Economics of Ber Orchard at Shri Karan Narendra College of Agriculture, Jobner – A Case Study

श्री कर्ण नरेन्द्र कृषि महाविद्यालय, जोबनेर के बेर फलोद्यान का अर्थशास्त्र – एक वृत अध्ययन

LALITHA S
(18-01-02-02-74)

Thesis

Master of Science in Agriculture
(Agricultural Economics)

2020

Department of Agricultural Economics
S. K. N. College of Agriculture, Jobner – 303 329
Sri Karan Narendra Agriculture University, Jobner

श्री कर्ण नरेन्द्र कृषि महाविद्यालय, जोबनेर के बेर फलोद्यान का अर्थशास्त्र – एक वृत अध्ययन

ललिता एस

(18-01-02-02-74)

शोध प्रबंध

कृषि विज्ञान में स्नातकोत्तर

(कृषि अर्थशास्त्र)

2020

कृषि अर्थशास्त्र विभाग

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Thesis

S. K. N. College of Agriculture, Jobner

In partial fulfillment of the requirement for the degree of

Master of Science

In the

Faculty of Agriculture

(Agricultural Economics)

By

LALITHA S

(18-01-02-02-74)

2020

Sri KaranNarendra Agriculture University, Jobner

S.K.N. College of Agriculture, Jobner

CERTIFICATE - I

Date:…… 2020

This is to certify that **Miss. Lalitha S** has successfully completed the comprehensive examination held on……. as required under the regulation for Master's degree.

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Sri Karan Narendra Agriculture University, Jobner
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CERTIFICATE - II

Date:…… 2020

This is to certify that the thesis entitled **"Economics of Ber Orchard at Shri Karan Narendra College of Agriculture, Jobner - A Case Study"** submitted for the degree of **Master of Science** in Agriculture in the subject of **Agricultural Economics** embodies bonafide research work carried out by **Miss. Lalitha S** under my guidance and supervision and that no part of this/her thesis has been submitted for any other degree. The assistance and help received during the course of investigation have been fully acknowledged. The draft of the thesis was also approved by advisory committee on…….

(Dr. A.K. Gupta)
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Department of Agricultural Economics

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Sri Karan Narendra Agriculture University, Jobner
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CERTIFICATE - III

Date:…… 2020

This is to certify that the thesis entitled **"Economics of Ber Orchard at Shri Karan Narendra College of Agriculture, Jobner - A Case Study"** submitted by **Miss. Lalitha S** to Sri Karan Narendra Agriculture University, Jobner in partial fulfillment of the requirements for the degree of **Master of Science** in the subject of **Agricultural Economics** after recommendation by the external examiner, was defended by the candidate before the following members of the examination committee. The performance of the candidate in the oral examination on her thesis has been found satisfactory. We therefore, recommend that the thesis be approved.

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Date:…… 2020

This is to certify that **Miss. Lalitha S** of the Department of Department of Agricultural Economics, S.K.N. College of Agriculture, Jobner has made all corrections/modifications in the thesis entitled **"Economics of Ber Orchard at Shri Karan Narendra College of Agriculture, Jobner - A Case Study"** which were suggested by the external examiner and the advisory committee in the oral examination held on …….. The final copies of the thesis duly bound and corrected were submitted on …….. and forwarded herewith for approval.

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Certificate of Anti Plagiarism
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Certificate

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Degree	:	M.Sc. (Ag.)
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Department	:	Agricultural Economics
Institute	:	S.K.N. College of Agriculture, Jobner.
Name of the Major Advisor with Designation	:	**Mr. Sonu Jain,** Assistant Professor
Similarity percentage	:	1% **Date**: 05/05/2020

Major Advisor

The Plagiarism report of the above thesis has been reviewed and similarity percentage is below the accepted norms **(report attached).** The thesis may be considered for submission to the university.

Univ. Head of the Department **Dean/Director**

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Gratitude takes three forms, “A feeling from the heart, an expression in words and a giving in return…..”

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Place: Jobner

Date: _____/____/2020 **(Lalitha S)**

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THESIS ABSTRACT

Economics of Ber Orchard at Shri Karan Narendra College of Agriculture, Jobner – A Case Study

Lalitha S[*] (Research Scholar)

Mr.Sonu Jain[**] (Major Advisor)

ABSTRACT

The present study was conducted at Shri Karan Narendra College of Agriculture, Jobner to study the cost structure of ber orchard, economic feasibility of investment in ber cultivation and identify the problems in the production of ber. Ber research farm of college was selected for the study which consist 156 plants in one hectare. The economic life of the ber orchard is 20 years and the actual data were collected for the period from 2010 to 2019 and for remaining period, costs data were estimated through extrapolation method and returns through assumption. In this study, costs and returns, discounted measures like Net Present Worth (NPW), Benefit Cost Ratio (BCR), Internal Rate of Return (IRR) and undiscounted measure like Payback period (PBP) were used for analysis and the problems in the production of ber were assessed by three categories *viz.,* highly severe, moderately severe and less severe.

The total costs for whole ber life i.e. for 20 years without and with salary of permanent staffs were estimated as ₹7,03,936.04 ha^{-1} and ₹15,61,286.90 ha^{-1}, respectively. The total variable costs and fixed costs without salary of permanent staffs accounted for 51.65 per cent and 48.35 per cent of total costs, respectively. The total variable costs and fixed costs with salary of permanent staffs were estimated to 23.29 per cent and 76.71 per cent of total costs, respectively.

The total establishment costs i.e. for initial three years of ber orchard without salary of permanent staff was ₹45,579.14 ha^{-1}. Out of which, 71.73 per cent and 28.27 per cent was contributed towards variable costs and fixed costs, respectively. Total establishment costs of ber orchard with salary of permanent staffs at research farm was ₹1,50,605.68 ha^{-1}. Out of which, 21.71 per cent and 78.29 per cent was contributed towards variable costs and fixed costs, respectively.The major costs items were care of plants with ₹15,666.21 ha^{-1} followed by cost for land preparation with ₹8000 $ha^{-1}$and under fixed costs, the cost items like interest on fixed capital with ₹10,775.61 ha^{-1} and depreciation with ₹ 2112.49 ha^{-1} were worked out.

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[**]Thesis submitted in partial fulfillment of the requirement for M. Sc. (Ag.) degree in Agricultural Economics under supervision of Mr. Sonu Jain, Asstt. Professor, Department Agricultural Economics), S.K.N. College of Agriculture, (Sri Karan Narendra Agriculture University) Jobner.

The total maintenance costs i.e. for remaining life of ber cultivation without salary of permanent staffs was ₹6,58,356.89 ha^{-1}. Out of which, ₹3,30,900.71 ha^{-1} and ₹3,27,456.18 ha^{-1} were contributed towards variable costs and fixed costs, respectively. Total maintenance costs of ber cultivation with salary of permanent staffs at research farm was ₹14,10,681.21 ha^{-1}. Out of which, ₹3,30,900.71 ha^{-1} and ₹10,79,780.50 ha^{-1} were contributed towards variable costs and fixed costs, respectively. In variable costs, major cost items were watching charges with ₹1,01,529.82 ha^{-1} followed by manures & fertilizers with ₹76,995.09 ha^{-1} and under fixed costs, the cost items like rental value of the land with ₹2,36,947.04 ha^{-1} and interest on fixed capital with ₹75,672.75ha^{-1} were worked out.

The total gross returns from per hectare of ber cultivation at research farm were found out as ₹11,84,735.37 ha^{-1}. The total net returns without salary and with salary of permanent staffs was found out with ₹4,80,799.33 ha^{-1} and ₹-3,76,551.53 ha^{-1} per hectare, respectively.

Net Present Worth (NPW) of the ber orchard at research farm without and with salary of permanent staffs was worked out to ₹1,04,880.18 ha^{-1} and ₹-1,94,452.08 ha^{-1}, respectively. Annuity of NPW of ber cultivation was found out with ₹14,035.06 and ₹-26,021.58 per annum/ha without and with salary of permanent staffs, respectively. Discounted gross benefit cost ratio of the ber orchard was calculated as 1.48 and 0.62 without and with salary of permanent staffs, respectively. Discounted net benefit cost ratio of the ber orchard was calculated as 0.48 and -0.38 without and with salary of permanent staffs, respectively. The IRR was 31.41 per cent and negative for ber orchard without and with salary of permanent staffs, respectively. The payback period was 7 years without salary and no payback period while considering the salary of permanent staffs.

The major technical constraints identified in the study area were the problem of pests and diseases especially whitefly andpowdery mildew, birds (parrot) and economic constraints were like high cost of protection of plants from pests and diseases and high labour cost. The study clearly shows that the cultivation of ber was economically viable and financially feasible to the farmers.

श्री कर्ण नरेन्द्र कृषि महाविद्यालय, जोबनेर के बेर फलोद्यान का अर्थशास्त्र – एक वृत अध्ययन

ललिता एस* (शोधकर्ता)

श्री सोनू जैन** (मुख्य सलाहकार)

अनुक्षेपण

वर्तमान अध्ययन श्री कर्ण नरेन्द्र कृषि महाविद्यालय, जोबनेर में किया गया। इस शोध मे बेर फलोद्यान में लागत संरचना, बेर खेती में निवेश की आर्थिक व्यवहार्यता एवं बेर उत्पादन में प्रमुख समस्याओं का अध्ययन किया गया है। महाविद्यालय के एक हेक्टेयर फार्म में 156 पादप है। बेर फलोद्यान का आर्थिक जीवन 20 साल होता है व 2010 से 2019 तक के वास्तविक डेटा एकत्रित किए गए एवं शेष अवधि के लिए लागत के डेटा एक्स्ट्रापोलेशन विधि के द्वारा एवं आय के डेटा काल्पनिक लिये गये। इस अध्ययन मे लागत और आय तथा बट्टाकारणो परान्त के साधन जैसे शुद्ध वर्तमान मूल्य, लाभ –लागत अनुपात, चुकाने की आन्तरिक दर एवं बट्टाकरण रहित साधन जैसे ऋण वापसी की अवधि को विश्लेषण के लिए इस्तेमाल किया एवं बेर उत्पादन में आने वाली समस्याओं को तीन श्रेणियों में विभाजित किया गया जैसे अत्यधिक गंभीर, मध्यम गंभीर एवं कम गंभीर।

बेर के पूर्ण जीवन जो कि बीस साल तक स्थायी कर्मचारियों के वेतन रहित व वेतन सहित कुल लागत क्रमशः 7,03,936.04 व 15,61,286.90 रूपये प्रति हेक्टेयर पाई गयी। बेर फलोद्यान में स्थायी कर्मचारियों के वेतन रहित कुल परिवर्तनशील लागत एवं स्थायी लागत कुल लागत का 51.65 व 48.35 प्रतिशत पाया गया। स्थायी कर्मचारियों के वेतन सहित कुल परिवर्तनशील लागत एवं स्थायी लागत, कुल लागत का क्रमशः 23.29 व 76.71 प्रतिशत पाया गया।

बेर फलोद्यान के प्रथम तीन वर्ष की स्थायी कर्मचारियों के वेतन रहित कुल स्थापना लागत 45,579.14 रूपये प्रति हेक्टेयर थी जिसमे से 71.73 प्रतिशत एवं 28.27 प्रतिशत क्रमशः परिवर्तनशील लागत व स्थायी लागत थी। बेर फलोद्यान के प्रथम तीन वर्ष की शोध फार्म पर स्थायी कर्मचारियों के वेतन सहित कुल स्थापना लागत 1,50,605.68 रूपये प्रति हेक्टेयर थी जिसमें से 21.71 प्रतिशत व 78.29 प्रतिशत क्रमशः परिवर्तनशील लागत व स्थायी लागत थी। परिवर्तनशील लागत के अन्तर्गत विभिन्न वृहद् लागत समूह जैसे पादप की देखरेख के लिए 15,666.21 रूपये प्रति हेक्टेयर व भूमि तैयारी के लिए 8000 रूपये प्रति हेक्टेयर एवं स्थायी लागत के अन्तर्गत स्थायी पूंजी पर ब्याज 10,775.61 रूपये प्रति हेक्टेयर व मूल्यह्रास 2112.49 रूपये प्रति हेक्टेयर थी।

कुल रखरखाव लागत जो कि बेर फलोद्यान के बचे हुए जीवन के लिए स्थायी कर्मचारियों के वेतन रहित 6,58,356.89 रूपये प्रति हेक्टेयर थी जिसमें से परिवर्तनशील लागत व स्थायी लागत क्रमशः 3,30,900.71 व 3,27,456.18 रूपये प्रति हेक्टेयर थी। बेर

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*स्नातकोत्तर कृषि छात्रा कृषि अर्थशास्त्र विभाग, श्री कर्ण नरेन्द्र कृषि महाविद्यालय, जोबनेर।

**कृषि संकाय में स्नातकोत्तर उपाधि की आंशिक आवश्यकता की पूर्ति के लिये श्री सोनू जैन, सहायक आचार्य, कृषि अर्थशास्त्र विभाग, श्री कर्ण नरेन्द्र कृषि महाविद्यालय, जोबनेर, (श्री कर्ण नरेन्द्र कृषि विश्वविद्यालय, जोबनेर) के निर्देशन में पूर्ण किया गया शोधग्रन्थ।

फलोद्यान के बचे हुए जीवन के लिए शोध फार्म पर स्थायी कर्मचारियों के वेतन सहित कुल रखरखाव लागत 14,10,681.21 रूपये प्रति हेक्टेयर थी जिसमें से परिवर्तनशील लागत व स्थायी लागत क्रमशः 3,30,900.71 व 10,79,780.50 रूपये प्रति हेक्टेयर थी। परिवर्तनशील लागत के अन्तर्गत विभिन्न वृहद् लागत समूह जैसे देखरेख पर खर्च 1,01,529.82 रूपये प्रति हेक्टेयर एवं खाद व उर्वरक के लिए 76,995.09 रूपये प्रति हेक्टेयर थी एवं स्थायी लागत के अन्तर्गत भूमि का किराया मूल्य 2,36,947.04 रूपये प्रति हेक्टेयर व स्थायी पूंजी पर ब्याज 75,672.75 रूपये प्रति हेक्टेयर थी।

शोध फार्म पर एक हेक्टेयर बेर की खेती से कुल सकल आय 11,84,735.37 रूपये प्रति हेक्टेयर पाई गई। स्थायी कर्मचारियों के वेतन रहित व वेतन सहित कुल शुद्ध आय क्रमशः 4,80,799.33 व –3,76,551.53 रूपये प्रति हेक्टेयर पाई गयी। बेर फलोद्यान के शोध फार्म पर स्थायी कर्मचारियों के वेतन रहित व वेतन सहित शुद्ध वर्तमान मूल्य क्रमशः 1,04,880.18 व –1,94,452.08 रूपये प्रति हेक्टेयर पायी गयी। बेर खेती के शुद्ध वर्तमान मूल्य का वार्षिक स्थायी कर्मचारियों के वेतन रहित व वेतन सहित क्रमशः 14,035.06 व –26,021.58 रूपये प्रति हेक्टेयर पाया गया। बेर फलोद्यान का सकल लाभ लागत अनुपात स्थायी कर्मचारियों के वेतन रहित व वेतन सहित क्रमशः 1.48 व 0.62 पाया गया। शुद्ध लाभ लागत अनुपात स्थायी कर्मचारियों के वेतन रहित व वेतन सहित क्रमशः 0.48 व –0.38 पाया गया । बेर फलोद्यान की वापसी की आन्तरिक दर स्थायी कर्मचारियों के वेतन रहित व वेतन सहित क्रमशः 31.41 प्रतिशत व नकारात्मक पाई गयी। स्थायी कर्मचारियों के वेतन रहित ऋण वापसी की अवधि 7 वर्ष जबकि वेतन सहित ऋण वापसी की अवधि कुछ भी नही पाई गयी।

अध्ययन क्षेत्र में मुख्य तकनीकी बाधाऐं जैसे कीट और रोगों की समस्या विशेष रूप से सफेद मक्खी और चूर्ण फफूंदी, पक्षी (तोता) एवं आर्थिक बाधाये जैसे कीट और बीमारियों से बचाव के लिए पौधों के संरक्षण की उच्च लागत एवं उच्च श्रम लागत पायी गई। अध्ययन से स्पष्ट है कि बेर की खेती आर्थिक रूप से व्यवहार्य एवं किसानो के लिए वित्तीय रूप से सम्भव है।

INTRODUCTION

CHAPTER - 1
INTRODUCTION

Agriculture is the most important sector of Indian economy. Contribution of agriculture and allied sector to the national GDP was 17.2% during the year 2018 (Anonymous 2018) and provides employment to more than 50% of the Indian labour force. Indian agriculture planning was only cereal food oriented, but later the horticultural crops *viz*., fruits getting attention and great investment support at the national level. Nowadays, the fruit crops are grown for commercial and nutritious purposes in all over the country. The fruits play an important role in both economy and social spheres, because the fruit crops are giving more income than the annual crops. The developing countries like India, mostly depending upon the perennial crops for earning the foreign exchange.

Cultivation of fruits has been practised in India since time immemorial. Fruits are important for maintaining human diet. They are the chief sources of minerals and vitamins, without which human body cannot maintain proper health and resistance to diseases. In India, Ber has a long history, as mentioned in the oldest Sanskrit literature. Ber is most common and ancient fruit of Indo-china and cultivated in the Indian subcontinent for fresh fruit. Scientific name of the ber is *Ziziphus mauritiana* and it belongs to the Rhamnaceae family. It is distributed in the subtropical and tropical regions of world and India, which include about 50 species. Ber is known to be indigenous to the area extending from India to southwest China and Malaysia (Vavilov, 1951).

Ziziphus numularia, *Ziziphus rugosa* and *Ziziphus rotundifolia* are few other species of ber grown in the India. Ber is also called as Indian jujube, jujube, Chinese date, Indian plum, Chinese apple, Baer, Ber (in Hindi), Kul (in Bengali), badari (in Malayalam), Ilanthai, Elanthai Pazham (in Tamil), Regi pandu (in Telugu), Bor (in Konkani and Marathi) and flattened (in Barbados).

The Indian ber plants are small to moderate, spreading with vine like branches. It is the most resistant fruit plant with greater adaptability to adverse climatic conditions, since it has xerophytic characters and can be successfully cultivated in the tropical and subtropical marginal ecosystems. The ber plants having a deep and tap root system, which responds well to a large number of soil types. Since their cultivation requires less input and care among fruit plants, plants are suitable for rehabilitating large area with scarce resources. The ber is having wider adaptability; it can be referred by the circumstance that it has grown in many countries with contrasting environmental conditions.

Frost does not have much effect on the ber plant. It can be grown up to a height of 1000 metres above MSL (mean sea level). It is a quick growing plants and early bearing fruit which yield a heavy crop every year. It can provide good fruit production even without irrigation and it can be grown as dry land in arid region and semi-arid regions. It can thrive well in unfavourable climate. During fruiting stage, the plants prefer dry, hot climate and adequate moisture. Good quality fruit development prefers dry weather. Extreme atmospheric humidity is not suitable for healthy fruit production. The ber plant grows on an extensive variety of soils ranging from gravel and sand to clay and from deep to shallow soils. The ber can also resist alkalinity and slightly flooded conditions. In fact, it can resist and often works better than most fruits in poor soils.

The ber fruit matures 155-170 days after flowering. Fully ripen fruits are collected from the harvest. Harvesting time may vary according to place, like in north India, the harvesting time is February to April and October to November in south India and January to March in Rajasthan. In rainfed conditions, the bearing starts from the second year. If it is budded plants, the bearing starts after 3 to 4 years. Average performance during the main bearing period varies from 80 to 200 kg / plant. In dry areas, in rainy conditions, 50-80 kg of fruit / plant can be obtained. Plants remain productive for 15-25 years.

The composition of ber fruit has been quite widely reported and much of information is cultivar specific. Pulp content of fresh fruits varies from 80 to 97 per cent. The pulp is very rich in nutritive value. The ber fruits contain significant amount of Vitamin C, A and B complex. About 49.7 per cent of total digestible nutrients and 5.6 per cent of digestible crude proteins are present in the leaves making it a nutritive fodder for animals. The ber contains more minerals, iron, phosphorus and calcium. The ber is richer than oranges in carbohydrates and calorific values and richer than apple in vitamin C, carotene and protein. According to FAO/WHO recommendation, the daily diet of an adult man should contain 30 mg ascorbic acid. This can be met by adding three ber fruits in daily diet.

The ber fruit has higher sugar content like sucrose, glucose fructose and starch. Therefore, the ber fruits contain higher level of carbohydrates, which provide energy. The amount of sugars may vary with cultivar. The fruits contain protein with many essential amino acids (arginine, asparginine, glutamic acid, glycine, aspartic acid, serine and threonine). In general, the ber fruit per 100 gm contains 22 gm of sugar, 1.3 gm of fibre and 0.2 gm of fat with a calorific value of 104 (Morton, 1987). Besides, it is used as dessert purpose, such as preserves, candy and dehydrated ber, murabba which are prepared from the fruits. Pulp made from ripe fruits is used to prepare products such as juice, jam, nectar, fruit leather, ready to serve drink and squash. Ber fruits easily available to the poor and therefore, known as poor man's fruit.

The ber is a multipurpose plant. The ber fruit is the well-known fruit and it is also a basis of seeds, timber, fodder, medicines and potential industrial components. The ber fruits are used as a traditional medicine in India. In Asia and Africa *Z. nummularia, Z. rugosa*, *Z. spina-christi* and *Z. jujuba* are used for medicinal purpose. All the parts of ber plant are used, like fruit pulp, seeds, leaves, bark and flowers. The ber fruit has anti-fungal, anti-inflammatory, antioxidant and

antibacterial properties and contains thiamine, pectin and riboflavin. The bark of the ber plant is used for curing the diarrhoea; its powder is applied to old sores and wounds, while the roots of plant are used in preparation of decoction for fever. The leaves also used as a medicine for conjunctivitis. The astringent seed is a tonic for the heart and brain. An infusion of flowers is used as an eye lotion.

In Ethiopia, ber fruits are used to astonish the fish. Camels, cows and goats eat the leaves easily and are considered nutritious. In India and Queensland, flowers are considered a minor source of nectar for bees. The plant was also used as a live fence and anorak.The ber plant wood is valued as fuel wood and produces a good charcoal. The fuel wood from ber plant can be collected after pruning, on an average, 15-20 kg/plant/year can be produced. The ber plants are also used as the best host plant for the lac insect *(Kerria lacca).* Lac insects suck the juice content from the ber leaves and it will produce an orange/red resin. This harvested lac is used as shellac in the industry for the manufacture of varnishes, paints and waxes.

The ber plants giving positive environmental benefits, because they provide perennial cover that protects the soil from adverse conditions. The strong deep root system also helps to maintain the structure of the soil so, as to preserve the soil. The arid regions experience scanty rainfall, frequent drought with erratic distribution of rainfall which often results in complete or partial crop failure. It is the only fruit crop which can give good production even under rain fed conditions. However, its systematic plantations are sporadic. Among several species, *Ziziphus mauritiana*is having commercial importance. *Ziziphus nummularia* leavescontain high level of protein, which provide fodder (Pala) for livestock in summer months particularly in fodder deficient areas of Rajasthan.

There are many different ber cultivars developed by researchers. Depending on their fruit production whether at the beginning, at the middle or at the last of the growing year, the cultivars

are known as early, medium or late ripening. This is crucial to consider, while selecting what to grow. Environmental requirements also differ, depending on the variety. In India, farmers grow numerous horticultural varieties of edible. Some of the highly popular varieties are Umran, Ilaichi, Mehrun, Gola, Chuhara, Sanaur - 2, Seb and Karaka. Among these, Gola variety is saline tolerant.

Economic aspects of ber:

Ber was mostly distributed in the dry parts of tropical Asia and Africa. Small and large plantations of ber exist in India, Afghanistan, China, France, Italy, Myanmar (Burma), Syria, Sri Lanka, South Europe, USA (California, Texas and Florida), Barbados, West Pakistan and some other parts of Mediterranean region.

In India, total area under horticulture was 25.43 million hectares with an annual production of 311.7 million metric tonnes. Out of this, the area under fruit cultivation was 6.509 million hectares with an annual production of 97.358 million metric tonnes (Anonymous 2017-18).

India stands first among the ber growing countries of the world. In India, total area under the ber cultivation was 50,000 hectares with an annual production of 5,13,000 metric tonnes with productivity of 10260 kg /ha. Gujarat, Haryana, Punjab, Uttar Pradesh, Rajasthan, Madhya Pradesh, Bihar, Maharashtra, Andhra Pradesh and Tamil Nadu were the major ber growing states of India. Gujarat stands first in the area and production of Ber (Anonymous 2017-18).

The major ber growing districts of Rajasthan were Bharatpur, Alwar, Barmer, Sri Ganganagar, Jodhpur, Jaipur, Pali, Chittor, Hanumangarh etc. In Rajasthan, total area under ber cultivation was 738.4 hectares with an average production of 5248 metric tonnes with productivity 7108 kg/ha (Anonymous 2017-18). Rajasthan holds tenth position in production of ber.

The ber cultivation ensures a low-cost nutritious fruit. It produces fruits in extremely adverse agro climatic conditions in

marginal lands and with low cultivation costs. The fruits are available at a lower price than many other fruits and therefore, remain accessible to the poor masses. The well-established and maintained ber orchard will provide better yield. During the establishment period, can grow intercrops, it will compensate the cost incurred for establishment of orchard.

A high degree of adoption of the ber cultivation package in the arid and semi-arid areas of the country has improved the income of many poor farmers. Due to the adoption of ber cultivation, land that previously had no commercial value is now considered worthy of thousands of rupees. This has a direct impact on the social status of farmers in the traditionally complex socio-economic-cultural network of rural societies in arid and semi-arid regions, which have successfully adopted the technology package. Furthermore, a high rate of job creation in arid and semi-arid areas, which are ecologically inhospitable, especially for women in rural areas, as considered more efficient in the collection and selection of ber, play an important role in empowerment of women.

In analyzing the records of ber growers, it emerged that six hundred man-days are needed to maintain a one-hectare ber plantation. Therefore, ber cultivation was generating employment in the arid west of Rajasthan. The technology package was very simple and acceptable for farmers with varying levels of households, i.e. from poor to rich. In the country like India, particularly in the rural sector of arid and semi-arid areas, where the large workforce faces a serious problem of lack of employment, the generation of employment through the cultivation of ber could play a vital role in improving the rural economy. Furthermore, this has helped to control the migration of rural youth to urban areas in search of work. The fruits are occupying a vital place in agricultural exports of our country. Therefore, fruits earn foreign exchange.

In recent years, due to development of high yielding varieties (HYV) and getting of high economic return by the farmers, the area under ber cultivation is increasing day by day. Due to short shelf life period of ber fruits, there was glut in market and receive low prices during peak harvesting period. No doubt, ber cultivation is profitable but it requires huge initial investment, mainly in capital, labour and skilled management. Further, it was necessary to know the initial cost for establishing a ber orchard, average cost of production and returns and also constraints in the ber production.

The level of fruit consumption may be increased through two ways i.e. increase in demand by outstretch of the familiarity about the nutritional requirement and increase in the supply, these making the production economically viable and relatively profitable. To deal with succeeding part, it was imperative to study the economic feasibility of the fruit grown area and find out the more ways for increasing profitability of the crop. The fruit crop has been taken for the present study was ber, which is technically viable to cultivate in the farm. The ultimate aim of the study was to improve the production, profitability and consumption of the ber fruit.

For present study, ber orchard at research farm of Shri Karan Narendra College of Agriculture was purposively selected which was established in the year 2010 (with assumption that its economic life is 20 years).Total area under ber orchard was one hectare. The total number plants in the orchard were 156. In research farm, gola ber variety was used for cultivation. It is an earliest variety of ber and it starts bearing of fruits from fourth year onwards.

An economic analysis of agricultural crops at research farm assumed tremendous importance in the transforming circumstances of traditional agricultural practices to scientific agriculture. As such, there was a strong need for several quarters of cost data and for return of the production of important fruit crop i.e. the ber. Only few studies are

reported to have been conducted on the economics of ber production. Therefore, it was necessary to extend this aspect to get more knowledge on costs, returns and production problems of ber. This study on the economics of ber production will provide the basis for farmers to make investment decisions.

The present study has been undertaken with the following specific objectives,

1. To study the cost structure of ber orchard.
2. To evaluate the economic feasibility of investment in ber cultivation.
3. To identify the problems in the production of ber.

1.1 Plan of Thesis

The study is presented under the following chapters:

Abstract: It deals with abstract in English and Hindi.

Introduction: It deals with the introduction and objectives as well as plan of the thesis.

Review of literature: This chapter deals with the review of the relevant past studies related to the present study.

Methodology: It deals with the methodology adopted in the selection of the study area, collection of data and analysis of data.

Results and discussion: The final results and discussion of the study and their analysis have been presented in this chapter after using various methodological tools and presented in the tables.

Summary and conclusions: Brief summary of the core findings of the study along with policy recommendations drawn from the findings have been presented.

Bibliography: The list of the referred books and journals were presented in this section.

1.2 Limitations of the study:

Though every effort has been made to make the objectives of the study comprehensive, some limitations remain. The main limitations of the study were as below:

1. Data were collected for limited periods. According to that, the results were arrived. So, the results might not stand up factual for the consecutive years, mainly due to changes in the input and output prices. Therefore, the results of the study depend on the reliability of the hypothesis considered in the study.
2. Even if every effort had been made to obtain correct information, the chances of error may still be there because of oblivion. Therefore, the study results are truthful to the extent that the data is reliable.
3. The inadequacy of time with the research scholar.

REVIEW OF LITERATURE

CHAPTER -2
REVIEW OF LITERATURE

A comprehensive review of the literature was an essential part of any scientific investigation. This chapter deals with the review of the work done by the scientists in parallel to the problems that have been undertaken for the present study. It facilitates to provide an insight into the method and procedures adopted by other scientists help to suggest changes therein and forms a basis for interpretations of results in relation to the findings of the other investigations. The work done so far on production of ber was limited, relevant research findings related to some other fruit crops, spices and medicinal plants have also been included. The existing studies are presented under the three broad heads *viz.,*

2.1 The cost structure of ber orchard establishment.

2.2 Economic feasibility of investment in ber cultivation.

2.3 Identification of the problems in the production of ber.

2.1 The cost structure of ber orchard establishment

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

₹34,338 as maintenance cost. The average yield per hectare per year was 6,479 kg. which, generated the net returns of ₹15,558 per year.

Mali *et al.* (2003) worked out the economics of production of banana in Jalgaon district of Maharashtra. They concluded that the per hectare cost of cultivation (Cost C_2) was ₹1,33,477.36. The proportion of cost 'A_1', 'B_1' and cost 'C_1' to the total costs was 67.40, 71.34 and 88.11 per cent, respectively. Rental value (16.76%), human labour (8.58%), manures (9.54%), fertilizers (12.49%) and seed material (12.04%) were observed to be the major items of cost and these together shared nearly 59.41 per cent of the total costs. Interest on working capital (10.39%) and irrigation cost (7.93%) were other important items of expenditure and they together contributed 18.32 per cent to the total cost of cultivation. The yield per hectare worked out to 533.14 quintals. The per hectares gross returns obtained by the cultivators were ₹2,14,867.24. Hence, per quintal cost of production came to ₹250.36. Per quintal gross price realized to ₹369.44 and the net price received by the producer was ₹341.89. The per hectare net profit worked out to ₹66,761.87.

Radha *et al.* (2006) conducted a study to analyse the economics of production of grape in Andhra Pradesh. The data were collected during 1998-99 from 126 farmers from Ranga Reddy district. Results showed that the cost of establishing a grape orchard was ₹316174/ha. In the total production cost of ₹176503/ha, direct cost incurred by applying manures and fertilizers (₹20768/ha) and fixed cost due to renting land (₹92956/ha) contributed major shares of 11.76 and 52.66%, respectively.

Ramachandra (2006) studied the production and marketing of sapota in northern Karnataka. The per hectare establishment cost of sapota was found to be ₹1,18,666 and ₹1,13,927.38 in Belgaum and Dharwad districts, respectively. The maintenance cost worked out to be as ₹16952 and ₹15662 in Belgaum and Dharwad district, respectively.

The average yield per ha from Belgaum district was 11.09 tonnes and from Dharwad district was 11.56 tonnes and net returns were ₹57,679 from Belgaum district and ₹50,149 from Dharwad district.

Rane and Bagade (2006) studied on economics of production and marketing of banana in Sindhudurg district of Maharashtra. The study revealed that the per hectare cost at cost C in Dodamarg and Sawantadi tahsils were 1.52 lakhs and 1.53 lakh, respectively. In Dodamarg tahsil, banana was grown as a sole crop where per hectare cost of cultivation was ₹1.28 lakh and in Sawantadi tahsil, per hectare cost was ₹1.15 lakh.

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

Naphade and Tingre (2008) worked out the economics of production of guava in Buldhana District of Maharashtra. They found that per hectare cost of establishment of guava orchard was ₹34,333. Per hectare cost of production was ₹22,522 and per hectare average yield was estimated 372 quintals with a profit of ₹82,036 per year. It was found that profit increased with the age of orchard.

Ali *et al.* (2011) conducted a study on costs and returns of ber orchard in southern districts of West Bengal. The study showed that average recurring cost in terms of Cost A_1 was ₹1,00,329.37 per ha and Cost D was ₹1,04,142.86 per ha. The average gross returns was ₹8,75,312.64 per ha. However, the average net returns per ha over Cost A_1 and Cost D were ₹7,74,983.27 and ₹7,71,169.78, respectively.

Initial investment in the first year was ₹87,665.36 per ha. But, considering the economic life of 15 years of the crop, the initial investment per year was minimized to ₹5,844.36 per ha. So, there is good scope of earning profit.

Dhandhalya and Shiyani (2012) studied on economic viability of sapota in Saurashtra region of Gujarat. A sample of 100 sapota growers spread over 20 selected villages of four blocks of Bhavnagar and Junagadh districts were selected for the study. Data was elicited for the year 2008-09. The study revealed that among various cost components, land rent (28.35 %) emerged as major item at pre-bearing stage, followed by human labour (25.55%) and material cost (24.78%) whereas, at early-bearing and mature bearing stages, human labour was found the major cost component, constituting 35.42 to 38.52per cent, respectively. Thus, human labour, land rent and material cost altogether accounted for a share of more than three-fourths in total cost of cultivation at different stages of orchard. The total cost per annum at pre-bearing, early bearing and mature bearing was ₹47,719, ₹68,890 and ₹90,401 per hectare, respectively. The annual yield of sapota in early bearing and mature bearing stages was 13067 kg/ha and 19355 kg/ha, respectively. The net returns per hectare per year were ₹11506 and ₹48445 at early bearing and mature bearing stages of sapota orchards, respectively. A positive return was obtained throughout the productive life of sapota orchard.

Sagar *et al*. (2012) studied the economics of production of papaya in middle Gujarat region. The present investigation was undertaken with a view to study the costs, returns and constraints in production and marketing of papaya (*Carica papaya* L.) in middle Gujarat. A multistage random sampling design was used for selecting the sample. Results of the study indicated that papaya was highly capital intensive crop and average cost of cultivation (Cost C_2) per hectare was ₹176660. On an average cost A (paid out cost) formed 61.64 per cent, while cost B accounted for 87.38 per cent of total cost.

The highest expensive item of the expenditure was rental value of owned land was ranked first with 17.35 per cent of the total cost followed by human labour cost (16.57 per cent), saplings cost (10.05 per cent), managerial costs (9.09 per cent), interest on working capital (9.05 per cent), interest on fixed capital (8.39 per cent), manures and cakes (7.47 per cent), irrigation charges (6.92 per cent) and fertilizers (6.37 per cent) on overall basis. The average yield of papaya per hectare was 810.97 quintals on sample farms which realized ₹492024, ₹383126, ₹337652 and ₹360838 as gross income, farm business income, family labour income and farm investment income, respectively. The net profit per hectare over Cost C_2 was ₹315364. The overall input-output ratio on Cost C_2 was about 1:2.79. The bulk line cost per quintal on Cost C_2 was ₹275.72 for papaya. On an average, per quintal cost of production on the basis of Cost C_2 was ₹217.84.

Thorat and Shelke (2012) studied on economics of production and marketing of ber in Beed district of Maharashtra. Study revealed that the net establishment cost of ber orchard by deducting the net returns from establishment cost was ₹47,163.33. Ber production was 91.17 q/ha in ber orchard. Cost-C was higher as ₹37,632.30 in ber orchard. The ber orchard gross returns was ₹59260.50 and per quintal cost of ber was 412.78. The results revealed that use of family human labour was more than hired human labour in ber production. Per hectare net profit was ₹21,628.20 on ber farm.

Haral and Pawar (2013) studied on economics of custard apple production in Maharashtra. About 60 custard apple growers were randomly selected from twelve villages of two tehsils of Aurangabad district of Maharashtra for the year 2010-11. Cross sectional data were collected from custard apple growers with the help of pretested schedule by personal interview method. The cost concept of Cost-A, Cost-B and Cost-C was used to analyze the data. The results revealed that per hectare cost of cultivation of custard apple was ₹55930.40.

Among individual items of expenditure, the share of rental value of land was 37.72 per cent followed by hired human labour (11.93%), amortized cost (11.35%), family human labour (7.78%), fertilizers (6.00%), manure (4.59%), irrigation (3.96%), machine labour (3.42%), bullock labour (2.49%) and so on. Per hectare gross returns and net profit was ₹1,27,336.52 and ₹71,406.12, respectively. Per quintal cost of production was found to be Rs 883.29.

Kireeti *et al*. (2014) studied the cost of production of apple in Shimla district of Himachal Pradesh. Narkanda block was selected randomly for the study. The study sample was drawn using random sampling method in four stages making a total of 70 orchardist households from five altitudinal zones namely 1500, 1500-2000, 2000-2500, 2500 -3000 and 3000 m MSL, respectively in the study area. General mathematical and statistical methods were used to perform the present study. On an average, per plant establishment cost worked out to ₹3318.19 in the study area. Maintenance cost of bearing apple per hundred in the study area ranged between ₹60,169.88 to ₹61,769.01 in different elevations and net returns varied between ₹162,817.14 and ₹269,362.63 in the assorted elevations.

Bhosale *et al.* (2015) conducted a study on economics of kesar mango production in plain zone of western Maharashtra. About 30 kesarmango growers from Khed, Ambegaon and Junnar tehsils of Pune district were selected. Cost of establishment of mango orchard per hectare for five years was ₹1,74,970. Initial establishment costs such as planting material, gap filling and fencing account for 9.76 per cent of total establishment cost. The average initial establishment cost was ₹17100. Total cost of production was ₹81,831. The prevailing rate in the market during the study period was ₹3200 per quintal. The gross income received from kesarmango was observed to be ₹1,31,200. The per hectare net profit at input cost and total cost was ₹83,065 and ₹49,369, respectively.

Patel *et al*. (2016) studied the economic viability of pomegranate cultivation in middle Gujarat. The study was based on the data collected from 90 pomegranate grower spread over 9 blocks of the Vadodara, Chhota udepur and Kheda district for the agricultural year 2013-14. Pomegranate cultivation involves high initial investment, but same time, annual net returns was also high. The establishment cost of pomegranate orchard was found to be ₹81063. The average per ha net returns was found ₹88686 and average production was found 5482 kg per hectare.

Pokharkar *et al.* (2016) worked out the economics of production of guava in western Maharashtra. Study revealed that the per hectare cost 'A', cost 'B' and cost 'C at the overall level, worked out to ₹48451.10, ₹81324.33 and ₹97168.82, respectively. The major items of cost were rental value of land with ₹23332.45 (24.12 per cent) followed by hired human labour with ₹19681.84 (20.25 per cent), family human labour of ₹15844.49 (16.30 per cent), manures of ₹8139.11 (8.38 per cent) and amortized establishment cost of ₹8105.02 (8.34 per cent). However, per hectare cost of cultivation in different size groups of holding was ₹1,01,657.57, ₹99,140.86 and ₹90,707.94 in small, medium and large size groups, respectively. Per hectare yield was highest (188.52 quintals) in large size group followed by medium (181.27 quintals) and small (110.45 quintals) size group farmers. On an average, per hectare yield was 160.08 quintals. The average per hectare gross returns of guava was ₹1,32,567.29, ₹1,40,020.97 and ₹1,47,395.86 for small, medium and large size farmer groups, respectively. The large size group was observed more efficient as compared to small and medium size groups.

Krishna *et al*. (2017) carried out the micro economic analysis of production of banana in Kurnool district of Andhra Pradesh. A sample of 120 farmers was randomly selected. The total cost of cultivation of banana was ₹3,27,531.06, ₹3,13,337.47, ₹2,47,989.47 and

₹3,21,323.07 on marginal, small, other and pooled farms, respectively. The gross returns were ₹4,47,592.71, ₹4,78,306.13, ₹4,91,516.58 and ₹4,79,795.94 on marginal, small, other and pooled farms, respectively indicated direct relationship with the farm size.

Mathew *et al*. (2017) studied the economic analysis of pineapple production in Sindhudurg district of Maharashtra. The study was based on the primary data collected from tenant growers of Dodamarg tehsil in Sindhudurg district. Per hectare physical input utilization pattern indicated that there was higher utilization of inputs such as hired labour, fertilizers and plant protection chemicals. Per hectare cost of cultivation and the net returns amounted to ₹5,88,220 and ₹9,93,511, respectively for the three years. The farm business analysis indicated that the pineapple cultivation was highly profitable in all the three years.

Prakash and Sarkar (2017) studied the production economics of strawberry in Haryana. The present study was conducted in Hisar and Bhiwani districts of Haryana which were selected purposively on the basis of highest area and production of strawberry cultivation in the state. A sample of 120 growers was selected from which 43, 30, 30 and 17 farmers were from Satrod, Saharwa, Chanana and Siwani, respectively depending upon the availability of strawberry growers in the region. On the basis of the nature of the data, simple tabular analysis was carried out. The overall average cost of strawberry production in both districts of Haryana was found to be ₹937.18 thousand per hectare. The total cost of cultivation was highest in case of large category growers followed by medium and small category. The overall net return earned by strawberry growers was ₹1174.80 thousand per hectare. Cost of production of per kg of Strawberry was highest for large farmers with ₹78.57 per kg, followed by medium with ₹74.33 per kg and small farmers with ₹71.34 per kg.

Rajashekar *et al.* (2017) studied the costs and returns of ginger in Bidar district of Karnataka. A sample of 120 respondents was taken

for the study. Study revealed that, the cost of cultivation of Ginger for small, medium and large farm groups was ₹2,09,774.00/ha, ₹2,01,572.80/ha and ₹1,95,584.00/ha, respectively. The gross returns obtained per hectare by large size farms were high (₹6,33,600/ha) as compare to medium and small size farms (₹6,17,600/ha and ₹6,08,000 /ha), respectively. Net return per hectare was highest in large size farms (₹4,36,036/ha) as compared to the medium and small size farms (₹4,16,027/ha and 3,98,226/ha). Cost A1 was highest in small size farms (₹1,80,754.00/ha) followed by medium size farms (₹1,74,192.80/ha) and lowest in large size farms (₹1,69,313.60/ha), respectively. Cost A2 in small, medium and large size of farms groups was ₹1,80,754.00/ha, ₹1,74,192.80/ha and ₹1,69,313.60/ha respectively. Cost B was highest in small size farms (₹1,94,474.00/ha) as compared to medium size farms (₹1,87,892.80/ha) and in large size of farms (₹1,82,983.60ha) respectively. Cost C was highest in small size farms (₹1,95,583.60/ha) and lowest in large size farms (₹2,09,774.00/ha). Farm business income in small, medium and large size of farms group was ₹4,27,246.00/ha, ₹4,43,407.20/ha and ₹4,64,286.00/ha, respectively. Farm investment income was highest in large size farms (₹4,49,706.00/ha) as compared to medium size farms (₹4,29,727.20/ha) and lowest in small size farms (₹4,11,946.00/ha), respectively. Family labour income was ₹4,13,526.00/ha for small size farms group, ₹4,29,707.20/ha for medium size farms group and ₹4,50,616.00/ha for large size of farm groups.

Gadekar and Hilli (2018) studied on economics of production and marketing of ber in Solapur disrtict of Maharashtra .The study revealed that the per hectare cost of establishment was highest (₹83,465.13) in case of small size group followed by medium (₹79,259.79) and large (₹74,279.55) size groups, respectively. The major items of the costs were manures and hired human labour in the establishment of ber orchard. The variations were noticed in case of

per hectare use of resources such as human labour, manure fertilizers among different size group of ber growers. The per hectare cost of maintenance at overall level was ₹2,02,315.86.

Mathew *et al*. (2018) conducted a study on economics of production of ginger in Wayanad district of Kerala, India. The present study was aimed to find out the input use levels and economics of ginger cultivation in Wayanad district of Kerala, during the crop year 2015-16. Total four villages which were leading in the area of ginger cultivation were selected and twenty farmers from each village i.e. total 80 farmers were chosen randomly as sample size. The study indicated that cost of cultivation and gross returns were positively related with size of the holding. The overall cost of cultivation was ₹4,54,991.62 and ₹4,94,501.03 per hectare on small and large size farms. The expenditure on seed was found to be maximum constituting about 35.01 per cent of total cost followed by human labour and machine power. All the farm income measures exhibited a positive relationship with the farm size.

Shrote *et al.* (2018) studied on economics of pomegranate production in Ahmednagar district of Maharashtra. Data collected from field survey and CPMC scheme MPKV Rahuri in year 2016-2017. Random sampling design was adopted in selection of district, tehsils, villages and growers. In all, 36 growers were selected for present study. The techniques like percentage, ratio and cost concept of cost A, cost B and cost C were apply for data analysis. Per hectare net profit was ₹2,53,695 on pomegranate orchard farm. Per quintal cost of production was ₹2196.52 in pomegranate orchard.

Thanki *et al.* (2018) analysed the economics of production and marketing of papaya in Bharuch district of south Gujarat. From the study, the total cost of cultivation of papaya crop (Cost C2) per hectare was worked out to be ₹2,42,124. The major items of cost of cultivation were human labour (17.69%), followed by chemical fertilizers (9.15%), seedlings (8.04%), bullock labour and tractor charges (6.14%),

manures (3.93%), irrigation (2.46%), insecticides/pesticides (1.80%) and miscellaneous costs (0.42%). The net return per hectare was found to be positive in papaya crop. The input-output ratio over cost C2 was 1: 2.28 which implied that on investment of one rupee, farmers got ₹2.28 during the period of study. Moreover, the high cost of inputs and planting material, non-availability of labour in time, absence of regulated markets, low and fluctuating market prices as well as high transportation costs were the major constraints faced by the papaya growers.

Bhong *et al.* (2019) studied on economics of production and marketing of ber in Solapur district of Maharashtra. Study revealed that per quintal cost of production was ₹698.02 and the gross returns from ber orchard were ₹3,16,217.19. It was clear that per hectare farm business income, family labour income and net profit was ₹2,57,377.98, ₹1,86,918.47 and ₹1,61,444.59 respectively, in ber garden.

Raj Kumar *et al.* (2019) studied on economic appraisal of mango production in Yamunanagar district of Haryana. They found that the initial investment in mango orchard establishment is very high yet it was an economically viable enterprise. The per hectare establishment cost of mango orchard was estimated to ₹28,034, whereas, variable cost of mango orchard for the sample as a whole was ₹71,928. Average net return per year for the sample as a whole was ₹2,56,856 among the different size groups of mango orchard.

2.2 Economic feasibility of investment in ber cultivation

Singh and Singh (1997) studied on profitability of ber cultivation in arid region of Haryana. Studyrevealed that investment on ber orchard was economically viable. On an average, the internal rate of return was found as high as 40 per cent, with a pay back period of 5 years and benefit cost ratio of 3.53. Further, the ber cultivation emerged as a better paying proposition than any other crop cultivated

in the region. Findings of the study lead to conclusions that the ber cultivation has much potential as an economically viable alternative to existing crop cultivation.

Pawan *et al.* (2002) conducted a study on cost-benefit analysis of ber cultivation in Rohtak district of Haryana. For the study, they collected the data from thirty ber growers randomly. To examine the economic feasibility of investment in ber cultivation four indicators like net present value, internal rate of return, benefit cost ratio and payback period were used. The study indicated that ber cultivation was profitable with an IRR of 22.5 per cent. The NPV and BCR at a discount rate of 14 percent were ₹26,346 and 1.22 respectively. The pay back period for ber orchard was 7 years.

Lokesh *et al*. (2004) carried out some investigations on the economics of cultivation of passion fruit in Karnataka. Study revealed that the net return per hectare in the third year was ₹81,125. The estimated economic life of passion fruit garden was six years and Net Present Value was ₹1,55,395 per hectare yielding a benefit-cost ratio of 2.17 at 15 per cent discount rate and internal rate of return was 67 per cent.

Gondalia and Patel (2007) studied on economic viability of aonla plantation in Gujarat. They studied a sample of 120 aonla growers spread over 12 selected villages of the Kheda and Anand districts for the agricultural year 2003-04. It has been found that establishment of aonla orchard involved high investment, but the annual net return was also quite high after the third year of plantation. The values of economic parameters, viz. NPV, BCR, IRR and PBP have been found to be ₹6,52,652, 5.25, 65.03 per cent and 55 months, respectively at 10 per cent discount rate. Under varying costs and returns situations, values of all these feasibility parameters have satisfied the acceptance rules for the investment proposition. It has confirmed the economic viability, stability and certainty of investment on aonla orchard.

Gangwar *et al.* (2008) conducted a study on production constraints and economics of peach in Punjab and Uttarakhand. The investment in peach orchards was a profitable business. The internal rate of return (IRR) was found to vary from 20.98 per cent to 23.80 per cent, depending on the size of peach orchards. The net present value, benefit/cost ratio and IRR at 12 per cent discount rate were reported as ₹44,807, 1.681 and 22.20 per cent, respectively for the overall category of the orchard. The economic productive life of peach orchard in Punjab and Uttarakhand was worked out to 24 years. The optimum size of peach orchards was above 2.0 ha. It was also observed that the peach orchards were worth retaining as long as they give the income of ₹5,713 over the maintenance cost.

Naveen (2009) studied on economics of production and value addition to wine grapes in Bijapur district of Karnataka. Primary data were collected from 60 wine grape growers in the district. Financial feasibility analysis showed that, NPV for wine grape orchards was ₹16,59,443.32 per hectare at 9.5 per cent discount rate. The BC ratio at 9.5 per cent discount rate was 2.2, the payback period was about 3.20 years and the IRR was found to be 44.77 per cent. The investment in wine grape orchard was found to be financially feasible.

Dhandhalya and Shiyani (2012) conducted a study on economic viability of sapota in Saurashtra region of Gujarat. A sample of 100 sapota growers spread over 20 selected villages of four blocks of Bhavnagar and Junagarh districts were selected for the study. Data were elicited for the year 2008-09. It was evident from the results that under the situation of normal costs and returns, the Net Present Value was found positive (₹23,601/ha) at 10 per cent rate of discount indicated the financial soundness of the investment on sapota orchard. The value of benefit cost ratio (BCR) was 1.04 indicated that the investment was worthwhile but critical. The value of internal rate of return (IRR) was found 10.89 per cent. The payback period (PBP) was found to be 14 years and 4 months.

Koujalgi *et al*. (2012) conducted a study on economic analysis of pomegranate cultivation in Karnataka for its viability and sustainabilityin Northern districts of Karnataka during 2009-10. The results indicated that NPV was ₹3,02,602.65 and ₹3,87,900.02 for Bagalkot and Koppal districts, respectively discounted at the rate of 9.00% opportunity cost of capital. The B: C ratio was 1.53 and 1.68, IRR was 19.76% and 22.45% for Bagalkot and Koppal districts, respectively. The payback period was 6.11 years for the orchards in in Bagalkot districts and 6.04 years in Koppal district.

Ramanan (2012) studied the cost of production and capital productivity of grape cultivation in Tamilnadu. The capital productivity analysis showed favourable figures for net present value was worked out to be ₹1,55,864.50 and benefit-cost ratio was 1.33. Internal rate of return was worked to be 24.76 as against an opportunity cost of 7 per cent. The pay back periods are worked out and they are 2.25 years. It indicates that the investment made in a vineyard will be obtained within 2.25 years.

Ramchandra and Khare (2015) studied the financial appraisal of Indian gooseberry (*Emblica officinalis*) cultivation in Pratap Garh district of Uttar Pradesh, India. The financial appraisal of Indian gooseberry cultivation in Pratap Garh has been studied through a sample of 150 Indian gooseberry growers from 12 selected villages i.e. Bhoj Pur, Hital Mau, Ajgara, Deva Pur, Ashpur Devsra, Sangipur and Khajuri and Dandi were selected for the study. It was found from the study after third year of plantation although initial establishment of Indian gooseberry orchard involves high outlay yet the annual net income is moderately high. The values of economic parameters, viz. NPV, BCR, IRR and PBP have been found to be ₹6,89,069, 5.58, 65.35 per cent and 52 months, respectively at 10 percent discount rate. Under varying cost and return situations, values of all these feasibility parameters have satisfied the acceptance rules for the investment proposition. It

has confirmed the economic viability, stability and certainty of investment on Indian gooseberry orchard.

Surwase *et al.* (2015) studied the financial feasibility of investment in sapota orchards in Thane district of Maharashtra. The study revealed profitability of enterprise. The analysis of investment in sapota orchard showed that, the investment made in sapota plantation is economically viable with benefit cost ratio (BCR) greater than unity (1.87), net present value (NPV) was positive (₹4,95,835) and internal rate of return (IRR) was higher than prevailing rate of interest (12%). While considering the total economic life of sapota orchard, the payback period also desirable.

Patel *et al.* (2016) studied on economic analysis of production of pomegranate in middle Gujarat. The study revealed that the value of economic parameters viz., net present value, benefit cost ratio, internal rate of return and payback period was ₹9,93,842, 3.07, 47.66 and 58 month, respectively at 10 per cent discount rate. This indicated that in varying situations of cost and return, the economic viability of investment on the pomegranate cultivation was stable and certain.

Singh *et al.* (2016) carried out the economic evaluation of pineapple cultivation in Manipur. The present study was conducted in Thoubal, Bishnupur, Senapati and Churchandpur districts of Manipur. Pineapple cultivation was found to be economically feasible in the state. The investment in pineapple orchard has been found a profitable business. In overall category, the internal rate of return (IRR) has been found 32.53 and 67.33 per cent during summer and winter season, respectively. The net present value, internal rate of return and benefit-cost ratio at 8 per cent discount rate have been reported as ₹24,857.80, 32.53 and 1.23, respectively for overall category of orchard during summer season and ₹10,454.44, 67.33 and 1.24, respectively for overall category of orchard during winter season. The economic productive life of pineapple orchard in Manipur has been calculated up to 3 years.

Sahana *et al.* (2017) studied the economic and financial feasibility of pomegranate cultivation in Chitradurga district of Karnataka. The study revealed that the net present value of net return of the project discounted at the opportunity cost of capital at 8 per cent was positive of ₹12,80,134. The BC ratio was 1.60 and IRR was 65 per cent in the study area. The payback period was 1.68 year for the pomegranate orchards in Chitradurga district.

Sidramayya *et al.* (2017) carried out an economic analysis of investment pattern and maintenance cost in sweet orange orchard in Raichur district of Karnataka. In this study, 120 respondents were purposively selected from the district for sampling. The data were elicited through personnel interview method and analyzed using mean, standard deviation, frequency and percentage. The financial feasibility analysis revealed that on an average, the investment in sweet orange orchard could be recovered within seven years. The net present values was positive and of higher magnitude indicated worthiness of investment. The returns per rupee of investment in this orchard were capable of generating nearly ₹3.5 which was highly profitable venture. The internal rate of return was found to be 43.18 per cent which was much higher compared to the cost of capital (9.5%) and hence highly profitable. Overall, the proposition of growing sweet orange crop was highly profitable as revealed by the financial feasibility tests.

Lokappa *et al.* (2018) studied the financial feasibility of fig cultivation (*Ficus carica* Linn.) in north-eastern Karnataka. The paper presents the costs and returns, economic and financial feasibility of fig cultivation in north eastern region of Karnataka. Data collected from 60 fig cultivators by adopting multistage sampling design were analyzed using tabular analysis, economic and financial feasibility measures like net present value (NPV), internal rate of return (IRR), benefit cost (BC) ratio and pay back period (PBP).The analysis of investment in fig orchard suggests that, the investment made in fig cultivation in the study area was economically viable with BCR greater than unity (3.01),

positive NPV (₹7,49,986.40) and IRR higher than prevailing rate of interest (12.00%). The payback period (3.44 years) was also desirable considering the total economic life of fig orchard.

Parameshwar *et al.* (2018) studied on economic analysis of sweet orange varieties in Akola district of Maharashtra. The present study was undertaken to estimate the cost and return per hectare, the economic feasibility of investment of the sweet orange fruit crop the study pertained to the year 2012-13. The study was based on data collected at All India Coordinated Research Project on Tropical Fruits (Citrus), Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra). The present investigation was carried out in eight sweet orange cultivars including Pera, Pineapple, Jaffa, Washigton navel, Hamlin, Valencia late, Sathgudi and Blood red malta. It was observed that Valencia late variety showing height fruit production (9.0 q ha^{-1}) followed by Sathgudi (8.1 q ha^{-1}) and Pera showing lower fruit production (2.8 q ha^{-1}). Thus, total investment per hectare of each variety was ₹97,665. It was observed that the more net present worth ₹3,17,485 was obtained from Valencia late and the benefit cost ratio was 3.2 followed by Sathgudi ₹2,84,235 with 2.91 per cent BC Ratio. Pera variety showing low net present worth ₹97,790 with 1.0 per cent BC Ratio.

Rede and Bhattacharyya (2018) examined the financial feasibility analysis of pomegranate production in Solapur district of Maharashtra. Data collected from primary sources have been analyzed with the set objectives using appropriate techniques and statistical tools. The financial feasibility of investment in pomegranate orchards has been studied with four relevant criteria namely, net present value (NPV), benefit-cost ratio (BC Ratio), internal rate of return (IRR) and payback period (PBP). The NPV, BC ratio, IRR and PBP for all farms were ₹9,21,035.57 per ha, 2.61, 48.23 per cent and 4.1 years, respectively which confirmed that investment on pomegranate orchard was highly profitable and economically feasible in the study area.

Raj Kumar *et al*. (2019) conducted a study on economic appraisal of mango production in Yamunanagar district of Haryana. The present study has been designed to investigate cost of production and returns per hectare of mango fruit. A sample of 30 mango farmers was taken purposively from various villages in Radaur block of Yamunanagar district of Haryana. The primary data for the agriculture year 2017-18 was collected by survey method by conducting personal interviews of the selected mango growers with the help of specially designed schedule. The economic viability of the mango fruit, mainly net present value, internal rate of return, benefit-cost ratio and payback period have been computed as ₹6,93,165.96, 29.14 per cent, 4.02 and 8 years, respectively. The orchards indicated that mango cultivation was a profitable enterprise.

Suresh *et al.* (2019) studied the cost and returns of grapes cultivation in Tamil Nadu. The pilot study data were obtained from the 30 grape growers in the study area. The study revealed that the net present value was estimated at ₹1,38,882.4 for small farmer's category, ₹1,37,869.9 for medium farmers and ₹1,31,558.3 for large-scale farmers. The benefit-cost ratio was estimated at 1.26, 1.27 and 1.24 for small, medium and large farmers respectively. In the above NPV and BC ratio estimates clearly showed that in the study area, small farmers were doing well compared to other class of farmers. Also, it was found that to recover the cost incurred, it took 5-6 years and the payback period also remained the same 5-6 years for various categories of orchardists. This finding signified that the farmer to recover the total cost incurred by them. The IRR for large farmers as against medium and small farmers seems to yield higher return as it was estimated at 24.48 percent implying that at this rate of interest, the discounted benefits become equilibrium to discounted cost and returns. Therefore, financial results showed that there was a high component of profit involved in grape cultivation, precisely for the medium class of farmers.

Zore *et al.* (2019) conducted a study on economic feasibility of pomegranate production in Marathwada region of Maharashtra state. The study has confirmed the economic soundness of investment on pomegranate in both the districts, with NPV of ₹32,694,58 and ₹35,65,778 and BCR was 3.04 and 3.00 while, IRR were 25.80 and 27.41 per cent in Aurangabad and Jalna districts, respectively, which indicated the economic worthiness of investment. On the whole, the cultivation of pomegranate found economically feasible.

2.3 Identification of the problems in the production of ber

Kameswara Rao (2000) studied on problems of production and marketing of banana in Tungabhadra command area of Karnataka. The study revealed that, the major problem faced by the 85 per cent of the farmers was non-availability of sufficient irrigation water. 73 per cent of farmers were opined higher prices of fertilizers, 68 per cent of the farmers were facing the problem of non-availability of quality planting material. The other major problems in production of banana in the study area were labour shortage in peak time, hazards of soil salinity, and storms of heavy winds. The major financing problems in the study area were available loan was inadequate, high procedural complication of loan and high rate of interest.

Mishra *et al.* (2000) conducted a study on production and marketing of banana in Gorakpur district of Uttar Pradesh. The researchers identified problems faced by the farmers in the production and marketing of banana were unavailability of quality suckers and high cost of seed suckers, high cost of transportation, lower ruling price for produce due to unavailability of sufficient storage facilities, problem of supply of electric power in critical period, non-availability of fertilizers and insecticides at reasonable prices and weak finance structure.

Guledagudda *et al.* (2002) conducted a study on economics of banana cultivation and marketing in Haveri district of Karnataka. The study identified production problems like lack of technical knowhow, scarcity of labour, pest and diseases, lack of adequate credit facility

and scarcity of water. The farmers in the study area expressed also marketing problems like involvement of intermediaries, lack of storage facilities and inadequate transportation.

Shivanand (2002) studied the performance of banana plantation in northern Karnataka. The study revealed as perceived by the farmers the major problems in cultivation of banana were service incidence of *Musa cercospora* disease in all the districts of northern Karnataka, the disease lead to heavy crop losses. Erratic onset of monsoon was another problem in Belgaum district affecting banana plantations. In Gulbarga district, the non-availability of labour and high labour wages and non-availability of technical assistance for improved cultivation of banana pose severe problems in production of banana.

Stephen *et al.* (2002) studied the socio-economic impact of tissue culture banana in Kenya. The study revealed that the tissue culture banana producers appeared to be constrained by capital for investment in irrigation facilities and acquisition of fertilizers or organic manures to produce good banana crop. Lack of organized marketing facilities makes exploitation of banana producers by traders/brokers fairly easily.

Alagumani (2005) carried on an economic analysis of tissue cultured banana and sucker propagated banana in Theni district of Tamil Nadu. It was observed from the study that the risk in cultivation of banana using tissue culture plantlets was lower than that of sucker propagated banana production. The constraints in tissue culture banana production were high cost of tissue culture plantlets and few farmers also expressed problem of marketing of big size bunches obtained from tissue culture banana.

Baliyan *et al*. (2009) studied the production and marketing problems in small scale horticultural farming in Botswana farmers. A survey based study was conducted in Botswana in the year 2007-08. Pareto analysis was used to prioritize (ranking) the problems and their causes. A total of ten problems in horticultural production were

identified and, poor access to inputs, high fuel costs, pests and diseases, high input costs, insufficient infrastructure, lack of finance, shortage of skilled labour, and breakdown of irrigation systems were found to be the major production problems (85.23% contribution).

Uwagboe *et al.* (2010) studied the constraints of farmers in cashew production in Oyo state of Nigeria. The study examined constraints of farmers in cashew production in Orire local government area of Oyo state Nigeria. There are problems of low yield and utilization of cashew pseudo apple. This study was carried out in 2008 and data were collected from one hundred and ten respondents with the aid of well-structured questionnaire. Respondents were selected using purposive and systematic sampling techniques. Data were analysed using descriptive and Pearson Product Moment Correlation (PPMC). Majority (70%) of the respondents in the study area ranked inadequate capital (finance) as the most severe constraint while lack of storage facilities was ranked by few (5.50%) of the respondents. This could be attributed to difficulty in obtaining loan from the banks due to collateralwhile storage facilities constraint could be attributed to the fact that the cashew farmers in the study area do not store their produce for processing. Incentives such as soft loan should be provided for cashew farmers to alleviate the constraints of inadequate financial capital, encourage establishment of processing industries to increase their level of income.

Rao *et al*. (2011) conducted a study on problems faced by farmers and traders of saffron and other spices in Jammu and Kashmir. They identified production of quality planting materials, postharvest management, quality standards, domestic price and marketing problems as the constraints for reduction in area and production of saffron.

Thorat and Shelke (2012) studied on economics of production and marketing of ber in Beed district of Maharashtra. They reported that the problems in production and marketing were unavailability of

labour in time and appropriate wages, less water in summer, cost of FYM and fertilizer is too high, instability in market prices, commission charges are high, unavailability of transport facility in time and at cheap rate and non-availability of good quality packing material.

Sain *et al.* (2013) carried out a study on constraints in production of guava in Haryana. Study was conducted in Hisar district, Hansi, Barwala Block, and Fatehabad district Bhuna, Fatehabad Block and Sirsa district Baraguda, Sirsa Block of Haryana which was selected purposively on basis of highest area and production under guava cultivation. Finally, 60 growers from randomly selected two blocks from each district were selected for the present study. On the basis of the nature of the data, budgeting technique and various economic tools were used for estimation of production constraints. Major problems faced by the guava growers in production of guava were damage due to aberrant weather conditions, non-availability of good seedlings and lack of technical knowledge.

Shukla *et al.* (2013) studied the constraints in production to consumption chain of mangoes in Malihabad, Lucknow district of Uttar Pradesh. The farmers were randomly selected from different categories. The results indicated that training and pruning in mango orchards were a rare phenomenon. They found several problems like irregular fertilizer application, problems relating to the technical know-how, post harvesting, marketing and financial assistance etc.

Tiedemann *et al.* (2013) conducted a study on production risk and technical efficiency on organic and conventional agriculture farmers in Germany. This empirical analysis was conducted using balanced panel of farm records from 1999- 2000 to 2006-2007 on 37 organic and conventional arable farms, respectively. Results indicated that output variability in both production technologies was mainly caused by production risk. Land and labour were identified as risk increasing inputs in both farm types whereas, higher capital endowment, seed costs and soil quality have risk reducing effects.

Anap *et al.* (2014) studied the constraints faced by banana growers in production of banana in Wardha district of Maharashtra. From this district, two tehsils were purposively selected on the basis of large area under banana production. From these tehsils, six villages of banana growers and from each village 15 banana growers were selected for the study. The frequency and percentage of each constraint were worked out to measure the constraint encountered by the respondents. Constraints faced by majority of the respondents were non- availability of electricity in time, losses due to high temperature, fertilizer cost, labour efficiency and other constraints faced by banana growers like lacunae in government policies, subsidies for the banana suckers.

Singh *et al.* (2014) studied on constraints and obstacles perceived by mango growers in adoption of scientific mango production technology in Banswara and Dungarpur districts of Rajasthan. The study revealed that tribal respondents possessed more constraints than non-tribal respondents about scientific mango production. Inadequate training for acquiring skills about scientific mango production, lack of skill in performing technical operations, long juvenile period, non-availability of reliable varieties and plant material, lack of finance & credit, high cost of establishment of mango orchards, high price of reliable plant materials, perishable nature of commodity results in economic losses were found most important constraints perceived by mango growers.

Bhat *et al.* (2015) studied the constraints in production of citrus fruit in Jammu region of J&K State. The various production constraints faced by the citrus growers of various districts of Jammu region were studied by selecting a sample of 192 citrus growers from four districts of Jammu region and suggestions were also made to overcome the said constraints. The data revealed that in Jammu region as a whole it was observed that in the cultivation of citrus several constraints such as lack of finance and credit facilities, inadequate irrigation facilities,

non-availability of good quality seedlings, farmyard manure, educated members of their family go outside and lack of latest technical knowledge were predominant and expressed by most of the farmers. To overcome these constraints,all respondents suggested that government should take initiative to establish fruit processing units in rural areas.

Oluyole *et al.* (2015) studied the constraints in cashew production in Nigeria.The study was carried out to determine the severity of constraints in cashew production in south western Nigeria. Multi-stage random sampling technique was used to select 63 cashew farmers from the study area. Regarding the severity of constraints, most respondents considered farm activities as very severe constraints while most farmers regarded age of farms and inadequacy of labour as severe constraints. However, most farmers considered access to market information and inadequate credit facilities as not severe constraints.

Daundkar *et al.* (2016) conducted a study on economic analysis of fig in Pune district of Maharashtra. The researchers identified problems faced by the farmers in the production of fig were unavailability of labour, high charges of labour for digging the pits, non-availability of good quality in farm yard manure, lack of availability of irrigation water, occurrence of the leaf rust, fruit cracking and fruit rot etc.

Golappanavar *et al.* (2016) analysed economics of mango cultivation in Dharwad district of northern Karnataka. Constraints faced by farmers in production and marketing of mango fruit crop were analysed using the primary data collected from 60 sample respondents by personal interview method using pre-tested schedule. The results revealed that major constraints faced by mango growing farmers in production were inadequate irrigation water facilities, erratic rainfall, lack of resources, non-availability of labour, irregular power supply and management.

Kumar *et al.* (2016) studied the constraints faced by farmers in masumbi (*Citrus sinensis*) cultivation in Bhiwani district of Haryana state. The constraints perceived by the respondents were measured by the scores on the basis of magnitude of the problems. Constraints were categorized into inputs, marketing, production, technical and psychological constraints. While analyzing overall constraints as perceived by farmers, the findings revealed that high price of insecticides/pesticides (weighted mean score 2.25), non-availability of inputs at proper time (1.13), absence of agro-processing units (2.05), no support price (1.86), aberrant climatic conditions (1.99), unawareness about proper and balanced fertilizer application and time of application (1.99), lack of guidance of post-harvest technology (1.95), lack of knowledge of current advances in fruit cultivation (1.34), longer time taken in fruit bearing (1.51) and orchard maintenance (1.34) etc. were major constraints faced by the farmers.

Kumari (2017) studied the estimation of demand supply gap and major constraints in production and marketing of major fruits and vegetables in Bihar. Study revealed that 90 per cent of farmers were facing the problems of inadequate knowledge of market information system and dissatisfaction from price of fruits and major constraints identified for vegetables were unavailability of cold storage facility, lack of processing plant in the state etc. Whereas, un-availability of input at right time and right prices were highly significant constraints for production of these crops in the state.

Dhenge *et al.* (2018) studied the constraints faced by the commercial mango growers in efficient management of mango orchard in Karnataka. The present study was conducted in Ratnagiri and Sindhudurg district of Konkan region of Maharashtra state. The results of the discussion led to the conclusions that as mango cultivation required more labours with increased labour cost. The problems of acute labour scarcity were found especially during peak period of farm operation. The demand of mango was seasonal and hence the price

fluctuates day by day. The mango crop required more inputs like fertilizers and pesticides and obtaining these have some difficulties; hence the respondents would have felt these as a constraints. Thus, it could be concluded that the concerned agencies should think of the strategy in the light of these constraints for efficient management of mango orchard by the growers.

Jajoria and Pradeep (2018) conducted a study on economics of aonla orchards in Jaipur district of Rajasthan. The results of the study showed that lack of technical persons for aonla cultivation was the major technical constraint faced by the farmers. Lack of cooperative marketing and non-availability of old storage were the major infrastructural constraint observed in the production and marketing of aonla. Low prices of aonla, high charges of commission agent and transportation of aonla were the major economic constraints observed in marketing of aonla. The low consumption tendency of aonla in the study area was the social constraint in the cultivation of aonla.

Ratnam Setu *et al*. (2018) studied on constraints faced by the farmers in production and marketing of guava in Allahabad district of Uttar Pradesh.The exploratory factor analysis was applied to analyze the constraints in production, marketing and processing of guava. The study revealed that insect-pests and diseases susceptibility was still a serious problem which discouraged the farmers to remain in this business related to production.

Sohi *et al.* (2018) studied the constraints faced by farmers in adoption of kinnow growing in Barnala district in Punjab, India. Kinnow area and production has increased profusely in arid irrigated and sub-mountainous zones. With all viable environmental conditions present in district Barnala farmers still faced some constraints in kinnow cultivation. Major constraints in kinnow plantation: die-back, yield, quality, planting material, technical guidance, socio-cultural, post-harvest management. Present study was conducted with the objective to extent in adoption and perceived constraints in kinnow cultivation.

The constraints as perceived by the respondents were measured by the scores on the basis of magnitude of the problems. While analyzing overall constraints as perceived by farmers the findings revealed that absence of agro processing units WMS (Weighted Mean Score) 2.87, lack of marketing at village level with WMS of 2.84, fruits with prolong juvenile period and higher costs for orchard establishment with WMS of 2.71, continuous adoption of traditional practices for growing fruit WMS of 2.70, lack of involvement of household women in orchards WMS of 2.61, lesser priority is given to orchard plantation than other farm activities WMS of 2.61, lack of knowledge regarding packaging and grading of produce WMS of 2.56, lack of knowledge about recommended fertilizer and manure application WMS of 2.52, lack of knowledge about current advance technologies WMS of 2.47 were major constraints faced by the farmers.

Sonwani *et al.* (2018) carried out an economic analysis of production of ginger in Bilaspur district of Chhattisgarh. The major constraints in production of ginger were high infestation of insects, pests and diseases which were reported by 68% spice growers. Another major problem was illiterate by ginger growers on availability of soil testing facilities and reported by 42% farmers. Third major problem was elucidated by farmers on lack of adequate training facility for cultivation of ginger, which was reported by 40% farmers.

Bhong *et al.* (2019) studied on economics of production and marketing of ber in Solapur district of Maharashtra. Study revealed that the major problems in production and marketing were non-availability of labour in time and proper wages, high cost of FYM and fertilizer, irrigation i.e. less water in summer, fluctuation in market prices, non-availability of transport facility in time and at cheap rate, high commission charges and non-availability of good quality packing material. It was observed that ber grower suggested the transport facility should make in time and cheap charges.

Kaysar*et al*. (2019) studied the profitability analysis of papaya cultivation in some selected areas of Bangladesh. The study was conducted to depict the overall economics of papaya cultivation in four districts namely Tangail, Jashore, Bandarban and Rajshahi. The objectives of the study were to examine the cost structure, resource use productivities, profitability and the problems of papaya production. In production of papaya, growers faced the problems of non-availability and high prices of quality seedlings, shortage of labour and no proper control over viral disease while, low price of papaya, fluctuating prices, higher transportation cost etc. were reported to be major problems of papaya marketing in the study areas.

The above discussed reviews clearly indicated that the production of ber fruits was found financially and economically feasible for the farmers. However, low productivity, lack of adequate labour, pests and diseases incidence, higher initial investment and lack of technical know-how were the major bottlenecks in production of fruits. So, in order to address these issues in an integrated way, the present study was undertaken.

METHODOLOGY

CHAPTER-3
METHODOLOGY

The object of any scientific investigation is to draw some useful conclusions in the light of objectives of the study. In order to arrive at meaningful conclusions, it was essential for the investigator to adopt appropriate methods, procedures and analysis of data during the course of research work. Keeping this in view, the methodology used in this study being presented under three heads *viz*., selection of crop & study area, collection of data and analysis of data.

3.1 Selection of crop and study area

Ber crop was selected purposively for the detailed study, because of lack of information about economics of ber orchard in the region.

For present study, ber orchard of Shri Karan Narendra College of Agriculture, Jobner, was selected purposively, as the study will be helpful to the farmers for taking decisions about ber orchard cultivation and for comparison with annual crops and other orchards.

3.2 Collection of data

Primary data were collected for the study. To meet the objectives of the present study, requisite data were collected from Horticultural farm and departmentof Horticulture at Shri Karan Narendra College of Agriculture, Jobner. Complete information about size of holding, resource inventory, land utilization, expenditure on variable inputs and crop budget for ber, price received etc. were collected.

Two permanent staffs were working in ber orchard, one is farm manager and another one is field worker. Along with ber production, they were involved in other activities such as vegetable production,

seed production of vegetables, fruits production like pomegranate and dragon fruit, maintenance of protected agriculture through polyhouse structures and assisting for research work of P.G. and Ph. D. scholars. As per information received from permanent staffs, three percent (3%) of their salary was contributed for ber cultivation.

3.3 Analysis of data

The collected data were thoroughly checked for consistency and accuracy and the same were transferred on master sheet for having a clear view and subjected them to further classification and analysis.

Concepts and definition of Terms and Variables

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

3.3.1 Terms

(A) Labour

(i) Hired/casual/permanent Labour: This category includes the hired/casual/permanentlabour employed in ber production. The payment was made in cash was considered.

(ii) Family Labour: It contains for actual work carried out by family members for crops. This labour was calculated on the basis of prevailing rates paid to the hired labour for the same category and nature of work.

(iii) Bullock Labour: Owned bullock labour has been accounted as per the rates of hired bullock labour prevailing in the locality.

(iv) Owned Machinery Charges: It was evaluated at the hiring charges prevalent in the villages.

(B) Plants, Manures (FYM) and Plant Protection Chemicals

Farm produced manure was calculated at the rate prevalent in the village while purchased plants, fertilizers and plant protection chemicals were valued at the actual prices paid by the ber producers.

(C) Irrigation charges

It was calculated for ber crop by multiplying the area under ber to the actual electricity charges dividing by the net cultivated area. In the study area had electric pump set and paid electric charges at a flat rate.

(D) Land revenue

At present, no land revenue is paid by the college farm to state government.

(E) Rental Value of Owned Land

It was calculated on the basis of prevailing rates in the study area that was one/fourth or one/fifth of the gross-product.

(F) Interest on Fixed Capital

Interest on fixed capital was charges at the rate of 12 per cent per annum, the prevailing rate of interest. Items on which interest was included were fixed capital like farm building, well and irrigation structure and machinery like electric motor excluding tractor and its accessories.

(G) Interest on Working Capital

Interest on working capital was calculated at the rate of 12 per cent per annually, the prevailing rate of interest for six months.

(H) Depreciation

It is decline in the value of a given asset as a result of use, wear and tear, accidental damages and time obsolescence. Items on which depreciation was computed were the same as included for the

calculation of interest on fixed assets. Straight line method was used for computing the depreciation.

$$\text{Depreciation} = \frac{\text{Purchase price of asset – Junk value}}{\text{Useful life of the asset (expected life)}}$$

After calculating total annual depreciation of the farm, the depreciation for a particular crop was worked out. This was done as follows:

$$\textbf{Depreciation for 'ber 'crop} = \frac{\textbf{Total annual depreciation}}{\textbf{Total cropped area}} \times \textbf{Area under 'ber' crop}$$

3.3.2 Cost Concepts

Since the structure of cost for the cultivation of ber was quite different to the traditional crop farming. The following cost concepts were devised.

(A) Establishment costs

All the costs borne by ber growers from preparation of land till planting of plants were denoted as an establishment cost. The cost of land in the establishment cost was not included. Establishment cost pertains to the cost incurred on land preparation, planting material, tools etc. The cost of establishment of ber orchards for the first two or three years was worked out by integrating the expenditure from the first to the age of first flowering.

Establishment costs = Land preparation + Cost of plants +Cost of planting of plants + tools and other costs.

i) Fixed costs = Land revenue + Earned value of rental land + Depreciation + Interest on fixed capital

ii) Variable costs= Cost of manures and fertilizer including labour cost + Irrigation charges including labour cost + Labour cost of weeding + Harvesting of ber

iii) Total Establishment costs=Fixed costs + Variable costs

(B) Maintenance costs

Even after the establishment of the crop, ber cultivators have to continue incurring expenditure year after year on regular basis for its maintenance. Depending on the nature of costs incurred, the maintenance costs was grouped as variable costs and fixed costs. Variable costs included expenses on items *viz.,* manures and fertilizers, irrigation, weeding and hoeing, harvesting and interest on working capital. Fixed costs constituted interest on fixed capital, depreciation, land revenue and earned value of rented land. The total maintenance costs was obtained by adding the variable costs and fixed costs.

i) Fixed costs = It included interest on fixed capital, depreciation on capital items, land revenue and earned value of rental land.

ii) Variable costs = It includedexpenses on items like manures and fertilizer, irrigation, weeding and hoeing, harvesting, transportation and interest on working capital.

iii) Total Maintenance costs = Fixed costs + Variable costs

(C)Total costs = Establishment costs + Maintenance costs

Total cost of cultivation:

The cost of cultivation of ber was worked out by considering the following cost items.

Cost A_1

1. Value of hired human labour.
2. Value of owned bullock labour.
3. Value of hired bullock labour.

4. Value of owned machine labour.
5. Value of hired machine labour.
6. Value of owned seed.
7. Value of purchased seed.
8. Value of owned farm yard manure.
9. Value of purchased farm yard manure.
10. Value of fertilizers and insecticides.
11. Irrigation charges.
12. Land revenue.
13. Interest on working capital.
14. Depreciation.
15. Miscellaneous expenses.

Cost groups: Items of cost included

Cost A_1: Sum cost of 1 to15

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

Cost B_1: Cost A_1+ Interest on amount of owned capital invested in the business excluding the value of land

Cost B_2: Cost A_1 + Rental value of owned land less land revenue + Rent paid for leased in land

Cost C_1: Cost B_1+ Imputed value of family labour

Cost C_2: Cost B_2 + Imputed value of family labour

Cost C_3: Cost C_2+10 percent of the total cost for management i.e. Cost C_2

Cost Structure:

The structure of cost of cultivation of ber was quite different from other traditional crop farming. Hence, cost structure was studied under following heads:

I. Establishmentcosts:

It includes the variable costs and fixed costs.

A. Variable costs

Variable costs includes the following items,

1. Digging of pits

2. Filling of pits
3. Planting cost
4. Care of plants (Plant protection, manures and fertilizers, training and pruning, hoeing and weeding)
5. Irrigation charges
6. Interest on working capital
7. Others

B. Fixed costs

Following are the items of fixed costs,

1. Interest on fixed capital
2. Depreciation
3. Rental value of land
4. Salary for permanent staffs
5. Others

II. Maintenance costs:

It constitutes the variable costs and fixed costs.

A. Variable costs

Variable costs includes the following items,

1. Training and pruning
2. Manures and fertilizers
3. Plant protection
4. Irrigation charges
5. Watching charges
6. Harvesting charges
7. Interest on working capital
8. Others

B. Fixed costs

Following are the items of fixed costs,

1. Interest on fixed capital
2. Depreciation
3. Rental value of land
4. Salary for permanent staffs

5. Others

III. Total costs:

The total cost was obtained by adding the establishment costs and maintenance costs of the orchard.

Total cost = Establishment costs + Maintenance costs

Cost of production:

$$\text{Cost of production} = \frac{\text{Cost of cultivation}}{\text{Total production}}$$

3.3.3 Returns:

Gross returns for ber orchard were the value of the product at the selling prices. Net returns were computed by deducting the cost of cultivation from the gross returns. Finally, return per rupee of investment was calculated by dividing total return over total cost.

I.Gross returns:

Gross returns was defined as

$$\mathbf{GR = Q_P \times P_P}$$

Where,

GR = Gross returns

Q_P= Quantity of product

P_P= Price of the product

Price of the product was considered as the actual price at which the ber producers sold the produce.

II. Net returns:

It was residue after deducting the all cost items i.e. total costs from the gross returns.

Net returns = Gross returns – Total costs

Extrapolation method:

Extrapolation is a statistical method beamed at understanding the unknown data from the known data. It tries to predict future data based on historical data.

Linear trend method:

Replaces missing values with the linear trend for that point. The existing series is regressed on an index variable scaled 1 to *n*. Missing values are replaced with their predicted values.

1. Use all the nonmissing observations in the series to fit the regression line of the form

$$\widehat{X}_t = a + bt$$

The least squares estimates are

$$b = \frac{\sum(X_t - \bar{X})(t - \bar{t})}{\sum(t - \bar{t})^2}$$

$$a = \bar{X} - b\bar{t}$$

2. Apply the regression equation to replace the missing values

$$\widehat{X}_{i+l} = a + b(i + l)$$

Where,

t = Time

X = Variable

a, b= Parameters to be estimated

3.3.4 Techniques of Economic Evaluation

The area under study was one hectare. The data on costs incurred and returns were taken into account for the period from 2010 to 2029. For the period from 2010 to 2019, data oncosts incurred and returns were actuallycollected from the horticultural farm and for remaining period i.e. from 2020 to 2029, costs incurred were estimated through extrapolation method and regarding returns from ber cultivation for the period from 2020 to 2029 were found out by assuming that the period was divided into two parts i.e. one part was from the period 2020 to 2024 and second part was from the period 2025 to 2029. The

returns in the last five years i.e. from 2025 to 2029were assumed equal to the average returns during first five years after gestation period i.e. from 2013 to 2017. The returns from 11th to 15th year of age i.e. from 2020 to 2024 were assumed equal to the average returns from 2015 to 2019 (Jajoria, Meenakshi, 2018). In order to assess the capital productivity or to evaluate the economic viability of such long term investment in ber, the economic indicators *viz*., net present worth, discounted benefit cost ratio, internal rate of return and payback period were used in the present study, which were discussed as below.

I. Net Present Worth:

The net present worth (NPW) represents the discounted value of the net cash inflows to the project. Net Present Worth is also called as Net Present Value (NPV). NPW was calculated by formula as

$$\boldsymbol{NPW = \sum_{n=1}^{t} \frac{Bn}{(1+r)^n} - \sum_{n=1}^{t} \frac{Cn}{(1+r)^n}}$$

Where,

NPW = Net present worth in period 't'

B_n = Benefits from ber cultivation in each year

C_n = Cost of ber cultivation in each year

r = Discount rate

n = 1, 2, 3…. n, the entire life of ber orchard in the study region.

t = number of years

Annuity of NPW:

Annuity of NPW was computed by using following formula

$$\text{Annuity of NPW} = \text{NPW} \frac{i\,(1+i)^n}{(1+i)^n - 1}$$

Where,

NPW = Net Present Worth

i = Discount rate

n = Period (years)

II. Discounted Benefit cost ratio:

The discounted benefit-cost ratio (BCR) measures the returns or benefits per unit cost of an investment. It is the ratio of sum of the discounted value of all cash inflows to the discounted value of all cash outflows during the life of the project. The discounted benefit-cost ratio was used for determining the viability of a particular project. The project is economically viable when it has a discounted net benefit cost ratio greater than zero, i.e. positive. Investment made for first year be discounted for one year only and investment made at the 20th year be discounted for 20 years and for other years be discounted likewise (Reddy *et al.,* 2018)*. To serve the purpose following formula was used.

$$\boldsymbol{BCR} = \sum_{\boldsymbol{n=1}}^{\boldsymbol{t}} \frac{\boldsymbol{Bn}}{(\mathbf{1}+\boldsymbol{r})^{\boldsymbol{n}}} \div \sum_{\boldsymbol{n=1}}^{\boldsymbol{t}} \frac{\boldsymbol{Cn}}{(\mathbf{1}+\boldsymbol{r})^{\boldsymbol{n}}}$$

Where,

B_n = Benefits from ber cultivation in each year

C_n = Cost of ber cultivation in each year

r = Discount rate

n = 1, 2, 3…. n, the entire life of ber orchard in the study regions.

t = number of years

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* **Reddy, S. Subba, P. Raghu Ram, T.V. Neelakanta Sastry and I. Bhavani Devi** (2018). Agricultural Economics, Oxford & IBH Publishing Co. Pvt. Ltd, pp: 481-482.

III. Internal rate of return (IRR):

Internal rate of return (IRR) is the rate of discounting at which the net present worth of project is equal to zero or IRR is the discount rate which makes the discounted benefit equal to discounted cost is internal rate of return (IRR) to the project. It gives the earning power of investment.

IRR was found out by trial and error method. Initially two discount rates, one which results in a positive NPW and the other one, which results in a negative NPW were found out. Discount rate with positive NPW is called lower discount rate and the discount rate with negative NPW is called higher discount rate. It was estimated as

$$\sum_{n=1}^{t} \frac{Bn}{(1+r)^n} - \sum_{n=1}^{t} \frac{Cn}{(1+r)^n} = 0$$

Where,

r = IRR

B_n = Benefits from ber cultivation in each year

C_n = Cost of ber cultivation in each year

t = number of years

$$\text{IRR} = \left(\text{Lower discount rate}\right) + \left(\text{Difference between higher and lower discount rate}\right) \times \left(\frac{\text{Present worth of the cash flow at lower discount rate}}{\text{Absolute difference between the present worth of cash flow at two discount rates}}\right)$$

IV. Pay Back Period:

It measures the length of time required to cover the initial outlay. The payback period was calculated successively deducting the initial investment by the undiscounted net returns until initial investment is fully recovered.

$$\mathbf{P = \frac{I}{E}}$$

Where,

P = Payback period of the project in years

I = Initial Investment of the project in rupees

E = Annual net cash revenue in rupees

In case of ber orchard, cash flows are uneven so, the following formula was used for calculating the payback period and was calculated by successively deducting the initial investment from the net returns until the initial investment was fully recovered. It indicates the number of years by which the net returns (R) equals to the initial cost of orchard establishment (K). For this condition, the following relationship must be satisfied.

$$\sum_{i=1}^{n} \boldsymbol{R_i = K}$$

Where,

i = 1, 2, 3 ……. 20 years,

R = Return over a number of year,

K = Initial cost of orchardestablishment.

3.3.5 Assumptions

The assumptions underlying the study were as follows:

1. The life period of ber orchard was considered to be 20 years.
2. The costs and returns were discounted at the rate of 12 percent per annum, prevailing rate of interest.
3. The yield was stabilized after 7-9 years of planting.
4. In the study of research farm, the original returns observed for 10 years were taken and rest of the period was divided into two

parts. The returns in the last five years were assumed equal to the average returns during first five years after gestation period. The returns from 11^{th} to 15^{th} year of age were assumed equal to the average returns of 6^{th} to 10^{th} years.

3.3.6 Problems in the production of ber:

While being ber orchard cultivation was profitable, it has many constraints in productions which were making it back stop in strengthening it. With the rapid increase in the area under this crop, several problems of production have emerged which needs a careful investigation. The constraints occurrence in the ber production were mainly analyzed by categorizing into three streams i.e. highly severe, moderately severe and less severe.

Technical, Economic, Infra-structural and Social constraints were studied in the research.

3.3.6.1 Technical constraints

Technical constraints imply impediments or restraints pertaining to know-how or skill in the way of adoption of particular recommended practice.

3.3.6.2 Economic constraints

It means the restraints pertaining to the finance, profitable operation, in the way of adoption of particular recommended production technology.

3.3.6.3 Infra-structural constraints

It represents impediments or restraints pertaining to the organization in the way of adoption of particular recommended practice.

3.3.6.4 Social constraints

Social constraints mean impediments or restraints pertaining to the society, habit and mental acceptance in the way of adoption of particular recommended practice.

RESULTS
&
DISCUSSION

CHAPTER- 4

RESULTS AND DISCUSSION

In this chapter, an attempt was made to the economic analysis of the ber orchard on the research farm. The results of the systematized investigation and description of data together with pertinent discussion are presented in detail. The data/information were collected, tabulated and analyzed to study the major objectives. The final results of the study were presented and deliberated through following major heads.

4.1 The Cost structure of the ber orchard establishment.

4.2 Economic feasibility of investment in ber cultivation.

4.3 Identification of the problems in the production of ber.

SECTION-1

4.1 The Cost structure of the ber orchard establishment

The ber orchard at Shri Karan Narendra College of Agriculture, Jobner was undertaken for this study. This orchard was established in 2010 and covers an area of one hectare.

In this section, cost structure of the ber orchard was discussed in three headings *viz.,* establishment cost, maintenance cost and total cost. The costs and returns from the ber orchard at research farm were evaluated in two different methods (a) without salary of permanent staffs and (b) with salary of permanent staffs. Two permanent staffs were working in ber orchard, one is farm manager and another one is field worker. Along with ber production, they were involved in other activities such as vegetable production, seed production of vegetables, fruits production like pomegranate and dragon fruit, maintenance of protected agriculture through polyhouse structures and assisting for research work of P.G. and Ph. D. scholars. As per information received from permanent staffs, three percent (3%) of their salary was

contributed for ber cultivation i.e. towards establishment and maintenance costs.

4.1.1 Establishment costs of the ber orchard

The appropriate establishment of ber orchard acts as a basis for supplementary prospects of yield from the ber crop. Because ber plant was a hardy and perennial fruit plant, once established a ber orchard, it continues to provide fruits marginally up to 20 years. The ber cultivators must have developed level commercial viewpoints and must be ardent on proper use of several resources in production practices.

The period from land preparation to fruiting stage is termed as establishment period. The establishment cost was the major share to the total costs. The establishment cost of ber orchard included in the initial investment up to 3 years.These costs were more to the working and maintenance overheads of the orchard till they start giving fruits. The ber cultivators must spend significant amount of cash for establishment of the ber orchard from the beginning year to age of first bearing. Commonly period of gestation for orchard crops is four years. But just in case of Gola ber variety, gestation period was 3 years because it's an earliest ber variety. Generally, ber cultivators do not get any profits from the ber plants during the gestation period. The outlay made by ber cultivators for orchard establishment from pre planting to age of first flowering was taken into account as capital investment.

The establishment period of ber orchard in research farm was three years. The establishment cost of ber orchard was divided into two sections specifically establishment cost without salary of permanent staffs and establishment cost with salary of permanent staffs. The establishment cost consist of two kinds of costs mainly variable cost or operational cost and overhead cost or fixed cost.

The details of the cost for different particulars given in the establishment cost were well explained and it can be seen from the

table 4.1. The total establishment costs i.e. for initial three years (2010-2012) of ber orchard without salary of permanent staffs were ₹45,579.14 ha^{-1}. The figure 4.1 clearly shows the percentage of various cost items of the establishment cost. The total variable costs occurred within the farm was ₹32,691.04 ha^{-1} (71.73 per cent) out of the total establishment costswithout salary. The foremost item of the total variable costs was constituted by care of plants i.e. cost incurred for care of plants included expenses on hoeing and weeding, training and pruning*****, plant protection, manures and fertilizers was ₹15,666.21 ha^{-1} (34.37 per cent in the total establishment cost without salary) followed by cost incurred for land preparation was ₹8000 ha^{-1} (17.55 per cent out of total establishment cost without salary). The expense for planting material cost was accounted to ₹4860 ha^{-1}, which holds 10.27 per cent of total establishment cost without salary. The cost for digging of pits and filling of pits was ₹850 ha^{-1} (1.86 per cent without salary) and ₹650 ha^{-1} (1.43 per cent without salary), respectively.

The cost incurred for irrigation was worked out to ₹994.39 ha^{-1}, which was 2.18 per cent of total establishment costs without salary. Interest on working capital was ₹1850.44 ha^{-1} (4.07 per cent without salary). The total fixed costs arisen were ₹12,888.10 ha^{-1} (28.27 per cent without salary). It includes two items mainly interest on fixed capital and depreciation. Interest was charged on fixed capital i.e. ₹10,775.61 ha^{-1} (23.64 per cent) of total establishment costs without salary and cost incurred for depreciation on farm machinery and equipment was ₹2112.49 ha^{-1} (4.63 per cent) of total establishment costs without salary. The percentage share of variable costs and fixed costs of the establishment costs was different, while adding salary of permanent staffs. It was clear from the fig 4.2. Total establishment cost of ber orchard with salary of permanent staffs at research farm was ₹1,50,605.68 ha^{-1}.

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* Training and pruning – As per the recommended package of practices.

The variable costs occurred within the farm was 21.71 per cent of the total establishment costs (₹32,691.04 ha^{-1} with salary). The total variable costs was constituted by care of plants i.e. cost incurred for care of plants included expenses on hoeing and weeding, training and pruning, plant protection, manures and fertilizers was 10.40 per cent (₹15,666.21 ha^{-1}) of total establishment costs with salary followed by cost incurred for land preparation i.e. 5.32 per cent of total establishment costs with salary (₹8,000 ha^{-1} with salary). The cost accounted for irrigation charges was 0.66 per cent (₹994.39 ha^{-1}) of total establishment costswith salary.

The expenses incurred for planting material was accounted by ₹4860 ha^{-1}, which holds 3.11 per cent of total establishment costs with salary. The cost for digging of pits and filling of pits were 0.56 per cent (₹850 ha^{-1} with salary) and 0.43 per cent (₹650 ha^{-1} with salary) of total establishment cost with salary, respectively. Interest on working capital was 1.23 per cent (₹1850.44 ha^{-1} with salary). The total fixed costs arisen was 78.29 per cent i.e. ₹1,17,914.64 ha^{-1}. It included interest on fixed capital, depreciation and salary of permanent staffs.Cost of interest on fixed capital was accounted for 7.15 per cent (₹10,775.61 ha^{-1} with salary) and cost incurred for depreciation was 1.40 per cent (₹2112.49 ha^{-1} with salary) of total establishment cost with salary. Out of total establishment cost, the salary for permanent staffs worked in the ber orchard at research farm was accounted to ₹1,05,026.54 ha^{-1} (69.74 per cent of the total establishment cost). These results were similar with study conducted by Thorat and Shelke (2012) and Ali *et al.* (2011) in their study as economic analysis of ber orchard.

Table 4.1 Establishment costs of ber orchard at research farm during the period from 2010 to 2012

S.No	Particulars	Cost (₹/ha)	Percentage of cost by total establishment cost without salary (%)	Percentage of cost by total establishment cost with salary (%)
A	**Variable costs**			
1.	Land preparation	8000.00	17.55	5.32
2.	Digging of pits	850.00	1.86	0.56
3.	Filling of pits	650.00	1.43	0.43
4.	Planting material	4680.00	10.27	3.11
5.	Care of plants *	15,666.21	34.37	10.40
6.	Irrigation charges	994.39	2.18	0.66
7.	Subtotal (1 to 6)	30,840.60		
8.	Interest on working capital	1850.44	4.07	1.23
	Total variable costs	**32,691.04**	**71.73**	**21.71**
B	**Fixed costs**			
1.	Interest on fixed capital	10,775.61	23.64	7.15
2.	Depreciation	2112.49	4.63	1.40
3.	Salary of permanent staffs**	1,05,026.54	-	69.74
	Total fixed costs			
4.	Without salary	**12,888.10**	**28.27**	-
5.	With salary	**1,17,914.64**	-	**78.29**
C	**Total Establishment costs**			
1.	Without salary	**45,579.14**	100	-
2.	With salary	**1,50,605.68**	-	100

***** Cost incurred for care of plants included expenses on hoeing and weeding, training and pruning, plant protection, manures and fertilizers.

** Permanent staffs were involving in other activities also. Only three percent (3%) of their salary was contributed for ber cultivation.

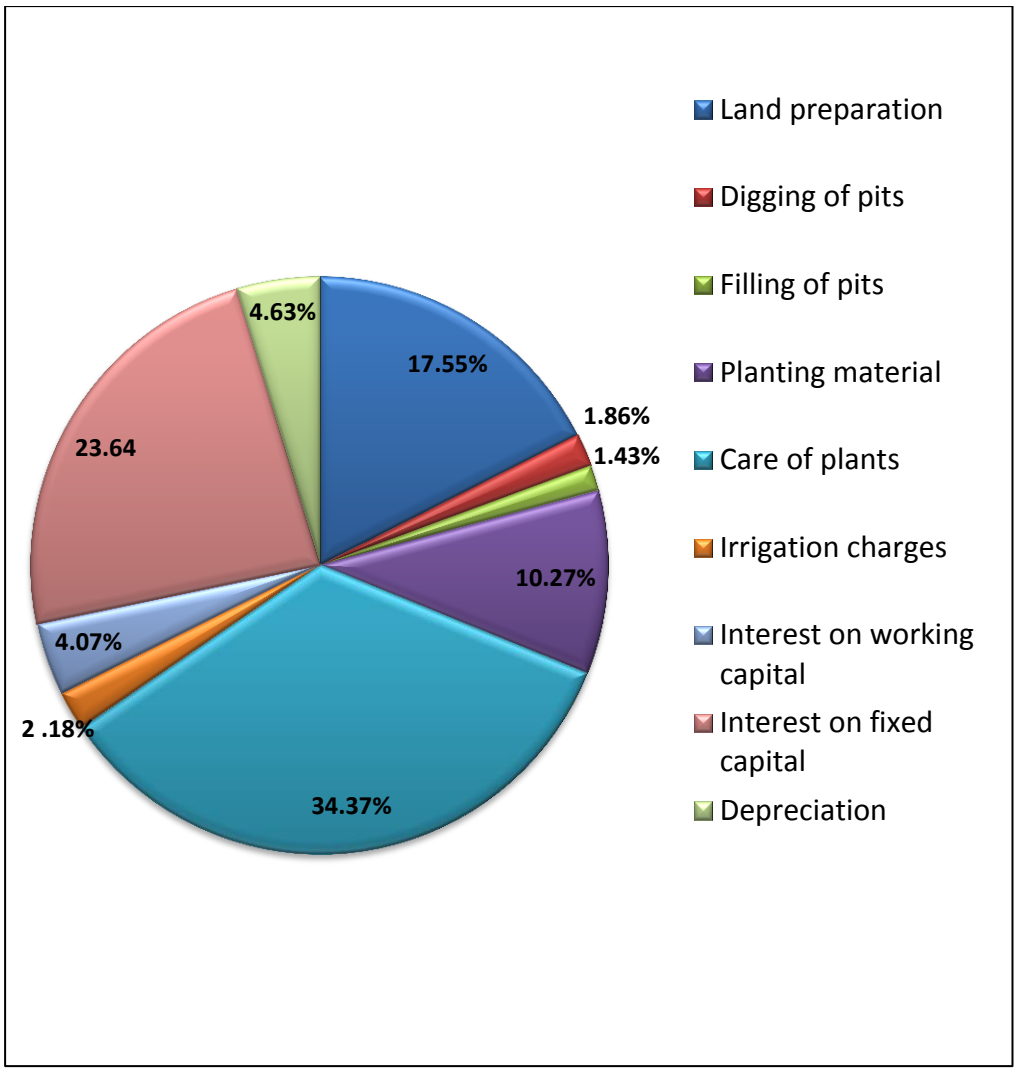

Fig.4.1 Establishment costs of the ber orchard at research farm without salary of permanent staffs

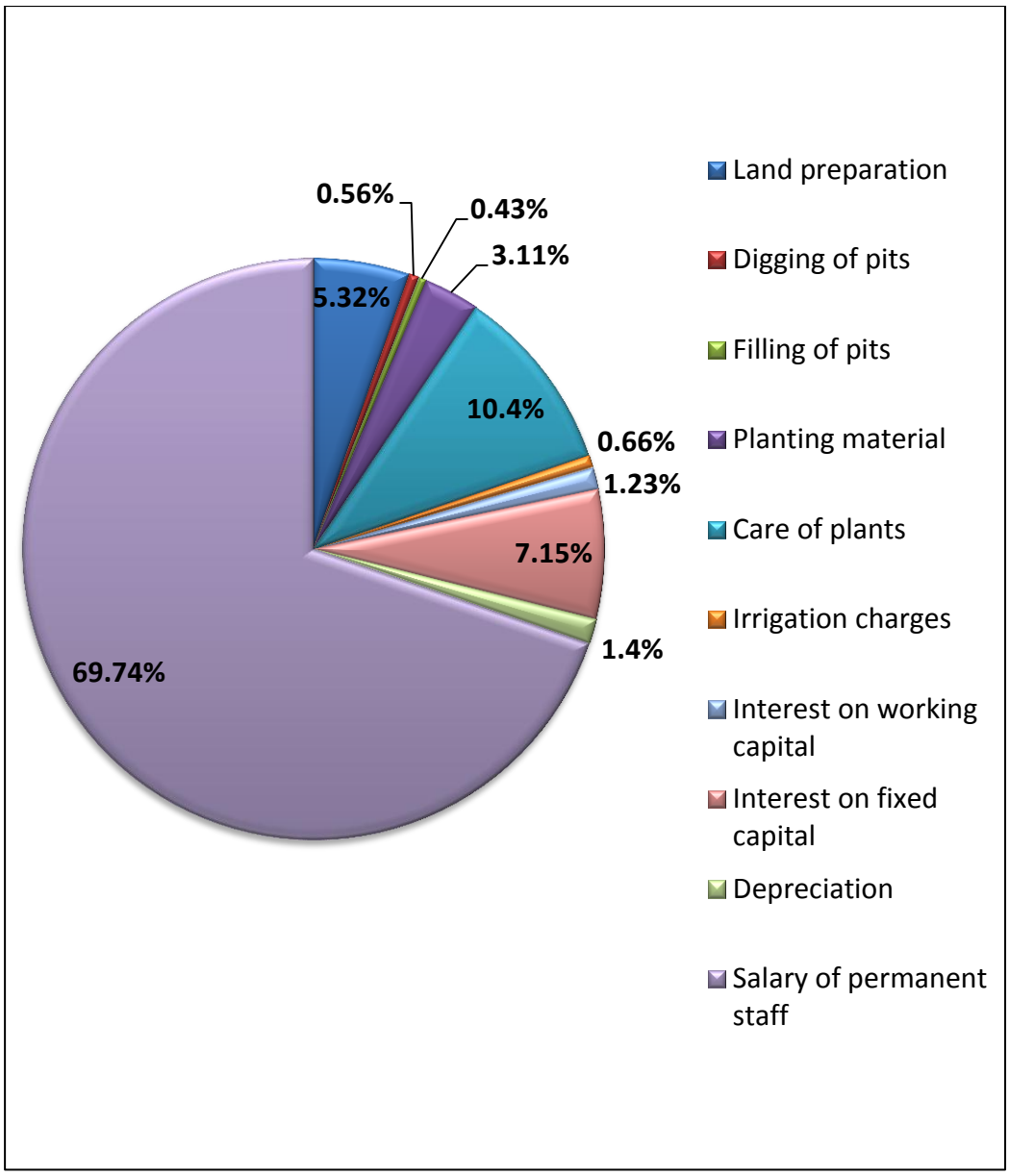

Fig.4.2 Establishment costs of the ber orchard at research farm with salary of permanent staffs

4.1.2 Maintenance costs of the ber orchard

Ber cultivators have to remain experiencing expenses on regular basis for the maintenance of orchard, even after the establishment of the orchard. Expenses occurred during the period on the maintenance was categorized as an operational or variable cost and overhead or fixed cost. Costs on items *viz.,* weeding and hoeing, manures and fertilizers, irrigation, harvesting and interest charged on working capital were included in variable costs. The fixed costs accounted for interest on fixed capital, depreciation on farm equipment and machineries, earned value of rented land and revenue of the land. The total maintenance costs was attained by addition of both the variable costs and fixed costs.

The maintenance period of ber orchard in the research farm was 17 years i.e. from 4^{th} year to 20^{th} year i.e. for the maintenance period from 2013 to 2019, data on costs and returns were actually collected from the horticultural farm and for remaining period i.e. from 2020 to 2029, costs incurred were estimated through extrapolation method and regarding returns from ber cultivation for the period from 2020 to 2029 were found out by assuming that the period was divided into two parts i.e. one part is from the period 2020 to 2024 and second part is from the period 2025 to 2029. The returns in the last five years i.e. from 2025 to 2029 were assumed equal to the average returns during first five years after gestation period i.e. from 2013 to 2017. The returns from 11^{th} to 15^{th} year of age i.e. from 2020 to 2024 were assumed equal to the average returns from 2015 to 2019. The expenses incurred for maintaining the ber plants varies year to year, because of the factors such as intensity of pests and diseases, insect population, variety of the crop, maintenance of plant canopy, allocation of irrigation resources etc. Likewise establishment costs, the cost incurred for maintenance was grouped into two kinds of costs i.e. variable costs and fixed costs, in addition these costs were categorized as

maintenance costs without salary of permanent staffs and maintenance costs with salary of permanent staffs. Items of the maintenance costs were presented in the table 4.2. The total maintenance costs i.e. for remaining life of ber cultivation at research farm without and with salary of permanent staffs were worked out as ₹6,58,356.89 ha^{-1} and ₹14,10,681.21 ha^{-1}, respectively.

The figure 4.3 illustrates the percentage of the cost items of the maintenance costs of ber orchard at research farm without salary of permanent staffs. It was apparent from that variable costs accounted to 50.27 per cent out of total maintenance costs without salary i.e. ₹3,30,900.71 ha^{-1}. Cost of weeding and hoeing was accounted to be ₹25,487.91 ha^{-1} and it was contributing 3.87 per cent to total maintenance costs without salary.

The requirement of manures and fertilizers to the ber crop was varied with the age of the plants. So, the cost incurred for these also vary throughout the crop period. The total cost on manures and fertilizers during the maintenance period was ₹76,995.09 ha^{-1} and percentage share was 11.70 of total maintenance costs without salary. Similar to manures and fertilizers, the plant protection was as well vital for better ber production. The incidence of powdery mildew was found on the young leaves and twigs of ber crop. For management of the pests and diseases, the plant protection chemicals were used. The cost incurred towards plant protection chemicals was ₹39,377.66 ha^{-1} (5.98 percent) of the total maintenance cost without salary.

The amount spent for training and pruning was worked out as ₹31,417.74 ha^{-1} (4.77 per cent) of the total maintenance costs without salary. The cost incurred for irrigation was ₹9548.99 ha^{-1} and it was accounted for 1.46 per cent of total maintenance costs without salary. Cost incurred for watching of ber orchard and harvesting of the ber were worked out to ₹1,01,529.82 ha^{-1} (15.42 per cent) and ₹27,813.27 ha^{-1} (4.23 per cent) of the total maintenance costs without salary,

respectively. Interest charged on working capital was ₹18,730.23 ha^{-1} (2.84 per cent without salary) of the total maintenance costs without salary.

The total fixed costs was worked out to ₹3,27,456.18 ha^{-1} (49.73 per cent) of the total maintenance costs without salary. It included three items mainly interest on fixed capital, rental value of land and depreciation. Interest was charged on fixed capital i.e. ₹75,672.75 ha^{-1} (11.49 per cent) of the total maintenance costs without salary. The rental value of the land was worked out to ₹2,36,947.04 ha^{-1} (35.98 per cent without salary) of the total maintenance costs without salary. Cost incurred towards depreciation on farm machinery and equipment was ₹14,836.39 ha^{-1} (2.26 per cent) of the total maintenance costs without salary. The findings of this study were similar with the study carried by Sidramayya *et al.* (2017).

The total maintenance costs of ber orchard at research farm with salary of permanent staffs was worked out as ₹14,10,681.21 ha^{-1}. The percentage share of variable costs and fixed costs of the maintenance costs was different, while adding salary of permanent staffs. It was presented in fig 4.4 and it was conspicuous from that the variable costs was accounted to 23.46 per cent (₹3,30,900.71 ha^{-1}) of the total maintenance costs with salary. Cost of weeding and hoeing was contributed to 1.80 per cent out of total maintenance costs with salary (₹25,487.91 ha^{-1}). Cost incurred on manures and fertilizers was 5.46 per cent (₹76,995.09 ha^{-1}) of the total maintenance costs with salary.

The cost incurred for plant protection chemicals constituted 2.79 per cent (₹39,377.66 ha^{-1} with salary) out of total maintenance costs with salary. The training and pruning was contributed 2.22 per cent (₹31,417.74 ha^{-1} with salary). The cost occurred for irrigation was 0.69 per cent (₹9548.99 ha^{-1} with salary). Watching and harvesting charges of the ber were accounted for 7.2 per cent (₹1,01,529.82 ha^{-1}) and 1.97

per cent (₹27,813.27 ha^{-1}) of the total maintenance costs with salary, respectively. Interest on working capital was accounted for 1.33 per cent (₹18,730.23 ha^{-1}) of the total maintenance costs with salary.

The total fixed costs was worked out to ₹10,79,780.5 ha^{-1} (76.54 per cent with salary) of the total maintenance costs with salary of permanent staffs. Totally, four cost items were included in this cost i.e. interest on fixed capital, rental value of land, depreciation and salary of the permanent staffs worked in the ber orchard at research farm. Interest charged on fixed capital was 5.36 per cent (₹75,672.75 ha^{-1}) of the total maintenance costs with salary.

The rental value of the land was accounted for 16.8 per cent (₹2,36,947.04 ha^{-1} with salary). Cost incurred for depreciation on farm machinery and equipment founded 1.05 per cent of the total maintenance costs with salary (₹14,836.39 ha^{-1}). The salary of the permanent staffs was accounted to be ₹7,52,324.32 ha^{-1} (53.33 per cent of the total maintenance costs). Comparable results were reported by Gadekar and Hilli (2018) in their study of ber orchard cultivations and Kireeti *et al*. (2014) reported that in apple cultivation.

Table 4.2 Maintenance costs of ber orchard at Research farm during the period from 2013 to 2029*

S. No.	Particulars	Cost (₹/ha)	Percentage of cost by total maintenance cost without salary (%)	Percentage of cost by total maintenance cost with salary (%)
A	**Variable costs**			
1.	Weeding and Hoeing	25,487.91	3.87	1.80
2.	Training and Pruning	31,417.74	4.77	2.22
3.	Manures and Fertilizers	76,995.09	11.70	5.46
4.	Plant protection	39,377.66	5.98	2.79
5.	Irrigation	9548.99	1.46	0.69
6.	Watching charges	1,01,529.82	15.42	7.20
7.	Harvesting charges	27,813.27	4.23	1.97
8.	Subtotal (1 to 7)	3,12,170.48	-	-
9.	Interest on working capital	18,730.23	2.84	1.33
	Total variable costs	3,30,900.71	**50.27**	**23.46**
B	**Fixed costs**			
1.	Interest on fixed capital	75,672.75	11.49	5.36
2.	Depreciation	14,836.39	2.26	1.05
3.	Rental value of land	2,36,947.04	35.98	16.80
4.	Salary of permanent staffs	7,52,324.32	-	53.33
	Total fixed costs			
5.	Without salary	3,27,456.18	**49.73**	**-**
6.	With salary	10,79,780.50	**-**	**76.54**
C	**Total Maintenance costs**			
1.	Without salary	6,58,356.89	**100**	
2.	With salary	14,10,681.21		**100**

***2013 to 2019 maintenance data were actual data. For the period from 2020 to 2029 data were estimated throughextrapolation method.

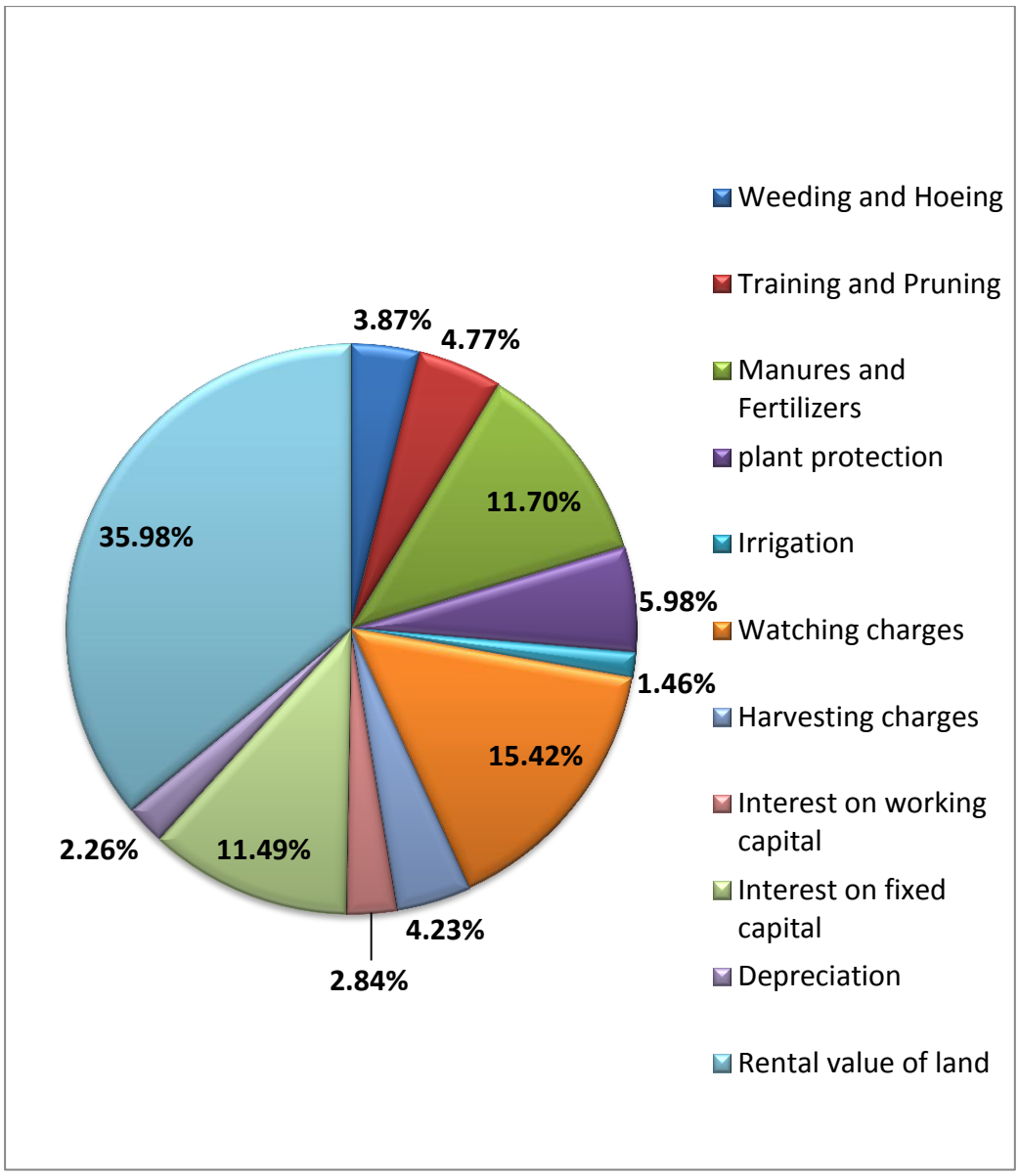

Fig.4.3 Maintenance costs of the ber orchard at research farm without salary of permanent staffs

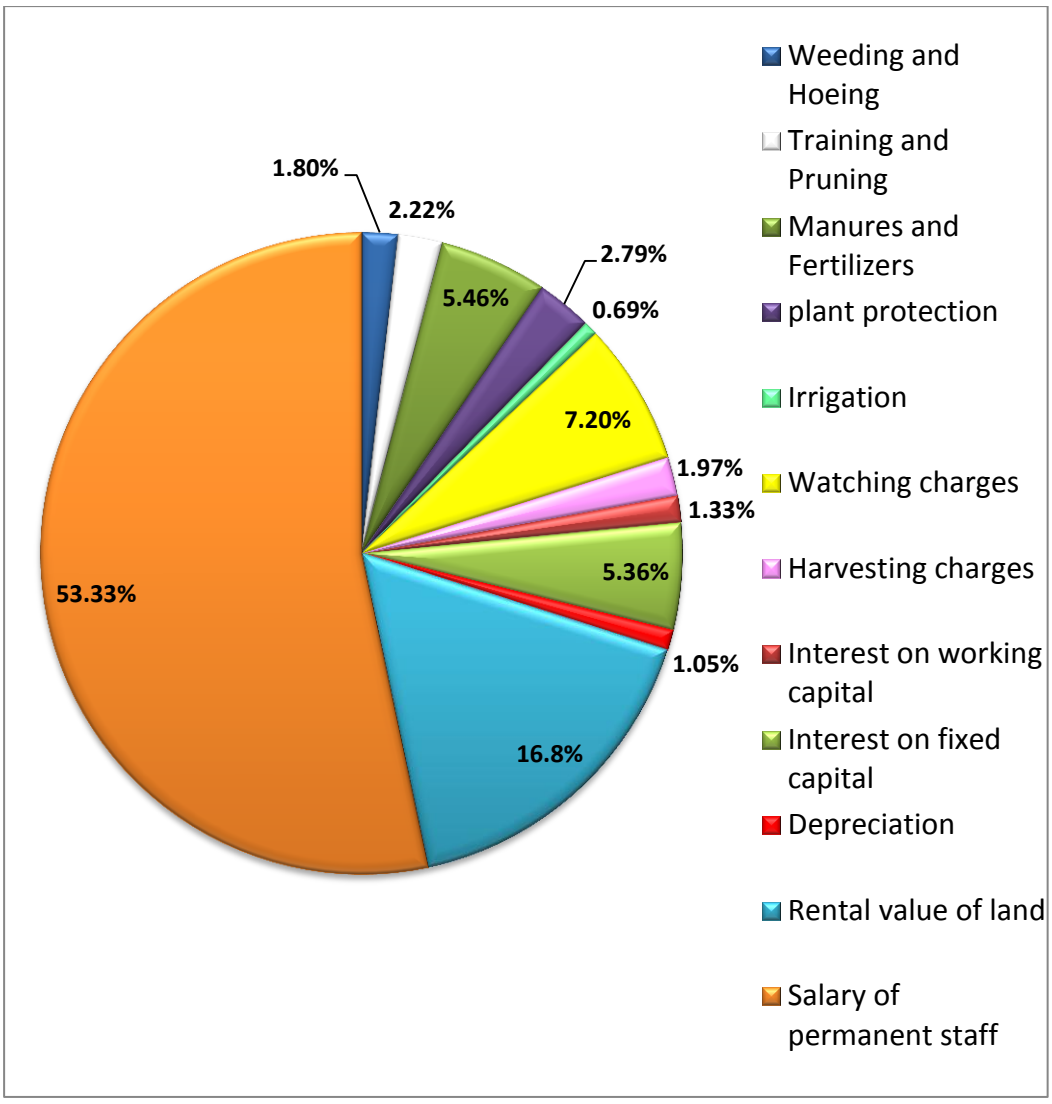

Fig.4.4 Maintenance costs of the ber orchard at research farm with salary of permanent staffs

4.1.3 Total costs of the ber orchard

The economic life period of the ber orchard is 20 years. The total cost of the orchard was calculated by adding the both establishment and maintenance costs of the orchard. The total cost of the ber orchard at research farm was calculated with and without salary of the permanent staffs.

The table 4.3 and fig 4.5 & 4.6 illustrate the total costs incurred for cultivation of ber orchard. The total costs for whole ber life i.e. for 20 years without and with salary of permanent staffs were estimated as ₹7,03,936.04 ha^{-1} and ₹15,61,286.90 ha^{-1}, respectively.

The total variable costs and fixed costs without salary of permanent staffs were accounted for ₹3,63,591.75 ha^{-1} (51.65 per cent) and ₹3,40,344.28 ha^{-1} (48.35 per cent) of the total costs without salary of the ber orchard, respectively. Out of this, maximum share was contributed by rental value of land with cost of ₹2,36,947.04 ha^{-1} (33.66 per cent) followed by interest on fixed capital was found with ₹86,448.36 ha^{-1} (12.28 per cent)of the total costs without salary.

In variable costs, the share of manures and fertilizers was worked out as ₹76,995.09 ha^{-1} (10.94 per cent) of the total costs without salary. Cost incurred for watching of orchard was ₹1,01,529.82 ha^{-1} (14.42 per cent without salary). The expenses occurred for plant protection chemicals and pesticides were ₹39,377.66 ha^{-1} (5.59 per cent without salary).Training and pruning charges was worked out to be ₹31,417.74 ha^{-1} (4.46 per cent without salary). The amount spent on weeding and hoeing was estimated that ₹25,487.91 ha^{-1} (3.62 per cent) of the total costs without salary.

The total variable costs and fixed costs with salary of permanent staffs were estimated to 23.29 per cent (₹3,63,591.75 ha^{-1} with salary) and 76.71 per cent (₹11,97,695.15 ha^{-1} with salary) of the total costs of the ber orchard, respectively. In variable costs, the percentage share of

watching charges was more i.e. 6.5 per cent (₹1,01,529.82 ha^{-1}) followed by cost incurred manures and fertilizers was 4.93 (₹76,995.09 ha^{-1}) of the total costs with salary. The expenses incurred for plant protection i.e. chemicals and pesticides were 2.52 percent (₹39,377.66 ha^{-1} with salary). Training and pruning charges was accounted to 2.01 per cent (₹31,417.74 ha^{-1}) and on weeding and hoeing was 1.63 per cent (₹25,487.91 ha^{-1}) of the total costs with salary.

The maximum share was contributed by salary of permanent staffs with cost of ₹8,57,350.87 ha^{-1} (54.9 per cent) of the total costs with salary followed by rental value of land with 15.18 per cent (₹2,36,947.04 ha^{-1} with salary) of the total cost. Interest on working capital and fixed capital were calculated that ₹20,580.66 ha^{-1} (1.32 per cent) and ₹86,448.36 ha^{-1} (5.54 per cent) of the total costs with salary. These results were at par with study conducted by Bhosale *et al.* (2015) in kesar mango cultivation.

4.1.4 The costs and returns analysis of ber orchard at research farm

The costs incurred towards ber orchard cultivation and returns from the orchard *viz.,* gross returns and net returns were presented in the following table 4.4 and fig 4.7 & 4.8. From this table, it could be concluded depends upon the age of plants that the costs and returns from ber orchard was varying year to year. The total cost of cultivation without salary was estimated to ₹7,03,936.04 ha^{-1}. The total costs of cultivation with salary of permanent staffs was worked out to ₹15,61,286.90 ha^{-1}. These results were at par with the study conducted by Haral and Pawar (2013).

The total gross returns from per hectare ber orchard at research farm has been calculated to be ₹11,84,735.37 ha^{-1}. From first year to third year, the net returns from the ber orchard without salary of permanent staffs were found negative and afterwards the net returns

became positive for remaining years. The total net returns without salary was ₹4,80,799.33 ha^{-1} (fig 4.7).

Per hectare net returns with salary of permanent staffs was found negative and total net returns with salary was ₹-3,76,551.53 ha^{-1} (fig.4.8). Similar results were reported by Bhong *et al.* (2019) in the study of economics of ber orchard and Raj Kumar *et al.* (2019) also estimated in the mango orchard cultivation.

Table 4.3 Total costs of ber orchard at Research farm during the period 2010 to 2029

S. No	Particulars	Cost (₹/ha)	Percentage of total cost without salary (%)	Percentage of total cost with salary (%)
A	**Variable costs**			
1.	Land preparation	8000.00	1.14	0.51
2.	Digging of pits	850.00	0.13	0.06
3.	Filling of pits	650.00	0.09	0.05
4.	Planting material	4680.00	0.66	0.30
5.	Care of plants*	15,666.21	2.23	1.00
6.	Irrigation	10,543.38	1.50	0.68
7.	Weeding and hoeing	25,487.91	3.62	1.63
8.	Training and pruning	31,417.74	4.46	2.01
9.	Manures and fertilizers	76,995.09	10.94	4.93
10.	Plant protection	39,377.66	5.59	2.52
11.	Watching charges	1,01,529.82	14.42	6.50
12.	Harvesting	27,813.27	3.95	1.78
13.	Subtotal (1 to 12)	3,43,011.08		
14.	Interest on working capital	20,580.66	2.92	1.32
	Total variable costs	3,63,591.75	**51.65**	**23.29**
B	**Fixed costs**			
1.	Interest on fixed capital	86,448.36	12.28	5.54
2.	Depreciation	16,948.88	2.41	1.09
3.	Rental value of land	2,36,947.04	33.66	15.18
4.	Salary of permanent staffs	8,57,350.87	-	54.90
	Total fixed costs			
5.	Without salary	3,40,344.28	**48.35**	-
6.	With salary	11,97,695.15	-	**76.71**
C	**Total costs**			
1.	Without salary	7,03,936.04	100	-
2.	With salary	15,61,286.90	-	100

***** Cost incurred for care of plants during establishment period included expenses on hoeing and weeding, training and pruning, plant protection, manures and fertilizers.

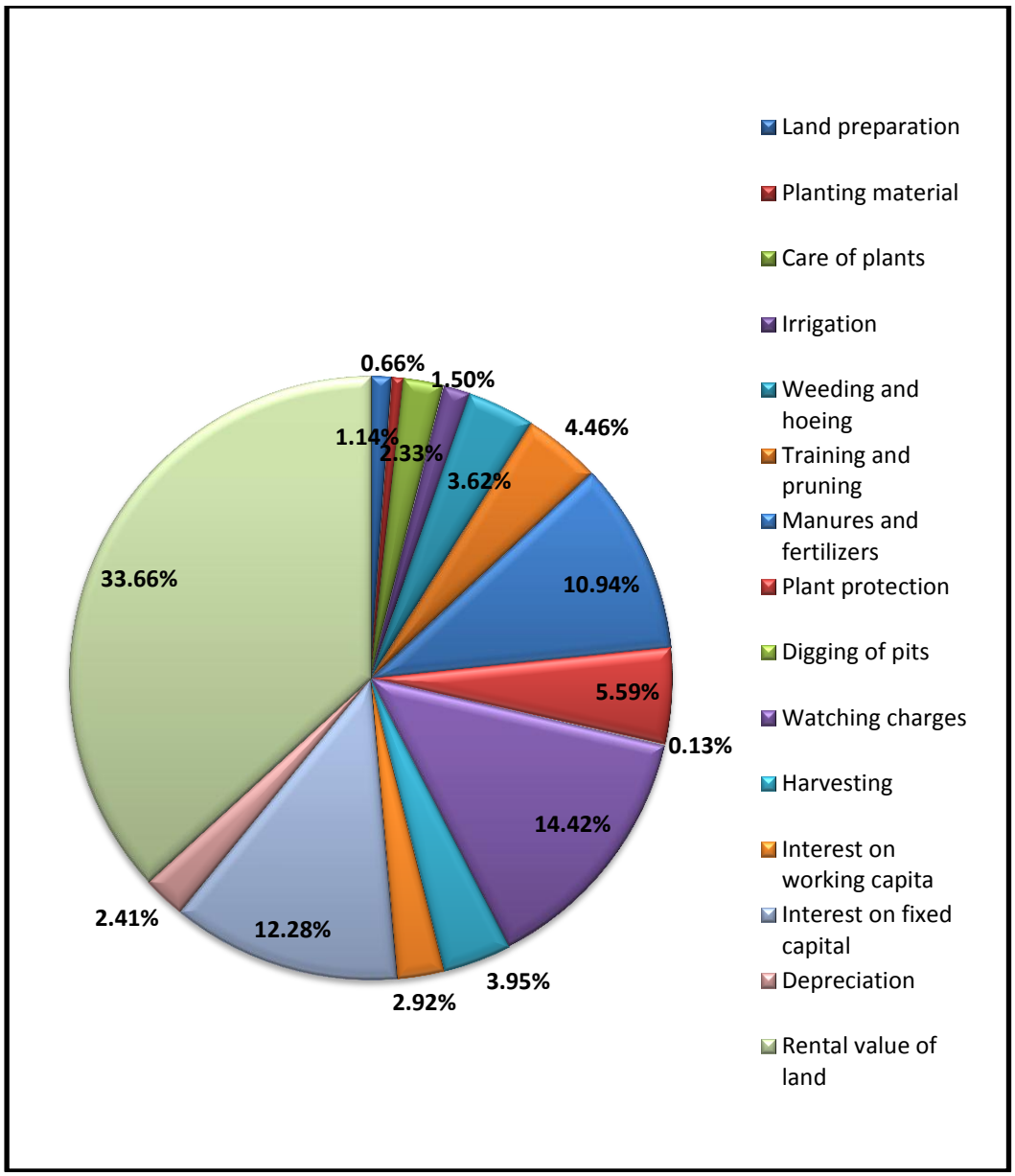

Fig. 4.5 Total costs of the ber orchard at research farm without salary of permanent staffs

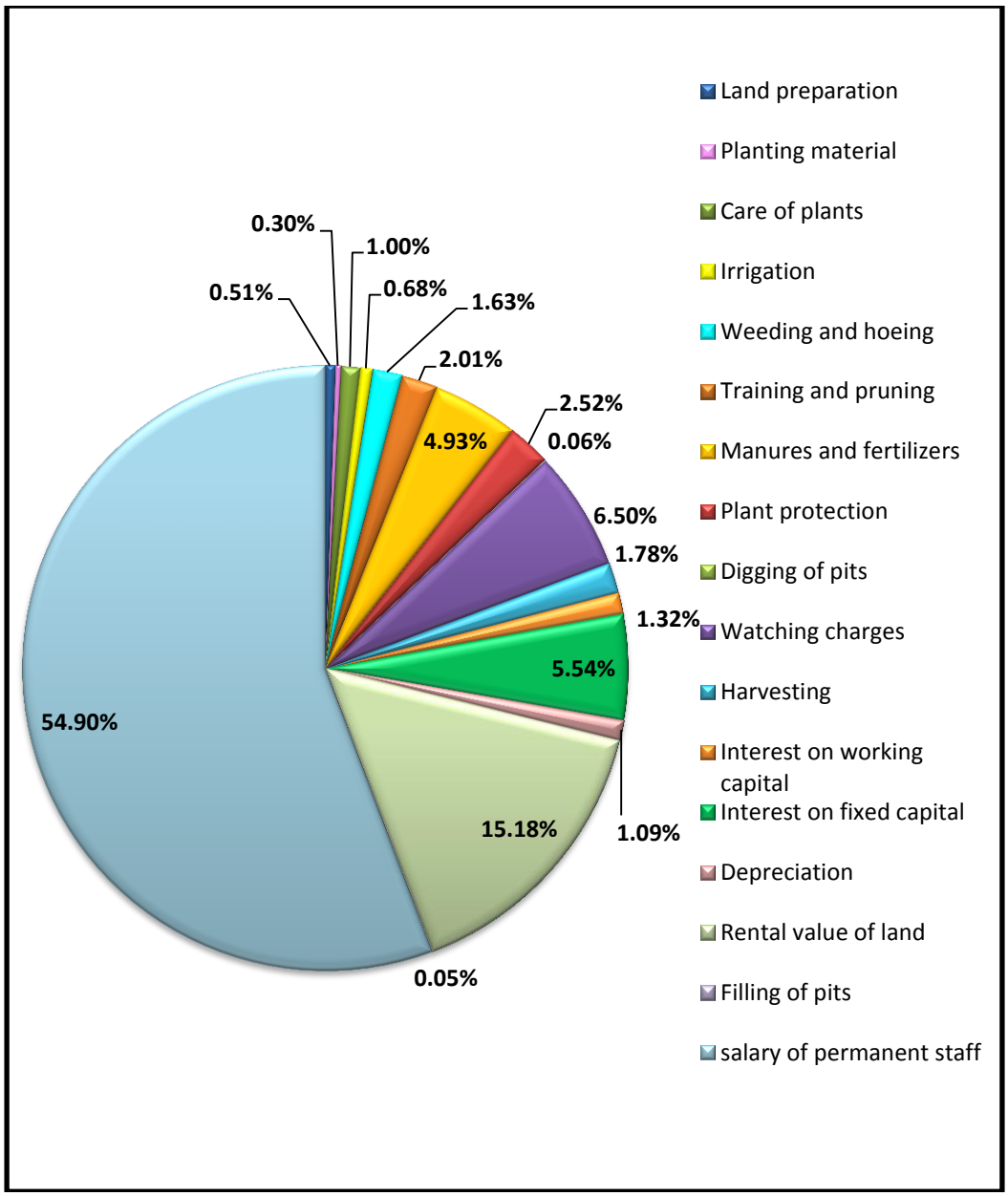

Fig. 4.6 Total costs of the ber orchard at research farm with salary of permanent staff

Table 4.4 Costs and Returns of Ber orchard at Research Farm for the period from 2010-2029*

Year	Cost of cultivation without salary (₹/ha)	Cost of cultivation with salary (₹/ha)	Gross Returns (₹/ha)	Net returns without salary (₹/ha)	Net returns with salary (₹/ha
1.	23706.37	58377.91	0	-23706.37	-58377.91
2.	9956.47	44731.72	0	-9956.47	-44731.72
3.	11916.30	47496.05	0	-11916.30	-47496.05
4.	23730.61	60586.06	24389.25	658.64	-36196.81
5.	26548.51	64813.76	33672.00	7123.49	-31141.76
6.	29394.06	68869.31	44538.90	15144.84	-24330.41
7.	34635.38	76275.93	62157.03	27521.65	-14118.90
8.	36248.60	78789.70	67718.01	31469.41	-11071.69
9.	42609.38	88244.98	92267.06	49657.68	4022.08
10.	46873.01	93136.26	109344.97	62471.96	16208.71
11.	39365.14	82394.38	87217.06	47851.92	4822.68
12.	40453.36	84179.39	87217.06	46763.70	3037.67
13.	41541.60	85964.41	87217.06	45675.46	1252.65
14.	42629.82	87749.43	87217.06	44587.24	-532.37
15.	43718.05	89534.45	87217.06	43499.01	-2317.39
16.	39945.41	86458.59	62912.57	22967.16	-23546.02
17.	41033.65	88243.62	62912.57	21878.92	-25331.05
18.	42121.87	90028.63	62912.57	20790.70	-27116.06
19.	43210.11	91813.65	62912.57	19702.46	-28901.08
20.	44298.34	93598.67	62912.57	18614.23	-30686.10
Total	7,03,936.04	15,61,286.90	11,84,735.37	4,80,799.33	-3,76,551.53

*Actual costs incurred for the period from 2010-2019 and for remaining period i.e.2020-2029 cost incurred were estimated through extrapolation method. Actual returns were found out for the period from 2010-2019 and for remaining period returns were found out through assumption.

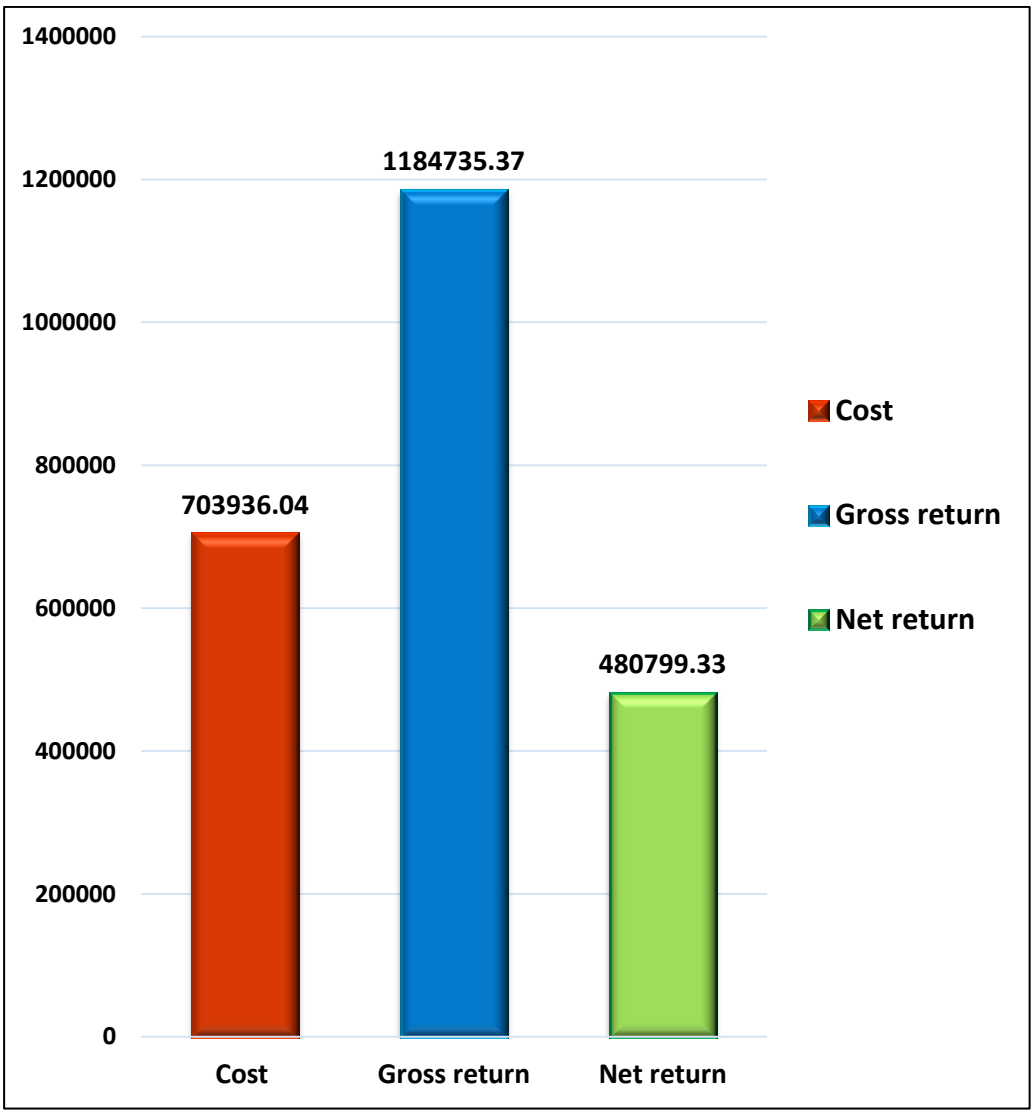

Fig.4.7 Costs and returns from the ber orchard at research farm without salary of permanent staffs

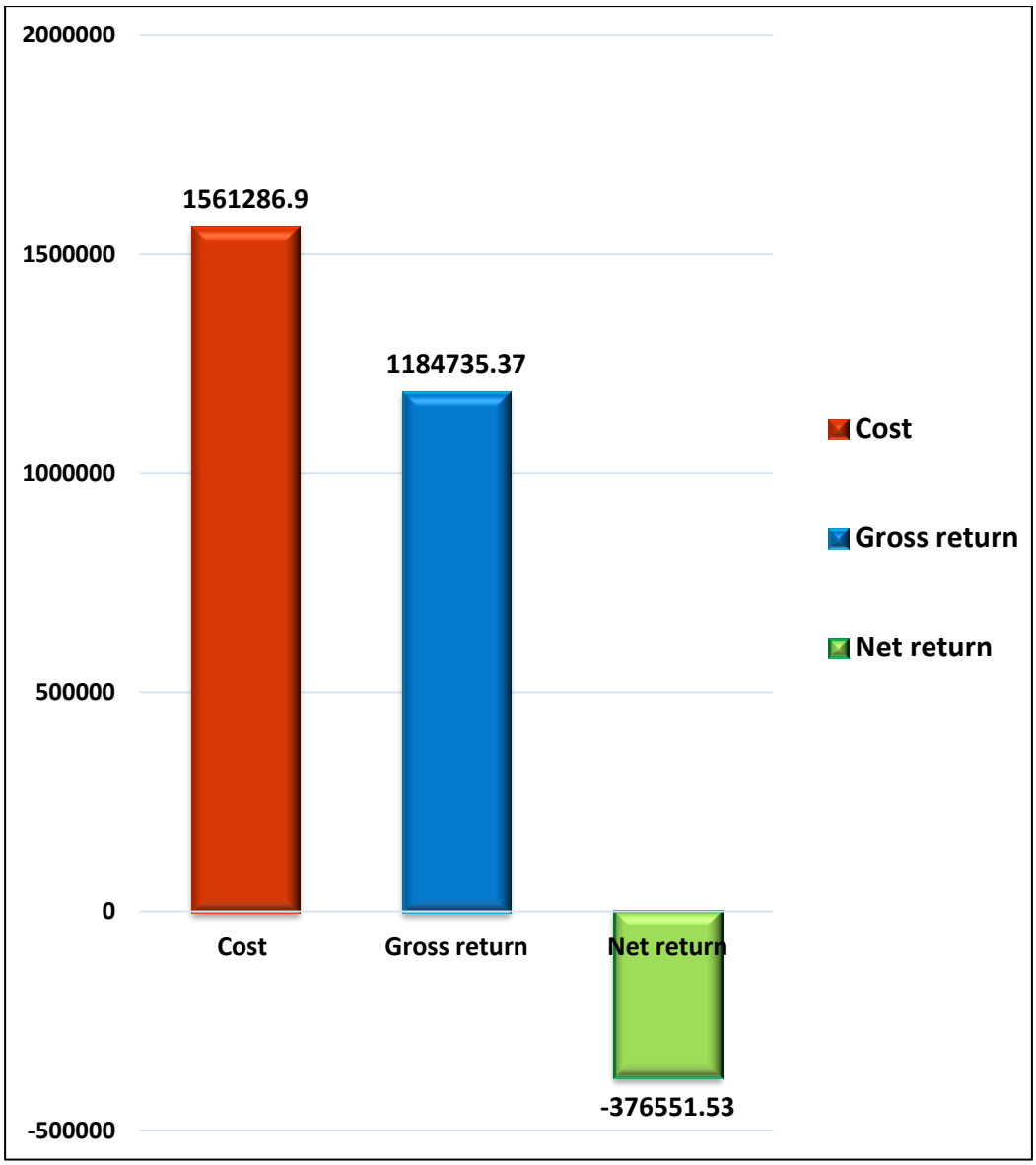

Fig.4.8 Costs and returns from the ber orchard at research farm with salary of permanent staffs

Section-2

4.2 Economic feasibility of investment in ber cultivation.

For estimating the economic feasibility of the project requiring higher investment, economic evaluation is objectively crucial. The investment analysis will support in deciding the investment made on ber orchard or not. Because an orchard crop generally requires a high initial investment and maintenance cost. This investment demands for the essential to measure the profits from the ber orchard and also assess the economic viability of that investment. So, the economic feasibility test of the ber orchard was intended to provide the assistance for decision making in the investment of ber orchard. In order to evaluate the capital efficiency for ber orchard at research farm, the costs and benefits were discounted at the interest rate of 12 per cent per annum, the prevailing rate of interest. To determine the economic feasibility of ber orchard at research farm, following discounted and undiscounted measures were used *viz.,*

4.2.1 Net Present Worth (NPW)

4.2.2 Discounted Benefit Cost Ratio (BCR)

4.2.3 Internal Rate of Return (IRR)

4.2.4 Payback Period (PBP)

The results of these measures was explained in a detailed manner are deliberated below.

4.2.1 Net Present Worth

The net present worth is the difference between the discounted values of cash inflows (returns) and outflows (costs) over the economic life period of the ber orchards. Table 4.5 shows the total discounted cash outflow or costs of ber orchard at research farm without and with salary of permanent staffs and estimated to ₹2,18,896.90 ha^{-1} and ₹5,18,229.15 ha^{-1} at 12 per cent discount rate, respectively. The discounted gross returns from ber orchard at research farm was

worked out to be ₹3,23,777.07 ha^{-1} at 12 per cent discount rate, it was same for both without and with salary of permanent staffs.

Net present worth of the ber orchard at research farm without salary of permanent staffs was positive and worked out to be ₹1,04,880.18 ha^{-1}, it was represented that the ber orchard cultivation was profitable project in the study area. Net present worth of ber orchard with salary of permanent staffs was found to be negative i.e. ₹-1,94,452.08 ha^{-1}. Discounted net returns are also called as net present worth. Annuity of NPW without salary of permanent staffs was worked out to ₹14,035.06 per annum/ha and found positive. Annuity of NPW with salary of permanent staffs was found negative i.e. ₹-26,021.58 per annum/ha. These results were similar to the net present worth observed by Pawan *et al.* (2002) in the ber orchard. Surwase *et al.* (2015) observed that NPV of the sapota cultivation was positive. Comparable findings were made by Lokappa *et al.* (2018) in the financial feasibility of fig cultivation. Similar results were reported by Rede and Bhattacharyya (2018) in their study about financial feasibility analysis of pomegranate orchard. Therefore, ber orchard cultivation was economically viable and worthiness.

4.2.2 Discounted Benefit Cost Ratio (BCR)

The discounted benefit-cost ratio was a measure for the benefits per unit cost or per rupee of an investment in the ber orchard. It was the ratio that discounted gross returns to discounted costs during the economic lifetime of the ber orchard. The benefit-cost ratio was used for determining the feasibility of ber orchard cultivation.

Table 4.6 illustrate that according to the data collected from ber orchard at research farm, discounted gross benefit cost ratio was calculated as 1.48 and 0.62 without and with salary of permanent staffs at 12 per cent discount rate, respectively. It was more than one when the salary of permanent staffs was not accounted in cost of cultivation. Discounted net benefit cost ratio was calculated as 0.48 and -0.38

without and with salary of permanent staffs at 12 per cent discount rate, respectively. These results were similar to the findings made by Pawan *et al.* (2002). He reported that benefit cost ratio of ber orchard was 1.22 and it was economically profitable cultivation. Thorat and Shelke (2012) found that the benefit cost ratio of ber orchard cultivation was 1.57 which described the economic soundness. Gadekar and Hilli (2018) stated that the BC ratio of the ber orchard was 1.76. Bhong *et al.* (2019) reported that the benefit cost ratio of ber cultivation was 1.74, it designated the economic worthiness. Sahana *et al.* (2017) reported that BC ratio was 1.87 in the pomegranate orchard and it was profitable. Hence, from these results, it could be determine that the cultivation of ber was economically feasible.

4.2.3 Internal Rate of Return (IRR)

One more method for computing the productivity of a project is the valuations of the internal rate of return i.e. yield of the project. This is a discount rate at which net present worth of the capital expenses is equal to the capital earnings is called as internal rate of return and net present worth is equivalent to the zero. IRR ought to be more than prevalent rate of the interest. The internal rate of return represents the earning capacity of the investment of the project.

IRR have taken into account the time value of money. Table 4.6 depicts the IRR. The IRR was computed to 31.41 per cent of ber orchard at research farm when salary of the permanent staffs was not included into the cost of cultivation. This IRR was higher than the prevailing rate of interest i.e. 12 per cent. The IRR was negative when the salary of the permanent staffs was taken into account. The results of study were found similar with study conducted by Pawan *et al.* (2002), Singh *et al.* (2016) and Zore *et al.* (2019). These all indicated the economic worthiness of the ber cultivation. Thus, from the results of the present study, it could infer that the ber orchard cultivation was financially feasible.

4.2.4 Payback Period (PBP)

The length of time period required to cover initial investment of the project is called as a payback period. It must be lesser for economic soundness of the investment. It indicates the number of years taken for equals the net returns to initial investment of the ber orchard cultivation. The table 4.4 reveals that the net costs incurred for the first three years of the ber orchard (without salary of permanent staffs) were ₹23,706.37 ha^{-1}, ₹9956.47 ha^{-1} and ₹11,916.30 ha^{-1}, respectively. The net returns from the ber orchard at fourth, fifth, sixth and seventh years were ₹658.64 ha^{-1}, ₹7123.49 ha^{-1}, ₹15144.84 ha^{-1} and ₹27521.65 ha^{-1}, respectively. The returns have been more than the costs during the seventh year. Therefore, payback period of the ber orchard was 7 years when the salary of the permanent staffs worked in the research farm was not taken into account. There was no payback period when considered the salary of permanent staffs. Similar findings were observed by Singh and Singh (1997) and they reported that the payback period of the ber orchard was 5 years and Pawan *et al.* (2002) reported the payback period of 7 years for ber orchard. These outcomes indicated that the cultivation of the ber crop was profitable and also financially viable one.

Table 4.5 Discounted benefit cost ratio and net present worth of ber orchard at research farm

Year	Cost of cultivation without salary (₹/ha)	Cost of cultivation with salary (₹/ha)	Gross Returns (₹/ha)	Discounted cost at 12% discounted rate (without salary)	Discounted cost at 12% discounted rate (with salary)	Discounted gross returns at 12% discounted rate	Discounted net return at 12% discounted rate (without salary)	Discounted net return at 12% discounted rate (with salary)
1	23706.37	58377.91	0	21166.40	52123.13	0.00	-21166.40	-52123.13
2	9956.47	44731.72	0	7937.24	35659.85	0.00	-7937.24	-35659.85
3	11916.30	47496.05	0	8481.79	33806.75	0.00	-8481.79	-33806.75
4	23730.61	60586.06	24389.25	15081.23	38503.54	15499.81	418.58	-23003.73
5	26548.51	64813.76	33672.00	15064.34	36777.07	19106.40	4042.06	-17670.67
6	29394.06	68869.31	44538.90	14891.95	34891.34	22564.79	7672.85	-12326.54
7	34635.38	76275.93	62157.03	15667.29	34503.36	28116.68	12449.40	-6386.67
8	36248.60	78789.70	67718.01	14640.20	31821.84	27350.17	12709.97	-4471.67

9	42609.38	88244.98	92267.06	15365.37	31822.02	33272.43	17907.06	1450.40
10	46873.01	93136.26	109344.97	15091.85	29987.38	35206.15	20114.30	5218.77
11	39365.14	82394.38	87217.06	11316.54	23686.42	25072.82	13756.28	1386.41
12	40453.36	84179.39	87217.06	10383.37	21606.75	22386.45	12003.08	779.69
13	41541.60	85964.41	87217.06	9520.26	19700.82	19987.90	10467.64	287.08
14	42629.82	87749.43	87217.06	8722.91	17955.27	17846.34	9123.43	-108.93
15	43718.05	89534.45	87217.06	7987.12	16357.61	15934.23	7947.11	-423.38
16	39945.41	86458.59	62912.57	6515.96	14103.27	10262.40	3746.44	-3840.87
17	41033.65	88243.62	62912.57	5976.32	12852.18	9162.86	3186.54	-3689.32
18	42121.87	90028.63	62912.57	5477.51	11707.29	8181.12	2703.61	-3526.16
19	43210.11	91813.65	62912.57	5016.99	10660.19	7304.58	2287.59	-3355.61
20	44298.34	93598.67	62912.57	4592.27	9703.07	6521.94	1929.68	-3181.13
Total	7,03,936.04	15,61,286.90	11,84,735.37	2,18,896.90	5,18,229.15	3,23,777.07	1,04,880.18	-1,94,452.08

Table 4.6 Financial feasibility of ber cultivation in research farm

S.no	Parameters of evaluation technique	Unit	Without salary	With salary
1.	Discounted costs	₹/ha	2,18,896.90	5,18,229.15
2.	Discounted gross returns	₹/ha	3,23,777.07	3,23,777.07
3.	Discounted Net Returns	₹/ha	1,04,880.18	-1,94,452.08
4.	Net Present Worth (NPW)	₹/ha	1,04,880.18	-1,94,452.08
5.	Annuity of NPW	₹/annum/ha	14,035.06	- 26,021.58
6.	Discounted Gross Benefit Cost Ratio	-	1.48	0.62
7.	Discounted Net Benefit Cost Ratio	-	0.48	-0.38
8.	Internal Rate of Return (IRR)	%	31.41	Negative
9.	Payback Period (PBP)	Years	7	No

Section-3

4.3 Problems in the production of ber at research farm

An effort has been made to observe the constraints in the production of ber. Even though the cultivation of ber was profitable, it was having number of the constraints in the production. These glitches are making retreat of strengthening the ber orchard. Occurrence of constraints in the ber orchard was scrutinizing by classified into three streams i.e. highly severe, moderately severe and less severe. The problems were further divided into four categories *viz.,* technical, economic, infrastructural and social constraints. The present study revealed that the following constraints in the ber cultivation were in the study area.

4.3.1 Technical constraints

In technical constraints, following were highly severe constraints i.e. “exhaustion of essential nutrients from soils”, “problems of pest and disease especially whitefly and powdery mildew” and “birds (parrot) were causes the intense damages to the fruits”. Moderately severe constraints were “problem fruit drop” and “sturdy wind storms caused the damage to the branches and affected the fruit growth of the ber plants”. Less severe constraints were “intercultural operation complications”, “irregular flowering of ber”, “lack of irrigation facility”, “scarce planting material accessibility at nurseries”, “difficulty in safeguard the plant from adverse climatic condition like frost, drought and rainfall” and “shedding of flowers”. These results were similar to the study conducted by Jajoria and Pradeep (2018) and Golappanavar *et al.* (2016) in mango orchards.

4.2.3 Economic constraints

In economic constraints, highly severe constraints were, “at initial stages, protection of plants from pests and diseases are costly” and “high labour cost”. Moderately severe constraints were “availability

of irrigation water was costly", "improved variety planting material wastoo costly", "fertilizer cost was high" and "ber plants provide fruits for short period". Less severe constraints were "production of fruit was low", "fruit quality was low", "no timely sale of product" and "ber fetches low prices". The constraints observed in the present study were par with the study carried out by Thorat and Shelke (2012) in ber orchard and Ratnam Setu *et al*. (2018) in guava production.

4.3.3 Infrastructural constraints

The infrastructural constraints were less severe in study area; they were "skilled and unskilled labour supply was less", "quality of irrigation water was poor" and "transportation facility". There were no highly and moderately severe infrastructural constraints. Similar constraints were reported in the study of ber orchard by Bhong *et al.* (2019) and in Kaysar *et al*. (2019) noticed in papaya cultivation.

4.3.4 Social constraints

In social constraints "fright of steals and stray animals", "social restraint for ber cultivation" and "low intake tendency of ber" were found less severe. There were no moderate and highly severe social constraints. The results obtained from the study were similar to constraints reported by Jajoria, Meenakshi (2018) in aonla cultivation and Sohi *et al.* (2018) observed in kinnow orchard of Punjab.

Table- 4.7 Problems in the production of ber at research farm

S.no	Constraints	Highly severe	Moderately severe	Less severe
1.	Technical constraints	i) Exhaustion of essential nutrients from soils ii) Problems of pest and disease especially whitefly and powdery mildew iii) Birds (parrot) were causes the intense damages to the fruits	i) Problem fruit drop ii) Sturdy wind storms caused the damage to the branches and affected the fruit growth of the ber plants	i) Intercultural operation complications ii) Irregular flowering of ber iii) Lack of irrigation facility iv) Scarce planting material accessibility at nurseries v) Difficulty in safeguard the plant from adverse climatic condition like frost, drought and rainfall vi) Shedding of flowers

2.	Economic constraints	i) At initial stages, protection of plants from pests and diseases are costly ii) High labour cost	i) Availability of irrigation water was costly ii) Improved variety planting material wastoo costly iii) Fertilizer cost was high iv) Ber plants provide fruits for short period	i) Production of fruit was low ii) Fruit quality was low iii) No timely sale of products iv) Ber fetches low prices
3.	Infrastructural constraints	-	-	i) Skilled and unskilled labour supply was less ii) Quality of irrigation water was poor iii) Transportation facility
4.	Social constraints	-	-	i) Fright of steals and stray animals ii) Social restraint for ber cultivation iii) Low intake tendency of ber

Summary, Conclusions & Policy Recommendations

CHAPTER - 5
SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

In this chapter, the summary of the appropriate results made during the research process and conclusions of the study with their recommendations have been deliberated.

5.1 Introduction

Agriculture is the most important sector of Indian economy. Contribution of agriculture and allied sector to the national GDP is 17.2% (Anonymous 2017-18) and provides employment to the 50% of the Indian labour force. Ber is most common and ancient fruit of Indo-china region.The ber fruits contain significant amount of Vitamin C, A and B complex.In general, the ber fruit per 100 gm contains 22 gm of sugar, 1.3 gm of fibre and 0.2 gm of fat with a calorific value of 104 (Morton, 1987). Ber fruits are known as poor man's fruit.

The present study was conducted in research farm at Shri Karan Narendra College of Agriculture, Jobner. This orchard was established during the year 2010. Total area under ber orchard was one hectare. The total number plants in the orchard were 156. In research farm gola ber variety was used for cultivation.

India stands first among the ber growing countries of the world. In India total area under the ber cultivation was 50,000 hectares with an annual production of 5,13,000 metric tonnes with productivity of 10260 kg /ha. Gujarat, Haryana, Punjab, Uttar Pradesh, Rajasthan, Madhya Pradesh, Bihar, Maharashtra, Andhra Pradesh and Tamil Nadu were the major ber growing states of India (Anonymous 2017-18).

The major ber growing districts of Rajasthan were Bharatpur, Alwar, Barmer, Sri Ganganagar, Jodhpur, Jaipur, Pali, Chittor and Hanumangarh. In Rajasthan total area under ber cultivation was 738.4

hectares with an average production of 5248 metric tonnes with productivity 7108 kg/ha (Anonymous 2017-18).

The cultivation of ber could play a vital role in improving the rural economy. The fruits are occupying a vital place in agricultural exports of our country. Therefore fruits earn foreign exchange. An economic analysis of agricultural crops at research farm assumed tremendous importance in the transforming circumstances of traditional agricultural practices to scientific agriculture. This study on the economics of ber production will provide the basis for farmers to make investment decisions.

5.2 Objectives

The present study titled **"Economics of Ber orchard at Shri Karan Narendra College of Agriculture, Jobner – A Case Study"** was conducted with the following main objectives;

1. To study the cost structure of ber orchard.
2. To evaluate the economic feasibility of investment in ber cultivation.
3. To identify the problems in the production of ber.

The first objective of the present study was investigated that the cost structure of the ber orchard.

The next objective has been tried to measure the profitability of the ber orchard by using various evaluation techniques.

The final objectives was found that major constraints in the production of ber. These measures are used for evade the production problems in the future.

5.3 Methodology

The various sources of journals were reviewed for the methodology to achieve the objectives of the present study**.** The study has been carried out in the research farm at SKN College of Agriculture. By using systematically arranged schedules, the data required for the study were collected from the research farm through

personal interview with farm manager. The financial feasibility of the ber orchard has been evaluated with the assistance of the Net Present Worth (NPW), Benefit Cost Ratio (BCR), Internal Rate of Return (IRR) and Payback period (PBP). The problems in the production of ber was assessed by three categories *viz.,* highly severe, moderately severe and less severe.

5.4 Results and Discussion

The final result of the present study was deliberated under the following sub headings.

5.4.1 The Cost structure of the ber orchard establishment

A. Establishment costs of the ber orchard

The total establishment costs i.e. for initial three years of ber orchard without salary of permanent staffs were ₹45,579.14 ha^{-1}. The total variable costs occurred within the farm was ₹32,691.04 ha^{-1} (71.73 per cent without salary). The total fixed costs arisen was ₹12,888.10 ha^{-1} (28.27 per cent without salary). Total establishment costs of ber orchard included with salary of permanent staffs at research farm was ₹1,50,605.68 ha^{-1}. The total variable costsand total fixed costs occurred within the farm were 21.71 per cent and 78.29 per cent with salary of permanent staffs, respectively.

B. Maintenance costs of the ber orchard

The total maintenance costs i.e. for remaining life of ber cultivation without salary of permanent staffs was worked out as ₹6,58,356.89 ha^{-1}. The totalvariable costs accounted to be ₹3,30,900.71 ha^{-1} (50.27 per cent without salary). The total fixed costs was worked out to be ₹3,27,456.18 ha^{-1} (49.73 per cent without salary). The total maintenance costs of ber orchard at research farm with salary of permanent staffs was worked out as ₹14,10,681.21 ha^{-1}. The total variable costs and total fixed costs were accounted to be 23.46 per cent and 76.54 per cent with salary of permanent staffs, respectively.

C. Total costs of the ber orchard

The total costs for whole ber life i.e. for 20 years without and with salary of permanent staffs were estimated as ₹7,03,936.04 ha^{-1} and ₹15,61,286.90 ha^{-1} respectively.The total variable costs and fixed costs without salary of permanent staffs were accounted for ₹3,63,591.75 ha^{-1} (51.65 per cent) and ₹3,40,344.28 ha^{-1} (48.35 per cent) of the total costs of the ber orchard, respectively. The total variable costs and fixed costs with salary of permanent staffs were estimated to be 23.29 per cent and 76.71 per cent with salary, respectively.

D. The costs and returns analysis of ber orchard at research farm

The total costs for whole ber life i.e. for 20 years without and with salary of permanent staffs were estimated as ₹7,03,936.04 ha^{-1} and ₹15,61,286.90 ha^{-1}, respectively. The total gross returns from per hectare ber orchard at research farm has been calculated to be ₹11,84,735.37 ha^{-1}. The total net returns without salary ₹4,80,799.33 ha^{-1}. Per hectare net returns with salary of permanent staffs was negative and total net returns with salary was ₹-3,76,551.53 ha^{-1}.

5.4.2 Economic feasibility of investment in ber cultivation

A. Net Present Worth

Net Present Worth (NPW) of the ber orchard at research farm without and with salary of permanent staffs were worked out to ₹1,04,880.18 ha^{-1} and ₹-1,94,452.08 ha^{-1}, respectively. Annuity of NPW of ber cultivation was found out with ₹14,035.06 and ₹- 26,021.58 per annum/ha without and with salary of permanent staffs, respectively.

B. Discounted Benefit Cost Ratio (BCR)

Discounted Gross BC ratio of the ber orchard at research farm was calculated as 1.48 and 0.62 without and with salary of permanent staffs at 12 per cent discount rate, respectively. Discounted Net BC

ratio was calculated as 0.48 and -0.38 without and with salary of permanent staffs at 12 per cent discount rate, respectively. Hence, from these results we could determine that the cultivation of ber was economically feasible.

C. Internal Rate of Return (IRR)

The IRR was computed to be 31.41 per cent of ber orchard at research farm when salary of the permanent staffs was not included into the cost of cultivation. This was indicated that the economic worthiness of the ber cultivation. The IRR was negative when the salary of the permanent staffs was taken into account.

D. Payback Period (PBP)

The payback period of the ber orchard was 7 years when the salary of the permanent staffs worked in the research farm was not taken into account. There was no payback period when considering the salary of permanent staffs. These outcomes indicated that the cultivation of the ber crop was profitable.

5.4.3 Problems in the production of ber at research farm

The problems were divided into four categories *viz.,* technical, economic, infrastructural and social constraints.

In technical constraints, highly severe constraints were, “exhaustion of essential nutrients from soils”, “problems of pest and disease especially whitefly andpowdery mildew” and “birds (parrot) were causes the intense damages to the fruits”.

In economic constraints, highly severe constraints were, “at initial stages, protection of plants from pests and diseases are costly” and “high labour cost”. Moderately severe constraints were “availability of irrigation water was costly” and “fertilizer cost was high”.

The infrastructural constraints were less severe in study area; they were “skilled and unskilled labour supply was less" and “transportation facility”.

In social constraints, “fright of steals and stray animals”, “social restraint for ber cultivation” and “low intake tendency of ber” were found less severe.

5.5 Conclusions

The following conclusions were drawn based on the study

1. The total costs incurred for ber orchard cultivation in the research farm at Shri Karan Narendra College of Agriculture, Jobner, was estimated as ₹7,03,936.04 ha^{-1} and ₹15,61,286.90 ha^{-1}, without and with salary of permanent staffs, respectively.
2. The total gross returns from per hectare ber orchard at research farm has been calculated to be ₹11,84,735.37 ha^{-1}, it was same for both without and with salary of permanent staffs.
3. The total net returns from per hectare ber orchard at research farm was ₹4,80,799.33 ha^{-1} without salary. Per hectare net returns of the ber orchard at research farm, with salary of permanent staffs was ₹**-**3,76,551.53 ha^{-1} and found negative.
4. Net Present Worth (NPW) of the ber orchard at research farm without and with salary of permanent staffs were worked out to ₹1,04,880.18 ha^{-1} and ₹-1,94,452.08 ha^{-1}, respectively. Annuity of NPW of ber cultivation was found out with ₹14,035.06 and ₹-26,021.58 per annum/ha without and with salary of permanent staffs, respectively.
5. Discounted gross benefit cost ratio of the ber orchard at research farm was calculated as 1.48 and 0.62 without and with salary of permanent staffs, respectively. Discountednet benefit cost ratio of the ber orchard at research farm was calculated as 0.48 and - 0.38 without and with salary of permanent staffs, respectively.
6. IRR was computed as 31.41 per cent of ber orchard at research farm when salary of the permanent staffs was not included into

the cost of cultivation. The IRR was negative when the salary of the permanent staffs was taken into account.

7. The payback period of the ber orchard was 7 years when the salary of the permanent staffs worked in the research farm was not taken into account. There was no payback period while considering the salary of permanent staffs.
8. In technical constraints, highly severe constraints were, “exhaustion of essential nutrients from soils”, “problems of pest and disease especially whitefly andpowdery mildew” and “birds (parrot) were causes the intense damages to the fruits”.
9. In economic constraints, highly severe constraints were, “at initial stages, protection of plants from pests and diseases are costly” and “high labour cost”.
10. The infrastructural constraints were less severe in study area; they are “skilled and unskilled labour supply was less", “quality of irrigation water was poor” and “transportation facility”.
11. In social constraints, “fright of steals and stray animals”, “social restraint for ber cultivation” and “low intake tendency of ber” were found less severe.

5.6 Policy Recommendations

Taking this into account, the following measures and policies were advocated.

1. Net present worth of the ber orchardwithout permanent staffs at research farm was positive, it represented that the ber orchard cultivation was profitable project. So, farmers may go for ber cultivation.
2. Discounted gross benefit cost ratio of the ber orchard without permanent staffs at research farm was found more than one. Therefore, the farmers may be encouraged to take ber orchard cultivation.

3. IRR of the ber orchard without permanent staffs at research farm was found higher than the prevailing rate of interest i.e. 12 per cent. Thus, the cultivation of ber orchard was found economically feasible project. So, farmers may invest in ber orchard cultivation rather than any other project.
4. Major problem observed in the study area was pest and disease, the integrated pest management and integrated disease management may be adopted to tackle this situation.

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APPENDICES

APPENDIX- I

Cost of cultivation of ber orchard at research farm (₹/ha)

Age of Orchard	Land Preparation	Digging of Pits	Filling of Pits	Planting Material	Care of Plants	Weeding & Hoeing	Irrigation	Training& Pruning	Manures &Fertilizers	Plant Protection	Watching Charges	Harvesting Charges	Interest on working capital	Total Variable cost
1	8000.00	850.00	650.00	4680.00	3894.92	0	312.53	0	0	0	0	0	1103.25	19490.70
2	0	0	0	0	5091.03	0	324.82	0	0	0	0	0	324.95	5740.80
3	0	0	0	0	6680.26	0	357.04	0	0	0	0	0	422.24	7459.54
4	0	0	0	0	0	1087.58	427.54	1248.56	3525.49	1427.14	4569.84	1294.98	814.87	14396.00
5	0	0	0	0	0	1125.53	472.86	1326.2	3648.53	1731.75	4783.45	1399.75	869.28	15357.35
6	0	0	0	0	0	1125.92	495.60	1419.77	3891.75	1952.21	4827.52	1409.42	907.33	16029.52
7	0	0	0	0	0	1249.75	519.71	1492.57	4102.62	2245.58	5372.25	1485.87	988.10	17456.45
8	0	0	0	0	0	1298.58	526.57	1583.38	4126.87	2298.32	5592.65	1514.65	1016.46	17957.48
9	0	0	0	0	0	1347.24	558.4	1886.72	4282.62	2325.69	5739.72	1537.45	1060.67	18738.51
10	0	0	0	0	0	1585.31	586.26	1914.63	4397.09	2198.32	5815.28	1565.45	1083.74	19146.08
11	0	0	0	0	0	1289.2	529.98	1587.26	3875.82	1979.81	5111.67	1398.99	946.36	16719.10
12	0	0	0	0	0	1373.11	544.70	1691.11	4103.86	2099.82	5416.39	1479.34	1002.50	17710.83
13	0	0	0	0	0	1457.02	559.42	1794.96	4331.9	2219.83	5721.11	1559.69	1058.64	18702.57
14	0	0	0	0	0	1540.93	574.13	1898.81	4559.95	2339.85	6025.83	1640.04	1114.77	19694.31
15	0	0	0	0	0	1624.84	588.85	2002.66	4787.99	2459.86	6330.55	1720.39	1170.91	20686.05
16	0	0	0	0	0	1708.76	603.56	2106.52	5016.03	2579.87	6635.27	1800.75	1227.05	21677.81
17	0	0	0	0	0	1792.67	618.28	2210.37	5244.08	2699.88	6939.99	1881.1	1283.18	22669.56
18	0	0	0	0	0	1876.58	633.00	2314.22	5472.12	2819.90	7244.71	1961.45	1339.32	23661.29
19	0	0	0	0	0	1960.49	647.71	2418.07	5700.16	2939.91	7549.43	2041.8	1395.45	24653.03
20	0	0	0	0	0	2044.4	662.43	2521.93	5928.21	3059.92	7854.15	2122.15	1451.59	25644.78
Total	8000.00	850.00	650.00	4680.00	15666.21	25487.91	10543.38	31417.74	76995.09	39377.66	101529.82	27813.27	20580.66	363591.75

Age of orchard	Interest on fixed capital	Depreciation	Rental value of land	Salary of permanent staffs	Total fixed cost without salary	Total fixed cost with salary	Total cost without Salary	Total cost with salary	Production (Kg/ha)	Gross returns
1	3524.58	691.09	0	34671.54	4215.67	38887.21	23706.37	58377.91	0	0
2	3524.58	691.09	0	34775.25	4215.67	38990.92	9956.47	44731.72	0	0
3	3726.45	730.31	0	35579.75	4456.76	40036.51	11916.30	47496.05	0	0
4	3726.45	730.31	4877.85	36855.45	9334.61	46190.06	23730.61	60586.06	786.75	24389.25
5	3726.45	730.31	6734.40	38265.25	11191.16	49456.41	26548.51	64813.76	1052.25	33672.00
6	3726.45	730.31	8907.78	39475.25	13364.54	52839.79	29394.06	68869.31	1272.54	44538.90
7	3969.24	778.28	12431.41	41640.55	17178.93	58819.48	34635.38	76275.93	1593.77	62157.03
8	3969.24	778.28	13543.60	42541.10	18291.12	60832.22	36248.60	78789.70	1714.38	67718.01
9	4529.35	888.11	18453.41	45635.60	23870.87	69506.47	42609.38	88244.98	2087.49	92267.06
10	4897.62	960.32	21868.99	46263.25	27726.93	73990.18	46873.01	93136.26	2231.53	109344.97
11	4349.81	852.82	17443.41	43029.24	22646.04	65675.28	39365.14	82394.38	1779.94	87217.06
12	4430.47	868.65	17443.41	43726.03	22742.53	66468.56	40453.36	84179.39	1779.94	87217.06
13	4511.14	884.48	17443.41	44422.82	22839.03	67261.84	41541.60	85964.41	1779.94	87217.06
14	4591.80	900.30	17443.41	45119.61	22935.51	68055.12	42629.82	87749.43	1779.94	87217.06
15	4672.46	916.13	17443.41	45816.39	23032.00	68848.40	43718.05	89534.45	1779.94	87217.06
16	4753.13	931.96	12582.51	46513.18	18267.60	64780.78	39945.41	86458.59	1283.93	62912.57
17	4833.79	947.79	12582.51	47209.97	18364.09	65574.06	41033.65	88243.62	1283.93	62912.57
18	4914.45	963.62	12582.51	47906.76	18460.58	66367.34	42121.87	90028.63	1283.93	62912.57
19	4995.12	979.45	12582.51	48603.54	18557.08	67160.62	43210.11	91813.65	1283.93	62912.57
20	5075.78	995.27	12582.51	49300.33	18653.56	67953.89	44298.34	93598.67	1283.93	62912.57
Total	86,448.36	16,948.88	2,36,947.04	8,57,350.87	3,40,344.28	11,97,695.15	7,03,936.04	15,61,286.90	26,058.06	11,84,735.37

Source of data: Horticultural farm and department of Horticulture at SKN College of Agriculture, Jobner.

APPENDIX- II

DEPARTMENT OF AGRICULTURAL ECONOMICS

SRI KARAN NADERNDRA AGRICULTURE UNIVERSITY, JOBNER

SKN College of agriculture, Jobner

Title of research**: Economics of Ber Orchard at Shri Karan Narendra College of Agriculture, Jobner – A Case Study**

Name of the investigator : Lalitha S

Reference year : 2010-2019

Date of interview :

Schedule for Research Farm to Studying the Economics of Ber

1. General Information

Name of the orchard **:**

Area under ber orchard **:**

Year of establishment **:**

Number of plants in the orchard **:**

Variety of ber **:**

Economic life period **:**

Peak yield **:**

Planting time **:**

Fruit production starts at **:**

Harvesting month **:**

Average yield per plant **:**

2. Land holding

Operational holding

S.no	Particulars	Irrigated	Unirrigated	Total	Present value (₹)

3. Irrigation

S.no	Source	Water lifting device	Time taken irrigate a hectare	Electricity or Diesel charges (₹)	Repair charges (₹)	Net Present Value of source (₹)

4. Farm building

S. no	Particulars	No.	Year of construction	Cost incurred (₹)	Expected future life	Present value (₹)
1. 2.	Farm house Pump house					

5. Farm Equipment

A. Animal /human operated

S.no	Particulars	No.	Purchased year	Cost incurred (₹)	Expected future life	Present value (₹)	Remarks
1.	Deshi plough						
2.	MB plough						
3.	Bullock						
4.	scraper						
5.	Planker						
6.	Bund former						
7.	Cultivator						
7.	Bullock cart						
8.	Sprayer/duster						
9.	Sickles/hoe						
10.	Digger						
	Others						

B. Machinery operated

S.no	Particulars	No.	Purchased year	Cost incurred (₹)	Expected future life	Present value (₹)	Remarks
1.	Tractor						
2.	Tractor trolly						
3.	MB plough						
4.	Cultivator						
5.	Leveler						
6.	Bund former						
7.	Drip irrigation/sprinkler						
8.	equipment						
9.	Electric motor						
10.	Diesel engine						
11.	Water pump						
12.	Chaff cutter						
13.	Sprayer/Duster						
	Others						

Cost incurred in raising ber orchards

Age of orchard	Variable cost										
	Land preparation	Digging of pits	Filling of pits	Planting material costs	Weeding and hoeing	Irrigation charges	Training&pruning	Manures &fertilizers	Plant protection	Watching charges	Harvesting charges
1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20.											

Age of orchard	Fixed cost		
	Interest on fixed capital	Rental value of land	Salary of permanent staffs
1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20.			

Production of ber

Age of orchard	Production (kg/plant)	Production (kg/ha)	Price (₹/kg)	Value (₹)
1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20.				

APPENDIX- III

DEPARTMENT OF AGRICULTURAL ECONOMICS

SRI KARAN NADERNDRA AGRICULTURE UNIVERSITY, JOBNER

S.K.N. College of Agriculture, Jobner

Title of the research: **Economics of Ber Orchard at Shri Karan Narendra College of Agriculture, Jobner – A Case Study**

Name of the investigator : Lalitha S

Reference year : 2010-2019

Date of interview :

Schedule for Research Farm to Study the Constraints in Production of Ber

S. No.	Technical constraints	Yes/No		
		Highly Severe	Moderately Severe	Less severe
1.	Exhaustion of the essential nutrients from the soil			
2.	Intercultural operation complications			
3.	Problems of pest and diseases			
4.	Birds are causes intense damages to The fruits			
5.	Difficulty in safeguard the plant from adverse climatic conditions like frost , drought and rainfall			

6.	Lack of irrigation facility			
7.	Scarce of planting material accessibility at nurseries			
8.	Problem of fruit drop			
9.	Irregular flowering of ber			
10.	Shedding of flowers			
11.	Sturdy wind storms causes the damage to the branches and affects the fruit growth of the ber plants			
12.	Others if any			

S. No.	**Economic constraints**	**Yes/No**		
		Highly Severe	**Moderately Severe**	**Less severe**
1.	Availability of irrigation water is costly			
2.	At initial stages, protection of plant from insects, pests and animals are very costly			
3.	Improved variety planting material is too costly			
4.	Fertilizer cost is high			
5.	Ber plants provides fruits for short period			
6.	Fruit quality is low			
7.	Production of fruits is low			

8.	High labour cost			
9.	No timely sale of product			
10.	Ber fetches low prices			

S. No.	**Infrastructural constraints**	**Yes/No**		
		Highly Severe	**Moderately Severe**	**Less severe**
1.	Skilled and unskilled labour supply is less			
2.	Quality of irrigation water is poor			
3.	Transportation facility			
4.	Others if any			

S. No.	**Social constraints**	**Yes/No**		
		Highly Severe	**Moderately Severe**	**Less severe**
1.	Fright of steals and stray animals			
2.	Social restraint for ber cultivation			
3.	Low intake tendency of ber fruits in study area			
4.	Others if any			