

**AN ECONOMIC ANALYSIS OF PRODUCTION AND
MARKETING OF KINNOW IN KANGRA DISTRICT
OF HIMACHAL PRADESH**

Thesis

by

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


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This is to certify that the thesis titled “An Economic Analysis of Production and Marketing of Kinnow in Kangra District of Himachal Pradesh”, submitted by Ms. Raj Rani Sharma (F-2016-08-M) d/o Sh. Gian Chand Sharma to the Dr. Yashwant Singh Parmar University of Horticulture & Forestry, (Nauni) Solan (HP)- 173230 India in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (AGRICULTURE)** in the discipline of **AGRICULTURAL ECONOMICS** has been approved by the Advisory Committee after an oral examination of the student in collaboration with an External Examiner.

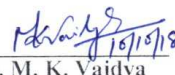

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(Raj Rani Sharma)

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ABBREVIATIONS

%	:	Per cent
&	:	And
@	:	At the rate
e.g	:	for example
<i>et al.</i>	:	<i>et alii</i> (co- workers)
B: C	:	Benefit Cost Ratio
H.P.	:	Himachal Pradesh
ha	:	Hectare
i.e.	:	that is
IRR	:	Internal Rate of Return
kg	:	Kilogram
No.	:	Numbers
NPV	:	Net Present Value
Qtl	:	Quintal
Rs.	:	Rupees
viz.	:	that is to say
GDP	:	Gross Domestic Product
r	:	Efficiency Ratio
R ²	:	Coefficient of multiple determination
MVP	:	Marginal Value Productivity
LDR	:	Lower Discounted Rate

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Chapter- 1

INTRODUCTION

Agriculture plays a vital role in India's economy. About 55 per cent of the rural households depend on agriculture as their principal means of livelihood. The share of agriculture and allied sectors is about 16 per cent to the country's GDP (Anonymous, 2017-18a). Agriculture depends on many factors known as 'act of god' over which one has no or very little control. Under the changing agriculture scenario, it has been realized that the horticultural sector plays a vital role in providing the livelihood security to the farmers globally. It is perhaps the fastest growing sector within agriculture contributing about 30 per cent in agriculture (Anonymous, 2017). The diversification in agriculture for improving sustainability, profitability and productivity not only help in improving the farm income but also generate gainful employment. Realizing these potentials, the government of India has started putting greater thrust for the development of horticultural sector after nineties in order to exploit the country's vast potential and generate the much needed value addition.

India, with its wide variability of climate and soil, is highly favourable for growing a large number of horticultural crops. The country has witnessed sharper increase in acreage in horticulture crops compared to food grains over the last few years. Over the last decade, the area under horticulture grew by about 3 per cent per annum and annual production increased by 5.4 per cent. During 2016-17, the production of horticultural crops was about 295.2 million tonnes from an area of about 24.9 million hectares (Anonymous, 2017). Fruits and vegetables account for nearly 90% of the total horticultural production in the country. India is the world's second largest producer of fruits with its projected value touching 98 million tonnes by the year 2020-2021 (Bhat *et al.*, 2011).

Fruits in human nutrition make balanced diet, which tends to the development of sound health and happiness of human beings. Fruits provide vitamins, proteins, minerals like Ca, Fe and P, enzymes and organic acids and therefore, they are considered as protective food. India contributes about 12.6 percent to the total world production of the fruits. In India, fruits are grown on an area of about 6.30 million hectares with an annual production of 92.84 million tonnes (Anonymous, 2017). Among different fruit crops, Citrus is the third largest fruit industry in India after Mango and Banana in terms of area under cultivation. The

demand for citrus fruits is very high because of its nutritive value. It is very rich in vitamins “C” (ascorbic acid), fruit sugar and in addition of this it also contains vitamins A and B. It provides vitamin P, which keeps the small blood vessels in healthy condition in our body.

After Mexico, India is the leading producer of citrus fruits with an area of about 1.06 million hectares and production of about 12.75 million tonnes annually (Anonymous, 2017). India alone has contributed 24% of the total world production of citrus fruits in the world (Anonymous, 2016). The major citrus growing states in India are Andhra Pradesh, Maharashtra and Madhya Pradesh, contribute about 44.1% to the total production of citrus fruits in the country. Among citrus crops, mandarin orange (Kinnow mandarin, Nagpur, Khasi, Darjling) covers largest area followed by sweet orange (Musambi, Pineapple, Blood Red and Jaffa) and Acid lime. Among these, Kinnow mandarin, originated as a hybrid of king and willow leaf mandarins (*Citrus nobilis* × *C. deliciosa*) at Riverside, California (Sharma *et al.*, 2007), bears highest place in production, productivity, juice content and fruit quality. In India, kinnow is being grown in Punjab, Himachal Pradesh, Rajasthan, Haryana, Jammu & Kashmir and Uttar Pradesh. Punjab is India’s leading producer of kinnow with 29% of total national production.

Himachal Pradesh, the north-western & Himalayan state of the country has been endowed with a wide range of agro-climatic conditions due to which a large number of horticulture commodities like fruit crops, vegetables, flowers, mushroom, medicinal & aromatic plants etc. are successfully grown here. Horticulture sector in the state has made remarkable contributions in the upliftment of socio-economic conditions of the farming community. Himachal Pradesh is the only state in the country whose 89.96 per cent population lives in rural areas (Anonymous, 2018a). Therefore, the dependency on agriculture/ horticulture is eminent as it provides direct employment to about 62 per cent of total workers of the state (Anonymous, 2017-18b). The topographical variations and altitudinal differences coupled with fertile, deep and well drained soils make it an ideal region for growing almost all kinds of fruits: temperate, sub-tropical and dry fruits. This particular suitability of the state has resulted in shifting of land use pattern from agriculture to fruit crops in the past few decades. The area under fruits, which was 792 hectares in 1950-51 with total production of 1,200 tonnes, has increased to 2, 29,202 hectares during 2016-17. The total fruit production in 2016-17 was 6.12 lakh tonnes, while during 2017-18 have been reported as 5.00 lakh tonnes (Anonymous, 2017-18b).

In the sub-tropical region of the state, cultivation of citrus is an important horticulture activity. This may be judged from the fact that the area and production under citrus fruit crops has increased by leap and bounds, i.e. from 7552 hectare in 1975-76 to 24475 hectare in 2016-17. The production of citrus fruits has reached up to 28051 metric tonnes in 2016-17 (Anonymous, 2018b). Among citrus fruits, kinnow mandarin has shown tremendous potential in the foothills of the state. It plays an important role in the socio-economic transformation of rural masses in the low-hill zone of the state. It has wide adaptability to variable agro-climatic conditions and also comparatively more resistant to insect pests and diseases. In Himachal Pradesh, kinnow/orange fruit occupies an area of 8765 hectares with annual production of 14687 metric tonnes (Anonymous, 2018b). Kinnow fruits have lot of market potential, which can help in increasing the farm income.

In Kangra district of Himachal Pradesh kinnow/orange are grown on an area of about 5736 hectares with annual production of about 10430 metric tonnes (Anonymous, 2016-17). Progressive farmers prefer to grow kinnow because of its high yielding characteristics and its attractive quality that possesses the potential to give the lucrative return in the form of profit. The extent of profitability of an enterprise also depends upon the efficiency of the marketing system. The expansion in the area and production alone is not an indicator of enhanced income, but its efficient marketing management is equally important to ensure better returns from the produce. It thus, becomes pertinent to review and analyze this farm activity in totality i.e. studying both production and marketing processes simultaneously, because they are partners of a progressive system. Therefore, efforts must be made to boost area, production and efficient marketing of the produce, which is possible only when a detailed cost & returns and marketing analysis is carried out systematically. Keeping in view the above facts, the present study was conducted to evaluate the costs & returns, resource use efficiency, marketing channels, marketing cost and marketing margins in kinnow cultivation in Kangra district of Himachal Pradesh with the following specific objectives;

a) Objectives

1. To work out the costs and returns structure of Kinnow orchard at existing level.
2. To study the resource use efficiency of selected Kinnow growers.
3. To examine the marketing efficiency and major constraints in production and marketing of Kinnow.

Chapter- 2

REVIEW OF LITERATURE

This chapter is devoted to review pertinent literature keeping in view the research entitled, “An economic analysis of production and marketing of kinnow in Kangra district of Himachal Pradesh”. For any research, a comprehensive review of literature is useful in several ways. It provides a thorough insight into the method and procedures adopted by different investigators, therefore, helps in defining concepts and operational definitions, choice of analytical tools as empirical models, evaluating the findings of the research and identifying the critical gaps for further improvement in the research work. Keeping this in view, a brief account of the work done in India and abroad related to the present study has been compiled in this chapter and documented chronologically under the following sections;

2.1 Cost and returns from fruit production

2.2 Resource use efficiency

2.3 Marketing efficiency

2.4 Problems faced by fruit growers

2.5 Conclusion

2.1 Cost and return from fruit production

Sikka and Swarup (1989) conducted a study on the economics of fruit production in Himachal Pradesh. The results revealed that the payback period was 7 years for peach, plum and apricot whereas it was 8 years for pears. The net present value worked out to be Rs. 1,17,837, Rs. 89,222, Rs. 1,60,541 and Rs. 32,602 for plum, peach, apricot, and pears, respectively whereas IRR was found to be 46.06, 32.97, 47.24 and 25.30 per cent in the same order. The B: C ratio was 4.62, 3.84, 5.10 and 2.05 for these orchards, respectively. All these results indicated that plum, peach, apricot and pear orchards raising was financially viable. In addition to this, these orchards were labour-intensive and hence offer potential to generate more employment.

Rani *et al.* (1997) studied the economic aspects of pineapple production in Andhra Pradesh. The cost analysis revealed that cost A₁ and cost A₂ were the same and stood at Rs. 5,531 and Rs. 6,634 per farm and per hectare of pineapple crop, respectively, because of

the absence of leasing in practice among the sample farmers in the study area. The respective figures of cost C_1 and cost C_2 were Rs. 6,047 & Rs. 6,817 and Rs. 7,285 & Rs. 8,213 per farm and per hectare. The analysis clearly showed that the contribution of cost A_1 was more in the cost of cultivation (cost C_2) due to higher cost incurred on inputs like suckers and human labour. The benefit-cost ratio at cost C_2 was 1.01 indicating that a rupee investment in the enterprise helped the farmer to obtain a net return of Rs. 1.02. The B: C ratio when worked out at cost A_1 was 1.49. An overview of the above analysis draw our attention to the point that gross income, net income, farm business income, family labour income and farm investment income in pineapple cultivation was satisfactorily high.

Saraswat (1997) studied the organization of production and marketing of apple in Himachal Pradesh. The data on input use, production and marketing expenses and returns from apple from 50 households from the Kiari village were obtained by survey method for the year 1995-96. The study revealed that about 80 to 90 per cent of the total production of the state was exported outside the state. In the study area, the average productivity per hectare of apple orchard was 1,285 standard boxes each of 18 kg. Apple cultivation was labour and capital intensive activity. The average maintenance cost of non-bearing orchard amounted to Rs. 18,173 per hectare while it was Rs. 56,473 per hectare for bearing orchards. The input-output ratio at cost A was 4.73 while on cost C it was 1.46.

Singh and Singh (1997) studied the profitability of ber cultivation in arid region of Haryana. The data were collected from 50 respondents spread over 6 villages of Rohtak and Meham blocks in year 1992-93. The economics of ber production indicated that the net returns per hectare from the ber orchards were Rs. 4,816 and the average cost of production of ber was found to be Rs. 114 per quintal and Rs. 6,746 per hectare. The returns per rupee investment in ber orchard were Rs. 1.99. The financial analysis indicated that the investment on ber orchard is an economically viable activity. On an average, the internal rate of return was found as high as 40 per cent, with a payback period of 5 years and benefit-cost ratio of 3.53. Further, the ber cultivation emerged as a better paying proposition than any other crop rotation followed in the region. The findings of the study lead to the conclusion that ber cultivation has much potential as an economically viable alternative to existing crop cultivation.

Singh *et al.* (1997) studied the cost structure and economic potentials of horticultural crops in district Farrukhabad, Utter Pradesh. The study revealed that the cost structure of different enterprises showed a great variation on account of their input requirements. In case

of horticultural crops like guava the cost per hectare per annum was worked out to be Rs. 11,667, Rs. 13,255 for mango and Rs. 14,205 for roses (average for the first three years). In all the three crops human labour accounted for the highest share (nearly 27 per cent) in their respective total cost.

Gangwar and Singh (1998) evaluated the profitability of Nagpur mandarin cultivation in Vidarbha Region of Maharashtra on the basis of present value summation method and motorization method. The results revealed that investment in Nagpur mandarin orchards is a profitable business from the production point of view and essential for strengthening the citrus industry in domestic as well as in international markets. They also suggested that the economic productive life of Nagpur mandarin orchards is approximately 22 years and the mandarin orchards need to be replanted after it.

Khunt *et al.* (2003) studied the economics of production of pomegranate in Bhavnagar district of Gujarat. The study 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.

Mali *et al.* (2003) worked out the economics of production of banana in Jalgaon district of Western Maharashtra. They concluded that the per hectare cost of cultivation (Cost C₂) worked out to Rs. 1,33,477.36. The proportion of cost A₁, B₁ and cost C₁ to the total cost was 67.40, 71.34 and 88.11 per cent, respectively. 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 they 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 who grown *Shrimanti* variety and adopted a better package of practices. The per hectare gross returns obtained by the cultivators were to the extent of Rs. 2,14,867.24. Hence,

the per quintal cost of production came to Rs. 250.36. The per quintal gross price realized was Rs. 369.44 and the net price received by the producer was Rs. 341.89. The per hectare net profit worked out to be Rs. 66,761.87.

Lokesh *et al.* (2004) studied the economics of cultivation of passion fruit in Karnataka. The study 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 and Net Present Value was Rs.1,55,395 per hectare yielding a benefit-cost ratio of 2.17 at 15 per cent discount rate and internal rate of return was 67 per cent.

Gangwar *et al.* (2005) evaluated the economics of production and constraints in kinnow cultivation in Punjab. The study revealed that the investment in kinnow orchards was profitable from producer's point of view. It was also found that the internal rate of return (IRR) varied from 22.41 to 25.65 percent depending upon the size of orchards. The net present value, benefit cost ratio and IRR at 12 percent discount rate was worked out to be Rs. 1,10,803, 1.43 and 24.48 percent, respectively for the overall orchard group.

Saraswat *et al.* (2006) studied the production of peach fruit in Rajgarh area of district Sirmour in Himachal Pradesh. The study revealed that the average maintenance cost of peach orchard was Rs. 65,227 in which per hectare fixed cost was Rs. 43,299 and variable cost was Rs. 21,928. The higher fixed cost was due to higher prorated establishment cost. Peach production was found to be economically viable on all size of farms. Overall per hectare net returns were worked out to Rs. 8558, which were Rs. 2347, Rs. 6117 and Rs. 12,734 on marginal, small and medium size of farms, respectively.

Chand *et al.* (2008) studied the progress and potential of horticulture in India and found that the main factor underlying diversification in favour of fruits and vegetables has been higher returns relative to other crop groups. The study revealed that during 1980-81 to 2005-06 the share of fruits and vegetables in total cropped area of the country increased from 2.8 to 4.9 per cent and their share in crop output increased from 15.95 per cent to 25.61 per cent. They also found that even though productivity of fruits and vegetables is about five times the productivity of other crops, there is a need to address the decline in productivity of fruits and vegetables.

Singh *et al.* (2009) studied the production and marketing of Sangtra and Kinnow in Himachal Pradesh and found that the number of bearing trees maintained by Kangra orchardists varies from 49.50 trees on marginal farm to 500.66 trees on large farms similarly non-bearing trees varies from two on marginal farms to 83.33 on large farms. Among citrus fruits, Kinnow was ranked first followed by Sangtra, lime and Galgal by the sample orchardist. The study also revealed that the production of citrus fruits during 1994-95 to 2006-07 has shown an annual compound growth rate of 10.22 per cent. The highest growth rate was observed in Solan districts (27.86%) followed by Mandi (23.28%) and Hamirpur (19.35%).

Kour and Singh (2010) studied the marketing of kinnow in Sri Ganganagar district of Rajasthan and found that the per quintal total marketing cost was estimated to be highest when the produce was sold through commission agent to wholesaler in the wholesale market compared to produce sold through other marketing channels. As for producer's share in consumer's rupee, the average category of kinnow orchardists had an average of 61.71 per cent share in the consumer rupee in the domestic market. Channel (Producer → Consumer → Retailer) was the best channel for local marketing. It was felt that a well-organized co-operative structure is needed and this could be the only solution for the problems faced by kinnow growers.

Bhat *et al.* (2011) studied the economic appraisal of kinnow production and its marketing under North-Western Himalayan region of Jammu. The study revealed that the benefit cost ratio of kinnow vary from 1.07 to 1.65, depending on the size of orchards. The overall per acre per year returns from kinnow orchards were worked out to be Rs. 6632.

Rauf *et al.* (2011) studied economics of production and marketing of apple in Himachal Pradesh and Jammu and Kashmir and revealed that, on average situation human labour and plant protection chemicals were being used efficiently by orchardists in both the states. However, there existed a scope for increasing the levels of manures and fertilizers, expenditure on fixed assets and irrigation since currently they were used sub-optimally on the sampled orchards of Himachal Pradesh. In Jammu and Kashmir sample orchards, however, manures and fertilizers, fixed assets and irrigation revealed significant inefficiencies.

Kalamkar (2012) studied economics of production and marketing of sweet orange in Nagpur district. The study revealed that per hectare establishment cost of sweet orange on an overall basis was Rs. 70,490.23. Human labour accounted highest share i.e. 41.86 per cent.

Cost of cultivation of sweet orange for the sample as a whole was Rs. 79,532 per hectare. Total yield obtained was 103.14 quintals and its cost was Rs. 1,90,275.76. Per hectare average net returns for the sample as a whole were Rs. 96,928.21 with output - input ratio as 2.58. It was observed from the study that, per hectare cost of cultivation of orange crop decreased with increase in the age of garden.

Meena (2012) studied the economics of production and marketing of kinnow in the state of Rajasthan and found that the total cost of cultivation of kinnow was Rs. 48126.24 per hectare with Rs. 2081.68 per hectare per year as establishment cost and Rs. 46044.56 per hectare per year as maintenance cost. The per hectare total gross returns were estimated to be Rs. 2758806 and total net returns & production were estimated to be Rs 1578149.81 and 306534 kg per hectare, respectively.

Porwal (2012) studied the economics of mandarin in Jhalawar district of Rajasthan and revealed that the total cost of cultivation of mandarin was Rs. 46933.16 per hectare with Rs. 5941.55 per hectare per year as establishment cost and Rs. 40991.61 per hectare per year as maintenance cost. In establishment cost, cost of plants was the single largest cost item of operational cost. Under maintenance cost, cost of earned value of rented land was the prime component of the fixed cost. The per hectare returns from mandarin cultivation on an average were estimated at Rs. 1,12,000 for the life span of one year. The average net returns of mandarin cultivation were worked out to be Rs. 65066.84 per hectare.

Dongre (2014) studied economic analysis of production and marketing of sweet orange in Ahmednagar district of Maharashtra. The study revealed that the per hectare establishment cost of sweet orange on an overall basis was Rs. 1,39,679.56. Human labour accounted highest share i.e. 24.18 per cent. Cost of cultivation of sweet orange for the sample as a whole was Rs. 200077.21 per hectare .Total yield obtained was 112.73 quintals and its cost was Rs. 361276.26. Per hectare average net returns for the sample as a whole were Rs. 201700.33 and output - input ratio was 2.27.

Bante *et al.* (2015) studied the economics of orange production in Nagpur district of Maharashtra based on a sample of thirty orange growers. The results revealed that per hectare establishment cost during the year 2010-11 of orange orchard was Rs.1,07,824/ha with average gross returns of Rs. 20,42,094. The benefit-cost ratio on the sample as a whole was found to be 2.24.

Bhat *et al.* (2016) studied that citrus growing is profitable enterprise with average returns of Rs. 6632/acre/year against the per year operational cost of Rs. 3980/acre for the orchardists of Jammu region of J&K state. It was concluded that area under citrus crop has increased from 618.5 thousand hectares in 2001-02 to 1042.5 thousand hectares in 2012-13 whereas production also increases from 4789.1 thousand metric tonnes in 2001-02 to 10089.7 thousand metric tonnes in 2012-13.

Verma *et al.* (2016) studied the profitability of kinnow mandarin cultivation in Himachal Pradesh. It was found that the average net profit per hectare was Rs. 4372.16 to Rs. 11319.86 and it increased with the increase in the size of farms. The overall input-output ratio was 3.44 on the basis of total cost of cultivation for large orchardists followed by medium farms (2.96) and small farms (2.63).

Kumar *et al.* (2017) studied the economics of kinnow production and marketing in Sirsa district of Haryana. The results revealed that the average first year establishment costs per hectare for kinnow was Rs. 3,99,466. The overall per hectare per year returns from kinnow orchards have been worked out to be Rs. 125478. The overall economic viability of the kinnow fruit, mainly net present value, internal rate of return, benefit-cost ratio and payback period have been computed as Rs. 261258, 15.57 per cent, 2.19 and 7.6 years, respectively.

2.2 Resource use efficiency

Thorat *et al.* (1989) made an attempt to estimate the resource productivity in Alphonso mango production and factors contributing to the yield in Ratnagiri district of Maharashtra. The study revealed that age of the orchard, number of the bearing trees and bearing score were important factors contributing in the yield of Alphonso mango. Further, marginal value product or factor cost ratios of cash input factors indicated the scope to intensify the use of manures and chemical fertilizers and plant protection chemicals. It was indicated that expenditure on human labour needed to be curtailed.

Koujalagi and Kunnal (1995) studied the resource use efficiency in pomegranate production. They Cobb Douglas production function analysis revealed that the regression coefficient for land, labour, manures and fertilizer were highly significant. The coefficient of multiple determinations (R^2) was 0.70. This indicated that the variable included in the function explained about 70 per cent of the variation in the gross returns from the orchards.

Thorat *et al.* (2006) studied the total factor productivity (TFP) in horticultural crops in Konkan region of Maharashtra and revealed that the magnitude of TFP growth varied from 1.3 per cent per annum during the 1990s to 6.2 per cent per annum during the 1980s. During the entire period under study (1981-2000), TFP has been found growing at the rate of 5.4 per cent per annum. The results present a divergent picture of horticultural growth in the Konkan region during the period under study. Investment on research has been the major source in TFP growth. The returns to horticultural research were high pay-off to the tune of IRR 119 per cent.

Muhammad (2007) studied the technical efficiency of sweet orange production among the small scale farmers in Osun State of Nigeria for the year 1999. He reported that the number of stands and size of sweet orange farms were the significant factors which affected sweet orange production in the study area. He found that 88 per cent variation in the output of sweet orange production was due to the technical inefficiency of the farmers. It was also found that the technical efficiency of sweet orange production among the small scale farmers in the study area was fairly high with a mean of 86.33 per cent. He opined that farmers need to be assisted in setting up sweet orange plantation as a way of increasing the output in the study area. The technical efficiency of sweet orange production among the small scale farmers was fairly high and the high differential in the efficiency estimates of the farmers indicated that sweet orange production in the study area can be increased simply by increasing the efficiency of production.

Iqbal *et al.* (2009) studied the technical efficiency of citrus production in Sangodha district, Punjab with the help of Cobb-Douglas production function. The results revealed that that less amount of fertilizer use and heavy seasonal pruning were major determinants of low productivity of citrus in the study area. The analysis also revealed that farmers in 2006-07 were technically less efficient by more than half as compared 2005-06, which resulted in overall decrease in the citrus productivity in 2006-07 nearly one third of production of previous year.

Yeware *et al.* (2009) analyzed the resource productivity and resource use efficiency in sweet orange production. The results showed that the partial regression coefficients of manure (0.126), irrigation (0.124), machine labour (0.048) and hired human labour (0.092) were positive and significant. It was also observed that these resources when increased by one per cent each, led to increase the production of sweet orange by 0.126, 0.124, 0.048 and 0.092 per cent, respectively. With regard to optimum resource use it was observed that

optimum use of manure was 300.34 quintals followed by irrigation (11823.26 m³), hired human labour (109.65 man days), machine labour (16.95 hours) and potash (125.91 kg).

Iqbal *et al.* (2010) analyzed the resource use efficiency and investment appraisal of mango in rain fed ecosystem of Jammu district of India. The results revealed that human labour was significant and underutilized in mango in all groups except in 20-24 year group where it was non-significant and over utilized. Manures & fertilizers, plant protection and pruning and training were over utilized in 10-14 year group while as in other groups these inputs were underutilized in all groups except pruning & training in the overall group where it was over utilized. The pruning & training were over utilized up to 14th year and from 15th year onwards it was underutilized. The instability was found higher in case of area as compared to yield and net returns.

Sekhon *et al.* (2010) evaluated technical efficiency in crop production based on different regions of Punjab for the year 2007 for the adoption of latest technology by the farmers. They estimated technical efficiency of individual farms through stochastic frontier production function analysis. They revealed that the technical efficiency exhibited wide variation across the regions. They indicated that the production function estimates had pointed towards the presence of disguised unemployment in the sub-mountainous region of Punjab state. They also found that the average technical efficiency was found maximum in the central region (90 per cent), followed by south-western and sub-mountainous regions. They reported that the main drivers of inefficiency have been identified as lack of experience in agriculture and the increasing age of the farmer.

Amor and Muller (2010) estimated the technical efficiency of irrigated agriculture by the application of stochastic production frontier. They estimated agricultural technology for Tunisian peasants, accounting for the crop choice of peasants and distinguishing inputs for individual crops such as vegetable farming, cereal and fruit-trees. Among the irrigated crop farmers, the significant variables were farm yard manure, fertilizer quantity, labour, mechanic traction and among of irrigated water applied. The study provided conclusive evidence that more than 85 per cent of the variation in the Tunisian irrigated output among farmers was due to the differences in their efficiencies. They revealed that the predicted technical efficiency widely varied across farms and crops from an average of 54.7 per cent for vegetable farming upto 80.6 per cent for fruit-trees. The study also revealed that the cultivation of cereals and fruittrees was found to be more efficient than vegetables farming.

Bhat *et al.* (2011) analysed the resource use efficiency of lemon cultivation in Jammu region of J&K state. The overall values of regression coefficients were found as 0.451, 1.257, -0.002, and -0.0023 for human labour, manure & fertilizers, irrigation, plant protection and training/ pruning, respectively, out of which human labour and manure & fertilizers were statistically significant, indicating that one percent increase of expenditure on these two inputs could increase the return to the extent of 0.45 per cent and 1.26 per cent, respectively, while as in case of irrigation, plant protection and training/ pruning one percent additional investment could decrease the production by 0.011 per cent, 0.03002 per cent and 0.023 per cent, respectively. The marginal value productivities of human labour and manure & fertilizers were positive with their value at 0.111 and 0.882, respectively where as that of irrigation (-0.020), plant protection (-59.710) and training/pruning (-0.039) were negative thereby indicating that with an additional one rupee spent on these inputs could reduce the total returns and hence should be checked.

Kumar *et al.* (2011) examined the resource-use efficiency for hill agriculture in Mandi district of Himachal Pradesh for the year 2008. They fitted Cobb-Douglas production function to examine the input- output relationship and also used frontier production function to determine the extent of efficiency in important crops among various sub-ecological regions. The study revealed that the use of seed and FYM (owned inputs) was higher on high hills followed by mid hills and low hills. They found that as far as fertilizer use was concerned, higher use was found for maize in comparison to other crops. They indicated that the use of human and bullock labour was more in low hills followed by mid hills. They also found that the FYM for maize and fertilizer for wheat in high hills had significant and positive influence on productivity. They estimated that the technical inefficiency in inputs resulted in 38 per cent less output than the frontier output in low hills, 43 per cent less in mid hills and 39 per cent less in high hills, which could be achieved by the farmers with better management and/or operations. They suggested that this can be made possible by providing good quality seeds, easy and cheap credit for the purchase of crucial inputs like fertilizers, plant protection chemicals, etc. on time.

Kachroo *et al.* (2012) analysed the resource use efficiency of orange and kinnow cultivation in Jammu region of J&K state. It was found that the regression coefficient values of selected inputs under orange orchards, mainly human labour, manures & fertilizers, irrigation, plant protection and training/ pruning varied significantly at the five age groups of five years from 5th to 28th years, corresponded to overall values as 0.955, 0.012, -0.012, 0.013

and -0.050, respectively. Out of which human labour, manures & fertilizers and plant protection with positive sign indicated that with one per cent increase in the use of these inputs, the output could be increased by 0.96 per cent in case of human labour and 0.01 per cent each in other two inputs. The regression coefficient of training/ pruning was statistically significant but negative indicating that one per cent increase in expenditures on training/ pruning could decrease the output to the extent of 0.05 per cent. The marginal value productivities of human labour, manures & fertilizers and plant protection were positive with their values at 0.185, 110.452, 0.076, respectively, whereas that of training/ pruning (-0.638) and irrigation (-0.054) were negative thereby indicating that there still existed scope of investing on human labour, manures & fertilizers and plant protection. The overall regression coefficient values obtained from kinnow cultivation were 0.029, -0.024, 0.016, 0.015 and 0.138 for human labour, manures & fertilizers, irrigation, plant protection and training/ pruning, respectively, out of which human labour and training/ pruning were statistically significant, indicating that one per cent increase in expenditures on these two inputs could increase the output to the extent of 0.03 per cent and 0.14 per cent, respectively. The regression coefficients of irrigation, plant protection and manures & fertilizers were non-significant. The marginal value productivities of human labour, irrigation, plant protection and training/ pruning were positive with their values at 0.031, 0.025, 0.014 and 0.175, respectively, whereas that of manures & fertilizers (-0.027) was negative thereby indicating that there still existed scope in the investment on human labour, irrigation, plant protection and training/ pruning.

Sharma and Dwivedi (2013) analysed the trends of area, production and productivity of major fruit crops in Himachal Pradesh. The study revealed that the growing of major fruit crops was not risky in the state as showed by the lower coefficient of variation (less than 100.13%). The results also revealed that the increase in production was due to the increase in area as well as interaction of area and productivity of fruit crops in the state. This may be due to the adoption of high yielding variety seed of major fruit crops and adoption of improved methods by the farming community during the last decade.

Chand et al. (2017) conducted study on resource use efficiency and marketing analysis of apple crop in Shimla district of Himachal Pradesh. Various factors like use of labour, pesticides, FYM, fertilizers and area under apple cultivation were regressed through Cobb-Douglas production function and the results showed that all these factors directly affected apple yield. Input of labour and fertilizers was moderately affecting the apple yield.

Increase in the pesticides input and area under apple cultivation by 1 per cent augmented the apple yield by 0.55 and 0.44 per cent respectively.

2.3 Marketing efficiency

Toor and Poonia (1995) studied marketable surplus and price spread in the marketing of kinnow in Hoshiarpur district of the Punjab state. The results revealed that average marketable surplus on small, medium and large farms worked out at 96.34 per cent, 97.72 per cent and 98.70 per cent, respectively of total kinnow production. The pre-harvest contract system was pre-dominant method of marketing kinnow fruits and about 70 per cent of the marketable surplus was sold through this system. The producer received maximum share of the consumer rupee (50.86 per cent) by selling the produce to Punjab Agro-industries Corporation.

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) and 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 %).

Singh *et al.* (1999) analysed the price spread in marketing of mango in district Samastipur, Bihar. The study revealed that generally, the mango produced in the project area is either sold at distant markets through pre harvest contractor or it is marketed through wholesaler in the local markets. The analysis further revealed that the producer's share in the consumer's rupee varied between 43.17 to 62.20 per cent in the identified channels and the rest 37.80 to 56.83 per cent was absorbed in meeting out the various costs and margins of marketing. The analysis also indicated that expenses on transportation accounted between 27.98 to 48.62 per cent of the total marketing cost in the identified channels followed by cost on packaging boxes and plucking charges. It further revealed that retailers obtained highest margin followed by pre-harvest contractors and wholesalers in the identified channels of marketing. The study concluded that the mango marketing in the project area is highly disorganized resulting in immense loss to the mango growers and suggested that proper facility and transportation be created and the producer – farmers be encouraged to market their produce themselves to earn economic returns for their produce.

Sharan and Singh (2002) examined the pattern of sales, marketing costs and margins for kinnow in Rajasthan. They found in their study that the producer's share in consumer's

rupee is more in indirect sale as compared to contract sale, due to elimination of pre-harvest contractor. Marketing cost and margin indicate that producer's share in consumer's rupee may be increased by decreasing the number of intermediaries in the existing marketing system.

Bala (2006) evaluated marketing systems for apple in hills including the prospects and problems in Kullu district of Himachal Pradesh for the year 2001. The study estimated marketable surplus, which varied from 99.25 per cent on small farms to 99.82 per cent on large farms. The study pointed out the need for improving the existing marketing system and developing innovative alternatives to promote producer's economic welfare. The study indicated that a substantial improvement in producer's share in consumer's rupee was expected to bring a desirable change in existing farm land uses towards more remunerative and employment generating farm activities in apple farming.

Radha *et al.* (2006) conducted a study to analyse the economics of production and marketing of grape in Andhra Pradesh. The results revealed that among the three channels identified for marketing of grapes, channel I (producer – commission agent – retailer – consumer) was the most popular. However, the most efficient marketing channel was channel II (producer - consumer) with 7.45 efficiency, followed by channel III (producer – retailer – consumer) with 6.65 efficiency and channel I with 2.85 efficiency.

Gangwar *et al.* (2007) estimated the post-harvest losses in kinnow mandarin in Punjab and found that a majority of kinnow producers sell their orchards to the pre-harvest contractors/ traders at different stages. The aggregate post-harvest loss from orchards to consumers in kinnow in two different markets ranges from 14.87 per cent in Delhi market to 21.91 per cent in Bangalore market. It has indicated the necessity of establishing kinnow processing industries for development of value-added ready-to-serve (RTS) quality products, minimizing post-harvest losses and providing remunerative price to the producers.

Anchal and Sharma (2009) studied price spread of litchi in Gurdaspur district of Punjab with a view to examine various marketing channels and price spreads of litchi in the study area. The results of the study showed that the producer reviled the maximum share in the consumers' rupee whereas the consumer paid the minimum price when the litchi was sold as well bought in the local market. The margins of the middlemen between producer and consumer was found to be at the tune of Rs. 255.80 in the channel producer –retailer – consumer in local market, Rs. 524.80 in the channel of producer – pre-harvest contractor – retailer – consumer in Amritsar market and Rs. 910.49 per quintal in the channel producer –

pre-harvest contractor- retailer – consumer in Delhi market. This increase in the margins of middlemen and costs of litchi per quintal led to the higher price spread in the marketing of litchi from local to Amritsar and further to Delhi market.

Singh *et al.* (2009) studied the production and marketing of Sangtra and Kinnow in Kangra and Sirmour districts of Himachal Pradesh and revealed that the Kangra growers generally send the produce to Jassur and Pathankot markets whereas, the markets like Poanta Sahib, Dehradun, Yamuna Nagar and Chandigarh are more popular with Sirmour district. The producer share in consumer rupees for Sangtra was 55.07 and 55.37 per cent in Pathankot and Jassur markets, respectively. The Kangra producers realized higher returns in Pathankot market for both Sangtra and Kinnow. The market costs incurred by orchardists of Sirmour have been worked out for Rs.50.28, Rs.69.03, Rs. 59.28 and Rs.60.08 for Sangtra in Poanta Sahib, Yamuna Nagar, Chandigarh and Dehradun markets respectively. The marketing cost of Kinnow has been observed to be almost the same. The producer's share in consumer rupees for Sangtra was 54.70, 46.02, 46.63, and 51.52 per cent in Poanta Sahib, Yamuna Nagar, Chandigarh and Dehradun markets respectively. The producers of Sirmour district realized highest net price for Sangtra in Dehradun market (Rs. 149.92), followed by Poanta Sahib (Rs. 49.72), Yamuna Nagar (Rs.135.97) and Chandigarh (Rs. 120.02).

Kour and Singh (2010) studied the marketing of kinnow in Sri Ganganagar district of Rajasthan and found that the per quintal total marketing cost was estimated to be highest when the produce was sold through commission agent to wholesaler in the wholesale market compared to produce sold through other marketing channels. As for producer's share in consumer's rupee, the average category of kinnow orchardists had an average of 61.71 per cent share in the consumer rupee in the domestic market. Channel (Producer → Consumer → Retailer) was the best channel for local marketing. It was felt that a well-organized co-operative structure is needed and this could be the only solution for the problems faced by kinnow growers.

Bhat *et al.* (2011) studied the Economic Appraisal of Kinnow Production and its Marketing under North-Western Himalayan Region of Jammu and revealed that the average per quintal marketing cost at producers' level was found to vary to the extent of Rs. 450, Rs.375, Rs.303 and Rs.223 for channels I (Producer → Forwarding/ Commission agent → Retailer → Consumer), channel II (Producer → Wholesaler → Retailer → Consumer), channel III (Producer → Retailer → Consumer) and channel IV (Producer → Consumer), respectively. The average per quintal marketing cost borne by the wholesaler in channel II

was Rs.61, while 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 revealed that producers' share in consumers' rupee was found highest (about 81%) in channel-IV, due to self-sale in the local market. The marketing efficiency has 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.

Rauf *et al.* (2011) studied economics of production and marketing of apple in Himachal Pradesh and Jammu and Kashmir and revealed that channel (Producer→Pre-harvest contractor → Commission agent →Retailers→Consumer) was patronized by about 11 per cent of the sample orchardists in Himachal Pradesh and more than 17 per cent growers in Jammu and Kashmir. Channel (Producer→commission agent→wholesaler→ retailers→ consumer) is largest channel through which 56 per cent of produce in HP and 64 per cent in J& K is routed. This channel was found most popular among apple producers in both the study regions.

Mavi *et al.* (2012) investigated the efficiency of various marketing models and problems of kinnow growers of Punjab and revealed that kinnow prices show negative response to arrivals and positive response to lagged prices. The study has shown that the kinnow growers suffered a loss by selling produce to pre-harvest contractors as their share in consumer rupee was low. It has been brought out in the study that kinnow growers would gain financially by selling their produce themselves in the markets. The lack of market information and marketing infrastructure, inadequate processing and post-harvest facilities and frequent price fluctuations have been identified as the major factors which inhibit expansion of kinnow cultivation in the state.

Meena (2012) studied the economics of production and marketing of kinnow in the state of Rajasthan and revealed that kinnow producers sold their produce through four marketing channels viz., channel-I (Producer→Retailer→Consumer), channel-II (Producer→Wholesaler→Retailer→Consumer), channel-III (Producer→Pre harvest contractor→Wholesaler→Retailer→Consumer) and channel-IV (Producer→ Pre harvest contractor →Retailer→Consumer). Among these channels, channel-I was found most important channel for farmers in study area. The total marketing cost were Rs. 100.90, 247.85, 280.11 and 132.46 per quintal of kinnow in channel-I, II, III and IV. The items which accounted for a

large share in marketing cost were basket and jute palli charges, commission, storage, transportation, market fee and value of quantity loss. The producer's share in consumers' rupee were 71.86, 59.38, 56.58 and 66.23 per cent in channel-I, II, III and IV, respectively.

Porwal (2012) studied the economics of mandarin in Jhalawar district of Rajasthan and results related to marketing of mandarin revealed that mandarin producers sold their produce through two marketing channels viz., Channel-I (Producer→Village Trader→Wholesaler→Retailer→Consumer) and Channel-II (Producer→Wholesaler→Retailer→Consumer). Among these channels, channel-II was found most important channel in the study area.

Grover *et al.* (2013) analysed the economics of marketing of kinnow in Punjab. They revealed that Kinnow growers in the state have been benefitted by selling their produce through direct marketing/ emerging marketing channels (EMC). Despite incurring higher marketing costs, the net price received by them was about 20 per cent higher than those received by farmers who disposed of their produce through traditional marketing channel (TMC) viz., pre-harvest contractors. The share of kinnow growers in the price paid by consumer under TMC was only 33.70 per cent, while the same in case of EMC was 55 per cent. They concluded that the expansion of such innovative/direct/emerging marketing channels for fruits in an organized manner, coupled with upgraded market infrastructure can go a long way to promote horticultural base in the state through reducing intermediaries, increasing net returns for the producers as well as for the benefit of the consumers.

Bhat *et al.* (2015) made a detailed analysis of citrus fruit by studying its marketing costs and price spread in Samba district of Jammu region. The marketing chain of three types mainly Producer→Forwarding/ Commission agent→Retailer→Consumer (channel I), Producer→Retailer→Consumer (channel II) and Producer→Consumer (channel III) were followed in the sample area. The results showed that the average per quintal marketing cost at producers' level varied to the extent of Rs.438.65, Rs.264.00 and Rs.226.67 per quintal for channel I, II and III, respectively. As far as the price spread analysis is concerned, the per quintal net price received by the producer was about Rs.945.90, Rs.1036.00 and Rs.1073.33 which was about 44.00 per cent, 51.29 per cent and 82.56 per cent of the price paid by the consumer for channel I, II and III, respectively. A comparison of different channels thus showed that producers' share in the consumers' rupee was the highest in case of channel III as compared to other channels. The channel-III with marketing efficiency 4.74 was most efficient followed by Channel-II (1.05) and channel-I (0.79).

Romana and Sachdeva (2015) compared the economics of kinnow marketed in the local as well as in the distant markets by Punjab farmers. The results revealed that fruit sold in the distant markets after due value addition can fetch better returns over the local market. Further producer wholesaler-retailer-consumer model is best as per quick disposal of huge quantity of fruit is concerned.

Verma *et al.* (2015) analyzed the economics of kinnow production and its marketing in lower hills of Himachal Pradesh and found that net farm income was highest in the category of large farms (87.09%) and the lowest in small ones. This indicated that farmers with larger holdings were more inclined towards horticultural crops particularly kinnow. 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.

Chand *et al.* (2017) conducted study on resource use efficiency and marketing analysis of apple crop in Shimla district of Himachal Pradesh and revealed that highest share of produce was traded through channel producer-primary wholesaler-secondary wholesaler-retailer-consumer (60%) followed by channel producer- primary wholesaler -retailer-consumer (29%) which implies that former channel was more efficient in apple transactions to the consumers. Study suggested that apple production is a profitable enterprise and is in its mature state in Himachal Pradesh as depicted by positive and increasing returns to scale respectively.

Kumar *et al.* (2017) studied the economics of kinnow production and marketing in Sirsa district of Haryana and found that the average per quintal marketing cost at producers' level varied to the extent of Rs. 1120, Rs. 1120, Rs.1195.83 and Rs. 1215.61 for channels -I (Producer → Pre-harvest contractor → Commission agent→ Wholesaler → Retailer → Consumer), channel - II (Producer → Pre-harvest contractor → Commission agent→ Retailer → Consumer), channel - III (Producer → Commission agent→ Retailer → Consumer) and channel - IV (III (Producer → Consumer), respectively. A comparison of price spread through different marketing channels revealed that producers' share in consumers' rupee was the highest (about 82.21%) in channel-IV, due to self-sale in the local market. The marketing efficiency has been found to be highest in channel-IV. The producer got maximum benefits in

channel-IV, therefore they concluded that this channel should be followed to make producer highest beneficiary; although this channel has its own limitations.

2.4 Production and marketing constraints

Putto and Razdan (1989) studied the constraints in the production of walnut in India. The constraints that account for the productivity and quality of walnut in India can be grouped as; Production constraints, Protection constraints and Processing constraints. The constraints related with low production was that non-availability of suitable root stocks, superior walnut strains and their multiplication, lack of standard propagation techniques, inadequate knowledge about the cultural practices, manuring, fertilization and pollination, etc. Problems with protection was that of non-availability of proper plant protection machinery, non-availability of water, provision of irrigation and carrying out plant protection measures need water, non-availability of suitable granular systemic insecticides or fungicides, gaps in knowledge about the biology of important pest and disease of walnut. At last the constraints associated with the processing comprised with lack of knowledge about the proper stage of maturity on tree, proper methods of bleaching and removing of stain from walnut shell and nonremunerative usage of walnut shells, hulls and other by products, adds to the low returns.

Sikka and Swarup (1989) conducted a study on the economics of fruit production in Himachal Pradesh and identified certain problems in fruit marketing like non-availability of inputs, high cost of labour, non-availability of packaging material at specific time, no storage facility etc. The farmers also faced many problems during transportation such as vehicles were not available in time, absence of link roads and high cost of transportations. The study also identified the problems of higher commission charges and lack of information about prices and supplies. The study suggested that the net returns of farmers could be increased by efficient marketing system.

Atibudhi (1997) conducted a study on the constraints associated to 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 the need for replacement of very old fruit trees with new ones, 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 that of 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 knowhow on pineapple cultivation and maintenance of hedgehogs were another problems complained by 85 per cent of the sample farmers.

Singh *et al.* (1997) studied the prospects of fruits cultivation in canal command area of Bikaner, Rajasthan. They revealed constraints faced by the farmers in regard to the cultivation of fruit crops such as problems relating to soil salinity, technical know-how, post-harvest handling, marketing and financial assistance.

Subrahmanyam (1998) in the summaries of group discussion on the subject “Horticulture in India, Organization of Production, Marketing and Processing” pointed out that there are two types of risks faced by the cultivators; the price risk i.e. the wide price fluctuations due to oversupply in peak season and the risk created by the middlemen in the market i.e. illegal deductions, overcharging, offering low prices through collusion and under weighing.

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 per cent). 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 have experienced that prices they received were not remunerative.

Choudhary (2006) studied that knowledge and adoption of recommended kinnow production technology by the farmers of Sriganganagar district of Rajasthan. The results revealed that the constraints which were most perceived by the farmers in adoption of recommended kinnow production technology where high initial cost in establishing of orchard, irregular water supply from the canal, lack of proper market and lack of need based training. Among technical constraints the irregular water supply from the canal was the most

perceived constraints, whereas the height cost in establishing of orchard was the major economic constraints.

Madulu and Chalamila (2007) examined the potential and constraints of fruit trees in coastal region of Tanzania for the year 2005. They reported that lack of reliable markets, lack of improved varieties, lack of technical knowledge and attack of pest and diseases were the major production constraints faced by 85 per cent of the farmers. They reported that for 50 per cent of farmers, lack of improved varieties was one of the production constraints. They indicated that the shortage of labour was another problem, as 52 per cent of growers perceived it.

Kaur and Gupta (2008) studied the problems and strategies in production and marketing of fruits and vegetables in India for the year 2003. They reported that in the emerging scenario of fruits and vegetables, productivity of fruits showed a negative growth rate while in the case of vegetables there was a positive growth rate. They indicated that there was great fluctuation in month-wise arrivals and prices of horticultural crops, thereby indicating large seasonal variability. They noticed that due to post-harvest losses, the per capita availability of fruits and vegetables declined.

Verma and Gupta (2008) determined the constraints in production and marketing of summer fruits and vegetables in Mahanadi river bed area of Raipur district, Chhattisgarh, for the year 2004. They selected five major fruits and vegetables, namely, watermelon, muskmelon, pumpkin, cowpea and cucumber. They found that 92 per cent of the farmers experienced the problem of lack of recommended package and practices in the crops followed by unbalanced use of manure and fertilizer in the fruit crops.

Singh *et al.* (2009) studied the production and marketing of Sangtra and Kinnow in Kangra and Sirmour districts of Himachal Pradesh and found that citrus fruit orchards were not properly maintained, the varieties grown were low yielding one and quality of produce was also not good. For these reasons the farmers of the state were getting poor returns from citrus fruit orchards. The findings of the study also revealed that packing of fruit from Himachal Pradesh was not being undertaken properly resulted in poor quality and quantity of fruits during transit to various markets.

Meena (2012) studied the economics of production and marketing of kinnow in the state of Rajasthan and found that major problems in cultivation of kinnow in the study area were lack of irrigation facilities, marketing, problem of intercultural operations, problems of

adverse weather conditions, short supply of labourers, lack of storage facilities, high cost of improved variety seeds, no timely sale of product, high marketing cost, low price of kinnow and fear of thieves & stray animals.

Porwal (2012) studied the economics of mandarin in Jhalawar district of Rajasthan and identified lack of irrigation facilities, problems of inter cultural operations, prevailing adverse weather conditions, short supply of labourers, high marketing cost, high cost of improved variety seeds, low price of mandarin and fear of thieves and stray animal as most important problems faced by the farmers in cultivation of mandarin in the study area.

Malik (2013) examined the problems with regard to apple production and marketing in Kashmir valley for the year 2011. The results showed that the main reason for mismatch in supply and demand of apples was the lack of cold and conditional atmosphere storage in the valley and the valley did not possess a single cold storage for apple preservation by the government. He also indicated that 4, 00,000 tonnes of apples are ruined by scab every year. The results further revealed that the price risk was faced both by growers and contractors, as market price fluctuates for apple crop. The researcher also noticed that the growers lack regulated markets, co-operative societies and existence of organized & planned irrigation infrastructure for the orchards in the valley.

Bhat *et al.* (2015) studied the various production and marketing constraints faced by the citrus growers of various districts of Jammu region. The data revealed that in Jammu region as a whole, in the cultivation of citrus several constraints such as lack of finance and credit facilities, inadequate irrigation facilities, non-availability of good quality seedlings, farmyard manure, educated members of their family go outside and lack of latest technical knowledge were predominant and expressed by most of the farmers. In the process of marketing, lack of processing units and marketing societies was the major constraint as expressed by almost all the respondents. Moreover, not getting remunerative price for the produce, un-organized marketing, low price paid to farmers, less demand of fruits, lack of market information and cheating in marketing by the middlemen in the form of malpractices, high and undue marketing margins and deductions in the market were the other major problems expressed by the farmers.

2.5 Conclusion

The literature review outlined above has highlighted various aspects of cost & returns, resource use efficiency, marketing issues and constraints in production and marketing of

various perennial fruit crops and kinnow in particular. The literature reviewed has also helped to identify some of the important factors which influence the production and marketing of kinnow in different states of the country. In recent years, there have been numerous studies both at macro and micro level focusing on various aspects of economics of kinnow production and marketing. However, in Himachal Pradesh no part of proposed research work has been carried out in recent past. Looking to the importance for kinnow cultivation in the state, it is essential that farmers must be motivated to adopt the kinnow cultivation on a large scale. Further, the obstacles in the way of adoption of kinnow cultivation by the farmers must properly be identified and removed. Therefore, a detailed and in depth analysis of economics of kinnow production and marketing is essential, so that suitable policy prescriptions can be designed. Hence, the present study is an attempt to fill this gap of knowledge.

Chapter-3

MATERIALS AND METHODS

This chapter deals with the methodology followed to accomplish the objectives of the study. The description of 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 are described under the following sub-heads:

Section 3.1: Sampling procedure

Section 3.2: Collection of data

Section 3.3: Analytical tools and techniques employed

Section 3.4: Definition of terms and cost concepts used

Section 3.5: Limitations of the study

3.1 Sampling procedure

3.1.1 Selection of the study area

For the present study, Kangra district of Himachal Pradesh was selected purposively as this area represents the main kinnow growing belt of the state and contributes significantly to area and production of kinnow in the state.

3.1.2 Selection of the sample

A multistage sampling technique was adopted to select the ultimate sample of the respondents. At the first stage of sampling, out of total 15 blocks falling in the Kangra district, two blocks namely Indora and Nurpur were selected purposively as these are major kinnow growing blocks of the Kangra district. At the second stage, a list of villages growing kinnow in each selected block was prepared and ten villages from each block were selected randomly. At the third stage, list of farmers growing kinnow was prepared

and a sample of five kinnow growers from each selected village was selected randomly to constitute a sample size of 100 farmers in total.

For the analysis of data, the selected farmers were further categorized into three categories according to the number of plants, viz., small (<300 plants) medium (300-700 plants) and large (>700 plants) through cumulative cube root frequency method. Thus, the total sample of 100 farmers consisted of 46 small farmers, 39 medium farmers and 15 large farmers.

Table 3.1: Distribution of sampled orchardist according to numbers of plants

Category of farmers	Numbers of plants	Numbers of farmers	Percentage
Small	<300	46	46.00
Medium	300-700	39	39.00
Large	>700	15	15.00
Total		100	100.00

3.1.3 Selection of market and market intermediaries

Marketing is an important operation in kinnow production. Therefore, to examine the various marketing aspects of kinnow, five pre-harvest contractor, five wholesalers and five retailers were selected randomly from the Jassur and Pathankot markets to study the functioning of the markets in the study area.

3.2 Collection of data

To meet the objectives of the present study both primary and secondary data was 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), cost of production, yield, marketing cost, marketing margin, marketing loss, mode of transportation and problems faced by the farmers on various aspects of production and marketing was collected on well-designed pre-tested schedule from the selected households by adopting a personal interview method in the study area during the year 2017-18.

3.2.2 Secondary information

The secondary data pertaining to the list of villages, households, area and production of kinnow etc. were collected from Horticulture Department and Block Development offices.

3.3 Analytical tools and techniques employed

To fulfill the specific objectives of the study, based on the nature and extent of availability of data, the following analytical tools and techniques have been adopted.

3.3.1 Tabular analysis

3.3.2 Cost and returns concepts

3.3.3 Economic viability of kinnow plantation

3.3.4 Resource use efficiency

3.3.5 Market analysis

3.3.6 Production and Marketing constraints.

3.3.1. Tabular analysis

Simple tabular analysis was used to examine the socio-economic status, land use pattern, cropping pattern, source of irrigation, livestock inventory, marketing channels, price spread and grower's opinions about the production and marketing problems of kinnow in the study area. Simple statistical tools like averages and percentages were used to compare, contrast and interpret the results. The sex ratio, literacy rate, literacy index and cropping intensity were calculated using the following formulae:

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

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

$$\text{Literacy Index} = \frac{\sum W_i X_i}{\sum X_i}$$

Where,

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

X_i = Number of persons in respective category.

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

3.3.2 Cost and returns concepts

In determining the cost and returns of perennial crops, age of plantation plays an important role. Hence, to account for the value of time and include the concept of time preference, a cash flow analysis of various categories of kinnow orchards was attempted by discounted cash flow approach. Since the collection of time series data pertaining to single farm holding is difficult, the analysis of life cycle data was made based on cross sectional information from kinnow plantation of different ages to approximate the entire plantation life cycle. Since average life of the plantation was considered 20 years, so, all the cost items were considered for 20 years.

The cost incurred in the initial year has been termed as establishment cost. The cost incurred for 2nd, 3rd and 4th year has been termed as maintenance cost during non-bearing stage and cost incurred in the age group of 5-8, 9-12, 13-16 and 16-20 years has been termed as maintenance cost during bearing stage of kinnow plantation. For computation of costs, various concepts viz. Total Fixed Cost, Total Variable Cost and

cost concepts framed by CACP viz. Cost A₁, Cost A₂, Cost B₁, Cost B₂, Cost C₁, Cost C₂ and Cost D (Appendix VII) were used.

CostA₁ = Expenditure on casual labour, gap filling, FYM, fertilizer, plant protection, interest on working capital, risk margin, land revenue, annual depreciation, interest on past establishment cost, prorated establishment cost.

Cost A₂ = CostA₁ + rent paid for leased-in land.

Cost B₁ = CostA₁ + interest on value of owned fixed capital excluding land.

Cost B₂ = CostB₁ + rental value of owned land + rent paid for leased-in land.

Cost C₁ = CostB₁ + imputed value of family labour.

Cost C₂ = CostB₂ + imputed value of family labour.

Cost D= Cost C₂ +10 per cent of cost C₂ on account of managerial function performed by the farmer.

3.3.3 Economic viability of kinnow plantation

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

a) Net Present Value

Net present value of an investment has been defined as the discounted value of all cash inflows, net of all cash outflows of the project during its life span. The net present values of the project have been estimated using the following equation that assumes all returns arise on the last day of each year, therefore,

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

Where,

- NPV = Net present value in period 't'
- B_t = Benefit from kinnow plantations in each year
- C_t = Cost of kinnow plantation in each year

- r = Discount rate
- t = 1,2,3...n, the entire life of plantation across the study regions (comprising four years of non-bearing stage followed by 16 years bearing stage).
- n = number of years

b) 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, can be computed as:

$$\text{B: C Ratio} = \frac{\sum_{t=1}^n \frac{B_t}{(1+r)^t}}{\sum_{t=1}^n \frac{C_t}{(1+r)^t}}$$

c) Annuity

Annuity value of the project is the annual expected income from the project. It was computed as follows:

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

Where,

- A = Annuity value
- i = Rate of interest

d) Internal rate of return

It is used to evaluate the overall feasibility of kinnow plantations in the study area. The internal rate of return is that discount rate at which the NPV is Zero. Derivation of the IRR is analogous to solving for ‘rate of interest’ in the equation given as under:

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

Where,

$$\text{LDR} = \text{Lower discount rate}$$

e) Pay-Back 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,

$$t^* = \text{the lowest value of } t$$

3.3.4 Resource use efficiency

For evaluating the economic efficiency of resources use in kinnow production multiple regression analysis was carried. Some of the non-strategic collinear variables were dropped from the analysis to improve the precision of regression parameter. The variables considered for explaining the level of production at the farmers end in regression equations were same between sampled categories and Cobb-Douglas type of production function was used as;

$$Y = aX_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4}$$

Log equation;

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

Where,

- Y = Gross returns per hundred plants (Rs.)
- X₁ = Human labour expenditure (Rs.)
- X₂ = Expenditure on farm yard manure (Rs.)

- X_3 = Expenditure on fertilizers (Rs.)
 X_4 = Expenditure on plant protection measures (Rs.)
 a = Intercept
 b_1 to b_4 are the elasticity coefficients.

The specification of the variables is given as under;

1. **Gross returns (Y):** The production has been defined as the gross value of the crop in money terms evaluated by converting the physical products into money values by multiplying yield by the prices in the reference year.
2. **Human labour (X₁):** Labour was measured in adult mandays of eight hours in this study.
3. **Farm yard manure (X₂):** Expenditure on farm yard manure has been evaluated by multiplying the physical quantities of farm yard manure used on the orchard by their respective prices.
4. **Fertilizers (X₃):** Expenditure on fertilizers has been evaluated by multiplying the physical quantities of different fertilizers used on the orchard by their respective prices.
5. **Plant protection (X₄):** Expenditure on plant protection material has been evaluated by multiplying the physical quantities of different chemicals by their respective prices.

3.3.4. Marginal Value productivity

In order to evaluate the economic rationale of resource use on different categories of farms, the marginal value productivities (MVPs) of different resources was calculated by multiplying regression coefficient of given resources with the ratio of geometric means of gross return to the geometric mean of given resources. The marginal value product of a particular resource represents the expected addition to the gross returns caused by an addition of one unit of that resource while other inputs are held constant. The formula for MVP is given as:

$$MVP (X_i) = b_i \frac{Y(G.M.)}{X_i(G.M.)}$$

Where,

MVP (X_i) is the marginal value productivity of ith resources

b_i is the regression Coefficient (estimated)

GM (Y) is the Geometric Mean of Output (yield)

GM (X_i) is the Geometric Mean of ith resources.

3.3.5 Market analysis

3.3.5.1 Marketing cost

The total marketing cost (MC) incurred by the producer / seller and by various intermediaries was calculated as:

$$MC = C_F + C_W + C_R$$

Where,

MC is the marketing cost

C_F is the cost incurred by farmer

C_W is the cost incurred by wholesaler and

C_R is the cost incurred by retailer.

3.3.5.2 Marketing margin

Marketing margin of the middlemen is the difference between the total payment (marketing cost + purchase price) and receipts (sale price) of the middlemen and was calculated as;

$$A_{mi} = P_{ri} - (P_{pi} + C_{mi})$$

Where,

A_{mi} is the absolute marketing margin of ith middlemen

P_{ri} is the total value of receipts per unit

P_{pi} is the purchase value per unit

C_{mi} is the cost incurred on marketing per unit.

3.3.5.3 Marketing Loss

The loss in the total value of produce due to injury/damage caused during handling of produce from the point of harvest till it reached the consumers was estimated as per equation:

$$ML = \{L_F \times GP_F\} + \{L_W \times GP_W\} + \{L_R \times GP_R\}$$

Where,

L_F is the physical loss in produce from harvest till it reaches to assembly market

GP_F is the gross price received by the farmers

L_W is the physical loss in produce from market till it reaches to retailer

GP_W is the gross price received by wholesaler

L_R is the physical loss in produce from retailer till it reaches to the consumer

GP_R is the gross price received by retailer.

3.3.5.4 Marketing Efficiency

For estimation of Marketing Efficiency (ME), Acharya and Agarwal approach (2001) was used which is given as:

$$ME = \frac{NP_F}{MM + MC + ML}$$

Where,

NP_F is the net price received by the farmers (Rs/kg)

MM is the marketing margin

MC is the marketing cost and

ML is the marketing loss.

3.3.6 Production and Marketing constraints

To study the various problems associated with the production and marketing of kinnow it is assumed that the extent of a particular problem varies from place to place and farmer to farmer. The selected sample farms were contacted through survey for

analyzing the constraints faced by them at various levels. The multiple responses of producers reporting various problems were taken into consideration for analysis.

3.3.6.1 Chi-square test

Chi-square test was used to test whether there is any significant difference among small, medium and large farms for the problems faced by them. The details of Chi-square test (χ^2) is given as under:

$$\sum_{i=1}^k \frac{(O_i - E_i)^2}{E_i} \sim \chi^2 (L - 1) (K - 1) \text{ d. f.}$$

Where,

O = Observed values

E = Expected values

K = number of problems

L = number of farm size groups.

3.4 Definitions of the terms and cost concepts used

The concepts and definitions of economic variables used in the study are outlined in this section.

3.4.1 Variable cost

Variable cost includes the expenditure made on labour, material input cost, interest on working capital, risk margin and managerial cost.

3.4.2 Family labour

Family labour cost was calculated on the basis of wages paid to hired labour.

3.4.3 Hired human labour cost

Hired human labour cost was estimated in terms of wages actually paid to the hired labour (8 hours of work in a day was considered as one man day).

3.4.4 Planting material cost

The planting material cost was worked out at the actual price paid by farmers for buying the planting material in the study area.

3.4.5 Fertilizer cost

The fertilizers cost was calculated at the actual price paid by farmers for the purchase of fertilizers.

3.4.6 Plant protection

The various plant protection chemicals used for kinnow were assessed. Charges actually paid by the farmers were calculated by multiplying the quantity of the various pesticides, insecticides, fungicides and herbicides with the market rates charged.

3.4.7 Interest on working capital

Interest on working capital is charged at the rate of 4 per cent per annum.

3.4.8 Risk margin

Risk margin is charged at 10 per cent of working capital.

3.4.9 Managerial cost

Managerial cost is charged at 10 per cent of working capital.

3.4.10. Fixed cost

It included land revenue, annual depreciation, interest on fixed capital, rental value of land, interest on past establishment cost and prorated establishment cost.

3.4.11 Land revenue

Actually paid land revenue by the farmers was taken into the study.

3.4.12 Interest on fixed capital

Interest on fixed capital has been charged at the rate of 5 per cent per annum on the average value of farm buildings, farm implements and other fixed assets which are exclusively used.

3.4.13 Rental value of land

Rental value of land was evaluated at the rate of one fourth of the total produce produced and then converted into monetary units by multiplying it with prevailing farm harvest price.

3.4.14 Interest on past establishment cost

In the non-bearing stage the interest on past establishment cost in each year has been charged at 6.75 per cent per annum.

3.4.15 Prorated establishment cost

The establishment cost is distributed over the bearing life (n) using principle of amortization at given rate of interest and is charged at 5 per cent and is amortized for 20 years during the bearing stage, with the following formula:

$$P = E.C. \frac{i}{1 - (1+i)^{-n}}$$

Where,

- P = Amount of annual amortized cost.
- E.C. = Establishment cost (cost during non-bearing stage).
- n = Number of productive life period of crop in years
- i = Interest rate

3.4.16 Marketing agencies

In the marketing of kinnow, the following agencies were involved:

a) Producer

Orchardist himself was one of the important market functionaries performing various functions in kinnow 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.

b) Pre-harvest contractor

The contract of kinnow produce on the basis of quality and quantity of fruits available in the orchard is made by pre-harvest contractor before harvesting.

c) Wholesaler

Wholesaler played an important role in the marketing process. Wholesaler buys the produce from farmers/market intermediaries and sells to the retailer/consumer for their own gain.

d) Retailer

They purchase the produce from the wholesaler and sell it to the consumer.

e) Consumer

Local practitioners or households are the ultimate consumers.

3.5 Limitations of the study

The study is based on the data collected for one year only i.e. 2017-18, which may not necessarily hold true for other periods as well. The data were collected by survey method through personal interview with the sample farmers. Generally, the farmers were not maintaining the proper farm records and estimates were provided by the recall memory. However, 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 in averages.

Chapter-4

RESULTS AND DISCUSSION

In this chapter efforts have been made to discuss the economics of kinnow production, its marketing efficiency and production and marketing problems faced by the kinnow growers in the study area. The collected data were tabulated and analyzed pertaining to different objectives of the study. For the sake of convenience, the results are presented and discussed under the following sections:

- Section 4.1 : Socio-economic characteristics of sample orchardists
- Section 4.2 : Existing resource structure
- Section 4.3 : Costs and returns of kinnow cultivation
- Section 4.4 : Resource use efficiency
- Section 4.5 : Marketing of kinnow
- Section 4.6 : Production and marketing problems faced by the sample orchardists

4.1 SOCIO- ECONOMIC CHARACTERISTICS OF SAMPLE ORCHARDISTS

4.1.1 Type of family

The distribution of kinnow growers according to the type of family has been given in Table 4.1 which has shown that percentage of joint families was worked out to be 45.65, 51.28 and 40.00 per cent for small, medium and large categories of farmers, respectively. The maximum percentage of joint families was found on the medium farm category while minimum percentage was found on the large farm category. The analysis has revealed that maximum percentage of the nuclear families was found on the large farm category (60.00 per cent) and minimum percentage was found in medium category (48.72 per cent). Overall situation shows that the 47.00 per cent families were found to be joint and 53.00 per cent as nuclear families.

Table 4.1: Distribution of sample households according to type of family (Farm category wise)

Family type	Small	Medium	Large	Overall
Numbers of Joint families	21 (45.65)	20 (51.28)	6 (40.00)	47 (47.00)
Numbers of Nuclear families	25 (54.35)	19 (48.72)	9 (60.00)	53 (53.00)
Total	46 (100.00)	39 (100.00)	15 (100.00)	100 (100.00)

Figures in parenthesis are percentages to total.

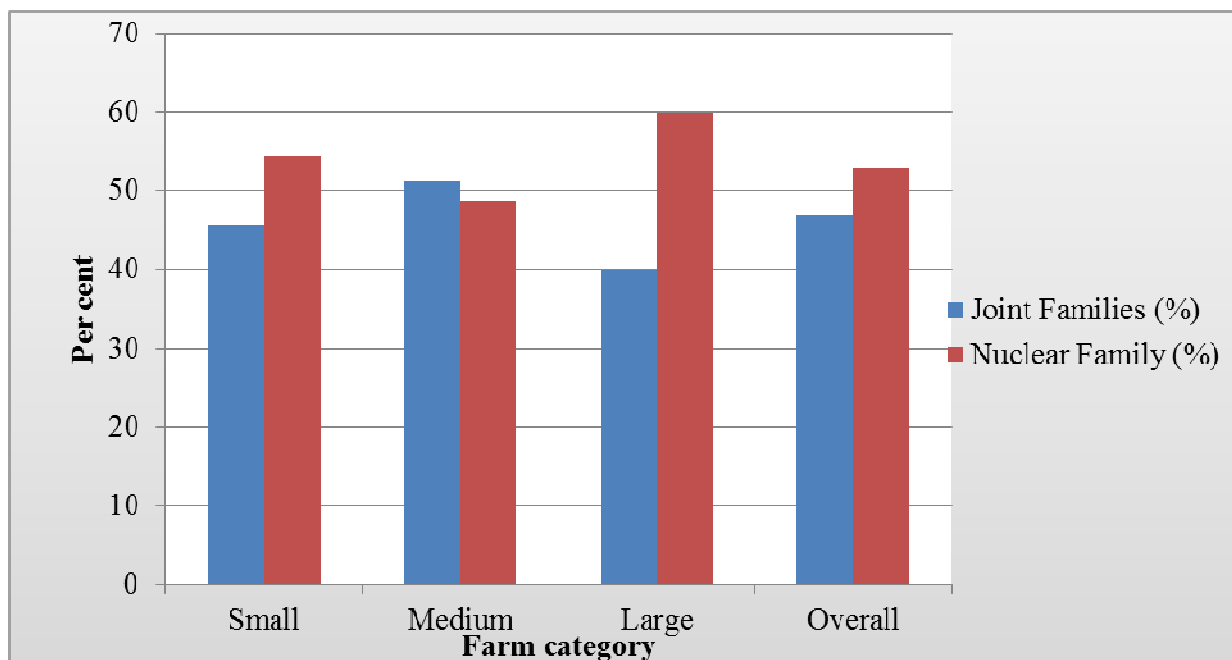


Fig 4.1 Type of family of sample households

4.1.2 Size of the family

Table 4.2 revealed that the average size of the family was maximum on the medium farm category (4.97) followed by 4.67 and 4.53 on small and large categories, respectively. Under overall situation, family size was found to be 4.77 with 52.83 per cent males and rest females. The number of females per thousand of males was worked out to be 868, 904 and 944 for small, medium and large farm categories, respectively.

Table 4.2: Distribution of sample households according to size of family (Farm category wise)

Particulars	Small	Medium	Large	Overall
Average family size	4.67 (100)	4.97 (100)	4.53 (100)	4.77 (100)
Average numbers of males	2.50 (53.53)	2.61 (52.52)	2.33 (51.43)	2.52 (52.83)
Average numbers of females	2.17 (46.47)	2.36 (47.48)	2.20 (48.57)	2.25 (47.17)
Sex ratio	868	904	944	893

Figures in parenthesis are percentages to average family size.

4.1.3 Literacy status

Education has remained the basis for the economic development of any society. This is true in the field of farming as well, because the literate persons in general, are better placed to perceive and adopt new technologies than illiterates. The results of educational status showed that the 8.70, 7.69 and 6.67 per cent of the sample orchardist were found to be illiterate in small, medium and large categories, respectively. Thus overall 8.00 per cent farmers were found to be illiterate. The percentages of farmers having education up to graduation were found to be highest in the small category (32.61%) followed by medium (20.51%) and large (20.00%) category. Highest education level was found to be senior secondary i.e. 31.00 per cent out of total sample size.

The results also revealed that on overall basis, the literacy rate was 92.00 per cent while among different categories it varied between 91.30 to 93.33 per cent. The literacy rate was observed higher in case of males in comparison to females. However, literacy index varied from 3.07 to 3.52 among the different categories of the farms with an overall index of 3.36. This highlights the fact that literacy rate in the study areas is higher, but the quality of education is poor as indicated by low literacy index, so there is scope of improvement in the literacy status.

Table 4.3: Literacy status of sample orchardists (Farm category wise)

Particulars	(No.)			
	Small	Medium	Large	Overall
Illiterate	4 (8.70)	3 (7.69)	1 (6.67)	8 (8.00)
Primary	3 (6.52)	2 (5.13)	2 (13.33)	7 (7.00)
Middle	2 (4.35)	5 (12.82)	2 (13.33)	9 (9.00)
Matriculation	8 (17.39)	8 (20.51)	3 (20.00)	19 (19.00)
10+2	14 (30.43)	13 (33.33)	4 (26.67)	31 (31.00)
Graduate	15 (32.61)	8 (20.52)	3 (20.00)	26 (26.00)
Total	46 (100.00)	39 (100.00)	15 (100.00)	100 (100.00)
Literacy rate	91.30	92.31	93.33	92.00
Literacy index	3.52	3.28	3.07	3.36

Figures in parenthesis are percentages to total.

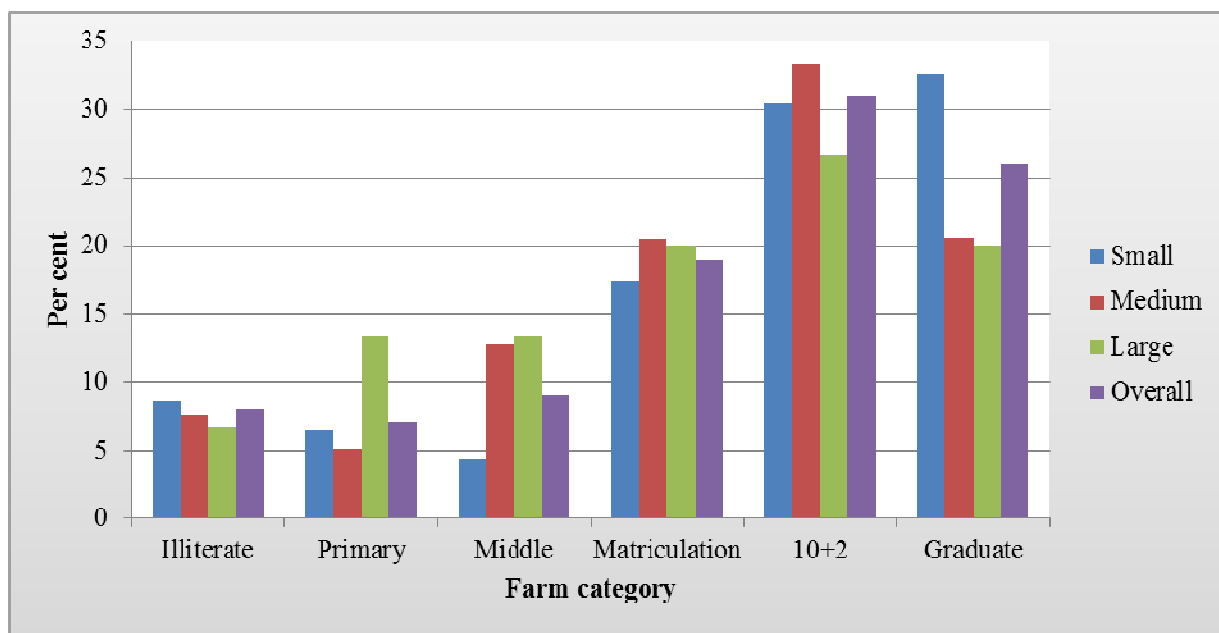


Fig 4.2 Literacy status of sample households

4.1.4 Occupational distribution

Occupational distribution of the farmers has been considered very important in determining the economic status of the family. It is assumed that more developed is the area, the more diversified is the employment pattern and same would result in increased income to the household. The occupation structure revealed that agriculture was main occupation as 69.00 per cent of selected households practice farming in the study area while remaining 31.00 per cent had service and business as their main occupation (Table 4.4). Out of total farmers having subsidiary occupation, 17.00 per cent had service as main occupation and 14.00 per cent had business as main occupation. Similar trend in occupational distribution was observed in case of small and medium farm categories. In case of large farms, business was preferred more than services.

Table 4.4: Distribution of sampled households according to their main and subsidiary occupation (Farm category wise)

Farm Size	Total farmers	No. of farmers with main occupation as agriculture	No. of farmers with other subsidiary occupation	Service	Business
Small	46 (100.00)	29 (63.04)	17 (36.96)	10 (21.74)	7 (15.22)
Medium	39 (100.00)	30 (76.92)	9 (23.08)	5 (12.82)	4 (10.26)
Large	15 (100.00)	10 (66.67)	5 (33.33)	2 (13.33)	3 (20.00)
Overall	100 (100.00)	69 (69.00)	31 (31.00)	17 (17.00)	14 (14.00)

Figures in parenthesis are percentages to total.

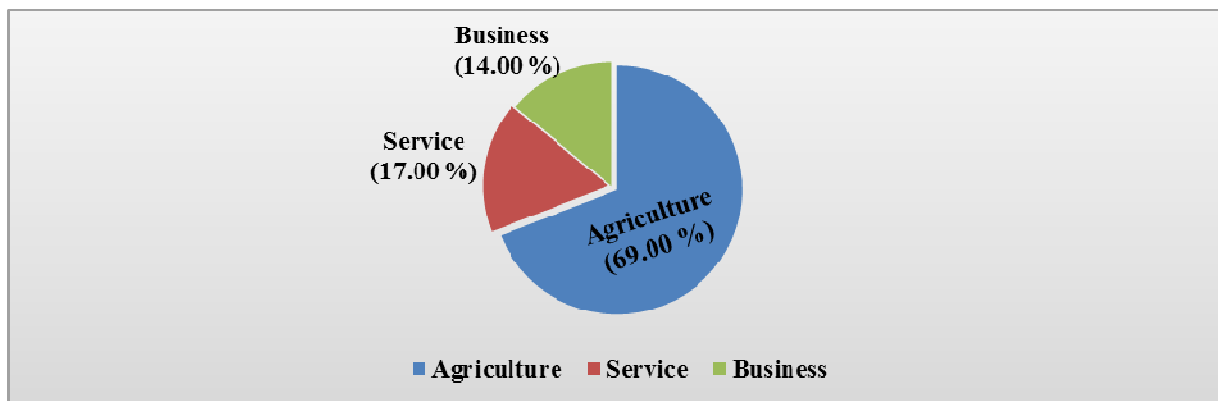


Fig 4.3 Occupational distribution of sampled households

4.2 EXISTING RESOURCE STRUCTURE

This section deals with the existing resource structure like land, labour, cropping pattern, livestock, farm investment, etc. Category wise results in different aspects are given below:

4.2.1 Land use pattern

Land is a basic resource in an agrarian economy. Land use pattern determine the type of farming system and attains a special status in determining the income generation opportunities, especially in rural areas. The land utilization pattern on different categories of farms in the study area has been summarized in Table 4.5. The average size of holding of small, medium and large farmers was found to be 0.70, 2.44 and 4.21 hectares, respectively. The average size of land holdings on overall category was found to be 1.90 hectares.

Table 4.5: Land use pattern of sample households (Farm category wise)

(in hectare)					
Sr. No.	Particulars	Small	Medium	Large	Overall
1.	Area Under food crops	0.21 (30.00)	0.48 (19.67)	0.7 (16.63)	0.39 (20.53)
i)	Irrigated	0.14 (20.00)	0.35 (14.34)	0.58 (13.78)	0.29 (15.26)
ii)	Un-irrigated	0.07 (10.00)	0.13 (5.33)	0.12 (2.85)	0.10 (5.26)
2.	Orchard Area	0.42 (60.00)	1.87 (76.64)	3.31 (78.62)	1.42 (74.74)
i)	Irrigated	0.36 (51.43)	1.68 (68.85)	3.05 (72.45)	1.26 (66.32)
ii)	Un-irrigated	0.06 (8.57)	0.19 (7.79)	0.26 (6.18)	0.16 (8.42)
3.	Forest land	0.02 (2.86)	0.02 (0.82)	0.04 (0.95)	0.02 (1.05)
4.	Pasture land	0.03 (4.29)	0.04 (1.64)	0.09 (2.14)	0.04 (2.10)
5.	Barren land	0.01 (1.43)	0.01 (0.41)	0.01 (0.24)	0.01 (0.53)
6.	Land put to non-agricultural use	0.01 (1.43)	0.02 (0.82)	0.06 (1.43)	0.02 (1.05)
7.	Total area	0.70 (100.00)	2.44 (100.00)	4.21 (100.00)	1.90 (100.00)

Figures in parenthesis are percentages of total area.

The results also showed that the area under orchard varied between 60.00 to 78.62 per cent of total land holding among the different categories of farm. Under over all scenario maximum percentage of area was found to be under orchard (74.74%) followed by food crops (20.53%), pasture land (2.10%), forest land (1.05%), land put to non– agricultural use (1.05%) and barren land (0.53%).

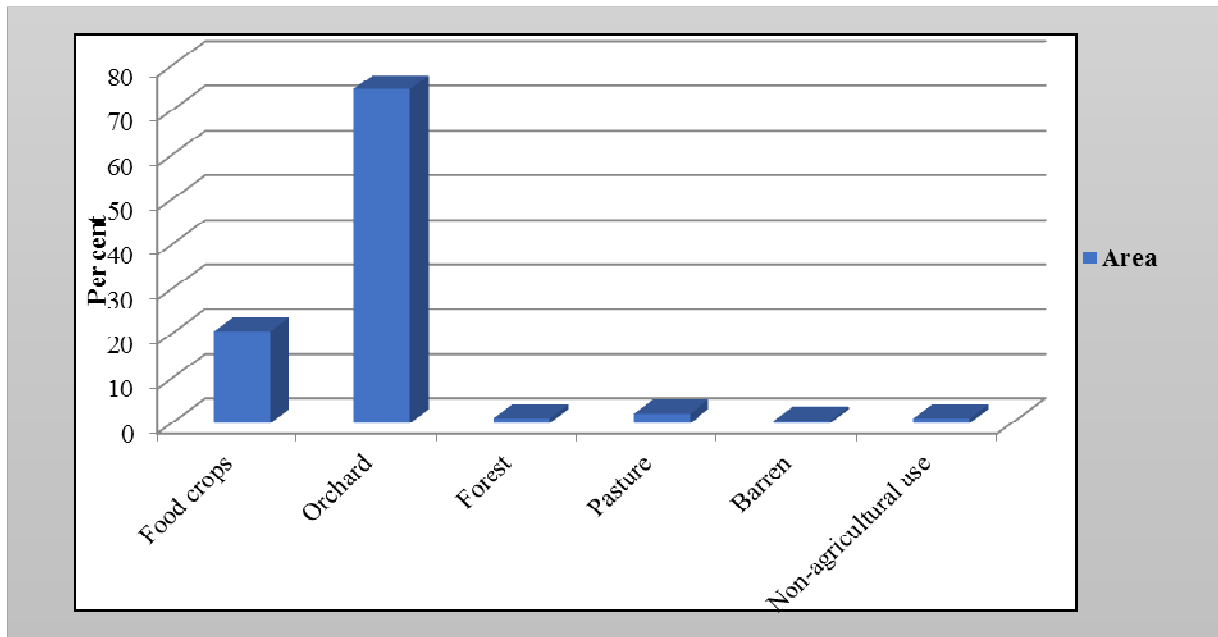


Fig 4.4 Overall land use pattern of sample households

4.2.2 Cropping pattern

Cropping pattern in any region depends mainly on soil, altitude, microclimate, availability of resources and management factors. The change in per cent share of area under different crops in the gross cropped area reveals the extent of agricultural diversification on sample farms. 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 farming in the area. The proportional share of a particular crop in gross cropped area on farm suggests the importance that the farmer attaches to a particular crop. The importance can be both of economic nature as well as social consideration on the part of the farmer.

The cropping pattern of sample farms was analyzed and presented in Table 4.6. It is evident from the table that the cropping intensity was highest on small farms (133.33%) followed

by medium farms (120.85) and large farms (117.46%). Overall, it was worked out to be 121.55 per cent which indicates that there is a scope for increase in farm efficiency. Lower cropping intensity is because of the area under fruit crop which accounted more than 50 per cent of gross cropped area. At overall level, wheat was found to be dominant crop of Rabi season and maize was found to be dominant crop in kharif season. The area under kinnow varied from 29.64 to 39.70 per cent of gross cropped area on different categories of farms. Overall, the area under kinnow was 33.64 per cent of gross cropped area.

Table 4.6: Cropping pattern of sample households

(in hectare)

Crops	Farm Size			
	Small	Medium	Large	Overall
Rabi				
Wheat	0.15 (17.86)	0.38 (13.38)	0.58 (12.31)	0.3 (13.64)
Mustard	0.02 (2.38)	0.04 (1.41)	0.04 (0.85)	0.03 (1.36)
Vegetables	0.03 (3.53)	0.05 (1.76)	0.06 (1.27)	0.05 (2.27)
Others	0.01 (1.19)	0.01 (0.35)	0.02 (0.42)	0.01 (0.45)
Kharif				
Maize	0.14 (16.47)	0.32 (11.27)	0.51 (10.83)	0.27 (12.27)
Paddy	0.03 (3.57)	0.09 (3.27)	0.1 (2.12)	0.06 (2.73)
Vegetables	0.04 (4.76)	0.06 (2.22)	0.07 (1.49)	0.05 (2.27)
Others	0.003 (0.36)	0.01 (0.42)	0.02 (0.42)	0.01 (0.45)
Kinnow	0.25 (29.64)	0.89 (31.41)	1.87 (39.70)	0.74 (33.64)
Other Fruits	0.17 (20.24)	0.98 (34.51)	1.44 (30.57)	0.68 (30.90)
Gross cropped area	0.84 (100.00)	2.84 (100.00)	4.71 (100.00)	2.2 (100.00)
Net Sown Area	0.63	2.35	4.01	1.81
Cropping Intensity	133.33	120.85	117.46	121.55

Figures in parenthesis are percentages of gross cropped area.

4.2.3 Investment on farm implements

Farm investment pattern has been found to determine adoption of specific farm activities and hence determinant of farming system. Farmers make investment on different equipments because these make the farming activity easier to perform. Farm implements have been grouped into two categories namely major implements and minor implements. A detailed account of farm investment on implements has been presented in Table 4.7.

Table 4.7: Average numbers and value of implements in different farm categories

Implements	Small		Medium		Large		Overall	
	No.	Value (Rs.)	No.	Value (Rs.)	No.	Value (Rs.)	No.	Value (Rs.)
Major implements								
Wooden plough	0.37	56.52 (1.63)	0.49	65.64 (91.52)	0.47	565.67 (9.84)	0.43	60.10 (1.43)
Iron Plough	0.44	103.26 (2.98)	0.49	128.21 (2.72)	0.53	133.33 (2.32)	0.47	117.50 (2.80)
Leveller	0.63	140.22 (4.050)	0.77	179.49 (3.81)	0.47	113.33 (1.97)	0.66	151.50 (3.65)
Knapsack Sprayer	0.52	494.57 (14.29)	0.62	578.21 (12.28)	0.73	690.00 (11.99)	0.59	556.50 (13.24)
High Power Sprayer	0.22	197.13 (5.695)	0.36	443.08 (9.41)	0.33	376.67 (6.55)	0.29	308.50 (7.34)
Sub total	2.18	991.70 (28.65)	2.73	1394.63 (29.62)	2.53	1879.00 (32.67)	2.44	1194.10 (28.45)
Minor implements								
Shovels (Phawada)	1.39	221.74 (6.41)	1.82	290.51 (6.17)	1.73	292.00 (5.08)	1.61	259.10 (6.16)
Pickaxe (Gainti)	0.85	209.78 (6.06)	0.97	262.31 (5.57)	1.27	325.33 (5.66)	0.96	247.60 (5.89)
Axe (Kulhadi)	1.02	304.35 (8.792)	1.56	475.64 (10.10)	1.93	554.00 (9.63)	1.37	408.60 (9.72)
Hoe	0.11	42.39 (0.25)	0.26	105.13 (2.233)	0.27	120.00 (2.09)	0.19	78.50 (1.87)
Machetes (Darrat)	1.89	432.61 (12.49)	1.87	482.82 (10.25)	2.13	536.67 (9.33)	1.92	467.80 (11.12)
Sickle	3.11	269.35 (7.78)	3.41	258.97 (5.50)	3.26	295.00 (5.13)	3.25	269.15 (6.40)
Spade	1.76	89.35 (2.58)	1.82	88.97 (1.88)	2.13	106.67 (1.85)	1.84	91.80 (2.18)

Pruning Saw	0.2	165.20 (4.77)	0.36	306.40 (6.51)	0.53	456.70 (7.94)	0.31	264.00 (6.28)
Basket Kiltas	1.02	144.78 (4.18)	1.59	167.44 (3.556)	2.4	208.67 (3.63)	1.45	163.20 (3.88)
Plastic Kiltas	0.54	104.35 (3.01)	1.15	198.72 (4.22)	1.27	233.33 (4.07)	0.89	160.50 (3.82)
Plastic Crates	3.11	160.90 (4.47)	4.87	205.90 (4.37)	5.53	216.70 (3.77)	4.16	186.80 (4.44)
Ladders	0.76	325.00 (9.39)	0.95	470.51 (9.99)	1.00	526.67 (9.16)	0.87	412 (9.80)
Sub total	15.76	2469.80 (71.35)	20.63	3313.32 (70.38)	23.45	3871.74 (67.33)	18.82	3009.05 (71.55)
Total	17.94	3461.50	23.36	4707.95	25.98	5750.74	21.26	4203.15

Figures in parenthesis are percentages to total value.

It can be observed from table that investment per farm was found to be Rs. 3461.50, Rs. 4707.95 and Rs. 5750.74 on small, medium and large farm categories, respectively, while overall investment was found to be Rs. 4203.15. A positive relationship was found between the farm size and the investment on farm implements in the study area. Overall, out of the total investment on implements, farmers were found to be investing 28.45 per cent on major implements and 71.55 per cent on minor implements. Among major implements the investment expenditure constituted highest proportion on knapsack sprayer (13.24%) followed by high power sprayer (7.34%), leveler (3.65%), iron plough (2.80%) and wooden plough (1.43%). Among the minor implements the carriage implements like kiltas, crates and baskets comprised of 12.14 per cent of the total investments. Investment on equipment like shovels, pickaxe, axe, hoe, machetes, sickle, spade, pruning saw and ladders was worked out to be 6.16, 5.89, 9.72, 1.87, 11.12, 6.40, 2.18, 6.28 and 9.80 per cent, respectively of total investment, on overall basis.

4.2.4 Source of irrigation

The results revealed that out of total cultivated area, 92.70 per cent of the area was found to be irrigated. Maximum percentage of irrigated area was found on large farm category (95.51%) followed by medium (90.64%) and small farm (82.54%). The table also revealed that out of total sample farmers, 10.00 per cent were found to be using *Kuhl* as source of irrigation and 13.00, 31.00, 16.00, 23.00 and 7.00 per cent of farmers were found to be using *Nallah*, tank, bore-well, tube-well and drip irrigation system, respectively.

Table 4.8 Irrigated area and source of irrigation (Farm category wise)

Farm categories	Total cultivate area (ha)	Irrigated Area (ha)	Source of Irrigation (No.)						Overall
			Kuhl	Nallah	Tank	Bore-well	Tube-well	Drip System	
Small	0.63	0.52 (82.54)	9	7	17	3	10	0	46
Medium	2.35	2.13 (90.64)	1	6	12	6	9	5	39
Large	4.01	3.83 (95.51)	0	0	2	7	4	2	15
Total	6.99	6.48 (92.70)	10 (10.00)	13 (13.00)	31 (31.00)	16 (16.00)	23 (23.00)	7 (7.00)	100 (100.00)

Figures in parenthesis are percentages to overall total.

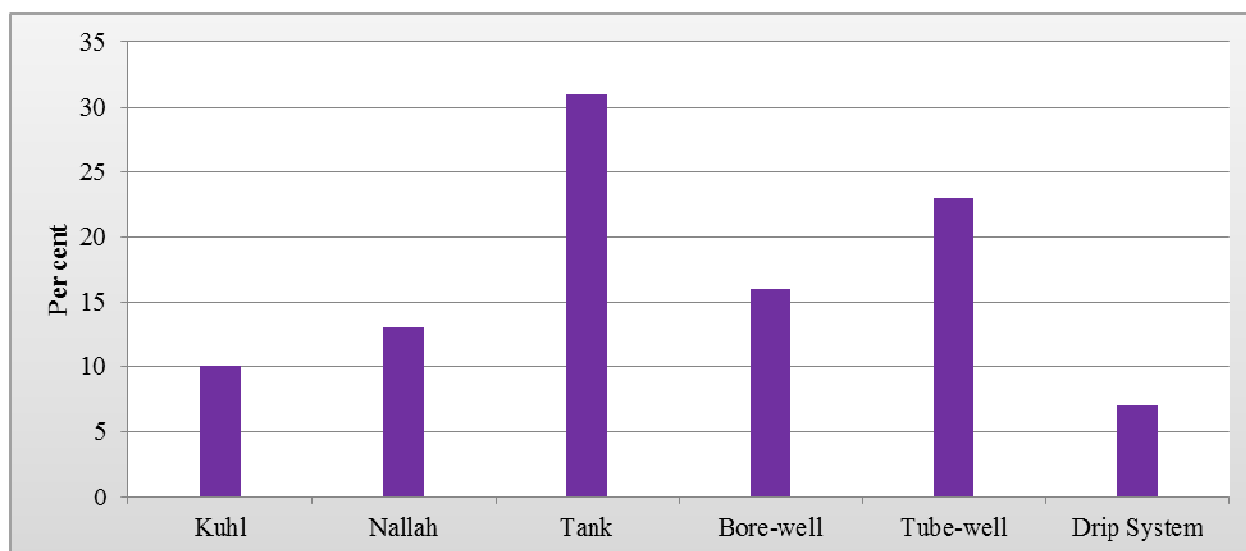


Fig. 4.5 Sources of irrigation in the study area

4.2.5 Livestock inventory

Livestock rearing is an integral part of farming system in the hilly states. Generally, the farming community maintains a livestock unit in order to meet their household's need for milk, milk products and farm yard manure (FYM). It is a good supplementary source of income for the farmers. Livestock and crop components have symbiotic relationship with each other as crop by-product provides fodder for livestock which in turn supply valuable FYM for cultivation of various crops. The detailed view of different types of livestock being kept on different categories

of selected farms was analyzed and presented in Table-4.9. The table revealed that farmers in small category were having more number of animals (3.89) as compared to medium (3.53) and large category (3.85). It was found that on overall basis, out of total number of animals, cow was most preferred farm animal (35.56%) followed by buffaloes (31.02%), young stocks (13.90%), goat/sheep (9.69%), mule (6.95%) and poultry (2.94%).

Table 4.9: Livestock inventory of sample orchardists (Farm category wise)

(No.)

Particulars	Small	Medium	Large	Overall
Cows	1.46 (37.53)	1.26 (35.69)	1.13 (29.35)	1.33 (35.56)
Buffaloes	1.2 (30.85)	1.05 (29.75)	1.33 (34.55)	1.16 (31.02)
Goat/Sheep	0.33 (8.48)	0.38 (10.76)	0.4 (10.39)	0.36 (9.63)
Young Stocks	0.57 (14.65)	0.46 (13.03)	0.53 (13.77)	0.52 (13.90)
Mule	0.26 (6.68)	0.23 (6.52)	0.33 (8.57)	0.26 (6.95)
Poultry	0.07 (1.80)	0.15 (4.25)	0.13 (3.38)	0.11 (2.94)
Total	3.89 (100.00)	3.53 (100.00)	3.85 (100.00)	3.74 (100.00)

Figures in parenthesis are percentages to total.

4.3 COSTS AND RETURNS OF KINNOW CULTIVATION

This section deals with the economic viability of kinnow cultivation in the study area. 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 helps in decision making about the selection of an enterprise. The data on costs and returns lead the planners to decide economical areas of production subject to the availability of raw materials. At the micro level, it enables the farm management experts to study the efficiency of the various cultivation practices and helps the experts to make practical recommendations for farm planning aimed at better allocation of existing resources which would further increase the efficiency of crop production.

The analysis of economics of production of kinnow in the study area has been discussed under establishment cost which includes initial cost of plantation plus the cost of maintaining the kinnow plantation during non-bearing stage and expenditure incurred during bearing stage. The costs and returns were worked out on hundred plant basis under small, medium, large and for overall farm categories. For estimating the cost and returns estimates for kinnow, it has been assumed that:

- i) Total economic life of kinnow plantation is 20 years.
- ii) First bearing start from 5th year onward.
- iii) The major operation and input requirement remains same in the groups 5-8, 9-12, 13-16 and 17-20 year old plants.

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

- 4.3.1 Cost of plantation (initial investment)
- 4.3.2 Maintenance cost during non-bearing stage of kinnow orchard.
- 4.3.3 Maintenance cost during bearing stage of kinnow orchard.
- 4.3.4 Returns from kinnow cultivation
- 4.3.5 Economic viability of kinnow orchards

4.3.1 Cost of plantation (initial investment)

The item wise plantation cost of kinnow incurred in the initial year is presented in Table 4.10. It is imperative to examine the resource position of the growers before deciding to establish an orchard. It is clear from the table that, kinnow orchardists in study area incurred on an average, a total cost of Rs. 7960.76 per hundred plants, at the initial stage. The variable cost and fixed cost was found to be 62.45 and 37.55 per cent of total cost for all farms. In small, medium and large categories, the initial cost was Rs. 7748.35, Rs. 8071.30 and Rs. 8319.78, respectively. The variable & fixed costs accounted for 61.84 & 38.16 per cent, 62.71 & 37.29 per cent and 63.02 & 36.98 per cent in small, medium and large categories, respectively. In total variable cost, expenditure on planting material was highest and rental value of land was highest in total fixed cost.

Table 4.10: Initial costs of kinnow orchard on sample farms

(Rupees/100 plants)

Sr. No.	Particulars	Establishment cost			
		Small	Medium	Large	Overall
1.	Variable cost				
i)	Family labour	1412.38	1378.85	1226.38	1388.62
ii)	Hired labour	64.95	305.53	537.38	229.64
iii)	Filling of pits (Soil & FYM)	738.92	753.20	782.23	741.84
iv)	Planting material cost	1921.12	1911.02	1919.81	1917.93
v)	Interest on working capital	109.00	118.79	129.58	115.58
vi)	Risk margin	272.50	296.98	323.94	288.94
vii)	Managerial cost	272.50	296.98	323.94	288.94
A.	Total variable cost	4791.37 (61.84)	5061.35 (62.71)	5243.26 (63.02)	4971.49 (62.45)
2.	Fixed cost				
i)	Land revenue	1.20	1.20	1.20	1.20
ii)	Annual depreciation	151.80	177.30	230.38	167.37
iii)	Interest on fixed capital	88.98	116.45	129.94	105.70
iv)	Rental value of land	2715.00	2715.00	2715.00	2715.00
B.	Total fixed cost	2956.98 (38.16)	3009.95 (37.29)	3076.52 (36.98)	2989.27 (37.55)
	Total cost(A+B)	7748.35 (100.00)	8071.30 (100.00)	8319.78 (100.00)	7960.76 (100.00)

Figures in parenthesis are percentages to total cost.

4.3.2 Maintenance cost during non-bearing stage of kinnow orchard

Kinnow growers have to incur expenditure on maintenance of the crop every year. The cost incurred after initial cost of plantation in first year up to bearing of fruit is categorised as

maintenance cost during non-bearing stage of kinnow orchard. During this gestation period (up to 4 years) the orchardist does not get any return from the tree in the form of fruits. The maintenance cost of the kinnow tree per annum varies due to factors like age of the tree, insect and pest intensity, variety of the tree, canopy of the tree, source of irrigation, distance from the market etc. The item wise maintenance cost per hundred plants during non-bearing stage of kinnow orchard for small, medium, large and overall farms has been presented in Tables 4.11 to 4.14. The total maintenance cost of non-bearing kinnow plants has shown positive relationship with age of the plants and on small farms, it was estimated to be Rs. 6808.68, Rs. 7593.47 and Rs. 8304.82 for second, third and fourth year, respectively (Table 4.11). The total variable & fixed costs accounted for 50.88 and 49.12 per cent, 51.47 and 48.53 per cent and 51.06 and 48.94 per cent of total cost in second, third and fourth year, respectively, for small farms.

In case of medium category, maintenance cost during non-bearing stage for second to fourth year was estimated to be Rs. 7139.23, Rs. 7773.18 and Rs. 8516.73, respectively and total variable & fixed costs accounted for 52.19 & 47.81 per cent, 51.49 & 48.51 per cent and 51.17 & 48.83 per cent of total cost in respective years (Table 4.12). In large farms, maintenance cost was estimated to be Rs. 7156.33, Rs. 7800.69 and Rs. 8503.70 in second, third and fourth year, respectively (Table 4.13). In case of large farms, the variable & fixed costs accounted for 51.20 & 48.80 per cent, 50.64 & 49.36 per cent and 50.14 & 49.86 per cent of total cost in second, third and fourth year, respectively. In case of overall farms, maintenance cost during non-bearing stage was estimated to be Rs. 6970.74, Rs. 7702.84 and Rs. 8431.03 for second to fourth year, respectively and total variable & fixed costs accounted for 51.41 & 48.59 per cent, 51.50 & 48.50 per cent and 51.12 & 48.88 per cent of total cost in respective years.

The material cost of critical inputs like hired labour, FYM, fertilizer and chemicals for plant protection increased with the age of plants. Interest on working capital, risk margin, managerial cost, interest on past establishment cost was found to have positive relationship with the age during non-bearing stage of kinnow plantation. Family labour and FYM were the main components of total variable cost, while, rental value of land and interest on past establishment cost were the main components responsible for highest per cent share of fixed cost in the total cost. The same trend was observed among the various categories.

Table 4.11: Maintenance cost during non-bearing stage of kinnow orchard in case of small farms

(Rupees/ 100 Plants)

Sr. No.	Particulars	Maintenance cost during non-bearing stage		
		2 year	3 year	4 year
1.	Variable cost			
i)	Gap filling	96.05	-	-
ii)	Family labour	1325.63	1526.62	1678.25
iii)	FYM	1323.71	1521.27	1652.34
iv)	Fertilizer	183.71	258.46	259.59
v)	Plant protection	121.25	141.25	154.25
vi)	Interest on working capital	68.99	76.84	82.65
vii)	Risk margin	172.47	192.10	206.62
viii)	Managerial cost	172.47	192.10	206.62
A.	Total variable cost	3464.28 (50.88)	3908.64 (51.47)	4240.32 (51.06)
2.	Fixed cost			
i)	Land revenue	1.20	1.20	1.20
ii)	Annual depreciation	151.80	151.80	151.80
iii)	Interest on fixed capital	88.98	88.98	88.98
iv)	Rental value of land	2715.00	2715.00	2715.00
v)	Interest on past establishment cost	387.42	727.85	1107.52
B.	Total fixed cost	3344.40 (49.12)	3684.83 (48.53)	4064.50 (48.94)
	Total cost (A+B)	6808.68 (100.00)	7593.47 (100.00)	8304.82 (100.00)

Figures in parenthesis are percentages of total cost.

Table 4.12: Maintenance cost during non-bearing stage of kinnow orchard in case of medium farms

(Rupees/ 100 plants)

Sr. No.	Particulars	Maintenance cost during non-bearing stage		
		2 year	3 year	4 year
1.	Variable cost			
i)	Gap filling	114.66	-	-
ii)	Family labour	1131.52	1208.24	1368.25
iii)	Hired labour	168.24	198.08	214.25
iv)	FYM	1458.26	1598.67	1702.24
v)	Fertilizer	209.65	278.26	308.52
vi)	Plant protection	141.28	178.59	185.74
vii)	Interest on working capital	83.68	90.14	96.43
viii)	Risk margin	209.21	225.36	241.08
ix)	Managerial cost	209.21	225.36	241.08
A.	Total variable cost	3725.71 (52.19)	4002.70 (51.49)	4357.59 (51.17)
2.	Fixed cost			
i)	Land revenue	1.20	1.20	1.20
ii)	Annual depreciation	177.30	177.30	177.30
iii)	Interest on fixed capital	116.45	116.45	116.45
iv)	Rental value of land	2715.00	2715.00	2715.00
v)	Interest on past establishment cost	403.57	760.53	1149.19
B.	Total fixed cost	3413.52 (47.81)	3770.48 (48.51)	4159.14 (48.83)
	Total cost (A+B)	7139.23 (100.00)	7773.18 (100.00)	8516.73 (100.00)

Figures in parenthesis are percentages of total cost.

Table 4.13: Maintenance cost during non-bearing stage of kinnow orchard in case of large farms

(Rupees/ 100 plants)

Sr. No.	Particulars	Maintenance cost during non-bearing stage		
		2 year	3 year	4 year
1.	Variable cost			
i)	Gap filling	134.40	-	-
ii)	Family labour	1089.67	1196.69	1287.56
iii)	Hired labour	268.24	298.68	308.59
iv)	FYM	1368.29	1408.89	1478.31
v)	Fertilizer	198.65	386.78	465.58
vi)	Plant protection	106.35	126.35	147.35
vii)	Interest on working capital	83.04	88.83	95.99
viii)	Risk margin	207.59	222.07	239.98
ix)	Managerial cost	207.59	222.07	239.98
A.	Total variable cost	3663.82 (51.20)	3950.36 (50.64)	4263.34 (50.14)
2.	Fixed cost			
i)	Land revenue	1.20	1.20	1.20
ii)	Annual depreciation	230.38	230.38	230.38
iii)	Interest on fixed capital	129.94	129.94	129.94
iv)	Rental value of land	2715.00	2715.00	2715.00
v)	Interest on past establishment cost	415.99	773.81	1163.84
B.	Total fixed cost	3492.51 (48.80)	3850.33 (49.36)	4240.36 (49.86)
	Total cost (A+B)	7156.33 (100.00)	7800.69 (100.00)	8503.70 (100.00)

Figures in parenthesis are percentages of total cost.

Table 4.14: Maintenance cost during non-bearing stage of kinnow orchard in case of overall farms

(Rupees/ 100 plants)

Sr. No.	Particulars	Maintenance cost during non-bearing stage		
		2 year	3 year	4 year
1.	Variable cost			
i)	Gap filling	109.05	-	-
ii)	Family labour	1207.27	1364.52	1519.69
iii)	Hired labour	110.49	121.59	132.28
iv)	FYM	1378.41	1534.61	1635.96
v)	Fertilizer	190.34	288.83	312.56
vi)	Plant protection	127.96	153.73	169.44
vii)	Interest on working capital	76.65	83.95	90.01
viii)	Risk margin	191.63	209.88	225.02
ix)	Managerial cost	191.63	209.88	225.02
A.	Total variable cost	3583.43 (51.41)	3966.99 (51.50)	4309.98 (51.12)
2.	Fixed cost			
i)	Land revenue	1.20	1.20	1.20
ii)	Annual depreciation	167.37	167.37	167.37
iii)	Interest on fixed capital	105.70	105.70	105.70
iv)	Rental value of land	2715.00	2715.00	2715.00
v)	Interest on past establishment cost	398.04	746.58	1131.78
B.	Total fixed cost	3387.31 (48.59)	3735.85 (48.50)	4121.05 (48.88)
	Total cost (A+B)	6970.74 (100.00)	7702.84 (100.00)	8431.03 (100.00)

Figures in parenthesis are percentages of total cost.

4.3.3 Maintenance cost during bearing stage of kinnow orchard

The grower has to invest on the maintenance of the kinnow orchards every year from the first bearing year to the last year of the life of the tree. Maintenance cost of the kinnow tree per annum varies due to factors like age of the tree, insect and pest intensity, canopy of the tree etc. To work out the maintenance cost during bearing stage of kinnow orchard in different farm categories the productive life of kinnow plants has been divided in four age groups with respect to relatively homogeneous productivity and input use etc., viz. 5-8 year, 9-12 year, 13-16 year and 17-20 year. Detailed analysis of maintenance cost per hundred plants of kinnow during bearing stage for small, medium, large and overall category farms has been carried out and presented in Tables 4.15 to 4.18.

The data in the Table 4.15 revealed that in case of small category of farmers, maintenance cost per hundred plants was estimated to be Rs. 18511.31, Rs. 18858.57, Rs. 18986.51 and Rs. 18244.26 in bearing age groups of 5-8 year, 9-12 year, 13-16 year and 17-20 year, respectively. It was found that the total cost increased in age groups 5-8 year, 9-12 year and 13-16 year, respectively and then gradually decreased in age group 17-20 years of plantation. In case of medium farmers (Table 4.16) total cost varied between Rs. 18175.49 to Rs. 19729.27, while in case of large farmers (Table 4.17) it varied between Rs. 18158.73 to Rs. 20131.27 and at overall level (Table 4.18) it was worked out to be Rs. 18706.04, Rs. 19292.84, Rs. 19437.39 and Rs. 18202.73 in age groups 5-8 year, 9-12 year, 13-16 year and 17-20 year, respectively. The costs were found decreasing in the age group of 17-20 years in all the categories of farms. It may be due to the reason that the labour and material inputs were increasing with the growth of the plants up to the maturity in the age group of 13-16 years, after which the productivity of kinnow plants start decreasing and also use of material inputs also decreases.

The percentage share of variable costs in the total maintenance cost during bearing stage among different categories of farms and at overall level also showed an increasing trend up to the age group of 13-16 years and thereafter it declined in the age group of 17-20 years of plantation. However, fixed cost in percentage term to total cost exhibited declining trend up to the age group of 13-16 years and then increased in 17-20 years age group of plantation. Interest on working

Table 4.15: Maintenance cost during bearing stage of kinnow orchard in case of small farms

(Rupees/ 100 plants)

Sr. No.	Particulars	Maintenance cost during bearing stage			
		5-8 year	9-12 year	13-16 year	17-20 year
1.	Variable cost				
i)	Family labour	5228.14	5240.19	5215.68	4969.38
ii)	Hired labour	253.84	259.71	263.96	246.27
iii)	FYM	4775.46	4886.35	4906.25	4647.93
iv)	Fertilizer	839.59	956.56	986.85	898.59
v)	Plant protection	487.86	524.47	592.98	557.28
vi)	Interest on working capital	254.27	265.08	270.00	254.00
vii)	Risk margin	635.68	662.71	675.00	635.01
viii)	Managerial cost	635.68	662.71	675.00	635.01
A.	Total variable cost	13110.52 (70.82)	13457.78 (71.36)	13585.72 (71.55)	12843.47 (70.40)
2.	Fixed cost				
i)	Land revenue	1.20	1.20	1.20	1.20
ii)	Annual depreciation	151.80	151.80	151.80	151.80
iii)	Interest on fixed capital	88.98	88.98	88.98	88.98
iv)	Rental value of land	2715.00	2715.00	2715.00	2715.00
v)	Prorated establishment cost	2443.81	2443.81	2443.81	2443.81
B.	Total fixed cost	5400.79 (29.18)	5400.79 (28.64)	5400.79 (28.45)	5400.79 (29.60)
	Total cost (A+B)	18511.31 (100.00)	18858.57 (100.00)	18986.51 (100.00)	18244.26 (100.00)

Figures in parenthesis are percentages of total cost.

Table 4.16: Maintenance cost during bearing stage of kinnow orchard in case of medium farms

(Rupees/ 100 plants)

Sr. No.	Particulars	Maintenance cost during bearing stage			
		5-8 year	9-12 year	13-16 year	17-20 year
1.	Variable cost				
i)	Family labour	4666.02	4703.77	4709.54	4587.46
ii)	Hired labour	901.98	910.73	924.14	806.36
iii)	FYM	4591.64	5054.27	4931.32	4505.74
iv)	Fertilizer	889.28	1098.09	1182.33	781.52
v)	Plant protection	481.27	547.26	609.06	398.63
vi)	Interest on working capital	274.57	304.41	305.87	259.69
vii)	Risk margin	686.42	761.04	764.69	649.23
viii)	Managerial cost	686.42	761.04	764.69	649.23
A.	Total variable cost	13177.60 (70.41)	14140.61 (71.86)	14191.64 (71.93)	12637.86 (69.53)
2.	Fixed cost				
i)	Land revenue	1.20	1.20	1.20	1.20
ii)	Annual depreciation	177.30	177.30	177.30	177.30
iii)	Interest on fixed capital	116.45	116.45	116.45	116.45
iv)	Rental value of land	2715.00	2715.00	2715.00	2715.00
v)	Prorated establishment cost	2527.68	2527.68	2527.68	2527.68
B.	Total fixed cost	5537.63 (29.59)	5537.63 (28.14)	5537.63 (28.07)	5537.63 (30.47)
	Total cost (A+B)	18715.63 (100.00)	19678.24 (100.00)	19729.27 (100.00)	18175.49 (100.00)

Figures in parenthesis are percentages of total cost.

Table 4.17: Maintenance cost during bearing stage of kinnow orchard in case of large farms

(Rupees/ 100 plants)

Sr. No.	Particulars	Maintenance cost during bearing stage			
		5-8 year	9-12 year	13-16 year	17-20 year
1.	Variable cost				
i)	Family labour	4206.23	4137.67	4167.55	4105.81
ii)	Hired labour	1466.67	1476.73	1520.76	882.58
iii)	FYM	4582.87	4962.25	5036.24	4598.63
iv)	Fertilizer	849.22	972.29	1121.36	892.61
v)	Plant protection	471.36	521.28	657.98	421.54
vi)	Interest on working capital	294.80	317.30	333.45	271.81
vii)	Risk margin	737.01	793.26	833.63	679.54
viii)	Managerial cost	737.01	793.26	833.63	679.54
A.	Total variable cost	13345.17 (70.34)	13974.04 (71.29)	14504.60 (72.05)	12532.06 (69.01)
2.	Fixed cost				
i)	Land revenue	1.20	1.20	1.20	1.20
ii)	Annual depreciation	230.38	230.38	230.38	230.38
iii)	Interest on fixed capital	129.94	129.94	129.94	129.94
iv)	Rental value of land	2715.00	2715.00	2715.00	2715.00
v)	Prorated establishment cost	2550.15	2550.15	2550.15	2550.15
B.	Total fixed cost	5626.67 (29.66)	5626.67 (28.71)	5626.67 (27.95)	5626.67 (30.99)
	Total cost (A+B)	18971.84 (100.00)	19600.71 (100.00)	20131.27 (100.00)	18158.73 (100.00)

Figures in parenthesis are percentages of total cost.

Table 4.18: Maintenance cost during bearing stage of kinnow orchard in case of overall farms

(Rupees/ 100 plants)

Sr. No.	Particulars	Maintenance cost during bearing stage			
		5-8 year	9-12 year	13-16 year	17-20 year
1.	Variable cost				
i)	Family labour	4856.63	4865.21	4861.08	4690.91
ii)	Hired labour	683.04	698.29	711.42	562.26
iii)	FYM	4678.88	4960.33	4935.44	4586.18
iv)	Fertilizer	855.41	1015.25	1082.16	852.06
v)	Plant protection	482.16	540.31	605.07	475.13
vi)	Interest on working capital	267.98	288.57	293.36	259.03
vii)	Risk margin	699.95	721.42	733.41	647.56
viii)	Managerial cost	699.95	721.42	733.41	647.56
A.	Total variable cost	13224.00 (70.69)	13810.80 (71.59)	13955.35 (71.80)	12720.69 (69.88)
2.	Fixed cost				
i)	Land revenue	1.20	1.20	1.20	1.20
ii)	Annual depreciation	167.37	167.37	167.37	167.37
iii)	Interest on fixed capital	105.70	105.70	105.70	105.70
iv)	Rental value of land	2715.00	2715.00	2715.00	2715.00
v)	Prorated establishment cost	2492.77	2492.77	2492.77	2492.77
B.	Total fixed cost	5482.04 (29.31)	5482.04 (28.41)	5482.04 (28.20)	5482.04 (30.12)
	Total cost (A+B)	18706.04	19292.84	19437.39	18202.73

Figures in parenthesis are percentages of total cost.

capital, risk margin, managerial cost was found to have positive relationship up to 13-16 year age group of kinnow plantation and thereafter, it decreased in age group of 17-20 years during bearing stage of kinnow plantation. Rental value of land and prorated establishment cost were the main components responsible for highest per cent share of fixed cost in the total cost. The same trend was observed among the various categories.

4.3.4 Returns from kinnow cultivation

From the Table 4.19, it was observed that the average production per hundred plants was recorded highest in medium farm category (36.12 Qtls) followed by large farms (35.02 Qtls) and small farm category (34.96 Qtls). In case of overall farms, the average production was estimated to be 35.24 quintals. Among different age group and farm categories, the average production varies between 21.82 quintals in case of 5-8 year age group of large farm category to 42.63 quintals in age group of 13-16 year in case of small farm category. On overall basis, the average production showed direct relationship with the age of plant up to 13-16 year age group of plantation and after that it showed decreasing trend. This is because the kinnow plant attains maturity in the age group of 13-16 years of plantation and after that the yield diminishes as shown by age group of 17-20 years of plantation.

Table 4.19: Average production from different age groups of kinnow plants
(Quintals/100 plants)

Farm categories	Age group				Average Production
	5-8 year	9-12 year	13-16 year	17-20 year	
Small	22.04	36.04	42.63	39.14	34.96
Medium	22.68	38.86	42.57	40.35	36.12
Large	21.82	38.21	41.32	38.74	35.02
Overall	22.05	37.35	42.28	39.29	35.24

The average gross returns in terms of money value (Table 4.20) were highest in case of medium farms category i.e. Rs. 87408.07 followed by large farms (Rs. 38525.10) and small farms (Rs. 38459.10). The overall average gross returns of kinnow were worked out to be Rs. 38767.10. On overall basis, the gross returns in different age groups also showed positive

relationship with the age of plant up to 13-16 year age group and after that returns decreased as shown by 17-20 age group of plantation.

Table 4.20: Average gross returns from different age groups of kinnow plants
(Rupees/ 100 plants)

Farm categories	Age group				Average Gross Returns
	5-8 year	9-12 year	13-16 year	17-20 year	
Small	24244.22	39644.36	46893.43	43054.39	38459.10
Medium	24948.23	42746.39	46827.43	44385.40	39726.86
Large	24002.22	42031.38	45452.41	42614.39	38525.10
Overall	24255.22	41085.37	46508.42	43219.39	38767.10

The results related to net returns per hundred plants (Table 4.21) revealed that average net returns were highest in case of medium farm category (Rs. 20652.21) followed by small farms (Rs. 19808.94) and large farms (Rs. 19309.46). The overall average net returns were worked out to be Rs. 19857.35. Among different age groups, for overall farms, the net returns were highest in 13-16 year age group and in 17-20 year of age group the net returns decreased due to decrease in production as shown in Table 4.19.

Table 4.21: Average net returns from different age groups of kinnow plants
(Rupees/ 100 plants)

Farm categories	Age group				Average Net Returns
	5-8 year	9-12 year	13-16 year	17-20 year	
Small	5732.91	20785.79	27906.92	24810.13	19808.94
Medium	6232.60	23068.15	27098.16	26209.91	20652.21
Large	5030.38	22430.67	25321.14	24455.66	19309.46
Overall	5549.18	21792.53	27071.03	25016.66	19857.35

Table 4.22: Per hectare costs and returns of overall sampled kinnow orchards

Age of plant	Average production (Qtl)	Gross returns (Rs.)	Total variable cost (Rs.)	Gross margin (Rs.)	Total fixed cost (Rs.)	Total cost (Rs.)	Net income (Rs.)
1	0.00	0.00	24857.45	-24857.45	14946.35	39803.80	-39803.80
2	0.00	0.00	17917.15	-17917.15	16936.55	34853.70	-34853.70
3	0.00	0.00	19834.95	-19834.95	18679.25	38514.20	-38514.20
4	0.00	0.00	21594.90	-21594.90	20605.25	42155.15	-42155.15
5-8	110.25	121276.10	66120.00	55156.10	27410.20	93530.20	27745.90
9-12	186.75	205426.87	69054.00	136372.87	27410.20	96464.20	108962.67
13-16	211.40	232542.11	69776.75	162765.36	27410.20	97186.95	135355.16
17-20	196.45	216096.96	63603.45	152493.51	27410.20	91013.65	125083.31
Total	704.85	775342.04	352758.65	422583.39	180808.20	533521.85	241820.19

The per hectare costs and returns of overall sampled kinnow orchards are presented in Table 4.22. The results revealed that the net income per hectare of kinnow orchard becomes positive from 5-8 years of age group i.e. the age group in which kinnow orchard starts bearing fruits. The per hectare total cost for was calculated to be Rs. 533521.85, out of which variable cost and fixed cost accounted for Rs. 352758.65 and Rs. 180808.20, respectively. It was found that gross returns as well as net income were highest in 13-16 years of age group, which may be due to the reason that this age group represents the peak period of kinnow orchard.

4.3.5 Economic viability of kinnow orchards

The principal objective of any plantation programme is to increase the productivity of land, to meet the basic requirements of rural population, to create employment opportunities in general and to promote socio-economic prosperity. Kinnow cultivation requires high capital investment for the establishment and maintenance of orchards. This high investment calls for the need to quantify the benefits and also evaluate the economic viability of such investment. The economic viability test of the kinnow orchard was designed to aid the decision-maker in deciding whether or not the economic benefits that occur from an investment were at least as high as the cost involved in the investment. Unlike, seasonal crops, in which returns are obtained within a

year, the returns in kinnow start after a gestation period of four years. This indicates the need to estimate the value of returns by discounting future returns.

In order to assess the capital productivity for kinnow orchards, different techniques were used for finding comparative economic viability of kinnow cultivation. Further the comparative viability of kinnow orchards was analysed by working out benefits cost ratio, pay-back period, net present value (NPV), uniform annual returns and internal rate of returns. A discount rate of 10 per cent was used to estimate the present worth of the future income. These formulae provide the sound base for information to decision makers, whether to invest or not to invest. The results of the analysis have been presented in Table 4.23.

Table 4.23: Measures of investment worth per 100 plants of kinnow

Measures of investment worth	Farm categories			
	Small	Medium	Large	Overall
Benefit-cost ratio	1.46	1.47	1.42	1.45
Net present value (Rs.)	113814.95	115401.29	105375.78	112369.90
Uniform annual returns (Rs.)	9132.81	9260.10	8455.63	9016.85
Internal rate of return (%)	17.52	17.58	16.91	17.48
Payback period (years)	8	8	8	8

The results in the Table 4.23 revealed that pay-back period for kinnow plantation was estimated at 8th year for all the farm categories. The pay-back period of kinnow was found to be high in the study area because the production of kinnow was found to be lower in the beginning of the years. At overall level, NPV was estimated to be Rs. 112369.90 per hundred plants and across various farm categories NPV was found to be highest in medium farms (Rs. 115401.29) followed by small farms (1,13,814.95) and lowest in large farms (Rs. 105375.78). The internal rate of returns were estimated to be 17.48 per cent on overall farms indicates that investing in kinnow is financially desirable as long as the rate of interest on loan doesn't exceed 17 per cent. The results related to benefit cost ratio (B: C ratio) revealed that B: C ratio was found to be maximum in case of medium farm category (1.47) followed by small farm (1.46) and large farm

category (1.42) and on overall farms, it was found to be 1.45. These results indicated that for all the categories of farms, B: C ratio was more than one which suggest that kinnow cultivation is economically profitable in the study area and each rupee spent on kinnow cultivation would yield return of Rs. 1.46, Rs. 1.47 and Rs. 1.42 in case of small, medium and large farms, respectively. On overall farm, it indicated that each rupee spent on kinnow cultivation would yield return of Rs. 1.45.

4.4 RESOURCE USE EFFICIENCY

The main objective of a production unit is to co-ordinate and utilizes resources or factors of production in such a manner that together they yield the maximum net returns. In agriculture, the efforts are related to the use and allocation of scarce resources among alternative uses with a view to maximize profit. The quantum of production under a normal crop is directly related to the availability of resource inputs and their techniques of application. The cost and return analysis does not throw sufficient light on the efficiency of resource allocation. It just depicts the general idea about the different factor of production or input used in the cultivation and production. In order to explain the contribution of individual factor/input in the total output/yield, production function analysis is helpful to evaluate the efficiency of various inputs or resources used by the sampled farmers. Production function is an analytical tool which describes the maximum output that can be obtained from given set of inputs and helps in the formulation of efficient farm planning for the rational use of available farm resources/inputs.

In the present study, the elasticity of inputs/factor used in the production of kinnow has been worked out by fitting Cobb-Douglas production function and estimates of the fitted production function were used to study the effect of different independent variables on output, production elasticity, resource use efficiency and the returns to scale. The results of regression analysis, for different category orchards are given in Tables 4.24 to 27. The 'F' test was applied to test the overall significance of the regression model.

In case of small farms (Table 4.24), the value of coefficient of determination; R^2 (0.88) was estimated to be statistically highly significant which means that 88 per cent of total variation in kinnow production was explained by independent variables taken under consideration. FYM and fertilizer were statistically significant with positive values of 0.445 and 0.587 at 10 and 1 per

cent level of significance, respectively, while human labour and plant protection were found to be non-significant but with positive regression coefficient value 0.298 and 0.512, respectively. It was also found that, the marginal value productivity for explanatory variables viz. human labour, FYM, fertilizers and plant protection chemicals was positive with its value of 1.286, 4.604, 5.016 and 3.053, respectively. The sum of elasticity coefficients ($\sum b_i = 1.03$) was greater than unity, which shows increasing returns to scale on small farms. The positive value of MVP for significant variables viz. FYM (4.604) and fertilizer (5.016) was greater than unity which means these inputs were under-utilized and by increasing FYM and fertilizer by 78.28 and 80.60 per cent, the profit would be increased. The MVP value of human labour (1.286) and plant protection (3.053) revealed that 22.24 and 67.24 per cent more use of these inputs could increase the profit.

Table 4.24: Estimated regression coefficients of various factors, their standard errors and marginal value productivity (MVP) of small farms for kinnow orchards

Variables	Regression Coefficients	Standard Error	MVP	Percentage change
Constant (α)	3.668**	1.384	-	-
Human labour (X_1)	0.298	0.357	1.286	22.24
FYM (X_2)	0.445*	0.225	4.604	78.28
Fertilizer (X_3)	0.587***	0.132	5.016	80.06
Plant protection (X_4)	0.502	0.512	3.053	67.24
Coefficient of Determination (R^2) = 0.88*** $\sum b_i = 1.03$ F-value = 27.24***				

***, **, * Significant at 1 %, 5% and 10% level of significance, respectively

Resource use efficiency on medium farms (Table 4.25) revealed that regression coefficient value for human labour, FYM and fertilizer was significant with positive values of 0.621, 0.474 and 0.267 at 10, 1 and 5 per cent level of significance, respectively, while plant protection was found non-significant but with positive value of 0.143. The marginal value productivity for explanatory variables viz. human labour, FYM, fertilizers and plant protection chemicals was found positive with its value of 1.134, 3.749, 5.824 and 4.224, respectively. The

sum of elasticity coefficients ($\Sigma b_i=1.36$) was found to be greater than unity, which shows increasing returns to scale on medium farms. The value of coefficient of determination (0.92) was found to be statistically significant means that 92 per cent of total variation in kinnow production was explained by independent or explanatory variables taken under consideration. The value of MVP for significant variables viz. human labour (1.134), FYM (3.749) and fertilizer (5.824) was greater than unity which means these inputs were under-utilized and by increasing these inputs by 11.82, 73.32 and 82.82 per cent, respectively, the profit would be increased. The MVP value for plant protection (4.224) revealed that 76.33 per cent more use of this inputs could increase the profit.

Table 4.25: Estimated regression coefficients of various factors, their standard errors and marginal value productivity (MVP) of medium farms for kinnow orchards

Variables	Regression Coefficients	Standard Error	MVP	Percentage change
Constant (α)	3.375	3.426	-	-
Human labour (X_1)	0.621*	0.324	1.134	11.82
FYM (X_2)	0.474***	0.135	3.749	73.32
Fertilizer (X_3)	0.267**	0.121	5.824	82.82
Plant protection (X_4)	0.413	0.539	4.224	76.33
Coefficient of Determination (R^2) = 0.92*** $\Sigma b_i = 1.36$ F-value = 86.24***				

***, **, * Significant at 1 %, 5% and 10% level of significance, respectively

The results in the Table 4.26 revealed that for large farms, coefficient of determination with its value of 0.96 was statistically significant means that 96 per cent of total variation in kinnow production was explained by independent variables taken under consideration and it also revealed that fertilizer, human labour and plant protection was significant with positive values 0.648, 0.399 and 0.158 at 1, 5 and 10 per cent level of significance, respectively, while FYM was found to be non-significant but with positive value of 0.946. It was also found that, the marginal value productivity for explanatory variables viz. human labour, FYM, fertilizers and plant protection chemicals was positive with its value of 1.665, 3.374, 4.072 and 4.854, respectively. The sum of elasticity coefficients ($\Sigma b_i=1.05$) was estimated to be greater than

unity, which shows increasing returns to scale on large farms for kinnow cultivation. The MVP value for significant variables viz. human labour (1.665), fertilizer (4.072) and plant protection (4.854) was greater than unity which means these inputs were under-utilized and by increasing these inputs by 39.94, 75.44 and 79.40 per cent, respectively, the profit would be increased. The MVP value for FYM (3.374) revealed that 70.36 per cent more use of this inputs could increase the profit.

Table 4.26: Estimated regression coefficients of various factors, their standard errors and marginal value productivity (MVP) of large farms for kinnow orchards

Variables	Regression Coefficients	Standard Error	MVP	Percentage change
Constant (α)	5.305	3.543	-	-
Human labour (X_1)	0.399**	0.158	1.665	39.94
FYM (X_2)	0.946	0.582	3.374	70.36
Fertilizer (X_3)	0.648***	0.067	4.072	75.44
Plant protection (X_4)	0.158*	0.087	4.854	79.40
Coefficient of Determination (R^2) = 0.96*** $\Sigma b_i = 1.05$ F-value = 45.24***				

***, **, * Significant at 1 %, 5% and 10% level of significance, respectively

The perusal of data in Table 4.27 revealed that for over all farms, coefficient of determination with its value of 0.89 was statistically significant which means that 89 per cent of total variation in kinnow production was explained by independent variables taken under consideration. In overall farms, fertilizer was found to be statistically highly significant at 1 per cent level of significance and human labour & FYM were statistically significant at 5 and 10 per cent level of significance, respectively. The regression coefficient for human labour, FYM and viz. human labour, FYM, fertilizers and plant protection chemicals was positive with its value of 1.327, 3.526, 4.527 and 3.689, respectively. The sum of elasticity coefficients ($\Sigma b_i = 1.20$) is greater than unity, which shows increasing returns to scale on overall farms under kinnow cultivation in the study area. The MVP value for significant variables viz. human labour (1.327), FYM (3.526) and fertilizer (4.527) was greater than unity which means these inputs were under-utilized and by increasing the use of these inputs by 24.64, 71.63 and 77.91 per cent,

respectively, the profit would be increased. The MVP value for plant protection (3.689) revealed that 72.89 per cent more use of this inputs could increase the profit.

Table 4.27: Estimated regression coefficients of various factors, their standard errors and marginal value productivity (MVP) of overall farms for kinnow orchards

Variables	Regression Coefficients	Standard Error	MVP	Percentage change
Constant (α)	3.217	4.563	-	-
Human labour (X_1)	0.399**	0.184	1.327	24.64
FYM (X_2)	0.381*	0.213	3.526	71.63
Fertilizer (X_3)	0.418***	0.126	4.527	77.91
Plant protection (X_4)	0.143	0.091	3.689	72.89
Coefficient of Determination (R^2) = 0.89*** $\Sigma b_i = 1.20$ F-value = 116.24***				

***, **, * Significant at 1 %, 5% and 10% level of significance, respectively

4.5 MARKETING STRUCTURE AND EFFICIENCY OF KINNOW

The production of any commodity is complete only when it reaches the hands of the consumers. Merely increasing production through proper campaign will simply not improve the economic conditions of farmers, unless there is a strong backing by efficient marketing system. An efficient marketing structure minimizes costs and benefits all sections of the society. Thus, marketing of any product is an integral part of any production system. A marketing system should be such that the produce should reach to consumer in good state, without damage and with least cost and within shortest time after harvest. The main objectives of an efficient marketing system are: (a) to enable the primary producers to reap the best possible benefits, (b) to make available all products of farm origin to consumers at reasonable price without impairing the quality of the produce, (c) to provide facilities for lifting all produce, the farmers are willing to sell at an incentive price, (d) to reduce the price spread between the primary produce and ultimate consumer.

Various marketing functions were performed by the kinnow growers in the study area for the marketing of their produce. The product has to be prepared for the market which involves timely picking, grading, packing, transportation, loading/ unloading, storage etc. All these factors are important determinants of prices which kinnow fetch in the market, and great care has to be ensured at every step. Any carelessness at any stage in marketing may lower the prices and hence affect net returns adversely. Due to the existence of various intermediaries viz. pre-harvest contractor, wholesalers and retailers, there were different marketing channels for marketing of kinnow and the following marketing channels have been identified as important channels in the study area:

Table 4.28: Quantity of kinnow marketed through various channels

Marketing Channels	Marketing intermediaries	% Shares in total quantity marketed
Channel-I	Producer – Pre-harvest Contractor – Wholesaler– Retailer – Consumer	52.21
Channel-II	Producer – Wholesaler – Retailer – Consumer	34.15
Channel-III	Producer – Retailer – Consumer	10.22
Channel-IV	Producer – Consumer	3.42

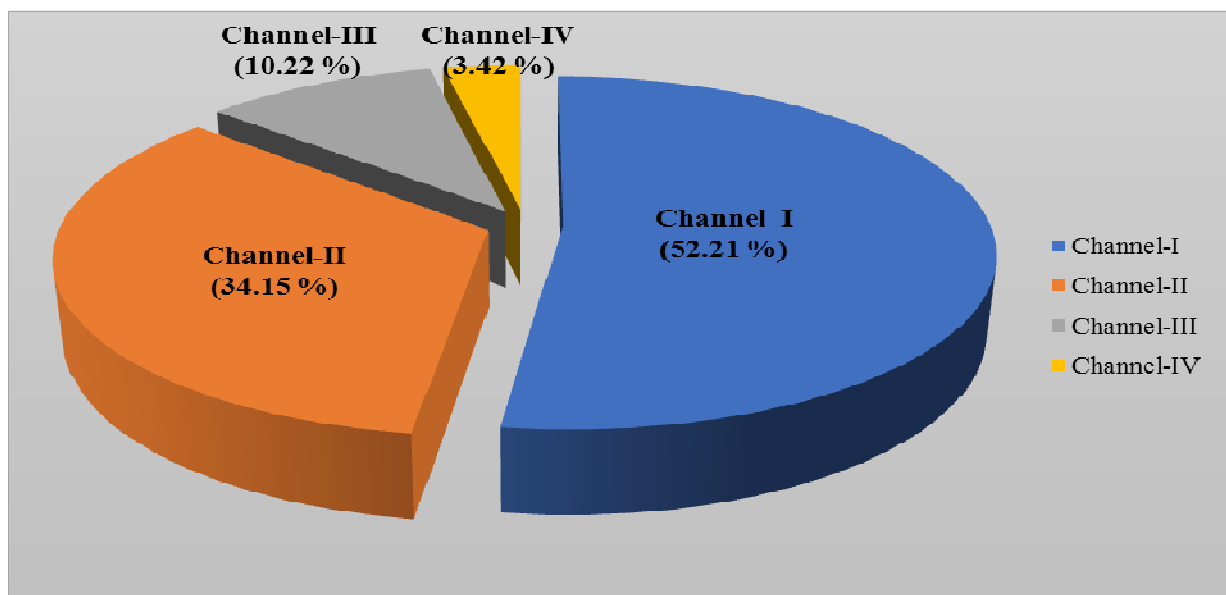


Fig 4.6 Quantity marketed through different marketing channels

a) Sale through pre-harvest contractor:

Pre-harvest contractors are the persons specialized in performing various marketing functions. 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. Farmers in the study area prefer to sell their produce on trees to pre-harvest contractor. The total quantity sold through this channel (Channel-I) worked out to be 52.21 per cent of the total produce sold in the study area (Table 4.28).

b) Sale through wholesaler:

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, industrial users, but does not sell in significant amounts to ultimate consumers. In the study area, wholesaler was most common market functionary found in channel-I and channel-II. About 34.15 per cent of the produce was disposed through the channel which involved selling of the produce from farmer to wholesaler (Channel-II).

c) Sale through Retailer

Retailers buy goods from wholesalers/producer and further sell them to the consumers in small quantities. A retailer is producer's personal representative to consumers. In the study area, about 10.22 per cent of the produce was disposed of through this channel (Channel-III).

d) 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 and improves economic viability of the farmers. About 3.42 per cent of the total produce was marketed through this channel (Channel-IV) in the study area.

It was further observed from the data that Channel- I was the most preferred channel, since 52.21 per cent of the produce was traded through this channel (Table 4.28).

4.5.1 Marketing cost, marketing margin and price spread of kinnow under different marketing channels

The marketing cost, marketing margin and price spread under different marketing channels of kinnow in the study area was analyzed and presented in Table 4.29, which revealed that in channel-I, II, III and IV, producer's sale price for one quintal of kinnow was Rs.1100.00, Rs. 1450.00, Rs. 1700.00 and Rs. 1800.00, respectively and per quintal consumer's purchase price was Rs. 2160.00, Rs. 2150.00, Rs. 1950.00 and Rs. 1800.00, respectively. Net price received by producer in channel-I, II, III and IV was Rs. 1100.00, Rs. 1294.12, Rs. 1548.25 and Rs. 1656.50, respectively.

In channel- I, producers marketed their produce through the pre-harvest contractor. There was no marketing cost incurred by the producer as pre-harvest contractor purchase the fruits on the tree in the orchard. The per quintal total marketing cost and marketing loss incurred by pre-harvest contractor was Rs. 223.00 and Rs. 14.55, respectively. Then, pre-harvest contractor further sold the produce to wholesaler with net margin of Rs. 117.45 per quintal. The wholesaler's and retailer's per quintal net margin in channel-I was Rs. 160.29 and Rs. 186.80, respectively. The per quintal market loss for wholesaler and retailer was estimated to be Rs. 13.31 and Rs. 16.20, respectively.

In channel- II, producer sold their produce to the wholesaler in the market and the total marketing cost incurred by the producer was worked out to Rs. 145.00 per quintal with market loss of Rs. 10.88 per quintal. The wholesaler's per quintal total marketing cost and margin was Rs. 146.00 and Rs. 13.25, respectively and further sold the produce to retailer with per quintal net margin of Rs. 155.75. The retailer's per quintal total marketing cost, margin and marketing loss was worked out to be Rs. 181.20, Rs. 16.13 and Rs. 187.67, respectively in channel-II.

In channel-III, producer sold the produce to retailer with per quintal total marketing cost of Rs. 139.00 and marketing loss of Rs. 12.75. The retailer's per quintal total marketing cost, margin and marketing loss in this channel estimated as Rs. 38.00, Rs. 19.50 and Rs. 192.50, respectively. In channel-IV, producers sold their produce directly to the consumer in the local

market or on road side and total marketing cost and marketing loss of producer in this channel were worked out to be Rs. 130.00 and Rs. 13.50, respectively.

Table 4.29: Marketing cost, marketing margin and price spread of kinnow under different marketing channels

(Rs. /Quintal)

Sr. No.	Particulars	I	II	III	IV
1.	Producer's selling price	1100.00	1450.00	1700.00	1800.00
2.	Marketing cost incurred by producer				
A	Picking, grading and packing	-	95.00	95.00	95.00
B	Depreciation of container	-	10.00	10.00	10.00
C	Transportation cost	-	15.00	22.00	10.00
D	Loading/ Unloading charges	-	10.00	10.00	10.00
E	Commission	-	-	-	-
F	Mandi tax		-	-	
G	Miscellaneous charges	-	5.00	2.00	5.00
	Total (A to G)	-	145.00	139.00	130.00
	Marketing Loss	-	10.88	12.75	13.50
	Net price received by farmer	1100.00	1294.12	1548.25	1656.50
3.	Marketing cost incurred by Pre-harvest Contractor				
A	Gross price paid by contractor	1100.00	-	-	-
B	Picking, grading and packing	95.00	-	-	-
C	Depreciation of container	10.00	-	-	-
D	Transportation cost	15.00	-	-	-
E	Loading/ Unloading charges	10.00	-	-	-
F	Commission charges	66.00	-	-	-

G	Mandi tax	22.00	-	-	-
H	Miscellaneous charges	5.00	-	-	-
	Total (B to H)	223.00	-	-	-
	Marketing Loss	14.55			
	Net margin of contractor	117.45	-	-	-
	Contractor's selling price	1455.00	-	-	-
4.	Marketing cost incurred by wholesaler				
A	Gross price paid by wholesaler	1455.00	1450.00	-	-
B	Transportation cost	15.00	15.00	-	-
C	Loading/ Unloading charges	10.00	10.00	-	-
D	Commission charges	87.30	87.00	-	-
E	Mandi tax	29.10	29.00	-	-
F	Miscellaneous charges	5.00	5.00	-	-
	Total (B to F)	146.40	146.00	-	-
	Marketing Loss	13.31	13.25		
	Net margin of wholesaler	160.29	155.75	-	-
	Wholesaler's Selling Price	1775.00	1765.00	-	-
5.	Marketing cost incurred by retailer				
A	Gross price paid by retailer	1775.00	1765.00	1700.00	-
B	Transportation cost	15.00	15.00	15.00	-
C	Loading/ Unloading charges	10.00	10.00	10.00	-
D	Cost of packing material	10.00	10.00	10.00	-
E	Commission charges	106.50	105.90	-	-
F	Mandi tax	35.50	35.30	-	-

G	Miscellaneous charges	5.00	5.00	5.00	-
	Total (B to G)	182.00	181.20	38.00	-
	Marketing Loss	16.20	16.13	19.50	
	Net margin of retailer	186.80	187.67	192.50	-
6.	Price paid by consumer	2160.00	2150.00	1950.00	1800.00

4.5.2 Marketing efficiency of different marketing channels for kinnow

The results of the analysis of marketing efficiency among different channels are presented in Table 4.30. It can be observed from the table that net price received by producer varied from Rs. 1100.00 to Rs. 1656.50 among different channels. The marketing cost and marketing loss in channel –I, II, III and IV was estimated to be Rs. 551.40, Rs. 472.20, Rs. 177.00, Rs.130.00 and Rs. 44.06, Rs. 40.26, Rs. 32.25 & Rs. 13.50, respectively. The marketing margin in channels-I, II and III was Rs. 464.54, Rs. 343.42 and Rs. 192.50, respectively while in channel-IV, there was no marketing margin involved due to absence of intermediaries between

Table 4.30 Marketing efficiency of kinnow among the different marketing channels
(Rs./ Quintal)

Particulars	Marketing channels			
	I	II	III	IV
Net price received by producer	1100.00	1294.12	1548.25	1656.50
Marketing cost (MC)	551.40	472.20	177.00	130.00
Marketing margin (MM)	464.54	343.42	192.50	0.00
Marketing loss (ML)	44.06	40.26	32.25	13.50
Price paid by consumer	2160.00	2150.00	1950.00	1800.00
Producer's share in consumer's price (%)	50.93	60.19	79.39	92.03
Marketing efficiency	1.04	1.51	3.85	11.54

producer and consumer. The highest producer's share in consumer price was found in channel-IV (92.03%) followed by channel-III (79.39%), channel-II (60.19%) and channel-I (50.93), indicated that direct sale of produce to consumer provided a higher share to producer in consumer's rupee. The results of marketing efficiency which is an indicator of overall performance of the marketing channels indicated that maximum marketing efficiency was found in in channel-IV (11.54), when the produce was sold directly to the consumer. When the produce was sold through intermediaries, the marketing efficiency was lower as it was 3.85, 1.51 and 1.04 in channel-III, II and I, respectively.

4.6 PRODUCTION AND MARKETING PROBLEMS FACED BY THE SAMPLE ORCHARDISTS

In this section, an attempt has been made to analyze the problems faced by the orchardists in the field of production and marketing of kinnow. The problems faced by kinnow orchardists were categorized into production related problems and marketing related problems. The results of the survey have been presented in Tables 4.31 and 4.32.

Table 4.31: Production related problems faced by the farmers in the study area
(Multiple response per cent)

Sr. No.	Particulars	Small	Medium	Large	Overall
1.	Labour problems				
i)	Shortage of skilled labour	34.78	35.90	53.33	38.00
ii)	Higher wage rate	26.09	43.59	46.00	36.00
iii)	Non- availability of labour at peak operation time	30.43	33.33	40.00	33.00
2.	Chemical fertilizers/ Plant protection chemicals				
i)	High cost of plant protection chemicals	54.34	43.58	40.00	48.00
ii)	Fertilizers not available in time	13.04	15.38	6.67	13.00
3.	Other problems				
i)	Shortage of desired plant material	17.39	17.95	13.33	17.00
ii)	Limited availability of FYM	50.00	35.89	46.66	44.00
iii)	Problem of stray animals	56.52	43.59	20.00	46.00

The results in the Table 4.31 showed that overall major problems faced by the farmers in the study area were high cost of plant protection chemicals followed by the problem of stray animals (46.00%), limited availability of FYM (44.00%), shortage of skilled labour (38.00%), higher wage rate (36.00%) and non-availability of labour at peak operation time (33.00%) . Similar response was observed among different farm categories. However, high cost of plant protection chemicals, higher wage rate and limited availability of FYM were more prominent problems in small, medium and large categories, respectively.

Table 4.32: Marketing related problems faced by the farmers in marketing of kinnow
(Multiple response per cent)

Sr. No.	Particulars	Small	Medium	Large	Overall
1.	Labour problems				
i)	Shortage of skilled labour	39.13	35.9	33.33	37.00
ii)	Higher wage rate	36.95	66.66	40.00	49.00
iii)	Non-availability of labour at peak operation time	21.74	38.46	26.67	29.00
2.	Packing material				
i)	Shortage of packing material	17.39	20.51	13.33	18.00
ii)	Higher prices	41.30	30.77	20.00	34.00
3.	Transportation				
i)	Villages not linked with roads	21.74	20.51	20.00	21.00
ii)	High transportation charges	52.17	53.85	26.67	49.00
4.	Market intelligence				
i)	Late information	13.04	15.38	13.33	14.00
ii)	Inadequate information	28.26	25.64	26.67	27.00
5.	Malpractices				
i)	Deduct more charges	56.52	53.85	40.00	53.00
ii)	Prices are not paid in time	34.78	38.46	33.33	36.00
iii)	Low prices	71.74	76.92	60.00	72.00

The various problems related to marketing of kinnow are presented in Table 4.32. The results revealed that even though the cultivation of kinnow is a profitable venture in study area but still, there are some lacunas in the marketing of kinnow. Overall, the major problems of kinnow marketing were low prices for the produce, deduction of more charges by various marketing agencies, high transportation charges and higher wage rates as reported by 72.00, 53.00, 49.00 and 49.00 per cent of respondents, respectively. Other main problems were non-payment of prices on time, higher prices of packing material and inadequate and late information about the market prices. The results revealed that among all farm categories, prominent problem was low price for the produce.

Table 4.33: Test of significance of problems faced by kinnow growers in the study area

Sr. No.	Particulars	Chi-square
	No. of Farmers	100
A.	Production related problems	
1.	Labour problems	
i)	Shortage of skilled labour	5.23**
ii)	Higher wage rate	6.12**
iii)	Non- availability of labour at peak operation time	1.39
2.	Chemical fertilizers/ Plant protection chemicals	
i)	High cost of Plant protection chemicals	2.42
ii)	Fertilizers not available in time	3.47
3.	Other problems	
i)	Non-availability of healthy plant material	0.78
ii)	Limited availability of FYM	2.46
iii)	Problem of stray animals	17.12**
B.	Marketing related problems	
1.	Labour problems	
i)	Shortage of skilled labour	0.47
ii)	Higher wage rate	11.16**

iii)	Non- availability of labour at peak operation time	5.10**
2.	Packing material	
i)	Shortage of packing material	1.52
ii)	Higher prices	7.39**
3.	Transportation	
i)	Villages not linked with roads	0.08
ii)	High transportation charges	10.49**
5.	Market intelligence	
i)	Late information	0.23
ii)	Inadequate information	0.13
6.	Malpractices	
i)	Deduct more charges	3.14
ii)	Prices are not paid in time	0.39
iii)	Low prices	2.16

** indicates significant at 5 per cent level.

The major problems in the production and marketing of kinnow were tested by chi-square test presented in Table- 4.33. The results revealed that in case of production related problems, shortage of skilled labour, higher wage rates and problem of stray animals were found to be statistically significant at 5 per cent level of significance. In case of marketing related problems, higher wage rate, non-availability of labour at peak operation time, higher prices of packing material and high transportation charges were found to be statistically significant indicating that response of the farmers related to these problem differ significantly among different categories of farms.

Chapter-5

SUMMARY AND CONCLUSIONS

India, with its wide variability of climate and soil, is highly favourable for growing a large number of horticultural crops. Fruits and vegetables account for nearly 90% of the total horticulture production in the country. Fruits in human nutrition make balanced diet, which tends to the development of sound health and happiness of human beings. India is the world's second largest producer of fruits with its projected value touching 98 million tonnes by the year 2020-2021. In India, fruits are grown on an area of about 6.30 million hectares with an annual production of 92.84 million tonnes. Among different fruit crops, Citrus is the third largest fruit industry in India after Mango and Banana in terms of area under cultivation. After Mexico, India is the leading producer of citrus fruits with an area of 1.06 million hectares and annual production of 2.75 million metric tonnes.

Himachal Pradesh, the north-western & Himalayan state of the country 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. The total fruits production in state was recorded 6.12 lakh tonnes from 229.20 thousand hectares area. In the sub-tropical region of the state, cultivation of citrus is an important horticulture activity. The production of citrus fruits in the state has reached up to 28051 metric tonnes from an area of about 24475 hectares. Among citrus fruits, kinnow mandarin has shown tremendous potential in the foothills of the state due to its wide adaptability to variable agro-climatic conditions and also comparatively more resistant to insect pests and diseases. It plays an important role in the socio-economic transformation of rural masses in the low-hill zone of the state. In the state, kinnow/orange fruit occupies an area of 8765 hectares with annual production of 14687 metric tonnes. In Kangra district of Himachal Pradesh kinnow/orange are grown on an area of about 5736 hectares with annual production of about 10430 metric tonnes. Keeping all these facts in view, the present study entitled "An economic analysis of production and marketing of kinnow in Kangra district of Himachal Pradesh" was conducted in Kangra district of Himachal Pradesh during the year 2017-18 to study the different

aspects of production and marketing including the problems faced by the households engaged in the production of kinnow with following objectives;

Objectives:

1. To work out the costs and returns structure of Kinnow orchard at existing level.
2. To study the resource use efficiency of selected Kinnow growers.
3. To examine the marketing efficiency and major constraints in production and marketing of Kinnow.

The present study was taken in Kangra district of the state. Multistage sampling technique was used to draw the 100 sample respondents for the study. To meet the objectives of the study both primary and secondary data was collected. The data collected were subjected to analysis for examining the cost and returns, resource use efficiency, marketing efficiency and major constraints in production and marketing of kinnow. Cobb-Douglas production function was used to study the relationship between output and various inputs by taking gross returns as dependent variable and expenditure on human labour, FYM, fertilizers and plant protection chemicals as independent variables. The various marketing aspects like marketing channels, marketing cost, marketing loss, marketing margin, producer's share in consumer's rupee and marketing efficiency were worked out. An attempt was also made to study the problems in production and marketing that were faced by kinnow producers in the study area. The major findings of the present investigation have been briefly summarized in this chapter.

4.1 Major findings of the study

- Socio-economic indicators revealed that majority of the sample households in the study area have nuclear families. At overall level, the average family size comprised of 4.77 persons, out of which 52.83 per cent were males and rest were females. The number of females per thousand of males worked out to be 868, 904, 944 and 893 for small, medium, large and overall farms, respectively.
- Literacy status of studied households revealed that 92.00 per cent family members were literates at overall level and literacy index was found 3.36, indicating that there is scope for improvement in the quality of education in the study area.

- Occupational distribution of the sampled households revealed that 69.00 per cent of work force practice farming followed by service sector (17.00%) and business (14.00%) at overall level. Similar trend was observed in case of small and medium farm categories.
- The analysis related to existing land use pattern revealed that out of total land holding at overall level, maximum area was under orchard (74.74%) followed by food crops (20.53%), pasture land (2.10%), forest land (1.05%), land put to non– agricultural use (1.05%) and barren land (0.53%). This indicates that fruit cultivation is more preferred vocation than any other vocation in the study area.
- Cropping pattern analysis of the sample households revealed that among the annual crops, wheat and maize cultivation was more common among all the farm categories followed by vegetables and others. In the study area, kinnow plantation occupies more than 33 per cent area. At overall level, cropping intensity was estimated to be 121.55 per cent which is lower due to more area under fruit crop.
- Investment pattern showed an increasing trend with increase in size of holding. Average investment on farm implements was found to be Rs. 3461.50, Rs. 4707.95, Rs. 5750.74 and Rs.4202.15 on small, medium, large and overall farms, respectively.
- Major source of irrigation in the study area was tank, followed by tube-well, bore-well, *Nallah*, kuhl and drip system. Out of total cultivated area, 92.70 per cent of the area was found to be irrigated through these sources in the study area.
- Livestock inventory per household was found 3.47 livestock units out of which 35.56 per cent were cows followed by buffaloes (31.02%), young stocks (13.90%), goat/sheep (0.36%), mule (6.95%) and poultry (2.94%).
- The analysis of cost and returns of kinnow in the study area revealed that initial cost of kinnow plantation per hundred plants was found Rs. 7960.76 at overall level. Total variable cost and total fixed cost was estimated at 62.45 per cent and 37.55 per cent of total cost, respectively. In total variable cost, expenditure on planting material was major component and rental value of land was highest in total fixed cost.
- The total maintenance cost during non-bearing stage of kinnow plants showed positive relationship with the age of plants, at overall level. The share of FYM was found highest followed by family labour cost in total variable cost while rental value of owned land contributed more in total fixed cost followed by interest on past establishment cost.

Similar trend was observed among medium and large categories while in small category the share of family labour was more than FYM in total variable cost.

- Maintenance cost per hundred plants during bearing stage at overall level showed an increase in cost up to 13-16 years of plant age and thereafter, it start decreasing which is due to the decrease in production which lead to lesser labour requirement. The proportion of variable cost in total cost ranged from 69.88 to 71.80 per cent in different years. The per cent share of fixed cost in total cost varied from 28.20 per cent to 30.12 per cent in different age groups of plantation. Pro-rated establishment cost accounted for the maximum share in fixed cost and family labour accounted for maximum share in total variable cost.
- The yield at overall level was found to vary across age groups from 22.05 to 42.28 quintals per hundred plants. The gross returns on an average were ranged between Rs. 24255.22 to Rs. 46508.42 in different age groups of plants. The net returns varied between Rs. 5549.18 to Rs. 27071.03 among different categories of farm.
- Per hectare gross returns for overall farm category varied between Rs. 121276.10 to Rs. 232542.11 among different age groups of kinnow orchard. It was also found that net income per hectare of kinnow orchard becomes positive from 5-8 years of age group.
- The payback period worked out to be of 8 years among all the categories with overall benefit-cost ratio of 1.45, internal rate of return (IRR) of 17.48 per cent and net present value of Rs. 112369.90. These measures clearly indicated that kinnow cultivation in the study area is a profitable venture. In small, medium and large category, benefit-cost ratio was worked out be 1.46, 1.47 and 1.42, respectively.
- The regression analysis with Cobb – Douglas production function revealed increasing returns to scale on overall farms under kinnow cultivation. Human labour, FYM and fertilizer were found statistically significant which means if there will be one per cent change in human labour, FYM and fertilizer, the returns will be changed by 0.399, 0.381 and 0.418 per cent, respectively. Plant protection was also found positively related with the output but not found statistically significant.
- It has been observed that MVP value for human labour, FYM and fertilizer was greater than unity thus showing under-utilization of these resources and increased use of these inputs will definitely increase the returns.

- Four marketing channels were prevalent for marketing of kinnow crop viz., channel-I (Producer - Pre-harvest contractor – Wholesaler – Retailer - Consumer), channel-II (Producer – Wholesaler – Retailer - Consumer), channel-III (Producer – Retailer - Consumer) and channel-IV (Producer - Consumer). Among these channels, channel-I was found to be the most preferred channel as 52.21 per cent of the produce was traded through this marketing channel followed by channel-II (34.15%), channel-III (10.22%) and channel-IV (3.42%).
- Producer's selling price varied from Rs. 1100/qtl to Rs. 1800/qtl among different marketing channels. Price spread was maximum in channel-I followed by Channel-II, III and channel-IV and the highest marketing cost, margin and loss was found in channel-I and lowest in channel-IV. Producer's share in consumer's rupee was highest in channel – IV followed by channels III, II and I, respectively.
- Marketing efficiency was found highest in channel-IV (11.54) when the produce is directly sold by producer to consumer followed by channels III (3.85), II (1.51) and I (1.04), respectively. Though channel-IV was found efficient but the volume transacted was very less (3.42%), because of certain limitations of trading directly from producer to consumer.
- Major production problems faced by farmers were high cost of plant protection chemicals, problem of stray animals, limited availability of FYM, shortage of skilled labour, higher wage rate and non- availability of labour at peak operation time. Major marketing related problems were low prices for the produce, deduction of more charges by various marketing agencies, high transportation charges and higher wage rates. Other main problems prevailing in production and marketing of the produce in the study area were shortage of desired plant material, shortage of packing material and non-availability of fertilizers in time.

4.2 Policy implications

The findings of the present study have resulted in to number of policy implications for the production and marketing of kinnow. Based on the conclusions drawn from the results of the study following policy implications emerged:

- The cost and financial feasibility analysis of the kinnow showed that kinnow cultivation is profitable in the study area, however, efficient marketing and its management was found to be the major bottleneck in proper disposal of produce.
- Resources were underutilized by the farmers in the study area. Therefore balanced use of these inputs by the orchardists can enhance the kinnow productivity and economic viability to a large extent. Hence the cultivators should adopt recommended package of practices which in turn would result in increasing the return by minimizing the costs. For this it is suggested to and upgrade the kinnow growers skills and for this an intensive training programme is needed which can be imported by Horticulture university and Horticulture department of the state.
- Information on market potential, price and market intelligence is required to be collected through market survey so that proper marketing strategy could be formulated.

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Appendix I: List of selected villages selected from Indora and Nurpur block in the study area

Sr. No.	Villages selected from Indora Block	Villages selected from Nurpur Block
1.	Bai Indoriyan	Basa Waziran
2.	Bhapoo	Bharmoli
3.	Chanour	Bhugnara
4.	Chubarpur	Charuri
5.	Gadran	Dhaneti
6.	Indpur	Jachh
7.	Mand Manjwa	Jasur Khas
8.	Rajakhassa	Kandi
9.	Sanore	Panjara
10.	Surawan	Sukhar

Appendix II: Establishment cost of kinnow orchard on per hectare basis

Sr. No.	Farm Size	Establishment cost (Rs./ha)		
		Total variable cost	Total fixed cost	Total cost
1)	Small	23956.85	14784.90	38741.75
2)	Medium	25306.75	15049.75	40356.50
3)	Large	26216.30	15382.60	41598.90
4)	Overall	24857.45	14946.35	39803.80

Appendix III: Maintenance cost during non-bearing stage of kinnow orchard on different categories of farm (per hectare basis)

Sr. No.	Particulars	Maintenance cost during non-bearing stage (Rs./ha)			
		Small	Medium	Large	Overall
A.	2 year				
i)	Total Variable cost	17321.40	18628.55	18319.10	17917.15
ii)	Total fixed cost	16722.00	17067.60	17462.55	16936.55
iii)	Total cost	34043.40	35696.15	35781.65	34853.70
B.	3 year				
i)	Total Variable cost	19543.20	20013.50	19751.80	19834.95
ii)	Total fixed cost	18424.15	18852.40	19251.65	18679.25
iii)	Total cost	37967.35	38865.90	39003.45	38514.20
C.	4 year				
i)	Total Variable cost	21201.60	21787.85	21316.70	21594.90
ii)	Total fixed cost	20322.50	20795.70	21201.80	20605.25
iii)	Total cost	41524.10	42583.65	42518.50	42155.15

Appendix IV: Maintenance cost during bearing stage of kinnow orchard on different categories of farm (per hectare basis)

Sr. No.	Particulars	Maintenance cost during non-bearing stage (Rs./ha)			
		Small	Medium	Large	Overall
A.	5-8 year				
i)	Total Variable cost	65552.60	65888.00	66725.85	66120.00
ii)	Total fixed cost	27003.95	27688.15	28133.35	27410.20
iii)	Total cost	92556.55	93578.15	94859.20	93530.20
B.	9-12 year				
i)	Total Variable cost	67288.90	70703.05	69870.20	69054.00
ii)	Total fixed cost	27003.95	27688.15	28133.35	27410.20
iii)	Total cost	94292.85	98391.20	98003.55	96464.20
C.	13-16 year				
i)	Total Variable cost	67928.60	70958.20	75523.00	69776.75
ii)	Total fixed cost	27003.95	27688.15	28133.35	27410.20
iii)	Total cost	94932.55	98646.35	100656.35	97186.95
D.	17-20 year				
i)	Total Variable cost	64217.35	63189.30	62660.30	63603.45
ii)	Total fixed cost	27003.95	27688.15	28133.35	27410.20
iii)	Total cost	91221.30	90877.45	90793.65	91013.65

Appendix V: Total maintenance cost under different categories of kinnow orchards/100 plants (including non-bearing and bearing kinnow plants)

(Rupees/ 100 Plants)

Sr. No.	Particulars	Small	Medium	Large	Overall
1.	Variable cost				
i)	Gap filling	96.05	114.66	134.40	109.05
ii)	Family labour	25183.89	22374.80	20191.18	23365.31
iii)	Hired labour	1023.78	4123.78	6222.25	3019.37
iv)	FYM	23713.31	23842.14	23435.48	23709.81
v)	Fertilizer	4383.35	4747.65	4886.49	4596.61
vi)	Plant protection	2579.34	2541.83	2452.21	2553.80
vii)	Interest on working capital	1267.99	1410.22	1479.66	1355.18
viii)	Risk margin	3169.98	3525.54	3699.64	3387.96
ix)	Managerial cost	3169.98	3525.54	3699.64	3387.96
A.	Total variable cost	64587.67	66206.16	66200.95	65485.05
2.	Fixed cost				
i)	Land revenue	8.40	8.40	8.40	8.40
ii)	Annual depreciation	1062.60	1241.10	1612.66	1171.59
iii)	Interest on fixed capital	622.86	815.15	909.58	739.90
iv)	Rental value of land	19005.00	19005.00	19005.00	19005.00
v)	Interest on past establishment cost	2222.79	2313.29	2353.64	2276.40
vi)	Prorated establishment cost	9775.24	10110.72	10200.60	9971.08
B.	Total fixed cost	32696.89	33493.66	34089.88	33172.37
	Total cost (A+B)	97284.56	99699.82	100290.83	98657.42

Appendix VI: Total maintenance cost under different categories of kinnow orchards on per hectare basis

Sr. No.	Farm Size	Total Maintenance cost (Rs./ha)		
		Total variable cost	Total fixed cost	Total cost
1)	Small	322938.35	163484.45	486422.80
2)	Medium	331030.80	167468.30	498499.10
3)	Large	331004.75	170449.40	501454.15
4)	Overall	327425.25	165861.85	493287.10

Appendix VII: Cost-concept wise total maintenance cost under different categories of kinnow orchards/100 plants
(Rupees)

Sr. No.	Particulars	Small	Medium	Large	Overall
A.	Cost-A₁				
1.	Hired labour cost	1023.78	4123.78	6222.25	3019.37
2.	Gap filling	96.05	114.66	134.40	109.05
3.	FYM	23713.31	23842.14	23435.48	23709.81
4.	Fertilizer	4383.35	4747.65	4886.49	4596.61
5.	Plant protection	2579.34	2541.83	2452.21	2553.80
6.	Interest on working capital	1267.99	1410.22	1479.66	1355.18
7.	Risk margin	3169.98	3525.54	3699.64	3387.96
8.	Land revenue	8.40	8.40	8.40	8.40
9.	Annual depreciation	1062.60	1241.10	1612.66	1171.59
10.	Interest on past establishment cost	2222.79	2313.29	2353.64	2276.40
11.	Prorated establishment cost	9775.24	10110.72	10200.60	9971.08
	Total Cost-A ₁	49302.83	53979.33	56485.43	52159.25
B.	Cost-A₂	49302.83	53979.33	56485.43	52159.25
C.	Cost-B₁				
12.	Cost-A ₁	49302.83	53979.33	56485.43	52159.25
13.	Interest on fixed capital	622.86	815.15	909.58	739.90
	Total Cost-B ₁	49925.69	54794.48	57395.01	52899.15
D.	Cost-B₂				
14.	Cost-B ₁	49925.69	54794.48	57395.01	52899.15
15.	Rental value of land	19005.00	19005.00	19005.00	19005.00
	Total Cost-B ₂	68930.69	73799.48	76400.01	71904.15
C.	Cost-C₁				
16.	Cost-B ₁	49925.69	54794.48	57395.01	52899.15
17.	Family labour cost	25183.89	22374.80	20191.18	23365.31
	Total Cost-C ₁	75109.58	77169.28	77586.19	76264.46
D.	Cost- C₂				
18.	Cost-B ₂	68930.69	73799.48	76400.01	71904.15
19.	Family labour cost	25183.89	22374.80	20191.18	23365.31
20.	Total Cost-C ₂	94114.58	96174.28	96591.19	95269.46
D.	Cost-D				
21.	Cost-C ₂	94114.58	96174.28	96591.19	95269.46
22.	Managerial cost	3169.98	3525.54	3699.64	3387.96
	Total Cost-D	97284.56	99699.82	100290.83	98657.42

Appendix VIII: Average production from different age groups of kinnow plants on per hectare basis

(Quintals/hectare)

Farm categories	Age group				Average Production
	5-8 year	9-12 year	13-16 year	17-20 year	
Small	110.20	180.20	213.15	195.70	174.81
Medium	113.40	194.30	212.85	201.75	180.58
Large	109.10	191.05	206.60	193.70	175.11
Overall	110.25	186.75	211.40	196.45	176.21

Appendix IX: Gross returns from different age groups of kinnow plants on per hectare basis

(Rupees/hectare)

Farm categories	Age group				Average Gross Returns
	5-8 year	9-12 year	13-16 year	17-20 year	
Small	121221.10	198221.80	234467.13	215271.96	192295.50
Medium	124741.13	213731.94	234137.13	221927.02	198634.31
Large	120011.09	210156.91	227262.07	213071.94	192625.50
Overall	121276.10	205426.87	232542.11	216096.96	193835.51

Appendix X: Net returns from different age groups of kinnow plants

(Rupees/ hectare)

Farm categories	Age group				Average Net Returns
	5-8 year	9-12 year	13-16 year	17-20 year	
Small	28664.55	103928.95	139534.60	124050.65	99044.69
Medium	31163.00	115340.75	135490.80	131049.55	103261.03
Large	25151.90	112153.35	126605.70	122278.30	96547.31
Overall	27745.90	108962.65	135355.15	125083.30	99286.75

Appendix XI: Survey Schedule

DR YS PARMAR UNIVERSITY OF HORTICULTURE AND FORESTRY, NAUNI, SOLAN-
173230

DEPARTMENT OF SOCIAL SCIENCES

Schedule for the Survey

An Economic Analysis of Production and Marketing of Kinnow in Kangra district of
Himachal Pradesh

Date of Interview:

1. General Information :

- Name of the respondent : _____ Name of the village : _____
- Education : _____ Sex : _____
- Village : _____ Panchayat : _____
- Block : _____
- Family Type : Joint/Nuclear
- No. of family members : Male _____ Female _____ Children _____

Sr. No	Relationship with Head	Age	Education I/P/M/H/D/S/NS	Occupation			
				Main		Subsidiary	
				Particular	Income(Rs.)	Particular	Income(Rs.)
1							
2							
3							
4							
5							
6							
7							

I-Illiterate, P- Primary, M- Middle, H-High/ Sr.Secondary, D- Degree & Above, S-School going, NS-Non-School Going.

2. Land Utilization Pattern (Bigha or ha)

Sr. No.	Particulars of land	Area			Source of Irrigation
		IR	UIR	Total	
1.	Total land holding(owned)				
2.	Cultivated area				
3.	Orchard Area				
4.	Forest land				
5.	Ghasnis/ Pastures land				
6.	Fallow land				
7.	Barren Land				
8.	Land put to non-agricultural use				

9.	Leased-in land				
10.	Leased-out land				
11.	Others				
12.	Total holding				

IR- IRRIGATED, UIR- UNIRRIGATE

3. Cropping Pattern & Production Details (Area in Bigha, Qty in Qtls & Value in Rs.)

Crop	Area (Bigha)/ No. of Plants		Production (Qtls)				Home Consumption Qty	Losses Qty	Marketed	
	IR	UIR	IR		UIR				Qty	Value
			Main	By-Product	Main	By-Product				
Kharif										
Maize										
Rice										
Tomato										
Cabbage										
Cauliflower										
Capsicum										
Cucurbits										
Rabi										
Wheat										
Onion										
Garlic										
Mustard										
Others										
Ginger										
Fruits										
Kinnow										
Oranges										
Galgal										
Mango										

Litchi										
Flowers										
Marigold										

4. INTER-CROPPING

Sr. No.	Name of the crop	Sowing Time	Harvesting Time	IR/ UIR	Cost of Cultivation (Rs.)	Total Income (Rs.)	Benefit or Loss (Rs.)
1.							
2.							
3.							
4.							
5.							
6.							

5. LIVESTOCK INVENTORY

Sr. No.	Type of animals	Number		Total	Production	Qty Retained for self-Consumption	Sold	
		Cross-bred	Local				Qty	Value
1	Cows a) Milch b) Dry							
2	Buffalo a) Milch b) Dry							
3	Goat							
4	Sheep							
5	Poultry							
6	Others							

6. FARM INVENTORY

S.No.	Implements	Number	Year of purchase	Purchase value (Rs.)
A	Major Implements:			
1	Traditional Plough			
2	Iron Plough			
3	Levelers			

4	Sprayers a)Knapsack/Foot sprayer b) High power sprayer			
5	Pruning Scissors			
B	Minor Implements:			
6	Shovels (Phawda)			
7	Pickaxe (Gainti)			
8	Axe (Kulhadi)			
9	Hoe			
10	Machetes (darrat)			
11	Sickle			
12	Spade (Khurpa\ Khurpi)			
13	Grafting knives			
14	Basket Kiltas			
15	Plastic Kiltas			
16	Plastic Crates			
17	Ladders			
18	Hail Nets			

7. SOURCE OF INCOME

Sr. No.	Particulars	Income
1.	Farm Income	
	Food grains	
	Fruits	
	Vegetables	
	Livestock	
2.	Non-Farm Income	
	Job/ Business	
	Total	

8a. Is there any inventory of irrigation Structures? Yes/ No

If yes, then

S.No.	Description	Type of construction	Year of Construction	Cost of Construction
1.	Kuhl			
2.	Tank			
3.	Lift			
4.	Nallah			

5.	Spring			
6.	Bawari			
7.	Bore well			
8.	Tube well			

8b. Type of Irrigation System

Sr. No.	Type	Area covered	Purchase value	Year of purchase	Remarks
1.	Drip System				
2.	Sprinklers				
3.	Any other				

9. Variety wise age, no. of plants and area under kinnow

Sr.No.	Variety	Age	Number of Plants	Area

10. COST OF CULTIVATION OF KINNOW

A. Establishment Cost

1. Year of Plantation:

2. Area:

3. No. of Plants:

4. Planting Distance:

Sr. No.	Particulars	Material Cost		Labour Charges (Rs.)			
		Qty.	Value	Family		Hired	
				Male	Female	Male	Female
1.	Layout						
2.	Preparatory tillage						
3.	Digging of pits						
4.	Filling of pits						
5.	Seedling/Planting material						
6.	Fencing of orchard						
7.	Manure application						
8.	Fertilizer application						
9.	Cost of plantation						

10.	Irrigation						
11.	Plant Protection						
12.	Interest on working capital @4 %						
13.	Managerial cost @10% of working capital						
14.	Risk margin @ 10% of working capital						
15.	Rental value of land						
16.	Land revenue						
17.	Annual depreciation						
18.	Interest on fixed capital @7.5%						
19.	Any other (Specify)						

B. Operational and Maintenance Cost:

Particulars	1-3 Years		4-6 Years		7-10 Years		>10 Years	
	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
Human Labour								
a) Hired								
b) Family								
FYM Application								
Fertilizer application								
Plant protection								
Pruning, Training, Weeding								
Harvesting/ Picking								
Interest on working capital @4 %								
Managerial cost @10% of working capital								

Risk margin @ 10% of working capital								
Land revenue								
Rental value of land								
Annual depreciation								
Interest on fixed capital @7.5%								
Any Other (Specify)								

11. Total Production (Kinnow)

Year	Quantity (Qtls)	Value (Rs.)
2011		
2012		
2013		
2014		
2015		
2016		
2017		

12. Production and Disposal Pattern

Total Product (Qtls)	Losses	Home Consumption	Quantity Sold

13. Marketing Channels

1. Producer → Wholesaler → Retailer → Consumer
2. Producer → Primary Wholesaler → Secondary Wholesaler → Retailer → Consumer
3. Producer → Pre harvest contractor → Commission Agent → Retailer → Consumer
4. Producer → Pre harvest contractor → Commission Agent → Wholesaler → Retailer → Consumer
5. Producer → Pre harvest contractor → Wholesaler → Retailer → Consumer
6. Producer → Pre harvest contractor → Primary wholesaler → Secondary wholesaler → Retailer → Consumer
7. Producer → Retailer → Consumer
8. Producer → Consumer

14. Marketing operations of kinnow

Particular	Family labour days/hr.		Hired labour days/hr.		Animal labour days/hr.		Machinery/Vehicles		Material cost/service charges		
	M	F	M	F	M	F	Days/hr	Days/hr	Qty	Rate	Value
1. Assembling											
2. Grading											
3. Packing cost											
i) Boxes											
ii) Gunny bags											
iii) Labeling											
iv) Others											
4. Transportation											
i. Field to road head											
ii. Road head to distant market											
iii. Loading/unloading											
iv. Others (specify)											
5. Storage											
6. Other charges											
i. Market fee											
ii. Octroi											
iii. Commission fee											
iv. Handling Charges											

15. Marketing Pattern of Kinnow

Crop	Place where sold	Agent to whom sold	Distance	Means of transport	Price received	Quantity sold

16. Have you borrowed funds from financial resources? Yes/ No

a) If Yes, then

Sr. No.	Amount Borrowed	Time Period	Borrowing of funds				Repayment Period
			Institutional		Non- Institutional		
			Amount	Rate of Interest	Amount	Rate of Interest	

b) Source of financial assistance?

Govt. Authorities/ Financial Institutions/ Money Lenders/ Middleman/ Any other

17. Problems faced by orchardist and their responses

I. Production Problems

Problems		Remarks (Agree/ Disagree)
A. Skilled labour		
i)	Shortage of skilled labour	
ii)	Higher wages rates	
iii)	Non-availability at peak operation time	
iv)	Lack of technical knowledge	
B. Chemical Fertilizer		
i)	High transportation cost	
ii)	Desired brand not available	
iii)	Fertilizer not available in time	
C. Plant Protection Chemicals		
i)	High prices of chemicals	
ii)	Chemicals not available in time	
iii)	Sale of spurious chemicals.	
Other problems		
i)	Non availability of healthy plant material	
ii)	Limited supply of FYM	
iii)	Perennial supply of irrigation not available	
iv)	Irrigation facility not available	

II. Marketing Problems

Problems		Remarks (Agree/ Disagree)
A. Grading and packing		
i)	Shortage of skilled labour	

ii)	Higher wages rates	
iii)	Non-availability at peak operation time	
iv)	Lack of technical knowledge	
B. Packing material		
i)	Shortage of wooden boxes and CFB cartons	
ii)	Shortage of other packing material	
iii)	Higher prices	
iv)	Non-availability of credit	
v)	Not available in time	
vi)	Not available at desired place	
C. Storage facility		
i)	No storage facility	
ii)	Inadequate storage facility	
D. Transportation		
i)	Lack of vehicles	
ii)	Vehicles not available in time	
iii)	Village not linked with roads	
iv)	High transport charges	
v)	Lack of all-weather roads	
E. Market intelligence		
i)	Late information	
ii)	Information available limited	
iii)	Limited to markets only	
iv)	Inadequate information	
v)	Misleading information	
vi)	Price information not available in time	
F. Malpractices		
i)	Deduct more charges	
ii)	Part payment	
iii)	Multiplicity of charges	
iv)	Deduct undue charges	
v)	Do not take the consent of farmers while selling	
vi)	Quote lower than actual price	
G. Others		
i)	Availability of buyers	
ii)	Getting good prices for the crop	

Trader's Schedule

Name:

Age:

Education:

I. Quantity Handled:

Sr. No.	Particulars	Varieties				
1.	Quantity handled					
2.	Average purchase price (Rs.)					
3.	Source of supply					
4.	Distance of source of supply (Km)					
5.	Commission charged (Rs.)					
6.	Storage (Qtls.)					
7.	Market fee					
8.	Loading/Unloading					
9.	To whom produce is sold					
a)	Consumer (Value of Produce)					
b)	Retailer (Value of Produce)					
c)	Secondary wholesaler (Value of Produce)					
d)	Processing unit					
e)	Any other (specify)					

2. Marketing cost

Sr. No.	Particulars	Cost (Rs.)
1.	Loading/Unloading	
2.	Weighing	
3.	Transportation	
4.	Taxes	
5.	License fee	
6.	Market fee	
7.	Union charges	
8.	Telephone charges	
9.	Cost of gunny bags/crates	
10.	Carriage charges	
11.	Miscellaneous	
	Total Cost	
	Sale Price	

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ABSTRACT

The present study entitled, "An economic analysis of production and marketing of kinnow in Kangra district of Himachal Pradesh" was conducted during the agricultural year 2017-18. A sample of 100 kinnow growers was selected using multistage sampling technique. The sample farms were further categorized into small (up to 300 plants), medium (300-700 plants) and large (>700 plants) based on number of plants. The primary data were collected through survey method by interviewing the kinnow growers directly through a well-designed pre-tested schedule. Local markets of Jassur and Pathankot were selected purposively for conducting marketing study. The results of the study revealed that overall literacy rate in the study area was 92.00 per cent with literacy index of 3.36 indicating low quality of education. Out of total land holding, maximum area was found under orchard (1.42 ha). The cropping intensity was worked out to be 121.55 per cent which is low due to more area under fruit plantation. Initial cost of kinnow plantation per hundred plants was calculated as Rs. 7960.76 at overall level and was practically found almost same in all categories of farmers. The maintenance cost of non-bearing plants was Rs. 6970.74, Rs. 7702.84 and Rs. 8431.03 per hundred plants in the second to fourth year of age, respectively. Maintenance cost during bearing stage was estimated to Rs. 18706.04, Rs. 19292.84, Rs. 19437.39 and Rs. 18202.73 per hundred plants in the age groups of 5-8, 9-12, 13-16 and 17-20 years, respectively which showed an increasing trend up to 13-16 years of age group and then gradually decreased in the age group of 17-20 years. The payback period worked out to be of eight years among all farm categories with overall benefit-cost ratio of 1.45, internal rate of return (IRR) 17.48 per cent and net present value of Rs. 112369.90. These measures clearly indicated that kinnow cultivation is profitable in the study area. It has been observed that human labour, FYM and fertilizer and plant protection chemical were under-utilized resources and more use of these inputs will increase output. However, human labour, FYM and fertilizer were found statistically significant while, plant protection was found non-significant. The findings of the study strongly recommend the optimum use of the resources in order to attain desired growth in kinnow cultivation and ultimately the productivity. The main marketing channels were found as channel-I (Producer - Pre-harvest contractor - Wholesaler - Retailer - Consumer, channel-II (Producer - Wholesaler - Retailer - Consumer, channel-III (Producer - Retailer - Consumer and channel-IV (Producer - Consumer) in the study area. Among these channels, channel-I was found to be the most preferred channel as 52.21 per cent of the produce was traded through this channel. However, channel-IV was found to be most efficient in the study area with marketing efficiency of 11.54. High cost of plant protection chemicals, problem of stray animals, limited availability of FYM, shortage of skilled labour, higher wage rate & non-availability of labour at peak operation time, low prices for the produce, deduction of more charges by various marketing agencies and high transportation charges were some of the production and marketing problems reported by the kinnow growers in the study area.


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