ECONOMICS OF PRODUCTION AND MARKETING OF LITCHI (*Litchi chinensis*) IN KANGRA DISTRICT OF HIMACHAL PRADESH

Thesis

by

RATIKA KAYASTHA
(F-15-08-M)

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Department of Social Sciences
College of Forestry
Dr. Yashwant Singh Parmar University of
Horticulture and Forestry Solan (Nauni) 173 230 HP India

Dr. Ravinder Sharma **Email:rsharmauhf@yahoo.co.in**
Professor (Agricultural Economics) **Mobile:+91-9418148202**

CERTIFICATE-I

This is to certify that the thesis entitled, "**Economics of Production and Marketing of Litchi (*Litchi chinensis*) in Kangra district of Himachal Pradesh**", submitted in partial fulfilment of the requirement for the award of degree of **MASTER OF SCIENCE (Ag.) AGRICULTURAL ECONOMICS** to Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.) is a record of bonafide research work carried out by **Ms. RATIKA KAYASTHA (F-2015-08-M)** under my guidance and supervision. No part of this thesis has been submitted for any other degree or diploma.

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

Place: Nauni, Solan **Ravinder Sharma**
Dated: **Chairman**
Advisory committee

CERTIFICATE-II

This is to certify that the thesis entitled, "**Economics of Production and Marketing of Litchi (*Litchi chinensis*) in Kangra district of Himachal Pradesh**", submitted by **Ms RATIKA KAYASTHA (F-2015-08-M)** to Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.), in partial fulfilment of the requirement for the award of degree of **MASTER OF SCIENCE** (**Ag.) AGRICULTURAL ECONOMICS** has been approved by the Student's Advisory Committee after an oral examination of the same in collaboration with the external examiner.

Ravinder Sharma
Chairman
Advisory Committee

External Examiner

Members of Advisory Committee

Manoj Vaidya
Professor
(Deptt. of Social Sciences)

R. K. Gupta
Professor
(Deptt. of Basic Sciences)

V.S. Rana
Principal Scientist
(Deptt. Of Fruit Science)

Dean's Nominee

Head
Deptt. of Social Sciences

Dean
College of Forestry

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Needless to say, all omissions and errors are mine.

Place: Nauni, Solan
Dated: ***(Ratika Kayastha)***

CONTENTS

ABBREVIATIONS

%	-	Per cent
&	-	And
@	-	At the rate
ACU	-	Adult Cattle Units
APEDA	-	Agricultural and Processed Development Authority
BCR	-	Benefit Cost Ratio
e.g	-	for example
et al.	-	*et alii* (Co- workers)
etc.	-	Many more
F&V	-	Fruit and vegetables
Fig.	-	Figure
FYM	-	Farm Yard Manure
Ha	-	Hectare
H.P.	-	Himachal Pradesh
HPMC	-	Horticulture Produce Marketing and Processing Corporation
Hrs	-	Hours
i.e.	-	that is
kg	-	Kilogram
IRR	-	Internal Rate of Return
No.	-	Number
NPV	-	Net Present Worth
NHB	-	National Horticulture Board
Qtls	-	Quintals
Qty	-	Quantity
Rs	-	Rupees
UHF	-	University of Horticulture and Forestry
viz.	-	that is to say

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Chapter-1

INTRODUCTION

Litchi (*Litchi chinensis)* belongs to the family Sapindaceae, one of the most environmentally sensitive subtropical tree fruit crop. Litchi fruit is native of China. Its systemic cultivation started in 1500 BC in China. It was introduced in Burma by the end of 17th Century and came to India through Burma in 18th century and after that it spread to other parts of the tropical and subtropical areas of the world. It is highly specific in climatic requirements, probably due to this reason; its cultivation is restricted to only a few tropical and subtropical countries of the world, where it is grown commercially, India being one of them. India is the second largest producer of litchi in the world after China. Litchi is an important fruit crop commercially grown in some states with tremendous export potential and plays a significant role in the economy. There has been ever-increasing demand for litchi in domestic and export markets.

In India area under litchi is 85000 hectare which accounts for a production of 528,300 MT (NHB, 2014). Commercial cultivation of litchi is restricted to the northern parts particularly, foothills of the Himalayas from Tripura to Jammu and Kashmir and Gangetic plains. The major litchi growing states are Bihar, West Bengal, Uttrakhand, Jharkhand, Assam, Tripura, Orrisa and Punjab. Bihar accounts for major share (70%) of the country's total litchi production. Litchi accounts for around 1 per cent of the total area under fruit crops in the country, having definite economic significance in the growing area.

Himachal Pradesh, principally a hilly region is situated in the laps of aesthetic Himalayan mountains between 32^0 22'40''N and 33^0 12'40''N latitude and 75^0 47'55''E and 79^0 04'22''E longitude. The altitude ranges from 350m to 7000m above mean sea level. The altitude and the direction of the mountain ranges and the nature of the soil have a direct bearing on the ecology of the local flora and fauna. The land is a limiting factor as the net sown area is only about one tenth of the total geographical area of the state. Under such circumstances a major section of the farming community cannot hope to raise its standard of

living by exclusive dependence on agriculture and thus the best alternative for the state is to utilize its natural gifts for other high payoff vocation and fruit farming is one of such enterprise best suited for this kind of terrain and climate.

Himachal Pradesh is known as the fruit bowl of the country. The state is having the advantage of varied climate ranging from sub-tropical to dry temperate. By virtue of its varied agro-climatic conditions and geographic features, Himachal Pradesh possesses vast potential for growing sub-tropical and temperate fruits. There is potential for growing different varieties of fruits like litchi, guava mango and citrus. Litchi cultivation is highly successful in areas having minimum temperature of 10°C from December to February and 38°C from April to June. In litchi-growing areas of India, the temperature varies from 21°C to 37.8°C during flowering and fruiting stages. The total fruit production in India in year 2014-15 is 866,330 MT from an area of 220,710 hectare (NHB, 2014).

The low hills and sub-montane zone of Himachal Pradesh is suitable for litchi cultivation thus it is a prominent fruit crop among orchardists of this zone. In Himachal, litchi is confined mainly to lower hills of district Kangra hich accounts for more than 80 per cent of the total area under litchi in the state. The area under litchi cultivation in the state was 5200 ha and production was 3500 MT in 2014-15. The Kangra district of Himachal Pradesh which is the major pocket under litchi cultivation covers an area under of 3025 hectare with a production of 2499 MT (Statistical Outline HP, 2014). Considering the agro-climatic conditions, its cultivation can be extended to Hamirpur, Una and warmer areas of Mandi and Sirmour districts as well.

During the past few years, the input cost has increased manifold, having an impact on the return to the farmer. The litchi fruits are highly perishable and needs to be marketed wisely. Keeping in view impact of cost on the benefit cost ratio, the proposed study has been conducted to evaluate the cost of production and marketing practices used in litchi fruit cultivation in Kangra District of Himachal Pradesh.

A very few studies have been conducted in the past on the economic aspect of production and marketing of litchi fruit in the state, however no such study was specifically conducted recently in the university on economic evaluation of litchi cultivation. Hence, there is a need to revalidate the economic indicators from time to time. Thus the present study on “Economics of Production and Marketing of litchi in Kangra District of Himachal Pradesh” was conducted to study the different production and marketing aspects along with the problems faced by the households engaged in litchi cultivation with the following specific objectives:

1. To examine the socio-economic status of litchi growers.
2. To work out economic feasibility of litchi cultivation in the study area.
3. To study the existing marketing system of litchi in the study area.
4. To analyze the problems faced by the litchi growers and suggest remedial measures.

Chapter-2

REVIEW OF LITERATURE

This chapter encompasses the recapitulation of the previous studies conducted by various researchers in India and abroad pertaining to the analysis of cost of production and marketing of different fruit crops. The available literature having relevance to the present study has been reviewed in this chapter under, three heads:

2.1 Economics of production

2.2 Marketing of fruit crop

2.3 Problems faced by the fruit growers in production and marketing

2.1 Economics of production

Handiganur (1995) studied the growth rates of area, production and productivity of grapes in Bijapur district from 1978-79 to 1992-93. Growth rate analysis showed that an increase of 7.12 per cent of area in Bijapur district, 2.80 per cent in production and 2.0 per cent in productivity of Grapes was observed in the Karnataka state. The increase in production and productivity was due to the use of improved cultural practices, increased use of manures, fertilizers and plant protection chemicals.

Chitra *et al.* (1997) studied the "Economics of ber production in and around Hyderabad city of Andhra Pradesh". The data obtained from 15 farmers during 1994-95, who were selected within 50 km radius around Hyderabad city and found that the total cost of establishment in the first year was Rs. 7,913 per hectare. The total cost incurred during the maintenance was Rs. 3,483 per hectare. The total cost of production of ber worked out to Rs. 16,737 per hectare. The payback period in ber cultivation was 4.42 years and benefit cost ratio was 5.25, indicating the profitability of ber cultivation. The net present value worked out to Rs. 12,061. The IRR was 73.54 per cent, which was higher than the lending rates of commercial banks. Thus, the economic indicators clearly indicated that the production of ber is economically viable.

Chaturvedi and Jha (1998) examined that the average height and diameter of litchi trees under 1 to 9 year-old plantation varied between 1.0 ± 0.20 to 5.47 ± 0.33 m and 5.10 ± 1.30 to 36.3 ± 3.82 cm respectively ; however the effect of relative light intensity under tree plantations decreased with increasing canopy depth and tree height. There was a marked reduction in yield of all intercrops with increase in age of the plantations. The economics of intercrops and plantations each from 1 to 9 years of age were calculated at the end of year 9 of planting. The benefit cost ratio under paddy-wheat-green gram-ginger and fruit systems was 2.17 and under maize-toria-green gram-pointed gourd and fruit were 2.73, indicating that the latter crop rotation under litchi plantation was more profitable than the earlier rotation. Thus, the intercropping under different growth stages of litchi plantation substantially increased the overall productivity of land from the first year of planting.

Chand *et al.* (2001) analyzed the variation in area, production and productivity of major fruit crops. The variation in area was observed to be maximum in sapota (21.65%), followed by citrus (7.82%), apple (7.46%), and lowest in pineapple (3.57%). In case of production maximum variability was observed in banana (14.82%) followed by papaya (13.97%), litchi (13.76%) and lowest in guava (6.95%). As far as yield is concerned the variability was highest in litchi (17.85%), followed by apple (14.08%), grapes (10.53%) and lowest in guava (4.00%).

Singh *et al.* (2001) carried out a study on production and marketing of fruits crop viz., pear, guava and grapes in Punjab. The study was based on the data that were collected from those sites where post-harvest infrastructural facilities were developed. The total annual cost of cultivation of guava was Rs. 22381.22 per hectare. Fertilizer and manure cost amounted to Rs. 1560.80 per hectare, accounting to largest share followed by human labour. Cost of cultivation of grapes was Rs. 26547.69 per hectare. The results concluded that manures/fertilizer occupied the major share in total cost of investment.

Dahiya *et al.* (2002) conducted a study on benefit-cost analysis of ber cultivation in Rohtak district of Haryana. To examine the economic feasibility in Ber cultivation four indicators like net present value, internal rate of return,

benefit cost ratio and payback period were used and found an IRR of 22.5 per cent with NPV of Rs. 26,346 and BCR of 1.22 at discount rate of 14 per cent. The investment in ber orchard had a payback period of 7 years. Liberal credit facilities, adequate supply system on inputs particularly good quality planting materials, were identified main factors which could increase viability of Ber cultivation.

Shah (2002) studied the production and marketing pattern of grapes in Maharashtra. The study dealt with grape orchards. The grape orchards were seen in three stages of production i.e., increasing stage, constant and decreasing production stage. The per acre annual gross maintenance cost of grape orchardists increased sharply during the phase the production rose before leveling off to a constant stage and thereafter, it declined. The cost structure revealed that 67 per cent of the gross maintenance cost was spent on production related operations and the remaining 33 per cent owed it to the investments on various marketing functions. The share of material input cost in gross maintenance cost of production was about 10-11 per cent. In general one acre of grape orchard yield a net income to the tune of Rs. 32,388 during increasing production stage, Rs. 36,345 during constant stage and Rs. 22,402 during declining production stage.

Guedgudda *et al*. (2002) conducted the study on "Banana cultivation in Haveri district of Karnataka state" and observed that the variable cost of cultivation of banana was Rs. 54,502.81 per hectare (65.01%). Among variable cost, the human labour was the major item of cost, which formed 17.61 per cent of the total cost of cultivation. Farmers used more number of labourers for planting, harvesting, weeding and desuckering operations. Next major items of cost incurred by farmers were suckers (Rs. 7,875), fertilizers (Rs. 6,318.94), bullock pair (Rs. 5,775.00) and farmyard manures (Rs. 5,250.00). The farmers incurred on an average Rs. 2,800 on micronutrients. Farmers used less than the recommended level of NPK fertilizers and used 376.92 kg per hectare of N, 153.80 kg per hectare of P_2O_5 and 398.80 kg per hectare of K_2O, as against the recommended level of 540, 325 and 675 kg per hectare of these fertilizers, respectively. The share of fixed cost and marketing cost in total cost was 28.47

per cent and 6.57 per cent respectively. Among fixed cost the rental value of land constituted more 22.06 per cent towards total cost of cultivation of banana. Depreciation accounted for 3.66 per cent and interest on fixed capital and land revenue, respectively contributed 2.69 per cent and 0.31 per cent to total cost. On an average, farmers got 475 quintals of banana yield. From main product, farmers realized an income of Rs. 1, 54,375 and by selling of suckers (byproduct) farmers earned Rs. 30,000. Hence, the gross return from banana cultivation was Rs. 1, 84,375 per hectare. The net return realized by farmers was Rs. 1, 00,545.96 with a B/C ratio of 2.19.

Mali *et al.* (2003) worked out the "Economics of production of banana in Jalgaon district of Western Maharashtra" and concluded that the rental value (16.76 %), human labour (8.58 %), manures (9.54 %), fertilizers (12.49%) and seed material (12.04 %) were observed to be the major items of cost and these together shared nearly 59.41 per cent of the total cost. Interest on working capital (10.39 %) and irrigation cost (7.93 %) were other important items of expenditure and together contributed 18.32 per cent to the total cost of cultivation. The yield per hectare worked out to 533.14 quintals. Relatively better yield was observed on the fields that grew 'Shrimanti' variety and adopted a better package of practices. The per hectares gross returns obtained by the cultivators were to the extent of Rs. 2, 14,867.24.

Khunt *et al.* (2003) studied the "Economics of production of pomegranate in Bhavnagar district of Gujarat" and revealed that the establishment cost of pomegranate orchard consisted of labour cost, material cost, rent of land, interest and depreciation charges incurred upto bearing stage of orchard i.e. for the period of 1 to 3 years. The results showed that total cost of establishment per hectare amounted to Rs. 39,586. Among the various cost components, the share of material cost was found highest to the tune of 41.05 per cent followed by labour cost (27.71 %), rent of land (24.04 %) and interest on working capital (6.59 %). The share of interest on fixed capital and depreciation was negligible. The total cost incurred per annum was Rs. 43, 930 per hectare, which comprised of Rs. 9,592 as amortized cost and Rs. 34,338 as maintenance cost. The average yield

per hectare per year was 6,479 kg which generated the net return of Rs. 15,558 per year.

Lokesh *et al*. (2004) carried out some investigations on the "Economics of cultivation of passion fruit in Karnataka" and revealed that the establishment and maintenance cost of passion fruit in planting year (2000-01) was Rs. 71,500, with yield per hectare as 200 quintals in the second year and 250 quintals in the third and subsequent years. Net return per hectare in the third year was worked out as Rs. 81,125. The estimated economic life of passion fruit garden was six years with a Net Present Value of Rs. 1, 55,395 per hectare and a benefit-cost ratio of 2.17 at 15 per cent discount rate the internal rate of return was estimated as 67 per cent.

Chidambaram *et al*. (2005) carried out the study on dynamics of costs and returns structure in agricultural farms in the perspective of the farmers in the Madurai district of Tamil Nadu. The multistage stratified random sampling method was adopted for selection of the samples. Results showed that the value of output per acre was highest in the case of small sized farms. The value of output per acre was found to be Rs. 11,041.48 Rs. 10, 915.79 and Rs. 10,301.56 respectively for the small, medium and large sized farms. Output-Input ratio for the small, the medium and the large sized farms were 1.54, 1.47 and 1.34 respectively. It was found that the output- input ratio per farms as well as per acre were found to be more in case of small sized farms compared to medium and large sized farms. As capital output ratio was considered to be an important index for considering the efficient use of capital. It was concluded that small sized farms were the most efficient farms, among the three sized groups of farms.

Bakhsh *et al.* (2006) conducted the study on "cost and profitability in growing mango orchards in Pakistan". Cost of production and returns in growing mango orchard were estimated in different ways compared to annual crops. The study was designed to investigate cost of production and returns per acre over the life time of mango trees. A sample of 20 mango growing farmers was taken purposively from various villages of Multan district with the objective to work out benefits cost ratio and net present worth of growing mango orchard. Net present worth of Rs. 1,55,607.16 per acre was estimated for the sample

respondents which indicated that mango cultivation fetched higher returns, whereas, benefit-cost ratio was reasonably high (2.61). The results indicated that investing in mango orchard would bring huge returns to the farmers on one hand and also for the country in the forms of foreign earning on the other hand.

Ahmad and Mustafa (2006) estimated the trend in the production of kinnow and found that the production of kinnow had considerably increased during the past years due to an increased demand for the fruit both in the domestic and international markets. Despite greater demand, the potential of kinnow export was not been fully reaped. The log linear model was applied to estimate the past trend in production. ARIMA model was used to forecast the production of kinnow for twenty years. The forecast value of production of kinnow for 2022-23 was worked out to be 2617.45 thousand tons, which suggest that an increased output of kinnow would be available for consumption. Further suggested the need for taking measure to increase export of kinnow to potential international markets by improving quality, packaging and following the international standards.

Ramchandra (2006) studied the growth rate in area, production and productivity of sapota in Dharwad and Belgaum districts of Karnataka from 1994-95 to 2004-05. Growth rate in area (3.73 %) and production (4.77 %) of sapota were found to be highest in Dharwad district. Whereas, Belgaum district registered -3.07 per cent in case of area, -9.18 per cent in production and -6.30 per cent in productivity. On the contrary, higher growth rates were observed in the case of the State as a whole, with a positive growth rate in area (4.54%) and negative growth in both production (-1.98%) and productivity (-6.24 %) of sapota.

Rane and Bagade (2006) conducted study on economics of production and marketing of Banana in Sindhudurg district of Maharashtra and revealed that the per hectare cost in Dadamarg and Sawantaadi tehsil were Rs.1.52 lakhs and Rs.1.53 lakh respectively. In Dadamarg tehsils banana was grown as a sole crop where per hectare cost of cultivation was Rs.1.28 lakh and in Sawantaadi tehsil the per hectare cost was Rs.1.15 lakh, benefit-cost ratio in Dadamarg tehsil and

Sawantwadi tehsil were 2.20 and 2.33 respectively. The average benefit cost ratio of Banana cultivation was 2.27.

Saraswat and Rane (2006) conducted the study on production and marketing of peach fruit in Rajgarh area of Sirimour district in Himachal Pradesh. For the detailed study 50 farmers were randomly selected. The compound growth rate with respect to area and production showed that the area under peach increased at the rate of 4.31 per cent per annum. The highest area under peach was recorded in Sirmour district, whereas Mandi district registered the highest growth rate of production in the state *i.e.*, 9.32 per cent per annum. The district wise production scenario indicated that there were variations. Out of 12 districts only 4 districts have registered a positive growth in production *i.e.*, Solan (22.55 %) followed by Una, Bilasapur and Mandi.

Gondalia and Patel (2007) studied the economic viability of aonla plantation in Gujarat. A sample of 120 aonla growers was selected from 12 villages of the Kheda and Anand districts. It was found that establishment of aonla orchard involved high investment, but the annual net returns were quite high after the third year of plantation. The values of economic parameters, viz. NPV, BCR, IRR and Payback period had been found to be Rs 652652, 5.25, 65.03 per cent and 55 months, respectively at 10 per cent discount rate.

Kareemulla *et al* (2007) studied the "Production and Marketing of Indian Gooseberry-Aonla (*Emblica officinalis*) in Pratapgarh district of Uttar Pradesh. Indian Gooseberry cultivation is getting popular in the country. With almost one-third area in Uttar Pradesh, Aonla is spreading to non-traditional areas also because of its adaptability and profitability. The area occupied by aonla has increased from 47329 to 82690 hectare in the reference period at a growth rate of 5.2 per cent and the average productivity increased from 5.7 to 6.5 t per hectare. The aonla arrivals grew at 21.31 per cent in Pratapgarh APMC with average arrivals of 9017 t with almost seven fold increase in a decade consequently the price fell from Rs 630 per qtl to Rs 396 per qtl in 2001-04 due to higher arrivals of aonla due to area expansion.

Gangwar *et al.* (2008) conducted the study on the "production constraint and economics of peach (*Prunus persica*) in Punjab and Uttarakhand". The investment in peach orchards was a profitable business. The internal rate of return (IRR) was found to vary from 20.98 per cent to 23.80 per cent, depending on the size of peach orchards. The net present value, benefit-cost ratio and IRR at 12 per cent discount were reported as Rs. 44,807, 1.68 and 22.20 per cent, respectively for the overall category of the orchard. The economic productive life of peach orchard in Punjab and Uttarakhand was worked out to 24 years.

Keerthi (2008) calculated the growth rates of area, production and productivity of pineapple from 1994 to 2004 for Shimoga district as well as for Karnataka State. The growth rate analysis revealed the increase of 3.95 per cent in area, 5.29 per cent in production and 1.31 per cent in productivity of pineapple in Shimoga district, whereas, growth rates for Karnataka State as a whole were 0.43 per cent, 17.76 per cent and 17.27 per cent respectively in that order. The increase in area was found to be the highest in Shimoga district. On the contrary, the growth in production and productivity was considerably more in Karnataka State as compared to Shimoga district. As far as the variation in area, production and productivity of pineapple was concerned, it was less in Shimoga district compared to the state as a whole.

Naphade and Tingre (2008) worked out the "Economics of production of guava in Buldhana District of Maharashtra" and found that per hectare cost of establishment of guava orchard was Rs. 34,333. The per hectare cost of production was Rs. 22,522 per hectare average yield estimated was 372 quintals with a profit of Rs. 82,036 per year . The major problems faced by the guava growers were the lack of market information, lack of appropriate grader and high market commissions.

Ravikumar (2009) studied the cost and returns in pomegranate orchards in Karnataka and found that the cost of establishment per hectare was Rs. 1,90,888.41 and Rs. 1,89,644.33 of which material cost constituted 56.87 and 58.15 per cent and maintenance cost 43.13 and 41.85 per cent in Challakere and Hiriyur taluks respectively. The net present value of investment for the orchards

in Challakere and Hiriyur taluk were Rs. 4,75,538.23 per ha and Rs.4,45,869.80 respectively at 9.5 per cent discount rate for pomegranate enterprise.

Bhat *et al.* (2011) conducted the study on economic appraisal of kinnow production and its marketing under North-Western Himalayan Region of Jammu during the year 2009-10 and revealed that the total establishment cost was Rs. 12,707 and the overall returns per acre from kinnow orchards were Rs. 6632. The net present value, internal rate of return, benefit-cost ratio and payback period were Rs. 7929, 15.42 per cent, 1.52 and 7.60 years respectively.

Das (2013) conducted the study in Tripura and evaluated the varieties of litchi Shahi, Muzaffarpur, Swarna Roopa, Bombai and Late Bedana which showed good performance in respect of bearing habit, number of fruits per plants, time of maturity and quality parameters. But Shahi variety showed excellence performance in all aspects like taste, flavor, aroma and other quality parameters. Litchi provides food, nutrition, generate income, livelihood opportunity, improve the socio-economic status and poverty alleviation in rural and interior areas of the state.

Prasher *et al.* (2013) studied that the initial investment on the litchi plantation was estimated Rs.16821.48 per hectare. The litchi cultivation was found profitable as it gave good internal rate of return (14.39%), benefit-cost ratio (1.21) and the net present value of Rs. 52, 069 per hectare. Sensitivity analysis of litchi plantation showed that up to 20 per cent change in the costs or returns, internal rate of return in litchi crop remained higher than the prevailing bank rates for long deposits therefore it is suggested that litchi cultivation should be encouraged among the orchardists in the foothills of Himachal Pradesh which offers climatic advantage due to the late maturity of the fruits.

2.2 Marketing of fruit crops

Sahu (1995) took a case study of coconut marketing in Puri district (Orissa) to find out marketing efficiency. Main market channel involved was producer → Trader → Wholesaler → Retailer → Consumer. Results revealed that share of producers turn out to be 62.22 percent of the consumers' price. Marketing cost of 1000 coconuts from producers' farm till to the sale by retailer

worked out to Rs. 1,700 which is 37.78 percent of the price paid by the consumer. Maximum share of price- spread goes to the retailer as profit followed by trader and wholesaler respectively which work out to be Rs. 15.89 per cent, 6.67 percent and 2.23 per cent of the consumers' price respectively. Marketing efficiency for two coconut markets i.e. Sakhigopal market and Satasarki market in the district were 1.65 and 2.18 respectively. The higher marketing efficiency in Satasanhi market is due to the fact that number of intermediaries in case of Sakhigopal market is more and their margins are more than the marketing cost. From the study, it is concluded that middleman's margin appear to be quite high, which can be brought down by creating competition at market level or by encouraging cooperative marketing.

Saraswati (1996) studied the marketing cost of orange in Kangra and Sirmour districts of Himachal Pradesh. The major components of marketing costs were picking, grading, packing, transportation, commission charge and state tax. The costs of marketing per basket incurred by the orchardists on these items depended mainly on the distance of market from the production area and the charges levied by the intermediaries. The orchard owners of Kangra district incurred a marketing cost of Rs. 31.20, 29.75,22.19 and 29.75 in Ambala, Chandigarh, Pathankot and Jammu markets, respectively, whereas, for those of Sirmour district the same was worked out to be Rs. 22.82, 25.46, 23.48, 25.24 and 23.29 in Dehradun, Jagdhari, Saharanpur, Ambala and Chandigarh markets respectively.

Singh (1996) studied the marketing of citrus fruits in Rajouri district of Jammu and Kashmir by surveying 60 citrus growers in the region and identified two channels of marketing namely,

- Channel-I: (producer → pre-harvest contractor → retailer → consumer)
- Channel- II: (producer → retailer → consumer).

The producer's share in the consumer's rupee was found to be highest (75%) in channel-II as compared to channel-I (35.71 %).

Shah (2000) studied the marketing pattern of grapes in Maharashtra. The following channels were found in marketing of grapes in the domestic market:

- Channel-I: Producer → Forwarding Agent → Wholesaler
- Channel-II: Producer → Commission Agents → Wholesaler
- Channel-III: Producer →Wholesaler
- Channel-IV: Producer →Pre Harvest Contractor→ Wholesaler

Srivastava and Mishra (2001) studied the price spread in marketing of mango in Varanasi district of Uttar Pradesh and identified two channels in marketing of mango:

- Producer →harvest contractor → wholesaler → retailer →consumers.
- Producer →wholesaler→ retailer → consumers.

The producer's share in the consumers rupee was 43.86 per cent when the mango was marketed to distant market at Calcutta (channel I) against 62.93 per cent in the case of sale of mango in local markets (channel II). Comparatively higher returns in channel II was observed than channel I. The marketing cost incurred in performing different market activities in channel I was Rs. 56 and Rs. 23 in channel II.

Ladaniya *et al.* (2003) in their study on marketing pattern of mosambi (sweet orange) found that most of the orchardists sold their produce through pre harvest contractor which was as high as 86.6 per cent followed by produce sold through commission agent which stood at 13.4 per cent. In the channel: producer – commission agent (distant market) – retailer – consumer, the producer's share in consumer's rupee was 49.42 per cent while in a channel where pre harvest contractor was involved, the producer's share in consumer's rupee was 30 per cent only. The marketing efficiency was maximum (0.97) when farmer sold his produce directly through commission agent as observed in Pune market. When the fruit was sold through pre- harvest contractor, market efficiency (0.43) was less. Cost of marketing also increased due to traders' margin in this channel.

Uma *et al.* (2004) studied the price spread in following four marketing channels of coffee in Visakhapatnam District of Andhra Pradesh:

- Channel I: Producer →Commission agents → Wholesalers → Retailer cum Roaster → Consumer.

- Channel II: Producer → Girijan Co-operative society →Wholesalers → Retailer cum Roaster →Consumer.
- Channel III: Producer → Girijan Co-operative society →Retailer cum Roaster _Consumer.
- Channel IV: Producer →Girijan Co-operative society →Exporter →Terminal market.

The producer's share in consumer rupee was maximum in channel IV (43.06) followed by channel II (38.09) and channel I (34.46). Among the four channels, marketing efficiency was found high in Channel III by 55.45 per cent.

Mair and Tehmina (2005) analyzed the contracting system of vegetable supply chain in Sindh province of Pakistan. The study showed that vegetables were produced at various geographical locations in Pakistan and distributed across the consumers of the country through a complex chain of marketing functionaries. The supply chain includes producers, contractors, commission agents, wholesalers and retailers. These chains perform marketing activities by following written and unwritten agreements .The producers obtain loans and inputs from the marketing agencies. The system of pre-harvest sale and post-harvest sale were prevalent in the vegetable marketing system of Pakistan. It was through contracts input marketing and that output marketing seemed to be interlocked because of informal money lending within the supply chain.

Meena *et al.* (2005) conducted study on the practices and channels in marketing of guava in Udaipur district of Rajasthan and revealed that the average quantity sold by producer seller was 34.45 quintals. More than 93 per cent of guava was sold by 82 per cent of producer seller in the lot size of more than 10 quintals. About 52 per cent farmers preferred to sell guava in 5 to 10 lots. Maximum quantity (71 %) of guava was sold within village by majority of producers-sellers (about 69 %). Pre-harvest contractors within village and wholesalers in regulated market were the most important agencies to whom producers sold their market surplus. The tractor trolley plays an important role in transportation of guava produce. Producer-pre-harvest contractor commission agents- retailer-consumer is the most important channel by which maximum quantity (53.19%) reaches to the consumer.

Singh (2005) while analyzing the price spread of kinnow in Punjab mentioned that net price received by the selected farmers of Ferozepur district was Rs 795 per quintal which was about 42 per cent of the price paid by the consumers of Delhi market in January, 2003. The margin to the contractor was about 28 per cent and the retailer got about 9 per cent in Delhi market. The grower's share in consumer's rupee in Hoshiarpur district was about 40 per cent for sale of fruit through contractor in Delhi market. The margin of contractor was about 29 per cent. The study showed that producer share in consumer's rupee in Ferozepur and Hoshiarpur districts was about 56 per cent and 54 per cent respectively. In the Amritsar market, the producer share in consumer's rupee in two districts was about 57 and 55 per cent respectively.

Gangwar *et al.* (2007) estimated the post - harvest losses in kinnow in Punjab during 2004-05. The unscientific post-harvest management results in substantial losses during transit and in distant marketing. The study revealed that aggregate post-harvest losses from orchards to consumers in Delhi market were 14.87 per cent and 21.91 per cent in the Bangalore market. The marketing cost of kinnow in Delhi market was Rs. 9.05/ kg and Rs. 14.34/kg in Bangalore market. The net profit to marketing functionaries had been estimated 49.1 per cent, 43.0 per cent and 33.2 per cent respectively in local, medium distant and long distant markets. The study concluded that inclusion of marketing loss in estimation of marketing margins and marketing efficiency indicated that the existing methods have unduly overstated the farmers' net price and profit margins. The results had emphasized that the efforts should be made to adopt improved packing techniques, cushioning material and cold storage at retailers' level. The producers share in consumers' price had been found to be higher in local markets than in Bangalore and Delhi markets, largely because of lower marketing costs and profit margins of traders.

Gondalia *et al*. (2007) studied the marketing of aonla (*Emblica officinalis*) in Gujarat and revealed that, on an average marketable surplus was 97.76 per cent of total production. Among the various marketing channels, channel-I (producers-wholesaler retailers- consumers) was the most popular among the farmers as about 91 per cent aonla was marketed through this channel. The total marketing

costs and margins came to be Rs 240.37 and Rs 507.33 per quintal respectively. The producers share in consumer's rupee was 58.26 per cent. The market efficiency was 1.40. This implied that aonla marketing system had been working at reasonable efficiency looking at the perishable nature of the crop.

Shankar *et al.* (2008) in their study on the marketing of grapes in Bangalore and Bijapur identified four different channels through which grapes were sold which were:

- Channel-I: Farmers → pre-harvest contractor → wholesaler → vretailer-consumer
- Channel-II: Farmers→commission agent→wholesaler→retailer→consumer
- Channel-III: Farmers→ HOPCOMS (The Horticultural Producers Cooperative Marketing and Processing Society)→Consumer
- Channel-IV: Farmers→consumer

They concluded that farmers share in consumers rupee were 42.86, 67.35, 72.45 and 100 per cent in channel-I, II, III and IV respectively.

Naphade and Tingre (2008) studied the price spread in marketing of guava in Buldhana district of Maharashtra and identified following three channels of guava marketing:

- Producer → Wholesaler → Retailer →Consumer
- Producer →Retailer →Consumer
- Producer →Consumer

The result of the study observed that the price spread in channel-I was Rs. 170, in channel-II it was Rs. 113 and for channel-III, it was Rs. 70. Marketing of guava was mostly done by channel-I.

Anchal and Sharma (2009) conducted the study in the sub mountainous region of Gurdaspur district of Punjab and identified the following three channels for marketing of litchi:

- Producer → Pre-harvest contractor → Retailer →Consumer (Local market)
- Producer →Pre-harvest contractor→ Retailer (through commission agent) → Consumer (Amritsar market)

- Producer→ Pre-harvest contractor (wholesaler) →Retailer (through commission agent) →Consumer (Delhi market)

Of the three channels, the first one was found to be the most efficient as the producer could get as high as 72.08 per cent of the consumer's rupee. The price spread was Rs.540.98 for local market, Rs. 1,126 for Amritsar market and Rs. 1664 for Delhi market.

Kerutagi *et al*. (2009) conducted the study on sapota marketing in Belgaum and Dharwad districts of Northern Karnataka and identified the following two channels of sapota marketing:

- Producer → Commission agents→ Retailers → Consumers
- Producer → Pre-harvest contractor cum wholesaler → Retailers →Consumers

The producer's share in consumer's rupee in channel-l was higher (59.58%) than in channel-II (48.14%). Similarly, the price spread in channel-I was Rs. 2500(26.32 %), in channel-II it was Rs. 4,000 (42.11%) indicating higher efficiency of channel-I.

Murthy *et al.* (2009) in their study on the marketing and post-harvest losses in fruits i.e. mango, grape, banana and pomegranate found that the marketing cost, margins and efficiency of marketing depend primarily on the channels of marketing. The marketing cost in mango, grapes, banana and pomegranate accounted for nearly 16.82, 23.15, 27.52 and 20.98 per cent, respectively. Farmers' net margin in the consumer's price was low due to predominant role played by the wholesalers and retailers who among themselves shared 37 per cent of the consumers' rupee about 46 per cent in mango and high with 68 per cent in grapes. In banana and pomegranate, the farmers' net share in the consumers' price was 53 and 50 per cent, respectively. The market efficiency in mango, grapes, banana and pomegranate was 0.85, 2.13, 1.12 and 1.01 per cent, respectively.

Kaur and Singh (2010) studied the marketing of kinnow in Srinagar district of Rajasthan state. The results indicated that on an average 8.97 quintals of kinnow per farm was retained for home consumption. The retention was 5.17, 12.98 and 18.90 quintals on small, medium and large farms respectively. The

average marketable surplus on all size farms was 99.31 percent of total production and only negligible part of the total output was retained for family consumption. The marketable surplus as percent of total production showed a tendency to increase with increase in the orchard size.

Kumar and Singh (2010) estimated the price spread in following four channels of mango marketing in Lucknow district of U.P:

- Producer (local) → Pre-harvest contractor (local) → Commission agent (Lucknow) → Wholesaler (New Delhi) → Retailer (New Delhi) → Consumer (New Delhi)
- Producer (local) → Pre-harvest contractor (local) → Commission agent(Lucknow) → Retailer (Lucknow) → Consumer (Lucknow)
- Producer (local) → Pre-harvest contractor (local) → Wholesaler (Lucknow) Retailer (Lucknow) →Consumer (Lucknow)
- Producer (local) → Pre-harvest contractor (local)) →Retailer (Lucknow) → Consumer (Lucknow)

Among the four channels, channel-IV was found most efficient one from the point of view of the producers as well as the consumers as the producers got as high as 46.09 per cent of the consumer's rupee and remaining 54 per cent was incurred on different marketing costs or the margin by the pre-harvest contractor/ retailer. Thus, the price spread was found to be minimum in local markets and maximum in distant markets.

Sharma *et al.* (2010) studied the production and marketing of walnut in Budgam district of Jammu and Kashmir, and identified three marketing channels.

- Channel-I: Producer → retailer → consumer
- Channel-II: Producer →wholesaler→ retailer → consumer
- Channel-III: Produce→kachha wholesaler→ retailer → consumer

The study highlights the fact that the producer's share was very low in channel-III (64.00%) of the consumer's price. Alternatively they also suggested that the regulated markets could expand their reach by appointing procurement agents for different clusters of villages as it would help walnut growers to cut down the transaction costs.

Bhat *et al.* (2011) conducted study on "Economic appraisal of kinnow production and its marketing under North-Western Himalayan region of Jammu" and found that the average per quintal marketing cost at producer's level vary to the extent of Rs. 450, Rs. 375, Rs. 303 and Rs. 223 for channels I, II, III and IV, respectively. The average per quintal marketing cost borne by the wholesaler in channel-IV was Rs. 61, while as it was Rs. 30, Rs. 32 and Rs. 19 in channels I, II and III, respectively at the retailer's level and in channel-IV, whole of the marketing cost was borne by the producer as there was direct marketing of produce. A comparison of price spread through different marketing channels had revealed that producer's share in consumer's rupee was the highest (81%) in channel-IV, due to self-sale in the local market. The marketing efficiency had been found to be highest in channel-IV. The producer got maximum benefits in channel-IV, therefore this channel should be followed to make producer highest beneficiary, although this channel has its own limitations.

Kumar *et al.* (2015) conducted the study to assess losses at the farm, wholesale and retail levels in the supply chain of litchi in India. Changes in fruit quality parameters after harvest and the effectiveness of an improved Corrugated Fibre Board (CFB) box versus conventional wooden box packaging to minimize post-harvest losses were also studied. Farm-level samples were collected immediately after harvest from farmers' orchards in the Muzaffarpur district of Bihar state. Wholesale market samples were procured from the Delhi market, and retail samples from the Muzaffarpur and Delhi market. Real time data on losses and quality parameters of fruits were recorded by transporting litchi from Muzaffarpur to Delhi (distance 1000 km) by truck. Studies indicated that the average loss (fruits discarded at sorting) apparent at the farm level during 2012 and 2013 was 30.4 per cent and 25.8 per cent, respectively. The average loss at the wholesale market level in Delhi was 15.8 per cent and 12.4 per cent during 2012 and 2013, respectively. The highest mean loss (up to 20.5 per cent) was observed at the retail level. The mean fruit weight loss during transport to Delhi was 9.42 per cent and 7.07 per cent during 2012 and 2013, respectively. The mean total loss in the supply chain of litchi ranged from 35.3 per cent to 43.8 per cent.

Negi and Anand (2015) conducted research on the supply chain of fruit and vegetables in India and suggested that there was an improper supply chain management, lack of cold chain infrastructure and food processing units which was leading to 11 maximum inefficiencies and resulting to loss and wastage of fruit and vegetables. The entire supply chain of F&V is laden with the issue of post-harvest losses and wastages due to long and fragmented chain, dependency on intermediaries, poor road infrastructure, inefficient mandi system, inadequate cold chain infrastructure facilities, high cost of packaging, poor quality of distribution, weak link in supply chain. which resulted to poor price realization of growers on one hand and exorbitant prices paid by consumers on the other end.

Verma *et al.* (2015) conducted the study on "Economic appraisal of kinnow production and its marketing in lower hills of Himachal Pradesh" to appraise the socio-economic status of kinnow orchardists and marketing system in the selected area. The sample comprised of 160 kinnow growers that was selected from Nurpur and Indora blocks of Kangra district using multistage sampling technique. The results revealed that the kinnow production makes significant contribution towards the upliftment of the socio-economic status of the kinnow orchardists in the study area. Out of the three marketing channels, channel-III was found to be most efficient with a marketing efficiency of 2.18 followed by channel II with a marketing efficiency of 1.56 while channel I was found to be the least efficient with a marketing efficiency of 0.76.

2.3 Problems faced by the fruit growers in production and marketing

Saraswat (1996) in his study on economics of marketing of orange in Himachal Pradesh identified Grading and packing, packing material, storage problem, transportation problem, problem of market intelligence and problem of malpractices as the major problems faced by the citrus growers in the marketing of the produce.

Atibudhi (1997) conducted the study on the constraints associated with horticultural development in Orissa and identified constraints such as non-availability of planting material, lack of marketing support and price incentives in the producing areas, poor management, non-adoption of package of practices recommended and shortage of disease free planting materials. The study

emphasized on the need for replacement of very old fruit trees with new ones and adoption of improved cultivars from consumer's point of view.

Rani *et al.* (1997) studied the "problems associated with pineapple production in Andhra Pradesh". The main problem identified was non-availability of good variety of pineapple suckers as expressed by 74 per cent of the sample farmers. Presence of excess calcium content in the soils of the study area was a problem as expressed by all the selected farmers. Coming to the credit aspect, cent per cent of the farmers were denied to the opportunity of availing the institutional credit, as the loan for this fruit crop was not included in the list of crop enterprises for which loans were advanced. Consequently the farmers were solely dependent on private tenders with whom the rate of interest was very high. Lack of technical know-how on pineapple cultivation and maintenance of hedgehogs were another problems complained by 85 per cent of the sample farmers.

Shanti (1999) identified exploitation by market intermediaries, low share of producer in consumer rupee and low prices and wide price fluctuations as the major problems faced by guava orchardists in marketing of produce in Andhra Pradesh.

Guledgudda *et al.* (2002) conducted the study on banana cultivation in Haveri district of Karnataka state and identified the problems faced during production were lack of technical know-how, lack of adequate credit facility and scarcity of water. The farmers in the study area also expressed marketing problems like involvement of intermediaries, lack of storage facilities and inadequate transportation facilities.

Khunt *et al.* (2003) studied the "Economics of production of pomegranate in Bhavnagar district of Gujarat". The study revealed that the problem of mite in pomegranate was the most severe problem felt by majority of growers (88.46%). About 86 per cent of the growers faced the problem of dying of young plant. Inadequacy of irrigation water was felt by 80.77 per cent of total growers. About 75 per cent growers faced the problem of poor quality water. Short supply of electricity was also felt by 63.46 per cent growers. About 23.08 per cent growers had experienced that prices received were not remunerative.

Mali *et al.* (2003) studied the "Economics of production of banana in Jalgaon district in Western Maharashtra" and observed that the banana growers were exploited especially in harvesting season for transplanting the bunches from field to road by demanding higher charges. The cultivation of banana was highly capital intensive and presently the primary agricultural co-operative credit society was not giving the crop loan in time as per requirement. As a result the banana growers had to depend for external assistance from private traders and commission agents. The grade wise loading of wagons was not followed by the co-operative fruit marketing societies. As a result all produce was valued at an average rate ignoring the high price for quality grade.

Mushtaq *et al.* (2005) in his study on post-harvest losses in mango in Pakistani Punjab had identified the total post-harvest losses in the marketing channel of mango which were 11.97 per cent at farm level (producer/contractor level), 11.1 per cent at market level (phariawala and retailer level) and 7.9 per cent at consumption level. Experience, area, picking stage, picking technique, number of workers and training of workers had significant effect on post- harvest losses of mango at farm level while education of producer/contractor, picking time, variety combination and average distance of farm to market had non-significant effect on losses.

Sikka *et al.* (2005) worked on problems and prospects in value chain of litchi export from Uttaranchal. They revealed that the cost of marketing is about five times that of domestic as lot of logistics are required in international trade but the absolute producer's share is twice meaning more returns to farmers. Litchi possesses a short shelf life at ambient condition. Hence, the study also suggested careful post-harvest techniques particularly grading, packing and transportation under controlled condition for effective marketing. They also focused on the need for bigger role from the Horticulture Technology Mission, APEDA, Directorate of Horticulture and NHB in order to facilitate in meeting out the demand for Uttaranchal litchi in Middle East countries and UK.

Kaur and Gupta (2008) studied the problems and strategies in production and marketing of fruits and vegetables in India. The study focused on the emerging scenario of fruits and vegetables, seasonal variability, pre and post-

harvest losses, and market infrastructure to improve the marketing and production process of these products. Seasonal variability showed that there was a great fluctuation from month to month in arrival and prices of horticulture crops, therefore indicating large seasonal variability. In the early stage of crop growth, there was physical and economic losses and due to post-harvest losses, the per capita availability of fruit and vegetable declines. With regards to market infrastructure, low capacity utilization is due to the fact that majority of the 5200 fruit and vegetable units are in small and cottage sectors which are plagued by the technological backwardness and lack of adequate funds for modernization.

Molla *et al.* (2010) in their survey of postharvest practices and losses of litchi in selected area of Bangladesh, had found that careless harvesting and handling also cause injuries and losses of marketable quality of litchis during harvesting and transportation to different points. Due to short shelf life and rapid quality deterioration, a considerable portion of litchi also goes waste after buying for consumption.

Bharadwaj *et al.* (2012) in their study on the challenges and constraints of production, marketing and export of litchi: *The SWOT Matrix Approach* had seen that on one hand they had to deal with hundreds of small scale farmers (usually through intermediate traders) who wanted a good price for their produce. On the other hand, exporters needed to deliver products that comply with quality requirements and increasingly with social and environmental standards of volatile markets. This required costly quality management systems and training of farmers. Producing litchi for high quality markets such as in Europe, UAE and US created opportunities (price margins are usually higher) as well as constraints (higher requirements on quality). Producers and exporters needed assistance to overcome these constraints. The pressures of globalization and liberalization were creating exclusive supply chains between preferred business partners. Small holder agriculture was poorly prepared for such changes and they suggested that targeted efforts were needed to include poorer households in value chains, organizational development, technical upgrading, management skills and access to financing.

Singh and Dwivedi (2012) have studied the status, constraints and opportunity in litchi production in India. The study conducted in various parts of Uttrakhand under the Horticulture Technology Mission Project revealed the problem like high sensitivity of litchi crop to environmental conditions, limited varietal wealth, long gestation period, low and irregular bearing, skin cracking, fruit dropping, incidence of pests during the reproductive phase, poor shelf life and post-harvest diseases as the major constraints in litchi production.

Khalil *et al.* (2014) conducted the study to point out the problems faced by the peach growers in District Swat. That majority of the respondents faced problems of non-availability of extension field services, lack of irrigation water, lack of cold storage facilities, extra commissions, distant markets, scab disease and fruit fly. These problems cause poor peach fruit productivity, in return, affecting the socio-economic study of the respondents. This study suggested the availability of inputs, provision of Agricultural Extension Field advisory services, improving the irrigation system, solution of market related problems with provision of storage and standard packing materials and transportation problems to get high yield production in order to improve the socio-economic status of the respondents.

Chapter-3

MATERIALS AND METHODS

This chapter outlines the characteristics of the study area, methods adopted in selection of the sample, nature and sources of data and various statistical tools applied and techniques employed in analyzing the data as described under the following sub-heads.

3.1 Sampling procedure

3.2 Collection of data

3.3 Analytical techniques

3.4 Assumptions of the study

3.5 Limitations of the study

3.1 SAMPLING PROCEDURE

Multistage random sampling design was used for the selection of the respondents.

3.1.1 Selection of the study area

The main objective of the study was to examine the production and marketing aspect of litchi and attempts to describe the various facets of litchi farming in study area. The mid hill zone ranging in altitude from 850-1400 meters above mean sea level, of Himachal Pradesh has comparative advantage of growing litchi due to congenial climatic conditions for its growth. Kangra district (Fig. 3.1) of Himachal Pradesh was selected purposively for the present study. This district was selected because of its significant contribution (nearly 60%) with respect to area and production of litchi in the state and simultaneously providing fruitful employment to the growers.

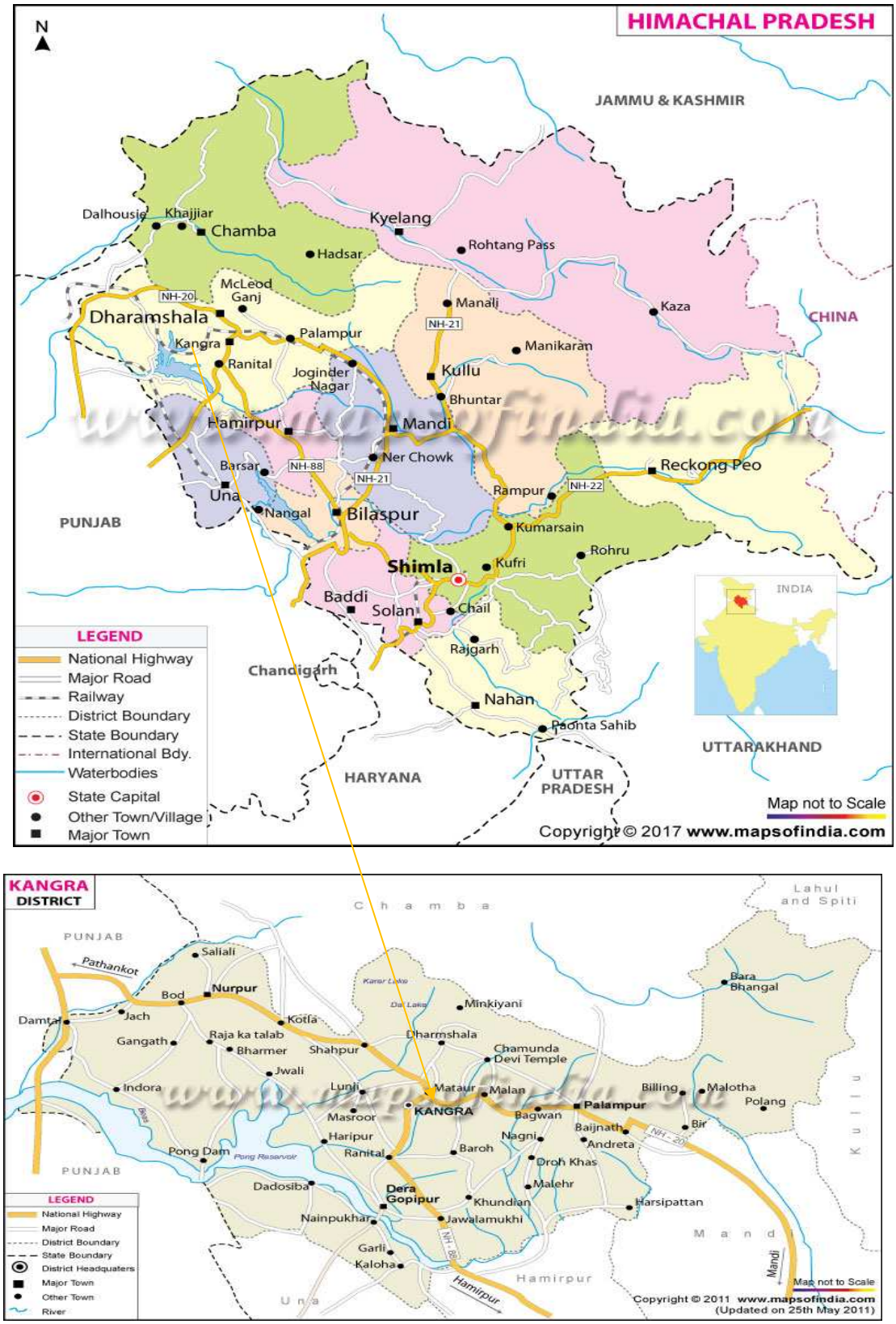

Fig. 3.1: Mapping of the selected study area

3.1.2 Selection of the sample

Multistage Random sampling technique was used to select the ultimate sample respondents i.e. the litchi growers.

At the first stage 3 blocks namely Bhawarna, Sulha and Nagrota Bagwan, out of 15 blocks were selected on the basis of area under litchi cultivation. At the second stage a list of litchi growing villages from each selected block was prepared and 2 villages from each block were selected randomly. The list of litchi growers in village selected in previous stage was prepared based on the area under litchi cultivation and 10 growers from each village were selected randomly thus forming a sample of 60 farmers. (Fig. 3.2)

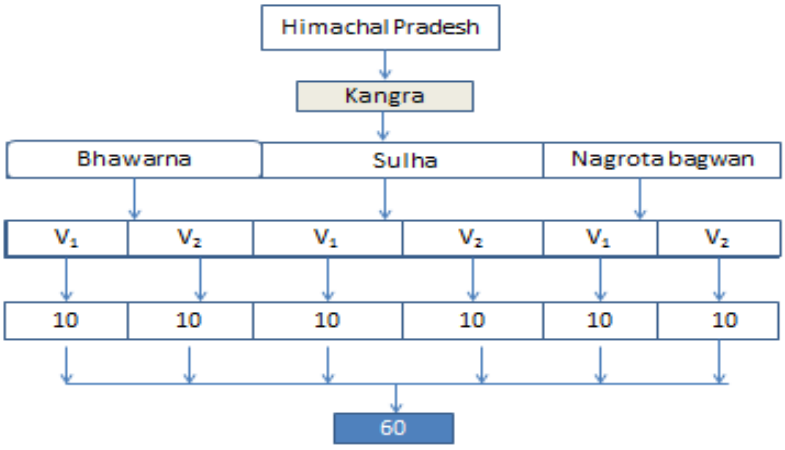

Fig. 3.2: Pictorial representation of selection of sample size

3.2 COLLECTION OF INFORMATION AND DATA

To meet the objectives of the present study, both primary and secondary data were collected.

3.2.1 Primary data

The primary data on demographic features such as family size, age, education, occupation, economic parameters (land inventory, farm building,

livestock, cropping pattern and income), cost of production, yield, marketable or marketed surplus, marketing costs, mode of transportation and problems faced by the litchi growers on various aspects of production and marketing were collected on well-designed pre-tested schedules by adopting a personal interview method from the selected households in the study area during the year 2016-17.

3.2.2 Secondary data

Secondary data were also collected with respect to area and production of litchi from the Agriculture department and block development offices.

3.3 Analytical tools and techniques employed

Data were analysed by using following analytical tools:

3.3.1 Cumulative cube–root frequency method of stratification

Cumulative cube - root frequency method of stratification **(Singh and Mangat , 1975)** as explained under was used for classifying the litchi growers into two groups, the detail of which is presented in Table 3.1.

$$L_i = y_{i-1} + \left(\frac{S_k \div L - S_{i-1}}{\sqrt[3]{f_i}} \right) (y_i - y_{i-1})$$

Where;

L = No. of strata

L_i = Upper limit of *i* th strata

Y_{i-1} = Lower limit of the class in which L_I lies

S_k = Cumulative total of $\sqrt[3]{f_i}$

$\sqrt[3]{f_i}$ = Cube root of the frequency of the *i* th class in which L_i lies

S_{i-1} = Cumulative cube root of the frequency of preceding class to the class to which L_i lies

Y_i = Upper limit of the class in which L_i lies

$Y_i - Y_{i-1}$ = Width of the class in which L_i lies

Table 3.1 Distribution of sampled litchi growers according to number of trees

Categories	Mean	Range	Min	Max	SD	CV (%)
<60(Group-I)	41.00	44.00	16.00	60.00	13.87	33.85
>60(Group-II)	92.00	70.00	65.00	135.00	19.48	21.29

It can be seen from the table that average number of trees in Group-I was 41, whereas, it was 92 in Group-II.

3.3.2 Analytical tools and techniques

Simple statistical tools like averages and percentages were used to compare, contrast and interpret the results. Socio economic status was found by working out sex ratio, literacy rate index and cropping intensity by using the following formulae:

$$\text{Sex Ratio} = \frac{\text{No. of females in a family}}{\text{No. of males}} \times 1000$$

$$\text{Literacy rate} = \frac{\text{Total no. of literate person}}{\text{Total population}} \times 100$$

$$\text{Literacy Index} = \frac{\sum W1\,Xi}{\sum Xi}$$

Where;

W_i = Weights (0, 1,2,3,4 and 5) for illiterate, primary, middle, matric, secondary and graduate & above respectively.

X_i = Number of persons in respective category.

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

$$\text{Dependency ratio w.r.t. average size of family} = \frac{\text{No. of dependents in a family}}{\text{Average size of family}}$$

$$\text{Cropping intensity} = \frac{\text{Gross cropped area}}{\text{Net sown area}} \times 100$$

$$\text{Coefficient of variation (\%)} = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100$$

3.3.3 Cost and Returns:

In determining the cost and returns of perennial crops, age of plantation plays an important role. Keeping in view this point, the sample has been further classified into different age groups of litchi plants. First group consisting of the year of plantation considered as zero year showing the initial cost of plantation. Second group consist of non- bearing plants from 1-7 years considered as non-bearing stage and third group consisted of bearing stage which has been further divided into six sub groups 8-10, 11-16, 17-22, 23-28, 29-35, 36-40 i.e. considering initial and full bearing stages based on law of diminishing returns and experience of fruit scientist.

The total age of litchi plantation for analysis was considered to be 40 years. The cost incurred in the initial year i.e. 0 year has been termed as initial cost of plantation or cost of establishment. The cost incurred in age group of 1-7 years has been termed as operational and maintenance cost during the non - bearing stage and cost incurred in age group of 8-10,11-16,17-22,23-28,29-35,36-40 years has been termed as operational and maintenance cost during the bearing stage. The total cost of establishment has been spread over the bearing stage as pro-rated establishment cost by adopting following formula:

$$\text{Amortized establishment value} = \text{Total establishment cost} \times \frac{(1+r)^n \times r}{(1+r)^n - 1}$$

3.3.4 Procedure for evaluating the inputs

(i) Human labour

(a) **Family labour**: It consists of actual work carried out by the family members for litchi plantation. The labour charges were valued on the basis of prevailing wages paid to the hired labour

(b) **Hired labour**: Hired human labour has been estimated in terms of mandays where in 8 hours of work in a day has been considered as one man day. The man days were valued at Rs. 300 per man day.

(ii) Plant material, manures and fertilizers

The purchased plant material, manures and fertilizers and other inputs were valued at actual price paid for these inputs. Manures and other inputs were valued at the prevailing price in the locality

(iii) Land revenue

Land revenue actually paid by the farmers was taken in the calculation.

(iv) Depreciation

The amount of depreciation for implements was calculated by the straight line method i.e. by dividing the original cost less junk value of implement by its expected life.

(v) Interest on working capital

Interest on working capital was charged at the rate of 8 per cent per annum equivalent to the interest earned by farmers/ growers from personal savings.

(vi) Interest on fixed capital

Interest on fixed capital has been charged at the rate of 2 per cent per annum on the value of farm buildings, farm implements and other fixed assets which have exclusively been used on per annum basis.

(vii) Prorated establishment cost

It is charged at 8 percent and is amortized for 40 years during the bearing stage.

$$I = B\frac{i}{1-(1+i)^{-n}}$$

Where,

I	=	Annual instalment in Rs.
B	=	Principal amount borrowed in Rs.
n	=	Loan period in years
i	=	Annual interest rate in fraction

3.3.5 Economic worth indicators

To evaluate the economic feasibility of investment in litchi cultivation economic indicators, viz., net present value, benefit-cost ratio, internal rate of return, annuity and Payback period have been worked out by using following formulae:

(a) Net Present Value

The net present value represents the discounted value of the net cash inflows to the project. A discount factor of 8 per cent was used to discount the net cash inflow representing the opportunity cost of capital with the following formulae:

$$NPV = \sum_{t=1}^{n} \frac{B_t - C_t}{(1+r)^t}$$

Where,

NPV	=	Net present value in period‘t’
B_t	=	Benefit from litchi cultivation in each year
C_t	=	Cost of litchi cultivation in each year
r	=	Discount rate
t	=	1, 2, 3…. n, the entire life of plantation across the study regions (comprising seven years of gestation period followed by 40 years bearing years)
n	=	number of years

(b) Payback period

Pay back period is the length of time required to recover the original investment on the project, through cash flow earned. Symbolically, the pay- back period equals t^*, where t^* is the lowest value of t for which the following inequality holds:

$$\sum_{t=1}^{t^*} C_t/(1+r)^t < \sum_{t=1}^{t^*} B_t/(1+r)^t$$

Where

t* = the lowest value of t

(c) Annuity

Annuity value of the project has been considered the annual expected income from the litchi orchard. It was computed as follows:

$$A = \frac{NPV \times (r) \times (1+r)^t}{(1+r)^t - 1}$$

Where,

A = Annuity

(d) Internal rate of return (IRR)

It is used to evaluate the overall feasibility of litchi plantations in the study area by using the following formula:

$$IRR = LDR + (\text{Difference between two discount rates}) \times \frac{\text{NPV of LDR}}{\text{Absolute difference between NPV of two discount rates}}$$

(e) Benefit – Cost ratio

The benefit-cost ratio of an investment is ratio of the discounted value of all cash inflows to the discounted value of all cash outflows during the life of the project. It has been computed as follows:

$$B:C\ Ratio = \frac{\sum_{t=1}^{n} Bt/(1+r)^t}{\sum_{t=1}^{n} Ct/(1+r)^t}$$

3.3.6 Market analysis

(a) Marketable and Marketed surplus

The Marketable and Marketed surplus of litchi has been worked as follows.

$M_s = Tp - C_h - C_k$

Where,

M_s = Marketable Surplus

T_p = Total production

C_h = Home consumption.

C_k = Gift and kind payment.

M_t = $M_s - L_m - L_t$

Where,

M_t = Marketed Surplus i.e. actual quantity sold in the market

M_s = Marketable surplus

L_m = Losses during transportation & marketing

L_t = Arbitrary deduction by traders at market

(b) Marketing Costs

The total costs, incurred on marketing by the farmers and of the various intermediaries involved have been calculated as follows:

$C = C_F + C_m$

Where,

C = Total cost of marketing

C_F = Cost paid by the farmers

C_m = Cost incurred by middlemen,

(c) Marketing Margin

Marketing margin of middleman calculated as the difference between the total payments (marketing cost + purchase price) and receipts (sale price) of the middlemen and calculated as follows:

$$A_{mi} = P_{Ri} – (P_{pi} + C_{mi})$$

Where,

A_{mi} = Absolute margin of middlemen

P_{Ri} = Total value of receipts per unit (sale price)

P_{pi} = Purchase value of goods per unit

C_{mi} = Cost incurred on marketing per unit

(d) Price spread

Generally the economic efficiency of the marketing system is measured in terms of price spread. The smaller the price spread, the greater the efficiency of marketing system. Price spread refers to the difference between the price paid by the consumer and price received by the producer.

(e) Producer's price

The net price received by the orchardist has been calculated by deducting the marketing costs borne by the producers from the original price paid to the producers by the commission agent/ wholesaler and is calculated as given below:

$$P_f = P_s - P_c$$

Where,

P_f = Net price received by the producer

P_s = Producer's selling price

P_c = Marketing cost incurred by the producers

(f) Producer's share in consumer's rupee has been worked as under

$$P_s = (P_f / P_r) \times 100$$

Where,

P_s = Producer's share in consumer's rupee.

P_f = Price received by farmer per unit.

P_r = Retail price per unit/ Consumer's purchase price

(g) Marketing efficiency of the marketing channels

In case of marketing channels, the marketing efficiency is concerned with the movement of goods from producer to consumer at the lowest possible cost consistent with the provision of services desired by the consumers. The marketing efficiency of various channels in the study area has been computed by using Acharya's method, as under;

Where,

$$\mathbf{ME = \frac{RP}{MC + MM} - 1}$$

ME = Marketing efficiency

RP = Retailer's price

MC = Total marketing costs.

MM = Total marketing margins

3.3.7 Production and Marketing problems.

To study the various problems associated with the production and marketing of litchi chi-square analysis was carried out with the following formula:

Chi square test

Chi square test has been applied to measure the degree to which a series of observed frequencies (O) of information on different problems deviate from their corresponding expected frequencies (E).

The details of approximate Chi square test (χ^2) is given as under:

$$\chi 2 = \sum \frac{(O-E)^2}{E}$$

Where,

O = observed frequencies

E = expected frequencies

3.4 ASSUMPTIONS OF THE STUDY

The study is based on following assumptions

(i) The litchi tree has been considered to start initial bearing at the age of 8, and continue to bear up to 40 years of age. Thus, the total life period of litchi tree has been taken as 40 years.

(ii) Age wise break up has been made on the basis of law of diminishing marginal returns.

(iii) Rental value of owned land has been calculated at 25 per cent of the total produce of cereal crop for non-bearing stage of orchard and 10 per cent of the total produce for bearing stage of orchard due to lower returns from food crop than a fruit crops.

(iv) The prorated establishment cost and economic worth indicators have been worked out at 8 per cent discount rate because present rates of savings and fixed accounts may revolve around 8 per cent over full life of litchi plantation.

3.5 LIMITATION OF THE STUDY

(i) The study is based on data collected for one year only i.e. 2016-2017, which may not necessarily hold true for other periods as well.

(ii) The data used for the present study were collected by survey method; the inherent lacunae associated with this type of enquiry have crept into the study, even though the estimates were provided by the recall memory on account of the non-maintenance of the farm records. Sincere efforts have been made to elicit accurate and reliable information as far as possible by cross questioning; the degree of discrepancy if any would be negligible as the estimates presented are on average basis.

Chapter – 4

RESULTS AND DISCUSSION

The results of the present study pertaining to the different objectives along with relevant discussion have been described in detail in this chapter. The whole chapter has been divided into five sections. Section-I describes the socio-economic characteristics of the sampled growers, Cost and returns from litchi cultivation have been discussed in section-II. Section-III describes the financial analysis of litchi production, whereas, marketing of litchi and production and marketing problems faced by the farmers have been presented in section-IV and V respectively.

4.1 Socio-economic characters of sampled farmers

4.2 Cost and return of litchi cultivation

4.3 Financial analysis of litchi production

4.4 Marketing of litchi

4.5 Production and marketing problems faced by the farmers

4.1 SOCIO-ECONOMIC CHARACTERS OF SAMPLED FARMERS

4.1.1 Size and structure of family

The size and structure of the family, work force and literacy status are among the important factors influencing the litchi cultivation. These factors determine the socio-economic well-being of the family that plays a vital role in farm business and marketing activities. The size and structure of sampled growers in the study area has been presented in Table 4.1 and Fig 4.1. The perusal of table shows that at overall level, the average family size was 5.57 persons, out of which 51.50 per cent were males and 48.50 per cent were females. It was found that across the different groups of sampled litchi growers, average family size varied between 5.88 and 5.15 per family respectively. The analysis of family structure revealed the dominance of nuclear families as 85 per cent of the sample households have nuclear families followed by 15 per cent joint families at overall level.

Table 4.1: Group wise size and structure of the sampled growers in the study area

Particulars Size of the family	Group-I	Group-II	Overall
Average size of the family	5.88 (100.00)	5.15 (100.00)	5.57 (100.00)
Males	2.97 (50.50)	2.73 (52.99)	2.87 (51.50)
Females	2.91 (49.50)	2.42 (47.01)	2.70 (48.50)
Sex ratio	831.68	732.39	788.66
Structure of family			
Joint families (No.)	6.00 (17.65)	3.00 (11.54)	9.00 (15.00)
Nuclear families (No.)	28.00 (82.35)	23.00 (88.46)	51.00 (85.00)

Figure in parentheses represent percentage to average family size

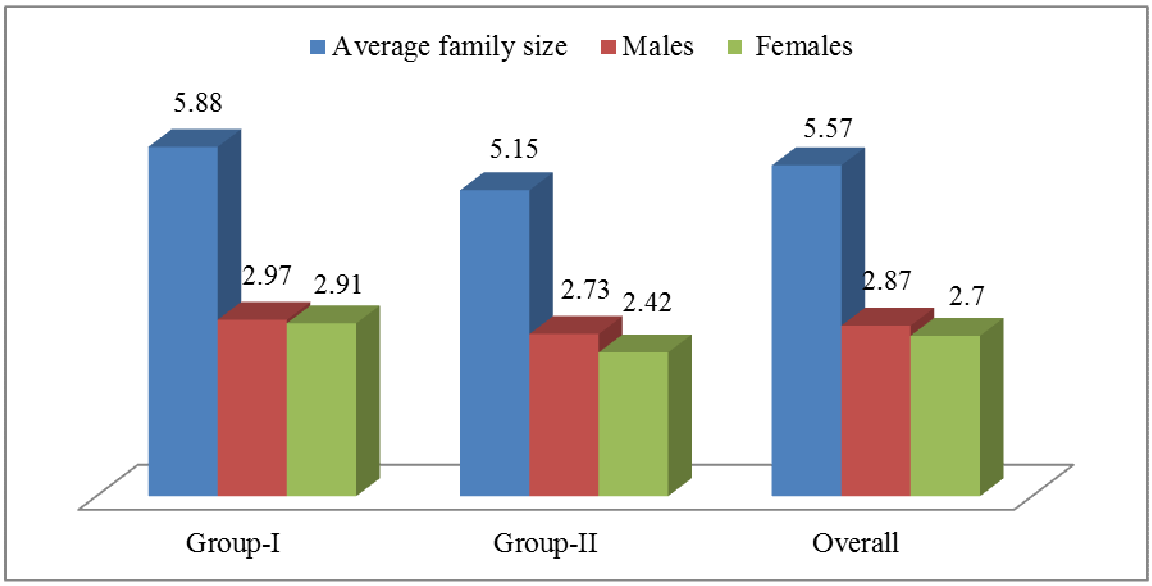

Fig 4.1 Group wise average family size of sampled growers

4.1.2 Literacy status

There has been significant improvement in the literacy rate in the study area as shown in Table 4.2. The literacy rate varied from 87.37 to 88.06 per cent among different groups (Fig 4.2). The overall literacy rate in case of males was 91.34 per cent which varied from 90.10 per cent to 92.96 per cent among different groups. The overall literacy rate in case of females was 83.85 per cent which varied from 82.54 per cent to 84.85 per cent among different groups. The table showed a marked improvement in the literacy rate. However, literacy index varied from 3.08 to 3.22 among the different groups with an overall literacy index of 3.13. The literacy index among the males varied from 3.52 to 3.67 with an overall

literacy index of 3.58 and in case of females it varied from 2.64 to 2.72 with an overall literacy index of 2.67. This highlights that literacy rate in the study area has been found to be higher. However literacy index was moderate. It can be further observed that the quality of education of females (2.67) was lower compared to the males (3.58).

Table 4.2: Group and gender wise literacy rate and index of the sampled growers

Particulars		Group-I	Group-II	Overall
Literacy rate (%)	Male	90.10	92.96	91.34
	Female	84.85	82.54	83.85
	Total	**87.37**	**88.06**	**87.65**
Literacy Index	Male	3.52	3.67	3.58
	Female	2.64	2.72	2.67
	Total	**3.08**	**3.22**	**3.13**

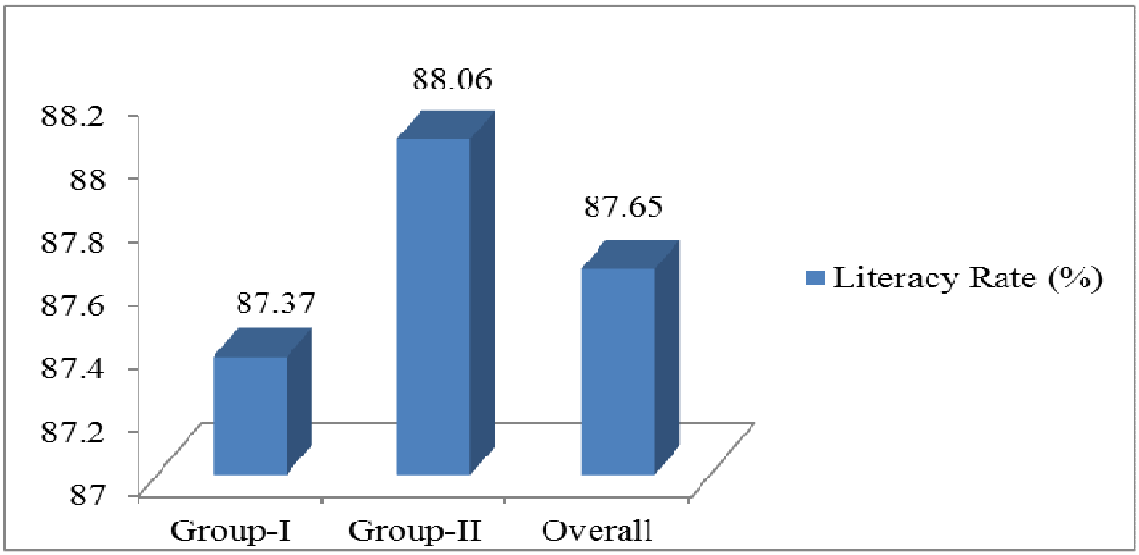

Fig 4.2 Group wise literacy rate of sampled growers

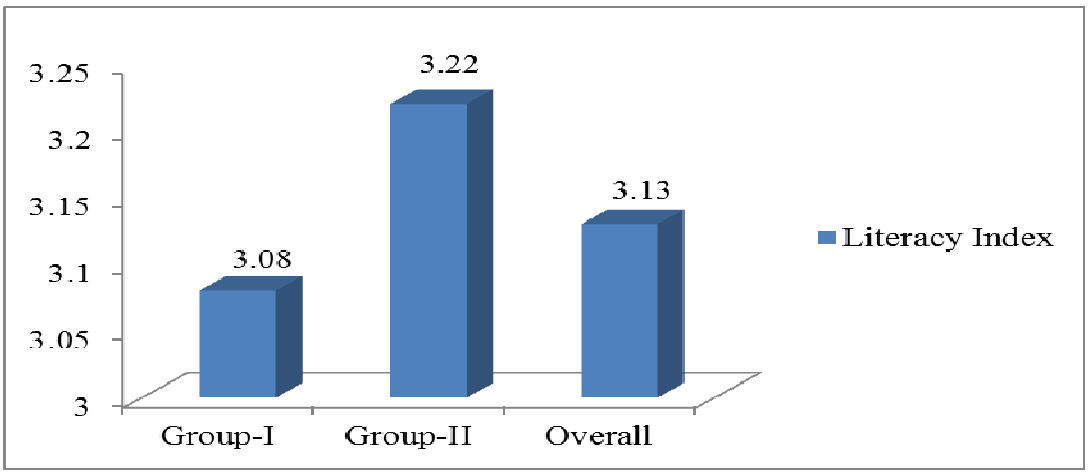

Fig 4.3 Group wise literacy index of sampled growers

4.1.3 Occupational distribution

Per household occupational structure of the selected households has been given in Table 4.3. It was noted from the table that agriculture was the main occupation as 77.22 per cent of work force practice farming. On an average 14.33 per cent workers' population was engaged in public/private services as secondary occupation at overall levels followed by business (8.45%). Similar trends in occupational distribution were observed in Group-I and Group-II. In case of Group-I, service was preferred more than business while Group-II members were engaged more in business than services.

Table 4.3: Group wise occupational distribution of the sampled growers

Particulars	Group-I	Group-II	Overall
Agriculture	3.24 (76.39)	3.19 (78.30)	3.22 (77.22)
Male	1.56 (36.81)	1.62 (39.62)	1.58 (38.03)
Female	1.68 (39.58)	1.58 (38.68)	1.63 (39.19)
Business	0.26 (6.25)	0.46 (11.32)	0.35 (8.45)
Service	0.74 (17.36)	0.42 (10.38)	0.60 (14.33)
Average number of workers	4.24 (100.00)	4.08 (100.00)	4.17 (100.00)

Figure in parentheses represent percentage to average workers

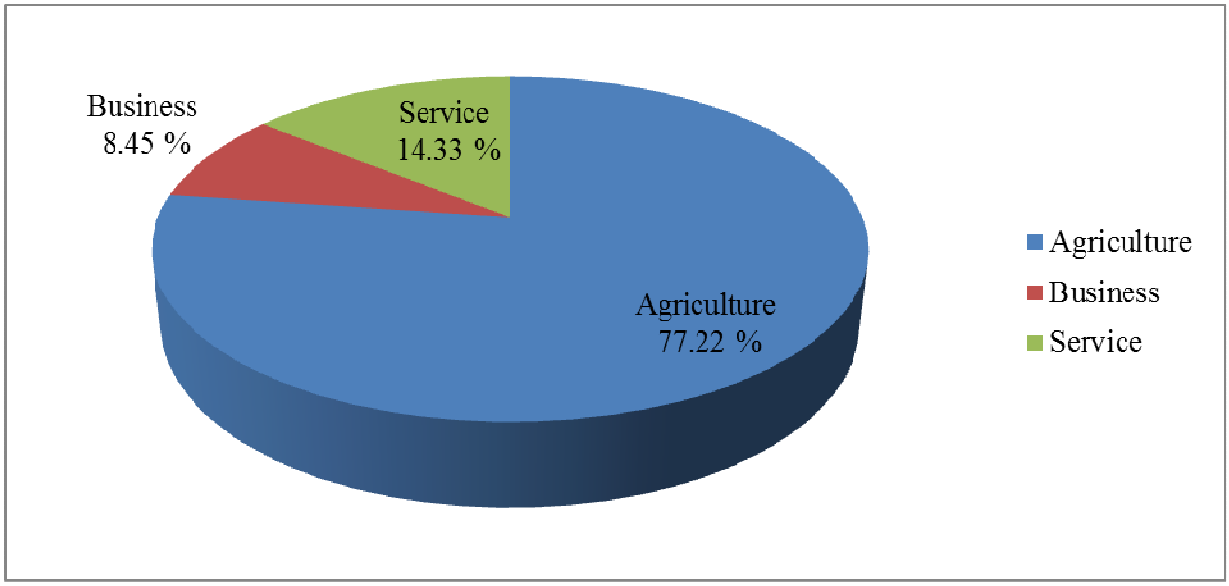

Fig 4.4 Occupational distribution of the sampled households at overall level

4.1.4 Work force

Per household distribution of workers and dependents of the sampled growers is given in Table 4.4. The proportion of active workers was worked out to be 79.10 per cent the highest in case of Group-I followed by 72.00 per cent in case of Group-II. It was assumed that persons in the age group of 15-65 year should be actively engaged in useful economic activities and were termed as working force. The highest dependents were found in case of Group-I and lowest in Group-II. The overall dependency ratio with respect to total workers was found to be 0.33 and among the different groups, it was observed highest in case of Group-I (0.39) followed by Group-II (0.26). Dependency ratio indicates that on an average one worker has to support less than one member in the family in the sampled area. Dependency ratio estimated with respect to family size was found 0.25 on an average level indicating dependence up to 21 per cent in the study area.

Table 4.4: Group wise distribution of workers and dependents of the sampled growers

(No)

Particulars	Group-I	Group-II	Overall
Average family size (no.)	5.88 (100.00)	5.15 (100.00)	5.57 (100.00)
Average no. of workers	4.24 (72.00)	4.08 (79.10)	4.17 (75.08)
Average no. of dependents (< 14yrs & >65 yrs)	1.65 (28.00)	1.08 (20.90)	1.40 (24.92)
Dependency ratio w.r.t. total workers	0.39	0.26	0.33
Dependency ratio w.r.t. family size	0.28	0.21	0.25

Figure in parentheses represent percentage to average family size

4.1.5 Land use pattern

Land use pattern determines the type of farming system in an area. Group wise land use pattern of litchi farmers is summarized in Table 4.5.

The average size of land holding on the overall category was found to be 0.79 hectares of which 18.98 per cent was cultivated area. The forest land was (0.04%), pastures land/*ghasnis* (0.27%) and barren /uncultivated land/ land put to non-Agriculture use was (3.68%). The total operational area varied from 95.49 to 95.70 per cent among different groups. The average size of the holding in case of Group-I and Group-II was found out to be 0.61 and 1.05 ha respectively. The orchard land varied from 66.34 to 84.35 per cent among different groups.

Table 4.5: Land utilization pattern of sampled growers

(ha)

Land use Classes	Group-I	Group-II	Overall
Cultivated Area	0.17 (29.36)	0.12 (11.14)	0.15 (18.98)
Irrigated	0.14 (24.22)	0.10 (9.67)	0.13 (15.94)
Unirrigated	0.03 (5.14)	0.02 (1.47)	0.02 (3.04)
Average area under fruit crops	0.39 (66.34)	0.89 (84.35)	0.61 (77.02)
Irrigated	0.38 (63.37)	0.84 (79.66)	0.58 (73.05)
Unirrigated	0.02 (2.97)	0.05 (4.69)	0.03 (3.97)
Total operationl area	0.57 (95.70)	1.00 (95.49)	0.76 (96.01)
Forest Land	- -	0.0008 (0.07)	0.0003 (0.04)
Ghasnis/Pastures	0.01 (1.68)	0.01 (0.95)	0.0022 (0.27)
Land put to Non Agriculture use	0.02 (3.91)	0.04 (3.48)	0.03 (3.68)
Total land holding (hectares)	0.60 (100.00)	1.05 (100.00)	0.79 (100.00)

Figures in the parenthesis represent percentage to total

4.1.6 Cropping pattern

Cropping pattern in any area depends mainly on soil, altitude, micro-climate, availability of resources and management factors. The changes in the per cent share of area under different crops in the gross cropped area reveals the extent of agricultural diversification. This reflects the future scope of each crop along with tentative requirement of the inputs for different crops. A close scrutiny of the cropping pattern also suggests the status of agriculture in the area. The proportional share of a particular crop in gross cropped area on the farm suggests the importance that the farmer attaches to a particular crop. This importance can be both of economic nature as well as social considerations on the part of the farmer.

The cropping pattern of sampled growers has been analyzed and the results have been presented in Table 4.6. It is evident from the table that the cropping intensity was highest (117.54 %) in Group-I followed by Group-II (112.00%). At overall level it was worked out to be 113.16 per cent, which indicates that there is a scope to increase the farm efficiency. The reason behind low cropping intensity has been attributed to the fact that intercropping was not followed in litchi tress and large percentage of the area was under litchi

cultivation. Maize (10.16%) in *Kharif* and wheat (9.08%) in *Rabi* were the predominant crops. Vegetable crops were also grown in the study area, however, area under *Rabi* crops was found higher in comparison to *Kharif* crops. This may be due to the fact that the area lacks irrigation facilities. The area under litchi crop varied from 55.28 per cent to 70.28 per cent among various groups.

Table 4.6: Group wise cropping pattern of the sampled growers

(ha)

Particulars	Group-I	Group-II	Overall
***Kharif* crops**			
Maize	0.10 (15.18)	0.07 (6.21)	0.09 (10.16)
Paddy	0.04 (5.26)	0.02 (1.52)	0.03 (3.17)
***Rabi* crops**			
Onion	0.02 (3.07)	0.03 (2.32)	0.02 (2.65)
Garlic	0.02 (2.53)	0.02 (1.94)	0.02 (2.20)
Potato	0.03 (4.61)	0.04 (3.75)	0.04 (4.13)
Wheat	0.06 (9.58)	0.10 (8.68)	0.08 (9.08)
Fruit crops			
Litchi	0.37 (55.28)	0.78 (70.28)	0.55 (63.68)
Other fruits	0.03 (4.48)	0.06 (5.31)	0.04 (4.94)
Gross cropped area	0.67 (100.00)	1.12 (100.00)	0.86 (100.00)
Net sown area	0.57	1.00	0.76
Cropping intensity (%)	117.54	112.00	113.16

Figures in the parenthesis represent percentage to total

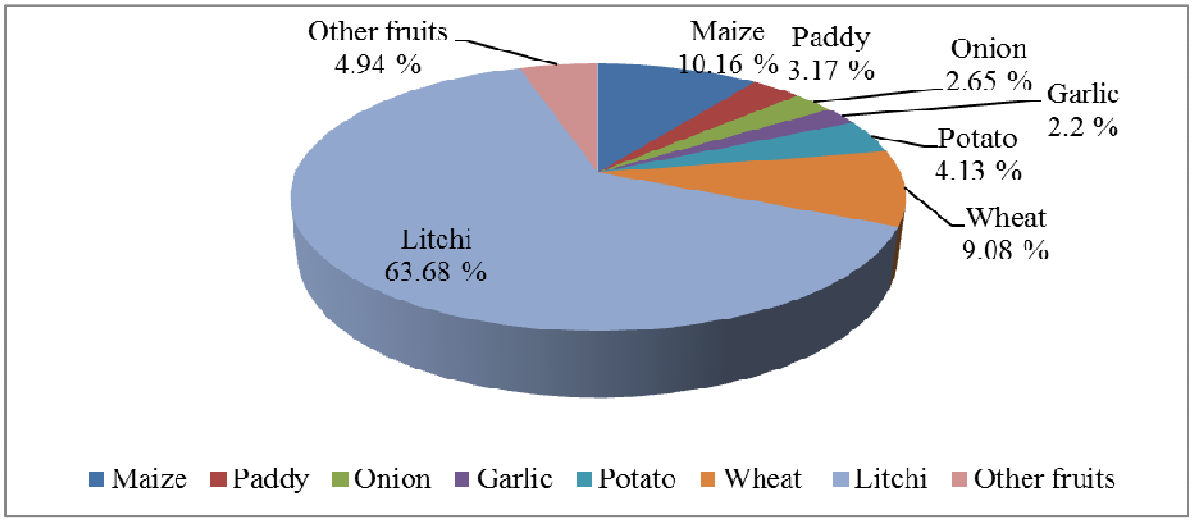

Fig 4.5 Land utilization pattern of the sampled growers at Overall level

4.1.7 Livestock inventory

Livestock has been found to be playing a crucial role in hill agriculture. Generally, the farming community maintains a livestock unit in order to meet their household needs for milk, milk products and farm yard manure (FYM). The size of the unit has been found to be dependent on the availability of fodder, household and farm needs. This component of farming also provides round the year income and employment to the farm families. Livestock and crop components have symbiotic relationship with each other as crop by-products provide fodder for livestock and livestock in turn supply valuable FYM for litchi cultivation.

The livestock inventory of sampled growers has been analyzed and presented in Table 4.7. The overall size of animal was 1.44 adult cattle units. Among the different groups of livestock, the population of cow (milking) was found to be highest (52.16%) followed by cow (dry) (25.50%) and young stock (18.26%) of sampled growers.

Table 4.7: Group wise livestock inventory of sampled growers

(ACU)

Particulars	Group-I	Group-II	Overall
Cow(dry)	0.35 (24.51)	0.38 (26.81)	0.37 (25.50)
Cow(milking)	0.71 (49.01)	0.81 (56.30)	0.75 (52.16)
Buffalo(dry)	0.05 (3.45)	- -	0.03 (1.96)
Buffalo(milking)	0.05 (3.45)	- -	0.03 (1.96)
Young stock	0.28 (19.53)	0.24 (16.59)	0.26 (18.26)
Goat	0.001 (0.046)	0.002 (0.121)	0.001 (0.078)
Sheep	- -	0.003 (0.181)	0.001 (0.078)
Total	1.44 (100.00)	1.43 (100.00)	1.44 (100.00)

Figures in parentheses represent percentage to adult cattle units

4.1.8 Investment on farm implements and buildings

In litchi cultivation, farmers make investment on different mechanical equipment's because these implements and equipment's make the farming activity easier to perform. They invest on cattle shed, storehouses, power tillers, sprayers, baskets, spade, sickle etc. Different farmers make different levels of investment on different items and farmers vary in their total investment on different items depending upon their requirement, ability, capital constraints

and many other factors. In this study, an attempt has been made to examine level of investment on different implements, buildings and their share in total investment.

Table 4.8 shows the detailed per farm average investment on the sampled growers. It has been observed that investment per farm was Rs. 465047.61 and Rs. 659067.09 for Group-I and Group-II respectively, while overall investment was Rs. 549122.72. At overall level, per farm average investment on farm buildings was Rs. 494198.97 (90.00%) followed by implements (10.00%) by the sampled growers.

Table 4.8: Group wise average investment on farm implements and buildings

(Rs./farm)

Implements	Group-I	Group-II	Overall
Plough	191.18	145.83	171.53
Tractor	-	25000.00	10833.33
Planker	767.65	787.50	776.25
Chaff Cutter	8470.59	12000.00	10000.00
Yoke	152.94	116.67	137.22
Power Sprayers	2985.29	3645.83	3271.53
Power Tiller	7352.94	35416.67	19513.89
Foot Sprayers	647.06	1000.00	800.00
Spade	785.29	1175.00	954.17
Sickles	332.35	412.50	367.08
Khilna	317.65	431.25	366.88
Pruning Scissors	2470.59	4416.67	3313.89
Axe	382.35	541.67	451.39
Grafting Knives	576.47	933.33	731.11
Basket *Kiltas*	520.59	700.00	598.33
Plastic Crates	463.24	1031.25	709.38
Ladders	1235.29	2833.33	1927.78
Subtotal	27651.47 (5.95)	90587.50 (13.74)	54923.75 (10.00)
Particulars			
Cattle Shed	35703.56	50224.19	41995.83
Store Room	28518.67	59686.72	42024.82
Subtotal	437396.14 (94.05)	568479.59 (86.26)	494198.97 (90.00)
Total	465047.61 (100.00)	659067.09 (100.00)	549122.72 (100.00)

Figures in the parenthesis represent percentage to total

4.1.9 Group wise average gross income

To examine the relative importance of litchi in the economy of sampled growers; source wise break up of family income of different categories has been summarized in Table 4.9. It was interesting to note that average production of litchi contributed about 44.79 per cent towards the total family income of the sampled growers in the study area. Rest of the

sources of income were from the other agricultural and non-farm activities like cultivation of field crops, other fruit crops and non-farm activities such as service and business.

Table 4.9: Group wise average income composition of the sampled growers

(Rs./annum)

Particulars	Group-I	Group-II	Overall
Field crop	7144.10 (2.01)	5468.20 (1.45)	6417.90 (1.76)
Vegetable	8185.30 (2.31)	4423.10 (1.17)	6555.00 (1.80)
Litchi	102002.00 (28.74)	243802.00 (64.49)	163449.00 (44.79)
Other fruits	17470.60 (4.92)	37211.50 (9.84)	26025.00 (7.13)
Service/business	220091.00 (62.02)	87149.30 (23.05)	162483.00 (44.52)
Total	354892.00 (100.00)	378054.00 (100.00)	364929.00 (100.00)

Figure in parentheses represent percentage to the total

The share of litchi income varied from 28.74 to 64.49 per cent among different groups with 44.79 per cent at overall level, indicating the importance of litchi cultivation in the economy of sampled households.

4.2 COST AND RETURN OF LITCHI CULTIVATION

The data on the cost of cultivation of agricultural commodities is useful for planning as these data inform the planners about the area where it is economical to produce various commodities and the regions which would be accordingly most suitable for the development of industries based on the agricultural raw material. At the micro level, it enables the farm management experts to study the efficiency of the various cultivation practices and alter the crop planning by providing information regarding their profitability. This helps the experts to make practical recommendations for farm planning aimed at better allocation of existing resources and introduction of agronomic practices which would further increase the efficiency of crop production.

The cost and return were worked out per hundred plant basis for Group-I, Group-II and overall. For estimating the cost and returns estimates from litchi, it has been assumed that:

i) First bearing start from 8^{th} year onwards in the study area.
ii) The major operation and input requirement remains constant in the age group 8-10, 11-16, 17-22, 23-28, 29-35 and 36-40.
iii) Total economic life of litchi plantation is 40 years.

The above mentioned groups are based on the physiological growth and productivity pattern of the plant. The analysis in this section has been divided as:

4.2.1 Establishment cost of litchi in the study area

4.2.2 Operational cost of litchi during non-bearing stages

4.2.2.1 Group wise operational cost of litchi during non-bearing stages

4.2.3 Maintenance cost of litchi during bearing stages

4.2.3.1 Group wise maintenance cost of litchi during bearing stages

4.2.4 Gross and net returns from different age groups of litchi orchard

4.2.5 Average costs and returns from litchi orchards

4.2.1 Establishment cost of litchi in the study area

The initial cost of establishing the litchi orchard consists of the preparation of the land and layout, digging and filling of the pits, cost of plants and planting material, cost of fencing and bunding etc. The total cost of establishing litchi orchard during 2016-17 was Rs. 32157.43 (Table 4.10). Its break up shows that among various components of establishment cost; cost of labour for digging and filling of pits is single largest (18.87%) cost item followed by planting material cost (12.45%). It can be seen further from the table that variable cost constituted 45.56 per cent of the total establishment cost.

Table 4.10: **Establishment cost of litchi in the study area**

Particulars		
Material Cost	Value	Per cent
Planting material	4003.47	12.45
FYM cost	2306.97	7.17
Soil treatment	522.57	1.63
Family labour cost	5752.96	17.89
Hired labour cost	313.61	0.98
Total working capital	7146.61	22.22
Interest on working capital	321.60	1.00
Risk Margin	714.66	2.22
Managerial cost	714.66	2.22
Sub total	1750.92	5.44
Total Variable Cost	14650.49	45.56
Fixed cost		
Land revenue	6.00	0.02
Depreciation	3209.47	9.98
Rental value of land	12031.88	37.42
Interest on Fixed capital	2259.59	7.03
Total fixed cost	17506.94	54.44
Total cost	32157.43	100.00

4.2.2 Operational cost of litchi during non-bearing stages

Litchi is a perennial crop with a gestation period of 7 years. The operational cost during the non-bearing stages have been presented in the table 4.11. A perusal of the table shows that per hundred plants operating cost varied from Rs. 29629.14 to Rs. 58312.41 during 1-7 years. The increase in the cost over the years is because of the high expenses incurred on various inputs such as manures and fertilizers, plant protection measures etc. it can be further seen from the table that the variable cost constituted about 32 per cent of the total cost during these years, whereas, 68 per cent was contributed by fixed cost which included land revenue, depreciation on farm implements used in litchi orchard, interest on fixed capital and interest on past establishment cost.

Table 4.11: Operational cost of litchi during non-bearing stages

(Per cent)

	Years						
Particulars	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Material Cost							
Gap filling	1.89	-	-	-	-	-	-
Lime	-	-	-	0.33	0.41	0.48	0.62
Manures and Fertilizer	14.59	14.94	14.30	13.33	12.48	12.17	12.56
Plant Protection		0.56	0.51	0.99	1.02	0.99	1.02
Family labour cost	11.71	9.92	9.82	10.28	10.25	9.95	9.15
Hired labour cost	0.00	1.65	3.03	3.34	3.87	4.87	4.93
Total working capital	16.48	17.15	17.83	17.99	17.78	18.51	19.13
Interest on working capital	0.74	0.77	0.80	0.81	0.80	0.83	0.86
Risk Margin	1.65	1.71	1.78	1.80	1.78	1.85	1.91
Managerial cost	1.65	1.71	1.78	1.80	1.78	1.85	1.91
Sub total	4.04	4.20	4.37	4.41	4.36	4.54	4.69
Total Variable Cost	32.23	31.27	32.02	32.68	32.39	33.01	32.97
Fixed cost							
Land revenue	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Deprecation	10.83	9.83	8.70	7.71	7.18	6.16	5.50
Interest on Fixed capital	7.63	6.92	6.13	5.43	5.06	4.34	3.87
Rental value of land	40.61	36.83	32.63	28.92	26.92	23.09	20.63
Interest on past establishment	8.68	15.13	20.49	25.25	28.43	33.40	37.01
Total fixed cost	67.77	68.73	67.98	67.32	67.61	66.99	67.03
Total cost	100.00 (29629.14)	100.00 (32664.84)	100.00 (36870.56)	100.00 (41610.86)	100.00 (44687.89)	100.00 (52118.38)	100.00 (58312.41)

Figure in parenthesis represent total cost per 100 plants

4.2.2.1 Group wise operational cost of litchi during non-bearing stages

The sampled litchi growers were classified into two groups *viz.* Group-I (<60 plants) and Group-II (>60 plants) and the detail of the yearly cost has been presented in table 4.12. It was observed that among the different age groups the cost differentials were negligible. It can be further seen from the table that the total cost increased with the increase in the age of the plants, thus a positive relationship was observed between the cost and age of the plants.

At overall level the variable cost was Rs. 9459.60 in 1st year which increased to Rs. 19226.34 in 7th year. Similarly the fixed cost showed an increasing trend. The total cost of establishment of litchi orchard worked out to be Rs. 328051.53. The amortization cost for forty years at the interest rate of 8 per cent was Rs. 28904.05.

Table 4.12 Group wise operational cost of litchi during non-bearing stages

(Rs./100 plants)

Age	Group-I			Group-II			Overall		
	Variable Cost	Fixed Cost	Total Cost	Variable Cost	Fixed Cost	Total Cost	Variable Cost	Fixed Cost	Total Cost
0	14423.76 (45.29)	17420.51 (54.71)	31844.27 (100.00)	14946.99 (45.90)	17619.97 (54.10)	32566.96 (100.00)	14650.49 (45.56)	17506.94 (54.44)	32157.43 (100.000
1	9640.50 (32.56)	19968.05 (67.44)	29608.55 (100.00)	9430.74 (31.80)	20225.32 (68.20)	29656.06 (100.00)	9549.60 (32.23)	20079.54 (67.77)	29629.14 (100.00)
2	9991.67 (30.91)	22336.74 (69.09)	32328.41 (100.00)	10506.98 (31.74)	22597.81 (68.26)	33104.79 (100.00)	10214.97 (31.27)	22449.87 (68.73)	32664.84 (100.00)
3	11145.94 (30.90)	24923.01 (69.10)	36068.95 (100.00)	12672.63 (33.42)	25246.19 (66.58)	37918.82 (100.00)	11807.50 (32.02)	25063.05 (67.98)	36870.55 (100.00)
4	12533.12 (31.07)	27808.52 (68.93)	40341.64 (100.00)	14990.92 (34.64)	28279.70 (65.36)	43270.62 (100.00)	13598.16 (32.68)	28012.70 (67.32)	41610.86 (100.00)
5	13523.26 (30.35)	31035.85 (69.65)	44559.11 (100.00)	15720.30 (35.05)	29135.99 (64.95)	44856.29 (100.00)	14475.31 (32.39)	30212.58 (67.61)	44687.89 (100.00)
6	16227.25 (31.93)	34600.58 (68.07)	50827.83 (100.00)	18476.16 (34.34)	35329.85 (65.66)	53806.01 (100.00)	17201.78 (33.01)	34916.60 (66.99)	52118.38 (100.00)
7	18484.26 (32.34)	38666.81 (67.66)	57151.07 (100.00)	20196.75 (33.76)	39634.33 (66.24)	59831.08 (100.00)	19226.34 (32.97)	39086.07 (67.03)	58312.41 (100.00)

Figure in parentheses represent percentage to total cost

4.2.3 Maintenance cost of litchi during bearing stages

The maintenance cost of litchi during bearing stages has been studied under 6 age groups *viz*. 8-10, 11-16, 17-22, 23-28, 29-35 and 36-40. It can be seen from the table that the maintenance cost increased upto 28th year and then it started declining. In the age group of 8-10 years the total maintenance cost was Rs. 78058.63 which increased to Rs. 117985.73 in the age group of 23-28 years. The maintenance cost was Rs. 110548.17 which further decreased to Rs. 109665.46 for the age group of 36-40 years. It can be seen that variable cost varied from 48.33 to 61.85 per cent of the total maintenance cost during different groups. Among variable cost, labour cost contributed the highest and varied from 25.05 to 41.21 per cent. It was further observed that family labour cost decreased with the age of orchard, whereas, hired labour cost increased.

Table: 4.13 Maintenance cost of litchi during bearing stages

(Per cent)

Particulars	**08- 10**	**11-16**	**17-22**	**23-28**	**29-35**	**36-40**
Material Cost						
Lime	0.58	0.63	0.68	0.73	0.74	0.73
Manures and Fertilizer	13.72	12.77	12.35	11.40	12.27	12.08
Plant Protection	0.93	0.91	1.12	1.19	1.22	1.19
Family labour cost	8.46	6.85	6.74	6.84	6.58	6.16
Hired labour cost	16.59	26.01	29.28	34.37	32.13	28.41
Total working capital	30.36	39.04	42.49	46.92	45.57	42.40
Interest on working capital	1.37	1.76	1.91	2.11	2.05	1.91
Risk Margin	3.04	3.90	4.25	4.69	4.56	4.24
Managerial cost	3.04	3.90	4.25	4.69	4.56	4.24
Sub total	3.51	6.29	7.88	8.09	7.12	10.39
Total Variable Cost	42.33	52.18	57.11	61.85	59.28	58.95
Fixed cost						
Land revenue	0.02	0.02	0.02	0.02	0.02	0.02
Deprecation	4.11	3.41	3.06	2.72	2.90	2.93
Interest on Fixed capital	2.89	2.40	2.15	1.92	2.04	2.06
Rental value of land	15.41	12.78	11.46	10.20	10.88	10.97
Pro-rated establishment cost	35.24	29.22	26.21	23.32	24.89	25.09
Total fixed cost	57.67	47.82	42.89	38.15	40.72	41.05
Total cost	(78058.63) 100.00	(94146.35) 100.00	(104968.51) 100.00	(117985.73) 100.00	(110548.17) 100.00	(109665.46) 100.00

Figure in parentheses represent total cost per 100 plants

4.2.3.1 Group wise maintenance cost of litchi during bearing stages

It is observed from the table that the total cost of cultivation per hundred plants in litchi ranged from Rs. 76807.62 to Rs. 115405.36 and from Rs. 79694.57 to Rs. 121360.05 in Group-I and Group-II respectively. In overall, total cost varied from Rs. 78058.63 to Rs. 117985.73. It can been seen from the table that the total cost increased from 8-10 years to 23-28 years age group and was found maximum for this age group. The variable costs exhibited increasing trend upto 23-28 year age group and then declined thereafter. The variable cost varied from Rs. 32322.93 to Rs. 70920.67 and Rs. 33980.56 to Rs. 75646.04 in Group-I and Group-II respectively. The fixed cost was found to be Rs. 44484.69 and Rs. 45714.01 for Group-I and Group-II respectively.

Table 4.14 Group wise operational cost of litchi during bearing stages

(Rs./100 plants)

Age	Group-I			Group-II			Overall		
	Variable Cost	Fixed Cost	Total Cost	Variable Cost	Fixed Cost	Total Cost	Variable Cost	Fixed Cost	Total Cost
08-10	32322.93 (42.08)	44484.69 (57.92)	76807.62 (100.00)	33980.56 (42.64)	45714.01 (57.36)	79694.57 (100.00)	33041.24 (42.33)	45017.39 (57.67)	78058.63 (100.00)
11-16	48321.30 (52.07)	44484.69 (47.93)	92805.99 (100.00)	50185.11 (52.33)	45714.01 (47.67)	95899.12 (100.00)	49128.95 (52.18)	45017.39 (47.82)	94146.34 (100.00)
17-22	58480.57 (56.80)	44484.69 (43.20)	102965.26 (100.00)	61874.14 (57.51)	45714.01 (42.49)	107588.15 (100.00)	59951.12 (57.11)	45017.39 (42.89)	104968.51 (100.00)
23-28	70920.67 (61.45)	44484.69 (38.55)	115405.36 (100.00)	75646.04 (62.33)	45714.01 (37.67)	121360.05 (100.00)	72968.33 (61.85)	45017.39 (38.15)	117985.72 (100.00)
29-35	63461.60 (58.79)	44484.69 (41.21)	107946.29 (100.00)	68236.62 (59.88)	45714.01 (40.12)	113950.63 (100.00)	65530.77 (59.28)	45017.39 (40.72)	110548.16 (100.00)
36-40	64557.27 (59.20)	44484.69 (40.80)	109041.96 (100.00)	64766.80 (58.62)	45714.01 (41.38)	110480.81 (100.00)	64648.07 (58.95)	45017.39 (41.05)	109665.46 (100.00)

Figure in parentheses represent percentage to total cost

4.2.4 Gross and net returns from different age groups of litchi orchards

The gross returns and net returns of different age groups orchard for Group-I and Group-II have been estimated and presented in Table 4.15. Perusal of the table shows that the gross income of Rs. 91601.12 was recorded in 8-10 year old litchi orchard which increased to Rs. 360856.27 for 23-28 years old litchi orchard. The gross returns were observed to decline after 28 years of plantations and were estimated about Rs. 217215.83 in 36-40 years old litchi orchard in the study area. Similar trends were observed in case of net returns from litchi orchards.

Table 4.15 Gross and net returns from different age groups of litchi orchards

Age	Gross returns (In Rs.)			Net returns (In Rs.)		
	Group-I	Group-II	Overall	Group-I	Group-II	Overall
8-10	89375.00	94512.20	91601.12	12567.38	14817.62	13542.49
11-16	261864.41	268253.97	264633.22	169058.42	172354.84	170486.87
17-22	311290.32	335087.72	321602.53	208325.06	227499.56	216634.01
23-28	348000.00	377668.31	360856.27	232594.64	256308.25	242870.54
29-35	268060.84	293229.17	278967.11	160114.55	179278.53	168418.94
36-40	214120.37	221263.74	217215.83	105078.42	110782.92	107550.37

4.2.5 Average costs and returns from litchi orchards

The average costs and returns from the litchi orchards have been estimated and results are presented in Table 4.16. It was found that the establishment amortized cost over 40 years

at 8 per cent discount rate was Rs. 28904.05 per 100 plants with average maintenance cost of Rs. 70097.46. Thus the total cost was estimated to be Rs. 98191.54. The average gross returns from 100 plants were estimated to be Rs. 25581.68, thus a net return of Rs. 157621.14 on an average basis.

Table 4.16 Average costs and returns from litchi orchards

(Rs. /100 plants)

Sr. No.	Particulars	Amount
1	**Establishment cost ***	28094.05
2	**Average maintenance cost**	70097.46
3	**Total cost per year**	98191.54
4	**Average gross income per year**	255812.68
5	**Net income per year**	157621.14

***Amortized over 40 years @ 8 per cent per year**

4.3 Financial analysis of litchi

The pay-back period for plantation was estimated at 12 years for both the groups. The discount rate 8 per cent was used to estimate the present worth of the future income. The analysis across groups revealed that NPV at 8 per cent discount rate was more for Group-II (Rs. 502690.51) and less for Group-I (Rs. 464221.78). The internal rate of return varied from 19.06 to 19.25 per cent which indicates the maximum paying capacity of litchi plantation implying hereby, that investing in the litchi is financially desirable as long as the rate of interest on loan does not exceed 19 per cent.

Table 4.17 Group wise measures of investment per 100 plants

Particulars	Group-I	Group-II
Internal Rate of return (%)	19.06%	19.25%
Net Present Value (Rs.)	464221.78	502690.51
Benefit-Cost Ratio	1.67	1.70
Internal Rate of return (%)	19.06%	19.25%
Payback Period (Years)	12.00	12.00
Annuity (Rs)	38929.71	42155.71

4.3.1 Comparative measures of investment

A comparison of the result obtained from the two appraisal methods reveal that the amortization method has slightly under estimated the benefit-cost ratio as compared to

present value method; however the difference was not large (Table 4.18). There was a wide difference in income calculated under present value method and amortization method. The amortization method suggested an income of more than Rs. 28094.05 over the maintenance cost for retaining the litchi orchards as this income was enough to meet the amortized establishment cost. The present value method required an income of more than Rs. 40327.64 for retaining the old litchi orchard. Hence present value method appeared more realistic as litchi orchards have to compete with other crops.

In view of the fact that litchi orchards have long productive life like other fruit crops and that it is difficult to collect information on cost and returns for all the years as required in present value method, the amortization method is more useful and convenient.

Table 4.18 Comparative measures of investment worth estimated by Present value and Amortization methods

Particulars	Present Value Method	Amortization
Net Present Value (Rs.)	480891.56	326610.10
Benefit-Cost Ratio	1.69	1.39
Payback Period (Years)	12.00	15.00
Internal Rate of return (%)	19.14%	-
Minimum income before replacement of orchard	40327.64	28094.05

4.3.2 Sensitivity analysis:

The rate of return from investment is likely to change according to changes in basic parameters, such as future yield projections, input and output prices and demand estimates. For example, it is quite possible that when the area under litchi plantation is increased, the supply of final product also increases. This will have an adverse effect on price and income of the producers. It is therefore important to examine the sensitivity of the benefit-cost, returns to change in costs and returns caused by changes in assumptions about price and yields.

The sensitivity analysis for litchi production is based on two assumptions:

a) Cash outflows of litchi increased by 5 and 10 per cent with constant returns.

b) Returns decreased by 5 and 10 per with constant cost.

The overall sensitivity analysis of litchi plantations has been presented in Table 4.19. The analysis shows that an increase of 5 to 10 per cent in cost does not make the cultivation uneconomic as economic measures are well in the range with small change in their

magnitudes. Similarly a decrease of 5 to 10 per cent in returns does not affect the economic feasibility. Net present value ranged from Rs. 79144.51 to Rs. 461881.40, Benefit cost ratio varied from 1.15 to 1.66 and IRR between 18.01 and 18.95 per cent at discount rates 10 and 15 per cent respectively. Hence investment in litchi proves to be stable to changes in cost and yield variations. This suggests that risk and uncertainties associated with price and cost were less in litchi crop under the prevailing situations in the study area.

Table 4.19: Overall sensitivity analysis per 100 plants for litchi plantation

Measure of Investment worth	Increase in costs		Decrease in return	
	5%	10%	5%	10%
NPV at discount rate of				
a.) 10 percent	461881.40	428337.60	437110.18	378795.08
b.) 15 percent	112803.80	92459.34	106146.37	79144.51
Internal rate of return (%)				
	18.95	18.18	18.91	18.01
BCR at discount rate of				
a.) 10 percent	1.66	1.58	1.65	1.56
b.) 15 percent	1.26	1.15	1.26	1.19

4.4 MARKETING OF LITCHI

4.4.1 Marketing functions

Various marketing functions are performed by the litchi growers for marketing the produce. The product has to be prepared for the market which involves picking, assembling, grading, packing, transportation, loading/unloading, storage etc. All these factors have been found to be important determinants of price which litchi fetch in the market and great care has to be ensured at every step. Any carelessness at any stage in marketing channel may lower the prices and hence affect net returns adversely.

4.4.1.1 Harvesting

Picking of litchi at the correct time is essential to ensure its quality production and maximum storage life. Litchi has to be harvested when mature but not yet fully ripe. Physico-chemical studies of litchi fruits during fruit development stage reveal that 19 °B TSS and red peel colour which appears during last week of May is the best time for harvesting in litchi. The stage of picking also depends on the time lag between the picking and expected arrival of the fruit in the market. However, for distant markets, produce be harvested when still hard-ripe or just have turned pinkish and the sharply pointed tubercles on the skin have become

flattened. The maturity of the fruit is judged from the tubercles on it. The litchi fruit is picked in whole clusters with a portion of the leafy stalk attached to each of them. Thus the fruit does not wilt after harvest. The fruit clusters are spot picked several times as they do not ripen on the tree at the same time. The harvested fruit should be kept in the shade because atmospheric temperature is very high at harvesting time. If allowed to remain exposed to the sun, the fruits lose their freshness, become dull in colour and deteriorate in quality. Litchi is very susceptible to post-harvest losses and other forms of mechanical injuries and therefore should not be handled any more than necessary. Damage from rough handling will accelerate deterioration, thus reducing the value of the produce. Covering the canopy with 30 per cent green or 50 per cent white shade net has extended the harvesting period by almost 16 days due to reduced total heat units and intercepted scorched sunlight/burning symptoms.

4.4.1.2 Grading

After picking the fruit grading is the next important marketing function. Grades and standards constitute an agreed upon market language which can greatly simplify the marketing process and reduce marketing costs. Product grades and standards also furnish an ethical basis for buying and selling. Various grades are: Extra class (Equatorial diameter 33 mm), Class I (Equatorial diameter 28 mm) and Class II (Equatorial diameter 23 mm). Grading is normally done manually by experienced family members or by hired graders. Most of the grading is done manually; this leaves much scope for variation.

4.4.1.3 Packing

Packaging is very useful function in the marketing. For commodities like litchi which are perishable, fragile in nature and transported to distantly located markets all over the country needs a special type of container for packaging which can protect and preserve its quality during transportation and handling. Litchi fruits are packed in mulberry baskets of suitable size. Soft dry grass or banana leaves should be placed in the baskets before litchi clusters are piled up. The clusters should not be packed too high or too deep as the bottom fruit gets crushed. The fruits are covered with some more grass or banana leaves and a piece of moist gunny bags should be wrapped around the basket and tied securely. Selection of packaging depends on market preferences and availability. The ideal package protects fruit from damage and minimizes water loss and condensation. For domestic markets litchi is usually packed in small bamboo baskets or wooden crates. Square baskets less than 30 cm high give good protection against injury. Proper packing of fruits is important in maintaining

freshness and quality and preventing fruit decay during transit for marketing to distant places. These are lined with litchi leaves or other soft packing material as paper savings, wood-wool, etc. Sesame leaves are supposed to be the best material for packing. A good box for packing fruits should be light in weight, shallow and rigid enough to protect the fruits. It should have few holes for ventilation and rope handles on either side for lifting the box. Fruits are packed in clusters along with few leaves. Plastic packaging combined with cool storage or fungicides has also been recommended.

4.4.1.4 Transportation

Transportation is another important marketing function which adds place utility to produce. The adequate arrangements for quick transportation of fruits to every nook and corner of the country are essential for realizing better returns from the produce. Various modes of transportation were used to carry fruits from orchards to road head. These include pack animals, human labour and ropeways. In addition, tractors and other light vehicles are also used in case orchards are connected with link roads. From road head to terminal markets the fruit is carried in trucks.

4.4.2 Identification of marketing agencies

These agencies are the functionaries specialized in performing various marketing tasks. The role of each marketing functionaries involved in litchi marketing is discussed as under:

4.4.2.1 Producer

Orchardist himself is one of the important market functionaries performing various functions in litchi marketing. He undertakes picking, assembling and grading of the fruit, making arrangements for packing material and transportation of the produce from orchard to road head and ultimately to consuming markets.

4.4.2.2 Pre-harvest Contractor

Pre-harvest contractors are the persons specialized in performing various marketing functions. They are efficient marketers of fruits. They overcome the difficulty of small produce by way of contracting more than one orchard at one time and perform most of the marketing functions themselves.

4.4.2.3 Wholesalers

Wholesalers are those individuals or business concerns who specialize in performing various marketing functions like buying, selling, storing etc. They buy and sell in large quantities for their own gain. The wholesaler sells to retailers, other wholesalers and industrial users, but does not sell in significant amounts to ultimate consumers. In litchi marketing generally the same firm acts both as commission agent as well as wholesaler.

4.4.2.4 Retailer

The retailer buy product from wholesaler for resale directly to ultimate consumers. He earns his income from the difference in the sale and purchase price.

4.4.2.5 HPMC

The Horticultural Produce Marketing and Processing Corporation Ltd. were incorporated in the year 1973 in Himachal Pradesh. The main functions of the corporations are to modernize litchi marketing system by developing infrastructure for the post-harvest handling of litchi on scientific lines. These HPMC's have set up many mechanical grading and packing houses, cold storage facilities in producing areas and consuming markets, transportation facilities both ordinary and refrigerated and fruit processing plants in their respective states. In addition, these corporations have to make arrangements for the sale of fresh fruits and processed products in various markets, supply of packing material to orchardist etc. These facilities are offered to litchi growers in the form of integrated marketing system to make use of them for better returns, through value addition.

4.4.2.6 Market Information agencies

Market information ensures the smooth and efficient operation of the marketing operation. Accurate, adequate and timely availability of market information facilitates decision about when and where to market the fruit. The National Horticultural Board collects prices of litchi for different varieties and grades from different markets of the country and disseminates the same through All India Radio Shimla and through monthly bulletins for the benefits of the producers, traders and consumers.

4.4.3 Marketing Channels

The marketing channel means the route through which a commodity travels from producer to the final consumer. Due to the existence of various agencies working between

producer and consumer, there are different marketing channels for the same commodity. The agencies involved in the marketing of litchi in the study area are local traders, wholesalers and retailers. Following marketing channels were observed in the study area in the marketing of litchi:

4.4.3.1 Sale through wholesaler:

Wholesaler was most commonly used in Channels B, C and D. Wholesaler collected the produce from the doorsteps of the producers and pre-harvest contractor. In the study area, about 78.77 per cent of the produce was disposed of through these channels (Table 4.20).

4.4.3.2 Sale through pre-harvest contractor:

Most of the farmers sold their produce through pre-harvest contractor. The total quantity marketed through this channel worked out to be 50.28 per cent of the total produce sold in the study area (Table 4.20).

4.4.3.3 Direct sale to consumer:

This channel establishes a direct relationship with the consumer. This channel promises higher share of producer in the consumer's rupee. About 5.84 per cent of the total produce was marketed through this channel (Table 4.20).

It can further be observed from the results (Table 4.20) that Channel- C was found to be the most preferred channel, since 50.28 per cent of the produce was traded through this channel (Table 4.20)

Table 4.20: Quantity of Litchi marketed through various channels

Marketing Channels	Marketing intermediaries	% Share in total Quantity marketed
Channel-A	Producer→Consumer	5.84
Channel-B	Producer→Wholesaler→Retailer→Consumer	28.49
Channel-C	Producer→Pre-harvest contractor→Wholesaler→Retailer→Consumer	50.28
Channel-D	Producer→Processing unit (Consumer)	15.39

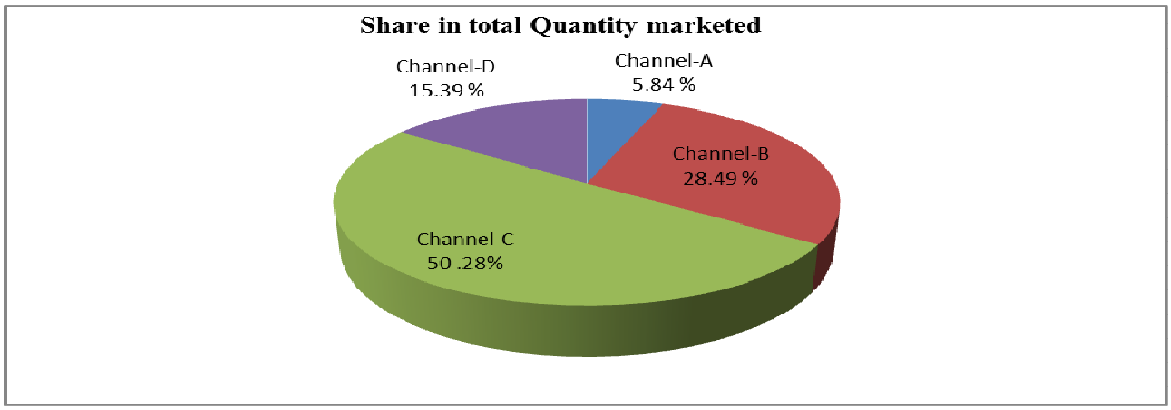

Fig 4.6: Per cent share in total quantity transacted through different marketing channels

4.4.3.1 Marketing costs

i) Cost incurred by producers:

In Channel-A, producer sold the produce directly to the consumer. The total marketing cost incurred by the producer worked out to be Rs.183.95 per quintal. In Channel-B, producer sold their produce to the wholesaler in the market. The total marketing cost incurred by the producer worked out to be Rs. 251.83 per quintal. In Channel-D, producer sold their produce to the processing unit in the HPMC. The total marketing cost incurred by the producer worked out to be Rs. 243.85 per quintal. In Channels-C producer sold their produce to the pre-harvest contractor. There was no marketing cost to be borne by the farmers as the pre-harvest contractor collected the produce from the doorsteps of the producers (Table 4.21).

ii) Marketing cost incurred by pre-harvest contractor:

The pre-harvest contractor was present in the marketing Channel-C. The total marketing cost incurred by the pre-harvest contractor in this marketing channel was Rs.625.46 per quintal. The major items of costs were commission charges (Rs.303.05) per quintal followed by transportation cost (Rs.100.45).

iii) Cost incurred by wholesaler:

The local traders were found in the marketing Channels B and C. The commission charges, transport and tax constituted the important items of marketing costs. In Channel-B and C wholesaler spent Rs. 1191.93 and 1193.97 per quintal in the marketing, out of which room rent, commission charges and transportation cost accounted for Rs. 1037.43 and Rs. 1039.48 per quintal respectively (Table 4.21).

Table: 4.21: Marketing costs and margin of different functionaries in the different marketing channels of litchi

(Rs./Quintal)

Sr. No	Particulars	Channel A	Channel B	Channel C	Channel D
I)	**Marketing cost incurred by producers**				
1	Net price received by farmer	6547.84	5635.26	5050.75	4172.17
2	Transportation cost	60.67	85.25		75.63
3	Cost of gunny bags	24.50	26.00		24.75
4	Cost of basket	75.68	95.67		98.37
5	Loading / unloading	15.70	18.54		16.73
6	Carriage Charges	7.40	16.37		18.37
7	Telephone Charges	0.00	10.00		10.00
	Total	183.95	251.83		243.85
	Farmer's selling price	6731.79	5887.09	5050.75	4416.02
II)	**Marketing cost incurred by pre-harvest contractor**				
A	Gross price paid by pre-harvest contractor			5050.75	
1	Loading / unloading			10.45	
2	Packing material cost			100.50	
3	Commission charge			303.05	
4	Telephone Charges			10.00	
5	Transportation cost			100.45	
6	Mandi Tax			101.02	
B	Total			625.46	
C	Pre-harvest contractor margin			300.00	
D	Pre-harvest contractor Selling price/ Wholesaler purchase price			5976.21	
III)	**Marketing cost incurred by Wholesaler**				
A	Gross price paid by Wholesaler		5887.09	5976.21	
B	Cost components of Wholesaler				
1	Loading / unloading		16.75	16.75	
2	Room rent		588.71	590.75	
3	Telephone Charges		20.00	20.00	
4	Transportation cost		95.50	95.50	
5	Mandi Tax		117.74	117.74	
6	Commission charge		353.23	353.23	
C	Total		1191.93	1193.97	
D	Wholesalers Margin		250.00	250.00	
E	Wholesaler Selling price/ Retailer purchase price		7329.02	7420.18	
IV)	**Marketing cost incurred by Retailer**				
A	Gross price paid by Retailer		7329.02	7420.18	
B	Cost components of Retailer				
1	Loading / unloading		18.75	18.75	
2	Telephone Charges		10.48	10.48	
3	Transportation cost		30.54	30.54	
4	Mandi Tax		146.58	148.40	
5	Commission charge		439.74	445.21	
C	Total		646.09	653.38	
D	Retailer Margin		350.00	350.00	
E	Retailer Selling price		8325.11	8423.56	
V)	**Consumer' Purchase Price**	6731.79	8325.11	8423.56	4416.02

iv) Price spread among different marketing channels

The price spread and marketing efficiency of litchi among different channels has been presented in Table 4.22. The price spread was found to be maximum in channel-C Rs 3372.81 followed by Channel B, D and A i.e. Rs. 2689.85, Rs 243.85 and 183.95 respectively. Producer's share in consumer rupee was found to be maximum in channel-A i.e. 97.27 per cent and minimum in channel-C i.e. 59.96 per cent. Marketing efficiency which has been an indicator of overall performance of the marketing channels was found to be highest in channel-A followed by channels D, B and C respectively. Though channel A has been found to be most efficient but the volume transacted was very less (5.84%).

Table 4.22: Price spread and marketing efficiency of litchi among the different marketing channels

(Rs./Quintal)

Particulars	Channel A	Channel B	Channel C	Channel D
Producer price (Rs.)	6547.84	5635.26	5050.75	4172.17
Consumer's price (Rs.)	6731.79	8325.11	8423.56	4416.02
Price spread	183.95	2689.85	3372.81	243.85
Producer's Share in consumer rupee	97.27	67.69	59.96	94.48
Marketing cost	183.95	2089.85	2472.81	243.85
Marketing efficiency	35.60	2.10	1.50	17.11

4.5 PRODUCTION AND MARKETING PROBLEMS FACED BY THE FARMERS

Problems faced by the farmers in the cultivation and marketing of litchi along with the reasons for their adoptions in the study area have been discussed in this section. The farmer's responses to the problems were recorded and results have been shown in Table 4.23. The problems were classified into production and marketing problems.

Shortage of labour, high wage rate and non-availability at peak operation time were problems faced by the farmers. Marketing problems included higher commission, lack of bargaining power, delay in payments, large number of intermediaries and lack of transport facilities. The major problem in the production and marketing has been tested using chi-square on the per cent multiple response of the farmers in Table 4.23. Problem of non-availability at peak operation time was found more in Group-II (57.69%) which was significantly different from Group-I and other problems were non- significant which means that these problems were faced by all farmers in both the groups.

Table 4.23: Problems faced by litchi growers in the study area

(Multiple response per cent)

Sr.No.	Problems	Group-I	Group-II	Overall	Chi-square
	No. of farmers	34	26	60	
1	**Production problems**				
	Shortage of labour	11.76	19.23	15.00	1.83
	Higher wages rates	32.35	42.31	36.67	1.34
	Non-availability at peak operation time	23.53	57.69	38.33	14.73**
	High transportation cost	44.12	65.38	53.33	4.19
	Desired brand not available	2.94	3.85	3.33	0.12
	Fertilizer not available	8.82	11.54	10.00	0.37
	High prices of chemicals	35.29	23.08	30.00	2.55
	Chemicals not available on time	50.00	46.15	48.33	0.15
	Irrigation facility not available	79.41	69.23	75.00	0.70
	Lack of extension education	47.06	57.69	51.67	1.09
	Non availability of healthy plant material	23.53	23.08	23.33	0.02
	Diseases and pest infestation	47.06	46.15	46.67	0.03
2	**Marketing problems**				
	Higher commission	23.53	15.38	20.00	1.70
	Lack of bargaining power	8.82	15.38	11.67	1.81
	Delay in payments	11.76	3.85	8.33	3.95
	Large number of intermediaries	5.76	7.85	6.67	3.95
	Lack of transport facilities	35.29	42.31	38.33	0.64
	Lack of rumenerative price	38.24	26.92	33.33	1.96

****significant at 5 per cent level of significance**

Chapter-5

SUMMARY AND CONCLUSIONS

Horticulture sector has a significant impact on the growth of the country's economy and is expected that in future also it can make significant contribution towards accelerating the agricultural growth and contribution in GDP. India is the second largest producer of litchi in the World after China. Litchi is an important fruit crop commercially grown in India with tremendous export potential and plays a significant role in the economy.

In India area under Litchi is 85000 ha which accounts for a production of 528,300 MT (NHB, 2014). In Himachal, litchi is confined mainly to lower hills of district Kangra, the area under litchi cultivation in the state is 5200 ha which accounts for production of 3500 MT. The Kangra district of Himachal Pradesh which is the major pocket under litchi cultivation covers an area under of 3025 ha with a production of 2499 MT (Statistical Outlines of HP, 2014).

It was with this background that, the present study "Economics of Production and Marketing of Litchi (*Litchi chinensis*) in Kangra district of Himachal Pradesh" was conducted in Kangra district of Himachal Pradesh to know about the different aspects of production and marketing including the problems faced by the households engaged in the production of litchi with following objectives;

1. To examine the socio-economic status of litchi growers.
2. To work out economic feasibility of litchi cultivation in the study area.
3. To study the existing marketing system of litchi in the study area.
4. To analyze the problems faced by the litchi growers and suggest remedial measures.

Multistage random sampling design was used for the selection of the respondents from Kangra district of Himachal Pradesh. A total sample of 60 households was drawn and households were divided into two different group's

viz. Group-I (<60 plants) and Group-II (>60 plants) according to cube root cumulative frequency method. The data collected and analyzed pertaining to reference year 2016-17. The primary data were collected on demographic features such as family size, age, education, occupation, economic parameters (land inventory, farm building, livestock, cropping pattern and income), cost of production, yield, marketable or marketed surplus, marketing costs, mode of transportation and problems faced by the growers on various aspects of production and marketing. Secondary data were also collected with respect to area and production of litchi from the developmental blocks and other allied departments. The data were collected on well-designed pre-tested schedules by adopting a personal interview method.

In order to meet out the requirements of study objectives various analytical tools were used.

Main findings of the study:

1. Average size of the family was found 5 persons in the study area.
2. At overall level the proportion of nuclear family was 85 per cent and that of joint family 15 per cent highlighting the dominance of nuclear family structure in the study area.
3. At overall level sex ratio was found to be 788.66.
4. Literacy rate revealed that nearly 87.65 per cent family members were literates at overall level and literacy index was 3.13, indicating good level of quality of education.
5. Occupational distribution revealed that 77.22 per cent of work force in the sampled households practice farming, followed by service (14.33%) and business sector (8.45 %) at overall level.
6. The proportion of farm workers in a family varied from 72 to 79.10 per cent across different groups.
7. Dependency ratio estimated with respect to family size was found 0.25 on an average level indicating dependence up to 24.92 per cent in the study area.
8. The average size of land holding in the overall category was found 0.79 hectares of which 18.98 per cent was cultivated area and majority of the

area i.e. 77.02 per cent was under fruit crops. The other uses of land in the study area were forest land (0.04%), *Ghasnis* / Pastures land (0.27 %) and Land put to non-Agricultural use was 3.68 per cent.

9. The analysis of cropping pattern showed that cereal crops grown were maize and wheat. Of the gross cropped area, the area under cereals was 31.39 per cent. The area under litchi was 55.28 and 70.28 per cent in Group-I and Group- II respectively. The total area under litchi was estimated 63.68 per cent.
10. Cropping intensity was found 113.16 per cent at overall level. The reason behind low cropping intensity was that intercropping was not followed in litchi tress and majority of the area was under litchi cultivation.
11. The overall size of animals was 1.44 ACU among the different groups. More than 50 per cent of the total livestock was cows, followed by young stock (18.26%). The other types of livestock included buffaloes (3.92%), goat (0.078%) and sheep (0.078%) respectively at overall level.
12. It was found that of the total farm investment by the farmers 90 per cent was on farm buildings and only 10 per cent was on the farm implements.
13. Litchi contributed maximum to farm income in case of Group-II i.e. 64.49 per cent and at overall its contribution was found 44.79 per cent to the total farm income.
14. Initial cost of litchi plantation per hundred plants was calculated to Rs. 32157.43 at overall level and practically found almost same in the both groups.
15. In litchi, non- bearing stage was found up to 7 years and variable and fixed cost varied from Rs. 9549.60 to Rs. 19226.34 and Rs. 17506.94 to Rs. 39086.07 in Group-I and Group-II respectively. The total cost of non-bearing litchi plantation was found to have positive relationship with the age of the plants. The fixed cost and the interest on past establishment cost was found to be the prominent cost item in the later years of non – bearing stages.
16. Maintenance cost per hundred plants during bearing stage at overall level showed an increase in the total cost upto 23-28 years and thereafter, it

started decreasing which is due to the decrease in production and lesser labour requirement. The per cent share of the variable and fixed cost varied from 42.33 to 58.95 and 38.15 to 57.67 per cent in the total cost.

17. The gross returns ranged between Rs. 91601.12 and Rs. 360856.27 on overall. The gross returns were showing an increasing trend up to 23-28 years of age and then started declining thereafter. The average life of litchi tree was considered 40 years. The net returns were found maximum (Rs. 242870.54) in 23-28 years age group of bearing stage.

18. The payback period worked out to be 12 years for both the groups. Benefit-cost ratio was estimated to 1.67 and 1.70 with an internal rate of return (IRR) 19.06 and 19.25 per cent for Group-I and Group-II. The net present value varied from Rs. 464221.78 to Rs. 502690.51 for Group-I and Group-II.Net Present Worth's and Benefit Cost Ratios indicated that litchi was financially viable at a discount rate of 8 per cent over a forty year production period.

19. The amortization method suggested an income of more than Rs. 28094.05 over the maintenance cost for retaining the litchi orchards, as this income was enough to meet amortized establishment cost. The amortized value of returns was calculated at the rate of 8 per cent, because financial institutions advance short-term loans to litchi growers at this rate of interest.

20. Sensitivity analysis of the litchi plantation showed that an increase of 5 to 10 per cent in cost and a decrease of 5 to 10 per cent in returns do not make the cultivation uneconomic. Net present value ranged from Rs. 79144.51 to Rs. 461881.40, Benefit cost ratio ranged between 1.15 and 1.66 and IRR between 18.01 and 18.95 per cent at discount rates 10 and 15 per cent respectively. This clearly shows that risks and uncertainties associated with price and costs are less in litchi crop.

21. Four marketing channels were found prevalent in the study area. Among these channels, Channel-C (Producer→ Pre-harvest contractor→ Wholesaler→Retailer→ Consumer) was found to be the most preferred

channel as 50.28 per cent of the produce was traded through this marketing channel.

22. Producer's price varied from Rs. 4172.17 to Rs. 6547.84 , Price spread was maximum in channel-C followed by B, D and A. Producer's share in consumer rupee was found to be maximum in channel-A i.e. 97.27 per cent and minimum in channel-C i.e. 59.96 per cent.
23. Highest efficiency was found in channel A followed by D, B and C respectively. Though channel A was found efficient but the volume transacted was very less (5.84%), because produce was traded directly to consumer.
24. Major problems faced by the farmers related to production in the study area were shortage of labour, high wage rate and non- availability of labour at peak operation time. Marketing problems included higher commission, lack of bargaining power, delay in payments, large number of intermediaries, lack of transport facilities and lack of rumenrative price.
25. Non-availability of labour at peak operations (53.33 %) and was the major problem. All other problems were non-significant meaning thereby that these problems were common to litchi grower in both the groups.
26. Lack of extension services and non- availability of healthy plant material were another important problems faced by the litchi growers in the study area.

Suggestions and policy options

The study has brought into focus many problems relating to the production and marketing of litchi in the study area. In order to meet the growing requirements of litchi, emphasis is needed on their marketing potential also. The findings of the present study have resulted in various suggestions regarding the production and marketing of litchi. The suggestions and policy issues emerged from the present study are:

1. The orchardists should be trained properly in performing various operations in the orchard, especially timely application of the fertilizers and insecticides and other improved management practices.

2. The inputs like fertilizers, plant protection chemicals should be made available to the orchardists on time and at subsidized rates.
3. HPMC should strengthen its branches in the area as it will increase producer's share in consumer's rupee.
4. Due to perishable nature of the produce fruit processing units in the study area can help the orchardists in getting better prices for culled fruits and can solve marketing problems upto some extent.
5. Information on market potential, price and market intelligence is required to be collected through market survey so that proper marketing strategy could be formulated. A sound data base of production potential along with their potential needs to be created.
6. Adoption of modern farm techniques should be encouraged by creating awareness among the producers.
7. Short term training programmes should be organized in the study area regarding the diseases management, high density planting, collection techniques and scientific methods of processing and grading in order to enhance the skill of producers to maximize the net profit and reduce wastage of produce.

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Dr. Y.S. PARMAR UNIVERSITY OF HORTICUTURE AND FORESTRY
NAUNI, SOLAN 173230 (HP)
DEPARTMENT OF SOCIAL SCIENCES

Title of thesis	**:**	**"Economics of Production and Marketing of Litchi (*Litchi chinensis*) in Kangra district of Himachal Pradesh"**
Name of the student	**:**	Ratika Kayastha
Admission number	**:**	F-2015-08-M
Major Advisor	**:**	Dr. Ravinder Sharma
Major field	**:**	Agricultural Production Economics
Minor field	**:**	i) Statistics ii) Mathematics
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ABSTRACT

In the present study entitled "**Economics of Production and Marketing of Litchi (*Litchi chinensis*) in Kangra district of Himachal Pradesh''** multistage random sampling technique was used for the selection of the sampled households from three blocks of Kangra district. Sample of 60 households was drawn randomly and by using cube root cumulative frequency method the sample was classified into two groups' *viz.* Group-I and Group-II. The economic analysis revealed that initial cost of investment on litchi plantation was estimated Rs. 32157.43 per hundred plants. The litchi cultivation was profitable and earned an internal rate of return of 19.14 per cent with a benefit-cost ratio of 1.69 and net present value of Rs. 48089.56 per hundred plants. Sensitivity analysis of litchi plantation showed that up to 15 per cent changes in costs or returns, internal rate of litchi crop remained higher than the prevailing bank rates for long deposits, which clearly shows that the risks and uncertainties associated with price and costs are minimum in litchi crop. Therefore, it is suggested that litchi cultivation should be encouraged among the orchardists in the foot hills of Himachal Pradesh. Three main marketing channels were found prevalent in the study area for the marketing of litchi crop. Amongst these channel-C (Producer → Pre-harvest contractor→ Wholesaler→ Retailer→ Consumer) was found to be the most preferred channel as 50.28 per cent of the produce was traded through this marketing channel. Shortage of labour, high wage rate and non-availability of labour at peak operation time were major production problems faced by the farmers. Marketing problems included higher commission, lack of bargaining power, delay in payments, large number of intermediaries, lack of transport facilities and lack of remunerative price. Problem of non-availability of labour at peak operation time was found maximum in Group-II (57.69%) which differs significantly from all other problems.

Signature of Major Advisor **Signature of the Student**

Countersigned

Professor and Head
Department of Social Sciences
Dr. Y. S. Parmar University of Horticulture and Forestry
Nauni, Solan-173230 (HP)

APPENDIX I

Literacy status of the sampled growers

Particulars	Group-I		Group- II		Overall	
	M	F	M	F	M	F
Illiterate	0.18 (5.94)	0.38 (13.13)	0.04 (1.41)	0.31 (12.70)	0.12 (3.98)	0.35 (12.94)
Non School Going	0.12 (3.96)	0.06 (2.02)	0.15) (5.63)	0.12 (4.76)	0.13 (4.69)	0.08 (3.21)
Primary	0.24 (7.92)	0.41 (14.14)	0.27 (9.86)	0.35 (14.29)	0.25 (8.76)	0.38 (14.20)
Middle	0.26 (8.91)	0.50 (17.17)	0.23 (8.45)	0.38 (15.87)	0.25 (8.71)	0.45 (16.61)
Matriculate	0.53 (17.82)	0.56 (19.19)	0.50 (18.31)	0.31 (12.70)	0.52 (18.03)	0.45 (16.38)
Sr. Secondary	0.56 (18.81)	0.56 (19.19)	0.46 (16.90)	0.58 (23.81)	0.52 (17.98)	0.57 (21.19)
Graduate	1.09 (36.63)	0.44 (15.15)	1.08 (39.44)	0.38 (15.87)	1.08 (37.85)	0.42 (15.46)
Literate	2.68 (90.10)	2.47 (84.85)	2.54 (92.96)	2.00 (82.54)	2.62 (91.34)	2.27 (83.85)
Total	2.97 (100.00)	2.91 (100.00)	2.73 (100.00)	2.42 (100.00)	2.87 (100.00)	2.70 (100.00)

APPENDIX II

Initial cost of investment of the sampled growers per hundred plants

Particulars	Group-I	Group-II	Overall
Material Cost			
Planting material	4000.00	4008.00	4003.47
FYM cost	2250.87	2380.33	2306.97
Soil treatment	500.99	550.78	522.57
Human family labour			
layout & preparation	890.67	815.67	858.17
Digging of pit	1259.67	1289.45	1272.57
Filling of pit	1050.31	980.25	1019.95
Soil treatment	721.66	789.45	751.04
Plantation	780.82	750.41	767.64
Irrigation	1002.55	1189.55	1083.58
Family labour cost	5705.68	5814.78	5752.96
Human hired labour			
layout & preparation	-	100.78	43.67
Digging of pit	250.61	295.22	269.94
Hired labour cost	250.61	396.00	313.61
Total working capital	7002.47	7335.11	7146.61
Interest on working capital	315.11	330.08	321.60
Risk Margin	700.25	733.51	714.66
Managerial cost	700.25	733.51	714.66
Sub total	1715.61	1797.10	1750.92
Total Variable Cost	14423.76	14946.99	14650.49
Fixed cost			
Land revenue	6.00	6.00	6.00
Depreciation	3167.51	3264.34	3209.47
Rental value of land	12031.88	12031.88	12031.88
Interest on Fixed capital	2215.12	2317.75	2259.59
Total fixed cost	17420.51	17619.97	17506.94
Total cost	31844.27	32566.96	32157.43

APPENDIX -III

Cost of establishment of non -bearing litchi for Group-I per hundred plants

Particulars	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
Material Cost							
Gap filling	510.55	-	-	-	-	-	-
Lime	-	-	-	130.67	180.29	240.58	348.67
FYM cost	3674.86	4008.21	4141.71	4075.94	4238.60	4955.85	5548.63
fertilizer cost	851.47	921.24	1050.13	1191.84	1261.95	1317.44	1768.93
Fungicide	-	-	-	200.45	240.12	300.56	361.34
Insecticide	-	180.51	186.90	200.27	205.08	212.91	225.89
Human family labour							
Gap filling	461.23	-	-	-	-	-	-
Training & Pruning	-	-	-	200.53	358.46	532.45	593.31
Maintenance of basin	800.56	880.32	900.21	961.78	998.55	1027.32	1070.56
Interculture	400.53	529.01	641.44	701.63	734.19	810.22	860.72
FYM labour	702.89	801.60	982.62	1102.94	1227.02	1475.66	1506.09
Fertilizer	583.25	641.18	782.09	842.25	896.14	912.78	988.84
Irrigation	421.12	478.56	681.82	802.14	813.42	867.14	912.78
Fungicide	-	-	-	200.53	344.67	441.18	593.31
Insecticide	-	299.10	461.23	501.34	523.90	578.09	608.52
Family labour cost	3369.58	3629.78	4449.40	5313.14	5896.34	6644.84	7134.12
Human hired labour							
FYM labour	-	-	-	-	-	669.37	863.12
Hired labour cost	-	-	-	-	-	669.37	863.12
Total working capital	5036.88	5109.96	5378.74	5799.17	6126.04	7696.72	9116.58
Interest on working capital	226.66	229.95	242.04	260.96	275.67	346.35	410.25
Risk Margin	503.69	511.00	537.87	579.92	612.60	769.67	911.66
Managerial cost	503.69	511.00	537.87	579.92	612.60	769.67	911.66
Sub total	1234.04	1251.94	1317.79	1420.80	1500.88	1885.70	2233.56
Total Variable Cost	9640.50	9991.67	11145.94	12533.12	13523.26	16227.25	18484.26
Fixed cost							
Land revenue	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Deprecation	3167.51	3167.51	3167.51	3167.51	3167.51	3167.51	3167.51
Interest on Fixed capital	2215.12	2215.12	2215.12	2215.12	2215.12	2215.12	2215.12
Interest on past establishment cost	2547.54	4916.23	7502.50	10388.01	13615.34	17180.07	21246.30
Rental value	12031.88	12031.88	12031.88	12031.88	12031.88	12031.88	12031.88
Total fixed cost	19968.05	22336.74	24923.01	27808.52	31035.85	34600.58	38666.81
Total cost	**29608.55**	**32328.41**	**36068.95**	**40341.64**	**44559.12**	**50827.84**	**57151.07**

APPENDIX-IV

Cost of establishment of non -bearing litchi for Group- II per hundred plants

Particulars	1st year	2nd year	3rd year	4th year	5th year	6th year	7 th year
Material Cost							
Gap filling	625.96	-	-	-	-	-	-
Lime	-	-	-	145.89	190.22	263.42	379.74
FYM cost	3164.97	3836.44	4223.24	4689.50	4392.04	5094.68	5511.28
Fertilizer	890.65	976.72	1151.19	1218.83	1287.67	1340.65	1820.94
Fungicide	-	-	-	220.45	250.87	305.44	365.34
Insecticide	-	189.34	191.56	210.56	216.91	218.45	238.68
Human family labour							
Gap filling	510.56	-	-	-	-	-	-
Training & Pruning	-	-	-	108.17	200.15	250.69	269.37
Maintenance of basin	818.93	920.84	450.34	480.96	150.35	200.90	377.41
Interculture	438.54	248.56	497.35	334.01	300.10	387.58	370.21
FYM labour	713.56	490.52	470.78	420.40	389.51	400.42	450.31
Fertilizer	600.24	387.28	417.60	428.38	694.69	754.46	730.14
Irrigation	520.34	685.96	701.42	850.34	875.03	910.39	790.42
Fungicide	-	-	-	100.39	250.19	378.55	-
Insecticide	-	-	-	198.94	-	-	-
Family labour cost	3602.17	2733.16	2537.49	2921.59	2860.03	3282.99	2987.86
Human hired labour							
Training & Pruning	-	-	-	-	250.35	368.19	423.21
Maintenance of basin	-	-	750.15	800.44	950.34	965.87	800.35
Interculture	-	300.45	317.58	250.24	450.82	555.21	690.75
FYM labour	-	490.74	550.00	850.42	900.20	1050.31	1100.45
Fertilizer	-	450.35	499.39	500.54	488.78	553.76	695.24
Irrigation	-	-	-	-	-	368.83	474.45
Fungicide	-	-	-	250.34	320.44	439.87	565.09
Insecticide	-	-	457.56	557.03	630.90	678.67	756.88
Hired labour cost	-	1241.54	2574.68	3209.01	3991.83	4980.71	5506.42
Total working capital	4681.58	6244.04	8140.67	9694.24	10329.54	12203.35	13822.40
Interest on working capital	210.67	280.98	366.33	436.24	464.83	549.15	622.01
Risk Margin	468.16	624.40	814.07	969.42	1032.95	1220.34	1382.24
Managerial cost	468.16	624.40	814.07	969.42	1032.95	1220.34	1382.24
Sub total	1146.99	1529.79	1994.46	2375.09	2530.74	2989.82	3386.49
Total Variable Cost	9430.74	10506.98	12672.63	14990.92	15720.30	18476.16	20196.75
Fixed cost							
Land revenue	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Deprecation	3264.34	3264.34	3264.34	3264.34	3264.34	3264.34	3264.34
Interest on Fixed capital	2317.75	2317.75	2317.75	2317.75	2317.75	2317.75	2317.75
Rental value of land	12031.88	12031.88	12031.88	12031.88	12031.88	12031.88	12031.88
Interest on past establishment	2605.36	4977.84	7626.23	10659.73	11516.02	17709.88	22014.36
Total fixed cost	20225.32	22597.81	25246.19	28279.70	29135.99	35329.85	39634.33
Total cost	**29656.06**	**33104.79**	**37918.82**	**43270.62**	**44856.30**	**53806.01**	**59831.08**

APPENDIX-V

Overall cost of establishment of non -bearing litchi per hundred plants

Particulars	1st year	2nd year	3rd year	4th year	5th year	6th year	7 th year
Material Cost							
Gap filling	560.56	-	-	-	-	-	-
Lime	-	-	-	137.26	184.59	250.48	362.13
FYM cost	3453.91	3933.78	4177.04	4341.82	4305.09	5016.01	5532.45
Fertilizer	868.45	945.28	1093.93	1203.54	1273.09	1327.50	1791.47
Fungicide	-	0.00	0.00	209.12	244.78	302.67	363.07
Insecticide	-	184.34	188.92	204.73	210.21	215.31	231.43
Human family labour							
Gap filling	482.61	-	-	-	-	-	-
Training & Pruning	-	-	-	160.51	289.86	410.36	452.93
Maintenance of basin	808.52	897.88	705.27	753.42	631.00	669.20	770.20
Interculture	417.00	407.48	579.00	542.33	546.09	627.08	648.17
FYM labour	707.52	666.80	760.82	807.17	864.10	1009.72	1048.58
Fertilizer	590.61	531.16	624.14	662.90	808.85	844.17	876.74
Irrigation	464.12	568.44	690.31	823.03	840.12	885.88	859.76
Fungicide	0.00	0.00	0.00	157.14	303.73	414.04	336.21
Insecticide	0.00	169.49	261.36	370.30	296.88	327.59	344.83
Family labour cost	3470.37	3241.24	3620.91	4276.80	4580.61	5188.04	5337.41
Human hired labour							
Training & Pruning	-	-	-	-	108.49	159.55	183.39
Maintenance of basin	-	-	325.07	346.86	411.81	418.54	346.82
Interculture	-	130.20	137.62	108.44	195.36	240.59	299.33
FYM labour	-	212.65	238.33	368.52	390.09	834.44	965.96
Fertilizer	-	195.15	216.40	216.90	211.80	239.96	301.27
Irrigation	-	-	-	-	0.00	159.83	205.60
Fungicide	-	-	-	108.48	138.86	190.61	244.87
Insecticide	-	-	198.28	241.38	273.39	294.09	327.98
Hired labour cost	-	538.00	1115.69	1390.57	1729.79	2537.62	2875.22
Total working capital	4882.92	5601.39	6575.58	7487.04	7947.56	9649.59	11155.77
Interest on working capital	219.73	252.06	295.90	336.92	357.64	434.23	502.01
Risk Margin	488.29	560.14	657.56	748.70	794.76	964.96	1115.58
Managerial cost	488.29	560.14	657.56	748.70	794.76	964.96	1115.58
Sub total	1196.31	1372.34	1611.02	1834.32	1947.15	2364.15	2733.16
Total Variable Cost	9549.60	10214.97	11807.50	13598.16	14475.31	17201.78	19226.34
Fixed cost							
Land revenue	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Deprecation	3209.47	3209.47	3209.47	3209.47	3209.47	3209.47	3209.47
Interest on Fixed capital	2259.59	2259.59	2259.59	2259.59	2259.59	2259.59	2259.59
Rental value of land	12031.88	12031.88	12031.88	12031.88	12031.88	12031.88	12031.88
Interest on past establishment	2572.59	4942.93	7556.11	10505.76	12705.64	17409.66	21579.13
Total fixed cost	20079.54	22449.87	25063.05	28012.70	30212.58	34916.60	39086.07
Total cost	**29629.14**	**32664.84**	**36870.56**	**41610.86**	**44687.89**	**52118.38**	**58312.41**

APPENDIX VI

Maintenance cost of bearing litchi for Group-I per hundred plants

Particulars	08- 10 year	11-16 year	17-22 year	23-28 year	29-35year	36-40 year
Material Cost						
Gap filling						
Lime	448.65	582.64	704.07	858.97	825.30	803.78
FYM cost	6979.063	7446.231	8046.478	8488.68778	8537.47	9008.33
Fertilizer	2582.25	3363.19	4095.90	4156.20	4253.43	4390.38
Fungicide	450.21	531.83	800.13	908.45	893.34	878.21
Insecticide	249.63	300.61	350.15	493.69	448.34	420.23
Human family labour						
Training & Pruning	747.76	860.23	900.21	1200.45	1045.71	950.68
Maintenance of basin	1278.34	1428.10	1678.34	2000.30	1885.49	1797.56
Interculture	687.94	750.63	813.58	860.55	797.34	755.88
FYM labour	1678.45	1892.45	1920.15	2219.39	2131.45	1990.75
Fertilizer	1150.35	1300.22	1596.30	1722.38	1662.28	1605.82
Irrigation	562.27	664.56	760.29	961.23	884.07	821.12
Fungicide	642.51	715.23	791.53	915.49	842.52	799.23
Insecticide	610.25	704.56	810.71	924.52	856.45	812.57
Family labour cost	7357.86	8315.98	9271.11	10804.31	10105.31	9533.61
Human hired labour						
FYM labour	548.38	600.25	650.45	890.91	799.32	680.33
Watch and ward	8500.00	9000.25	9050.00	10000.00	10050.00	10115.22
Harvesting	4145.54	13998.31	18942.40	27477.91	22500.22	17899.23
Hired labour cost	13193.92	23598.81	28642.85	38368.82	33349.54	28694.78
Total working capital	23903.73	35823.31	42639.57	53274.82	48307.42	44195.71
Interest on working capital	1075.67	1612.05	1918.78	2397.37	2173.83	1988.81
Risk Margin	2390.37	3582.33	4263.96	5327.48	4830.74	4419.57
Managerial cost	2390.37	3582.33	4263.96	5327.48	4830.74	4419.57
Sub total	1061.34	4182.01	6569.89	6841.54	5048.87	10827.95
Total Variable Cost	32322.93	48321.30	58480.57	70920.67	63461.60	64557.27
Fixed cost						
Land revenue	6.00	6.00	6.00	6.00	6.00	6.00
Deprecation	3167.51	3167.51	3167.51	3167.51	3167.51	3167.51
Interest on Fixed capital	2215.12	2215.12	2215.12	2215.12	2215.12	2215.12
Rental value	12031.88	12031.88	12031.88	12031.88	12031.88	12031.88
Pro-rated establishment cost	27064.18	27064.18	27064.18	27064.18	27064.18	27064.18
Total fixed cost	44484.69	44484.69	44484.69	44484.69	44484.69	44484.69
Total cost	**76807.62**	**92805.99**	**102965.26**	**115405.36**	**107946.29**	**109041.96**

APPENDIX-VII

Maintenance cost of bearing litchi for Group-II per hundred plants

Particulars	08- 10 year	11-16 year	17-22 year	23-28 year	29-35 year	36-40 year
Material Cost						
Lime	449.74	600.86	735.05	860.14	810.57	798.38
FYM cost	7005.23	7415.93	8156.62	8689.51	8640.67	9037.48
Fertilizer	2588.48	3414.88	3600.87	3720.23	3913.67	4000.82
Fungicide	499.71	580.38	830.15	902.57	898.40	882.34
Insecticide	253.34	310.44	369.45	500.13	461.39	425.67
Human family labour						
Training & Pruning	700.45	520.55	500.45	418.56	357.67	330.71
Maintenance of basin	905.29	317.32	300.51	524.77	419.37	350.36
Interculture	623.78	520.33	498.32	254.69	215.46	198.47
FYM labour	1025.58	1248.64	1358.72	1490.37	1275.83	1107.43
Fertilizer	675.61	648.52	622.87	728.78	683.56	578.86
Irrigation	512.92	280.75	247.56	228.23	193.36	160.35
Fungicide	602.57	247.26	355.67	460.83	223.36	206.14
Insecticide	574.73	220.68	321.43	376.62	208.38	186.36
Family labour cost	5620.93	4004.05	4205.53	4482.85	3576.98	3118.68
Human hired labour						
Training & Pruning	-	378.64	579.78	783.65	742.55	720.68
Maintenance of basin	-	514.28	600.44	831.45	901.33	987.30
Interculture	-	257.32	435.35	597.58	440.67	389.44
FYM labour	556.42	633.56	750.30	884.60	998.45	1127.44
Fertilizer	-	648.40	730.83	1245.75	1083.96	881.80
Irrigation	-	336.71	886.35	1018.63	975.49	720.78
Fungicide	-	418.91	794.25	920.29	837.95	783.24
Insecticide	-	391.50	748.24	879.45	820.85	691.47
Watch and ward	8050.00	9000.00	9050.00	11150.55	9080.50	9070.50
Harvesting	4023.53	13080.45	18900.33	25087.21	22484.31	18999.22
Hired labour cost	12629.95	25659.77	33475.86	43399.17	38366.06	34371.88
Total working capital	23426.44	37982.26	47168.00	58071.75	53090.76	49516.56
Interest on working capital	1054.19	1709.20	2122.56	2613.23	2389.08	2228.25
Risk Margin	2342.64	3798.23	4716.80	5807.17	5309.08	4951.66
Managerial cost	1536.36	2691.38	3661.25	4671.04	3870.72	4951.66
Sub total	4933.19	8198.80	10500.61	13091.45	11568.88	12131.56
Total Variable Cost	33980.56	50185.11	61874.14	75646.04	68236.62	64766.80
Fixed cost						
Land revenue	6.00	6.00	6.00	6.00	6.00	6.00
Deprecation	3264.34	3264.34	3264.34	3264.34	3264.34	3264.34
Interest on Fixed capital	2317.75	2317.75	2317.75	2317.75	2317.75	2317.75
Rental value of land	12031.88	12031.88	12031.88	12031.88	12031.88	12031.88
Pro-rated establishment cost	28094.05	28094.05	28094.05	28094.05	28094.05	28094.05
Total fixed cost	45714.01	45714.01	45714.01	45714.01	45714.01	45714.01
Total cost	**79694.57**	**95899.13**	**107588.16**	**121360.05**	**113950.63**	**110480.81**

APPENDIX-VIII

Overall maintenance cost of bearing litchi per hundred plants

Particulars	08- 10 year	11-16 year	17-22 year	23-28 year	29-35 year	36-40 year
Material Cost						
Lime	449.12	590.53	717.49	859.48	818.92	801.44
FYM cost	8121.56	8634.75	9081.26	9482.36	9462.34	9020.96
Fertilizer	2584.95	3385.59	3881.39	3967.28	4106.20	4221.57
Fungicide	471.66	552.87	813.14	905.90	895.53	880.00
Insecticide	251.24	304.87	358.51	496.48	454.00	422.59
Human family labour						
Training & Pruning	727.26	713.04	726.98	861.63	747.56	682.03
Maintenance of basin	1116.69	946.76	1081.28	1360.90	1250.17	1170.44
Interculture	660.14	650.83	676.97	598.01	545.19	514.34
FYM labour	1395.54	1613.47	1676.86	1903.48	1760.68	1607.98
Fertilizer	944.63	1017.82	1174.48	1291.82	1238.17	1160.80
Irrigation	540.89	498.24	538.11	643.59	584.76	534.79
Fungicide	625.20	512.44	602.66	718.47	574.22	542.22
Insecticide	594.86	494.88	598.69	687.10	575.62	541.21
Family labour cost	6605.19	6447.48	7076.03	8065.01	7276.37	6753.81
Human hired labour						
Training & Pruning	-	164.08	251.24	339.58	321.77	312.29
Maintenance of basin	-	222.85	260.19	360.30	390.58	427.83
Interculture	-	111.51	188.65	258.95	190.96	168.76
FYM labour	551.86	614.68	693.72	888.18	885.61	874.08
Fertilizer	-	280.97	316.69	539.82	469.72	382.11
Irrigation	-	145.91	384.08	441.41	422.71	312.34
Fungicide	-	181.53	344.17	398.79	363.11	339.41
Insecticide	-	169.65	324.24	381.10	355.70	299.64
Harvesting	4092.67	13600.57	18967.02	26441.94	20940.27	19886.10
Hired labour cost	12949.53	24491.89	30737.16	40548.64	35523.36	31154.85
Total working capital	23696.90	36758.85	44601.89	55353.49	50380.20	46501.41
Interest on working capital	1066.36	1654.15	2007.09	2490.91	2267.11	2092.56
Risk Margin	2369.69	3675.89	4460.19	5535.35	5038.02	4650.14
Managerial cost	2369.69	3675.89	4460.19	5535.35	5038.02	4650.14
Sub total	2739.14	5922.62	8273.20	9549.83	7874.21	11392.85
Total Variable Cost	33041.24	49128.95	59951.12	72968.33	65530.77	64648.07
Fixed cost						
Land revenue	6.00	6.00	6.00	6.00	6.00	6.00
Deprecation	3209.47	3209.47	3209.47	3209.47	3209.47	3209.47
Interest on Fixed capital	2259.59	2259.59	2259.59	2259.59	2259.59	2259.59
Rental value of land	12031.88	12031.88	12031.88	12031.88	12031.88	12031.88
Pro-rated establishment cost	27510.45	27510.45	27510.45	27510.45	27510.45	27510.45
Total fixed cost	45017.39	45017.39	45017.39	45017.39	45017.39	45017.39
Total cost	**78058.63**	**94146.35**	**104968.51**	**117985.73**	**110548.17**	**109665.46**

BRIEF BIO-DATA

Name	:	Ratika Kayastha
Father's Name	:	Sh. Raj Kumar Kayastha
Mother's Name	:	Smt. Alka Kayastha
Date of Birth	:	6th Jan, 1993
Permanent Address	:	Near Police Station , Bhawarna ,Tehsil Palampur, District- Kangra, H.P

Educational qualifications:

Certificate/degree	Month & Year	School/College	Board/University	Marks (%)	Division
Matriculation	March,2009	Mount Carmel School	Indian Certificate of School Education	80	First
10+2	March,2011	Rainbow International School	Central Board Of Secondary Education	70	First
B. Sc. (Agriculture)	June,2015	Lovely Professional University	Lovely Professional University	78.5	First

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(Ratika Kayastha)