PRODUCTION AND MARKETING OF PEAR IN PUNJAB: AN ECONOMIC ANALYSIS

Thesis

Submitted to the Punjab Agricultural University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE
in
AGRICULTURAL ECONOMICS
(Minor Subject: Statistics)

By

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LUDHIANA – 141 004

2017

CERTIFICATE I

This is to certify that the thesis entitled, "**Production and marketing of pear in Punjab: an economic analysis**" submitted for the degree of **M.Sc.** in the subject of **Agricultural Economics** (Minor subject: **Statistics)** of the Punjab Agricultural University, Ludhiana, is a bona fide research work carried out by **Kawalpreet Kaur (L-2015-BS-202-M)** under my supervision and that no part of this thesis has been submitted for any other degree.

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

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CERTIFICATE II

This is to certify that the thesis entitled, **"Production and marketing of pear in Punjab: an economic analysis"** submitted by **Kawalpreet Kaur (L-2015-BS-202-M)** to the Punjab Agricultural University, Ludhiana, in partial fulfillment of the requirements for the degree of **M.Sc.** in the subject of **Agricultural Economics** (Minor subject: **Statistics**) has been approved by the Student's Advisory Committee along with External Examiner after an oral examination on the same.

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ACKNOWLEDGEMENT

Apart from the efforts of me, the success of any project depends largely on the encouragement and guidelines of many others I take this opportunity to express my gratitude to the people who have been instrumental in the successful completion of my research. At first, I wish to thank the almighty for giving me powers to complete my entire work.

I express my insufficiency to trace out appropriate words to express my deep sense of gratitude and indebtedness to my esteemed Major Advisor, ***Dr. Jatinder Sachdeva****, Senior Farm Economist, Department of Economics and Sociology, Punjab Agricultural University, Ludhiana for his valuable guidance, constant encouragement, immense patience, useful discussion and peerless criticism during the course of investigation and preparation of the manuscript. Without his encouragement and guidance this research would not have been materialized. I have real appreciation and regards for his warm, friendly behaviour and sense of forgiveness throughout my association with him. It was my proud privilege and unforgettable experience to work under the supervision of such a dedicated guide.*

I express my deep sense of gratitude to the respected members of my advisory committee. This thesis would not have been possible without the help, immaculate guidance, constructive reviews and continuous support of ***Dr. D.K. Grover****, Director (Agro Economic Research Centre) Department of Economics and Sociology. I feel elated in expressing thanks to* ***Dr. Mohammad Javed,*** *Professor of Statistics, Department of Mathematics, Statistics and Physics and* ***Dr. Jasdev Singh****, Senior Agricultural Economist, Department of Economics and Sociology for helping during tenure of my study. Today what I am, I owe to them and my family as their selfless sacrifices will remain indelible in my life.*

I find no words to acknowledge in so formal manner the unending patience, encouraging moral support, affection and inspiration rendered by my respected Grandparents, ***Mrs. Balwinder Kaur and S. Lakha Singh*** *and parents* ***Mrs. Bhupinder Kaur*** *and* ***S. Dilbagh Singh*** *and uncle* ***Malhi*** *&* ***Harbhajan Singh*** *My words of acknowledgement will never convey the depth of my feelings for my sister,* ***Sukhman*** *and brothers,* ***Jaskaran*** *and* ***Rajkaran.***

Loving thanks to my dear friends, ***Navdeep, Sunaina, Shaveta*** *and* ***Harash*** *as we mutually engaged in making sense of the various challenges we faced and in providing encouragement to each other at those times when it seemed impossible to continue.*

In the end, I am thankful to all those who may not have been mentioned but are not forgotten. Needless to say, errors and omissions if any are all mine.

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Title of the Thesis	**:**	Production and marketing of pear in Punjab: an economic analysis
Name of the student **Admission No.**	**:**	Kawalpreet Kaur (L-2015-BS-202-M)
Major Subject	**:**	Agricultural Economics
Minor Subject	**:**	Statistics
Name and designation of **Major Advisor**	**:**	Dr. Jatinder Sachdeva Assistant Farm Economist
Degree to be Awarded	**:**	M.Sc.
Year of award of Degree	**:**	2017
Total Pages in Thesis	**:**	65 + Appendix + VITA
Name of University	**:**	Punjab Agricultural University, Ludhiana-141 004, Punjab, India

ABSTRACT

The present study was conducted to examine the economics of production and marketing of pear cultivation in Punjab. A sample of 60 pear growers representing different size categories became the basis of present study. During the period 2000-01 to 2015-16, the area, production and productivity of pear in the state increased significantly with compound annual growth rate of 5.88, 9.50 and 3.42 per cent, respectively. On overall basis, establishment cost of pear orchards came to be Rs 28307 per hectare. The annual operational cost was low in the initial years and increased consistently during the subsequent years. Annual maintenance cost during first year of plantation was Rs 6285 per hectare which increased to Rs 33653 per hectare for 14 to 20 year old orchards. Manures and fertilizers, intercultural operations, plant protection measures and training and pruning were the major components of operational cost. Over the life period of pear orchards average annual cost, annual total returns and net annual returns were Rs 126353, Rs 185045 and Rs 58692 per hectare, respectively. It emerged out that net annual returns received by the sample pear growers were quite high when they sold the produce themselves in the market than sale through pre-harvest contractor. On overall basis, positive net present value, BCR greater than unity and IRR greater than discount rate indicated that pear cultivation was economically viable in the study area. However, benefit-cost ratio and IRR had direct relationship with the farm size indicating significant economies of scale. Thus, large and medium pear orchards were relatively more profitable than small farms. A comparison of price spread through different marketing channels revealed that producer's share in consumer's rupee was higher in channel-I (Producer → wholesaler (Commission agent) → Retailer → Consumer) as compared to channel-II (Producer →pre-harvest contractor→ wholesaler (Commission agent) → Retailer → Consumer. So, the marketing efficiency was higher in channel- I than in channel-II. Lack of skilled labour, poor quality of planting material and weak research and extension linkages emerged as the major production problems, while price fluctuations, lack of processing facilities and poor market infrastructure were the major marketing constraints confronted by pear growers of the study area. In order to promote the cultivation of this high value crop, these problems need to be addressed immediately through policy and institutional measures.

Keywords: Pear, costs and returns, marketing, price spread, economic viability, problems

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Signature of Major Advisor Signature of the Student

ਖੋਜ ਦਾ ਸਿਰਲੇਖ	:	ਪੰਜਾਬ ਵਿੱਚ ਨਾਖਾਂ ਦਾ ਉਤਪਾਦਨ ਅਤੇ ਮੰਡੀਕਰਨ: ਇੱਕ ਆਰਥਿਕ ਵਿਸ਼ਲੇਸ਼ਣ
ਵਿਦਿਆਰਥੀ ਦਾ ਨਾਮ ਅਤੇ ਦਾਖਲਾ ਕ੍ਰਮਾਂਕ	:	ਕੰਵਲਪ੍ਰੀਤ ਕੌਰ (ਐਲ-2015-ਬੀ.ਐਸ.-202-ਐਮ.)
ਪ੍ਰਮੁੱਖ ਵਿਸ਼ਾ	:	ਖੇਤੀਬਾੜੀ ਅਰਥਸ਼ਾਸਤਰ
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ਡਿਗਰੀ	:	ਐਮ.ਐਸ.ਸੀ.
ਡਿਗਰੀ ਨਾਲ ਸਨਮਾਨਿਤ ਕਰਨ ਦਾ ਸਾਲ	:	2017
ਖੋਜ ਪੱਤਰ ਵਿੱਚ ਕੁੱਲ ਪੰਨੇ	:	65 + ਅੰਤਿਕਾ + ਵੀਟਾ
ਯੂਨੀਵਰਸਿਟੀ ਦਾ ਨਾਮ	:	ਪੰਜਾਬ ਖੇਤੀਬਾੜੀ ਯੂਨੀਵਰਸਿਟੀ, ਲੁਧਿਆਣਾ - 141 004, ਪੰਜਾਬ, ਭਾਰਤ

ਸਾਰ-ਅੰਸ਼

ਮੌਜੂਦਾ ਅਧਿਐਨ ਪੰਜਾਬ ਵਿੱਚ ਨਾਖਾਂ ਦੇ ਉਤਪਾਦਨ ਅਤੇ ਮੰਡੀਕਰਨ ਦੀ ਆਰਥਿਕਤਾ ਜਾਂਚਣ ਲਈ ਕੀਤਾ ਗਿਆ। ਵੱਖ-ਵੱਖ ਆਕਾਰ ਦੇ 60 ਨਾਖ ਉਤਪਾਦਕ ਇਸ ਅਧਿਐਨ ਦਾ ਅਧਾਰ ਬਣੇ। 2000-01 ਤੋਂ 2015-16 ਦੌਰਾਨ ਪੰਜਾਬ ਵਿੱਚ ਨਾਖਾਂ ਦਾ ਰਕਬਾ, ਉਤਪਾਦਨ ਅਤੇ ਉਤਪਾਦਕਤਾ ਅਰਥਪੂਰਨ ਤੌਰ ਤੇ ਵਧੀ ਜਿਸ ਦੀ ਸਲਾਨਾ ਵਿਕਾਸ ਦਰ ਕ੍ਰਮਵਾਰ 5.88, 9.50 ਅਤੇ 3.42% ਸੀ। ਸੰਪੂਰਨ ਤੌਰ ਤੇ ਨਾਖਾਂ ਦਾ ਇੱਕ ਹੈਕਟੇਅਰ ਬਾਗ ਲਗਾਉਣ ਵਿੱਚ 28307 ਰੁਪਏ ਲਾਗਤ ਆਉਂਦੀ ਹੈ। ਸ਼ੁਰੂਆਤੀ ਸਾਲਾਂ ਵਿੱਚ ਪਰਿਚਾਲਨ ਖਰਚ ਘੱਟ ਸੀ ਜੋ ਅਗਲੇ ਸਾਲਾਂ ਵਿੱਚ ਲਗਾਤਾਰ ਵਧਦਾ ਗਿਆ। ਪਹਿਲੇ ਸਾਲ ਵਿੱਚ ਰੱਖ-ਰਖਾਅ ਖਰਚ ਪ੍ਰਤੀ ਹੈਕਟੇਅਰ 6285 ਰੁਪਏ ਸੀ ਜੋ 14-20 ਸਾਲ ਪੁਰਾਣੇ ਬਾਗ ਵਿੱਚ ਵਧ ਕੇ 33653 ਰੁਪਏ ਹੋ ਗਈ। ਪਰਿਚਾਲਨ ਖਰਚ ਵਿੱਚ ਖਾਦਾਂ, ਗੋਡੀ, ਪੌਦ ਰੱਖਿਆ ਅਤੇ ਕਾਂਟ-ਛਾਂਟ ਦਾ ਖਰਚ ਮੁੱਖ ਸੀ। ਨਾਖਾਂ ਦੇ ਬਾਗ ਦੀ ਸਾਰੀ ਉਮਰ ਵਿੱਚ ਔਸਤ ਸਲਾਨਾ ਖਰਚ, ਸਲਾਨਾ ਮੁਨਾਫਾ, ਸਲਾਨਾ ਸ਼ੁੱਧ ਮੁਨਾਫਾ ਕ੍ਰਮਵਾਰ 126353, 185045 ਅਤੇ 58692 ਪ੍ਰਤੀ ਹੈਕਟੇਅਰ ਸੀ। ਇਹ ਦੇਖਣ ਵਿੱਚ ਆਇਆ ਹੈ ਕਿ ਸਲਾਨਾ ਸ਼ੁੱਧ ਮੁਨਾਫਾ ਜਦੋਂ ਉਤਪਾਦਕ ਖੁਦ ਨਾਖਾਂ ਵੇਚਦੇ ਹਨ ਤਾਂ ਕਾਫੀ ਜ਼ਿਆਦਾ ਹੁੰਦਾ ਹੈ। ਸੰਪੂਰਨ ਤੌਰ ਤੇ ਸਾਕਾਰਾਤਮਕ ਸ਼ੁੱਧ ਮੁਨਾਫਾ, ਬੀ.ਸੀ.ਆਰੀ. ਇਕਾਈ ਤੋਂ ਜ਼ਿਆਦਾ ਸੀ ਅਤੇ ਛੋਟ ਕਰ ਤੋਂ ਆਂਈ.ਆਰ.ਆਰ. ਤੋਂ ਵੱਧ ਇਹ ਦਰਸਾਉਂਦਾ ਹੈ ਕਿ ਅਧਿਐਨ ਖੇਤਰ ਵਿੱਚ ਨਾਖਾਂ ਦੀ ਕਾਸ਼ਤ ਆਰਥਿਕ ਤੌਰ ਤੇ ਵਿਵਹਾਰਿਕ ਸੀ। ਪਰ ਮੁਨਾਫਾ-ਖਰਚ ਅਨੁਪਾਤ ਅਤੇ ਆਈ.ਆਰ.ਆਰ. ਦਾ ਫਾਰਮ ਦੇ ਆਕਾਰ ਨਾਲ ਸਿੱਧਾ ਸਬੰਧ ਦਰਸਾਉਂਦਾ ਹੈ ਕਿ ਖੇਤ ਦਾ ਆਕਾਰ ਆਰਥਿਕਤਾ ਵਿੱਚ ਅਰਥਪੂਰਨ ਭੂਮਿਕਾ ਅਦਾ ਕਰਦਾ ਹੈ। ਇਸ ਤਰ੍ਹਾਂ ਛੋਟੇ ਫਾਰਮ ਦੇ ਮੁਕਾਬਲੇ ਵੱਡੇ ਅਤੇ ਦਰਮਿਆਨੇ ਆਕਾਰ ਦੇ ਫਾਰਮ ਦੀ ਆਮਦਨ ਜ਼ਿਆਦਾ ਸੀ। ਵੱਖ-ਵੱਖ ਮੰਡੀਕਰਨ ਦੇ ਚੈਨਲਾਂ ਵਿੱਚ ਕੀਮਤ ਦੀ ਤੁਲਨਾ ਦਰਸਾਉਂਦੀ ਹੈ ਕਿ ਚੈਨਲ-I (ਉਤਪਾਦਕ-ਥੋਕ(ਆੜਤੀਆ) - ਪਰਚੂਨ - ਖਪਤਕਾਰ) ਵਿੱਚ ਚੈਨਲ II (ਉਤਪਾਦਕ - ਠੇਕੇਦਾਰ - ਪਰਚੂਨ - ਖਤਪਕਾਰ) ਦੇ ਮੁਕਾਬਲੇ ਖਤਪਕਾਰ ਦੇ ਰੁਪਏ ਵਿੱਚ ਹਿੱਸਾ ਵੱਧ ਸੀ। ਇਸ ਕਰਕੇ ਚੈਨਲ I ਵਿੱਚ ਚੈਨਲ II ਦੇ ਮੁਕਾਬਲੇ ਮੰਡੀਕਰਨ ਕੁਸ਼ਲਤਾ ਵੱਧ ਸੀ। ਉਤਪਾਦਨ ਮੁਸ਼ਕਿਲਾਂ ਵਿੱਚ ਨਿਪੁੰਨ ਕਾਮਿਆਂ ਦੀ ਕਮੀ, ਖੋਜ ਅਤੇ ਪਸਾਰ ਵਿੱਚ ਕਮੀ, ਪਲਾਂਟਿੰਗ ਮਟੀਰੀਅਲ ਦੀ ਖਰਾਬ ਗੁਣਵੱਤਾ ਸ਼ਾਮਿਲ ਸੀ ਜਦਕਿ ਉਤਪਾਦਕਾਂ ਨੂੰ ਦਰਪੇਸ਼ ਮੰਡੀਕਰਨ ਮੁਸ਼ਕਿਲਾਂ ਵਿੱਚ ਕੀਮਤਾਂ ਵਿੱਚ ਉਤਰਾਅ-ਚੜਾਅ, ਪ੍ਰੋਸੈਸਿੰਗ ਸਹੂਲਤਾਂ ਦੀ ਕਮੀ, ਅਤੇ ਘਟੀਆ ਮੰਡੀਕਰਨ ਢਾਂਚਾ ਸੀ। ਇਸ ਉੱਚ ਕੀਮਤਾ ਵਾਲੀ ਫਸਲ ਦੀ ਕਾਸ਼ਤ ਨੂੰ ਹੁਲਾਰਾ ਦੇਣ ਲਈ ਇਹਨਾਂ ਮੁਸ਼ਕਿਲਾਂ ਦਾ ਹੱਲ ਨੀਤੀ ਅਤੇ ਢਾਂਚਾਗਤ ਕਦਮ ਚੁੱਕ ਕੇ ਫੌਰੀ ਕੱਢਣਾ ਚਾਹੀਦਾ ਹੈ।

ਮੁੱਖ ਸ਼ਬਦ: ਨਾਖ, ਕੀਮਤ ਅਤੇ ਮੁਨਾਫਾ, ਮੰਡੀਕਰਨ, ਆਰਥਿਕ ਵਿਵਹਾਰਿਕਤਾ, ਸਮੱਸਿਆਵਾਂ

ਮੁੱਖ ਸਲਾਹਕਾਰ ਦੇ ਹਸਤਾਖਰ **ਵਿਦਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ**

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CHAPTER I

INTRODUCTION

Agriculture sector plays a vital role in Indian society as well as in Indian economy, About 58 per cent of the Indian population is involved in agriculture. Along with other allied sectors like forestry and fisheries, agriculture contributes a large share in the Gross Domestic Product (GDP). According to the estimates of the Central Statistics Office (CSO), agriculture and allied sectors (including agriculture, livestock, forestry and fishery) had a share of 17.3 per cent in the Gross Value Added (GVA) during 2016-17 at 2011-12 prices (Anonymous 2017). India has a wide variability of climate, which enables farmers to grow large range of field crops and horticultural crops, such as fruits, vegetables, flowers, ornamental crops, medicinal crops, root tubers, aromatic plants, spices and plantation crops like coconut, arecanut, cashew and coca (NAAS, 2001). India has huge range of varieties of fruits in its basket and account for 10 percent of world's total fruit production. Mango, banana, citrus, pineapple, guava, spota, jackfruit, litchi and grapes, among the tropical and sub-tropical fruits; apple, pear, peach, plum, apricot, almond and walnut among the temperate fruits and anola, ber, pomegranate, annona, fig, phalsa among the arid zone fruits are important. In horticultural production, a voluminous increase has been observed in India over last few years. India has grabbed second rank in fruit production in the world after China. India has made a significant progress in area expansion resulting in higher production (Anonymous 2017).

Fruits play vital part in the agricultural economy of India. Farming of fruit crops adds to health, happiness of the people and wealth of the country. The living standard of the people is often arbitrated by production and per capita consumption of fruits. A well- established orchard can give better returns than other agronomical crops. Growing fruits is one of the important branches of diversified farming (Shinde *et al* 2016). Fruits are rich in nutrients and provide various health benefits. Eating plenty of fruits and vegetables daily reduce the risk of many diseases. Fruits and vegetables give energy to the body for growth, development and to fight against diseases. The USDA recommends that a balanced diet should contain minimum of 400 grams of fruits and 80 grams of vegetables per day.

Studies regularly show that fruits and vegetables has significantly higher ratio of benefits to costs than the consistent ratio for principal cereals and pluses. Realizing the significance of fruit farming, voluminous farmers are diverting their resources towards plantation of fruit crops (Banerjee 2009).

In India, during 2015-16, the production of total horticultural crops which includes fruits, vegetables, plantations, aromatic and medicinal plants, flowers, spices and honey was about 283360 thousand tonnes from an area of 23787 thousand hectares. The area under total

fruits during 2015-16 was 6405 thousand hectare and production was 91443 thousand tonnes (Anonymous 2016a).

Pear, a temperate fruit is having a good flavor and taste and is one of the important fruit crops of native to coastal and mildly temperate regions of the world, from Western Europe, North Africa and east across Asia. The main countries where pear is grown are China, India, USA, Russian Federation, Germany, Japan, and Spain. As per the estimation of the Pear Bureau Northwest, around 3000 well-known varieties of pears are cultivated globally (Anonymous 2014).

Most of the pear varieties are deciduous, but in Southeast Asia one or two species are evergreen. Most of the varieties of pear can withstand the extreme temperatures ranging between −25 °C (−13 °F) and −40 °C (−40 °F) in winter, excluding the evergreen species, which merely bear temperatures less than or about −15 °C (5 °F).

In India low chilling hours requiring pear are cultivated in plains of North India. The cultivars of pear being cultivated at higher hills of Jammu and Kashmir, Himachal Pradesh and Uttarakhand require high chilling hours (900-1000). November to March is the planting period for pear and November is the best month. Pear is not very fastidious to its soil requirements. Pear can be cultivated successfully on a range of soils from sandy loam to clay loam but soil must be deep, well drained and fertile without hard pans in top 2 meters and with pH less than 8.5. The soils having high pH always have a problem of deficiency of iron and zinc (Anonymous 2016c). Generally, while establishing a pear orchard plants of age one year are used but two-three years old plants trained in nursery can also be planted. Pear starts fruiting at the age of 5 years after planting, but it start giving profit from production at and after the age of 7 years. In India pear is mainly grown for consumption as a fresh fruit. The area under pear in India was 24.50 thousand hectare during 2011-12, which increased to 51 thousand hectare during 2015-16. During the same period production increased from 49 thousand tonnes to 399 thousand tonnes (Anonymous 2016b). The states where pear is commercially grown are Jammu and Kashmir, Himachal Pradesh, Haryana, Punjab and certain portions of Assam and Nillgiri hills in south India. Punjab is at number nine in the production of pear.

In Punjab pear is planted in winter. The plants remain dormant up to middle of February. The month of January is more preferable for planting pear. In Punjab, area under pear was 2879 hectares and production was 66047 tonnes during 2015-16 (Anonymous 2016b). The main districts of Punjab where pear is cultivated are Amritsar, Tran Taran, Jalandhar, Ludhiana, and Patiala. Area under pear in these districts was 828, 922, 289, 212 and 113 hectares, respectively during 2015-16, while production was 18957, 21113, 6792, 4811, 2600 tonnes, respectively (Anonymous 2016b).

Pear is divided into three categories according to grittiness and softness as hard pear, semi-soft pear, and soft pear. Cultivars under hard pear are Punjab Nakh, Parthernakh; under semi-soft pear are Punjab Gold, Punjab Nectar, Punjab Beauty, Baggugosha and soft pear are Nijisseeiki, Punjab Soft. Most of farmers in Punjab cultivate Parthernakh instead of other cultivars of pear because it is less perishable as compare to other varieties and also not prone to diseases and insects pests. Parthernakh fruits are famous for their keeping quality and ability to endure transportation enabling farmers to sell their produce to the distant market without spoilage of the produce.

Pear crop faces many problems in its production and marketing. The major production constraints faced by producers are lack of technological advancement, higher input costs, insect attack, failure of crop due to sudden rain, etc. The competing crops like wheat and paddy give more and stable profits as compare to fruits and vegetables because minimum support price is given by the government. The production related constraints are more faced by small farmers as compared to large framers. Fruits and vegetables are perishable commodities, so are more prone to marketing problems. Major marketing problems include large numbers of intermediaries in market, inadequate transport facilities, lack of proper infrastructure in market, lack of proper grading, packing, transportation, storage facilities, and processing units. Marketing system is not favorable to the interest of the producers and consumers. It is full of malpractices. The marketing of fruits in the state as a whole is on the mercy of middlemen, private traders and pre-harvest contractors due to absence of well-organized cooperatives and regulated markets. Also due to too many intermediaries, the sale and distribution procedure has become so complex that growers would not know the right place and right time to market the produce (Gupta, 2011). Generally farmers lease out their orchards to pre-harvest contractors. Most of the farmers and contractors prefer distant market (Delhi) for selling their produce instead of local market because Delhi is the biggest consuming market in the entire north India and here prices do not crash at the time of glut (Sekhon *et al* 2006).

To encourage diversification of agriculture in Punjab, it is necessary to enhance the returns from fruits. This can be done by bringing efficiency in production and marketing processes. Therefore, the present study is an attempt in this direction. The specific objectives of present study were:

i. To examine the cost and return from pear cultivation in Punjab.
ii. To identify the important marketing channels and price spread in marketing of pear in Punjab.
iii. To study the problems and suggest policy measures to encourage pear cultivation in Punjab.

CHAPTER II

REVIEW OF LITERATURE

The broad review of literature is a necessary part of any scientific research. To obtain a clear and in depth understanding of the problems of the study and to choose appropriate methodology, the relevant literature related to the study has been reviewed. The studies related to production and marketing of fruits conducted in India have been taken into sight in order to choose appropriate methodology with gaps left there in. A brief review of literature of the studies is presented in this chapter under the following headings:

2.1 Studies related to production

2.2 Studies related to marketing

2.1. Studies related to Production

Shah (2000) evaluated various aspects of production and marketing of grapes in Niphad taluka of Nasik district in the state of Maharashtra. Stratified random sampling procedure was adopted to select the sample farmers and primary data were collected from the sample orchardists for the reference year 1995-96. The per acre annual gross maintenance cost as well as returns of grape orchardists increased sharply during the initial fruit bearing phase before leveling off to a constant stage and, thereafter, these declined. About 67 per cent of the gross maintenance cost was spent on various production related operations and the remaining 33 per cent owed it to investments on various marketing functions. Among various components of production costs, the establishment cost alone accounted for about 34-35 per cent of the gross maintenance cost of production. The share of material input cost in gross maintenance cost of production was seen to be in the order of about 10-11 per cent. In general, one acre grape orchard yielded a net annual income to the tune or Rs 32388 during the increasing production stage, Rs 36345 during constant stage and Rs 22402 during declining production stage with an average of Rs 31758 during the stage of all-bearing age.

Dahiya *et al* (2001) in their study have examined the growth rates of area, production and yield of fruit crops in Haryana for the period 1990-91 to 1997-98. The results indicated that the area and production of guava and ber showed statistically significant increasing trend. In the case of mango, citrus and grapes, the area showed significant increasing trend while the increase in production was found to be statistically non-significant. In the case of yield, all crops showed non-significant declining trend. The annual growth rate for fruit crops registered a positive growth.

Mali *et al* (2004) studied economics of production and marketing of banana in Jalgaon district of Maharashtra. The total cost of cultivation was Rs. 120539.12 per hectare. Fertilizers were the component that occupied the largest proportion followed by seeds,

manures and irrigation. The total returns calculated were Rs. 214867.24 per hectare. The study identified high cost of transportation, non-availability of sufficient credit by the institutions in time, high price fluctuations, the problem of cheating in weighing of produce and lack of suitable grading of the produce according to quality as the main problems in production and marketing.

Suresh and Reddy (2004) estimated the cost of production of banana cultivation in Kerala. It was estimated that in Thrissur district of Kerala the total cost of cultivation was Rs. 108670 per hectare and returns were Rs. 185792. The cost component which occupied the largest proportion was human labour which accounted for 44 per cent of the total cost followed by chemical fertilizer, organic manures and plant protection chemicals. The study concluded that use of fertilizers and plant protection chemicals were significantly affecting the yield of banana. The efficiency analysis indicated that there is scope for increasing the returns by giving more resources to fertilizer. However, increasing plant density and high application of fertilizer decrease the total returns.

Verma and Singh (2004) have analyzed the trends in area, production and productivity of banana in India during the period of 1991-92 to 2000-01. The study found that area under banana improved by 25.76 per cent during the period under reference, while production had registered an escalation of 107.54 per cent. This upsurge in production had been assisted by improvement in productivity from 20.3 to 33.5 tonnes per hectare. However, the percentage decline in area as percentage of total fruit cultivated area had been detected, while production in terms of percentage of total fruit production had retained 31 per cent increase.

Saraswat *et al.* (2006) studied the production and marketing of peach fruit in Rajgarh area of Sirmour district in Himachal Pradesh. It was found that the average maintenance cost of peach orchard was Rs. 65227 in which fixed cost was Rs. 43299 and variable cost was Rs. 21928 per hectare. The result revealed that peach production was economically viable for all size of farms. Overall per hectare net returns were worked to be Rs. 8558 which were Rs. 2347, Rs. 6117 and Rs. 12734 on marginal, small and medium size of farms, respectively. The researchers also observed the problems related to marketing viz. lack of approach road to village, picking/ packing material available to producer, grading and packing of peach, storage facilities, transportation, market intelligence and malpractices in the market.

Sharma *et al* (2007) estimated the costs and returns from litchi production in Gurdaspur district of Punjab. The authors found that Rs. 73246 was invested by average litchi grower on installation of litchi orchard and 80 per cent of that was incurred on farm machinery and implements and rest 20 per cent on farm buildings. The per hectare total cost

on litchi cultivation bore a direct relationship with the farm size, while per hectare fixed cost showed an inverse relationship with farm size. It was found that Rs 72,501 were the total cost incurred on one hectare of litchi orchard. Total returns over costs from the litchi orchard were worked out Rs. 30244 per hectare on an average farm. In case of small, medium and large farms the returns were Rs. 27904, Rs. 28602 and Rs. 31059 per hectare, respectively. The study also concluded that returns over total costs increased with increase in farm size.

Gangwar *et al* (2008) observed the production constraints and economics of peach cultivation in Punjab and Uttarakhand. The investment in peach orchards has been found to be a profitable business. Depending on the size of peach orchards,the Internal Rate of Return (IRR) has been found to vary from 20.98 per cent to 23.08 per cent. For the overall category of orchards, the net present value, benefit-cost ratio at 12 per cent discount rate and IRR have been reported as Rs 44807, 1.681 and 22.20 per cent, respectively. The economic productive life of peach orchards in Punjab and Uttarakhand has been calculated up to 24 years and the optium size of peach orchards was above 2.0 hectare. It has been revealed that the peach orchards were worth retaining as long as they give income of Rs 5713 over the annual maintenance cost. To achieve the target of fruits production, study emphasized on proper post-harvest management, including establishment of mechanical grading, packaging, on-farm processing and cold storage and quality control measures to minimize post- harvest losses and provide remunerative prices to the peach growers.

Singh *et al* (2008) studied the area, production and productivity of major fruit crops of India. According to the study there was a positive growth trend in area and yield during the study period, 1970-71 to 2006-07. In the case of yield, a positive growth had been observed in banana and papaya, whereas in case of citrus, mango and guava the growth had been observed negative. In most of the fruit crops, the instability in area, production, and productivity had been recorded very high. The decomposition analysis suggested that positive growth of production was mainly due to area, while contribution of yield was negative. The study suggested adoption of better horticultural techniques to enhance the production of fruit crops as area diversion from cereal to fruit crops.

Maheshwari (2009) has observed the trends in area, production and productivity of fruit crops in Punjab state as well as in Bathinda district for the period 1987-88 to 2006-07. The study showed that in the case of Punjab state, the C.G.R. of area under fruits had enumerated reduction at a rate of 2.73 per cent per annum but its production had registered a positive growth of 0.55 per cent per annum, which was mainly due to escalation in yield which increased at a rate of 3.83 per cent per annum. In the case of Bathinda district, the growth in production (1.96 per cent per annum) was also due to growth in yield of fruits

which showed an increase of 3.15 per cent per annum for the same period, whereas area decreased at a rate of 1.16 per cent per annum.

Karpagam *et al* (2010) studied the constraints in grapes production in India and discussed government policies and plans for grapes development in India. The authors pointed out that although grapes cultivation was considered as highly remunerative, yet the share of India in world production was very low because of reasons like heavy initial investment for establishing grape orchard, high recurring costs in vineyard management, less exports, high risk of crop damage because of uncertain changes in weather, marketing problems, etc. Study also suggested that both the state and central governments should provide considerable support for promoting grape sectors by providing soft loans and subsidies for pre-cooling and cold storage.

Palaniappan and Sengottaiyan (2010) have examined the status of apple production in India and its contribution in the world market during 2008-09 and also discussed various factors that influenced apple yield. The study highlighted that India was the sixth largest producer and consumer of apples in the world. Indian apple production was nearly 1985 thousand metric tonnes and area was 274 thousand hectares, which was estimated to be the second largest in the world during the year 2008-09. Jammu and Kashmir, Himachal Pradesh and Uttrakhand were found to be the major apple producing states in India that contributed about more than 75 per cent of the apple production in the country. Despite this, the average yield was about 7.24 metric tonnes per hectare, which was the lowest of the major world producers.

Dhandhalya and Shiyani (2012) examined the costs and returns from sapota orchard in Saurashtra region of Gujarat state. The study analyzed that total investment per hectare was Rs. 1440501 per hectare. Land had the highest share among the various components involved in investment followed by well, cart and tractor, plant materials and electric motor. The establishment cost of sapota orchard was worked out Rs. 41732 per hectare. Here the rental value of land had the highest among the various components followed by labour cost, material cost. The study brought out that the total annual cost of cultivation and net returns from spota orchard were Rs. 69904 and Rs. 58777 per hectare, respectively. The values of NPV, BCR, IRR and payback period have been found acceptable in normal cost return conditions, but critical in varying conditions. The study also reported that 81 per cent of the orchardists faced the problem of non-availability of good saplings and 78 per cent faced problem of failure of saplings. Another major problem faced by sapota grower while raising orchard was the lack of information of crop production technology (52 per cent). Main problems reported by

growers while marketing sapota were high commission rate (97 per cent), malpractices in market (96 per cent), unavailability of sufficient price for sapota (82 per cent).

Kachroo *et al* (2012) studied the cost and return from orange cultivation in Jammu and Kashmir State. The total establishment cost calculated was Rs. 12337.16 per acre. During first year of establishment the highest cost incurred on digging, filling and planting and the lowest was on plant protection. The study also revealed that establishment cost was the highest in case of large farmers (Rs.5590.11/acre) followed by medium (Rs.5362.70/acre) and small farmers (Rs.5018.76/acre). The total returns were worked out Rs. 25449.83 per acre. The overall returns were highest in case of large orchards and were Rs. 8789.82 per acre. The study concluded that, larger the size of the holding, larger will be the returns.

Sidhu *et al* (2012) estimated the costs and returns from kinnow orchard in Punjab. The total establishment cost calculated was Rs. 47219 per hectare. Study revealed that establishment cost was the highest as compare to operational costs, and net returns increased with increase in age because of increase in productivity with maturity. At the age of 5-7 years, average net returns from kinnow orchard were Rs. 22510 per hectare and for the age group of 8-22 years, average net returns were Rs. 42000 per hectare.

Prasher *et al* (2013) studied the economics of production and marketing of litchi in Himachal Pradesh. It was found that an initial investment on litchi cultivation was Rs. 16821 per hectare. Cost analysis indicated that alone labour cost per ha was about 27.34 per cent of the total plantation cost. Labour cost was more because of manual land development, layout and digging of pits, filling of pits, fertilization, irrigation and plantation. After labour the next major cost component was plant material that accounted for about 11.89 per cent of total cost of cultivation. The total cost was estimated Rs.146632 per hectare which includes establishment cost and maintenance cost. The study also revealed that variable cost in maintenance cost went on increasing up to 29^{th} years and then started decreasing. Here also in case of variable cost component the highest share was of labour (47 per cent) and it was higher for initials years as compare to later years. A gross income of Rs. 166900 per hectare and net income of Rs. 129271 per hectare was obtained from litchi cultivation.

Kaur *et al* (2016) examined the economic viability of Kinnow Orchards in South-Western Punjab. The study brought out that the initial investment on an average farm was Rs 38802 per hectare. It was found that the plants and planting materials had the largest share in establishment cost and was 25.07 per cent. The next main components having largest share in establishment cost were digging and filling of pits and fencing with share of 20.21 per cent and 19.77 per cent, respectively. The annual maintenance /operational cost on an average Kinnow orchard was low for initial years and started increasing up to orchards ranging

between age group 13-16 years, from age group 17-22 years the cost declined. The study also showed that the returns were higher when farmers sold their produce by themselves to the market as compare to when they sold their produce through pre-harvest contractors. It was observed from the study that returns were negative for first five years and from sixth year onwards orchards started giving positive returns. IRR and benefit-cost ratio were higher when produce is sold directly in the market (1.53 and 30.25 per cent, respectively) as compare to sell through pre-harvest contractors (1.26 and 19.54 per cent, respectively).

2.2. Studies related to Marketing

Singh and Sidhu (1976) conducted a study entitled, "Marketing of Mangoes in Punjab State". They analyzed the marketing margin, price structure and other marketing aspects such as transportation and grading, packing, etc. It was found that total marketable surplus for mango was about 96.40 per cent of the total production. About 70 per cent of the orchardists sold their orchards to pre-harvest contractors and the share of pre-harvest contractors in consumer's rupee was near about 34 per cent. Study also revealed that the prices varied according to the varieties. Grafted varieties of mango got higher prices as compare to the local varieties.

Gill *et al* (1990) in their study analyzed the marketing of grapes in Bathinda district. The study revealed that the average yield from grapes orchards was 52.62 quintals per acre. The marketable surplus from small, medium and large categories of farmers was 96.58, 97.48 and 98.40 per cent, respectively. It was found that only 21.05 per cent of the farmer leased out their orchards to pre-harvest contractors.

Jairath *et al* (1995) examined the costs and margins in marketing of fruits in Himachal Pradesh. The study revealed that producer's share in consumers rupee was 53 per cent. The marketing margins of the retailer were 26 per cent while the marketing cost was 20 per cent. Producer's share for apricot, peach, and plum was 47 per cent, 46 per cent and 49 per cent, respectively. The study revealed that over the period the net price spread decreased.

Singh *et al* (2001) in their study examined the production and marketing pattern of three fruit crops (pear, guava and grapes) in Punjab. The study period was 1997-98. The average area under pear was 1.27 hectare, while area under guava and grapes was 0.87 and 1.19 hectare, respectively. Marketed surplus was the highest for grapes followed by pear and was about 98 per cent and 95 per cent, respectively. The authors found that only 75 per cent of guava crop was sold in market due to perishability and spoilage. In the case of grapes, the spoilage was 2.91 per cent of the total production. Some of the produce was retained to use as gifts to relatives, etc. In the case of pear, the proportion of spoilage was 4.71 per cent of the total production on all farms.

Mali *et al* (2004) studied the marketing channels and marketing practices for banana as well as estimated the marketing cost of banana through different marketing channels in Jalgaon district of Maharashtra. According to the study banana was marketed through three agencies viz. co-operative marketing societies, private traders through co-operative fruit sale societies and local merchants/group sale agencies. Among the three marketing agencies, large proportion of the banana was marketed to the local traders (57 per cent), 26 per cent to the private dealers through co-operative fruit sale societies and 17 per cent in Delhi market through co-operative fruit marketing societies. The marketing cost incurred by producer through local merchants/group sale agencies was 29.47 per cent, through private traders through co-operative fruit sale societies was 27.32 per cent and through co-operative marketing societies was 16.50 per cent.

Singh (2004) has examined the marketing pattern of kinnow in Ferozepur and Hoshiarpur districts of Punjab for the period 2002-03. The results of the study showed that in Ferozepur district, the producer's share in consumer's rupee was about 42 per cent in Delhi market, whereas this share was 40 per cent in Hoshiarpur district. The study revealed that when the produce was sold through contractor in Ludhiana, Amritsar and Abohar markets, the producer's share in consumer's rupee was found to be 56, 57 and 81 per cent respectively in Ferozepur district; and it was found to be 54, 55 and 76 per cent respectively in Hoshiarpur district when the produce was sold through same channel in Ludhiana, Amritsar and Abohar markets.

Verma (2004) studied the marketing of fruits and vegetables in Himachal Pradesh. The authors found that the area under fruits during 1971-72 was 15,767 hectares, which increased to 57,772 hectares during 1999-2000. The marketing costs incurred by producers in marketing of apple, plum, pear and kinnow was 26.13, 33.97, 28.17 and 39.63 per cent, respectively during 2004. During that period the production of fruits in Himachal Pradesh raised with an annual growth rate of 2.80 per cent. Vegetable production had inclined from 259 tonnes in 1985-86 to 627 tonnes in 2000-01.

Singh and Sidhu (2005) examined the price spread of kinnow in Punjab. It was found that farmers of Ferozepur district received net price of Rs 765 per quintal in Delhi market. The producer's share in consumer's rupee was about 40 per cent when produce sold in Delhi market through contractor. When kinnow was sold in Ludhiana market the producer's share in consumer's rupee was about 56 per cent and 54 per cent for Ferozepur and Hoshiarpur districts, respectively. In Amritsar market producer's share in consumer's rupee of these two districts was about 57 and 55 per cent, respectively.

Sekhon *et al* (2006) studied the marketing of pear in Amritsar district of Punjab.

According to the study overall yield of pear with the selected farmers was 210.04 quintals per hectare. The yield of pear was the lowest in case of medium farmers and highest with large farmers and was 204.27 and 215.41 quintals per hectare, respectively. Yield was 208.84 quintals per hectare with small farmers. The study also concluded that marketed surplus was highest with large farmers followed by medium and small farmers and was 1687.49, 651.61, 302.62 quintals, respectively. Producer's share of consumer's rupee was the highest when produce was sold in local market and was 69.8 per cent.

Kaur and Singh (2010) studied the marketing of kinnow in Sri Gagannagar district of Rajasthan state. Study examined the marketable surplus, utilization pattern and worked out marketing cost, price spread. Marketable surplus was more in case of large farmers and less in case of small farmers. Producer's share in consumer's rupee was the highest in channel-III (Producer-Retailer-Consumer) and was 64.26 per cent and marketing cost was the highest in channel-I (Producer-Pre-harvest contractor-Wholesaler-Retailer-Consumer) because of more middlemen. For consumer's point of view channel-I was found to be the best channel and for local marketing channel-III was best. From consumer's point of view, channel-II (Producer - Wholesaler-Retailer-Consumer) was the better distant channel as the consumer got kinnow at the lowest price in this channel. Producer's share in consumer was highest in channel-III (64.26%) followed by channel-I (62.84%) and channel-II (58.04%). The study suggested that efficiency of marketing system should be improved so that the producer has a better prize in the consumer's rupee involving this commodity.

Kumar and Singh (2010) studied the price spread of mango in Lucknow district of Utter Pradesh. The study revealed that the producer sold their produce through four different marketing channel viz. channel- I (Producer-Pre-harvest contractor-commission agent-wholesaler (New Delhi)-retailer (New Delhi)-consumer (New Delhi)), channel-II (Producer-Pre-harvest contractor-commission agent- retailer (Lucknow)-consumer (Lucknow)), channel-III (Producer-Pre-harvest contractor -wholesaler (Lucknow)-retailer (Lucknow)-consumer (Lucknow)) and channel-IV (Producer-Pre-harvest contractor - retailer (Lucknow)-consumer (Lucknow)). Out of four marketing channels the most efficient was channel-IV from both producer's as well as consumer's point of view. The producer's share in consumer rupee was the highest in this channel (46%). The percentage share of the total marketing margin in consumer's rupee was highest in channel-IV (34.06%) followed by channel-III (32.79%), channel-II (30.06%), channel-I (28.32%). The authors concluded that the price spread was minimum in local market (Lucknow) and maximum in distant market (Delhi).

Kurkute *et al* (2010), in their study identified the channels and estimated marketing costs, margins and price spreads in the marketing of banana in Jhunnar tehsil of Pune district

for the year 2006-07. The results revealed that the marketing of banana in the study area was done through two main market agencies, viz. co-operative fruit sale societies and group sale agencies. The results brought out that out of total produce marketed, 52.11 per cent was sold through channel-II and 47.89 per cent was through channel-I. The maximum per quintal marketing cost was observed in Mumbai market (Rs.135.80) followed by Pune market (Rs.122.04). The cost was higher in channel-I (Rs.117.61) than channel-II (Rs.109.83). Producer's share in consumer's rupee was the highest in Jhunnar market (51.13 %) and the lowest in Mumbai market (42.23 %). The lowest share of producer's in consumer's rupee in Mumbai market was mainly because of higher marketing charges and commission charges. Channel-II had relatively higher share of consumer's rupee (46.50 %) than channel-I (45.37 %). The study further concluded that in spite of higher marketing costs and lower price paid by the consumers in channel-II, the producer's share in consumer's rupee was higher in channel-I.

Gupta (2011) in her study "Constraints in the marketing of fruits and vegetables in Punjab", studied the problems related to the production and marketing. The major production constraints faced by producers were lack of technological advancement, higher input costs, more returns in case of competing crops like wheat and paddy and the size of holding. The study also revealed that production related constraints were more faced by small farmers as compared to large framers. Due to perishability fruits and vegetables were more prone to marketing problems. Major marketing problems included large numbers of intermediaries in market, inadequate transport facilities, lack of proper infrastructure in market and lack of processing units.

Kachroo *et al* (2012) examined the marketing cost, price spread and marketing channels followed for orange in Jammu and Kashmir State. Orange was marketed through four important marketing channels viz. producer to commission agent/forwarding agent to retailer and then consumer; producer to wholesaler to retailer and finally to consumer; producer to retailer to consumer, and in fourth marketing channel producer sold his producer directly to consumer. The study examined that the total marketing cost incurred in marketing of orange was the highest when sold through channel-I because of large number of middlemen and was Rs. 539.77 and marketing cost was the lowest when producer sold his producer through channel-IV and was Rs. 302.25. The producer's share in consumer rupee was the highest in channel-IV followed by channel-III, channel-I and channel-II and was 80.94 per cent, 57.24 per cent, 49.40 per cent and 45.01 per cent, respectively.

Romana and Sachdeva (2015) studied the economics of Kinnow marketing in Punjab. The study was conducted to compare the economics of Kinnow marketed in the distant

market as well as in local markets by the Punjab Kinnow growers. The study revealed that the sampled farmers sell their produce in both the markets i.e. local markets and distant markets. The total cost incurred by the farmers in the distant market was quite higher than that incurred in local market and was Rs 126750 per acre and Rs 30060 per acre, respectively. But the net returns were higher in distant market (Rs 177250 per acre) as compare to the local market (Rs 88940 per acre). The authors concluded that although the marketing costs were high in case of distant markets but farmers fetched good returns from their produce as compare to the local market. Study also revealed that the channel viz. producer- wholesaler-retailer-consumer is best for quick disposal of huge quantity of fruits.

CHAPTER III

MATERAILS AND METHODS

The quality of any research depends upon the methodology adopted to carry it. It explains the steps adopted by the researcher in studying the research problem along with logics behind them. Thus, the chapter deals with frame work adopted in selection of study area, collection of data, analytical framework used to achieve the objectives of the present study. The discussion is concentrated under the succeeding sub-heads:

3.1 Methodological framework

3.2 Details of data collection

3.3 Statistical analysis of data

3.1 Methodological framework

Locale of the study

In order to accomplish the stipulated objectives, the present study has been conducted in the Punjab state during the year 2016-17.

Selection of districts and blocks

Multistage sampling technique was used for the selection of sample. At the first stage two districts viz. Amritsar and Tarn-taran with the highest area under cultivation of pear were selected purposively. Block-wise data on area under pear cultivation in the selected districts were obtained from the Department of Horticulture, Punjab. At second stage one block each from both of the selected districts with the highest area under pear was chosen (Table 3.1.1)

Table 3.1.1: Districts and blocks selected from Punjab

State	Districts	Blocks
Punjab	Amritsar	Verka
	Tarn-taran	Patti

Selection of respondents

A complete list of pear growers along with area under pear spread in villages of the selected blocks was obtained from the respective block offices of the Department of Horticulture, Punjab. These cultivators were arranged in ascending order with respect to area under pear. By using cumulative cube-root frequency method, pear growers were categorized into three farm size groups viz. Small (up to 2.38 ha), Medium (2.38- 6.07 ha) and Large (6.07 ha and above). Using proportional allocation method, the farmers were selected from each category in proportion to their number falling in the respective size group. The category-wise number of farmers selected is presented in Table 3.1.2

Table 3.1.2: Number of pear growers selected in different categories

Farm Category	Blocks		Total number of selected growers
	Verka	Patti	
Small (up to 2.38 ha)	16	21	37
Medium (2.38- 6.07 ha)	12	5	17
Large (≥ 6.07 ha)	2	4	6
Overall	30	30	60

Selection of markets

To analyze the price spread, market margins, marketing costs involved in marketing of pear, 10 wholesalers and 10 retailers were selected randomly. The Azadpur mandi of Delhi was selected for examining the price spread, market margins, marketing costs involved in marketing of pear on the basis of highest quantitative arrivals of pear.

3.2 Details of data collection

Construction of interview schedule

In order to accomplish the objectives of the study an interview schedule was constructed to record the observations from the selected pear growers. Pre-testing of the schedule was done before starting data collection in the study area. Some ambiguous undesirable questions were modified or deleted. Certain important questions that emerged during pre-testing were also included in the final schedule.

Collection of data

The time series data on area, production and productivity of total fruits as well as pear in the state were obtained from various issues of the *Statistical Abstract of Punjab.* District-wise data on area, production and productivity of total fruits as well as pear were also obtained from the same source of information.

The survey method was used for the collection of primary data. The relevant information related to the socio-economic characteristics like age, education, family size, along with area under orchards, number of tress and age of trees of orchards were collected form the selected pear growers. Data on details of various components of establishment and operational cost, value of pear orchard were recorded for orchards of different ages separately. As most of the pear growers practice intercropping during the initial years of non-bearing orchards, so the net returns from intercropping were also recorded. The data regarding the leasing out of pear orchards to pre-harvest contractors and retained for self-marketing and profits gained were also collected from the farmers.

Information was also collected from the selected wholesaler regarding purchase price, market charges, commission and labour charges paid by them. Further, the data were also collected from them regarding sale price to the retailers and other miscellaneous cost. Similarly, the data were collected from retailers about purchase price, market charges, transportation, labour and packaging cost, etc. The information about sale price of pear to the consumer was also taken.

3.3 Statistical analysis of data

Simple statistical tools like averages, percentages and growth rates were used for the analysis of the collected data. Net present value, Benefit-cost ratio, internal rate of returns were also worked out from pear cultivation. The brief description of the used techniques is given as below:

Growth analysis

The compound growth rates (CAGR) for area, production and productivity of pear were estimated for 2000-01 to 2015-16. Growth model implemented is as under:

$$Y_t = AB^t$$

Where,

Y_t = Area/production/productivity of pear for year't'

t = Time variable (1, 2….n)

A = Constant

B = Regression coefficient

Log transformation of the above function is:

$$\text{In } Y_t = \text{In } A + t \, (\text{In } B)$$

$$r = [\text{antilog } (\text{In } B) - 1]$$

$$\text{CAGR } (\%) = [\text{antilog } (\text{In } B) - 1] \times 100$$

Coefficient of variation

Coefficient of variation (CV) was worked out to see the variation in area, production and productivity of pear over the time as well across the various districts of Punjab state. It was calculated by using following formula:

$$CV = \frac{SD}{Mean} \times 100$$

Where

CV = Coefficient of variation (%)

SD = Standard Deviation calculated by using following formula

$$SD = \sqrt{\frac{d^2}{N}}$$

Where

d = Deviation from mean

N = Number of observations

Economic viability of pear orchard

To examine the economic viability of pear orchard while studying the economics of pear cultivation, three indicators were taken viz. net present value, benefit-cost ratio, and internal rate of return and are given in detail as below:

Net present value

Net present value of a venture is the present-day value of expected future returns/net cash flow, discounted at the cost of capital during the life span of project. Net present value has been estimated as below:

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

Where

NPV = Net present value

R_t = returns from orchard during time 't'

C_t = costs on orchard during time 't'

r = discount rate

n = economic life of orchards in years

Benefit-cost ratio

The benefit-cost ratio was calculated by taking into account all the components of establishment costs and operational costs along with total returns at all the stages of useful life of pear. Benefit-cost ratio was worked out by discounting the stream of total returns and costs during the useful life period of the orchard at 12 per cent.

$$BCR = \sum_{t=1}^{n} \frac{R_t}{(1 + r)^t} \div \sum_{t=1}^{n} \frac{C_t}{(1 + r)^t}$$

Where,

BCR = benefit cost ratio

R_t = returns from orchard during time 't'

C_t = costs on orchard during time 't'

r = discount rate

n = economic life of orchards in years

Internal rate of return

The internal rate of return (IRR) is the discounted rate 'r' that makes the net cash flow (both positive and negative) from an investment equal to zero.

Marketing pattern of pear

Information about marketing pattern/channels of pear was collected from the pear growers and marketing agencies involved in the marketing of pear through different channels. Information was also obtained from the market intermediaries involved in the purchase of pear in the market.

Marketing margins and costs

For estimating the marketing margins and costs for different channels, ten wholesalers and ten retailers were selected from the market. The relevant data were collected through the help of a pre-tested, interview schedule. Information regarding marketing aspects of pear was collected from the producers and the retailers in order to find out the producer's share in the price paid by the consumers. The main channels involved in the marketing of pear were studied to work out the price spread.

Market margin is the profit of the various market functionaries and was calculated by subtracting the purchase price and marketing cost from the sale of market functionaries. It was worked out as:

$A_{mi} = P_{ri} – (P_{pi} + C_{mi})$ (Acharya and Agarwal, 2011)

Where,

A_{mi} = Absolute margin of the ith middlemen

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

P_{pi} = Purchase value of goods per unit (purchase price)

C_{mi} = Cost incurred on marketing per unit

Marketing efficiency

The marketing efficiency was calculated by using Acharya's method and is as follow:

MME = FP ÷ (MC+MM)

Where

MME = Marketing efficiency

FP = Price received by farmer

MC = Total marketing costs

MM = Net marketing margins of intermediaries (Acharya and Agarwal, 2011)

Producer's share in consumer rupee

Producer's share in consumer rupee can be defined as the price received by the farmer indicated as a per cent of the retail price (price paid by consumer). It may be expressed as follows:

$$Ps = \frac{Pf}{Pr} \times 100$$

Where,

Ps = Producer's share in consumer rupee

Pf = Producer's price

Pr = Retail price (Acharya and Agarwal, 2011)

Price spread

The price spread can be defined as the difference among the price paid by the consumer and the price received by the producer for the same quantity at a given point of time in a specific market.

CHAPTER-IV

RESULTS AND DISCUSSION

This chapter primarily focuses on the results found by analyzing the collected data. Besides, socio-economic profile of the pear growers, costs and returns from cultivation of pear, marketing channels and price spread of pear and problems faced by pear growers in the production and marketing of pear have been discussed in this chapter. This chapter has been divided into following heads:

4.1 Trends in area, production and productivity of pear in Punjab

4.2 Socio-economic profile of sampled pear growers

4.3 Costs structure of pear cultivation

4.4 Returns from pear cultivation

4.5 Marketing channels and price spread in the marketing of pear

4.6 Production and marketing constraints

4.1 Trends in area, production and productivity of pear in Punjab

4.1.1 Growth in area, production and productivity

For calculating growth in area, production and productivity of fruits in the Punjab state, time-series data from 2000-01 to 2015-16 have been obtained from various published sources. The results obtained have presented in table 4.1.1.

It can be seen from the table that area under total fruits which was 34209 hectares in 2000-01 increased to 43721 hectares during 2003-04 with an annual growth of 6.95 per cent. This trend continued for the subsequent periods and area under fruits reached to 79086 hectare in 2015-16. During 2003-04 to 2006-07, per annum increase in area under total fruits in Punjab state was 7.77 per cent. The corresponding figure for 2006-07 to 2009-10 was 4.47 per cent per annum, while it was 2.72 and 1.40 per cent per annum during 2009-10 to 2012-13 and 2012-13 to 2015-16, respectively. Same trends were observed in case of production of total fruits. The average annual growth rate of production was 7.74 per cent during 2000-01 to 2003-04. During 2003-04 to 2006-07 production registered a growth of 8.06 per cent per annum. The corresponding figures for 2006-07 to 2009-10, 2009-10 to 2012-13 and 2012-13 to 2015-16 were 16.09, 2.52 and 2.58 per cent per annum, respectively. The average annual growth during 2000-01 to 2003-04 for productivity was 0.62 per cent per annum. During 2003-04 to 2006-07 and 2006-07 to 2009-10 the productivity increased by 0.22 and 9.86 per cent per annum. The productivity registered a negative growth of 0.18 per cent per annum

during 2009-10 to 2012-13. During 2012-13 to 2015-16 the productivity again started increasing at an annual growth rate of 1.12 per cent.

In the case of pear, area increased from 2147 hectares in 2000-01 to 2257 hectares during 2003-04 showing an increase of 1.28 per cent per annum. Further, during 2006-07 the area under pear again increased to 2616 hectares with an annual growth of 3.98 per cent. This trend continued except for 2009-10 when area under pear decreased to 2598 hectares with a negative annual growth of -0.17 per cent per annum. The corresponding values for 2009-10 to 2012-13 and 2012-13 to 2015-16 were 1.82 and 0.83 per cent per annum, respectively. The production also improved from 42940 metric tonne during 2000-01 to 45140 metric tonne during 2003-04 and per annum per cent increase was same as in case of area (1.28%). The production of the pear increased for the succeeding periods and reached to 66047 metric tonne during 2015-16. The values of annual growth rate for 2003-04 to 2006-07, 2006-07 to 2012-13 and 2012-13 to 2015-16 were 3.98, 3.02, 1.87 and 1.19 per cent per annum respectively. The productivity of pear in Punjab during 2000-01 was 20 metric tonne per hectare which remained same during 2003-04 and 2006-07. During 2009-010 productivity increased to 22.57 metric tonnes with an annual growth rate of 3.22 per cent per annum. The annual growth rate for 2009-10 to 2012-13 and 2012-13 to 2015-16 was 0.05 and 0.36 per cent per annum, respectively.

The compound annual growth rates of area, production and productivity are also given in table 4.1.1. The area, production and productivity of total fruits have been increased at significant compound annual growth rate (CAGR) of 5.88 per cent, 9.50 per cent and 3.42 per cent, respectively. In case of pear the area, production and productivity also increased significantly by 2.12 per cent, 3.34 per cent and 1.19 per cent, respectively. The values of coefficient of variation of area, production and productivity for total fruits were 24.93, 38.79 and 16.28, respectively. In case of pear, the respective values of coefficient of variation were relatively low at 9.91, 15.04 and 5.92 per cent indicating low degree of variation in this regard as compared to that observed in case of total fruits in the state.

Table 4.1.1 Trends in area, production and productivity of total fruits and pear in Punjab, 2000-01 to 2015-16

(Rs/ha)

Year	Total fruits			Pear		
	Area (ha)	**Production (MT)**	**Productivity (MT/ha)**	**Area (ha)**	**Production (MT)**	**Productivity (MT/ha)**
2000-01	34209	479659	14.02	2147	42940	20.00
2003-04	43721 (6.95)	628170 (7.74)	14.37 (0.62)	2257 (1.28)	45140 (1.28)	20.00 (0.00)
2006-07	57309 (7.77)	830577 (8.06)	14.49 (0.22)	2616 (3.98)	52320 (3.98)	20.00 (0.00)
2009-10	67554 (4.47)	1365063 (16.09)	20.21 (9.86)	2598 (-0.17)	58643 (3.02)	22.57 (3.22)
2012-13	74897 (2.72)	1502517 (2.52)	20.06 (-0.18)	2787 (1.82)	63040 (1.87)	22.62 (0.05)
2015-16	79086 (1.40)	1657460 (2.58)	20.96 (1.12)	2879 (0.83)	66047 (1.19)	22.94 (0.36)
CAGR (%)	5.88*	9.50*	3.42*	2.12*	3.34*	1.19*
CV (%)	24.93	38.79	16.28	9.91	15.04	5.92
S.E.	0.3913	0.5671	0.3382	0.1946	0.1875	0.1332

*** Significant at 1% level of significance**
Figures in parentheses indicate per annum percent change as compared to the previous period
Source: Statistical Abstract of Punjab, Various Issues

4.1.2 District-wise area, production and productivity of pear in Punjab

District-wise area, production and productivity of pear in Punjab during 2015-16 have been shown in table 4.1.2. It can be seen from the table that pear crop was cultivated on an area of 2879 hectares. Total production of pear during 2015-16 was 66047 metric tonnes. Among all the pear growing districts of the state, Tarn Taran was the district which ranked first with an area of 922 hectares and production of 21113 metric tonne. Amritsar ranked second with an area of 828 hectares and production of 18927 metric tonnes. Percentage share of district Tarn-taran in state area and production of pear was 32.03 per cent and 31.97 per cent, respectively followed by Amritsar with percentage share of 28.76 per cent in state area and 28.70 per cent of the total production of pear in the state. Other major pear growing districts were Jalandhar and Ludhiana having 10.04 per cent, 7.36 per cent share in state area and 10.28 per cent and 7.28 per cent share in state production, respectively. The value of coefficient of variation for area and production was calculated 181.97 per cent and 181.78 per cent, respectively. The high value of coefficient of variation with respect to area and

production depicted that in terms of area and production pear crop is unevenly distributed across the various districts of Punjab state.

Table 4.1.2 District-wise area and production of pear in Punjab, 2015-16

S. No.	Districts	Area (ha)	% share in state area	Production (MT)	% share in state production
1.	Gurdaspur	57	1.98	1310	1.98
2.	Amritsar	828	28.76	18957	28.70
3.	Tarn-Taran	922	32.03	21113	31.97
4.	Kapurthala	50	1.74	1145	1.73
5.	Jalandhar	289	10.04	6792	10.28
6.	S.B.S.Nagar	69	2.40	1545	2.34
7.	Hoshiarpur	57	1.98	1336	2.02
8.	Rupnagar	27	0.94	602	0.91
9.	S.A.S. nagar	56	1.95	1270	1.92
10.	Ludhiana	212	7.36	4811	7.28
11.	Firozpur	4	0.14	93	0.14
12.	Faridkot	8	0.28	183	0.28
13.	Shri Muktsar sahib	54	1.88	1217	1.84
14.	Moga	1	0.03	23	0.03
15.	Bathinda	22	0.76	517	0.78
16.	Sangrur	32	1.11	727	1.10
17.	Barnala	4	0.14	91	0.14
18.	Patiala	113	3.92	2600	3.94
19.	Fathegargh sahib	29	1.01	664	1.01
20.	Fazilka	42	1.46	981	1.49
21.	Mansa	0	0.00	0	0.00
22.	Pathankot	3	0.10	69	0.10
	Punjab	2879	100	66047	100
	CV (%)	181.97		181.78	

Source: Statistical abstract of Punjab

4.2 Socio-economic profile of sampled pear growers

Social status of an individual is represented by socio-economic profile of the family. In this section various socio-economic parameters like age, family composition and education level have been discussed under the following heads:

4.2.1 Education profile of the head of the family

The education of the family members particularly the education of household's head acts as a catalyst for the adoption of the new technology for obtaining higher income. The household's head here refers to the family member who takes all the decisions and who is responsible for all the decisions. The education status of sampled farmers is given in table 4.2.1. Out of total sample of 60, large numbers of the farmers (45 per cent) were found to be graduated. The percentage of farmers that have education up to matriculation level and higher secondary were 28.33 per cent and 30 per cent, respectively.

Table 4.2.1: Educational status of head of the family on sampled farms in Punjab, 2016-17

Particulars	Small	Medium	Large	Overall
Up to Matriculation	7 (18.92)	7 (41.17)	2 (33.33)	16 (28.33)
Up to Higher Secondary	11 (29.73)	5 (29.41)	2 (33.33)	18 (30.00)
Up to Graduation	19 (51.35)	5 (29.41)	3 (50.00)	27 (45.00)
Total	37 (100.00)	17 (100.00)	6 (100.00)	60 (100.00)

Figures in parentheses are the percentages to their respective totals

Category-wise, the proportion of graduate farmers was the highest in case of small farmers (51.35 per cent) followed by large farmers (50 per cent) and medium farmers (29.41 per cent). Proportion of small, medium and large framers having education up to matriculation level was 18.92, 41.17 and 3.33 per cent, respectively. The respective proportion of sampled farmers having higher secondary level of education was 29.73, 29.41 and 33.33 per cent. It can be said that the most of the sampled farmers growing pear were well educated in the study area.

4.2.2 Age of the head of the family

The general status of the individual in the society is greatly influenced by the age of the individual. The distribution of farmers according to the age of the head of the family is presented in Table 4.2.2. It can be seen from the table that a large proportion of the heads of families either belonged to the most productive age group i.e. 40-50 years (41.66 per cent) or mature and experienced age group of above 50 years (38.33 per cent) in the study area. The proportion of relatively younger age group (up to 40 years) family heads was 20 per cent. Almost similar pattern was observed in different categories as large proportion of the

household's heads belonged to the age group of 40-50 years and above 50 years in all the categories of the sampled farmers. It was observed that 50 per cent family heads corresponding to large category farms belonged to the age group of 40-50 years, while the proportion of household's head with this regard to this age group came out 45.94 and 29.41 per cent in case of small and medium farm size groups, respectively.

Table 4.2.2 Distribution of sampled farmers according to age of the head of the family in Punjab, 2016-17

Age (Years)	Small	Medium	Large	Overall
Up to 40	5 (13.51)	6 (35.29)	1 (16.66)	12 (20.00)
40-50	17 (45.94)	5 (29.41)	3 (50.00)	25 (41.66)
Above 50	15 (40.54)	6 (35.29)	2 (33.33)	23 (38.33)
Total	37 (100.00)	17 (100.00)	6 (100.00)	60 (100.00)
Average age	50	49	55	50.22

Figures in parentheses are the percentages to their respective totals

The average age of the sampled farmers came to be 50.22 years. In case of small farmers the average age calculated was 50 years, while for medium and large farmers it came out 49 and 55 years respectively. So, it can be concluded that in the study area the decision makers were mature and experienced persons.

4.2.3 Family composition

The availability of family members for timely agricultural operations comes out with fruitful outcomes in terms of farm productivity. Thus, size of family is an important socio-economic parameters that determine the efficiency of farm operations. The family composition of sampled pear growers is highlighted in Table 4.2.3. The results showed that on overall basis 50 per cent of sampled farmers were having 5 to 8 members in their family, while nearly 38 per cent of the respondents were having small family size of up to five members per household. Only 11.66 per cent of sampled farmers were having family size of 8 and above.

Overall, the average family size came out to be 5.23 members per household. The corresponding value for small, medium and large farm size categories came out to be 5.32, 5 and 5.33 members per household, respectively. It can be seen from the table that the composition of families in terms of number of adult males, adult females and children was 2.27, 1.87, and 1.10, respectively.

Table 4.2.3 Family size and composition of sampled pear grower in Punjab, 2016-17

S. No.	Particulars	Number of respondents			
1.	**Size of family**	**Small**	**Medium**	**Large**	**Overall**
i.	Up to 5	13 (35.14)	9 (52.29)	1 (16.66)	23 (38.33)
ii.	5-8	19 (51.35)	6 (35.29)	5 (83.33)	30 (50.00)
iii.	8 and above	5 (13.51)	2 (11.76)	0 (0.00)	7 (11.66)
iv.	Total	37 (100.00)	17 (100.00)	6 (100.00)	60 (100.00)
	Average family size	5.32	5	5.33	5.23
2.	**Family composition**				
i.	Adult Male	2.29	2.24	2.17	2.27
ii.	Adult Female	1.92	1.76	1.83	1.87
iii.	Children	1.11	1.00	1.33	1.10

Figures in parentheses are the percentages to their respective totals

4.3 Costs structure of pear cultivation

4.3.1 Initial investment on the establishment of orchard

Pear cultivation is long term capital-intensive enterprise. So, the pear growers have to devote considerable amount while establishing pear orchards as pear cultivation is long-term capital-intensive enterprise. The major cost components for establishing pear orchard include land preparation, digging and filling of pits, manuring and fertilizer application, plants and planting costs, irrigation, plant protection and transportation of inputs.

Before planting, the land is well prepared by giving on an average two ploughing followed by planking. Land is leveled with the help of tractor mounted leveler and laser leveler which improves irrigation efficiency. The operation of digging and filling of pits is labour intensive in nature. Three feet deep pits having 3 feet diameter are dug and these pits are filled with the mixture of silt and farmyard manure. During the establishment of pear orchards, the sample farmers were found applying FYM and fertilizers to meet the requirement of pear plants. Planting cost is one of the important components of initial investment. Planting cost basically includes the cost of plant and planting charges. Planting of pear is done in winter from January to mid-February. Besides transportation of inputs, irrigation and plant protection measures also become the part of the establishment cost.

Table 4.3.1 Initial investment on sampled pear orchards of different farm categories in Punjab, 2016-17

S. No.	Particulars	Small	Medium	Large	Overall
1.	Land preparation				
A.	Ploughing & Planking	4621 (16.63)	4807 (16.83)	5209 (17.52)	4734 (16.72)
B.	Leveling & layout	846 (3.05)	844 (2.96)	885 (2.98)	818 (2.89)
	Sub-total	5467 (19.68)	5651 (19.79)	6094 (20.49)	5552 (20.40)
2.	Digging and filling of Pits	5496 (19.78)	5367 (18.80)	4831 (16.25)	5374 (18.98)
3.	Manuring and Fertilizer				
A.	FYM	3098 (11.15)	2848 (9.97)	2858 (9.61)	3000 (10.60)
B.	Urea	516 (1.86)	543 (1.90)	630 (2.12)	536 (1.89)
	Sub-total	3614 (13.01)	3391 (11.88)	3488 (11.73)	3536 (12.99)
4.	Plants and planting cost	7022 (25.28)	7534 (26.39)	8398 (28.24)	7305 (25.81)
5.	Irrigation	2823 (10.16)	2964 (10.38)	2717 (9.14)	2853 (10.08)
6.	Plant protection	790 (2.84)	1099 (3.85)	1396 (4.69)	1095 (3.87)
7.	Transportation of inputs	1630 (5.87)	1581 (5.54)	1811 (6.09)	1636 (5.78)
8.	Interest @ 7%	940 (3.38)	966 (3.38)	1006 (3.38)	920 (3.38)
	Total cost	27782 (100.00)	28552 (100.00)	29740 (100.00)	28307 (100.00)

Figures in parentheses are the percentages to their respective totals

The category-wise and item-wise details of initial costs are presented in Table 4.3.1. The initial investment on average farm was Rs 28307 per hectare. Plants and planting costs were Rs 7305 per hectare with a share of 25 per cent in initial establishment cost. The initial cost incurred on land preparation and digging and filling of pits was Rs 5552 per hectare and Rs 5374 per hectare constituting about 20 per cent and 19 per cent of the total establishment cost, respectively. The expenditure incurred on other important components like manures and fertilizers, irrigation, transportation of inputs and plant protection was Rs 3536 per hectare, Rs

2853 per hectare, Rs 1636 per hectare and Rs 1095 per hectare, respectively with percentage share of 13 per cent, 10 per cent, 5 per cent and 3 per cent, respectively.

Farm category-wise, the initial expenditure was the highest on large farms (Rs 29740 per hectare), followed by medium farms (Rs 28552 per hectare) and small farms (Rs 27782 per hectare). Cost of digging and filling of pits was the highest on small farms (Rs 5496 per hectare) followed by medium and large farms where it was Rs 5496 per hectare and Rs 5367 per hectare, Rs 4831 per hectare, respectively. On the other hand planting cost was the highest on large farms (Rs 8398 per hectare) followed by medium (Rs 7534 per hectare) and small farms (Rs 7022 per hectare). Cost incurred on manures and fertilizers was the highest on small farms (Rs 3614 per hectare), followed by large farms (Rs 3488 per hectare) and medium farms (Rs 3391 per hectare). Amount spent on other components like land preparation, plant protection, transportation cost inputs etc. has also shown small variations across various farm size categories.

4.3.2 Operational/maintenance cost

In case of orchards, investment is not only required for the establishment but operations are also carried out for the maintenance of the orchards every year till the last year. The maintenance and operational cost of pear orchard varies due to several factors like age of the tree, outbreak of insect-pests, distance from the market etc. Operational cost comprises components like manures and fertilizers, insecticides/pesticides, irrigation, pruning/thinning, hoeing and replanting. Further, in pear cultivation most of the operations are done by labour, which is hired, so labour cost, was taken jointly along with the input or operation involved.

Element-wise yearly operational costs of orchards of different size groups are presented in Table 4.3.2a to 4.3.2d. On account of significant increase in costs during initial years, the item-wise operational costs of pear orchards for first six years are taken separately for each year. Annual operational costs for orchards of age seven and above were worked out by adding the expenses over age sets of plantation for 7 to 9 years, 10 to 13 years and 14 to 20 years and 21 years and above.

It was observed from results that among different components of operational costs, manure and fertilizers were the components having the highest share in pear cultivation. The total amount spent by pear growers on manures and fertilizers including the application charges on overall basis was Rs 3970 per hectare in second year (Table 4.3.2d), which amplified regularly over the life of the orchard and was the highest during the age group 21 years and above (Rs 15040 per hectare). Second important component that hold large share in operational cost was intercultural operations, which include operations like weeding, hoeing, clearing etc. These operations were done mechanically as well as manually. Mechanically, intercultural operations were done by tractor mounted plough, while weeding was finished with hand hoes

by human laborers. The cost spent on this operation was Rs 3252 in the first year and increased yearly with slight change up to age group of 14-20 years.

Another important component of operational cost was insectides/pesticides. Suitable plant protection measures to control the insect-pests infestation and disease attack were used by the sampled farmers. The results showed that large amount was spent for the application of insecticides/pesticides by the pear growers. Total expanses spend containing application charges in this regard on average farm were Rs 2384 in second year which inclined slightly every year over the useful life of orchard. Sampled farmers irrigate their orchards with tube wells. Expenses incurred by farmers on irrigating orchards were Rs 2244 during first year and cost went on increasing over the life of orchard. One more component which had share in operational cost was training and pruning. Sampled farmers performed training up to five years, while pruning once a year, as pear tree bear on spurs and do not need much pruning like other orchards. In pruning all the old, dead, diseased shoots are removed to encourage fruiting. Cost devoted on training and pruning during second year on an average farm was Rs 942 per hectare which increased to Rs 1857 per hectare during third year and further increased to some extent every year.

Table 4.3.2a revealed that annual operational cost on small farms varied from Rs. 6495 per hectare in initial year to Rs. 33668 per hectare in age group 14 to 20 years and decreased to Rs 31067 per hectare for orchards of age group 21 years and above. It was observed from the results that during initial years operational cost was low which then consistently inclined during the succeeding years. Manures and fertilizers was the components which has largest share in operational cost and was Rs 4294 per hectare during initial year and hiked to Rs 13609 per hectare for orchards of 21 years and above. Intercultural operations were second component after manures and fertilizers which had major share in operational cost followed by plant protection measures (insecticides/fungicides). Table 4.3.2b showed that annual operational expenditure in case of medium size orchard ranged from Rs 6315 per hectare in the first year to Rs 32615 per hectare in the age group 14 to 20 years. In this group of farms manures and fertilizers had the highest share followed by intercultural operations and insecticides/fungicides. Item-wise operational costs pertaining to large sized pear orchards are presented in table 4.3.2c. The operational cost for first year was worked out to be Rs. 6038 per hectare which rose every year and reached Rs. 33960 per hectare during the age 14 to 20 years.

Therefore, it can be concluded that the operational cost in pear cultivation was relatively lower during the initial years and increased regularly during the succeeding years and was highest during the age group 14 to 20 years of orchards. Further, the annual operational cost or maintenance cost of pear orchards were directly proportional to fruit bearing ability of plants and were observed to be the high corresponding to the high productivity 14 to 20 years age of orchards.

Table 4.3.2a Operational cost of sampled pear orchards of small size category in Punjab, 2106-17

(Rs/ha)

S. No.	Particulars	Age in years									
		1	**2**	**3**	**4**	**5**	**6**	**7-9 (average)**	**10-13 (average)**	**14-20 (average)**	**21 and above (average)**
1.	Manuring and fertilizer										
A.	FYM	-	2343	3063	3112	3211	3903	4718	6224	6027	6632
B.	Urea	-	605	729	741	840	865	1112	1581	1757	2077
C.	DAP	-	728	840	988	1457	1470	1606	1647	2469	2361
D.	MoP	-	618	815	865	939	988	1371	1509	2590	2539
	Sub-total		4294	5446	5706	6447	7225	8806	10961	12843	13609
2.	Insecticides and Fungicides	-	2440	3357	3416	3661	3752	3967	4663	4899	3487
3.	Irrigation	2463	2495	2915	2964	3088	3310	3480	3892	4337	4022
4.	Pruning	-	900	1939	2272	2519	2799	3335	3798	3890	2916
5.	Intercultural operation and Hoeing	3112	3260	3302	3794	3977	4364	4678	5622	5654	5341
6.	Replanting	693	618	-	-	-	-	-	-	865	605
7.	Interest	227	506	614	658	713	777	880	1050	1180	1086
	Total cost	6495	14513	17573	18810	20405	22227	25145	29985	33668	31067

Table 4.3.2b Operational cost of sampled pear orchards of medium size category in Punjab, 2106-17

(Rs/ha)

S. No.	Particulars	Age in years									
		1	**2**	**3**	**4**	**5**	**6**	**7-9 (average)**	**10-13 (average)**	**14-20 (average)**	**21 and above (average)**
1.	Manuring and fertilizer										
A.	FYM		2322	2984	3223	3132	3754	4347	4446	6422	6501
B.	Urea		390	457	469	571	640	709	1210	1581	2329
C.	DAP		627	823	840	868	963	1650	2705	3857	3668
D.	MoP		692	704	790	865	914	1334	1368	2641	2591
	Sub-total										
2.	Insecticides and Fungicides		2379	3295	3379	3582	3656	3856	4209	4772	3925
3.	Irrigation	2196	2391	2882	3043	3102	3283	3751	4051	4246	3747
4.	Pruning	-	1050	1890	1964	2196	2089	2228	2519	2862	2673
5.	Intercultural operation and Hoeing	3244	3456	3517	3579	4022	4167	4543	4624	4742	3154
6.	Replanting	654	613	623	-	-	-	-	-	346	677
7.	Interest	221	503	622	626	664	705	812	911	1146	1060
	Total cost	6315	14423	17797	17914	19001	20170	23230	26044	32615	30325

Table 4.3.2c Operational cost of sampled pear orchards of large size category in Punjab, 2106-17

(Rs/ha)

S. No.	Particulars	Age in years									
		1	**2**	**3**	**4**	**5**	**6**	**7-9 (average)**	**10-13 (average)**	**14-20 (average)**	**21 and above (average)**
1	Manuring and fertilizer										
A.	FYM		2087	2764	3184	3194	3643	3947	4357	7756	7741
B.	Urea		325	350	420	523	615	675	946	1586	2337
C.	DAP		605	704	766	812	865	1568	2458	4308	3764
D.	MoP		568	655	679	790	852	1048	1134	2589	2581
	Sub-total										
2	Insecticides and Fungicides		2334	2401	2663	3107	3446	3628	4120	4651	3932
3	Irrigation	2075	2282	2705	2964	2828	3174	3438	3591	4130	2964
4	Pruning		875	1741	1887	2087	2025	2087	2384	2618	2655
5	Intercultural operation and Hoeing	3400	3643	3826	4162	4211	4261	4557	4681	5175	3853
6	Replanting	358	173	-	-	-	-	-	-	-	366
7	Interest	205	451	530	585	614	661	733	828	1148	1057
	Total cost	6038	13344	15675	17310	18167	19542	21682	24498	33960	31250

Table 4.3.2d Overall operational cost of sampled pear orchards in Punjab, 2016-17

(Rs/ha)

S. No.	Particulars	Age in years									
		1	**2**	**3**	**4**	**5**	**6**	**7-9 (average)**	**10-13 (average)**	**14-20 (average)**	**21 and above (average)**
1.	Manuring and fertilizer										
A.	FYM	-	2251	2937	3173	3179	3767	4337	5009	6735	6958
B.	Urea	-	440	512	543	644	707	832	1246	1641	2248
C.	DAP	-	654	789	865	1046	1099	1608	2270	3545	3264
D.	MoP	-	626	725	778	865	918	1251	1337	2607	2570
	Sub-total	-	3970	4962	5359	5734	6491	8028	9862	14527	15040
2.	Insecticides and Fungicides	-	2384	3018	3153	3450	3618	3817	4331	4774	3781
3.	Irrigation	2244	2389	2834	2990	3006	3255	3556	3845	4238	3578
4.	Pruning	-	942	1857	2041	2267	2304	2550	2900	3123	2748
5.	Intercultural operation and Hoeing	3252	3453	3548	3845	4070	4264	4593	4975	5190	4116
6.	Replanting	568	468	623	-	-	-	-	536	606	549
7.	Interest	220	498	617	637	679	731	827	971	1195	1100
	Total cost	6285	14105	17458	18025	19206	20663	23371	27420	33653	30912

4.3.3 Disposal pattern of pear

Being perishable commodity, pear fruit need attention with respect to its disposal pattern. The pear orchards are leased-out to the pre-harvest contractors or self-marketed by the growers. The relevant information on the disposal pattern of pear is given in the Table 4.3.3. The data given in the table clearly indicates that majority of the pear growers (80 per cent) disposed-off their produce through pre-harvest contractors. Only 20 per cent of the sampled pear growers retained orchards for direct selling in the market. It was observed that pre-harvest contractors were quite active and has a strong link between production system and distribution channels in the study area. Pre-harvest contractors come in the contact with the farmers before the initiation of harvesting season. The terms and conditions of the contract like rate of contract, payment schedule etc. are finalized on the basis of the condition of the orchards and trends in market price in the previous years. During the contract period only irrigation facility is provided by the owner while all other arrangements like, picking of fruits, grading, packing and transportation etc. are conducted by pre-harvest contractors in the study area. Farm category-wise, about 84 per cent of the small, 76 per cent of the medium and 67 per cent of the large farmers leased-out their orchards to pre-harvest contractors. Large farmers being more resourceful can manage marketing of pear better than medium and small farmers, retained relatively larger share of orchards for selling their produce directly in the market.

Table 4.3.3: Category-wise disposal pattern of pear orchards by the sampled farmers in Punjab, 2016-17

(n=60)

Farm category	Orchards retained by farmers	Leased out to pre-harvest contractor	Total
Small	6 (16.22)	31 (83.78)	37 (100.00)
Medium	4 (23.53)	13 (76.47)	17 (100.00)
Large	2 (33.33)	4 (66.66)	6 (100.00)
Overall	12 (20.00)	48 (80.00)	60 (100.00)

Figures in parentheses are the percentages to their respective totals

4.4 Returns from pear cultivation

The sampled farmers either sold their produce through pre-harvest contractor or disposed-off it directly in the market. The costs and returns were considerably different in these two marketing channels. In this regard, age-wise costs and returns from pear orchards were assessed individually and discussed as follow:

4.4.1 Annual income from pear cultivation - when sold through pre-harvest contractors

In case the orchard were disposed-off to pre-harvest contractor, the age-wise operational costs, total returns, and net returns per hectare for small, medium, large pear growers are given in Table 4.4.1a, Table 4.4.1b and Table 4.4.1c, respectively. On overall basis estimates of operational cost, total return and net returns per hectare have been presented in Table 4.4.1d. Pear plant starts fruit bearing at the age of five years. The sample growers were found to practice inter-cropping to generate extra income till the plants become productive. Net profit from intercropping on the small sized pear orchards was Rs 42057 per hectare, Rs 41948 per hectare, Rs 30530 per hectare and Rs 25969 per hectare during 1st, 2nd, 3rd and 4th year of orchard age, respectively (Table 4.4.1a). The respective amount for medium farmers were Rs 38948 per hectare, Rs 36828 per hectare, Rs 26430 per hectare, Rs 24876 per hectare (Table 4.4.1b) and for large farmers the returns from intercropping came out to be Rs 44541 per hectare, Rs 42564 per hectare, Rs 36881 per hectare and Rs 25415 per hectare respectively (Table 4.4.1c). The overall corresponding data were worked out to be Rs 41849 per ha, Rs 40446 per ha, Rs 31280 per ha and Rs 25420 per ha (Table 4.4.1d). It can be observed from the tables that the net returns from pear remain negative for first six years of plantations, because the total returns were less than the total cost which includes land rent, initial establishment cost and the operational cost and starts giving positive returns from seventh year onwards and was the highest for 14-20 years of old plantation. The income created from intercropping helped in minimizing the net loss during the initial years of orchards. On overall basis the net returns from pear orchard were Rs 91510 per hectare and Rs 112670 per hectare during 10-13 years and 14- 20 years, respectively and shown in Table 4.4.4. Nearly same trends in terms of operational cost, total cost, total returns and net returns were observed in case of small, medium and large farms.

Considering the entire useful life of pear orchards up to 25 years, the per hectare average annual Total cost, annual total returns and net returns on overall basis were Rs 126353 per hectare, Rs 185045 per hectare and Rs 58692 per hectare, respectively. For small, medium and large farms the average annual net returns over the life period of pear orchards, worked out to be Rs 52986 per hectare, Rs 57837 per hectare and Rs 69382 per hectare, respectively.

Table 4.4.1a: Costs and returns from small size pear orchards (when sold through pre-harvest contractors) in Punjab, 2016-17

(Rs/ha)

Particulars	Age of the orchard(years)										
	1	**2**	**3**	**4**	**5**	**6**	**7-9 (average)**	**10-13 (average)**	**14-20 (average)**	**21 and above (average)**	**Annual average**
Land rent	98399	98399	98399	98399	98399	98399	98399	98399	98399	98399	-
Initial cost	27782	-	-	-	-	-	-	-	-	-	-
Operational cost	6495	14513	17573	18810	20405	22227	25145	29985	33668	31067	27309
Total cost	132676	112912	115972	117209	118804	120627	123544	128385	132067	129467	126967
Total returns*	42057	41948	30530	25969	98800	112385	186619	212844	239200	212300	179953
Net returns	-90619	-70964	-85442	-91240	-20004	-8242	63075	84459	107133	82833	52986

***Returns from intercropping included**

Table 4.4.1b: Costs and returns from medium size pear orchards (when sold through pre-harvest contractors) in Punjab, 2016-17

(Rs/ha)

Particulars	Age of the orchard(years)										
	1	**2**	**3**	**4**	**5**	**6**	**7-9 (average)**	**10-13 (average)**	**14-20 (average)**	**21 and above (average)**	**Annual average**
Land rent	99091	99091	99091	99091	99091	99091	99091	99091	99091	99091	-
Initial cost	28552	-	-	-	-	-	-	-	-	-	-
Operational cost	6315	14423	17797	17914	19001	20170	23230	26044	32615	30325	25717
Total cost	133957	113513	116887	117004	118091	119261	122321	125134	131706	129415	126967
Total returns*	38948	36828	26430	24876	103740	112632	187720	213655	248853	223381	184804
Net returns	-95009	-76685	-90457	-92128	-14351	-6629	65399	88521	117147	93966	57837

***Returns from intercropping included**

Table 4.4.1c: Costs and returns from large size pear orchards (when sold through pre-harvest contractors) in Punjab, 2016-17

(Rs/ha)

Particulars	Age of the orchard(years)										
	1	**2**	**3**	**4**	**5**	**6**	**7-9 (average)**	**10-13 (average)**	**14-20 (average)**	**21 and above (average)**	**Annual average**
Land rent	98388	98388	98388	98388	98388	98388	98388	98388	98388	98388	-
Initial cost	29740	-	-	-	-	-	-	-	-	-	-
Operational cost	6038	13344	15675	17310	18167	19542	21682	24498	33960	31250	25884
Total cost	134166	111733	114064	115698	116556	117930	120071	122887	132348	129639	125461
Total returns*	44541	42564	36881	25415	104975	114114	197600	228475	258698	237000	194843
Net returns	-89625	-69169	-77183	-90283	-11581	-3816	77529	105588	126350	107361	69382

***Returns from intercropping included**

Table 4.4.1d: Overall Costs and returns from pear orchards (when sold through pre-harvest contractors) in Punjab, 2016-17

(Rs/ha)

Particulars	Age of the orchard(years)										
	1	**2**	**3**	**4**	**5**	**6**	**7-9 (average)**	**10-13 (average)**	**14-20 (average)**	**21 and above (average)**	**Annual average**
Land rent	98594	98594	98594	98594	98594	98594	98594	98594	98594	98594	-
Initial cost	28307	-	-	-	-	-	-	-	-	-	-
Operational cost	6285	14105	17458	18025	19206	20663	23371	27420	33653	30912	26378
Total cost	133186	112699	116053	116620	117800	119257	121966	126014	132247	129506	126353
Total returns*	41849	40446	31280	25420	102505	113044	188646	217525	244917	224227	185045
Net returns	-91337	-72253	-84772	-91200	-15295	-6214	66681	91510	112670	94721	58692

***Returns from intercropping included**

4.4.2: Annual income from pear cultivation – when directly sold to market by growers

During self-marketing of produce, gross expenditure increased because of harvesting cost as well as marketing cost. Harvesting cost includes picking/plucking, grading, loading/unloading and packing material cost. The orchard's age-wise operational cost, total cost, total returns and net returns from small sized, medium sized and large sized pear orchard are presented in Table 4.4.2a, Table 4.4.2b and Table 4.4.2c, respectively. Overall estimates of operational cost, total cost, total returns and net returns are presented in Table 4.4.2d. It was observed from the results that despite of higher total cost, the net returns were relatively higher when growers self-sale their produce instead of giving it to pre-harvest contractors. The amount of net loss declined significantly during 5^{th} and 6^{th} year's age of pear orchards. The result indicates that the total cost, total returns and net returns were highest during the age group of 14-20 years on all farm size categories.

When the produce is directly sold in the market by the farmers themselves, the per hectare annual total cost, total return and net return on overall basis were Rs 182009 per hectare, Rs 328504 per hectare and Rs 146495 per hectare, respectively. The average annual net return over the useful life period of pear orchards on small, medium and large farms were Rs 137247 per hectare, Rs 146520 per hectare and Rs 156823 per hectare, respectively which were considerably higher as compared to that in case when farmers sold their orchards to pre-harvest contractors.

While comparing returns from pear orchard with paddy-wheat crop rotation (Appendix-I) it was found that the net returns from pear orchards were higher than wheat and paddy crops when farmers sold their produce directly in the market. Therefore, it can be concluded that pear orchards when retained by farmers, were economically more profitable as compare to traditional crops like wheat and paddy.

4.4.3: Age-wise annual return from pear (overall)

On overall basis the age–wise average costs and returns from pear orchards sold through pre-harvest contractors and farmers themselves in the market are presented in Table 4.4.3.

The perusal of Table 4.4.3 indicate that net returns for the first six years of plantation were negative, because the gross returns were less than the total cost which includes land rent, initial investment and the operational cost. It is evident from the results that pear growers start earning positive net returns from pear orchards from seventh years onwards and the annual average gross returns and net returns increased consistently and were the highest in the orchards of age group 14-20 years. On an average situation, average annual net returns generated during 14-20 years were Rs 183864 per hectare. Almost same trends in the terms of net returns were observed in the case of small, medium and large farmers. Over entire life

Table 4.4.2a: Costs and returns from small size pear orchards (self-sale by farmers) in Punjab, 2016-17

(Rs/ha)

Particulars	Age of the orchard(years)										
	1	**2**	**3**	**4**	**5**	**6**	**7-9 (average)**	**10-13 (average)**	**14-20 (average)**	**21 and above (average)**	**Annual average**
Land rent	98399	98399	98399	98399	98399	98399	98399	98399	98399	98399	-
Initial cost	27782	-	-	-	-	-	-	-	-	-	-
Operational cost	6495	14513	17573	18810	20405	22227	25145	29985	33668	31067	27456
Total cost*	132676	112912	115972	117209	140857	149680	178015	181662	213214	199581	180816
Total return#	42057	41948	30530	25969	74485	121051	323022	363910	464088	388444	318063
Net return	-90620	-70964	-85442	-91240	-66372	-28628	145006	182248	250874	188862	137247

***Returns from intercropping included, # Total cost includes harvesting costs and post harvesting costs**

Table 4.4.2b: Costs and returns from medium size pear orchards (self-sale by farmers) in Punjab, 2016-17

(Rs/ha)

Particulars	Age of the orchard(years)										
	1	**2**	**3**	**4**	**5**	**6**	**7-9 (average)**	**10-13 (average)**	**14-20 (average)**	**21 and above (average)**	**Annual average**
Land rent	99091	99091	99091	99091	99091	99091	99091	99091	99091	99091	-
Initial cost	28552	-	-	-	-	-	-	-	-	-	-
Operational cost	6315	14423	17797	17914	19001	20170	23230	26044	32615	30325	25976
Total cost*	133957	113513	116887	117004	142094	152114	179756	187756	213717	201176	182710
Total return#	38948	36828	26430	24876	86240	131294	345510	401385	464088	395252	329280
Net return	-95009	-76685	-90457	-92128	-55854	-20820	165755	213629	250371	194075	146570

***Returns from intercropping included, # Total cost includes harvesting costs and post harvesting cost**

Table 4.4.2c: Costs and returns from large sized pear orchards (self-sale by farmers) in Punjab, 2016-17

(Rs/ha)

Particulars	Age of the orchard(years)										
	1	**2**	**3**	**4**	**5**	**6**	**7-9 (average)**	**10-13 (average)**	**14-20 (average)**	**21 and above (average)**	**Annual average**
Land rent	98388	98388	98388	98388	98388	98388	98388	98388	98388	98388	-
Initial cost	29740	-	-	-	-	-	-	-	-	-	-
Operational cost	6038	13344	15675	17310	18167	19542	21682	24498	33960	31250	25884
Total cost*	134166	111733	114064	115698	141909	151133	177876	182174	215891	202364	182163
Total return#	44541	42564	36881	25415	91021	141393	353484	414081	480443	402591	338986
Net return	-89625	-69169	-77183	-90283	-50888	-9740	175608	231907	264552	200227	156823

***Returns from intercropping included, # Total cost includes harvesting costs and post harvesting costs**

Table 4.4.2d: Overall Costs and returns from pear orchards (self-sale by farmers) in Punjab, 2016-17

(Rs/ha)

Particulars	Age of the orchard(years)										
	1	**2**	**3**	**4**	**5**	**6**	**7-9 (average)**	**10-13 (average)**	**14-20 (average)**	**21 and above (average)**	**Annual average**
Land rent	98594	98594	98594	98594	98594	98594	98594	98594	98594	98594	-
Initial cost	28307	-	-	-	-	-	-	-	-	-	-
Operational cost	6285	14105	17458	18025	19206	20663	23371	27420	33653	30912	26627
Total cost*	133186	112699	116053	116620	140883	150960	178536	184410	214481	201039	182009
Total return#	41849	40446	31280	25420	83915	131246	340672	393125	469540	395429	328504
Net return	-91337	-72253	-84772	-91200	-56968	-19714	162136	208715	255058	194390	146495

***Returns from intercropping included, # Total cost includes harvesting costs and post harvesting costs**

Table 4.4.3: Costs and returns from pear cultivation on different farm categories in Punjab, 2016-17

(Rs/ha)

Year	Small			Medium			Large			Average		
	Total Cost	Gross return*	Net return	Total cost	Gross return*	Net return	Total cost	Gross return*	Net return	Total cost	Gross return*	Net return
1	132676	42057	-90620	133957	38948	-95009	134166	44541	-89625	133186	41849	-91337
2	112912	41948	-70964	113513	36828	-76685	111733	42564	-69169	112699	40446	-72253
3	115972	30530	-85442	116887	26430	-90457	114064	36881	-77183	116053	31280	-84772
4	117209	25969	-91240	117004	24876	-92128	115698	25415	-90283	116620	25420	-91200
5	129831	86643	-43188	130093	94990	-35103	103788	97998	-31235	62794	93210	-36132
6	135153	116718	-18435	135688	121963	-13725	129662	127754	-6778	72373	122145	-12964
7-8 (average)	150780	254821	-104041	151038	266615	115577	236777	275542	126569	122608	264659	114409
9-13 (average)	155023	288377	133354	156445	307520	151075	268484	321278	168748	137960	305325	150113
14-20 (average)	172641	351644	179004	172711	357471	183759	306396	389571	195451	163575	357229	183864
21 and above (average)	164524	300372	135848	165296	309317	144021	266115	319796	153794	147880	309828	144556
Annual average (over orchard life)	153892	249008	70147	154460	256913	102174	153812	272514	113102	154181	256775	102594

***Returns from intercropping included**

period of pear orchard the annual average net returns generated on small, medium and large farm was Rs 70147, Rs 102174 and Rs 113102 per hectare, respectively. Over the life period of pear orchards the per hectare average annual total cost, average annual gross returns and average annual net returns on an average farm were Rs 154181, Rs 256775 and Rs 102594 per hectare, respectively.

4.4.4: Economic viability of pear cultivation

Pear plantation is an economic activity which requires investments every year and yield returns each year during its useful life. Cost and returns data do not give clear guidance to take pear orchard vis-à-vis other annual crops. This was mainly because of the fact that costs incurred and returns obtained from pear orchard over time are not comparable with annual crops grown in the area. So, in order to have clear picture regarding the economic viability of pear orchard, both the undiscounted indicator viz. average annual net returns and annual rate of returns and the discounted indicators viz. Net Present Value (NPV), Benefit-Cost Ratio, Internal Rate of Returns (IRR) have been used. The net present value and benefit-cost ratio have been worked out at 12 per cent discount rate. These parameters have been worked out separately for both the cases where farmers sold their produce to pre-harvest contractors and directly in the market and are presented in Table 4.4.4a and Table 4.4.4b, respectively.

It can be observed from the tables that the overall annual average returns (Rs 146495 per hectare) were higher when produce was sold by farmers themselves as compared to when sold through pre-harvest contractor (Rs 58692 per hectare). Similarly, the average rate of return was also higher for direct sale in the market and was 80.49 per cent and for pre-harvest contractor it was 46.45 per cent. On the similar pattern the net returns received by sampled farmers were relatively higher when they sold their output themselves in the market as compared to the pre-harvest contractor because the net margins of this intermediary got transferred to the farmers.

The net present value was recorded positive and was Rs 40454 per hectare, Rs 53776 per hectare and Rs 126279 per hectare for small, medium and large respectively when sold through pre-harvest contractor. Net present value for respective categories was Rs 400581 per hectare, Rs 458933 per hectare, Rs 537925 per hectare when directly sold by farmers in the market. On overall basis, NPV in case when sold through pre-harvest contractor and directly by farmers was recorded Rs 65333 per hectare and Rs 461993 per hectare, respectively.

The benefit-cost ratio was calculated by discounting the stream of total returns and costs during the beneficial life period of the orchard at 12 per cent and it came out to be 1.04, 1.05, and 1.13 for small, medium and large farms when sold through pre-harvest contractors. The values of benefit-cost ratio for respective category in direct sale by farmers in the market were

recorded to be 1.32, 1.37 and 1.43. The greater than unity value of benefit-cost ratio indicate that all farms were economically viable, in the study area.

Internal Rate of Returns (IRR) is earning-ability of the venture which equalizes discounted benefits or returns (B) with the discounted cost (C). IRR for small, medium and large farmers who sold their produce directly in the market came out to be 21.84 per cent, 23.99 per cent, 25.26 per cent, while IRR for corresponding categories when produce sold through pre-harvest contractors was 13.44 per cent, 13.80 per cent and 16.29 per cent, respectively. The value of IRR in both the cases was higher than the discount rate i.e. 12 per cent per annum, which indicates that investment on pear orchards was profitable.

Overall, the net present value, B: C ratio and IRR for pear orchards was Rs 65333 per hectare, 1.07 and 14.26 per cent, respectively when produce were sold through pre-harvest contractor and in case of direct sale by the farmers, the corresponding values were Rs 461993 per hectare, 1.38 and 23.37 per cent, respectively. Since the benefit-cost ratio of pear cultivation was greater than unity, all the farms were economically viable. However, benefit-cost ratio and IRR had direct relationship with the farm size indicating significant economies of scale. Thus, large and medium pear orchards were relatively more profitable than small farms.

The results revealed that viability of pear orchards increased significantly when produce is sold in market themselves by the farmers instead of disposing off through pre-harvest contractors. In general, the net income was negative in the initial years, while it increased regularly in the succeeding years with age of the plantation and became the highest in the age of 14 to 20 years. From 21 to onwards, corresponding to the declining productivity of plants the costs and returns declined each year up to the end of useful life of orchards. The large pear orchards were comparatively more profitable as compared to their small and medium counterparts. Overall, the benefit-cost ratio was more than unity and IRR significantly higher than prevailing bank lending rate indicating that investments in pear cultivation were attractive. Thus, it justified the growers' investment decisions for pear cultivation.

Table 4.4.4a: Economic viability of pear cultivation: when sold through pre-harvest contractors

Farm category	Annual average returns* (Rs/ha)	Average rate of return (%)	Net present value @ (Rs/ha)	B:C ratio@	Internal Rate of Return@ (%)
Small	52986	41.73	40454	1.04	13.44
Medium	57837	45.55	53776	1.05	13.80
Large	69382	55.30	126279	1.13	16.29
Overall	58692	46.45	65333	1.07	14.26

@12 per cent discount rate,* Undiscounted

Table 4.4.4b: Economic viability of pear cultivation: when sold by growers directly in the market

Farm Category	Annual average returns* (Rs/ha)	Average rate of return (%)	Net present value @ (Rs/ha)	B:C ratio@	Internal Rate of Return@ (%)
Small	137247	75.90	400581	1.32	21.84
Medium	146570	80.22	458933	1.37	23.99
Large	156823	86.09	537925	1.43	25.26
Overall	146495	80.49	461993	1.38	23.37

@12 per cent discount rate,* Undiscounted

4.5 Marketing of pear

This section deals with the analysis of marketing structure for pear, price spread, marketing costs and margin of different intermediaries involved in the different marketing channels of pear in the study area.

Marketing channels

Marketing of a commodity is an essential part of every production process. Marketing channel refer to the path through which a product moves from producer to the ultimate consumer. It is desired that the movement of the commodity from producer to consumer should be at the minimum cost with the facility of services. The marketing of pear from producer to consumer involved various intermediaries in the study area. Two major marketing channels were recognized in the study area through which the commodity moved from producer to the final consumer. In channel-I the producer sold his produce to the wholesaler through commission agent, who then retailed the produce to the retailer and then it finally reached to consumer. In case of marketing channel-II the producer sold his orchard to the pre-harvest contractor, who sold it in the market through commission agent to the wholesaler and then passed to retailer and finally reached to the consumer.

Channel-I: Producer → Wholesaler (through commission agent) → Retailer → Consumer

Channel-II: Producer → Pre-harvest contractor → Wholesaler (through commission agent) → Retailer → Consumer

4.5.1 Marketing costs and Margins of pear

The marketing costs and margins of pear in different channels are presented in the Table 4.5.1a and Table 4.5.1b. The net price received by the producer was Rs 1257.71 per quintal when produce was sold through channel-I and Rs 976.42 per quintal when sold through channel-II. The total expenses borne by the producer through respective channels were Rs 786.73 per quintal in channel-I and Rs 769.73 in channel-II. Item-wise costs incurred by producer in channel-I were Rs 135.97 per quintal, Rs 20.43 per quintal, Rs 300.71 per quintal, Rs 35.38 per quintal, Rs 12.50 per quintal and Rs 159.08 per quintal for plucking/picking, grading, packing material/container, packing and loading, unloading charges and transportation cost, respectively, while in channel-II these costs incurred by pre-harvest contractor and the corresponding figures were Rs 135.97, 20.43, 294.91, 30.38, 12.50 and 152.88 per quintal, respectively. The commission fee was estimated Rs 122.67 per quintal, in both channel-I and channel-II. The marketing costs borne by wholesaler were loading charges, transportation/freight charges and were calculated Rs 13.89 per quintal and Rs 24.69 per quintal, respectively. The market fee estimated for wholesaler and retailer was Rs 20.44 per quintal and Rs 29.56 per quintal. The other marketing costs incurred by retailer were transportation/freight charges, rehri charges, plastic bag cost and were Rs 13.75 per quintal, Rs 7.50 per quintal, Rs 18.63 per quintal, respectively. The market margin of the wholesaler and retailer was recorded to be Rs 263.19 per quintal and Rs 133.91 per quintal, respectively for both the channels. The producer's share in consumer rupee was 48.94 per cent in channel-I, while it was 37.99 per cent in channel-II.

Table 4.5.1a: Marketing costs, margins of pear and producer's share in consumer rupee in (Channel-I)

S. No.	Particulars	Rs/qtl	% Share in consumer rupee
1.	Net margin or price received by producer	1257.71	48.94
2.	**Expenses borne by producer**		
i.	Plucking/picking	135.97	5.29
ii.	Grading	20.43	0.79
iii.	Packing material/container	300.71	11.70
iv.	Packing& loading	35.38	1.38
v.	Unloading charges	12.50	0.49
viii.	Transportation cost	159.08	6.19
vi.	Commission @ 6%	122.67	4.77
	Sub-total(2i-vii)	786.73	30.61
	Sale price of producer/purchase price of wholesaler	2044.44	79.55
3.	**Expenses borne by wholesaler**		
i.	Market fee @ 1%	20.44	0.80
ii..	Loading charges	13.89	0.54
iii.	Transportation/freight cost	24.69	0.96
	Sub-total(2i-iii)	59.02	2.30
	Net margin or price received by wholesaler	263.19	10.24
	Sale price of wholesaler/purchase price of retailer	2366.65	92.09
4.	**Expenses borne by retailer**		
i.	Transportation/freight cost	13.75	0.54
Ii	Market fee @ 1%	29.56	1.15
iii.	Rehri charges	7.50	0.29
iv.	Cost of plastic bags	18.63	0.73
	Sub-total(2i-vi)	69.44	2.70
	Net margin or price received by retailer	133.91	5.21
	Sale price of retailer/purchase price of consumer	2570.00	100.00

Table 4.5.1b: Marketing costs, margins of pear and producer's share in consumer rupee in (Channel-II)

S. No.	Particulars	Rs/qtl	% Share in consumer rupee
1.	Net margin or price received by producer/purchase price of contractor	976.42	37.99
2.	**Expenses borne by contractor**		
i.	Plucking/picking	135.97	5.29
ii.	Grading	20.43	0.79
iii.	Packing material/container	294.91	11.48
iv.	Packing& loading	30.38	1.18
v.	Unloading charges	12.50	0.49
viii.	Transportation cost	152.88	5.95
vi.	Commission @ 6%	122.67	4.77
	Sub-total(2i-vii)	769.73	29.95
	Net margins of pre-harvest contractor	281.29	10.95
	Sale price of contractor/purchase price of wholesaler	2044.44	79.55
3.	**Expenses borne by wholesaler**		
i.	Market fee @ 1%	20.44	0.80
ii.	Loading charges	13.89	0.54
iii.	Transportation/freight cost	24.69	0.96
	Sub-total(3i-iii)	59.02	2.30
	Net margin or price received by wholesaler	263.19	10.24
	Sale price of wholesaler/purchase price of retailer	2366.65	92.09
4.	**Expenses borne by retailer**		
i.	Transportation/freight cost	13.75	0.54
ii.	Market fee @ 1%	29.56	1.15
iii.	Rehri charges	7.50	0.29
iv.	Cost of plastic bags	18.63	0.73
	Sub-total(2i-iv)	69.44	2.70
	Net margin or price received by retailer	133.91	5.21
	Sale price of retailer/purchase price of consumer	2570.00	100

4.5.2 Market margin of different intermediaries and price spread

The perusal of Table 4.5.2 indicates the market margins of different intermediaries and price spread through both the channels. The sale price of producer was Rs 2044.44 per quintal when marketed through channel-I and Rs 976.42 when sold through channel-II. The net margin of the producer was also more in case of channel-I as compare to channel-II viz. Rs 1257.71 per quintal, Rs 976.42 per quintal, respectively. The net margin of the pre-harvest contractor was recorded to be Rs 281.29 per quintal and the total cost incurred was Rs 769.73 per quintal. The net margin received by the wholesaler and retailer was Rs 263.19 per quintal and Rs 133.91 per quintal, respectively in both the channels. Total cost borne by the wholesaler and retailer in both the channels was Rs 59.02 per quintal and Rs 69.44 per quintal, respectively. The net margin was high and total cost incurred was low in case of wholesalers. It can be observed from the table that the price spread for channel-I was Rs 1312.29 per quintal and Rs 1593.58 per quintal for channel-II. The producer's share in consumer rupee was 48.94 per cent in channel-I and 37.99 in channel-II.

Table 4.5.2: Market margin of different intermediaries and price spread, 2016-17

S. No.	Particulars	Channel I	Channel II
1.	Sale price of farmer	2044.44	976.42
	Marketing cost of the producer	786.73	-
	Net margin or price received by producer	1257.71	976.42
2.	Purchase price of pre-harvest contractor	-	976.42
	Total cost incurred by pre-harvest contractor	-	769.73
	Sale price of pre-harvest contractor	-	2044.44
	Net margin of the pre-harvest contractor	-	281.29
3.	Purchase price of wholesaler	2044.44	2044.44
	Total cost incurred by wholesaler	59.02	59.02
	Sale price of wholesaler	2366.65	2366.65
	Net margin or price received by wholesaler	263.19	263.19
4.	Purchase price of retailer	2366.65	2366.65
	Total cost incurred by retailer	69.44	69.44
	Sale price of retailer	2570.00	2570.00
	Net margin or price received by retailer	133.91	133.91
	Purchase price of consumer	2570.00	2570.00
5.	Price spread	1312.29	1593.58
6.	Producer's share in consumer rupee	48.94	37.99

4.5.3 Marketing efficiency

Table 4.5.3 revealed the marketing efficiency of both the channels through which the pear is reached to ultimate consumer. It can be observed from the table that the sale price of retailer/purchase price of consumer Rs 2570 per quintal. The total marketing cost was Rs 915.19 per quintal in channel-I and Rs 813.05 per quintal in channel-II. The total net margins of the intermediaries were the highest in channel-I and were Rs 1654.81 per quintal and for channel-II there were Rs 1346.52 per quintal. The net price received by the farmers through channel-I and channel-II was Rs 1257.71 per quintal and Rs 976.42 per quintal, respectively. Producers received higher net price through channel-I as compare to channel-II.

Market efficiency of both the channels was calculated through Acharaya's method which came out to be 0.49 and 0.45 for channel-I and channel-II, respectively indicating that channel-I was more efficient.

Table 4.5.3: Marketing efficiency of different marketing channels followed by sampled pear growers in Punjab, 2016-17

S. No.	Particulars	Units	Channel I	Channel II
1.	Sale price of retailer/purchase price of consumer	Rs/qtl	2570.00	2570.00
2.	Total marketing cost	Rs/qtl	915.19	813.05
3.	Total net margins of intermediaries	Rs/qtl	1654.81	1346.52
4.	Net price received by farmers	Rs/qtl	1257.71	976.42
5.	value added (1-4)	Rs/qtl	1312.29	1593.58
	Index of market efficiency			
	Acharaya method 4÷(2+3)	Ratio	0.49	0.45

4.6 Production and marketing constraints

During past few years area and production of pear has increased. Also many problems related to production and marketing of pear has been emerged which need to be tackled with suitable policy measures. Problems perceived by selected farmers were categorized into production and marketing related problems and presented in Table 4.6.1 and Table 4.6.2.

4.6.1 Production related constraints

The production related problems perceived by farmers are presented in table 4.6.1. To study the constraints multiple response of farmers were taken. The major problem reported by sampled pear growers was lack of skilled labour. Pear orchard need skilled and trained

laborers for operations like pruning, thinning, grading. Labour is also required for other operations such as hoeing, plucking, grading, packaging, loading, unloading and transportation. About 56 per cent of farmers faced the problem of lack of skilled labour. Category-wise 59.46 per cent small farmers, while 52 per cent medium farmers and 50 per cent large farmers reported this problem. The second prominent problem toward which most of farmers responded was poor quality of planting material. Good quality of planting materials leads to more production but due to the shortage, most of the farmers bought planting materials from private nurseries which do not meet the requirements of good quality. Overall 50 per cent of the framers responded towards this problem. Category-wise, this problem was reported by about 54 per cent of the small farmers, medium farmers reported it about 47 per cent and about 33 per cent of the large farmers faced this problem.

The problem of weak research and extension linkages was perceived by about 45 per cent of the total farmers. The severity of this problem came to be the highest among small farmers (45.94 per cent), followed by large farmers (50 per cent) and medium farmers (41.18 per cent). The major pests of pear are aphids and about 35 per cent of the total farmers were affected by this problem. Nearly 37 per cent of the small farmers, about 35 per cent of the medium farmers and 16.67 per cent of the large farmers reported this problem. Another problem reported by the sampled farmers was damage due to climatic factors like wind storms, heavy rainfall due to which fruits shed and get spoiled. Overall, 26.66 per cent farmers reported this problem. Category-wise, 33.33 per cent of large farmers faced this problem, 29.72 per cent of the small farmers and nearly 17 percent of the medium farmers reported this problem.

Table 4.6.1: Production related problems perceived by the sampled pear growers in Punjab, 2016-17

(n=60)

Problems	**Farm category**			
	Small	**Medium**	**Large**	**Total**
Lack skilled labour	22 (59.46)	9 (52.94)	3 (50.00)	34 (56.67)
Poor quality of planting material	20 (54.05)	8 (47.05)	2 (33.33)	30 (50.00)
Weak research and extension linkages	17 (45.94)	7 (41.18)	3 (50.00)	27 (45.00)
Damage by insect pests and diseases	14 (37.83)	6 (35.29)	1 (16.67)	21 (35.00)
Damage due to climatic factor	11 (29.72)	3 (17.65)	2 (33.33)	16 (26.66)

Multiple responses

4.6.2 Marketing related constraints

The problems faced by the framers during marketing of produce and in the market are presented in Table 4.6.2. The foremost market related problem reported by farmers was price fluctuations. During the peak harvest season, there is glut in the market, which in turn affects the price. From total sampled farmers it was observed that 80 per cent of the farmers encountered the problem of price fluctuations. It was observed that nearly 83 per cent of the small farmers, 82.35 per cent of the medium farmers and 50 per cent of the large farmers met this problem. The farmers also stated the problem of lack of processing facilities. Total 76.67 per cent of the farmers had this problem. Category-wise about 72 per cent of the small, 88.24 per cent of medium and around 66 per cent of the large farmers faced this problem. Around 66 per cent of the sampled farmers reported the problem of poor market infrastructure. Small farmers reported it the highest, followed by medium farmers and large farmers and were about 75 per cent, 58.82 per cent and 33.33 per cent, respectively. About 53 per cent farmers stated that the availability of market information related to price is very poor. The incidence of this problem was the highest in case of small farmers (59.45 per cent), followed by large (50 per cent) and medium farmers (41.17 per cent). Another problem perceived was lack of storage facilities. Due to limited storage facilities available in the market, produce get spoiled. Overall, nearly 51 per cent of the farmers had the problem of lack of storage facilities.

Table 4.6.2: Market related problems perceived by the sampled pear growers in Punjab, 2016-17

(n=60)

Problems	**Farm category**			
	Small	**Medium**	**Large**	**Total**
Price fluctuations	31 (83.78)	14 (82.35)	3 (50.00)	48 (80.00)
Lack of Processing facilities	27 (72.97)	15 (88.24)	4 (66.67)	46 (76.67)
Poor market Infrastructure	28 (75.68)	10 (58.82)	2 (33.33)	40 (66.67)
Lack of market Information	22 (59.45)	7 (41.17)	3(50.00)	32 (53.33)
Lack of storage facilities	20 (54.05)	8 (47.06)	3 (50)	31 (51.66)

Multiple responses

Suggestions

Pear cultivation has great scope in the Punjab state, but it is risky enterprise as the sample pear growers perceived many problems both in production and marketing of pear in the study area. Keeping in mind the findings of the study and the problems perceived by farmers the following suggestions may be given to pear growers, policy makers and researchers to grow pear orchards as profitable enterprises.

1. From the study it was observed that the orchards which were retained by the farmers gave more profits as compare to the orchards which were leased out to pre- harvest contractors. Therefore, farmers may be encouraged to sell their produce themselves in the market to fetch more profit instead of selling through pre-harvest contractors.
2. There is a need to develop quality planting material through combined efforts of the state and private agencies through proper check on public and private plant nurseries so that only quality plant material is supplied to the farmers.
3. There is need to establish sound marketing intelligence system to generate and provide up to date price information along with changing demand and supply perspectives of pear. The market broadcasting should be strengthened through using the latest communications technologies.
4. The government should support pear growers in terms of suitable price policy to save farmers from price fluctuations and assuring profitability.
5. Value addition can be promoted by establishing processing plants in pear growing areas which may lead to higher and stabilized prices of pear.
6. There is need to strengthen the existing extension services to educate the farmers. Trainings can be conducted to educate the farmers about the insect-pest attack, diseases of pear etc.
7. During the peak season, pear growers do not get remunerative prices due the glut of pear in the market. Cold storage facilities can be developed in the pear growing areas to check the falling prices during the harvesting period of excessive supply.

CHAPTER-V

SUMMARY

Agriculture sector plays a vital role in Indian society as well as in Indian economy. About 58 per cent of the Indian population is involved in agriculture. Along with other allied sectors like forestry and fisheries, agriculture contributes a largest share in the Gross Domestic Product (GDP). India has huge range of varieties of fruits in its basket and account for 10 percent of world's total fruit production. Mango, banana, citrus, pineapple, guava, spota, jackfruit, litchi and grapes, among the tropical and sub-tropical fruits; apple, pear, peach, plum, apricot, almond and walnut among the temperate fruits and anola, ber, pomegranate, annona, fig, phalsa among the arid zone fruits are important. In horticultural production, a voluminous increase has been observed in India over last few years. India has grabbed the second rank in fruit production in the world after China. Fruits play vital role in the agricultural economy of India. A well-established orchard can give better returns than other agronomical crops. In India, during 2015-16, the production of total horticultural crops including fruits, vegetables, plantations, aromatic and medicinal, flowers, species and honey was about 283360 thousand tonnes from an area of 23787 thousand hectares. The area under total fruits during 2015-16 was 6405 thousand hectare and production was 91443 thousand tonnes.

Pear, a temperate fruit is having a good flavor and taste and is one of the important fruit crops, native to coastal and mildly temperate regions of the world, from Western Europe, North Africa and east right across Asia. The main countries where pear is grown are China, India, USA, Russian Federation, Germany, Japan, and Spain. In India low chilling hours requiring pears are being cultivated in plains of North India. The cultivars of pear being cultivated at higher hills of Jammu and Kashmir, Himachal Pradesh and Uttarakhand require high chilling hours (900-1000). November to March is the planting period for pear and November is the best month.

In Punjab planting of pear is done in winter, while plants remain dormant up to middle of February. The month of January is more preferable for planting pear. In Punjab, area under pear was 2879 hectares and production was 66047 tonnes during 2015-16. The main districts of Punjab where pear is cultivated are Amritsar, Tran Taran, Jalandhar, Ludhiana, and Patiala. Area under pear in these districts was 828, 922, 289, 212 and 113 hectares, respectively during 2015-16, while production was 18957, 21113, 6792, 4811, 2600 tonnes, respectively.

Pear crop faces many problems in its production and marketing. The major production constraints faced by producers are lack of technological advancement, higher input costs,

insect attack, failure of crop due to sudden rain, etc. The competing crops like wheat and paddy give more and stable profits as compare to fruits and vegetables because minimum support price is given by the government. The production related constraints are more faced by small farmers as compared to large framers. Fruits and vegetables are perishable commodities so are more prone to marketing problems. Major marketing problems include large numbers of intermediaries in market, inadequate transport facilities, lack of proper infrastructure in market, lack of proper grading, packing, transportation, storage facilities, and processing units. Moreover, the marketing facilities are also inadequate. Marketing system is not favorable to the interests of the producers and consumers. It is full of malpractices. The marketing of fruits in the state as a whole is on the mercy of middlemen, private traders and pre-harvest contractors due to the absence of well-organized cooperatives and markets. To encourage diversification of agriculture in Punjab, it is necessary to enhance the returns from fruits. This can be done by bringing efficiency in production and marketing processes. Therefore, the present study is an attempt in this direction. The specific objectives of present study were:

i. To examine the cost and return from pear cultivation in Punjab.
ii. To identify the important marketing channels and price spread in marketing of pear in Punjab.
iii. To study the problems and suggest policy measures to encourage pear cultivation in Punjab.

The present study has been conducted in the Punjab state. In order to achieve stipulated objectives of the study, multistage sampling technique was used for the selection of districts and blocks. At the first stage two districts viz. Amritsar and Tarn-taran with the highest area under cultivation of pear were selected purposively. Block-wise data on area under pear cultivation in the selected districts were obtained from the Department of Horticulture, Punjab. At second stage one block each from both of the selected districts with the highest area under pear was chosen. For the selection of respondents a complete list of pear growers along with area under pear spread in villages of the selected blocks was obtained from the respective block offices of the Department of Horticulture, Punjab. These cultivators were arranged in ascending order with respect to area under pear. By using cumulative cube-root frequency method, pear growers were categorized into three farm size groups viz. Small (up to 2.38 hectare), Medium (2.38- 6.07 hectare) and Large (6.07 hectare and above). Using proportional allocation method, the farmers were selected from each category in proportion to their number falling in the respective size group. Therefore, 37 small farmers, 17 medium and 6 large farmers were selected. Thus, sample of 60 pear growers was selected. To analyze the

price spread, market margins, marketing costs involved in marketing of pear, 10 wholesalers and 10 retailers were selected randomly. The Azadpur mandi of Delhi was selected for examining the price spread, market margins, marketing costs involved in marketing of pear on the basis of highest quantitative arrivals of pear. The study is based on secondary as well as on primary data. The secondary data on area, production and productivity of total fruits as well as pear in the state were obtained from various issues of the *Statistical Abstract of Punjab.* District-wise data on area, production and productivity of total fruits as well as pear were also obtained from the same source of information. The primary data were collected from the pear growers through personal interview method. Information was also collected from the selected wholesalers and retailers. Apart from working out simple averages and percentages, compound annual growth rate (CAGR) was calculated to see the overtime trends in area production and productivity of pear and total fruits in the Punjab state. In order to see variation w.r.t. area, production and productivity of pear across the various districts of Punjab coefficient of variation was calculated. Benefit-cost ratio, net present value and internal rate of return along with undiscounted measures were calculated to examine the economic viability of pear cultivation.

The results showed that, area under pear in Punjab has been increased from 2147 hectare during 2000-01 to 2879 hectare during 2015-16 with CAGR of 2.12 per cent. District-wise, Taran-Tarn district occupied maximum share in state area (32.03 per cent) and state production (31.97 per cent) followed by Amritsar. The pear growers have invested significant amount as initial cost for the establishment of pear orchards. Farm category-wise, initial cost on establishment was the highest on large farms (Rs 29740 per hectare), followed by medium (Rs 28552 per hectare) and small farms (Rs 27782 per hectare). On overall basis, initial investment on pear orchards worked out to be Rs 28307 per hectare. It is evident that plants and planting costs (25.81 per cent) had the largest share among the different component involved in the establishment of pear orchards followed by land preparation (20.40 per cent) and digging and filling of pits (18.98 per cent). The expenditure incurred on other important components like manure and fertilizers, irrigation, transportation of inputs and plant protection measures was 12.99 per cent, 10.08 per cent, 5.78 per cent and 3.38 per cent, respectively.

Operational/maintenance cost of the pear orchard per annum varies due the factors like age of the plant, insect-pest attack, variety of plant, distance from market etc. It is evident that the operational cost was low in the initial years, which consistently increased during the subsequent years. On an overall basis, operational cost during first year of plantation was Rs 6285 per hectare and observed to be highest for the orchards of age 14-20 years (33653 per hectare). Manure and fertilizers, intercultural operations and plant protection measures were

the major cost components. The total amount spend by pear growers on fertilizers and manures including the application charges on overall basis was Rs 3970 per hectare in second year, which amplified regularly over the life of the orchard and was the highest during the age group of 21 and above years (Rs 15040 per hectare). Second important component that hold large share in operational cost was intercultural operations, it includes operations like weeding, hoeing, clearing etc. These operations were done mechanically and manually. Mechanically intercultural operations were done by tractor mounted plough, manually the hoeing; weeding was finished with hand hoes by human laborers. The costs spend on this operation increased from Rs 3252 per hectare in the first year to the maximum at Rs 5190 per hectare during the age of 14-20 years. Another important component of operational cost was insectides/pesticides. Total expanse spent containing application charges in this regard on average farm was Rs 2384 per hectare in second year which incline slightly every year and was at its maximum for orchards of age 14-20 years (Rs 4774 per hectare) and then declined to Rs 3781 per hectare for orchards of age group 21 years and above. Similarly, over the useful life of orchards the annual cost of irrigation on overall basis varied from Rs 2244 per hectare to Rs 4238 per hectare. The similar trends of annual operational costs over the life period of orchard were observed on different categories of farm size with some variations. On small farms annual operational costs over the life period of orchard varied from Rs 6495 per hectare in the initial year to Rs 33668 per hectare during the orchard age of 14-20 years. On medium and large farms the annual operational costs for different aged orchards varied from Rs 6315 per hectare to Rs 32615 per hectare and from Rs 6038 per hectare to Rs 33960 per hectare, respectively.

Disposal pattern of pear orchards indicates that majority of the pear growers (80 per cent) disposed their produce through pre-harvest contractors. Only 20 per cent of the sampled pear growers retained orchards for direct selling in the market. Farm category-wise, about 84 per cent of the small, 76.47 per cent of the medium and 66.66 per cent of the large farmers leased out their orchards to pre-harvest contractors.

It was observed that pear growers started receiving positive net returns from pear orchards from seventh year onwards and was the highest for 14-20 years of plantation. On an average situation, average annual net returns generated during 14-20 years was Rs 183864 per hectare. Almost same trends in the terms of net returns were observed in the case of small, medium and large farmers. Over entire life period of pear orchard the annual average net returns generated on small, medium and large farm was Rs 70147, Rs 102174 and Rs 113102 per hectare, respectively. Over the life of period of pear orchards the per hectare average annual total cost, average annual gross returns and average annual net returns on average farm were Rs 136713, Rs 256775 and Rs 102594 per hectare, respectively.

Pear plantation is an economic activity which actually needs considerable investments every year and yields returns during its useful life. In case of orchards which were sold to pre-harvest contractors, the estimated benefits-cost ratio on small, medium and large farms was 1.04, 1.05 and 1.13, respectively. The internal rate of return (IRR) on small, medium and large farms was 13.44, 13.80 and 16.29 per cent respectively. It was emerged out that net returns received by the sampled pear growers were quite high for selling the produce themselves than through pre-harvest contractor; as the margins of this important intermediary got transferred to the farmers. The benefit-cost ratio in this case was 1.32, 1.37 and 1.43 for small, medium and large farms, respectively. The net present value in this case were highly positive and IRR on, small, medium and large farms was 21.84, 23.99 and 25.26 per cent respectively. In this case overall benefit-cost ratio and IRR was 1.38 and 23.37 per cent respectively. Thus, despite of spending huge cost on harvesting and marketing of pear, the benefit cost ratio was significantly higher as compared to the disposing-off the produce through pre-harvest contractors.

The marketing of pear from producer to consumer involved various intermediaries in the study area. Two marketing channels were recognized in the study area through which the commodity moved from producer to the final consumer. In channel-I the producer sold his produce to the wholesaler through commission agent which then retailed the produce to retailer and then it finally reached to consumer. In case of marketing channel-II the producer sold his orchard to the pre-harvest contractor which sold the produce in the market through commission agent to wholesaler and then passed to retailer and finally reached to consumer.

Channel-I: Producer → Wholesaler (through commission agent) → Retailer → Consumer

Channel-II: Producer → Pre-harvest contractor → Wholesaler (through commission agent) → Retailer → Consumer

The results related to marketing aspects revealed that the net price received by the producer in channel-I was Rs 1257.71 per quintal and in channel-II it was Rs 976.42 per quintal. The producer's share in consumer rupee was higher in channel-I (48.94 per cent) as compare to channel-II (37.99 per cent). It shows that producer's share in consumer rupee increased with decrease in market functionaries. The price spread in the respective channels was Rs 1312.29 per quintal and Rs 1593.58 per quintal, respectively.

Market efficiency of both the channels was calculated through Acharaya's method. The marketing efficiency calculated came out to be 0.49 and 0.45 for channel-I and channel-II, respectively which indicates that channel-I was more efficient.

Pear cultivation has great scope in Punjab state, but it contains some constraints. The major problem is of lack of skilled labour. Pear orchard need skilled and trained laborers for operations like pruning, thinning, grading. Labour is also required for other operations such as hoeing, plucking, grading, packaging, loading, unloading and transportation. About 56 per cent of farmers faced the problem of lack of skilled labour. Good quality of planting materials leads to more production but due to the shortage, most of the farmers bought planting materials from private nurseries which do not meet the requirements of good quality. Overall 50 per cent of the framers responded towards this problem. There is a need to develop quality planting material through combined efforts of state and private agencies through proper check on public and private plant nurseries so that only quality plant material is supplied to the farmers. There is need to strengthen the existing extension services to educate the farmers. Trainings can be conducted to educate the farmers about the insect/pest attack, diseases of pear etc. The problem of weak research and extension linkages was perceived by about 45 per cent of the total farmers. Another problem reported by the sampled farmers was damage due to climatic factors like wind storms, heavy rainfall due to which fruits shed and get spoiled. Overall, 26.66 per cent farmers reported this problem. The foremost market related problem reported by farmers was price fluctuations. During the peak harvest season, produce is in glut in the market which in turn affects the price. From total sampled farmers it was observed that 80 per cent of the farmers encountered the problem of price fluctuations. The government may support pear growers in terms of suitable price policy to save farmers from price fluctuations and assuring profitability. Around 66 per cent of the sampled farmers faced the problem of poor market infrastructure. About 53 per cent farmers stated that the availability of market information related to price was very poor. There is need to establish sound marketing intelligence system to generate and provide up to date price information along with changing demand and supply perspectives of pear. The market broadcasting should be strengthened through using the latest communication technologies. Another problem perceived was lack of storage facilities. Due to limited storage facilities available in the market produce get spoiled. Overall, nearly 51 per cent of the farmers had the problem of lack of storage facilities. During the peak season, pear growers do not get remunerative prices due the glut of pear in the market. Cold storage facilities can be developed in the pear growing areas to check the falling prices during the harvesting period of excessive supply. These steps may help in further promotion of pear cultivation in the Punjab state.

REFERENCES

Acharya S S and Agarwal N L (2011) *Agricultural Marketing in India.* pp 428-467. Oxford and IBH Publishing Company Pvt. Ltd., New Delhi.

Anonymous (2014) Retrieved from https://www. usapears/pear-varieties.org

Anonymous (2016a) Horticultural Statistics at a Glance 2016. Department of Agriculture, Cooperation and Farmers Welfare. Ministry of Agriculture and Farmers Welfare, New Delhi, India.

Anonymous (2016b) Statistical Abstract of Punjab. Economic and Statistical Organization, Chandigarh.

Anonymous (2016c) *Package of Practices for Cultivation of fruits.* Pp 36-45. Punjab Agricultural University Ludhiana.

Anonymous (2017) Retrieved from https://www.ibef.org/industry/agriculture-india.aspx

Banana in Jalgaon District of Western Maharashtra. *Agril Situ Ind* **60:** 733-741.

Banana in Jalgaon District of Western Maharashtra. *Agril Situ Ind* **60:** 733-741.

Banerjee G D (2009) Poised for golden revolution. *Time Agri J* 01. April.

Dahiya P, Malik D P and Singh I J (2001) Trend and growth rate of area, production and yield of fruit crops in Haryana. *The Bihar J Agril Mktg***9**: 170-77.

Dhandhaliya M G and Shiyani R L (2012) Economic viability of Sapota (*Achrias Sapota L.*) in Saurashtra region. *Ind J Agril Mktg* **26:** 179-190.

Gangwar L S, Singh D and Mandal G (2008) Economic evaluation of peach cultivation in north Indian plains. *Agri Econ Res Rev* **21:** 123-29.

Gill K S, Sidhu M S and Singh H (1990) Marketing of grapes in Punjab. Annual research report, Department of Economics and Sociology, PAU, Ludhiana.

Gupta S (2011) Constraints in the marketing of fruits and vegetables in Punjab. *Kisan World* **38**: 1-12

Jairath M S, Ratan R S and Gupta B K (1995) Temporal behavior of costs and margins in marketing of fruits in Himachal Pradesh. *Ind J Agril Mktg* **9:** 17-26.

Kachroo J, Bhat A and Kachroo D (2012) Economic evaluation of production and marketing of orange in Jammu and Kashmir state. *Ind J Agril Mktg***26**:150-61.

Karpagam C, Theodore K R, Palanisamy S and Shanthy R T (2010) Grape Production-An Overview. *Kisan World* **37:** 43-45.

Kaur H and singh I P (2010) Marketing of Kinnow in Sri Ganganagar district of Rajasthan state. *Ind J Agril Mktg* **24:** 141-149.

Kaur M, Singh J and Kumar S (2016) Economic Viability of Kinnow Orchards in South-Western Punjab. *Ind J Econ and Dev* **12:** 703-710.

Kumar K and Singh H L (2010) Price spread of Mango in Lucknow district of U.P. *Ind J Agril Mktg* **24:** 50 57.

Kurkute B V, Shendage P N, Jadhav K L and Nirgude R R (2010) Marketing of Banana in Pune District of Maharashtra. *Ind J Agril Mktg* **24:** 178-187.

Maheshwari S (2009) *Production and marketing of fruits: A case study of Bathinda district.* Unpublished M.Phil Dissertation, Department of Economics, Punjabi University, Patiala, India.

Mali B K, Bhosale S S, Shendage P N and Kale P V (2004) Economics of Production and Marketing of

NAAS (2001), Hi tech Horticulture in India, Policy Paper No. 13, National Academy of Agricultural Sciences, New Delhi 1-13

Palaniappan G and Sengottaiyan A (2010) Apple production. *Kisan World* **37**: 32-36.

Prasher R S, Chandel S and Thakar R (2013) Economic appraisal of production and marketing of litchi In Himachal Pradesh. *Ind J Agri Mktg* **27:** 1-13.

Romana G S and Sachdeva J (2015) Economics of Kinnow Marketing in Punjab vis-à-vis distant markets: a case study. *Ind J Econ dev* **11:** 761-766.

Saraswat S P, Dahiya P S and Singh P (2006). Production and Marketing of Peach Fruit: A Case Study of Rajgarh Area of District Sirmour in Himachal Pradesh. *Ind J Agril Mktg* **20:** 81-91.

Sekhon N S, Bhullar A S and Sidhu M S (2006) Production and marketing of pear in Amritsar district of Punjab. *Ind J AgrilMktg***20**: 1-14.

Sharma V K, Anchal D and Singh V (2007) Production performance and economics of litchi cultivation in Punjab. *Ind JAgrilMktg***21**:157-61.

Shinde H R, Dorge J T, Mulla K B (2016) Marketing of grapes with special reference to Good Agricultural Practices (GAP) in Sangali District. *Ind J Eco and Dev* **12**: 75-80

Sidhu R S, Vatta K, Kumar S and Singh P (2012) Production and Marketing System for Kinnow in Punjab. *J Agril Dev and Pol* **22:** 49-58.

Singh B and Sidhu D S (1976) *Marketing of mangoes in Punjab state*. A research report, Department of Economics and Sociology, Punjab Agricultural University, Ludhiana, India.

Singh H P, Singh O P, Singh R and Chand S (2008) *Dynamics of area, production and productivity in major fruit crops of India.* A research report, College of Horticulture, Kerela Agriculture University, Thrissur, India.

Singh K, Grover D K, Vatta K and Kumar S (2001) Pattern of production and marketing of fruit crops in Punjab. *Ind J AgrilMktg***12**: 8-16.

Singh S (2004) *A Study on Production Performance and Marketing of Kinnow in Punjab*. Unpublished M.Sc. Dissertation, Department of Economics and Sociology, PAU, Ludhiana.

Singh S and Sidhu M S (2005) Price spread of kinnow in Punjab. *Ind J AgrilMktg***19**: 15-24.

Suresh A and Reddy T R K (2004) An Economic Analysis of Banana Cultivation in Peechi Command Area of Thirssur District of Kerala State. *Agri Situ Ind* : 629-631

Verma A and Singh K P (2004) Growth in Production and Export of Banana. *Agri Situin Ind* 25-27.

Verma L R (2004) Marketing of fruits and vegetables in Himachal Pradesh: Strategies for sustainable development. *Ind J Agril Mktg* **18**: 201-16.

APPENDIX-I

Comparative economics of pear, wheat and paddy

(Rs/ha)

Particulars	Wheat	Paddy	Pear (sale through pre-harvest contractor)	Pear (self-sale)
Total returns	90155	103864	185045	328504
Total costs	34103	41331	126353	182009
Net returns	56052	62533	58692	146495

Source: Enterprise budget of Kharif and Rabi crops (2016-17), Department of Economic and Sociology, Punjab Agricultural University, Ludhiana

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