all the vegetable farmers and the co-efficient of multiple determination (R^2) was 74 per cent, 86 per cent, 97 per cent and 96 per cent in case of onion, potato, green chilli and potato, respectively. The marginal value product (MVP) to marginal factor cost (MFC) ratio for seed was 19.06, 3.10, 12.53, and 7.49 for onion, potato, green chilli and tomato farmers, respectively.

Daundkar and Bairagi (2015) in their study on economics of capsicum in Akola district of Maharashtra revealed that cost C at overall level was found to be Rs 125260 per hectare. Net returns over cost C were Rs 273388 per hectare and input-output ratio at cost C was 3.11. The cost of cultivation was highest in capsicum grown in greenhouse cultivation followed by open condition under drip irrigation system and lower in traditional irrigation system. Whereas, per quintal cost of production was highest in open condition under traditional irrigation system in medium size group. Capsicum cultivation under greenhouse condition had more gross income than open condition.

Rao and Mrunalini (2015) from their study in exotic vegetables on Visakha Agency area highlighted that the area is viable for producing exotic vegetables that were in high demand in foreign countries, including the United States. Exotic vegetable markets have been growing at the rate of 15 to 20 per cent per annum as India has been importing more than 85 per cent exotic vegetables. The study also found that exotic vegetables have major two niche markets that were hotel industry and export. The growing of exotic vegetable and fruits was found to be more profitable business than cultivation of traditional Indian vegetables. The study further reported that exotic vegetables production driven by demand was suitable for the farmers as they have assured market through contract with consumers. An innovative woman farmer was growing 25

vegetable varieties in 2.2 ha with an expenditure of Rs 6250/day/ha and obtained earnings of Rs 8750/day/ha.

Soare et al. (2016) studied the main tendency in the vegetables field of Romania by examining economic indicators. The study revealed that quantitative vegetables export decreased in 2015 compared to 2011 (from 680 tons to 446 tons). In 2015, the highest exports were recorded for tomatoes, peppers and dry onion. As regards export value declined in total vegetable export especially to cabbage, dry onion, eggplants and garlic. From quantitative point of view imports were higher than exports which indicated that domestic production of vegetables may not have covered consumption needs of the population. The other conclusions referred to prices average procurement for certain types of vegetables which have decreased significantly in 2015 compared to 2012.

Bhat et al. (2017) study of profitability and marketing of vegetables in Chenani block of Udhampur district of Jammu. The study showed readiness of farmers to cultivate fruit and vegetable crops other than cereals because it had provided them more profitability over cereals. The costs and returns breakdown discovered that respective gross returns per hectare were Rs 410000 and Rs 60000, Rs 200000, Rs 80000 and Rs 150000, respectively, for tomato, cucumber, radish, beans and garlic. Net returns were found to be maximum (Rs 258276/ha) in tomato cultivation, Producer's share in consumers' rupee for different vegetables ranged from 41.67 per cent for cucumber to 57.14 per cent for tomato and beans.

Choudhary et al. (2017) come up with a study of profitability of vegetables in Dhari block of Nainital district, Uttarakhand. For the study primary as well as secondary data were collected. The study was limited to only four vegetable crops based on a share of vegetable area in total cultivated land. Around 60 vegetable growers were selected from four different villages with the condition that only 15 growers will represent each vegetable. The results of the study revealed that the returns per rupee invested on pea, cabbage, tomato, and bean were 1.56,1.25,1.20 and 1.10, respectively. Thus, vegetable growers of the study area were in profit by growing these vegetables.

Kumar et al. (2017) studied the economy of vegetable cultivation and farm incomes in Himachal Pradesh. The result of the study indicated that growth in area, production and productivity of vegetable crops witnessed higher growth during 2003-04 to 2014-15 than that achieved during 1991-92 to 2002-03. Among the different vegetables, tomato and peas accounted for nearly 50 per cent of total area and production of all vegetables in the state. The study further revealed that increased net returns from

the vegetables *viz*. tomato, peas, cabbage, cauliflower and capsicum were not adequate with increased cost of inputs during the study period which indicated declining profitability of vegetable farming in the state.

Sharma et al. (2017) analyzed the economics of potato production in Kangra district of Himachal Pradesh. Based upon the primary survey of 60 growers grouped into small and large category on the basis of area under cultivation of potato crop. This crop was found capital and labour intensive due to substantial cost incurred on seed, fertilizer and human labour. Out of the total cost of Rs 135317, the human labour alone accounted for around 35 per cent followed by seed (23%). As such, the output input ratio over all paid out cost was 1:1.39.

Kumar et al. (2018) carried out a study to evaluate profitability and resource use efficiency in vegetable cultivation in Yamunanagar and Karnal districts of Haryana. The study concluded that return per rupee investment was 1.40 in case of potato and 2.09 in tomato. The returns were found highest in medium farm category for both the vegetable crops. This indicated that out of all categories medium farms were more efficient and had higher economies of scale in the production of these vegetables.

Show (2018) studied the economics of different vegetables in Paschim Medinipur district in West Bengal. The study revealed that cost of cultivation in case of vegetables was higher than food grains cultivation. It was observed that estimated per acre cultivation cost was highest in parwal followed by brinjal, cauliflower, cabbage, chili, bitter gourd, cucumber, ridge gourd, arum and pumpkin. The returns per acre in chilli cultivation were higher than that of other vegetables. The gross profit per acre in chilli cultivation was highest followed by brinjal, cauliflower, parwal, ridge gourd, arum, cucumber and bitter gourd. The total mandays per acre used were found highest in brinjal followed by parwal, cauliflower, cabbage, chilli, bitter gourd, arum and pumpkin.

Singh and Chauhan (2018) studied production and marketing of off-season vegetables in *Chhota* Bhangal, one of the remotest area of district Kangra in Himachal Pradesh. The study found that the total production on an average farm was found to be highest in case of cabbage (57.53 q) per farm that followed by cauliflower (15.11 q) per farm.

Sinha and Singh (2019) carried out a study in Northern hills zone of Chhattisgarh. Two districts were selected for this study. A sample of 100 potato growers from selected areas was used to achieve study objectives. The study revealed that the overall cost of potato cultivation was Rs 47408/ha. The labour cost constituted a major part of this cost.

The cost of production was Rs 625/q. The study also observed that cost of cultivation, cost of production, gross returns, net returns, yield and marketed surplus of potato were found to be increasing with the increases in the size of holdings land. The average gross income and average net income were found to be Rs. 92766.74 per ha and Rs. 45357.83 per ha, respectively. The overall marketable surplus of potato crop was found to be 97.37 per cent. Out of this 2.98 per cent was marketed through village trader, 85.96 per cent through wholesaler, 9.98 through retailer and remaining 1.08 per cent was marketed to consumer directly.

Wongnaa et al. (2019) conducted study to determine profitability of production of exotic vegetables which were not native of Ghana. The study used data collected from 80 urban exotic vegetable farmers. It was found that the most profitable system from the results of the net margin ratio was the production of lettuce as a sole crop with net margin ratio of 71 per cent which explained the popularity of lettuce among exotic vegetable producers in the metropolis.

Singh et al. (2020) conducted study on economic analysis of pea cultivation in Solan district of Himachal Pradesh. The finding of this study revealed that total cost of cultivation of pea production was Rs 84699 per hectare. In this cost A_1, A_2, B_1, B_2, C_1, C_2, and C_3 were Rs 44151, Rs 44151, Rs 45136, Rs 57522, Rs 64613, Rs 76999 and Rs 84699, respectively. The cost of cultivation in case of marginal farmer was higher as compared to different farm size categories. The total returns and net returns from pea production were Rs.144324.32 and Rs.59624.95 per hectare, respectively. The total returns and net returns in case of large farmers were higher as compared to other farm size categories.

2.2 Marketing functions, channels and cost

Hugar and Hiremath (1984) conducted a study in Bazi market of Belgaum city. It studied two marketing channels, one through commission agents and one through co-operatives. The study was restricted to only cabbage and brinjal in month of January during 1979 and 1984. The study revealed that marketing margins increased in the case of co-operatives over five-year period as compared to the commission agents in the both the commodities. For cabbage increase in margin came to Rs 8.77 per quintal under commission agents as against increase of Rs 10.53 per quintal under co-operatives. In the

case of brinjal, corresponding numbers came to Rs 23.03 per quintal and Rs 26.02 per quintal, respectively.

Mehta and Chauhan (1996) estimated marketed surplus of various vegetables in Kangra, Kullu and Solan districts of Himachal Pradesh. The findings revealed that in all the regions vegetable crops were being cultivated on commercial lines since marketed surplus varied from 80 to 98 per cent in different regions. On farm retention of studied vegetables was very low. The marketed surplus on large farms was found to be very high. In case of large farmers in Kangra, Kullu and Solan districts marketed surplus was 93.24 per cent, 97.11 per cent and 98.42 per cent, respectively.

Agarwal (1998) carried out an analysis of marketing costs, margins and price-spread in the marketing of various agricultural commodities in the state of Rajasthan. The results of his study revealed that farmers got 52 to 54 per cent share in consumer's rupee in the marketing of cabbage and cauliflower. The rest of share in consumer's rupee was that of marketing cost which accounted for 8 per cent and remaining share of 37 to 39 per cent was the marketing margins of wholesalers.

Arora and Saxena (1999) in the study on the vegetable marketing in hill region of Uttar Pradesh revealed that the cost of marketing in hill region of Uttar Pradesh was very high due to high cost of packaging, transportation and high commission charges. In case of capsicum, marketing cost came to Rs. 173.75 per quintal. The study also revealed that the producer's share in consumer's rupee was 76.08 per cent. The study suggested that a lot of improvement is required for marketing in hill region.

Tripathi and Sharma (1999) estimated the costs and margins of off-season vegetable pea in two villages Chaupariyal and Jaripani in Garhwal hills of district of U.P. The study found that total marketing cost was Rs 199.44/q out of which 54.54 per cent was paid by producer/local contractors/ forward agent and 46.46 per cent was paid by retailer. The commission agent/ wholesaler paid nothing but they charged exorbitant amount of margin in marketing process of off-season vegetable pea.

Sharma et al. (2004) studied all existing marketing channels for vegetables in Kangra district of Himachal Pradesh. The majority of the farmers sold their produce through the producer-commission agent-retailer-consumer marketing channel, according to the study. Only five per cent of sellers sold their produce directly to consumers and when compared to other marketing channels, this was found to be more efficient.

Shelke (2009) conducted a study in APMC, Parbhani. The results of his study revealed that although agricultural production had increased substantially but this had not

resulted in a proportionate increase in farm incomes. During the peak period of arrivals of these vegetables the wholesale and retail prices remained much lower. The study observed a wide difference between wholesale and retail prices. The margin of the retailer was extraordinarily high in all the vegetables in the study area. The retailer's share ranged between 12 to 41 per cent while the producer's net share ranged between 42 to 57 per cent. The retailers received a large share of the consumer's rupee. The producers found to be highly benefited and increased their share to 95.85 per cent from 55.35 per cent in consumer's price by selling their vegetables directly to consumer rather than selling it through wholesalers. Hence the arrangements should be made by producers to sell their vegetables directly to the consumers.

Baba et al. (2010) laid out research in the districts of Srinagar and Budgam in Kashmir valley. The study revealed that on an average, producers' marketed surplus has been found more than 92 per cent of the total production of studied vegetables. Also, net price received by the producers was relatively higher in those channels in which the producers directly sold their products to the consumers or retailers.

Balaji et al. (2010) studied the role of market intermediaries in marketing of potato in Punjab. The study found that 73 per cent of production was found to be a marketable surplus. It was found higher for large (74.5%) and medium farmers (74.5%) compared to small farmers (68.2%). The study identified two marketing channels, namely producer-wholesaler-retailer-consumer (Channel-1) and producer-village trader-wholesaler-retailer (Channel-2). The findings further revealed that producer's share in consumer's price with context to Jalandhar market was 70.80 and 68.60 per cent in Channel-1 and Channel-2, respectively. While in Hoshiarpur market it was estimated to be 70.90 and 68.30 per cent for Channel-1 and Channel-2, respectively.

Dastagiri et.al (2013) conducted a nationwide study in eight states of India as a whole for production, export competitiveness and marketing efficiency of 20 crops. The study found that area under total vegetables cultivation has grown at the rate of 4.12 per cent and production growth rates was 6.48 per cent. The most common marketing channel for the majority of the crops in these states was producer-wholesaler-retailer-consumer. The results further showed that the producer's share in consumer's rupee was highest in Punjab, Tamil Nadu and Manipur compared to Andhra Pradesh, West Bengal and Rajasthan. It varied from 46 per cent to 74 per cent in Andhra Pradesh, 26 per cent to 60 per cent in West Bengal, 33 per cent to 60 per cent in Rajasthan, 85 per cent to 88 per cent in Manipur 91 per cent to 95 per cent in Tamil Nadu and 100 per cent in Punjab. The

study clearly showed that majority of the horticultural commodity markets were operating efficiently. The highest marketing efficiency was found in producer-consumer channel of marketing.

Xaba and Masuku (2013) made an analysis of the vegetable supply chain in Swaziland. A descriptive research design was used in the study area and data were collected from 100 randomly selected vegetable growers. The study revealed that among those marketing channels that producers used to obtain attractive prices and a higher share of the consumer price, the largest producer's share was obtained through direct sale to consumers. The channels that included restaurants had high total gross margins and low producer's share of the consumer prices. The study suggested that the concern for issues on post-harvest and marketing should form an integral part of policy making decisions and also the public and private sectors should facilitate contractual arrangements for vegetable growers. There is need to form cooperatives among growers in order to gain strong bargaining power within the different vegetable supply chains.

Devkota and Sharma (2014) studied the conduct and performance of vegetable marketing in Kangra district of Himachal Pradesh. The study was concerned with marketing practices followed by growers and intermediaries in study area. The study was based upon the primary survey of 80 vegetable growers and 20 intermediaries. It was found that farmers were still following the traditional practices for marketing of vegetables. The hundred per cent of the producers sold their produce immediately after harvest due to unavailability of storage facility in their villages. Though there exist government rule to determine the price of the produce through open auction, yet the commission agents were the ones who fixed the prices in the study markets. The price information by commission agents was collected from main and local markets. The finding revealed that marketing practices followed in the study area were not in accordance with the standards laid down in the Market Regulation Act.

Matsane and Oyekale (2014) examined the factors affecting marketing of vegetables among small-scale farmers in Mahikeng Local Municipality, Ngaka Modiri Molema district in the North West Province of South Africa. The vegetable produce from small-scale farmers was often lost after production due to so many marketing challenges which made it difficult for small-scale farmers to explore full market potentials which discouraged them from participating in formal (commercial) or high-value markets. The results of the study showed that variables that significantly influenced monthly net farm

income were gender, farm size, number of employees, access to storage, grading of products and access to extension services.

Singh and Chauhan (2018) studied production and marketing of off-season vegetables in *Chhota* Bhangal area of district Kangra in Himachal Pradesh. The plastic net bags, gunny bags and corrugated boxed were different packaging material used widely by farmers. Channel-I (producer-local trader-commission agent-cum-wholesale-retailer-consumer) was the most pertinent channel for all the cole crops.

2.3 Production and marketing constraints

Sharma et al. (1995) carried out a study of marketing of vegetables in Solan district of Himachal Pradesh. The results revealed that in the case of capsicum 75 per cent of farmers reported that packaging material was costly. The 100 percent of them complained about non-availability of quick and timely transportation and more than 25 per cent of farmers faced labour scarcity during harvesting and assembling practices.

Kumar and Arora (1999) analyzed economic issues in vegetable production in UP hills. Various vegetable crops selected for economic assessment were pea, potato, capsicum, cabbage and cauliflower. The results highlighted that as many as 92 per cent of vegetable growers faced problems related to irrigation in the region. 87.33 per cent of growers reported issues related to plant protection chemicals, while 80 per cent of them were having issues related to seed.

Lal and Sharma (2004) conducted a study in Lahaul valley of Himachal Pradesh which is famous for production of off-season green peas. The study was based upon the primary data collected from 50 farmers selected randomly. The major constraints faced by farmers were availability of seeds of good varieties and assured transport facilities in addition to these problems the marketing system has also not kept pace and in the absence of organized marketing the producers were not even getting one third or one fourth of the price paid by the consumers. The study also concluded that to get genuine benefit of high consumer's price of off-season peas to the producers, there is a strong need to strengthen bargaining power of farmers by promotion of cooperatives or group marketing.

Mohanty et al. (2013) carried out constraints analysis in adoption of vegetable production technologies for livelihood perspective of tribal farmers in the Dzongu block of North Sikkim. This study revealed that mean scores for all these constraints were higher among small farmers as compared to marginal, medium and large farmers in case of vegetable production in North Sikkim district. Among these farmers most recurrent constraints identified by them were technological, socio-economic, and organizational

constraints resulting vegetable cultivation into non-profitable enterprise. Lack of knowledge on conservation of natural resources, lack of entrepreneurial ability and inadequate storage facility were ranked first by farmers under technological, socio-economic, and organizational constraint categories, respectively.

Babalola et al. (2016) carried out a study in Ibadan, the capital of Oyo State, southwestern Nigeria. The research was centered around handling practices and challenges encountered in exotic vegetables marketing. All marketers in the study area were engaged in sales of carrots, sweet pepper, cabbage, cucumber, and watermelon. Almost all sold potato, lettuce, yardlong bean, and green bean and only four per cent sold radish . Carrot, sweet pepper, and cucumber deteriorated within four days and lettuce deteriorated within two days. The most common packaging materials used were polyethylene sacks. The major method of preservation used by marketers was keeping produce in baskets in airy rooms/well-ventilated stores. The major problems encountered by marketers were postharvest losses, inadequate storage facilities, transportation, and low patronage. The study suggested that appropriate cooling and storage facilities during transportation at wholesale and retail centers levels are required to handle these problems.

Kumar et al. (2018) studied the profile and problems of tomato cultivation in Bilaspur district of Himachal Pradesh. The study revealed that regarding various problems in tomato cultivation in the study area, the non-availability of improved varieties at the time of sowing, lack of confidence about using high yielding varieties and lack of awareness regarding disease resistant and high yielding varieties and lack of storage facilities were reported to be the severe problems in the study area. The study suggested that overcoming of these problems could pave the way for increased tomato production in the study area.

Singh and Chauhan (2018) studied production and marketing of off-season vegetables in *Chhota* Bhangal area of district Kangra in Himachal Pradesh. The study found that high incidence of pest and diseases was most prevalent in production of vegetables in the study area. The constraints related to marketing such as non-remunerative price received by farmers and lack of organized vegetable market was the most important problem recorded in the survey using Garrett's mean score of 70.70 on all farm situation.

The comprehensive review of literature presented in the foregoing sections indicated that most of the research work in this area of study relates to economics and marketing of vegetables other than exotic vegetables. The review of various studies

related to present investigation conducted in the past clearly brought out that one or two studies on exotic vegetables have been done in the country. The present study, therefore, is a step to bridge these information gaps which would be helpful in tailoring the policies relating to production and marketing of exotic vegetables in the state and other areas of country at large.

3. MATERIALS AND METHODS

The precision, reliability, and validity of the findings related to the research problem are improved by systematic methodology, which is the bedrock of every scientific inquiry. The selection of representative sample at the first instance and thereafter derivation of the reasonable estimates invariably depends upon the methodology adopted. In this regard, the current chapter has been meticulously prepared and covers in detail the methodological approach used to achieve stated objectives of the study as well as the selection of study area, sampling design, and analytical framework.

The methodology used in this study has been described under the following four sections.

3.1 Selection of the study area

3.2 Sampling design

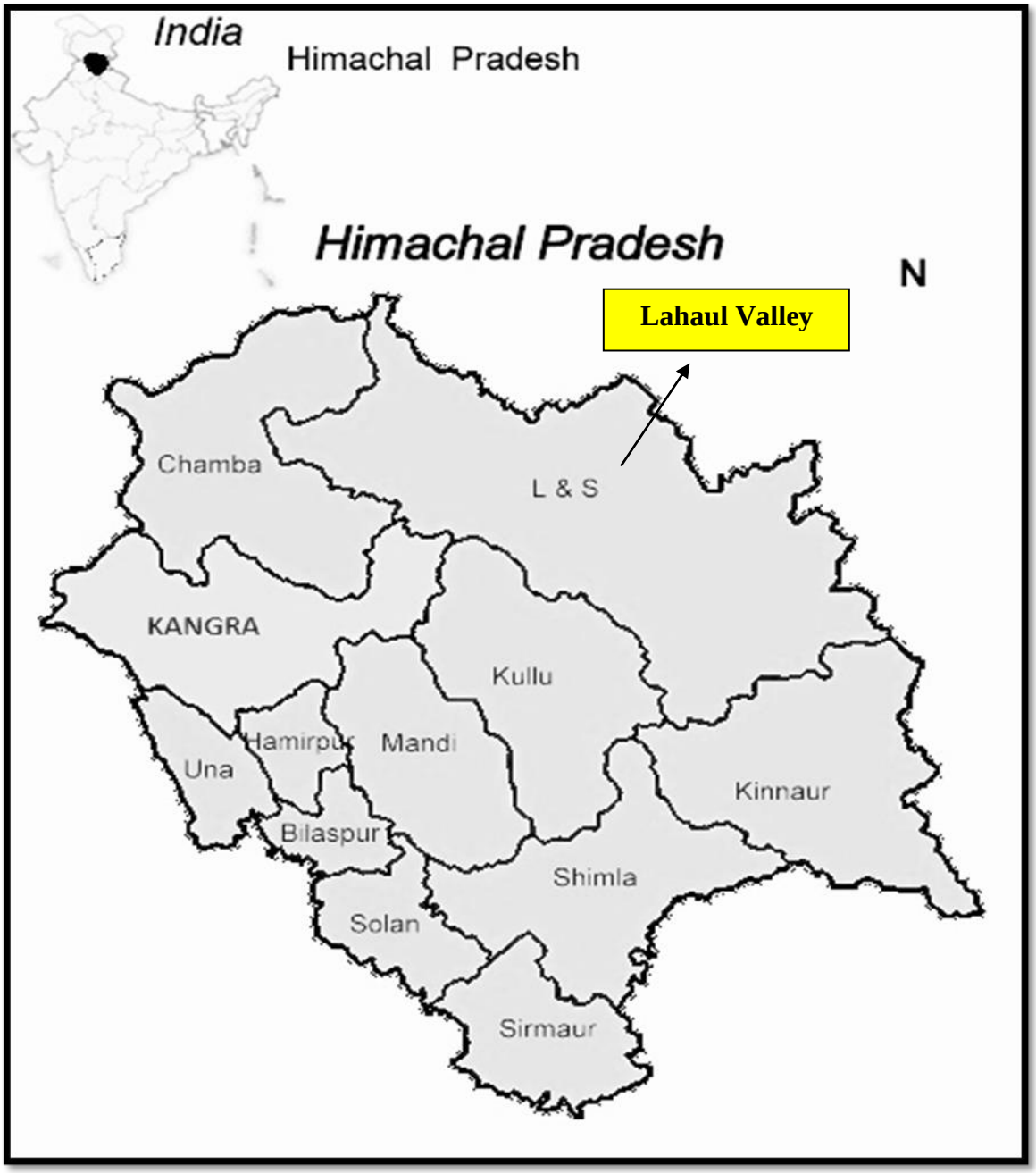
3.3 Data collection

3.4 Analytical tools and models

3.5 Limitations of the study

3.1 Selection of the study area

The study was conducted in the Lahaul Valley, which is situated in the Lahaul & Spiti district. This area was purposely chosen because it is one of niche area in Himachal Pradesh, where agricultural diversification towards exotic vegetable crops has attained momentum in the recent years. The district is divided into two valleys namely, Lahaul where potato, pea, cauliflower and exotic vegetables are the principal crops and Spiti valley where pea, barley and other foodgrain and millets crops are the main crops and the process of diversification towards exotic vegetables is still unnoticed.



= **Study area**

Fig. 3.1 Map showing the location of Himachal Pradesh in India and Lahaul & Spiti District in Himachal Pradesh

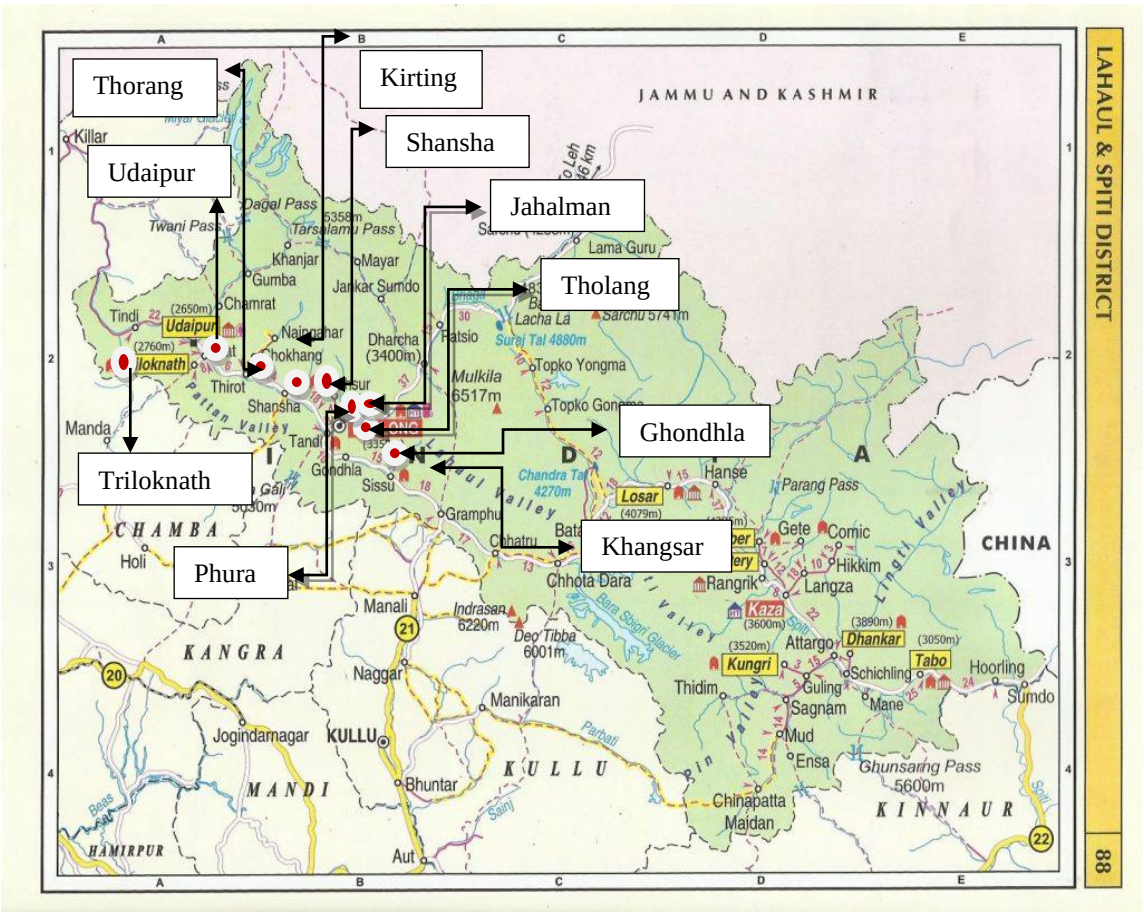


Fig. 3.2: Map showing the location of sample villages in Lahaul valley

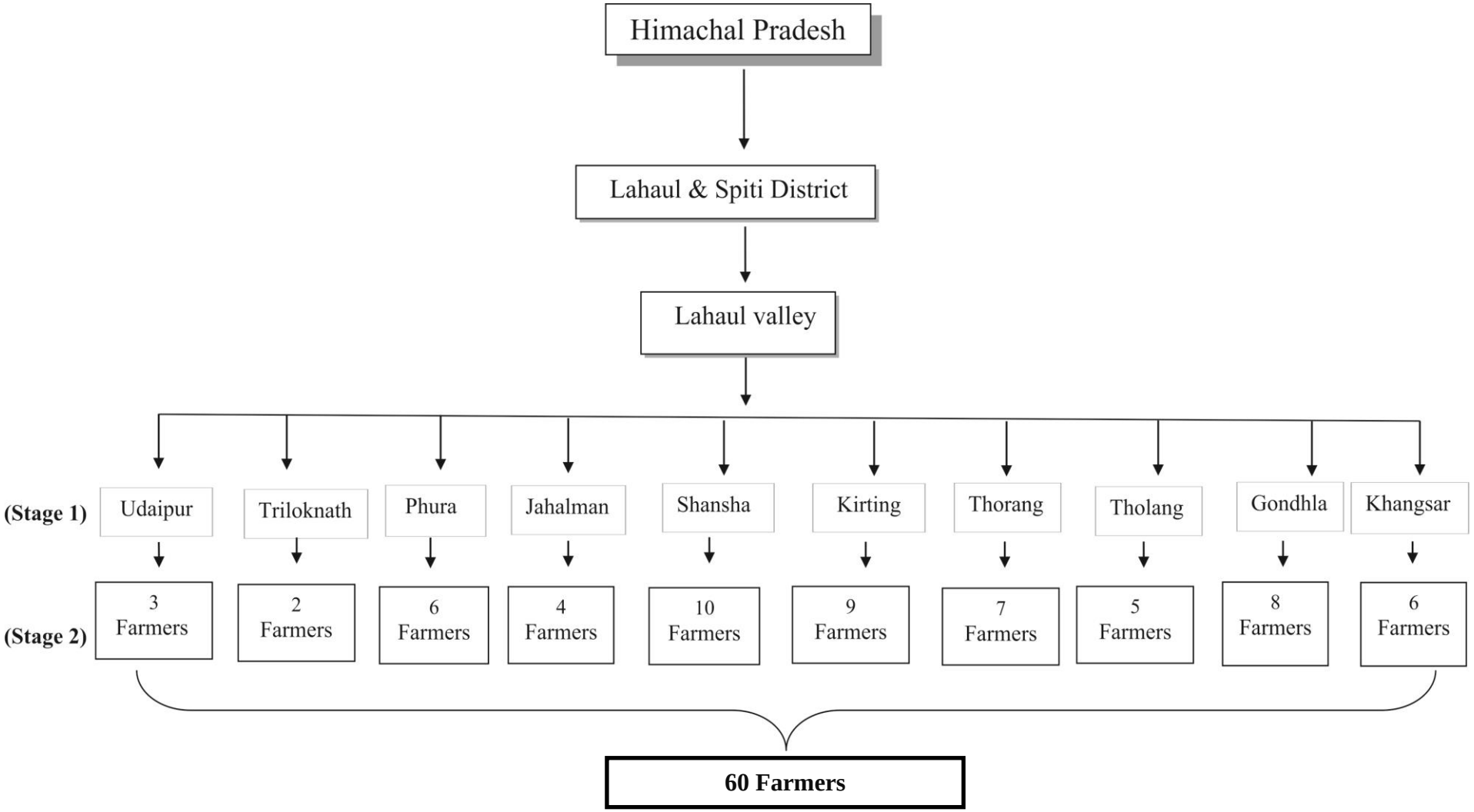


Fig. 3.3 Sampling plan of the study

3.2 Sampling design

Two-stage random sampling design was employed for the selecting representative/ sample farm-households. The sampling design is composed of the following steps.

3.2.1 Selection of villages (Stage 1)

In the first stage of sampling, a complete list of all those villages where commercial cultivation of exotic vegetable is being carried out was taken from the Department of Agriculture, Keylong. In the study area, there were 75 villages commonly growing exotic vegetables. Out of these 10 villages were selected randomly. (Fig. 3.2 and Fig. 3.3).

3.2.2 Selection of sample farm-households (Stage 2)

In the stage 2, a complete list of exotic vegetable growers along with their land holding size from each sample village was prepared in consultation with officials of revenue department and Gram Panchayat pradhans. Keeping the time and resource availability at the disposal of researcher in view, manageable sample of 60 farm households was drawn from the selected villages through proportional allocation technique (Table 3.1). The following formula was used:

$$n_i = \frac{Ni}{N} \times n \qquad i = 1, 2, 3, \ldots\ldots, 10$$

where,

n_i = Number of farmers to be sampled in i^{th} village

N_i = Total number of farmers in i^{th} village

N = Total number of farmers in all the selected villages

n = Total sample size to be chosen (60 farmers)

Plate 3.1: Data collection from exotic vegetable growers

Table 3.1 Distribution of sample farm households

(Number)

Sr. No.	Name of village	No. of farm households
1	Udaipur	3
2	Triloknath	2
3	Phura	6
4	Jahalman	4
5	Shashna	10
6	Kirting	9
7	Thorang	7
8	Tholang	5
9	Gondhla	8
10	Khangsar	6
Total	**10**	**60**

3.3 Data collection

The present study was primarily based on primary data which were collected through survey method. A comprehensive survey schedule was prepared in order to collect comprehensive data from the sample farm households (Appendix-I). The pretesting of survey schedule was done by personally contacting the vegetable growers in the nearby areas to examine the relevance of framed questions and the shortcomings. Thereafter the schedule was modified accordingly by incorporating the lacking information/questions before conducting the main survey. Personal contact on a specially designed and pre-tested schedule was used to obtain primary data on the following aspects. The data pertained to agricultural year 2019-20.

- Demographic features like family size, age, education, occupation, size of land holding, etc. in the study area.
- Economic parameters like land utilization pattern, inventory of farm buildings, tools and machinery, livestock inventory, inventory of land, cropping pattern, production and utilization of crops.

- Farm resources utilization like use of seed, manure, fertilizers, pesticides, employment human labour, power tiller and machinery charges used for different crops.
- Quantity marketed and pattern of disposal and marketing costs, etc.
- Price of various inputs and output of different crops.
- Problems & suggestions of the respondents.

3.4 Analytical tools and models

To achieve the stated objectives of the study different analytical tools were employed for data analysis and interpretation of the results so obtained.

The simple tabular analysis involving averages, ratios, and percentages has been used extensively. Regression analysis was also used to investigate the factors that influenced the output of various crops.

3.4.1 Demographic and crop indices

The following types of indices were worked out:

1. Sex-ratio (females per 1000 males) $= \frac{\text{Total population of females}}{\text{Total population of males}} \times 1000$

2. Literacy rate (per cent) $= \frac{\text{Total number of literate persons}}{\text{Total population excluding non school going below 5 years of age}} \times 100$

3. Cropping intensity (per cent) $= \frac{\text{Total cropped area}}{\text{Net sown area}} \times 100$

4. Dependency ratio w.r.t total workers $= \frac{\text{No. of dependents in the family}}{\text{No. of active workers}}$

3.4.2 Costs concepts

The following cost concepts were used in working out the costs and returns of different crops.

3.4.2.1 CACP cost concepts: The Commission for Agricultural Costs & Prices has categorized the different costs as under:

Cost A_1: Sum of all Variable costs incurred in production+ depreciation on fixed capital assists

Cost A_2: Cost A_1+ rent paid for leased in land

Cost B_1: Cost A_1 + interest on value of owned fixed capital assets (excluding land)

Cost B_2: Cost B_1+ rental value of owned land (net of land revenue) and rent paid for leased-in land

Cost C_1: Cost B_1 + imputed value of family labour

Cost C_2: Cost B_2 + imputed value of family labour

Cost C_3: Cost C_2+ value of management input at 10 per cent of total cost (C_2)

The interest on working capital was calculated on the total working cost of the crop enterprise at the prevailing bank interest rate of 4 per cent rate for half of the crop period.

The interest on fixed capital was computed as per the prevailing lending rate of 7.5 per cent during 2020-21.

For the rental value of land, based on the sample survey customary average rental value was used.

The value of family labour was estimated in terms of eight hours of work per day equivalent to one man day and was valued on the basis of prevailing market wage rate of Rs 400 per day.

3.4.2.2 Farm management cost concept (Dhondhyal 1985): It categorized total cost into total variable cost and total fixed cost. The items included in computation of both of these costs are as under:

1. Variable cost:

1. Human labour
2. Bullock labour
3. Machine labour
4. F.Y.M
5. Seed/seedlings

6.Fertilizers

Sub total

7. Interest on working capital

Total variable cost

2. Fixed cost

1. Depreciation

2. Land revenue

3. Rental value of land

4. Interest on fixed capital

Total fixed cost

Total cost (Total variable cost + Total fixed cost)

3.4.3 Farm efficiency measures

To evaluate the farm income and profits the following measures of farm income and profit efficiency were employed.

1. Gross farm income (GFI)

It is defined as gross value of output including by-product priced at farm harvest rates.

2. Net Farm Income (NFI)

It is also known as profit at Cost C_3. It provides an estimate of returns to the farmer for his labour and profit. It was calculated as:

NFI = GFI – Cost C_3

3. Farm business income (FBI)

It is also known as profit at Cost A_2. It is defined as the disposable income out of the enterprise and is calculated by deducting Cost A_2 from Gross income

FBI = GFI – Cost A_2

4. Farm family labour income (FLI)

It is also known as profit at Cost B_2. It is the return to family labour (including management) and has been calculated by deducting Cost B_2 from the Gross Income.

FLI = GFI – Cost B_2

5. Farm investment income

It is defined as the sum total of net farm income, interest on owned fixed capital and rental value of land.

Output-input ratio (returns per rupee):

$$\text{Output-input ratio} = \frac{\text{Gross returns}}{\text{Cost } C_3}$$

3.4.4 Break-even analysis

Break-even analysis indicates costs-volume-profit relationship in short run. Break-even point is a point at which producer neither loses money nor makes profit. This analysis helps to understand relationships of costs, price and volume within a farm's range of operations.

$$BEP = \frac{TFC}{Py - AVC}$$

where,

BEP = Break-even point in terms of physical units of production

TFC = Total fixed costs (Rs)

AVC = Average variable cost (Rs) = TVC/TO

P_y= Price of the output

where,

TO = Total output

TVC = Total variable cost (Rs)

3.4.5 Marketable and marketed surplus

The marketable surplus and marketed surplus of exotic vegetables grown by farmers were worked out as follows:

$$MSi = TPi - (HCi + KPi + Gi); \quad i=1..2$$

where,

MSi = Marketable surplus of i^{th} vegetable (q)

TPi = Total production of i^{th} vegetable (q)

HCi = Home consumption of i^{th} vegetable (q)

KP_i = Kind payments of i^{th} vegetable (q)

G_i = Disposal of i^{th} vegetable (q)

Likewise, the marketed surplus (actual quantity sold by the farmers) was estimated as follows:

$$Mt_i = MS_i - LM_i$$

where,

Mt_i = Marketed surplus of i^{th} vegetable sold (q)

MS_i = Marketable surplus of i^{th} vegetable (q)

LM_i = Losses of i^{th} vegetable during transportation (q)

3.4.6 Statistical analysis

To examine the factors affecting the output, multiple linear and log-linear functions were tried. Depending upon the value of R^2 (best fit) and the statistical significance of regression coefficients, Cobb-Douglas production function was employed for detailed analysis and discussion.

The multiple log linear (Cobb-Douglas) model of the following form was used.

$$Y = b_0 X_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} e^u$$

Logarithm form of the model is:

$$\text{Log } Y = \text{Log}b_0 + b_1\text{Log}X_1 + b_2 \text{ Log } X_2 + b_3 \text{ Log } X_3 + b_4 \text{ Log}X_4 + u$$

where,

Y= Output of crop (q)

b_0 = Constant term

X_1 = Area under crop (ha)

X_2 = Human labour (man days)

X_3 = Cultivated land fragments (Number)

X_4 = Fertilizers (kg)

$b_{i's}$= Regression coefficients (Production elasticities), i= 1,2,..,4

u = Random term

To examine the significance of each parameter, t-test was employed as under:

$$t_{(\alpha,n-k)} = \frac{b_i}{SE(b_i)}$$

where,

SE (b_i) = Standard error of regression coefficient, i = 1, 2…, 4

n = Number of sample observations

α = Selected level of probability (1 % or 5 %)

As $\bar{R}^2$ is better measure for explaining the variations than R^2, because the value of R^2 goes on increasing as more and more variables in the model are added. Therefore, $\bar{R}^2$ was calculated as under.

$$\bar{R}^2 = 1 - (1 - R^2)\frac{N-1}{N-k}$$

The significance of adjusted co-efficient of multiple determination ($\bar{R}^2$) was tested with help of F- test as under:

$$F = \frac{\bar{R}^2}{(1-\bar{R}^2)} \times \frac{N-k}{k-1} \sim F\,(k-1), (N-k)\ df$$

where,

N = Number of sample observations

k = Total Number of $b_{i's}$ (including constant b_0)

3.4.7 Garrett ranking

Garrett's ranking technique was chosen to identify the most significant problems affecting the farmers. It basically converts the order of constraints and advantage into numerical scores. The main benefit of this method over a basic frequency distribution is that the constraints are ordered according to the importance of the constraints from the respondent's perspective. As a result, different ranks can be assigned to the same number of respondents on two or more constraints. Garrett's formula for converting ranks into per cent is given by:

$$\text{Per cent position} = \frac{100 \times (R_{ij} - 0.5)}{N_j}$$

where,

R_{ij}= Rank given for i^{th} factor by j^{th} individual

N_j = Number of factors ranked by j^{th} individual

The per cent position of each rank was converted into scores referring to the table given by Garrett and Woodworth (1969). For each problem individual respondent scores were put together and divided by the total number of respondents for whom scores were added. These mean scores for all the factors were arranged in descending order and the most ranks were given and most important factors were identified through the ranks assigned.

3.5 Limitations of the study

The present investigation has been carried out systematically using scientific methodology. Every care was taken to draw a representative sample to collect and generate the necessary information to accomplish the research work. The accuracy of the data was ensured through cross-checks in the survey schedules. However, a few limitations as expected in every socio-economic survey may not be overruled, though these limitations would hardly limit the relevance and fidelity of the results derived. Some of the limitations of this study are as under:

1. The present study is based on the data collected for a single agricultural year 2019-20. As variations in output from year to year are very common in agriculture, the results of the study can be generalized only with the assumption that the study year was a normal year.
2. This study is based upon the sample observations collected from 60 households of the selected villages of the study area. This is done keeping in view the limited time and resource constraints at the disposal of the researcher. However, random selection was done to obtain representative sample for the study.
3. As no farm records were maintained particularly by the sampled farmers, the data were, therefore, collected by survey method based on respondent's memory power and past experience. Though, due care was taken by cross checking the information, the possibility of a few slips in the memory of the respondents could not, however, be ruled out.

4. Agriculture being a biological phenomenon is subjected to a number of uncertainties from natural hazards, price fluctuations, market conditions and institutional factors. Hence the best estimates may prove fallacious.
5. The study was confined to a particular geographical area and certain farm size categories. Hence necessary precautions ought to be taken for any generalizations from its findings and its application to other areas and different farm size categories.

4. RESULTS AND DISCUSSION

The most important part of every research investigation is a thorough presentation of results, which allows the researcher to validate or reject the presented hypotheses. This chapter, which is the core of the study, shows the analysis based on various factors such as socio-economic conditions, resource use patterns, economics of different crops grown, their marketing system, and various types of problems faced in vegetable production and marketing. The results in this chapter have been supported by data presented in the form of tables given under the following sections.

4.1 Description of the study area

4.2 Socio-economic contour of sample farm households

4.3 Resource use, costs, returns and efficiency

4.4 Market supply, functionaries and disposal

4.5 Production and marketing constraints

4.1 Description of the study area

Himachal Pradesh is also known as *Dev Bhumi*, which literally means the Land of the Gods. The state of Himachal Pradesh is located in the western Himalayas and it is a small state, with geographical area of 55,673 square kilometre. Its altitude ranges between 350 and 6,975 metre above mean sea level. Sub-montane Low Hills Zone, Mid-hills High Humid Zone, High Hills Temperate Wet Zone, and High Hills Temperate Dry Zone are the four agro-climatic zones of the state.

The state is bordered on the north by Jammu and Kashmir, on the west and south-west by Punjab, on the south by Haryana, on the south-east by Uttarakhand, and on the east by China. The state economy is largely dependent on agriculture, tourism and hydroelectric energy. The state has a total population of 68,64,602 out of which 89.97 per cent population lives in rural areas. Himachal Pradesh currently has 109 tehsils, 63 sub-tehsils, and 80 blocks. (Table 4.1)

Table 4.1 Himachal Pradesh and Lahaul & Spiti district at a glance

Sr. No.	Particulars	Himachal Pradesh	Lahaul-Spiti	Per cent of H.P.
1	Area (sq. km)	55673	13841	24.86
2	Tehsils (No.)	109	2	-
3	Sub-tehsils (No.)	63	1	-
4	Development blocks (No.)	80	2	-
5	Population (No.)	6864602	31564	0.46
6	Rural population (No.)	6176050	31564	0.51
7	Urban population (No.)	688552	-	-
8	Total cropped area (ha)	959223	4235	-
9	Net sown area (ha)	547556	3397	-
10	Cropping intensity (%)	175.18	124.77	-
11	Foodgrain production (’000 MT)	1488.11	7.50	0.50
12	Vegetable production (’000 MT)	2057.38	81.36	3.95
13	Sex-ratio (Female per 1000 males)	972	903	-
14	Literacy rate (%)	82.80	76.80	-
	Male	89.53	85.70	-
	Female	75.93	66.80	-
15	Rainfall (mm)	1232.20	650.70	-

Source: Statistical Abstract of Himachal Pradesh (2019-20), Economics and Statistics Department, Govt. of HP, India.

The study district Lahaul & Spiti lies between 31° 44’ 57″ to 32° 59’ 57″ N latitude and 76˚ 46′ 29″ to 78˚ 41′ 34″ E longitude. The district was formed in 1960, and is the fourth least populous district in India and first in Himachal Pradesh. The salient features of Lahaul & Spiti district are presented in Table 4.1. The table shows that district accounts for 0.46 per cent of the state's total population. The entire population (100%) is located in rural areas. In comparison to the state, the sex ratio is lower (903 females for 1000 males). Overall, the literacy rate is 76.80 per cent, which is lower than the state average (82.80%). The literacy rates for males and females are 85.70 per cent and 66.80 per cent, respectively. The cropping intensity is 124.77 per cent which is less than the state cropping intensity of 175.18 per cent.

4.2 Socio-Economic contour of sample farm households

The study of a farming household's socio-economic profile is fundamental, since it significantly influences the farm functioning. It affects and influences the effectiveness of every farming operation. The profile of the family head, the family's age distribution, the education of family members, land ownership and cropping patterns all have a role in resource utilization and adoption of new technology. This section tries to touch on these areas and provides an overview of the socio-economic condition of the farm household in the research region.

4.2.1 Profile of head of the family

The information about head of the family is vital since he or she is the one who makes all the decisions about the production process and farm management. Risk bearing ability is directly connected with the age and education level of the decision-maker. Table 4.2 represents the profile of head of the family of sample farm households. It includes age, education and occupation detail of the head of the family. It can be seen from the table that the majority of the respondents (58.33%) were between the age of 41 and 60 years. In terms of education, four respondents (6.67%) were post-graduates, 24 were graduates (40.00%), and 16 were matriculate (26.67%). Agriculture was the main occupation of majority of the heads/respondents (80.00%), while service/job was reported as the main occupation by the 20 per cent of the heads/respondents. The proportion of heads/respondents, who had no secondary occupation was three-fourth of total heads and just a handful had secondary occupations such as salesmanship, shopkeeper, and contractor, etc. The details of age-wise distribution and education level of head of the family also have been depicted through Figures 4.1 and 4.2.

4.2.2 Family size and structure

In the agriculture sector, family size and structure have a significant bearing on decision-making. Because our agriculture is labour-intensive, the size of the family determines the size of the labour force as well as the well-being of that household. The sample household family size and structure have been displayed in Table 4.3. The average family size was four persons, according to the findings of the study. The number of male and female was two each per household. The average family was composed of three adults and one child. As per the family structure information, 31 households (51.67%) had

a nuclear family structure, compared to 29 (48.33%) households with a joint family structure having family members above five or six.

Table 4.2 Profile of head/respondent of the family of sample farm households

Sr. No.	Particulars	No.	Per cent
1	Age (years)		
I	26-40	11	18.33
II	41-60	35	58.33
III	Above 60	14	23.34
	Total	60	100.00
2	Education		
I	Illiterate	3	5.00
II	Primary	5	8.32
III	Middle	4	6.67
IV	Matriculate	16	26.67
V	Senior secondary	4	6.67
VI	Graduation	24	40.00
VII	Post-graduation	4	6.67
	Total	60	100.00
3	Occupation (Main)		
I	Agriculture	48	80.00
II	Service/Job	12	20.00
	Total	60	100.00
4	Occupation (Subsidiary)		
I	Agriculture	12	19.99
II	Salesman	1	1.67
III	Shopkeeper	1	1.67
IV	Contractor	1	1.67
V	No occupation	45	75.00
	Total	60	100.00

Table 4.3 Family size and structure of sample farm households

Sr. No.	Particular	Number	Per cent
1	Family Members		
a	Males per household	2.48	
b	Females per household	2.05	
2	Average family size	4.53	100.00
a	Adult	3.98	87.86
b	Children*	0.55	12.14
3.	Family Structure		
a	Nuclear	31	51.67
b	Joint	29	48.33
c	Total	60	100.00

Note: *Children below 15 years of age.

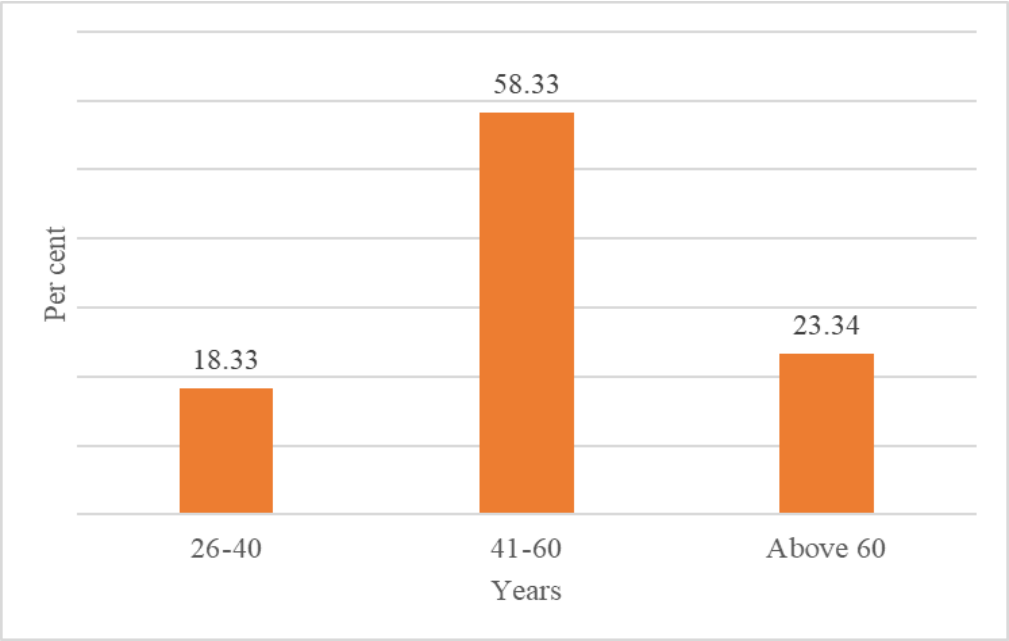


Fig. 4.1 Age-wise distribution of head of family

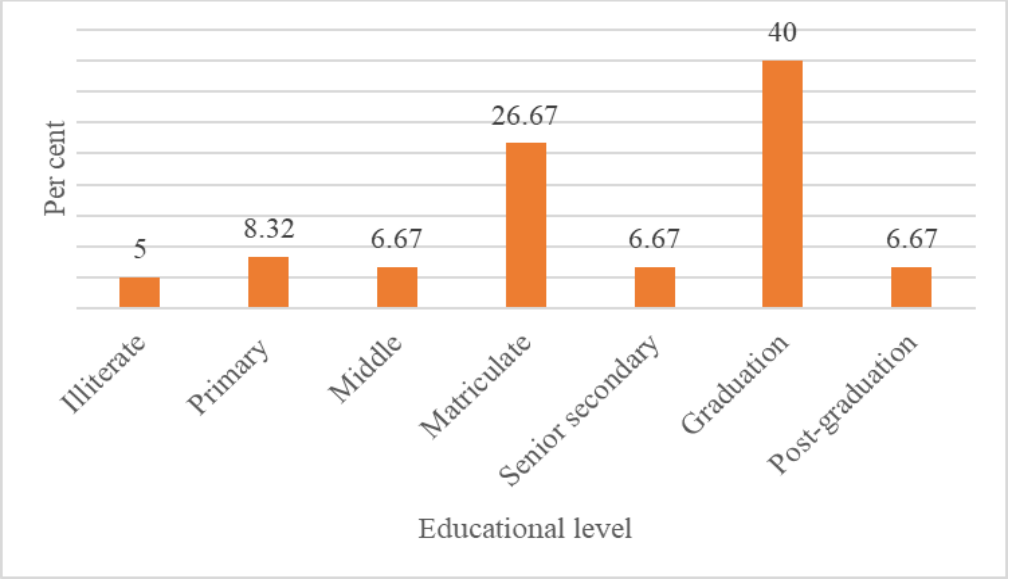


Fig. 4.2 Education level of head of family

4.2.3 Age and gender-wise classification

The age and gender distribution of a family unit can also be used to evaluate its dependency ratio and active workforce. Both of these are equally important from the perspective of policymaking. A dependency ratio is primarily formed by individuals under the age of 15 and those over the age of 60 as a proportion of total population. The age-wise distribution of sample farm household is given in Table 4.4. This table illustrates that, dependency ratio w.r.t total workers was 0.45. The dependency ratio of males was 0.48 and in females it was 0.41. Table also presents that more than 50 per cent of population was between 31-60 years of age. The sex ratio turned out to be 826, which indicates an adverse female population compared to the male population. The gender also influences the access to land and capital assets which is having direct impact on farm production and productivity. The share of male and female in total population was observed to be 54.78 per cent and 45.22 per cent, respectively. The detail of age-wise distribution of family members has also been depicted through Figure 4.3.

4.2.4 Education status of family members

Education is essential not only for an individual's personal progression, but also for society's development. With this in mind, Table 4.5 shows the level of education of the family. It can be seen from the table that around eight per cent of the family members in the sample were illiterate, with female members accounting for the majority of the illiteracy. In comparison, only two per cent of male members were illiterate as against 15.45 per cent of illiterate female members. Around 19 per cent of literate members had attained education up to the matriculate level. Members with education up to graduation and post-graduation were 38.97 per cent and 3.31 per cent, respectively. This suggested that maximum number of persons in the study area completed their education above secondary level. After examining the literacy rates of sample farmers, large disparity was seen among male (96.30%) and female literacy rates (82.11%). In the sample farm households, the overall literacy rate was reported to be 89.34 per cent. The detail of education status of family members has also been depicted through Figure 4.4.

Table 4.4 Age-wise classification of the total population of sample farm households

(Number)

Sr. No.	Age group (Years)	Male	Female	Total
1	Upto 15	17 (11.41)	16 (13.01)	33 (12.12)
2	16-30	21 (14.09)	13 (10.57)	34 (12.49)
3	31-45	35 (23.49)	32 (26.02)	67 (24.62)
4	46-60	45 (30.20)	42 (34.14)	87 (31.98)
5	Above 60	31 (20.81)	20 (16.26)	51 (18.79)
Total		149 (100.00)	123 (100.00)	272 (100.00)
Sex ratio#			826	
Average Dependents		0.80	0.60	1.40
Average workers		1.68	1.45	3.13
Dependency ratio w.r.t total workers		0.48	0.41	0.45

Note: Figures in parentheses indicate percentages to total.
#Number of females per thousand males

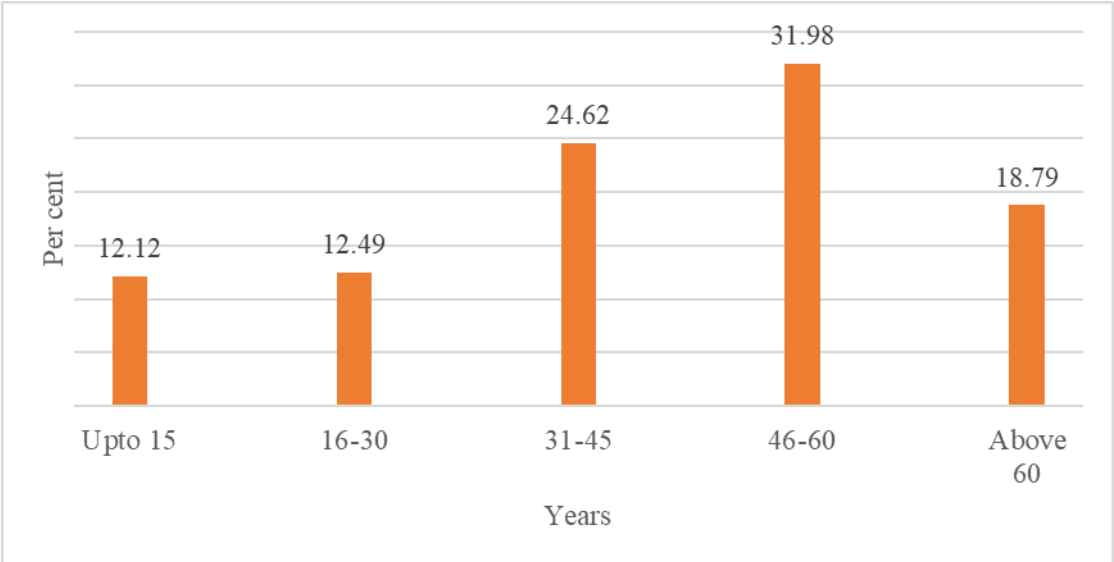


Fig. 4.3 Age-distribution of family members

Table 4.5 Educational status of family members

(Number)

Sr. No.	Particulars	Male	Female	Total
1	Non-school going*	4	3	7
		(2.68)	(2.44)	(2.57)
2	Illiterate	3	19	22
		(2.01)	(15.45)	(8.09)
3	Primary	7	16	23
		(4.70)	(13.01)	(8.46)
4	Middle	14	11	25
		(9.40)	(8.94)	(9.19)
5	Matriculation	34	18	52
		(22.82)	(14.63)	(19.12)
6	Senior secondary	15	13	28
		(10.07)	(10.57)	(10.29)
7	Graduation	67	39	106
		(44.97)	(31.71)	(38.97)
8	Post-graduation	5	4	9
		(3.35)	(3.25)	(3.31)
	Total	149	123	272
		(100.00)	(100.00)	(100.00)
Literacy rate (%)		95.30	82.11	89.34

Note: Figures in parentheses indicate percentages to total.
*Children below 5 years of age

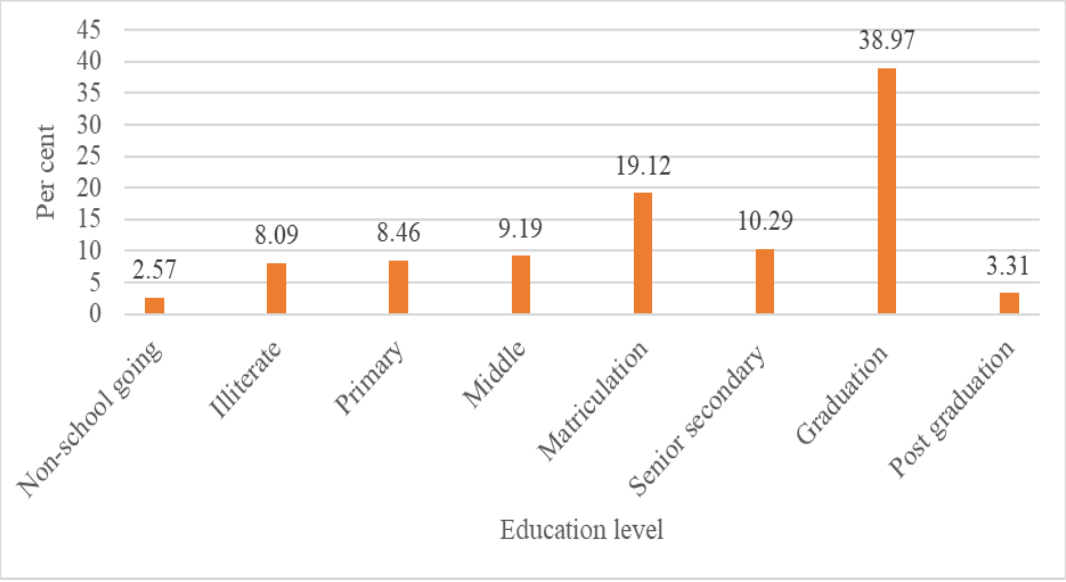


Fig. 4.4 Education level of family members

4.2.5 Landholdings and its distribution

Agriculture is a land-based occupation in general. By far the most basic requirement for agriculture is land, and the whole occupation revolves around it. The size of a farmer's landholding seems to have a direct link with his or her social standing, but it also has a major effect on all the decisions made by a farmer in the production of any crop enterprise. Table 4.6 presents the land holding details and its distribution on sample farm households. Because of the weather patterns and the abundance of water, the entire area presented in the table is irrigated. The total land area per farm household was 1.60 hectares of which 96.25 per cent was owned land and the remaining 3.75 per cent was leased-in area. The area under cultivation was 1.04 hectares (65.00%), with the remaining 0.56 hectares (35.00%) being used for grazing as pastures. The total cultivated area falls under field crops solely (46.88% of operational holding) and mixture of fruits and field crops (18.12% of operational holding).

Table 4.6 Land holdings and its distribution

(ha/farm household)

Sr. No.	Particulars	IR	UIR	Total
1	Owned land	1.54	-	1.54
		(96.25)		(96.25)
2	Leased-in	0.06	-	0.06
		(3.75)		(3.75)
3	Leased-out	-	-	-
4	Total land holding	1.60	-	1.60
		(100.00)		(100.00)
I	Cultivated land	1.04	-	1.04
		(65.00)		(65.00)
	a. Cultivated area under field crops	0.75		0.75
		(46.88)		(46.88)
	b. Cultivated area under fruits and field crops*	0.29		0.29
		(18.12)		(18.12)
II	Pastures and grassland	0.56	-	0.56
		(35.00)		(35.00)

Note: Figures in parentheses indicate percentages to total land holding.
IR= Irrigated; UIR= Unirrigated
*The cultivated area under fruit plants on an average were having 127 plants of apple and cherry per farm household.

4.2.6 Distribution of land according to land fragments

The landholdings in the study area are generally divided into many land fragments. As a result, it is necessary to present additional land classifications based on land fragments. Table 4.7 presents the exact details. The table reveals that about 13 per cent of farm households owned land holding having less than five fragments, with an average size of 0.65 hectares. The land holdings consisting of 5-8 fragments were owned by 35.00 per cent of farm households with an average size of 1.07 hectares. With an average holding size of 1.86 hectares having 8-16 fragments were owned by about 43 per cent of households. About 8 per cent of sample farm households were having large holding with an average size of 3.36 hectares consisting of more than 16 fragments.

Table 4.7 Distribution of land according to number of land fragments.

Sr. No.	No. of fragments	No. of farm households	Average size of land holdings (ha)
1	<5	8 (13.34)	0.65
2	5-8	21 (35.00)	1.07
3	8-16	26 (43.33)	1.86
4	>16	5 (8.33)	3.36
	Total	60 (100.00)	

Note: Figures in parentheses indicate percentages to the total.

4.2.7 Livestock composition and investment

Livestock husbandry is an essential element of agriculture. It acts as a complementary enterprise to agriculture, and a ready source of additional income for the farmer. When comparing animals of various types across farms, the livestock were converted into Standard Animal Units (SAUs), with 1.40 unit of improved cow, 0.75 unit of heifer, 0.33 unit of calves, and 0.50 unit of sheep (Kumbhare et al. 1993).

Table 4.8 portrays livestock composition and its investment pattern in sample farm households. The total number of livestock per household was 3.95, with sheep being the most popular among the farmers. The number of sheep was 1.85. The number of improved cows was 1.63, with in which milk cows accounted for 1.38 and dry cows accounted for 0.25. For the sample farm households, the wet-dry ratio was found to be 5.52. The sample farm households had a total of 3.43 SAUs. The table also contains

information on investment in various farm animals. Improved cows accounted for largest investment of 61.47 per cent. The sheep ranked second in number sharing 28.80 per cent of total investment on livestock.

Table 4.8 Livestock composition and investment

(Per farm)

Sr. No.	Particulars	Number	Value (Rs)	Percentage
1	Cow (improved)	1.63	31601	61.47
	a. In milk	1.38	26084	50.74
	b. Dry	0.25	5517	10.73
	Wet-dry ratio	5.52		
2	Young stock	0.47	5005	9.73
	a. Heifer	0.17	3667	7.13
	b. Calves	0.3	1338	2.60
3	Sheep	1.85	14800	28.80
Total livestock		3.95	51406	100.00
Total SAUs		3.43		

4.2.8 Investment on farm buildings and structures

The number and types of farm and residential buildings reflects the economic conditioning of any household. Table 4.9 shows that residential buildings accounted for more than 95 per cent of the total investment made by sample households on buildings and structures. The other farm structure included cattle shed, and vermicompost/storehouse that accounted for 4.07 per cent and 0.50 per cent of total investment. According to the table, 78.00 per cent buildings were a *pucca* home structure, 10.00 per cent were *kuchcha* house structure, and 12.00 per cent were mixed type house construction. *Pucca*, *kuchcha*, and mixed buildings for cattle were 81.82 per cent, 13.64 per cent, and 4.54 per cent, respectively.

4.2.9 Farm implements, tools and machinery

The quantum of investment in farm implements, tools and machinery reflects the extent of mechanization and soundness of the farming. The mechanization is critical for timely performing the various farm operations, reducing their cost of accomplishing, efficient mechanization of inputs used, land and labour productivity improvement and drudgery reduction. Table 4.10 presents the inventory and investment scenario in sample farm households. The total investment in all types of implements, tools, and machinery

was to the tune of Rs 147336. On an average, the highest investment was made on machinery (54.93%) as there were power driven farm machinery like power tiller and chaff cutter in possession of majority of sample farm households. In the total investment, implements and tools accounted for the investment of Rs 126392 (85.77%), and farm irrigation Rs 20944 (14.23%). The maximum investment by average farm household was made on power tiller (32.68%). The investment on plough (12.46%) and sprinkler pipes (7.34%) accounted for considerable share of total investment. Since equipment like a power tiller and a sprinkler system was acquired under a subsidy programme, the values in the table solely represent the amount paid by a farmer.

Table 4.9 Investment on farm buildings and structures

(Per farm)

Sr. No.	Particulars	Number	Value (Rs.)	Per cent
1	Residential building	1.00	2892288 (95.43)	100.00
	a. *Pucca house*	0.78	2742288 (90.48)	78.00
	b. *Kuchcha house*	0.10	45833 (1.51)	10.00
	c. *Mixed type*	0.12	104167 (3.44)	12.00
2	Cattle shed	1.10	123384 (4.07)	100.00
	a. *Pucca*	0.90	109967 (3.63)	81.82
	b. *Kuchcha*	0.15	7417 (0.24)	13.64
	c. Mixed	0.05	6000 (0.20)	4.54
3	Other farm structure (vermicompost, Store house)	0.52	15100 (0.50)	100.00
	a. *Pucca*	0.32	11817 (0.39)	61.54
	b. *Kuchcha*	0.20	3283 (0.11)	38.46
	Total		3030772 (100.00)	

Note: Figures in parentheses indicate percentages to total value.

Table 4.10 Investment on farm implements, tools (operated by hand) and machinery (Per farm)

Sr. No.	Particulars	Number	Value (Rs)	Percentage
A	Farm operations			
a	Implements/ tools			
1	Plough	1.03	18362	12.46
2	Wheel hoe weeder	0.70	1056	0.72
3	Spade	3.2	2260	1.53
4	Hoe	9.4	1887	1.28
5	Rake	3.3	1998	1.36
6	Sickle	10.4	3125	2.12
7	Axe	2.3	900	0.61
8	Knapsack power sprayer	1.48	5132	3.48
9	Plastic crates	17.9	8950	6.08
10	Plastic *Kiltas*	4.5	1787	1.21
	Sub Total (a)		**45457**	**30.85**
b	Machinery			
1	Tractor	0.05	23750	16.12
2	Power tiller*	1.13	48154	32.68
3	Chaff cutter	0.95	9031	6.13
	Sub Total (b)		**80935**	**54.93**
	Total of A (a+b)		**126392**	**85.77**
B	Farm irrigation			
1	Sprinkler pipes*	67.65	10817	7.34
2	Sprinklers*	13.15	3153	2.14
3	Rain gun/mini rain gun	1.85	6974	4.74
	Total of B		**20944**	**14.23**
	Total (A+B)		**147336**	**100.00**

Note: *indicate subsidized items.

4.2.10 Occupational pattern

The family's occupational structure has a direct influence on the household income and financial stability. The more developed a region is higher the prospects for employment and income for the family. However, in hilly areas, residents mostly depend on agriculture and agricultural occupations to supplement their income. Table 4.11 presents the occupational pattern of the working population of sample farm households. Agriculture was reported to be the primary source of income for a large number of working persons (82.27%). The table shows that 73.91 per cent males and 93.18 per cent females were occupied in agriculture. In comparison to 167 persons who have agriculture

as their primary occupation, only 36 persons reported agriculture as a secondary occupation and they were either working in government service or receiving a pension. Other occupation such as businesses/ trade, etc. as a main or subsidiary was negligible, but some of the households had salesmanship (1 person), shopkeeper (2 persons), homestay (1 person), and contractor ship (1 person) as a subsidiary occupation to supplement their income. Jha (2007) also reported that agriculture was the main source of income for the majority of the farming population. The table further highlights that 19.71 per cent of working population has the one or other subsidiary occupation whereas a large fraction of workers (80.29%) have no subsidiary occupation. The average workforce per household in the study area was recorded to be 3.38 man days per day.

Table 4.11 Occupational pattern of working population of sample farm households

(No. of persons)

Sr. No.	Occupations	Male		Female		Total	
		Main	**Subsidiary**	**Main**	**Subsidiary**	**Main**	**Subsidiary**
1	Agriculture and allied activities	85 (73.91)	30 (26.09)	82 (93.18)	6 (6.82)	167 (82.27)	36 (17.73)
2	Service/Pensioner	30 (26.09)	-	6 (6.82)	-	36 (17.73)	- -
3	Salesman	-	1 (0.87)	-		-	1 (0.50)
4	Shopkeeper	-	-	-	2 (2.27)	-	2 (0.98)
5	Homestay	-	1 (0.87)				1 (0.50)
6	Contractor	-	1 (0.87)	-		-	
7	No occupation	-	82 (71.30)		80 (90.91)		163 (80.29)
	Total	115 (100.00)		88 (100.00)		203 (100.00)	
	Available workforce (man days/ farm/ day)	3.38					

Note: Figures in parentheses indicate percentages to total.

4.2.11 Cropping pattern and sequence

Cropping pattern indicates the distribution of operational holding under different crops during a particular period. The study of existing cropping pattern shows the importance of each crop in the cultivated area, as it evaluates the proportion of area under various crops at a point of time in a unit area. It also reveals the extent of crop diversification in the study area. Table 4.12 presents the cropping pattern on sample farm households for *kharif*/summer season of the agricultural year of 2019-20 because there is only one cropping season in the study area. It can be seen from the table that exotic vegetables occupied the maximum area of 0.67 hectares (51.54%) of the total cropped area, followed by other vegetables such as cauliflower & peas (37.69%) and potato (10.77%). Lettuce (Crisphead) was the main vegetable among the category of exotic vegetables accounting for 28.46 per cent of gross cropped area followed by broccoli (18.46%) and lettuce (leafy) which accounted for nearly five per cent of gross cropped area. The other vegetable category included cauliflower and peas as the major crops, which shared about 25 per cent and 10 per cent of gross cropped area. In the sample farm households, cropping intensity was found to be 125.00 per cent. The Figure 4.5 also showed cropping pattern on sample farm. Jha (2007) also reported a cropping intensity of 102.23 per cent in the same study area.

Table 4.12 Cropping pattern on sample farm households

Sr. No.	Crops	Area (ha)	% of total cropped area
1	Exotic vegetables	0.67	51.54
I	Lettuce (Crisphead)	0.37	28.46
II	Lettuce (Leafy)	0.06	4.62
III	Broccoli	0.24	18.46
2	Other vegetables	0.49	37.69
I	Cauliflower	0.33	25.38
II	Peas	0.13	10.00
II	Other crops	0.03	2.31
3	Potato	0.14	10.77
	Gross cropped area (1+2+3)	1.30	100.00
	Net sown area	1.04	
	Cropping intensity (%)	125.00	

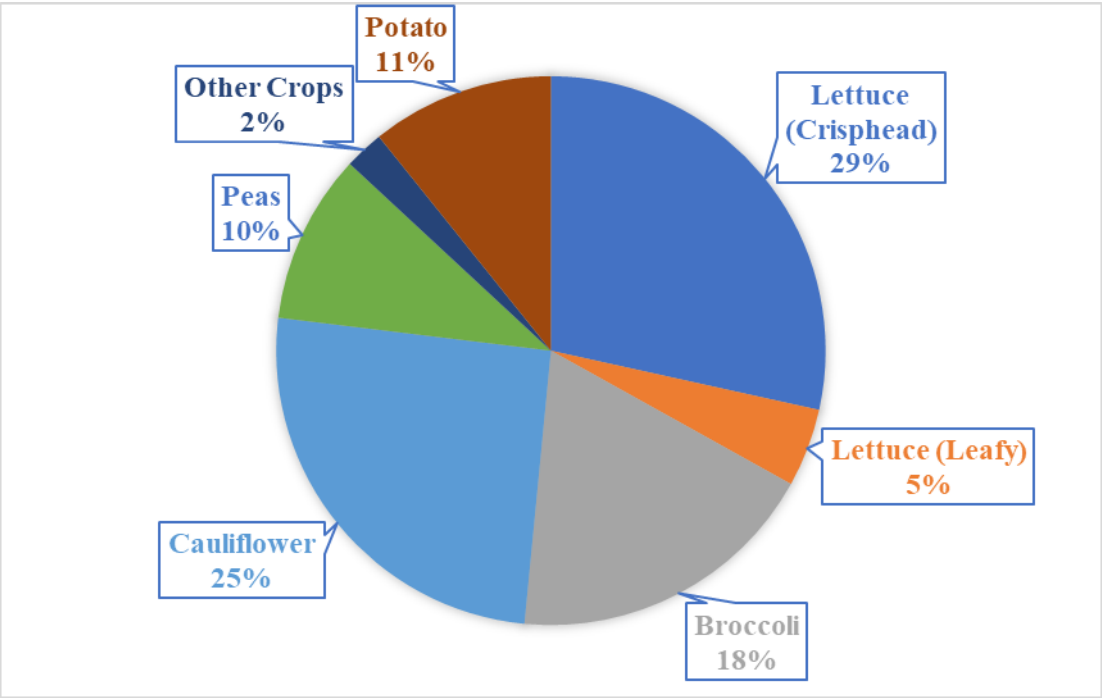


Fig. 4.5 Cropping pattern on sample farms

4.2.12 Cropping sequence

The climatic condition of the study area traditionally restricts farmers from taking two crops in one season but after diversification towards exotic vegetables new trend in cropping sequence emerged in the study area. The exotic vegetables are short duration crops which facilitated growing of two crops in single season. Table 4.13 represents the double cropping sequence followed by the farm households. It can be seen from the table that 55.00 per cent of farmers were following lettuce-lettuce cropping sequence covering nearly 15.00 per cent of operational holding. The other cropping sequence followed was pea-lettuce which was patronized by more than 41.00 per cent of farmers and accounted for 25.00 per cent of operational holding and third cropping sequence was broccoli-broccoli followed by 36.67 per cent of farmers shared about 12.00 per cent of operational holding.

Table 4.13 Double cropping sequence followed by sample farm households

Sr. No.	Cropping sequence	Farmers		Area (ha)	
		No.	Per cent	Per farm	Per cent of operational holding
1	Lettuce-lettuce	33	55.00	0.16	15.38
2	Pea-lettuce	25	41.67	0.26	25.00
3	Broccoli-broccoli	22	36.67	0.13	12.50

4.2.13 Production and productivity of major crops grown

The production and productivity of main vegetables produced in the study area are shown in Table 4.14. The table depicts that among exotic vegetables, the per farm production was maximum in case of lettuce crisphead (115.62 q) followed by broccoli (60.00 q) and lettuce leafy (16.50 q). Among other vegetables grown, cauliflower yielded nearly 95 quintals per farm followed by potato (47.25 q) and pea (16.25 q). The table further showed, productivity of major crops grown on sample farms. In case of exotic vegetables, lettuce (Crisphead) has highest productivity of 312.50 quintals per hectare followed by lettuce (leafy) which has productivity of 275.00 quintals per hectare and broccoli (250 quintals/ha). In case of other vegetables, potato has highest productivity of 337.50 quintals per hectare followed by cauliflower (287.50 q/ha) and pea (125.00 q/ha).

Table 4.14 Production and productivity of major crops grown

Sr. No.	Crops	Production (q/farm)	Productivity (q/ha)
1	Lettuce (Crisphead)	115.62	312.50
2	Lettuce (Leafy)	16.50	275.00
3	Broccoli	60.00	250.00
4	Potato	47.25	337.50
5	Cauliflower	94.88	287.50
6	Pea	16.25	125.00

4.2.14 Gross household income

Income statistics give us an insight into standard of living of people in the study area. The farm and non-farm activities are the main source of income in the study area. The farm income was estimated as value of main product multiplied with its price. The income generated from non-agricultural activities like services, business, etc. were considered as non-farm income. Table 4.15 gives the average annual gross income of sample farm households. The gross income per household was estimated to be 14.91 lakhs. The proportion of farm income (84.31%) was strikingly large in comparison to non-farm income, as can be seen from the table (15.69%). Exotic vegetables provided the most to farm income (53.58%), followed by other vegetables and livestock, which contributed (30.73%). As regards non-farm income, government services were the most important contributor (10.73%) followed by pension (3.35%). The table concludes that agriculture was the primary source of income for farm household in the study area. The composition of income has also been depicted in Figures 4.6 and 4.7. The high income per household was also found to be in accordance with the results of Chand et al. (2009). The study done by them in 551 districts of India found that four districts recorded productivity of more than Rs one lakh per hectare of which three districts were from Himachal Pradesh and Lahaul and Spiti was one of them. The study observed the productivity of Rs 1.5 lakh per hectare in Lahaul & Spiti district which was highest in India.

Table 4.15: Average annual gross income of sample farm households

(Rs /farm)

Sr. No	Particulars	Annual gross income	Per cent
A	Farm income		
1	Agriculture	1215286	81.49
I	Exotic vegetables		
	Lettuce	289050	19.38
	Broccoli	510000	34.20
II	Other vegetables		
	Potato	118125	7.92
	Cauliflower	208736	14.00
	Pea	89375	5.99
2	Livestock	42066	2.82
	Sub total	1257352	84.31
B	Non-farm income		
1	Govt service	160000	10.73
2	Pension	50000	3.35
3	Other sources (Homestay, Salesman, Shopkeeper, Contractor)	24000	1.61
	Sub-total (1+2+3)	234000	15.69
	Total (A+B)	1491352	100.00

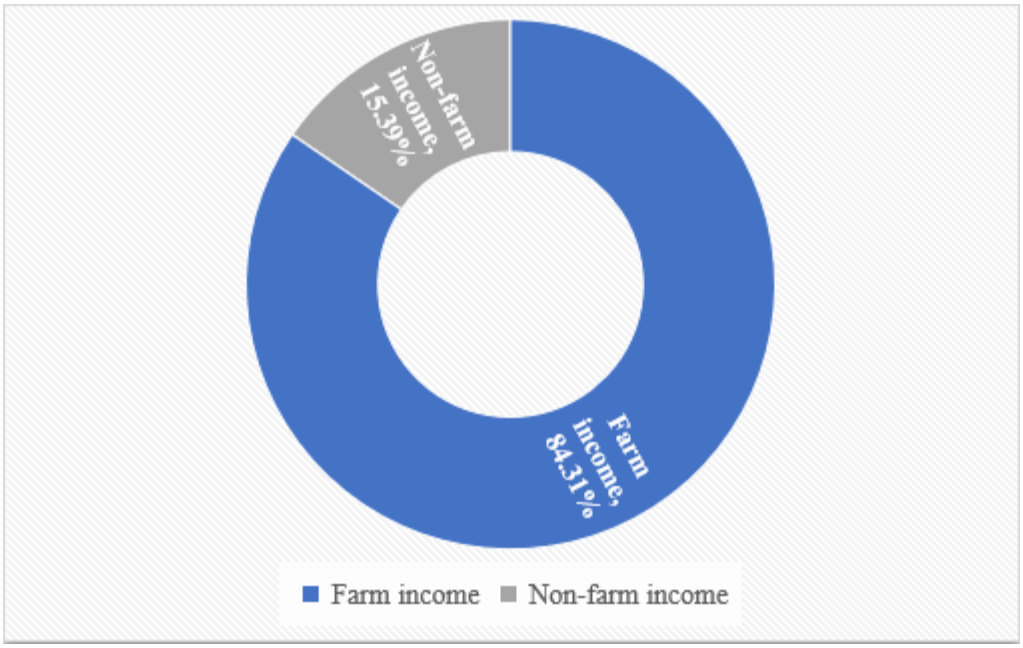


Fig. 4.6 Distribution of farm and non-farm income of sample farm households

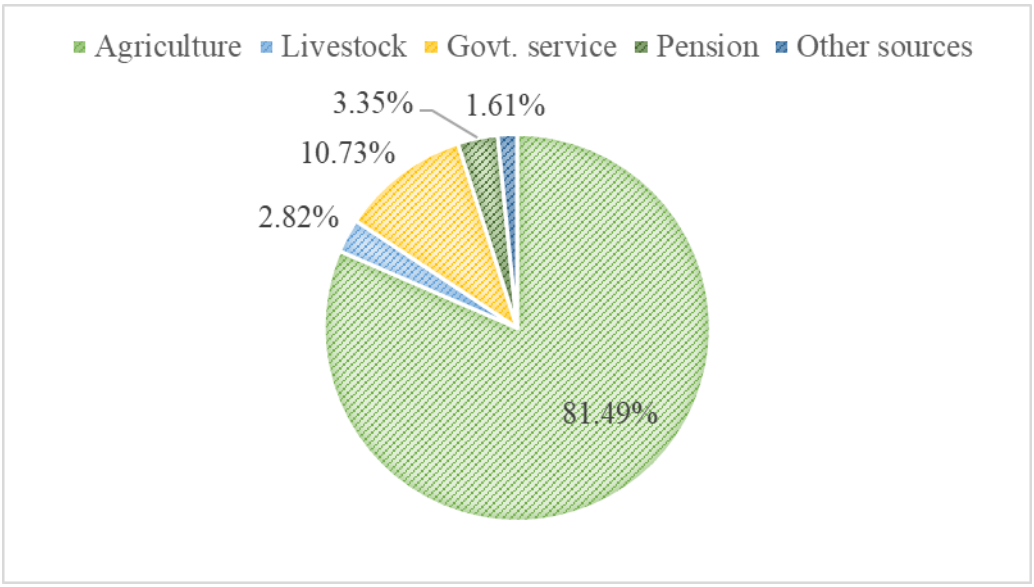


Fig. 4.7 Share of different components in annual gross income of sample farm households

Table 4.16 Labour utilization pattern in production of major crops

Sr. No.	Particulars	Exotic vegetables				Other vegetables					
		Lettuce		Broccoli		Potato		Cauliflower		Pea	
		Per ha	Per cent	Per ha	Per cent	Per ha	Per cent	Per ha	Per cent	Per ha	Per cent
1	Nursery raising	13.13 (2.36)	4.14	19.04 (4.57)	4.19	-	-	18.49 (6.47)	5.93	-	-
2	Transplanting	32.85 (5.91)	10.36	38.08 (9.14)	8.39	-	-	33.71 (11.80)	10.82	-	-
3	Seed treatment and sowing	-	-	-	-	92.04 (21.17)	19.17	-	-	21.74 (5)	7.54
4	Field preparation	19.66 (3.54)	6.20	12.71 (3.05)	2.80	35.65 (8.2)	7.42	12.34 (4.32)	3.96	24.83 (5.71)	8.61
5	Application of FYM/vermicompost	26.22 (4.72)	8.27	50.79 (12.19)	11.19	41.91 (9.64)	8.73	37.00 (12.95)	11.87	35.00 (8.05)	12.14
6	Fertilizer application	39.35 (7.09)	12.42	34.92 (8.38)	7.69	45.09 (10.37)	9.39	31.29 (10.95)	10.04	37.26 (8.57)	12.92
7	Weeding operation	105.01 (18.90)	33.12	165.08 (39.62)	36.37	37.56 (8.64)	7.82	92.49 (32.37)	29.68	39.04 (8.98)	13.54
8	Plant protection measures	2.12 (0.38)	0.67	31.75 (7.62)	6.99	35.65 (8.2)	7.42	12.34 (4.32)	3.96	6.22 (1.43)	2.16
9	Harvesting/picking/digging/cutting	78.73 (14.17)	24.83	101.58 (24.38)	22.38	192.26 (44.22)	40.04	73.97 (25.89)	23.74	124.22 (28.57)	43.09
	Total	317.06 (57.07)	100.00	453.95 (108.95)	100.00	480.17 (110.44)	100.00	311.63 (109.07)	100.00	288.3 (66.31)	100.00

Note: Figures in parentheses indicate per farm man days for respective operation.

4.3 Resource use, costs, returns and efficiency

From the perspective of creating a comprehensive production plan and price policy, a study of resource utilization and returns received is critical. The input utilization calculation shows the amount and type of technologies used in the production process, as well as how these affect crop productivity. The objective of this section is to present and compare the resource utilization pattern and economics of different vegetable crops cultivated by farm households.

4.3.1 Labour employment

In the production of crops, labour plays a vital role. Particularly in vegetable farming, where mechanization is limited, labour becomes a crucial factor. Various operations, such as nursery raising, transplanting, interculture and up to vegetable harvesting, require continuous use of human labour. The different crop enterprises have different potential of generating employment to the available labour workforce. The duration of labour engaged in different operational activities was converted into human labour days to estimate the total labour requirement for the production of different vegetable crops. Eight hours of working in field were considered equivalent to one man day. Table 4.16 shows the labour utilization pattern in the production of major crops grown in the study area. The vegetables like lettuce and broccoli required a total of 317 and 454 man days per hectare, for performing all the operations in the crop production period. The operation wise labour use pattern highlighted that weeding and harvesting were the labour consuming operations on which collectively 58 to 59 per cent of total labour employment was utilized. In case of potato and pea, total labour requirement for all operations was 480 and 288 man days per hectare, respectively, where harvesting accounted for about 40 per cent and 43 per cent of total labour used. Besides harvesting, the other important operations in both the crops included sowing, fertilizer application, and weeding. In cauliflower, weeding (29.68%) and harvesting (23.74%) emerged out to be labour consuming operations. The table further shows that total man days per farm used during the entire cropping pattern of exotic vegetables were recorded to be 57.07, 108.95 for lettuce and broccoli, respectively. For potato, cauliflower and pea crops, the same figures turned out to be 110.44, 109.07 and 66.31 man- days, respectively. Kumar (2013) also reported that potato and pea required a total of 375 and 425 man days per hectare for performing all the operation in the crop production period in the same study area.

4.3.2 Input Utilization

The existing use pattern like seeds, farm yard manure (FYM), chemical fertilizers (Urea, IFFCO mixture, calcium nitrate, muriate of potash and organic fertilizers.), plant protection chemicals/ pesticides, tilling hours, etc. was analyzed in respect of various input used. In addition, the extent of labour use was also examined. Table 4.17 provide the results of the use of various inputs in different vegetable crops. It can be seen from the table that there was a notable variation in the usage of various inputs such as seed, farm yard manure, fertilizers, chemicals such as herbicides, fungicides, and insecticides, and human labour in the production of both exotic and other vegetables. The table revealed that per hectare use of seed in lettuce and broccoli was 0.12 kg and 0.62 kg, respectively. The farmers were applying FYM ranging from 175 quintals in case of lettuce to as high as 250 quintals in broccoli. The use of vermicompost did not differ much across lettuce and broccoli. It was applied at the rate of 62.50 q and 75.00 q per hectare for lettuce and broccoli. Many chemical fertilizers like urea, IFFCO mixture and calcium nitrate were mostly applied. The farmers applied about 1350 kg and about 1169 kg of total fertilizers in broccoli and lettuce crops, respectively. The use of urea and calcium nitrate was noticed higher in lettuce than that in broccoli, whereas the quantity of IFFCO mixture was more in broccoli than lettuce. Muriate of potash was applied only in broccoli production. Pesticide usage was recorded double in broccoli than its usage in lettuce. The figures of human labour shows that broccoli production consumed about 454 man days which were 43 per cent higher than used for the production of lettuce (317.06 man days). This was mainly due to more number of pickings and careful harvesting of broccoli. Out of total labour used nearly 55 per cent was arranged within the family and rest of 45 per cent was hired labour.

In case of other vegetables, it was noticed that in potato farmers were sowing more tubers (40 q) than recommended (25 q). This might be explained by the high fertility of the soil, which would result in bigger tuber sizes if the seed rate was kept low. The use of vermicompost was likewise high in cauliflower, followed by potato, with 93.75 and 87.50 q, respectively. In case of chemical fertilizers application in other vegetables, potato farmers applied 1350 kg of total fertilizers followed by cauliflower (1225 kg). Pesticides have been used highest in potato. The figures of human labour use shows that potato production consumed about 480 man days which were higher than that of cauliflower (311.63 man days) and pea (288.30 man days). This was mainly due to

manual harvesting of potato tubers in the study area which is highly labour intensive operation.

Table 4.17 Input use in production of exotic vegetables

(Per ha)

Sr. No.	Particulars	Exotic Vegetables		Other Vegetables		
		Lettuce	**Broccoli**	**Potato**	**Cauliflower**	**Pea**
1	Seed (kg)	0.12	0.62	4000	0.65	90
2	FYM (q)	175.00	250.00	162.50	250.00	150.00
3	Vermicompost (q)	62.50	75.00	87.50	93.75	68.75
4	Fertilizers (kg)					
I	Urea	312.50	250.00	187.50	275.00	150.00
II	IFFCO mixture	368.56	467.04	375.00	162.50	187.50
III	Calcium nitrate	437.50	375.00	475.00	500.00	350.00
IV	Muriate of potash	-	262.50	312.50	287.50	-
	Total	1168.56	1354.54	1350.00	1225.00	687.50
5	Pesticides (Rs)	1275.00	2535.00	4050.00	775.00	1400.00
6	Irrigation (No.)	16	14	12	14	10
7	Tilling hours	18.75	18.75	18.75	18.75	9.38
8	Human labour (man days)	317.06	453.65	480.17	311.63	288.30
I	Family labour	174.38	249.51	264.09	171.40	158.57
II	Hired labour	142.68	204.14	216.08	140.23	129.74

4.3.3 Production costs

The study of costs and returns of a particular crop enterprise provides very useful information for improving efficiency at the farm. Their analysis is also having importance in evolving profitable production plans and framing sound future policy. The costs and returns were estimated on per hectare basis. Table 4.18 presents the total cost of producing exotic and other vegetables. Variable cost/working capital included both material and non-material inputs, as shown in the table. Interest on fixed capital and depreciation charges were included in fixed cost. The table reveals that for lettuce and broccoli the total variable cost per hectare was estimated to be Rs 167234 and Rs 251102, respectively. Human labour was found to be the most significant contributor of total working capital in both the exotic vegetables. Pesticide consumption was found quite low in both these vegetables as could be judged from its share which was about one per cent of the total variable cost. Both the vegetables had a fixed cost of Rs 48081 per hectare, which was computed using interest on fixed capital of Rs 20606 (42.86%) and

depreciation costs of Rs 27475 (57.14%). The table further highlighted that the total cost of production per hectare was higher in broccoli (Rs 299183) compared to lettuce (Rs 215315).

The other vegetables such as potato, cauliflower and pea, had the per hectare total variable cost of Rs 309737, Rs 220477, and Rs 159333, respectively. The expenditure on seed accounted for maximum amount (32.29%) of total variable cost in the case of a potato. Lal and Sharma (2006) also carried out a study in same area. The study also found that in potato human labour alone accounted for 30.00 per cent of total cost of cultivation followed by seed (18.00%).

In case of cauliflower and pea, human labour contributed around 27 per cent and 25 per cent to the total working capital. The total cost of potato cultivation was Rs 357818 per hectare which was observed to be higher than that of cauliflower (Rs 268558/ha) and pea (Rs 207414/ha). This could be due to higher cost of tubers and higher human labour cost in potato production. Kumar (2013) also reported that the total cost of cultivation for pea was Rs 190318 per hectare in the same study area.

Table 4.18 Total cost in production of exotic vegetables

(Rs /ha)

Sr. No.	Particulars	Exotic vegetables		Other vegetables		
		Lettuce	**Broccoli**	**Potato**	**Cauliflower**	**Pea**
A.	Variable cost/ working capital					
1	Seed	7800	40300	100000	29250	19800
		(4.67)	(16.04)	(32.29)	(13.27)	(12.43)
2	FYM	35000	50000	32500	50000	30000
		(20.93)	(19.91)	(10.49)	(22.68)	(18.83)
3	Vermicompost	28125	33750	39375	42188	30938
		(16.75)	(13.44)	(12.71)	(19.13)	(19.42)
4	Fertilizers					
I.	Urea	2083	1668	1251	1834	1001
		(1.25)	(0.66)	(0.40)	(0.83)	(0.63)
II.	IFFCO mixture	8736	11068	8888	3851	4444
		(5.23)	(4.41)	(2.87)	(1.75)	(2.79)
III.	Calcium nitrate	18812	16125	20425	21500	15050
		(11.26)	(6.42)	(6.59)	(9.75)	(9.45)
IV.	Muriate of potash	-	5250	6250	5750	-
			(2.10)	(2.02)	(2.61)	
	Total	29631	34111	36813	32936	20494
		(17.74)	(13.59)	(11.88)	(14.94)	(12.87)
5	Pesticides	1275	2535	4050	1050	1400
		(0.77)	(1.01)	(1.31)	(0.48)	(0.88)
6	Tilling hours	7500	7500	7500	7500	3752
		(4.49)	(2.99)	(2.42)	(3.40)	(2.35)
7	Human labour	57071	81657	86431	56093	51894
		(34.15)	(32.52)	(27.90)	(25.43)	(32.57)
8	Total working capital	166402	249853	306674	219016	158282
		(99.50)	(99.50)	(99.00)	(99.33)	(99.35)

9	Interest on working capital@ 4%	832 (0.50)	1249 (0.50)	3067 (1.00)	1460 (0.67)	1055 (0.65)
	Total variable cost (8+9)	167234 (100.00)	251102 (100.00)	309737 (100.00)	220477 (100.00)	159333 (100.00)
B.	Fixed Cost					
1	Interest on fixed capital @7.5% p.a.	20606 (42.86)	20606 (42.86)	20606 (42.86)	20606 (42.86)	20606 (42.86)
2	Depreciation charges	27475 (57.14)	27475 (57.14)	27475 (57.14)	27475 (57.14)	27475 (57.14)
	Total fixed cost (1+2)	48081 (100.00)	48081 (100.00)	48081 (100.00)	48081 (100.00)	48081 (100.00)
C.	Total cost (A+B)	**215315**	**299183**	**357818**	**268558**	**207414**

Note: Figures in parentheses indicate percentage to total.

4.3.4 Cost structure of different crops

Table 4.19 depicts the structure of various cost concepts for exotic and other vegetables. The table shows that the operation cost (Cost A_1) in case of exotic vegetables Rs 194709/ha for lettuce and Rs 278577/ha for broccoli. Cost A_2 was similar as Cost A_1 because very small leased-in area was taken for cultivation of vegetables by the sample farm households. Cost B_2 (which includes rental value of owned land) was observed to be Rs 425315/ha and Rs 509183/ha for lettuce and broccoli, respectively. Cost C_1 (which includes imputed value of family labour) was Rs 285068/ha for lettuce and Rs 398986/ha for broccoli. Cost C_2 was Rs 495068/ha and Rs 608986/ha for lettuce and broccoli, respectively. The total cost per hectare (Cost C_3) was estimated to be Rs 544575 and Rs 669885 for lettuce and broccoli, respectively. In case of other vegetables per hectare Cost A_1 for potato, cauliflower and pea was Rs 337212, Rs 247951 and Rs 186809, respectively. Whereas per hectare Cost B_2 for potato, cauliflower and pea was Rs 567818, Rs 478557 and Rs 417415, respectively. Cost C_1 for potato was observed to be Rs 673455/ha, whereas in case of cauliflower and pea it was estimated to be Rs 547116/ha and Rs 480841/ha, respectively. Cost C_2 for potato, cauliflower and pea was observed to be Rs 673455/ha, Rs 547116/ha and Rs 480841/ha, respectively. Cost C_3 or the total cost per hectare was reported to be Rs 740801, Rs 601827 and Rs 528925 for potato, cauliflower and pea, respectively.

Table 4.19 Cost structures of different vegetable crops

(Rs/ha)

Sr. No.	Particulars	Exotic Vegetables		Other Vegetables		
		Lettuce	Broccoli	Potato	Cauliflower	Pea
1.	Cost A_1	194709	278577	337212	247951	186809
2.	Cost A_2	194709	278577	337212	247951	186809
3.	Cost B_1	215315	299183	357818	268557	207415
4.	Cost B_2	425315	509183	567818	478557	417415
4.	Cost C1	285068	398986	463455	337116	270841
5.	Cost C_2	495068	608986	673455	547116	480841
6.	Cost C_3	544575	669885	740801	601827	528925

4.3.5 Returns from vegetable production

Table 4.20 presents costs and returns from exotic and other vegetables in the study area. It can be seen from the table that per hectare total variable cost accounted for around 77 per cent and 83 per cent of total cost in lettuce and broccoli, respectively. The table

further revealed that in case of exotic vegetables, broccoli gave highest net returns per hectare (Rs 1825811) followed by lettuce (Rs 565935). The net returns per farm were also found to be highest in case of broccoli (Rs 438196) followed by lettuce (Rs 209396). In case of other vegetables, the total variable cost per hectare accounted for 86.56, 82.10 and 76.82 per cent of total cost in potato, cauliflower and pea, respectively.

The table further shows that potato gave the highest gross returns per hectare of Rs 843750 followed by pea (Rs 480086) and cauliflower (Rs 363942). The net returns per farm were found to be highest in cauliflower (Rs 120101) followed by that of potato (Rs 68030) and pea (Rs 62411). This could be attributed to more area allocated to cauliflower compared to potato and pea.

The table further revealed that in case of exotic vegetables, broccoli had the highest returns over variable cost (Rs 1873898) and total cost (Rs 1825811) than lettuce (Rs 614016 and Rs 565935). As per the output-input ratio concept being used in farm management, broccoli gave comparatively higher output-input ratio of 7.10 as against 3.62 in case of lettuce.

In case of other vegetables returns over variable cost and return over total cost were highest in potato (Rs 534013 and Rs 485932) followed by pea (Rs 528167 and Rs 480086) and cauliflower (Rs 412023 and Rs 363942). In case of output-input ratio analyzed for other vegetables, pea had the highest ratio of 3.32 followed by potato (2.36) and cauliflower (2.33).

The same details of total cost, gross returns and return over total cost from different vegetables have also been depicted through figure 4.8. The output-input ratio (as per the CACP concept) for different exotic vegetables has been given in Appendix-III. Lal and Sharma (2006) conducted study in same area. The study reported output-input ratio of 1.03 in potato.

Table 4.20 Cost and returns from exotic vegetables

(Rs /ha)

Sr. No.	Particulars	Exotic vegetables		Other vegetables		
		Lettuce	**Broccoli**	**Potato**	**Cauliflower**	**Pea**
1	Total variable cost	167234	251102	309737	220477	159333
		(77.67)	(83.93)	(86.56)	(82.10)	(76.82)
2	Total fixed cost	48081	48081	48081	48081	48081
		(22.33)	(16.07)	(13.44)	(17.90)	(23.18)
3	Total cost (1+2)	215315	299183	357818	268558	207414
		(100.00)	(100.00)	(100.00)	(100.00)	(100.00)
4	Gross returns	781250	2125000	843750	632500	687500
5	Net returns	565935	1825817	485932	363942	480086
6	Gross returns/farm	289063	510000	118125	208725	89375
7	Net returns/farm	209396	438196	68030	120101	62411
8	Return over variable cost	614016	1873898	534013	412023	528167
9	Return over total cost	565935	1825811	485932	363942	480086
10	Output-Input ratio	3.62	7.10	2.36	2.33	3.32

Note: Figures in parentheses indicate percentage to total cost.

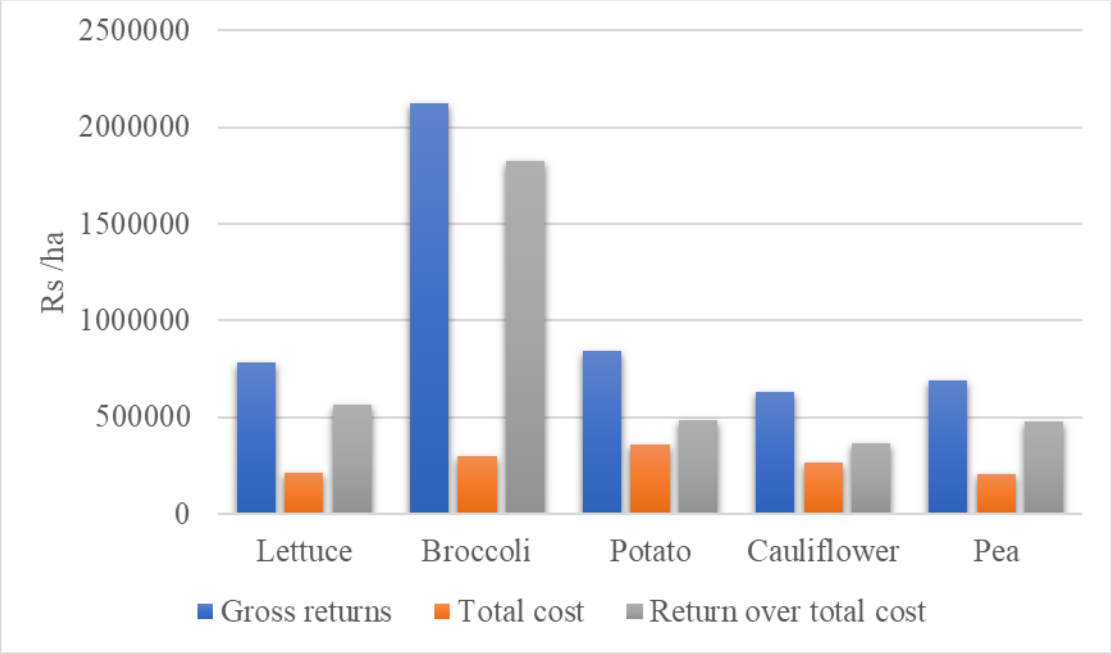


Fig. 4.8 Gross returns, total cost and return over total cost from vegetable crops

4.3.6 Farm efficiency

The farm efficiency measures such as gross farm income, net farm income, farm family labour income and farm business income have been worked out and the results have been presented in Table 4.21. The table shows that various measures of farm business returns from exotic vegetables such as farm business income (Rs 461606),

family labour income (Rs 403954), net farm income (Rs 363779) and farm investment income (Rs 421430) were recorded to be higher in broccoli production as compared to the lettuce production. In case of other vegetables, farm business income (Rs 134592) and farm investment income (Rs 91448) were highest in cauliflower. However, the family labour income was recorded highest in potato (Rs 63464), whereas the net farm income was highest in pea (Rs 36472). The comparison across exotic and other vegetables indicated higher economic viability of broccoli and lettuce production in the study area.

Table 4.21 Various measures of farm business returns for exotic vegetables

(Rs/farm)

Sr. No.	Particulars	Exotic vegetables		Other vegetables		
		Lettuce	**Broccoli**	**Potato**	**Cauliflower**	**Pea**
1.	Gross farm income	148438	531250	194063	221375	158125
		(781250)	(2125000)	(843750)	(632500)	(687500)
2.	Farm business income	111443	461606	116504	134592	115159
		(586541)	(1846423)	(506538)	(384549)	(500691)
3.	Family labour income	67628	403954	63464	53880	62120
		(355935)	(1615817)	(275932)	(153943)	(270085)
4.	Net farm income/Revenue	44968	363779	23678	10736	36472
		(236675)	(1455115)	(102949)	(30673)	(158575)
5.	Farm investment income	88783	421430	76718	91448	89512
		(467281)	(1685721)	(333555)	(261279)	(389181)

Note: Figures in parentheses indicate per hectare value.

4.3.7 Break-even analysis

Break-even output level is one when the farmer makes neither a profit nor a loss. Table 4.22 presents the break-even output for different vegetables grown by the farmers. It can be seen from the table that cost of production per quintal for broccoli was higher (Rs 689) than that of lettuce (Rs 1197), whereas average variable cost per quintal for broccoli and lettuce was Rs 1104 and Rs 535, respectively. The estimation of the break-even output revealed that farm households would be at no profit and no loss if they produced at least 24.47 q and 6.41 q of lettuce and broccoli, respectively. In case of other vegetables, cost of production per quintal was highest in pea (Rs 1659) followed by that of potato (1060) and cauliflower (Rs 934). The average variable cost per quintal was Rs 1275, Rs 918 and Rs 767 for pea, potato and cauliflower, respectively. The break-even analysis of these vegetables showed that farmers would be at no profit and no loss if they produced at least 30.39 q, 33.55 q and 11.38 of potato, cauliflower, and pea, respectively.

Table 4.22 Break-even output of different vegetables

Sr. No.	Particulars	Exotic vegetables		Other vegetables		
		Lettuce	**Broccoli**	**Potato**	**Cauliflower**	**Pea**
1.	Total fixed cost (Rs/ha)	48081	48081	48081	48081	48081
2.	Total variable cost (Rs/ha)	167234	251102	309737	220477	159333
3.	Total Cost (Rs/ha) (1+2)	215315	299189	357818	268558	207414
4.	Cost of production (Rs/q)	689	1197	1060	934	1659
5.	Price received (Rs/q)	2500	8500	2500	2200	5500
6.	Output (q/ha)	312.50	250.00	337.50	287.50	125.00
7.	Average variable cost (Rs/q)	535	1004	918	767	1275
8.	Break-even output(q)	24.47	6.41	30.39	33.55	11.38

4.3.8 Regression analysis

To examine the key determinants of exotic vegetable production, regression analysis was carried out. The factors considered affecting the output of exotic vegetables were area under crop, total labour employed, number of cultivated land fragments, and the quantity of fertilizers used. These were used as explanatory variables. Both linear and log linear production function were tried. However, on the basis of best fit, the Cobb-Douglas production function was finally selected for the analysis of the factors affecting the output of lettuce and broccoli. The regression coefficients of Cobb-Douglas production function are direct measure of elasticity of production for resources. The table shows that area and total labour have a significant positive effect on exotic vegetable production, whereas fertiliser has a negative effect, suggesting diminishing marginal returns, and the number of land fragments was not significantly different from zero at the 5 per cent level of significance in both vegetables. At one per cent level of significance, area was found to be substantially different from zero, indicating that a 1 per cent increase in area resulted in 0.72 and 0.71 per cent increase in the output of lettuce and broccoli, respectively. Total labour used was significantly different from zero at 5 per cent level of significance in case of lettuce and at 1 per cent level of significance in broccoli indicated that one per cent increase in total labour employed resulted in 0.39 per cent and 0.59 per cent increase in output of lettuce and broccoli, respectively. Fertilizers, on the other hand, had a detrimental impact. It was substantially different from zero at the 5 per cent level of significance, indicating that one per cent increase in fertilisers will reduce lettuce and broccoli output by 0.25 and 0.37 per cent, respectively. The adjusted coefficient of

multiple determination ($\bar{R}^2$)explained about 90 to 96 per cent variation in output of lettuce and broccoli, respectively.

Table 4.23 Different factors influencing output of exotic vegetables

Sr. No.	Particulars	Regression coefficients	Lettuce	Broccoli
1	Constant	b_0	4.9798	4.2825
			(1.1601)	(1.4941)
2	Area under crop 'X_1'	b_1	0.7252**	0.7072**
			(0.1855)	(0.2253)
3	Total labour 'X_2	b_2	0.3879*	0.5869**
			(0.1603)	(0.1626)
4	No. of land fragments 'X_3'	b_3	0.0741	0.0748
			(0.0576)	(0.0759)
5	Fertilizer 'X_4'	b_4	-0.2561*	-0.3774*
			(0.1094)	(0.1573)
6	Adjusted coefficient of multiple determination ($\bar{R}^2$)		0.9040**	0.9611**
7	F- value		132.87	260.80

Note: Figures in parentheses show standard errors of regression coefficients.
** and * denote 1 and 5 per cent levels of significance.

4.4 Market supply, functionaries and disposal

Marketing is a complicated and specialized activity, particularly in the case of exotic vegetables, which require prompt and timely disposal despite constraints and bottlenecks such as perishability, transportation, and topographical barriers. Marketing of exotic vegetables is more important in the study area because it provides comparatively higher and quick returns given the crop duration. The marketing pattern of exotic vegetables in the study area has been studied and presented in this section.

4.4.1 Marketable and marketed surplus

The detailed analysis of production, utilization, marketable and marketed surplus of exotic vegetables per farm is given in Table 4.24. The table revels that there was no record of utilization of exotic vegetables in the form of consumption in the family, gifts and other purposes in the study area. Since there was no utilization, the marketable surplus was also same as total production of these vegetables realized by the farmers. The marketed surplus was calculated by deducing the losses from the marketable surplus. The

losses due to spoilage in handling and damage by pest were found to be ranging between 8.50 per cent in lettuce and as high as 12.35 per cent in broccoli. The marketable surplus of lettuce and broccoli were estimated to be 105.79 q/farm and 52.59 q/farm, respectively. The volume of total marketed surplus of lettuce and broccoli were estimated to be about 6030 q and 2209 q, respectively. The table shows that in comparison to 42 growers of broccoli, lettuce was being grown by 57 growers.

Table 4.24 Marketable and marketed surplus of exotic vegetables on sample farm households

(q/farm)

Sr. No.	Particulars	Lettuce	Broccoli
1	Total production	115.62	60.00
2	Utilization	-	-
3	Marketable surplus	115.62	60.00
		(100.00)	(100.00)
4	Losses	9.83	7.41
		(8.50)	(12.35)
5	Marketed surplus	105.79	52.59
		(91.50)	(87.65)
6.	No. of growers	57	42
7.	Total marketed surplus (q)	6030.03	2208.78

Note: Figures in parentheses indicate percentage to total marketable surplus.

4.4.2 Marketing functions

A marketing function is defined as any action that is carried out with the objective of moving a product from its point of production to its final customer. These marketing functions assist in the creation of various types of utility, and the person or agency who assists in the accomplishment of these activities is referred to as a middleman or intermediary. The various kinds of marketing functions that are performed in the marketing of exotic vegetables have been described and also highlighted in Table 4.25.

i) Assembling: Given the farm gate marketing arrangements in the study area, it was observed that all of the farmers found it more convenient and cost-effective to assemble their produce on the farm area.

ii) Grading/sorting: One of the most important functions in the marketing of any commodity is grading. This not only maintains the quality of produce but it also ensures fetching of higher price for the uniform produce. During the survey it was observed that rather grading of vegetables in a systematic manner, majority of farmers used to sort vegetables into different lots on the basis of similar characteristics. Lettuce was

graded/sorted based on its green colour, compactness, and well-trimmed head. Similarly, a compact head, colour, disease/insect infections, and a head weight of 400-500 g were strictly preferred for grading of broccoli. Any violation of this preference resulted in fetching of lower price of broccoli in the market.

This table shows that the proportion of farmers following grading in lettuce was quite low. Nearly 44 per cent of farmers were found to be performing grading/sorting in lettuce. The low percentage of farmers practicing grading was due to the nature of the produce and traders' flexible marketing directives. All broccoli farmers adopted grading/sorting because the traders were typically stringent about the head weight specification.

iii) Packaging: Packaging is an important and necessary function because it not only delivers produce to the marketing channel but also preserves and protects it throughout transit and storage. The packaging of exotic vegetables was done manually in the study area. Plastic crates and cardboard boxes were utilized to package both the vegetables. Plastic crates were only used to transport produce up to the road, while produce in transit was packaged in cardboard boxes. Plastic crates used were of size containing 15-20 kg of the produce and costed around Rs 350 per crate. Cardboard boxes costed Rs 40 per box and had a capacity of about 25 kg. It was noticed that in the study area mostly traders supplied the packaging materials, thus growers need to bear no expenditure on packaging material.

Table 4.25 Marketing functions performed in market process

(% farmers)

Sr. No.	Marketing functions	Lettuce	Broccoli
1	Assembling		
	At field	100.00	100.00
	At home/ store house	-	-
2	Grading/sorting	43.86	100.00
	Characters considered	Green colour, compactness, well-trimmed head	Compact head, colour, disease/insect infections, Head weight between 400-500 g (Grade A)
3	Packaging		
	Up to road	Plastic crates	Plastic crates
	Road to market	Cardboard box	Cardboard box

Vegetable	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
Lettuce							■	■	■			
Broccoli							■	■	■			

Note: ■ Supply season

Fig 4.9 Supply season of exotic vegetables in the study area

4.4.3 Market supply chain

The alternative pathways through which produce moves from producers to consumers are the market supply chains or marketing channels. Several functionaries are involved in this process, who help to facilitate the movement and connect the producer and the customer. Each supply chain has a significant impact on the producer's share of the consumer's rupee. As a result, studying of marketing channels is critical for evaluating market conduct and performance, as well as arguing for ways to enhance existing marketing techniques.

The distribution of farmers patronizing the particular marketing channel and the quantity of vegetables routed through these marketing channels is given in Table 4.26. The following marketing channels existed for disposal of exotic vegetables from place of produce (farm) to place of consumer (market).

Channel I: Producer-trader--retailer-consumer

Channel II: Producer-contractor-cum-trader-retailer-consumer

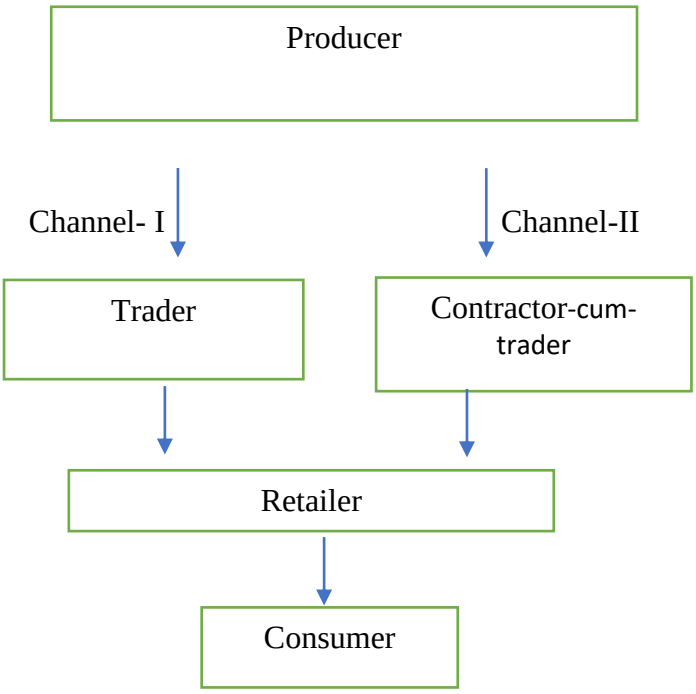


Fig. 4.10 Market supply chains

Plate 4.1: Packaging of lettuce (crisphead) in cardboard boxes

Plate 4.2: Packaging of lettuce (crisphead) in plastic crates

The main distinction between the two channels was that channel-II involved a mutual agreement with a trader at the time of transplanting, the crops which guaranteed the growers pre-determined prices for their produce and protected them against the market shocks of price fluctuations. The quantum of total marketed quantity of exotic vegetables disposed-off through the identified channels has been presented in Table 4.26. It can be seen from the table that about 56 per cent of growers patronized channel-I to dispose of 3144 quintals of lettuce, while about 44 per cent used channel-II to dispose of about 2209 quintals of broccoli. In broccoli 66.67 per cent growers disposed-off their 1515.25 quintals of marketed surplus produce through channel-I and 33.33 per cent disposed-off 693.53 quintals of marketed surplus produce through channel-II. The table shows that channel-I was comparatively followed by more number of farmers.

Table 4.26 Disposal of total marketed surplus through different marketing channels

Sr. No.	Vegetable	No. of growers	Quantity sold (q)
1	Lettuce		
I	Channel I	32	3144.06
		(56.14)	(52.14)
II	Channel II	25	2885.97
		(43.86)	(47.86)
III	Total	57	6030.03
		(100.00)	(100)
2	Broccoli		
I	Channel I	28	1515.25
		(66.67)	(68.60)
II	Channel II	14	693.53
		(33.33)	(31.40)
III	Total	42	2208.78
		(100.00)	(100)

Note: Figures in parentheses indicate percentage to total.

4.4.4 Marketing cost

Table 4.27 reveals the structure and composition of marketing cost incurred by producers. A closer look at this table reveals that the marketing cost borne by farmers in both the channels was almost same. Because assembling and transporting are so intimately associated, the table only shows these under one head. Packaging is done manually, the producer does not incur a separate cost for packaging since it is done at the same time as harvesting. The table shows that the grading/sorting cost of lettuce in both

the marketing channels did not differ much and was found to varying between Rs 26 to Rs 27 per quintal. The similar type of trend was observed in the grading/sorting cost of broccoli and it ranged between Rs 39 to Rs 41 per quintal. Broccoli had a transportation cost of Rs 83.33 whereas, lettuce had a transportation cost of Rs 75 per quintal. Out of total cost of marketing borne by growers, the proportion of grading/ sorting and transportation cost in both the marketing channel were observed to be varying between about 26 to 27 per cent and about 74 to 75 per cent in lettuce, respectively. In case of broccoli the proportion of grading/ sorting and transportation cost in both the marketing channels were observed to be varying between 32 to 33 per cent and about 67 to 68 per cent, respectively.

Table 4.27 Marketing costs incurred by producer

(Rs/q)

Sr. No.	Particulars	Lettuce		Broccoli	
		Channel-I	Channel-II	Channel -I	Channel-II
1	Grading/Sorting	25.87	27.53	39.41	41.05
		(25.65)	(26.85)	(32.11)	(33.00)
2	Transportation cost	75.00	75.00	83.33	83.33
		(74.35)	(73.15)	(67.89)	(67.00)
3	Total	100.87	102.53	122.74	124.38
		(100.00)	(100.00)	(100.00)	(100.00)

Note: Figures in parentheses indicate percentage to total.

4.6 Problems and constraints

Table 4.28 depicts problems faced by farmers in production of exotic vegetables. The general situation of material input constraints revealed that major problems faced by exotic vegetable growers were associated with availability of quality seed/ planting material, FYM and chemical fertilizers. Majority of farmers complained about the availability of quality seed/ planting material. This constraint ranked first with average score of 50.32 among the material input constraints followed by availability of chemical fertilizers (average score of 50.00). Availability of FYM was ranked third in the prioritization of the problems recorded by farmers in the availability of material inputs. With regard to labour and hiring power related constraints it has been found that availability of hired labour (cost/ wage/ time) and cost of hired draught power / machinery were major constraints confronted by farmers. The average score of 54.33 was

estimated in availability of hired labour and it was ranked first. The higher area under vegetable crops in the study area could explain the shortage of human labour, as the production of these crops was typically labour intensive.

The knowledge of incidence of insects and their control measures was major technical constraints confronted by the farmers of the study area. The average score for this problem was recorded to be 60.20 and it was followed by knowledge concerning incidence of diseases and their control measures with average score of 53.35. Proper guidance regarding package of practices of exotic vegetables and knowledge of weed infestation and their control measures were ranked third and fourth, respectively. The table also shows that support in form of subsidies for vegetables production was the most mentioned financial constraint amongst the surveyed farm-households (average score of 54.75). The constraints related to purchase of machinery and implements was ranked second and availability of money/ finance was ranked third.

Marketing of the produce is one of the most cumbersome and difficult operation in hilly areas. The farmers of the study area due to its geography and climatic conditioning suffered most from this aspect. The major constraint encountered by growers in marketing of exotic vegetables was the lack of organized market with the average score of 62.85. The produce not being sold at premium/fair price was ranked second. Market news / information and scientific packaging of vegetables were ranked third and fourth, respectively. Transporting function and facilities associated with it and lack of competition in marketing / market agencies were ranked fifth and sixth, respectively. In case of other constraints related to production it was observed that the majority of the farmers complained about wild animal’s threat destroying their crops throughout the growing season. The changes in climate, extreme cold, hot-weather, and extreme drought at same time have also been experienced by farmers in recent years, resulting in a flux in yield, and it was placed second. The third ranking was given to stray animals causing damage to the crops thereby incurring huge losses with low output of crops.

Table 4.28 Problems faced by farmers in production and marketing of exotic vegetables

Sr. No.		Problem	Score		
			Garrett score	Avg. Score	Rank
1		**Material inputs**			
	I	Availability of FYM	2981	49.68	3
	II	Availability of chemical fertilizer	3000	50.00	2
	III	Availability of quality seed/planting material/nursery	3019	50.32	1
2		**Labour**			
	I	Availability of hired labour (cost/ wage/ time)	3260	54.33	1
	II	Cost of hired draught power / machinery	2740	45.67	2
3		**Technology**			
	I	Knowledge of incidence of insects and their control measures	3612	60.2	1
	II	Knowledge incidence of disease and their control measures	3201	53.35	2
	III	Knowledge of weed infestation and their control measures	2448	40.8	4
	IV	Package of practices of exotic vegetables proper guidance regarding production of exotic vegetables	2739	45.65	3
4		**Finance**			
	I	Availability of money/ finance	2658	44.3	3
	II	Support in form of subsidies for vegetables production	3285	54.75	1
	III	Purchase of machinery/equipment/ implements	3057	50.95	2
5		**Market**			
	I	Market availability	3771	62.85	1
	II	Produce not being sold at premium prices/moderate prices/low prices	3506	58.43	2
	III	Competition in marketing / market agencies	2063	34.38	6
	IV	Market news / information	3180	53.00	3
	V	Transporting function and cost	2320	38.67	5
	VI	Scientific packaging of exotic vegetable	2860	47.67	4
6		**Miscellaneous**			
	I	Wild animals	3342	55.7	1
	II	Stray animals	2715	45.25	3
	III	Change in climate, extreme cold, extreme Heat, extreme drought	2943	49.05	2

5. SUMMARY AND CONCLUSIONS

5.1 Introduction

The state of Himachal Pradesh has a potential of becoming the country's vegetable bowl because of diverse agro climatic conditions and greater possibilities for producing off-season vegetables. The vegetables may well be grown in quite difficult climatic conditions thanks to the advent of new hybrid seed varieties. Additionally, the majority of the state's farmers are marginal, and many of them have realized the potential income from producing other cash crops such as vegetables, fruits, etc. The recent technological breakthrough in agriculture has emphasized the need for diversification, which would help state economy grow at a faster rate and vegetables production could be the major contributor in this process. The vegetables also have a high nutritional value since these are rich source of proteins, minerals, vitamins, and, to a smaller extent, carbohydrates. Hence, their importance cannot be overlooked. The fresh off-season vegetables produced in the state are marketed at higher prices in the markets of the neighbouring states as these do not face any competition from plains. Thus, vegetable growers have a full advantage in vegetable production as compared to other traditional crops. Moreover, the vegetables have a shorter gestation time (three to four months), produce more marketable surplus, and fetch higher market prices than other crops, thus these offer more hope for uplifting farmers out of poverty

The vegetables production is suited for all the farmers irrespective of land size holding but especially for marginal and small land parcels it is more suited where the decreasing size and increasing number of operational holdings are the major problems of the cultivators. According to data from Department of Agriculture, Himachal Pradesh in the year of 2020-21 state had an area of 87.48 thousand ha under various vegetable crops, with a total production of 18.67 lakh tonnes. Presently, over thirty vegetables, including exotic vegetables like as lettuce, asparagus, celery, swiss chard, parsley, kale, brussels sprouts, broccoli, red cabbage, yellow and red capsicum, etc. are being grown successfully in the state and these are in high demand. A sizeable area in the state is under cultivation of exotic vegetables that are of European and Oriental origins. Exotic vegetables are being cultivated in an area of 798.2 ha in Himachal Pradesh with a production of 17906.6 MT for the year of 2020-21 (Department of Agriculture, Himachal Pradesh). The climate as well as soil conditions in the state at an altitude of 2000 to 2500

metre above sea level favour the growing of these vegetables. The potential growing areas are in the districts of Lahaul & Spiti, Shimla, Kullu, Solan, Mandi and Sirmaur where the farmers have taken to growing these vegetables.

In the Indian state of Himachal Pradesh, Lahaul & Spiti district is made up of the two formerly separate districts of Lahaul & Spiti. The district was formed in 1960 and is India's fourth least populated district and first in Himachal Pradesh. In the 2020-21 year, the district produced 0.66 lakh tonnes of vegetables from the area of 4.44 thousand ha. In 2020-21 district Lahaul & Spiti had an area of 141 ha under different exotic vegetables with a production of 5724 MT (about 32 % of total production in state during 2020-21). Though, due to a lack of consumer awareness, the demand for exotic vegetables at vegetable markets is not particularly high. However, there is a high demand for these vegetables among the middle and upper-class urban population, as well as in hotels in big cities in view of foreign tourists. Hence, the area under exotic vegetables needs to be increased to match the demand-supply gap. The present study, therefore, was undertaken in Lahaul valley of district Lahaul & Spiti of Himachal Pradesh to examine the economics of production and marketing of exotic vegetables.

Objectives:

1. To examine the extent and importance of exotic vegetables in cropping pattern and to work out the input use, costs and returns from these exotic vegetables in the study area,
2. to study the marketing system and identify the problems in production and marketing of exotic vegetables.

5.2 Methodology

The study was conducted in the Lahaul Valley, which is situated in the Lahaul & Spiti district. This area was purposely chosen because it is one of Himachal Pradesh's niche areas, where agriculture diversification toward exotic vegetable crops has gathered momentum in the recent years. Two-stage random sampling design was employed for the selecting representative sample farm-households. In the first stage, out of total 75 villages of the valley where commercial cultivation of exotic vegetable is being carried out, 10 villages were selected randomly. In the second stage of sampling manageable sample of 60 farmers was drawn from the 10 sample villages through proportional allocation method. The present study was primarily based on primary data which were collected

through survey method. To achieve the stated objectives of the study the simple tabular analysis involving averages, ratios, and percentages has been used extensively. Regression analysis was used to investigate the factors that influenced the output of various crops.

5.3 Major findings

The following is a summary of the main findings of the present study:

- Profile of head of the family of sample farm households revealed that 58.33 per cent respondents were between the age of 41 and 60 years, in terms of education 40 per cent were graduates. Agriculture was the main occupation of 80 per cent respondents.
- The socio-economic profile of sample farm households showed that the average family size in the sample household was four people, in case of family structure information 51.67 per cent had a nuclear family structure, compared to 48.33 per cent farm households with a joint family. Nearly 50 per cent of population was between 31-60 years of age. The sex ratio turned out to be 826. Dependency ratio with respect to total workers was 0.45. In comparison to 2.01 per cent of illiterate males 15.45 per cent of females were illiterate. About 39 per cent of members had education up to graduation. The overall literacy rate was recorded to be 89.34 per cent.
- The total land area per farm household was 1.60 hectares of which 1.54 hectares (96.25%) was owned land. The remaining 0.06 hectares (3.75%) was leased-in area. The total cultivated area under sole field crops was about 46% of operational holdings and mixture of fruits and field crops accounted for 18% of operational holding.
- Distribution of land according to land fragments reveled that with an average holding size of 1.86 hectares having 8-16 fragments were owned by about 43 per cent of households.
- Livestock inventory showed that the average number of livestock per farm was 3.95, with sheep being the most popular among the farm households. The number of sheep was 1.85. The number of improved cows was 1.63. The sample farm households had a total of 2.12 SAUs. Improved cows accounted for investment of

61.47 per cent. The sheep ranked second in number accounting for 28.80 per cent of total investment on livestock

- Investment on farm buildings and structures revealed that the residential building accounted for more than 95 per cent of the total investment made by sample farm households.
- The per farm investment in all types of implements, tools, and machinery was Rs 147336. In the total investment, implements and tools accounted for the investment of Rs 126392 (85.77%) and farm irrigation Rs 20944 (14.23%).
- Agriculture was reported to be the primary source of income for 82.27 per cent people. Occupational pattern of sample farm household showed that 19.71 per cent of working population has one or other subsidiary occupation whereas a large fraction of workers nearly (80.29%) have no subsidiary occupation.
- The exotic vegetables occupied 51.54 per cent of total cropped area. In case of exotic vegetables lettuce accounted for 28.46 per cent of total cropped area. In case of other vegetables, cauliflower accounted for 25.38 per cent of total cropped area. The cropping intensity was found to be 125 per cent.
- The short duration of exotic vegetables enabled double cropping sequence in the study area. The lettuce-lettuce cropping sequence covering nearly 15.00 per cent of operational holding, was followed by 55.00 per cent of farmers. Whereas, the pea-lettuce cropping sequence was followed by more than 41.00 per cent of farmers and which covered 25.00 per cent of operational holding. The broccoli-broccoli cropping sequence was followed by 36.67 per cent of farmers and accounted about 12.00 per cent of operational holding.
- The production per farm of lettuce (crisphead) was highest (115.62 q) followed by broccoli (60.00 q) and lettuce (leafy). Among other vegetables grown, cauliflower production was nearly 95 quintals per farm followed by potato (47.25 q) and pea (16.25 q).
- The total household gross income per annum, on an average farm, was estimated to be Rs 1491352. The share of farm income was 84.31 per cent, in which crops contributed 81.49 per cent and livestock contributed 2.82 per cent. Exotic vegetables provided the most to farm income (53.58%), followed by other vegetables which contributed (21.91%). The government service and pension

contributed 10.73 per cent and 3.35 per cent to the total household income, respectively.

- Labour utilization pattern in production of different exotic and other vegetables shows that lettuce and broccoli required 317 and 454 man days per hectare for performing all operations during the crop production period. The operation-wise labour use pattern highlighted that weeding and harvesting were the labour consuming operations on which collectively 58 to 59 per cent of total labour employment was utilized. In case of potato and pea, total labour requirement for all operations was 480 and 288 man days per hectare, respectively, where harvesting accounted for about 40 per cent and 43 per cent of total labour used. In cauliflower, weeding (29.68%) and harvesting (23.74%) emerged out to be maximum labour consuming operations.
- The per ha input utilization in production revealed that per hectare use of seed in lettuce and broccoli was 0.12 kg and 0.62 kg, respectively. The farmers applied about 1350 kg and about 1169 kg of total fertilizers in broccoli and lettuce crops, respectively. Pesticide use was recorded double in broccoli than its usage in lettuce. In case of other vegetables, the use of vermicompost was likewise high in cauliflower, followed by potato, with 93.75 and 87.50 q, respectively. In case of chemical fertilizers application, potato farmers applied 1350 kg of total fertilizers followed by cauliflower (1225 kg). Pesticides have been used highest in potato.
- The per ha total cost of production showed that human labour was found to be the most significant contributor of working capital and its contribution ranged between 32 to 34 per cent in lettuce and broccoli. The total variable cost per hectare was estimated to be Rs 167234 in lettuce and Rs 251102 in broccoli. The total cost of cultivation per hectare was recorded to higher in broccoli (Rs 299183) compared to the lettuce (Rs 215315).
- Broccoli gave highest net returns per hectare (Rs 1825811) followed by lettuce (Rs 565935). The net returns per farm were also found to be highest in case of broccoli (Rs 438196) followed by lettuce (Rs 209396). Broccoli had the highest returns over variable cost (Rs 1873898) and total cost (Rs 1825811) than lettuce (Rs 614016 and Rs 565935). The broccoli gave significantly higher output-input ratio of 7.10 as against of 3.62 in lettuce.

- The cost of production per quintal was found to be higher for broccoli (Rs 689) than lettuce (Rs 1197). The average variable cost per quintal for broccoli and lettuce was Rs 1104 and Rs 535, respectively.
- Farmers would be at no profit and no loss if they produced at least 24.47 q and 6.41 q of lettuce and broccoli, respectively.
- The cost of production per quintal of other vegetables was highest in pea (Rs 1659) followed by potato (1060) and cauliflower (Rs 934). The average variable cost per quintal was Rs 1275, Rs 918 and Rs 767 for pea, potato and cauliflower, respectively.
- The various measures of farm business returns such as farm business income, family labour income, net farm income and farm investment income were recorded to be higher in broccoli as compared to the lettuce.
- The influence of area on output was found to be positive and significant in both lettuce and broccoli crop. The chemical fertilizers, on the other side, had negative influence on output of both these vegetables. The adjusted coefficient of multiple determination explained about 91 to 96 per cent of variation in output of lettuce and broccoli.
- The marketable surplus of lettuce and broccoli were estimated to be about 106 and 53 quintal per farm. The volume of total marketed surplus of lettuce and broccoli was estimated to be about 6030 quintal and 2209 quintal, respectively.
- Given the farm gate marketing arrangements in the study area, it was observed that all farmers found it more convenient and cost-effective to assemble their produce in the fields. Nearly half of total farmers were performing grading/sorting in lettuce and in broccoli due to the trader's more rigorous regulation regarding the head weight specification all the farmers were found to be following grading/sorting.
- The disposal of total marketed surplus through different marketing channels revealed that 57 to 67 per cent of farmers patronized channel-I (producer-trader--retailer-consumer) to dispose of 3144 quintal of lettuce and 1515.25 quintal of broccoli.
- The grading/sorting cost of lettuce amounted to Rs 25.87 per quintal in channel-I (producer-trader--retailer-consumer) and in channel-II (producer-contractor-cum-

trader-retailer-consumer) it was estimated to be Rs 27.53 per quintal. In case of broccoli in channel-I grading/sorting cost was estimated to be Rs 39.41 per quintal and in channel-II it was recorded to be Rs 41.05 per quintal. The lettuce and broccoli had a transportation cost of Rs 75 and Rs 83.33 per quintal, respectively.

- The lack of quality seeds/planting material, availability of hired labour, lack of knowledge about insects/pest and how to control them, not enough support in the form subsidies, market availability and wild animals damaging the crops were the major problems faced by farmers in production of exotic vegetables.

5.4 Suggestions and policy implications

The commercial growing of exotic vegetable in the coming years will play big role in the economy of Lahaul & Spiti district and niche areas of the state as well. Based on the findings of the study and researcher's own observations during the survey provide the following policy suggestions for making commercial cultivation of exotic vegetable more paying in the state.

- There is need to develop scientific packaging method that will fetch them better prices for the quality produce on one hand and will reduce the losses after the harvest of the produce.
- Based on the higher output-input ratio of exotic vegetables in comparison to other cash crops grown in the study area, there is need to give more emphasis on expansion in the area under these crops.
- The farmers were found to be using comparatively higher quantity of chemical fertilizers such as IFFICO mixture and urea irrespective of their nutrient requirement. Therefore, the farmers need to be given training and made aware of their use as per the proper package of practice of cultivating these crops to reduce the cost of production and to maintain the fertility of soil.
- There is strong need for the development of organized farmer groups in the marketing of exotic vegetables. This will help in strengthening bargaining power of unorganized growers and benefitting them from organized system of marketing.
- The district level regular crop training programmes and training manuals should be provided to address the local issues faced by farmers in the production process.

- The problem of non-availability of quality seed, fertilizers, pesticides and other inputs well in time have held back a few farmers from earning profit. For this reason, the government should regulate registered seed suppliers/input dealers and hold them accountable for supplying high-quality seed and technical expertise.

LITERATURE CITED

Agarwal NL. 1998. Marketing costs, margins and price-spread for major agricultural commodities in Rajasthan. *Indian Journal of Agricultural Marketing* 12: 122-132

Akter S, Islam MS and Rahman MS. 2011. An economic analysis of winter vegetables production in some selected area of Narsingdi district. *Journal of Bangladesh Agricultural University* 9: 241-246

Arora VPS and Saxena R. 1999. Vegetable marketing in hill region of Utter Pradesh – issues and challenges. *Indian Journal of Agricultural Marketing* 42: 13-20

Baba SH, Wani MH, Wani SA and Yousuf S. 2010. Marketable surplus and price spread of vegetables in Kashmir valley. *Agricultural Economics Research Review* 23: 115-127

Babalola SO, Adeoye IB and Adegbite OO. 2016. Patterns and challenges in exotic vegetables marketing. *International Journal of Vegetable Science* 22: 376-382

Badmus MA and Yekinni OT. 2011. Economic analysis of exotic vegetable production among urban Fadama women farmers in Akinyele local government area Oyo state, Nigeria. *International Journal of Agriculture Economics & Rural Development* 4: 19-24

Bala B and Sharma SD. 2005. Effect on income and employment of diversification and commercialization of agriculture in Kullu district of Himachal Pradesh. *Agricultural Economics Research Review* 18: 261-269

Bala B, Sharma N and Sharma RK. 2011. Cost and return structure for the promising enterprise of off-season vegetables in Himachal Pradesh. *Agricultural Economics Research Review* 24: 141-148

Balaji MN, Chahal SS and Kataria P. 2010. Market intermediaries and their margins in marketing of potato in Punjab. *Indian Journal of Agricultural Marketing* 24: 164-177

Bhat A, Kachroo J, Dwivedi S, Singh SP, Sharma PK, Rizvi SHE, Sharma MK and Bhat MIJ. 2017. Profitability and marketing of fruit and vegetable crops in Chenani block of Udhampur district. *Maharashtra Journal of Agricultural Economics* 20: 146-149

Chand R, Garg S and Pandey L. 2009. Regional variations in agricultural productivity- a district level study. Discussion paper NPP01. NCAP (National Centre for Agricultural Economics and Policy Research). ICAR, New Delhi.

Choudhary H, Bisht D, Badal PS, Singh V, Shah R and Saryam M. 2017. Profitability of vegetables in hill agriculture: an economic analysis. *International Journal of Current Microbiology and Applied Sciences* 6: 1674-1682

Dastagiri MB, Chand R, Immanuelraj TK, Hanumanthaiah CV, Paramsivam P, Sidhu RS, Sudha M, Mandal S, Singh B, Chand K and Kumar BG. 2013. Indian vegetables: production trends, marketing efficiency and export competitiveness. *American Journal of Agriculture and Forestry* 1: 1-11

Daundkar KS and Bairagi SK. 2015. Economics of production of capsicum in Akola district. *International Journal of Commerce and Business Management* 8: 81-83

Devkota R and Sharma KD. 2014. Conduct and performance of vegetable marketing system in Kangra district of Himachal Pradesh in India. *International Journal of Agriculture Innovations and Research* 3: 737-744

Dhondyal SP and Singh GN. 1985. Production Economics & Farm Management. Aman publishing house. P 121-122.

Dileep BK, Grover RK and Rai KN. 2002. Contract farming in tomato: an economic analysis. *Indian Journal of Agricultural Economics* 57: 197-210

Garrett HE and Woodworth RS. 1969. Statistics in Psychology and Education. Bombay: Vakils, Feffer and Simons Pvt. Ltd.

Ho ST, Rickard BJ, Kikkert J, Klotzbach K, Reiners S and Smith M. 2011. Examination of the cost of producing processing snap beans and green pea in New York state. *Extension Bulletin* 35: 30

Hugar LB and Hiremath KC. 1984. Efficiency of alternative channels in the marketing of vegetables in Belgaum city. *Indian Journal of Agricultural Economics* 39: 192-200

Jha, C. 2007. Economic sustainability and market potential of garden pea in Himachal Pradesh. Unpublished M.Sc. Thesis, p 48. Department of Agricultural Economics, Extension Education & Rural Sociology. CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, India

Kumar A and Arora VPS. 1999. Economic issues in vegetable production in UP hills. *Agricultural Situation in India* 56: 535-540

Kumar A, Rohila K and Pal VK. 2018. Profitability and resource use efficiency in vegetable cultivation in Haryana: application of Cobb-Douglas production model. *Indian Journal of Agricultural Sciences* 88: 1137-1141

Kumar A, Sharma SK and Vashist GD. 2002. Vegetable farming holds potential in hills: A case study of Kullu region of Himachal Pradesh. *The Bihar Journal of Agricultural Marketing* 10: 355-361

Kumar S. 1999. Resource use and marketing of important high value crops in Himachal Pradesh, Unpublished Ph.D. Thesis, University of Horticulture and Forestry, Nauni, Solan, India

Kumar V, Sharma D and Lal H. 2017. Economy of growing vegetables and farm incomes in Himachal Pradesh. *Agricultural Situation in India* 77*:* 23-29

Kumar V, Sharma H, Sharma D and Shivalika. 2018. Profile and problems of tomato cultivation in Bilaspur district of Himachal Pradesh. *Himachal Journal of Agricultural Research* 44: 60-67

Kumar V. 2013. Estimation of cost of cultivation of commercial crops in Himachal Pradesh. Research Report:64. Department of Agricultural Economics, Extension Education & Rural Sociology, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, India

Kumbhare SL, Sharma KNS and Patel RK. 1993. Standardization of bovine units. *Indian Journal of Animal Science* 53: 543-547

Lal H and Sharma KD. 2004. Economics of production and marketing of off-season garden peas in Lahaul valley of Himachal Pradesh. *Indian Journal of Agricultural Marketing* 18: 277-278

Lal H and Sharma KD. 2006. Economics of potato production in Lahaul valley of Himachal Pradesh. *Potato Journal* 33: 139-143

Lokapur S, Kulkarni GS, Gamangatti PB and Gurikar R. 2014. Resource use efficiency of major vegetables in Belgaum district in Karnataka. *International Research Journal of Agricultural Economics and Statistics* 5: 108-110

Matsane SH and Oyekale AS. 2014. Factors affecting marketing of vegetables among small-scale farmers in Mahikeng local municipality, North West province, South Africa 5: 390-397

Mehta P and Chauhan SK. 1996. Marketed surplus of vegetables in Himachal Pradesh. *The Bihar Journal of Agricultural Marketing* 4: 361-368

Mohanty AK, Lepch B and Kumar A. 2013. Constraints analysis in adoption of vegetable production technologies for livelihood perspective of tribal farmers in North Sikkim. *Indian Research Journal of Extension Education* 13: 51-56

Raghubanshi CS, Sharma RK and Sood SK. 1974. Regional specialization in cultivation of commercial crops. *Indian Journal of Agricultural Economics* 29: 179

Rao SS and Mrunalinisasanka V. 2015. Exotic Veggies: a practical utility of innovation-lured by the easy returns. *International Journal of Applied Research* 1: 1038-1041

Shah SL. 1982. Ecological degradation and future of agriculture in Himalayas. *Indian Journal of Agricultural Economics* 37: 1-3

Sharma A, Kumar A and Sharma SK. 2004. Marketing channels, production problems and constraints in vegetable cultivation: A case study in Himachal Pradesh, *The Bihar Journal of Agricultural Marketing* 12: 47-51

Sharma HR and Thakur DR. 1988. Comparative economics of commercial crops of Himachal Pradesh. *Agricultural Situation in India* 43: 579-580

Sharma R. 2007. Vegetable cultivation in North West Himalayan region: a study of Indian state. *International Journal of Agriculture and Biology* 4: 79-96.

Sharma RK, Sharma SK and Thakur RK. 1995. Marketing of vegetables in Himachal Pradesh. *Indian Journal of Agricultural Marketing* 9: 44-50

Sharma SK and Kumar V. 2012. Improving economic viability of small and marginal landholders through vegetable cultivation in Himachal Pradesh. *Agricultural Situation in India* 69: 493-497

Sharma V, Lal H, Debnath U and Hatte V. 2017. Economics of potato production in Kangra district of Himachal Pradesh. *International Journal of Current Microbiology and Applied Sciences* 6: 123-129

Shelke RD. 2009. Economics of price spreads in marketing of major vegetables in Parbhani market. *Economic Affairs* 54: 118-123

Show. 2018. Economics of vegetables crops in Paschim Medinipur district of West Bengal: A micro level analysis. *International Journal of Research and Analytical Reviews* 5: 1601-1607

Sikka BK, Swarup R and Rashbanshi CS. 1977. Problems of financing small vegetable growers in Solan district, HP. *Financing Agriculture* 9: 16-19

Singh DV. 1993. Regional specialization in the cultivation of off-season vegetables on commercial scale: a case of Himachal Pradesh. *Agricultural Situation in India*: 891-893

Singh N, Sharma R and Kayastha R. 2020. Economic analysis of pea in Himachal Pradesh. *Economic Affairs* 65: 191-195

Singh S and Chauhan SK. 2018. Production and marketing of off-season vegetables in Himachal Pradesh. *Himachal Journal of Agricultural Research* 44: 68-74

Singla R. 2006. Economics of production of green peas in Punjab. *Agricultural Economics Research Review* 19: 237-250

Sinha AK and Singh SK. 2019. Economics of potato production in Northern hills of Chhattisgarh. *Economic Affairs* 64: 1-7

Soare E, Dobre I and David L. 2016. Economic analysis in vegetable sector of Romania. *Economic Engineering in Agriculture and Rural Development* 16: 333-338

Thakur DS, Thakur RS, Sharma KD and Sanjay. 1994. Vegetable revolution and economics in Himachal Pradesh. *The Bihar Journal of Agricultural Marketing* 2: 145-151

Thakur DS. 1994. High stakes for banks in off-season vegetable production and marketing. *The Bihar Journal of Agricultural Marketing* 2: 89-95

Tripathi RS and Sharma ML. 1999. Costs and margins of off-season vegetable pea in Garhwal hills of U.P. *The Bihar Journal of Agricultural Marketing* 7: 63-68

Wilson P and Robertson P. 2001. Economic efficiency in main crop potato production in England and Wales. *Farm Management* 11: 163-176

Wongnaa CA, Akuriba MA, Ebenezer A, Danquah KS and Ofosu AD. 2019. Profitability and constraints to urban exotic vegetable production systems in the Kumasi metropolis of Ghana: a recipe for job creation. *Journal of Global Entrepreneurship Research* 9:1-19

Xaba BG and Masuku MB. 2013. An analysis of the vegetable supply chain in Swaziland. *Sustainable Agriculture* 2: 1-10

APPENDICES

Appendix-I
FARMER' SURVEY SCHEDULE

Code No:.....

Department of Agricultural Economics, Extension Education & Rural Sociology
CSK HP Krishi Vishvavidyalaya, Palampur (H.P.) – 176062

Farmer's Survey Schedule

Title of research problem: Economic analysis of exotic vegetable production in Lahaul & Spiti district of Himachal Pradesh

Objectives:

1. To examine the extent and importance of exotic vegetables in cropping pattern and to work out the input use, costs and returns from these exotic vegetables in the study area,
2. to study the marketing system and identify the problems in production and marketing of exotic vegetables.

1) Farmer/Respondent's information

Name: -	Contact No: -
Age: -	Education: -
Village: -	Post office: -
Panchayat: -	Block: -
Tehsil: -	District: -
Caste :- SC/ST/GEN/OBC/Other	Category: - IRDP/APL/BPL
Main occupation: -	Subsidiary occupation: -
Type of family: - Joint/ Nucleus	Distance of farm from road (kms): -.....

2) Demographic information

Sr. No	Relation with the respondent	Age (years)	Gender (M/F)	Education I/P/M/H/S/D/G/PG	Occupation		Approximate annual income (₹)	
					Main Occupation	Subsidiary Occupation	Main Occupation	Subsidiary Occupation
1								
2								
3								
4								
5								
6								
7								

Where, I- Illiterate, P-Primary, M- Middle, H- High school, S- Senior secondary, D- Diploma, G- Graduation and PG- Post Graduation

3) Land inventory and utilization

Sr. No.	Particulars	Area (*Kanal*/Bigha)			Source of irrigation	No. of land fragments	Average size of fragments (Kanal/Bigha)	Remarks
		IR	UIR	Total				
1.	Total land owned							
2.	cultivated land							
3.	Leased-in							
4.	Leased-out							
5.	Land under grazing land/ pastures/							
6.	Land under forest							
7.	Other (wasteland, barren)							
8.	Fellow land							
9.	Area under exotic vegetables							
10.	Area under other crops							
11.	Area under fruits							

Land rent:- (1) Leases in .....**Rs/(*Kanal*/Bigha)**
(2) Leased out..... **Rs/(*Kanal*/Bigha)**

4) Inventory of farm and residential buildings

Sr. No.	Particulars	No.	Type of building			Year of Construction	Present Value (Rs.)	Annual Repair	Source of funds (PS/L)	Remarks
			Kuccha	Pucca	Mixed					
1.	Residential building									
2.	Cattle shed									
3.	Store house									
4.	Vermicompost shed									
5.	Any other									

Note: PS- Personal savings, L- Loan from bank/ society/ friends/ relatives/ money lenders

5) Inventory of farm and residential buildings

Sr.No.	Particulars	No.	Lactation (No.)	Milk (l per day)/ Eggs (No. per day)/ Wool (kg/yr)/Meat (kg)	Present value (Rs.)	Remarks
1.	Local cow/ Churi					
	a. In milk					
	b. Dry					
2.	Improved cow					
	a. In milk					
	b. Dry					
3.	Bullocks/ Churu					
4.	Heifer					
5.	Young stock					
6.	Sheep					
7.	Goat					
8.	Poultry birds					
9.	Horse					
10.	Mule					

6) Inventory of farm machinery and implements

Sr.No.	Particulars	No.	Year of purchase	Present value (Rs.)	Annual repair (Rs.)	Source of funds (PS/L)
A.	**Major implements**					
1.	Tractor					
2.	Power tiller					
3.	Chaff-cutter					
4.	Spray/Duster					
5.	Power sprayer					
6.	Wheel hoe weeder					
7.	Seed treatment drum					
8.	Water pump					
9.	Water pipes					
10.	Seed drill					
11.	Potato digger					
12.	Any other (specify)					
B.	**Minor implements**					
1.	Plough					
a.	Wooden					
b.	Iron					
2.	Spade					
3.	Hoe					
4.	Brush cutter					
5.	Rake					
6.	Sickle					
7.	Axe					
8.	Planker					
9.	Chain saw					
10.	Plastic crates					
11.	Plastic *kultas*					
12.	Any other (specify)					

Note: PS- Personal savings, L- Loan from bank/ society/ friends/ relatives/ money lenders

7) Cropping pattern

Sr. No.	Season/Crop	Variety	Area (Bigha)		Leased in area	Time of transplanting and sowing	Method of sowing	Harvesting/ picking		Production (q)		Quantity sold(q)				Remarks
			I	UI						MP	BP	MP		BP		
								Time	Mode			Qty.	P (Rs/q)	Qty	P (Rs/q)	
A	**Exotic Vegetables**															
1	Lettuce(iceberg)															
2	Broccoli															
3	Brussels sprouts															
4	Celery															
5																
6																
7																
8	Others (Specify)															
B	**Cole crops**															
1	Cauliflower															
2	Cabbage															
3	Knol Khol															
C	**Root crops**															
1	Radish															
2	Turnip															
3	Carrot (European)															
4	Sweet potato															

D	**Other vegetable crops**															
1	Potato															
2	Pea															
3	Capsicum															
4	Other (specify)															
E	**Other crops**															
1	Maize															
2	Wheat															
3	Barley															
4	Buck Wheat															
5	Mustard															
6																
7																
8																
9																

8) Human labour inventory and utilization (man days)

	Crops											
	Lettuce		**Broccoli**		**Cauliflower**		**Cabbage**		**Potato**		**Pea**	
Operations	TL	HL	TL	HL	TL	HL	TL	HL	TL	HL	TL	HL
Nursery raising												
Field Preparation including bunding etc.												
Disposal of FYM (transportation+ spreading)												
Transplanting of nursery												
Seed treatment and sowing												
Application of fertilizers												
Application of organic manure												
Interculture operations (mulching/ weeding/ earthing up)												
1. (.....days after transplanting/sowing)												
2. (..... days after transplanting/sowing)												
3. (.....days after transplanting/sowing)												
Spraying/ Dusting operations												
Application of pesticide												
Picking / harvesting/ cutting/digging												
Other operations (specify)												

TL= Total Labour HL= Hired Labour
The existing wage/charge for human labour: Rs...../ man day

9) Input use pattern other than human labour in major crops

Sr.No.	Particulars	Name of crops											
		Lettuce		Broccoli		Cauliflower		Cabbage		Potato		Pea	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1	Area (Bigha)												
	(a) No.of Plants (Bigha)												
2	No. of ploughings												
3	Ploughing Charges												
	(a) Tractor (hrs.)												
	(b) Bullock (No. of BPD)												
4	Seed treatment for sowing & nursery raising												
	(a) chemical used												
	(b) quantity (g)												
5	Type of varieties used												
	(a) Local												
	(b) Hybrid/HYV (Specify)												
6	Seed rate (Kg/Bigha)/No. of seedlings per Bigha												
7	Use of seed drill/Nursery planters												
8	Organic/Natural farming input used												
	(a) FYM (in qt.) (Own/Purchased)												
	(b) Vermi-compost (in qt.) (Own/Purchased)												
	(c) Vermi-wash (lts.)												
	(d) Jeevamrit (lts.)												
	(e) Beejamrit (lts.)												
9	Fertilizers (Kg/Bigha)												
	(a) 12:32:16												
	(b) SSP												
	(c) MOP												
	(d) Urea												

10	Biofertilizer												
	(a) Rhizobium												
	(b) Others (Specify)												
11	Method & application of fertilizers												
	(a) Broadcasting												
	(b) Fertigation												
	(c) Line application												
12	Interculture operations (No.)												
13	Green manuring												
14	Mulching												
15	Irrigation (No.)												
	(a) At time of sowing												
	(b) At critical period												
16	Chemicals for plant protection												
	(a) Herbicides												
	(b) Fungicides												
	(c) Insecticides												
	(d) Stickers												
	(e) Any other (specify)												

10) Production and utilization of exotic vegetable

Sr.No.	Crop	Production (q)	Utilization (q)		Sale/Disposal (q)						Unsold (if any) (q)
					Agency 1		Agency 2		Agency 3		
			Family	Other Purposes	Qty.	Price (Rs.)	Qty.	Price (Rs.)	Qty.	Price (Rs.)	
1.											
2.											
3.											
4.											
5.											
6.											
7.											
8.											

Agency 1.....
Agency 2.....
Agency 3.....

11) Market function/ practices and cost incurred by vegetable growers:

Sr. No.	Market function/practices	Crops									
		Lettuce		Broccoli		Celery		Chinese Cabbage		Brussels sprout	
		Mode	Marketing cost	Mode	Marketing cost	Mode	Marketing cost	Mode	Marketing cost	Mode	Marketing cost
1.	Assembling										
2.	Cleaning/Washing										
3.	Grading										
4.	Packaging										
5.	Transportation										
6.	Storage										
7.	Loading/unloading										
8.	Sale/Marketing										

12) Problems faced by farmers and their responses

Sr. No.	Problems regarding	Response		Rank	Suggestion
		Yes	No		
A.	**Material inputs**				
i.	Availability of FYM (Available / scarcity is there)				
ii.	Availability of hired labour				
iii.	Availability of organic inputs				
iv.	Availability of bio-pesticide				
v.	Availability of chemical fertilizer				
vi.	Availability of biofertilizer				
vii.	Availability of quality seed/planting material/nursery				
viii.	Irrigation water availability/scarcity				
B.	**Labour**				
i.	Availability of hired labour (cost/ wage/ time)				
ii.	Availability of draught power/ machinery/ power tiller/ Bullocks				
iii.	Cost of hired drought power / machinery				
C.	**Technology**				
i.	Knowledge of incidence of insects and their control measures				
ii.	Knowledge incidence of disease and their control measures				
iii.	Knowledge of weed infestation and their control measures				
iv.	Package of practices of exotic vegetables proper guidance regarding prodcution of exotic vegetables				
v.	Method and time of irrigation				
vi.	Others (specify)				
D.	**Finance**				
i.	Availability of money/ finance				
ii.	Support in form of subsidies for vegetables production				
iii.	Purchase of seeds				

iv.	Purchase of fertilizers				
v.	Purchase of pesticides				
vi.	Purchase of machinery/equipment/ implements				
E.	**Pests**				
i.	Incidence of insects is there				
ii.	Incidence of disease is there				
iii.	Problem of weed infestation is there				
F.	**Market**				
i.	Market availability				
ii.	Produce is sold at premium prices/moderate prices/low prices				
iii.	Competition in marketing / market agencies				
iv.	Market news / information				
v.	Transporting function and cost				
vi.	Packing material availability and costs				
vii.	Scientific packaging of exotic vegetable				
viii.	Other (specify)				
G.	**Miscellaneous**				
i.	Wild animals				
ii.	Stray animals				
iii.	Birds				
iv.	Change in climate, extreme cold, extreme Heat, extreme drought				
v.	Other (specify)				

Appendix-II: List of sample farmers in the study area

Name of respondent	Name of village	Contact number
Rajan Thakur	Gondhla	9418004200
Sonam	Gondhla	9459830580
Navang Tenjing	Gondhla	9459015319
Rohit	Gondhla	7876431972
Sohan Lal	Gondhla	9418556222
Sumsher Singh	Gondhla	8028830812
Amar chand	Gondhla	8219080629
Rakesh	Gondhla	9418720751
Ashok Kumar	Khangsar	7876436800
Vijay Kumar	Khangsar	9459258280
Jagdish	Khangsar	9459519550
Subhash Kumar	Khangsar	9418354354
Mandasi	Khangsar	9459996884
Prem chand	Khangsar	7876933760
Vikram kurmar	Tholang	8988289881
Sonam Thakur	Tholang	9459987161
Rahul Thakur	Tholang	7018223325
Vivek Kapoor	Tholang	9418319230
Surinder Kumar	Tholang	9428205338
Bhushan Thakur	Thorang	9418378177
Sundar Lal	Thorang	8580556801
Sunil Anand	Thorang	9418972436
Ranbir Singh	Thorang	
Sankar Lal	Thorang	7876450906
Hira Lal	Thorang	9418318238
Lal singh	Thorang	9418280612
Premchand	Triloknath	9418442039
Devanti	Triloknath	
Shree Dola ram	Udaipur	9015127323
Shyam Lal	Udaipur	9418953236
Shamsher singh	Udaipur	9418205816
Pawan Kishor	Kirting	9459705177
Nirmal Chand	Kirting	9418552193
Sapal Singh	Kirting	9418204192
Bimal Sen	Kirting	9418718488
Prittam singh	Kirting	9418139922
Ram Lala	Kirting	

Surinder Kumar	Kirting	
Ram Thakur	Kirting	9418773746
Jaramdassi	Kirting	
Rajiv Thakur	Phura	7876572392
Surender Kumar	Phura	9418990616
Anil Kumar	Phura	8988606565
Surinder Kumar	Phura	9459014040
Sher Singh	Phura	9418430608
Surinder Singh	Phura	9418529646
Sohan Lal	Jahalman	9418122697
Sujender	Jahalman	9418271372
Ranjeet singh	Jahalman	8278875019
Ranjit Singh	Jahalman	9459248620
Bir singh	Shansha	9418356313
Rakesh	Shansha	9182707967
Asha	Shansha	8580906811
R.L. Chahaun	Shansha	9459988784
Vivek Sharma	Shansha	9459989844
Gnaesh Lal	Shansha	9418953140
Prittam Lal	Shansha	9015120582
Devi Singh	Shansha	9418282153
Dhruv Thapa	Shansha	7651033571
Bhushan Dev	Shansha	9418717978

Appendix III: Output-input ratio (CACP concept) for different exotic vegetables

(Rs /ha)

Sr. No.	Particulars	Exotic vegetables		Other vegetables		
		Lettuce	Broccoli	Potato	Cauliflower	Pea
1.	Gross returns	781250	2125000	843750	632500	687500
2.	COST A	194709	278577	337212	247951	186809
3..	COST B_1	215315	299183	357818	268557	207415
4.	COST B_2	425315	509183	567818	478557	417415
5.	COST C1	285068	398986	463455	337116	270841
6.	COST C_2	495068	608986	673455	547116	480841
7.	Cost C_3	544575	669885	740801	601827	528925
	Net return over					
8.	COST A	586541	1846423	506538	384549	500691
9.	COST B_1	565935	1825817	485932	363943	480085
10.	COST B_2	355935	1615817	275932	153943	270085
11.	COST C_1	496182	1726014	380295	295384	416659
12.	COST C_2	286182	1516014	170295	85384	206659
13.	COST C_3	236675	1455115	102949	30673	158575
14.	Output-input ratio	1.43	3.17	1.14	1.05	1.30

Brief Bio data of Student

Name	: Borisagar Dharmik Gaurishanakr
Father's Name	: Shri Borisagar Gaurishankar
Mother's Name	: Smt. Borisagar Hansaben
Date of Birth	: 15.08.1997
Permanent Address with Contact Number	: "Ramkrupa", Block no.15/c, Kamnath nagar, Timbavadi, Junagadh Teh- Junagadh Dist.- Junagadh Gujarat-(362001) Contact no.- 8160835427

Academic Qualification: (starting with 10^{th} class)

Qualification	**Year**	**School/Board/ University**	**Marks (%)**	**Division**	**Major subjects**
10^{th}	2012	Gujarat Secondary & Higher Secondary Education Board	88.80	First	Gujarati, Social Science, Science & Technology, Mathematics, English
10+2	2014	Gujarat Secondary & Higher Secondary Education Board	73.00	First	Biology, Physics, Chemistry, English, Sanskrit
B.Sc. (Hons.) Agriculture	2019	Junagadh Agricultural University, Junagadh	84.80	First	All agricultural courses
M.Sc. (Agricultural Economics)	2021	CSKHPKV, Palampur	84.10	First	Agricultural Economics
Fellowships/ Scholarships/ Gold Medals/ Awards/ any Other Distinction:		NTS(PGS) of Rs 5000/- per month for two years from ICAR, Delhi.			