AN ECONOMIC ANALYSIS OF ARECANUT PRODUCTION IN MALAPPURAM DISTRICT OF KERALA

By

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CERTIFICATE

This is to certify that **Mrs. HASNA HASSAN P. P** *has satisfactorily prosecuted the course of research and that the thesis entitled* **"AN ECONOMIC ANALYSIS OF ARECANUT PRODUCTION IN MALAPPURAM DISTRICT OF KERALA"** *submitted is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination. I also certify that the thesis or part thereof has not been previously submitted by her for a degree of any university.*

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DECLARATION

I, **Mrs. HASNA HASSAN P. P.** hereby declare that the thesis entitled "**AN ECONOMIC ANALYSIS OF ARECANUT PRODUCTION IN MALAPPURAM DISTRICT OF KERALA"** is a result of the original research work done by me. I further declare that the thesis or part thereof has not been published earlier elsewhere in any manner.

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CERTIFICATE

This is to certify that the thesis entitled "**AN ECONOMIC ANALYSIS OF ARECANUT PRODUCTION IN MALAPPURAM DISTRICT OF KERALA"** submitted in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE IN AGRICULTURE** of the Acharya N G Ranga Agricultural University, Hyderabad, is a record of bonafide research work carried out by **Mrs. HASNA HASSAN P.P** under our guidance and supervision. The subject of the thesis has been approved by the student's Advisory Committee

No part of the thesis has been submitted for any other degree or diploma. The published part has been fully acknowledged. All assistance and help received during the course of investigation have been duly acknowledged by the author of the thesis.

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LIST OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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ABSTRACT

The present study entitled **"An Economic Analysis of Arecanut Production in Malappuram district of Kerala"** was intended to examine the cost structure and economic viability in the cultivation of arecanut.

Two taluks and six villages having maximum area under arecanut plantations were selected. All the arecanut growers in the selected villages were listed out and sixty farmers were selected at random. The sample so selected was subjected to post classification into pre-bearing orchards (1^{st} – 5^{th} year) and bearing orchards (6^{th} – 50^{th} year) which comprised of three stages *viz.*, yield increasing period (6^{th} – 25^{th} year), yield stabilization period

(26^{th} – 40^{th} year) and yield declining period (41^{st} – 50^{th} year). The data were collected from the selected respondents on well structured survey schedule designed for the purpose for the year 2008 – 2009. The data were analysed to fulfill the objectives by using conventional and project evaluation techniques.

The total labour requirement during economic life span (50 years) of arecanut garden stood at 14,243.43 mandays per hectare of which watch and ward, irrigation, dehusking, weeding, harvesting and intercultivation took major share of 4,100 mandays (28.79 per cent), 2,620 mandays (18.39 per cent), 1,595.52 mandays (11.20 per cent), 1,540 mandays (10.81 per cent), 1,200 mandays (8.42 per cent) and 980 mandays (6.88 per cent) respectively.

The commercial cost of cultivation (Cost C) for the life span of arecanut garden was Rs.34,52,903.35 per hectare. . The gross and net income realized for the entire economic life period were Rs.59,58,675 and Rs.25,05,771.65 per hectare respectively.

The net present value was as high as Rs.5,38,049.12 at 10 per cent and Rs. 71,810.82 at 24 per cent . The B-C ratio was 1.87 even at higher discount rate of 24 per cent. The IRR was calculated at 40 per cent. All the measure indicated the economic viability of arecanut cultivation.

CHAPTER – I

INTRODUCTION

Arecanut (*Areca catechu L.*) is an important commercial crop in India. Arecanut is the seed of the arecanut palm. It plays a prominent role in the religious, social and cultural functions and economic life of people in India. The economic produce is the fruit called betel nut. In many areas arecanuts are also known as supari. It is estimated that nearly ten million people depend on arecanut industry for their livelihood in India. The quality, variety and types of arecanut vary from one place to another.

Arecanut is one of the most important commercial crops in the South East Asia. The nut is cultivated in the palm plantations and the tree as well as the nut has a never ending list of uses like i.e. for chewing purposes, as a vegetable, as a medicine, as a stimulant, timber, fuel wood, clothing, wrapping, lubricant, tannin etc. When the nut is chewed along with the betel leaf, it increases the stimulating effect, though excessive consumption enhances the risk of cancer. Areca is taken up from the Malayan language that means ‘cluster of nuts’. The arecanut is produced in two varieties – white variety supari and red variety supari. The first variety is prepared by harvesting the fully ripe nuts and drying them in sun for around two months and the latter one is produced by harvesting the green arecanut, boiling them and then by peeling off the outer husk.

Arecanut has been cultivated as a cash crop in the Asian continent for quite a long time. Even today, the regions that produce maximum quantity of nut are the same areas where the arecanut came into existence i.e. the South East Asia. The world production of arecanut sums upto around 0.64 million tonnes from an area of 0.476 million hectares, Asian contribution being the maximum. India is the leading country in the context of production contributing to around 51 per cent of world's total production followed by China with 25 per cent share. Regarding the area under the cultivation of betel nut, the world figures have reached an approximate of around 0.476 million hectares. India again, stands tall in the list of the countries having the maximum area under betel nut cultivation with around 60 per cent of the total area covered around the world.

India dominates the world production of arecanut, producing almost half of the nuts produced in the world. It has also got the maximum area covered under the betel nut. India has an annual production figure of around 4.81 lakh tonnes during 2008-09 and the plantation is cultivated over 3,87,100 hectares in the country. Productivity wise, the country stands fourth in the world (1.243 tonnes per hectare). The states producing the maximum output of the arecanut plantation are Karnataka, Kerala, Assam, Tamil Nadu, Maharashtra, Andhra Pradesh, West Bengal and Orissa. Karnataka is the leading betel nut producing state in India involved in the production of 40 per cent of the country's produce. Kerala follows the topper on the second

place and Assam on the third place with one-fourth and one-fifth share in the total production respectively. Karnataka, Kerala and Assam are also the leaders if the area under the betel nut cultivation and productivity in India are considered. The states have an area of 1.68, 1.017, 0.74 lakh hectares respectively.

Regarding the consumption scenario in India, the country is the largest consumer of arecanut in the world. The current consumption figures have mounted upto around 3,20,000 metric tonnes. The per capita availability of arecanut in India is 1.58 grams per adult per day. A large part of the production is consumed for chewing purposes and used in the industries that involve production of quids and other processed forms of nut.

Because of the fact that a large part of the arecanut is consumed within the country itself, the export potential of India is limited. India exports small quantities of the nut in its processed form to the neighboring countries. In 2005-06 exports were to the tune of 3,458 tonnes valued at rupees 23.31 crores. To take care of the procurement of arecanut in India an organization has been appointed since September 2002 with the name Central Arecanut and Cocoa Marketing and Processing Cooperative (CAMPCO).

In Kerala, during 2008-09, arecanut was cultivated in an area of 1,01,700 hectares with a production of 1,16,900 tonnes. Major arecanut producing districts are Malappuram, Kasargod, Kannur, Kozhikode and

Wayanad. Malappuram district ranks first in area (20,020 hectares) and second in production (15,620 tonnes) of arecanut in Kerala.

PROBLEM STATEMENT

Arecanut or betel nut is an extensively cultivated tropical palm, the nuts of which form a popular masticatory in India, the Middle East and the Far East. It is a tall-stemmed erect palm, reaching varied heights, depending upon the environmental conditions. Palm attaining a height of 30 metres are not uncommon. Arecanut is an essential ingredient of gutka and paan masala. It is consumed as a raw or ripe nut (adaka or kacha tamul), as dried ripe nut (chali supari) and as a semi- mature cut and processed varieties 'Bateldike' or 'Kalipak'. There are over 150 trade types, differing in maturity, processing conditions and varying in their taste characteristics as per market conditions prevailing at different centers of the country.

The profitability of arecanut enterprise depends upon its cost structure and income generating capacity. However, much information is not available on the economic aspects of arecanut cultivation in Kerala in general and Malappuram district in particular. So, it is felt necessary to probe into the economic aspects of arecanut production in Malappuram district of Kerala with the following specific objectives:

1. To estimate the investment required for the establishment of arecanut garden.

2. To work out the costs and returns of bearing gardens.

3. To examine the economic feasibility of investment on arecanut gardens.

4. To identify production and marketing problems and to suggest remedial measures.

SCOPE OF THE STUDY

The results of the study provide information on the investment required for establishment of arecanut plantations, cost structure, returns, economic feasibility and production and marketing problems of arecanut. This information is useful to the existing arecanut orchardists in planning for higher returns and to the new entrepreneurs who plan for the establishment of arecanut orchards. The findings of the study are also useful to the institutional financing agencies in estimating the credit requirements for arecanut orchards. It also provides information on the magnitude of employment opportunities as a result of investment in arecanut cultivation.

LIMITATIONS OF THE STUDY

Research studies conducted by individuals are always confronted with various bottlenecks and hence the present study is not an exception to such limitations. The study was confined for a particular agro-climatic region and conclusions drawn are applicable to similar areas only. Further, the primary data regarding production of arecanut were collected from respondents based on their memory recall by interview method. But utmost care had been taken

in collecting data. The study was carried out in a limited period of time and limited size of sample and hence generalization of results is not advisable.

PLAN OF THE THESIS

The thesis is presented in five chapters. In the introductory chapter, the economic importance of arecanut, objectives, scope and limitations of the study are presented. The second chapter is devoted to review the past research work done on economic aspects of arecanut and other related plantations. The third chapter deals with the sampling design, methods of collection of data and economic evaluation techniques employed. The fourth chapter presents critical analysis of results and discussions. The last chapter presents the summary and conclusions of the study.

CHAPTER – II

REVIEW OF LITERATURE

An effort has been made in this chapter to critically review the literature of the past research work done relevant to the present study. Such a review of earlier studies and past experience of specialists in the relevant field is very much helpful in providing guidelines to the present researchers and to know the strengths and weaknesses of the concepts used earlier and also to study different results obtained and the policy implication there on. Since the literature on arecanut is limitedly available, literature on some related perennial crops was also reviewed.

For better exposition, the review has been discussed under the following heads.

2.1 Studies on costs and returns

2.2 Studies on economic feasibility

2.3 Studies on problems in production and marketing

2.1 STUDIES ON COSTS AND RETURNS

Das (1984) estimated cost of production of coconut at Rs.1.10 per nut at 1982-83 factor costs, but without taking land values into consideration. When a moderate price of Rs.50,000 per hectare of land was added to

investment, the production cost has gone upto Rs.1.94 per nut. He estimated the net returns at Rs.4,200 per hectare at a farm gate price of Rs.1.50 per nut. The returns to family labour and investment per hectare of coconut garden was worked out to Rs.5,760.

Elsamma Job and Mukundan (1984) while studying the worthiness of investment in rubber plantations revealed that the total cost of cultivation till taping stage (for 7 years) was worked out to Rs.11,054 in terms of 1980-81 prices.

Naidu (1987) in his study on coffee plantations found that on an average, the cost of cultivation of coffee ranged from Rs.6,209 on old aged gardens to Rs.6,381 on middle aged gardens.

Thiam (1987) found out that the cost of production of one tonne of palm oil in Malaysia ranged from M$ 499 to M$ 575 with an average of M$ 572. The production cost was lowest for the plantation sector and highest for the land development scheme. Similar analysis carried out for Malaysia, Indonesia, Thailand and Coted Ivorie revealed that the cost of production was lowest for Malaysia (U$ 240 per hectare).

Nallathambi *et al.* (1988) in their study on production costs and returns of coconut cultivation observed that the cost of establishing one hectare of coconut garden worked out to Rs.23,804 and Rs.33,254 under rainfed and;

irrigated conditions respectively for the initial 7 years period excluding the interest on investment. The production cost for the same was estimated at Rs.1.18 and Rs.1.10 per nut respectively and respective annual net returns worked out to Rs.5,197 and Rs.8,277 per hectare.

NABARD (1988) in its project on coconut development in Quilan district of Kerala studied the per acre investment costs and maintenance costs of coconut garden and found out that the actual investment costs per acre, estimated at 1971-72 prices were Rs.5,564. The maintenance costs per year of a full developed garden worked out to be Rs.1,284 per acre (including the imputed value of family labour). During the pre-full development stage the annual cost of cultivation excluding the imputed value of family labour ranged from Rs.892 in 7th year to Rs.1,160 in 13th year. The average gross income per acre realised by sample beneficiaries of full development stage was Rs.9,900.

Thomas and Nampoothiri (1988) in their study on economics of oil palm cultivation reported that the respective cost of maintaining the plantations in rainfed and irrigated conditions was Rs.3,600 and Rs.4,200 per hectare. The gross cost of establishing one hectare of oil palm plantation upto the end of 8th year under rainfed and irrigated conditions was Rs.37,000 and Rs.50,000 respectively and respective profits stood at Rs.14,000 and Rs.33,500. The net profits were Rs.31,500 and Rs.48,700 per hectare per year during stabilized bearing period.

Srinivas (1989) in his study on economics of coconut cultivation in East Godavari district of Andhra Pradesh revealed that the cost of establishment of one hectare of coconut garden was Rs.4,692.47 in I year. The cost of maintaining one hectare of garden from II year to VI year was in the order of Rs.4,091.13, Rs.3,993.71, Rs.4,146.85, Rs.4,059.71 and Rs.4,659.00 respectively. The maintenance costs from 7th year (bearing period) onwards were Rs.6,201.37. The per hectare gross income and net income over cost stood at Rs.40,860.73 and Rs.15,152.25 respectively.

Elsamma Job and Prakash (1990) found out that the total maintenance cost per hectare of coconut was Rs.4,975. Gross returns per hectare stood at Rs.12,569 which included returns from nuts (Rs.11,680) and returns from by-products (Rs.889).

Patil and Dalvi (1990) in their study on financial appraisal of coconut plantation considered the first 6 years of orchard life as establishment period. The maintenance cost started from VII year onwards. The annual maintenance cost was Rs.6,513 per hectare and annual amortization cost was Rs.4,154.

Sivanantham *et al.* (1990) in their study on economics of cashew production in Tamilnadu worked out the average return from apple at Rs.385 per hectare in local variety. The respective gross return by sale of nuts and apples was Rs.12,110 and Rs.1,515 per hectare in the case of improved variety. The net return from the improved variety was Rs.9,229 higher than the local variety.

Srinivas (1991) calculated the total cost of establishment of cashewnut orchard in Prakasam district of Andhra Pradesh during the first year at Rs.3,588.97. About Rs.2,524.29 was incurred on labour and Rs.1,057.11 on material inputs. The cost of establishment from second to fifth year was Rs.1,582.57, Rs.1,601.24, Rs.643.72 and Rs.518.48 respectively. Maintenance cost during bearing period (from 6th year onwards) was Rs.903.48 which remained the same for every year till the end of life of the orchard. The annual share of establishment cost calculated at 15 per cent discount rate was Rs.119.62 per hectare.

Kumar (1992) in his study reported that the cost of production of oil palm to raise one hectare of plantation upto 4th year was Rs.30,000 and further revealed that the cost of maintenance per year was about Rs.6,500 per hectare.

Hiremath *et al.* (1995) while studying the role of intercrops in reducing establishment cost of lime orchards worked out cost of establishment of orchard at Rs.56,429.58 in small, Rs.49,179.62 in medium and Rs.47,143.09 in large orchards per hectare. The intercrops grown helped the farmers in reducing the establishment cost of lime orchards to the extent of 58.82 per cent in small, 53.90 per cent in medium and 46.88 per cent in large orchards.

Joshi *et al.* (1995) worked out per hectare cost of maintenance of mixed arecanut at Rs.36,444.26. The gross and net returns per hectare were Rs.54,772.08 and Rs.18,327.82 respectively.

Radhika (1995) in her study on economics of oilpalm cultivation in Andhra Pradesh concluded that the establishment cost of the crop during first year was Rs.14,286 per hectare of which the planting material accounted for highest expenditure of Rs.6,636 (44.76 per cent). The maintenance cost of oil palm orchards ranged from Rs.5,391 to Rs.7,727 per hectare of which fertilizer accounted for highest expenditure ranging from Rs.2,346 to Rs.3,400 per hectare (42 to 49 per cent).

Rangachary (1995) in his study on economic analysis of oil palm cultivation in West Godavari district of Andhra Pradesh revealed that the cost of cultivation during pre-bearing period from first year to third year was Rs.34,081.01 per hectare and average cost of cultivation for fourth year and fifth year of bearing orchard was Rs.7,009.31 per hectare per year.

Oil palm development programme in Andhra Pradesh (1995) introduced by NABARD estimated the unit cost of oil palm cultivation for a period of 4 years at Rs.38,000 per hectare including the cost of planting material.

Chinnappa and Umesh (1996) in their work on arecanut production under command area noticed that the establishment cost incurred by arecanut growers was Rs.1,50,581.98 per acre out of which Rs.28,691.56 was spent in first year itself. Variable costs accounted for 77.35 per cent while fixed costs 22.65 per cent of the establishment costs.

Motial (1996) worked out the net returns from oil palm cultivation during its life span of 25 to 30 years and revealed that it ranged from Rs.40,000 to Rs.90,000 per hectare depending upon the management of crop.

Sairam *et al.* (1997) in their study on coconut, estimated cost of cultivation of coconut based on 1995-96 prices under rainfed conditions ranged from Rs.28,600 per hectare during the first year of planting to Rs.23,450 per hectare during the stabilized bearing period. The same under irrigated condition ranged between Rs.52,650 and Rs.27,750 per hectare and the cost of production was estimated as Rs.3.30 per nut and Rs.2.60 per nut under rainfed and irrigated conditions respectively.

Korikanthimath *et al.* (1998) carried out a study for 4 years (1990-91 to 1993-94) on mixed cropping of cardamom, pepper and coorg mandarin with robusta coffee revealed that a net income of Rs.1,05,213 per hectare was realized in mixed cropping which was 3.69 times more than that of monocrop.

Sairam *et al.* (1998) worked out the per hectare cost of cultivation of rainfed coconut during the first stage as Rs.14,400, Rs.14,600 and Rs.15,100 for small, medium and large farms respectively. In second stage, the same was Rs.9,900, Rs.10,400 and Rs.11,300 for the above said farms. The respective figures for the third stage stood at Rs.15,400, Rs.16,200 and Rs.16,500. The maintenance cost of irrigated coconut was Rs.15,400, Rs.16,200 and Rs.16,500

respectively for the corresponding farms. Respective gross returns worked out to Rs.37,600, Rs.40,000 and Rs.42,500 and the net returns were Rs.11,000, Rs.12,100 and Rs.13,600 for small, medium and large farms.

Murthy (1999) in his study on coconut worked out establishment cost per hectare of coconut as Rs.9,848.30. The costs incurred in maintaining a hectare of garden from second year to sixth year were Rs.6,307.36, Rs.6,437.46, Rs.6,218.04, Rs.6,483.81 and Rs.6,746.05 respectively. The maintenance cost incurred from seventh year onwards was Rs.11,479.30 per hectare per year. The gross and net returns obtained per hectare of garden were Rs.49,723.98 and Rs.38,244.08 per year respectively.

A study conducted by Remold (1999) on cost benefit analysis of coconut cultivation under irrigated conditions in the Central State Farm, Aralam in Cannanore district of Kerala revealed that annual expenditure per hectare of irrigated coconut was Rs.52,573 and the annual income derived was Rs.78,750.

Appa Rao and Krishnaiah (2001) while analysing the cost of production of cashewnut in Srikakulum district of Andhra Pradesh observed that the establishment cost per hectare amounted to Rs.6,686.87 and maintenance cost was Rs.5,967.92 per hectare. Gross and net returns stood at Rs.20,953.21 and Rs.7,059.23 for the same.

Chinnappa (2001) estimated the per hectare cost of production of arecanut at Rs.78,179 and Rs.83,951 per hectare respectively for command and non-command areas respectively. The total output obtained was in the order of 19.23 Quintals and 20.25 Quintals per hectare for the above said areas respectively. The respective profits over cost amounted to Rs.89,078 and Rs.92,224 for the above areas.

Rengaraju (2002) in his study on coconut worked out the total maintenance cost varied through the years and was Rs.3,487.21, Rs,4,093.46 and Rs.4,061.98 during second year, fifth year and seventh year respectively in group I. The average yield was 15,750, 19,850 and 18,900 nuts per hectare in group I, II and III respectively.

Sahapurmath *et al.* (2003) studied arecanut-based agroforestry in North Canara district, Karnataka. The cost of cultivation of arecanut mixed crop with banana, pepper and cardamom in different combinations were determined. All the mixed cropping systems were found to be economically better with a net profit per hectare ranging from Rs.3,52,858 in arecanut + cardamom + pepper to Rs.1,69,539 in arecanut + banana, compared to sole cropping of arecanut (Rs.1,46,277 per hectare).

Latha Bastine *et al.* (2004) worked out the establishment cost of coconut (upto seven years) garden to be Rs.1,22,129 and the annual maintenance cost as Rs.24,690.66 and the cost of production to be Rs.4.13 per nut.

Thamban *et al.* (2006) in their study estimated total cost including annuity value at Rs.22,115 on small farms and Rs.27,496 on large farms in the cultivation of coconut with conventional basin method of irrigation whereas the same under drip irrigation system ranged from Rs.21,682 to Rs.27,726 respectively on the above said categories of farms. The realized net income in the case of farmers adopting the conventional irrigation system varied from Rs.6,435 per hectare in the case of marginal farmers to Rs.17,395 per hectare on large farms. In the case of farmers adopting drip irrigation system, it varied from Rs.7,368 on marginal farms to Rs.19,941 per hectare on large farms.

The per hectare cost of cultivation of arecanut was estimated at Rs.89,738, Rs.98,328, Rs.93,401 and Rs.93,912 on small, medium, large and pooled farms respectively by Deorukhakhar *et al.* (2007). The benefit-cost ratios were 2.06, 2.55, 2.10 and 2.24 on the above said categories of farms. Yields were highest on medium farms (30.86 Quintals) and lowest on small farms (24.36 Quintals).

Kalathiya *et al.* (2007) estimated the cost of investment (including maintenance) of bearing coconut garden at Rs.7896.43, Rs.7159.37, Rs.8220, Rs.6603.10 and profit was Rs.14,225.71, Rs.13,066.06, Rs.9372.07, Rs.13,413.50 per hectare for marginal, small, medium and large farmers respectively.

Chinnappa and Nagaraj (2009) reported that the arecanut gardens with drip irrigation required higher investment (Rs.5,30,839 per hectare) than gardens without drip irrigation (Rs. 4,19,046 per hectare). The establishment cost of arecanut could be further reduced by growing intercrops by 42.27 and 44.18 per cent. Maintenance of gardens under drip irrigation was found to be less expensive than gardens under flood irrigation due to substantial savings in labour cost. The break- even output for drip irrigation and flood irrigation was in the order of 4.69 and 3.69 quintals respectively.

2.2 STUDIES ON ECONOMIC VIABILITY

Raghupathy *et al.* (1979) evaluated the economic feasibility of coconut plantation in 3 different projects. A discount rate of 9 per cent was used to discount the costs and returns at the lending rate of co-operative bank for long term loans. The economic life of coconut was taken as 70 years. Among these projects net present worth (Rs.2,659) and benefit-cost ratio (5.95) were maximum in project III. But IRR (31.55 per cent) was the highest in project II.

Jayaraman (1981) while evaluating the profitability of cashew enterprise worked out the IRR as 60 per cent for adopters of new packages and 50 per cent for non-adopters and showed that the investment in cashew would be much profitable since this discount rate was high above the market rate of interest.

Krishna Raja (1981) in his study on arecanut garden revealed that net present worth stood at Rs.18,124, Rs.22,157.41 and Rs.25,999.41 per hectare for small, medium and large gardens respectively. The respective benefit-cost ratios were 1.43, 1.57 and 1.66 with the internal rate of return of 22.28, 26.28 and 27.53 per cent.

Elsamma Job and Mukundan (1984) while studying the worthiness of investment in rubber plantations measured the productivity of capital and reported that the BCR, IRR and NPW were 2.04, 24.20 per cent and Rs.25,397 respectively.

Herath (1986) in his study on coconut worked out benefit-cost ratio at 25 per cent discount rate and IRR as 1.76 and 30 per cent respectively.

Nagaraj *et al*. (1987) examined the profitability and economic feasibility of investment in coconut enterprise and found out that the NPW for the entire project was Rs.77,167. The discounted benefit cost ratio was 1.69 at 12 per cent discount rate and the IRR was 21.40 per cent.

Thakur *et al.* (1987) in their study on kinnow plantations in Himachal Pradesh revealed that kinnow plantation is quite profitable with the BCR of 3.04 (on gross returns) and 2.04 (on net returns) and the IRR was as high as 46 per cent.

Patil *et al.* (1989) in their study on economic evaluation of coconut plantation in Maharashtra, found that the BCR and NPV at 10 per cent discount rate stood at 2.27 and Rs.18,186 respectively, where as the IRR was 22.06 per cent.

Goswami (1990) carried out investment analysis of plum and mandarin plantations and worked out the NPW for plum and mandarin plantations at Rs.6,884.83 and Rs.10,216.76 respectively. The respective values of BCR were 1.38 and 1.52.

Vijuipe and Varghese (1990) in their study on economics of nutmeg cultivation in Kerala estimated the NPW, BCR and IRR at Rs.1,22,018, 1.89 and 24.62 per cent respectively at 14 per cent discount rate.

Jaganathan's (1992) study on an economic analysis of coconut farming in Anaimalai Block of Coimbatore district of Tamilnadu observed that the BCR at 12 per cent discount rate was 1.42 without intercropping and 2.18 with intercropping. NPV was found to be Rs.23,750 in case of gardens without intercropping and the same was Rs.66,717 in case of gardens with intercropping. The IRR was about 25.68 per cent.

Naik *et al*. (1992) in their study on economic evaluation of investment in cashew orchard revealed that the calculated NPV and BCR were Rs.86,424 and Rs.72,332 and 2.37 and 1.89 at 11 and 14 per cent discount rates respectively.

Rangachary (1995) worked out the NPV, BCR and IRR as Rs.5,474.57, 0.85:1 and 24.2 per cent which indicated that the investment made on oil palm orchard upto 5th year was not profitable.

Remold's (1999) study on benefit-cost analysis of coconut cultivation under irrigated conditions estimated the annuity value and benefit-cost ratio as Rs.33,914 and 1:1.3 respectively at 13 per cent discount rate.

Murthy (1999) while studying the economics of coconut found out NPV, BCR and IRR were Rs.22,633.68, 1.38 and 20.03 per cent respectively.

Remold (2000) in his study on cost-benefit analysis of rainfed coconut observed the annuity value (at 13 per cent) and benefit cost ratio of rainfed coconut as Rs.28,469 and 1:1.01 respectively.

Chinnappa (2002) in his techno economic appraisal of arecanut plantation in non-traditional areas found that the present worth (NPW) was positive indicating financial viability of investment on arecanut. The benefit-cost ratios were in the order of 1.56 and 2.03 indicating that each rupee of investment made in arecanut would bring a gross income of Rs.1.56 for command area and Rs.2.03 for non-command area. The internal rate of return was 26.31 and 34.35 for command and non-command areas respectively.

Khunt *et al.* (2003) examined economic feasibility of investment on mature and tender coconut gardens. The positive net present value (Rs.2,60,000) at 10 per cent discount rate, the higher value of benefit-cost ratio (2.72) and higher value of IRR (41.5 per cent) indicated the financial soundness of the investment on mature nut orchard. The NPV, BCR and IRR were Rs.2,50,166, 2.08 and 30.10 per cent in the case of tender nut orchard.

Latha Bastine *et al.* (2004) in their study on capital productivity of coconut showed favourable figures for net present value (Rs.5286.31) and benefit-cost ratio (1.02). The internal rate of returns was worked out to be 7.26 as against an opportunity cost of 7 per cent.

Sharma *et al.* (2006) examined the economic feasibility of mango orchards and found net present value, benefit cost ratio and internal rate of return at Rs.1,10,165, 1:3 and 25 per cent respectively.

Thamban *et al.* (2006) revealed that the benefit-cost ratio ranged from 1.32 on marginal farms to 1.7 on large farms in the cultivation of coconut with drip irrigation system. In the case of coconut cultivation with basin irrigation, it varied between 1.29 on marginal farms and 1.63 on large farms. Similarly net present worth ranged from Rs.49,087 on marginal farms to Rs.1,32,684 on large farms with basin irrigation and the same was Rs.52,127 on small and 1,40,232 on large with drip irrigation.

Gondalia and Patel (2007) in their study on the economic viability of aonla plantations in Gujarat found that the establishment of aonla orchard involves high investment, but the annual net returns were also quite high after the third year of plantation. The values of economic parameters *viz.*, NPV, BCR, IRR and PBP had been found to be Rs.6,52,652, 5.25, 65.03 and 55 months respectively at 10 per cent discount rate.

The study of Varghese (2007) on economics of cardamom cultivation in Kerala revealed that the cost of cultivation was significantly high. If rental value of land was included in the cost of cultivation, the net present value turned negative, the benefit-cost ratio became less than one and internal rate of returns 6 per cent. This implied that cardamom cultivation was unprofitable in Kerala.

Chinnappa and Nagaraj (2009) in their study on the establishment and maintenance of arecanut plantations under different water management regimes revealed that the investment on arecanut with drip irrigation is economically feasible even without government subsidies.

2.3 STUDIES ON PRODUCTION AND MARKETING PROBLEMS

Balakrishnan (1979) observed the indebtedness of farmers as the major factor that caused forced sales of farm products at unfavourable prices and further reported that available transport facilities were highly inadequate for efficient marketing of farm products and inadequacy of storage facilities was the other serious problem.

Raghupathy *et al*. (1979) found out that the coconut farmers were not generally following the improved cultivation practices for which coconut palm responds positively. Time lag between the investment and returns realized appeared to be the reason for this neglect in coconut production.

Subramanyam (1986) in his study on horticultural crops identified the production and marketing constraints *viz.,* (i) These crops were highly capital intensive, (ii) the credit advanced by the institutional agencies like commercial banks and co-operative societies was far below the cost of cultivation, (iii) and the high marketing costs were because of lack of infrastructural facilities.

Narasimhappa (1987) reported the marketing problems of coconut as lack of systematic organisational set up for marketing, the exploitation by middlemen and other functionaries and prevalence of malpractices in the markets.

Sugata Ghose (1988) in her study on the market situation of desiccated coconut in Assam identified the constraints as arrival of adulterated desiccated coconuts in Gowahati market as complained by desiccated wholesalers and higher price fluctuations.

Sikka and Swarup (1989) identified the following problems faced by orchardists *viz.,* lack of proper grading and packing facilities, non availability of inputs on credit basis and non-availability of labour and material in time at desired place at reasonable price.

Srinivas (1989) in his study observed that coconut farmers were not following recommended package of practices and there were no facilities for providing information regarding the high yielding varieties which led to the farmers to grow low yielding local varieties. He further pointed out that the recommended plant population was not maintained on the coconut gardens.

Rao and Rajasekhar (1992) identified major constraints in oil palm cultivation like non-availability of planting material, narrow genetic base of higenous tenerae problems in acquiring planting material, pests and diseases, organisational problems etc.

Kameswara Rao (1995) in his study on problems and prospects of coconut marketing in Andhra Pradesh identified the marketing problems of coconut *viz.,* lack of amenities at marketing yards and transport facilities.

Supriya Guha (1998) in her study on tender coconut marketing in Calcutta identified marketing problems *viz.,,* lack of space for unloading of tender coconuts and inadequacy of finance.

Murthy (1999) identified the production and marketing problems of coconut *viz.,* non application of fertilizers and plant protection chemicals, lack of proper credit facilities, inadequate transport and storage facilities, forced sales due to distant regulated market etc.

Non availability of labour and machinery, high wage rate, high cost of fertilizers and pesticides, frequent failures in power supply, lack of

knowledge of package of practices were the various problems identified by Sivanarayana (2000) in the production of arecanut.

Chowdhury (2002) in his study on problems and prospects of coconut cultivation in Assam identified the following constraints *viz.*,

1. Lack of awareness of the farmers on recent developments in crop protection and cropping systems.

2. Lack of quality planting material

3. Lack of proper management practices and

4. Attack of pests and diseases

Sit and Ghosh (2005) identified the following constraints associated with arecanut cultivation in Sub Himalayan Terrai region of West Bengal (1) cultivation of poor yielding cultivars (2) improper planting material (3) inappropriate spacing (4) inadequate fertilizer application (5) inadequate irrigation (6) pests mainly white grub.

Chinnappa and Nagaraja (2009) reported that higher transportation cost on the one hand and lack of transportation facilities on the other hand were the major problems confronting the arecanut growers.

CHAPTER – III

METHODOLOGY

This chapter presents the procedural details in selection of samples, mode of data collection and analytical techniques employed in attaining the stated objectives of the study. The contents of this chapter are presented under the following heads:

3.1 SAMPLING DESIGN

Multistage stratified random sampling technique was adopted to select the ultimate sample.

3.1.1 Selection of the district

Malappuram district which ranks first in area (20,020 hectares) and second in production (15,620 tonnes) of arecanut in Kerala was purposively selected.

3.1.2 Selection of taluks

Two taluks namely Nilambur and Ernad were selected as they rank first and second in area under arecanut cultivation in Malappuram district.

3.1.3 Selection of villages

The villages growing arecanut in the selected taluks were arranged in the descending order of the area under arecanut. The first three villages from each taluk having maximum area under arecanut were purposively selected for a detailed study. The selected villages were Nilambur, Vandoor and Karuvarankundu in Nilamboor taluk and Urangattiri, Vettilappara and Pulpetta in Ernad taluk.

3.1.4 Selection of arecanut orchardists

The list of arecanut growers was prepared from the village records of selected villages. From the list so prepared 60 farmers were selected at random. The sample so selected was subjected to post classification into pre-bearing orchards ($1^{st} – 5^{th}$ year) and bearing orchards ($6^{th} – 50^{th}$ year), which comprised of three stages *viz.,* yield increasing period ($6^{th} – 25^{th}$ year), yield stabilization period ($26^{th} – 40^{th}$ year) and yield declining period ($41^{st} – 50^{th}$ year).

3.2 COLLECTION OF DATA

The required primary data to fulfil various objectives were collected through personal interview of selected farmers with the help of pretested

schedules designed for the purpose. The data for the present study pertained to the agricultural year 2008-09.

3.3 COST STRUCTURE

Arecanut is a perennial crop with an economic life span of 50 years and starts yielding from 6th year onwards. The cost incurred in raising arecanut orchards can be classified into two groups *viz.*, (i) establishment cost and (ii) maintenance cost.

Establishment cost included all the expenses incurred in the first year for establishment of arecanut garden. Items like land preparation, digging of pits and filling, cost of manures, fertilizers, lime, plant protection chemical, expenditure incurred on different farm operations, *viz.,* terracing, weeding, irrigation, gap filling, watch and ward and repairs and maintenance were considered as establishment cost.

Expenses incurred on input services like human labour utilised for laying of irrigation and drainage channels, clearing of basins, weeding, application of manures, fertilizers and lime, irrigation, channel maintenance, bullock labour and services of machinery and on material inputs *viz.*, manures, fertilizers, plant protection chemicals, lime and fuel and repairs and maintenance charges were regarded as maintenance costs from 2nd year onwards till its economic life period.

3.4 METHODS OF COMPUTATION

The economic analysis of production of arecanut necessitates proper estimation of the cost of inputs, input services and the valuation of output. The detailed procedure followed in computing the production costs of arecanut is described below.

3.4.1 Human labour

Actual days worked in performing various cultural operations in the establishment and maintenance of arecanut orchard were recorded separately for male, female, family and hired labour. The womandays were converted into man equivalent days by assigning a ratio 1.5 womandays equivalent to one man-equivalent day. Human labour was quantified in terms of productive man-work units (usually about 8 hours of productive work). Family labour was valued at the prevailing wage rates of casual labour engaged for similar operations in the study area.

3.4.2 Bullock labour

It included both owned and hired bullock labour and was measured in terms of plough units of 6 hours. The wage rates of both hired and owned bullock labour were estimated at the prevailing rates in the locality.

3.4.3 Machine labour

Tractor services both owned and hired were charged at the prevailing rates in the locality per an hour of work.

3.4.4 Plant Material

The plant material was evaluated at the actual price paid plus transportation charges if any.

3.4.5 Farm Yard Manure

The cost of farm yard manure per tonne was calculated on the basis of prevailing market rates both for purchased and farm produced.

3.4.6 Fertilizers and Plant Protection Chemicals

Market price formed the basis to estimate the cost of monetary inputs like fertilizers plant protection chemicals, lime and ash.

3.4.7 Interest on Working Capital

It was calculated at the rate of 12 per cent per annum at which commercial banks in the study area were lending loans for crops.

3.4.8 Interest on fixed capital

It was calculated at the rate of 8 per cent per annum as the fixed deposits in commercial banks would fetch this rate of interest. Since rental value of owned land was considered, land value was excluded from fixed capital.

3.4.9 Depreciation

Annual amount of depreciation on each working asset owned by the farmer was computed following the straight line method. Later, it was apportioned based on acreage under arecanut.

3.4.10 Land revenue

Actual amount paid by the orchardist towards land revenue was taken into account.

3.4.11 Rental value of owned land

One fourth of the gross returns received in each year was considered as the rental value of owned land.

3.4.12 Annual share of establishment cost

The total expenditure incurred in the first year of establishment of the garden was spread over the rest of the economic life period to get the annual share of establishment.

3.5 TOOLS OF ANALYSIS

Conventional analysis and discounted cash flow techniques were used to analyse the data and to arrive at valid conclusions. For finding out costs and returns and farm efficiency measures, simple arithmetic averages and percentages were worked out. Discounted cash flow techniques were used to obtain net present worth, benefit- cost ratio and the internal rate of return.

3.5.1 Conventional analysis

It was used to arrive at labour and material input requirements, costs and returns etc.

3.5.1.1 Cost concepts

The cost concepts *viz.*, Cost A_1, Cost A_2, Cost B and Cost C were used in the present study and these were derived as follows.

Cost A_1 : This cost includes value of hired human labour, owned and hired bullock labour, owned and hired machine labour, plant material, manures, fertilizers, plant protection chemicals, lime, land revenue, depreciation on working assets, repairs and maintenance charges and interest on working capital.

Cost A_2 : Cost A_1 + rent paid for leased in land. In the present study all the orchardists were owner cultivators. Hence cost A_1 and A_2 were one and the same.

Cost B : Cost A_2 + rental value of owned land + interest on fixed capital (excluding land value) + Annual share of establishment cost.

Cost C : Cost B + imputed value of family labour. It is the commercial cost of cultivation.

3.5.1.2 Farm efficiency measures

Gross income

This represents the total amount of money obtained by the arecanut growers from the sale proceeds of arecanuts.

Net income

This is the surplus of gross income over total costs.

Net income = Gross income – Cost C

Farm business income

This is the return to the farm operator for his management, family labour contribution and investment on land and fixed capital.

Farm business income = Gross income – Cost A_1

Family labour income

It is a measure of returns for family labour in the cultivation of arecanut.

Family labour income = Gross income – Cost B

Farm investment income

This measure of income indicates the returns to capital invested in the farm and is computed from the following equation.

Farm investment income = (Gross income – Cost C) + (Cost B – Cost A_1)

3.5.2 Project Evaluation Techniques

In case of perennial crops, for the capital invested now, the benefit would be realised in future for over a period of time. Discounted cash flow

measures were used to evaluate the profitability of investment in arecanut orchards. The discounted cash flow method of evaluating long term projects is a process of finding the present worth of the amount received or paid in the future. This technique has an advantage that future cash flows are reduced to a single sum at one specific point of time and this facilitates comparison between alternative investment choices, if any. Depreciation, rental value of owned land, interest on working capital and fixed capital were excluded while estimating the stream of costs over the economic life period of arecanut orchards. The discounted cash flow measures used in the analysis were net present worth (NPW), benefit–cost ratio (B-C ratio) and internal rate of return (IRR). The costs and returns were discounted by using the formula.

$$P = \frac{F}{(1+i)^n}$$

where P = present worth of future amount

F = Future amount

I = Rate of interest

n = Period

Net Present Worth (NPW)

It is also known as net present value. The NPW method is a process of calculating the present value of cash flows (inflows and outflows) of an investment proposal, using the cost of capital at the appropriate discounting rate and finding out the net present worth by subtracting the present value of

cash out flows from the present value of cash inflows. The selection criterion of the project depends on the positive value of net present worth, when discounted at the opportunity capital. The NPW of the project is estimated using the following formula.

$$\text{NPW} \sum_{t=1}^{n} \frac{B_t - C_t}{(1+i)^t}$$

where B_t = benefit in t^{th} year

C_t = benefit in t^{th} year

t = 1, 2, 3, ...n

n = number of years

i = discount rate

Benefit-cost ratio

Yet another time adjusted method of evaluating the investment proposal is the benefit-cost (B/C) ratio or profitability index (PI). It is the ratio of the present value of cash inflows to the present value of cash outflows. The common procedure of selecting the project is to choose the projects having the B-C ratio of more than one where cash inflows and outflows are discounted at opportunity cost of capital. This ratio was arrived by using the following formula.

$$\text{Benefit Cost ratio} = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+i)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1+i)^t}}$$

where B_t = benefit in t^{th} year

C_t = benefit in t^{th} year

t = 1, 2, 3, ...n

n = number of years

i = discount rate

Internal rate of return

The internal rate of return can be defined as that rate which equates the present value of cash inflows with the present value of cash outflows of an investment. In other words, it is the rate at which the net present value of the investment is zero. It is called internal rate because it depends solely on the outlay and proceeds associated with the project and not on any rates determined outside the investment. IRR is the maximum interest rate that the project could pay for the resources used if the project is to recover its investment and operating costs and still breaks even. It is also known as marginal efficiency of capital or yield of an investment or rate of return over cost.

To compute IRR, select any discount rate to estimate the present value of cash inflows and outflows. If the calculated present value of the expected cash inflow is lower than the present value of cash outflows, a lower rate should be tried. On the other hand, a higher value should be tried if the present value of inflows is higher than the present value of outflows. This

process will be repeated till the net present value becomes zero. The equation for finding IRR is as follows.

$$\text{IRR} = \text{Lower discount rate} + \text{difference between two discount rates}\left[\frac{\text{Present worth of the cash flows at the lower discount rate}}{\text{Absolute difference between the present worth of the cash flows at the two discount rates}}\right]$$

Sensitivity analysis

It involves changing one or more values in net present worth equation and recalculating the NPW. This analysis provides better insight into the profitability of investment.

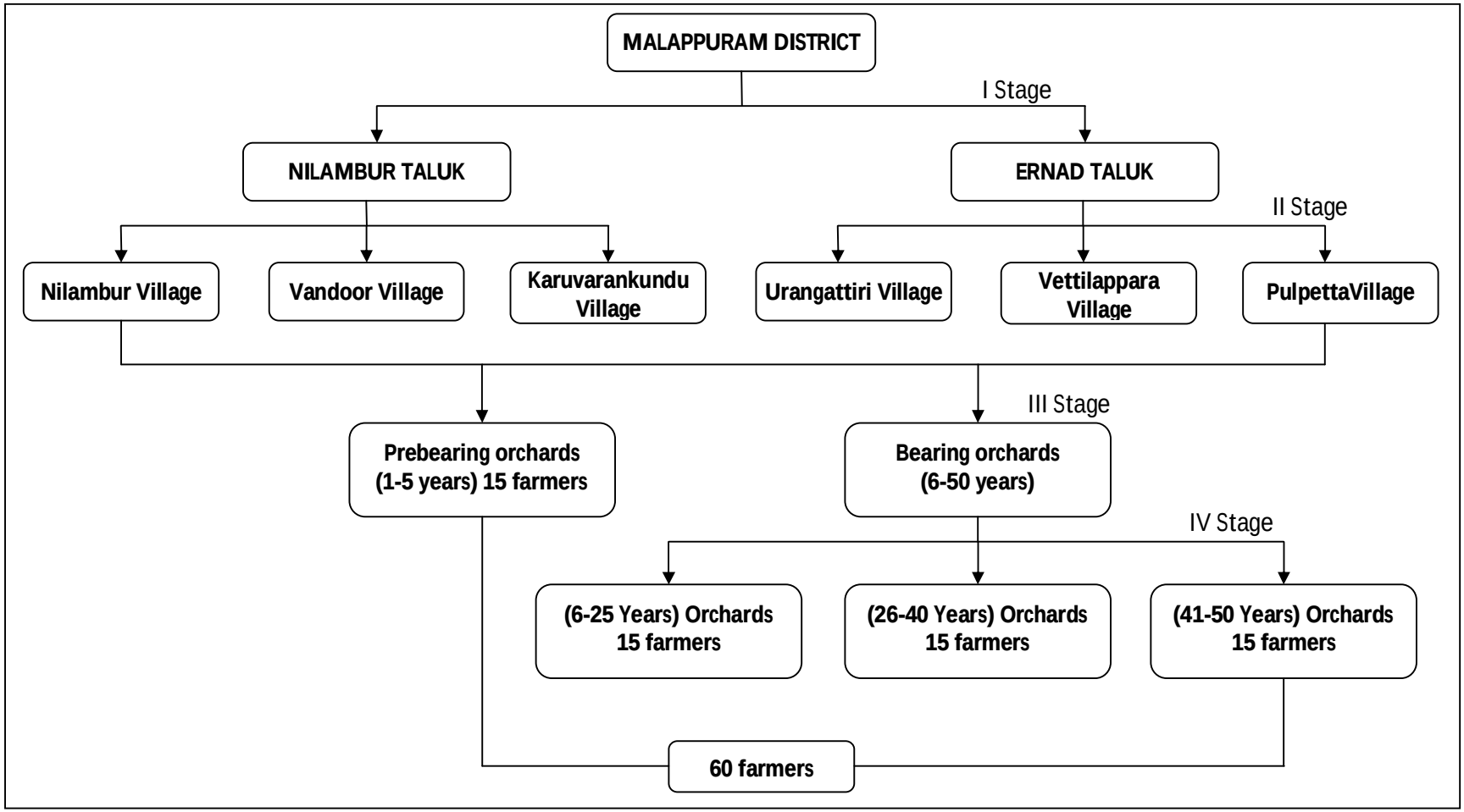

Fig. 3.1 : Chart showing the sampling technique

CHAPTER - IV

RESULTS AND DISCUSSION

The present study embodies the results of a field investigation concerning the economics of production and economic feasibility of arecanut in Malappuram district of Kerala. The important findings of the study are presented with relevant discussion under the following heads in accordance with the objectives of the study.

4.1 SOCIO – ECONOMIC PROFILE OF SELECTED ORCHARDISTS

The socio – economic profile provides comprehensive understanding of social and financial status of the farm families. In this section family size and composition, size of the farm and farm inventory are discussed.

4.1.1 Family size and composition

The composition of the family in respect of male, female, children and farm family workers is presented in Table 4.1. The average size of the family was 6.56 members consisting of 2.33 males, 2.75 females and 1.48 children. It is also clear from the particulars of the table that the number of family members participating in agriculture was 1.53 which accounted for 23.32 per cent of total family members. The number of male and female workers in the family stood at 0.80 and 0.73 members respectively. The participation of family members in agriculture was less because majority of the arecanut growers belonged to well-to-do families.

4.1.2 Size of the farm

Farm size is one of the crucial factors that affect magnitude and efficiency of production and income for the farm families. As is seen from Table 4.2, the average farm size was 1.66 hectares. The average size of the wet land was 0.79 hectares accounting for 47.59 per cent of total holding. The area under garden land was 0.87 hectares accounting for 52.41 percent of total holding. Arecanut which was the selected enterprise for an economic analysis occupied 0.65 hectares and this constituted 39.16 per cent of the total holding.

Table 4.1 : Farm Family Composition of Sample Farmers

Particulars	Number	Percentage
Male	2.33	35.52
Female	2.75	41.92
Children	1.48	22.56
Total	**6.56**	**100**
Farm family workers		
Male	0.80	52.29
Female	0.73	47.71
Children	-	-
Total	**1.53**	**100**

Table 4.2 : Land Holding Pattern of the Sample Farmers

(hectares)

Sl. No.	Particulars	Area (ha)	Percentage
1	Wet land	0.79	47.59
2	Garden land	0.87	52.41
3	Total holding	1.66	100
4	Area under arecanut	0.65	39.16

4.1.3 Farm inventory

The value and composition of farm assets reflect economic background of orchardists. The particulars of farm assets per hectare are presented in Table 4.3. A perusal of the results indicates that the total value of assets including land was Rs. 2,79,545.69 per hectare. It was observed that land, the basic input that supports the production of all farm products was the single most valuable asset on the sample farms and accounted for 89.43 per cent of the total value of assets. An assessment of value of assets excluding land was made. The value of farm assets excluding land on the selected gardens was Rs. 29,545.69 per hectare accounting for 10.57 per cent of total value of assets. As regards magnitude and pattern of value of assets, the value of farm buildings occupied the second place claiming 6.01 per cent of value of total assets. Next in order was value of livestock followed by value of machinery and implements accounting for 1.83 and 1.67 per cent of total value of assets respectively. Value of irrigation equipment amounted to Rs. 2,951.72 per hectare which was 1.06 per cent of total value of the assets.

4.2 RESOURCES AND RESOURCE SERVICES UTILIZATION IN ARECANUT GARDENS

Production of arecanut requires both material inputs *viz.*, planting material, fertilizers, farm yard manure, lime, plant protection chemicals etc. and resource services like human labour, cattle labour, machinery etc. The

Table 4.3 : Asset Structure on Sample Farms

Sl. No.	Particulars	Per hectare (Rs.)	Percentage
1.	Value of land	250000	89.43
2.	Value of irrigation equipments	2951.72	1.06
3.	Value of farm buildings	16788.56	6.01
4.	Value of livestock	5112.87	1.83
5.	Value of machinery and implements	4692.54	1.67
6.	Value of assets		
	a. With land	279545.69	100
	b. Without land	29545.69	10.57

value of these resources and resource services forms the cost structure of arecanut cultivation.

4.2.1 Resource use per hectare of arecanut garden

The material inputs committed in the production of arecanut were plant material, FYM, fertilizers, lime and plant protection chemicals.

It is observed from Table 4.4 that a plant population of 1,375 seedlings per hectare was maintained in the garden which is more than the recommended plant population of 1,200 trees per hectare. The quantity of manures varied from 4.28 tonnes during initial years to 7.80 tonnes per hectare during later stages of garden. The total quantity of manures applied during the entire economic life period of arecanut was 328.76 tonnes per hectare which is less than the recommended dose of 825 tonnes per hectare. The use of N, P,K nutrients through chemical fertilizers for the entire 50 years of economic life of arecanut stood at 6,392, 8,413.30 and 10,548.80 Kgs per hectare respectively. There was an increase in the application of N, P and K from 8^{th} year, the year of commencing economic yields upto the yield stabilization period. The orchardists used 80.02 tonnes of ash, 4,992 Kgs of lime and 732.23 litres of plant protection chemicals for the entire life period of arecanut cultivation.

4.2.2 Human labour use per hectare of arecanut garden

Human labour is one of the factors of production and also a major cost component that influences the cultivation of any enterprise. Successful

completion of every agricultural operation requires some amount of human labour. The human labour use depends on the nature and size of the enterprise. Keeping this in view, an attempt has been made to examine the magnitude and pattern of labour use in arecanut cultivation.

4.2.2.1 Human labour utilization per hectare of arecanut garden during the year of establishment

The operation wise labour use in the cultivation of arecanut during the year of establishment is presented in Table 4.5. The total labour utilized for the establishment of arecanut garden during the first year was 351.5 mandays per hectare. It is noted that terracing was the most labour absorbing operation requiring 100 mandays per hectare accounting for 28.45 per cent of the total labour used during the first year. Terracing is practiced in slopy lands in order to prevent soil erosion. After planting, arecanut seedlings need frequent irrigation. The seedlings were irrigated through field channels and this operation requires human labour for guiding the water to each plant. Irrigation was the next important labour absorbing operation and needed 58 mandays per hectare. This accounted for 16.50 per cent of total labour use in the first year.

Weeding which involved digging of earth around the plant and the preparation of basins for irrigation required 35 mandays per hectare accounting for 9.96 per cent of total labour used in the year of establishment. Proper weeding facilitates better establishment and growth of arecanut plants.

Table 4.5 : Operation – wise human labour utilization on arecanut garden during the year of establishment (mandays per hectare)

Sl. No.	Operation	Mandays	Percentage
1	Terracing	100	28.45
2	Digging of pits	32	9.10
3	Filling of pits	5.5	1.56
4	Fertilizer application	1	0.28
5	Planting	17	4.84
6	Application of lime	1	0.29
7	Weeding	35	9.96
8	Laying of irrigation channels	10	2.85
9	Irrigation	58	16.50
10	Gap filling	2	0.57
11	Watch & Ward	90	25.60
	Total	351.5	100
	Owned	119.7	34.05
	Hired	231.8	65.95

To plant arecanut seedlings, 75 cm x 75 cm x75 cm sized pits were dug at a spacing of 2.25 cm x 2.25 cm. The digging of pits required 32 mandays (9.10 per cent of total human labour).

Seedlings which are of one year of age having four to five leaves are planted in the dugout pits after filling the pits with top soil and farm yard manure. It needed 22.50 mandays (6.40 per cent). Application of fertilizers and lime required two mandays of labour.

Ten mandays of labour was used for laying of irrigation channels. To compensate the mortality of the seedlings, orchardists resorted to gap filling which needed two mandays.

During the period of establishment, the arecanut seedlings should be protected from livestock. Therefore watch and ward is necessary and this operation consumed maximum labour of 90 mandays per hectare accounting for 25.60 per cent of the total labour used during the year of establishment.

4.2.2.2 Human labour utilization per hectare of arecanut garden during pre-bearing period (2nd to 5th year)

An examination of labour use during the period from second year to fifth year revealed that it was almost uniform use of the human labour for all the operations except the application of lime in 3rd year and 5th year (Table 4.6).

Watch and ward, irrigation and weeding were the major labour absorbing operations with 90, 58 and 35 mandays per hectare. These three

Table 4.6 : Operation – wise Human Labour Utilization in Mandays per hectare of Arecanut Garden (2nd to 5th Year)

S. No.	Operations	Years				Total
		2	3	4	5	
1	Maintenance of irrigation channels	10 (4.33)	10 (4.31)	10 (4.33)	10 (4.29)	40 (4.31)
2	Inter cultivation	20 (8.66)	20 (8.62)	20 (8.66)	20 (8.58)	80 (8.63)
3	Maintenance of drainage channels	2 (0.87)	2 (0.86)	2 (0.87)	2 (0.86)	8 (0.86)
4	Application of manures	7 (3.03)	7 (3.02)	7 (3.03)	7 (3.00)	28 (3.02)
5	Green leaf manuring	8 (3.46)	8 (3.45)	8 (3.46)	8 (3.43)	32 (3.45)
6	Fertilizer application	1 (0.43)	1 (0.43)	1 (0.43)	1 (0.43)	4 (0.43)
7	Application of lime	-	1 (0.43)	-	2 (0.86)	3 (0.32)
8	Weeding	35 (15.15)	35 (15.09)	35 (15.15)	35 (15.02)	140 (15.10)
9	Irrigation	58 (25.11)	58 (25.00)	58 (25.11)	58 (24.89)	232 (25.03)
10	Plant protection	-	-	-	-	-
11	Watch & Ward	90 (38.96)	90 (38.79)	90 (38.96)	90 (38.63)	360 (38.83)
	Total	231 (100)	232 (100)	231 (100)	233 (100)	927 (100)
	Owned	95.71 (41.43)	96.71 (41.69)	95.71 (41.43)	97.71 (41.94)	385.84 (41.62)
	Hired	135.29 (58.57)	135.29 (58.31)	135.29 (58.57)	135.29 (58.06)	541.16 (58.38)

operations together accounted for 79.57 per cent of the total labour used during the pre bearing period. Intercultivation was done around the seedlings in the basins using a spade and hoe by digging the upper soil layer and widening the basins. This cultural practice enables better infiltration of water, loosening the upper soil and preventing the weed growth and needed 20 mandays per hectare (8.66 per cent). Farmers had to use 10 mandays annually for the maintenance of irrigation channels. Green manuring required 8 mandays annually whereas the application of manures and fertilizers needed 8 mandays per hectare annually.

For better growth and development of plants, proper drainage is essential. This operation consumed 2 mandays of labour per annum during pre bearing period. In all during the period from second year to fifth year the total human labour requirement was 927 mandays per hectare. Out of which 541.16 mandays came from hired source and the remaining 385.84 mandays from the family labour.

4.2.2.3 Human labour utilization per hectare of arecanut garden during the yield increasing period (6 to 25 years)

Arecanut, a perennial commercial crop starts bearing from 6^{th} year onwards, calls for more employment of human labour with increase in the age of the gardens.

Human labour utilization pattern for different operations during yield increasing period (6^{th} to 25^{th} year) is presented in Table 4.7. To begin with, the total annual labour requirement increased from 257.18 mandays per hectare in the 6^{th} year to 320.99 mandays per hectare in 10^{th} year. From 11^{th} year onwards, the annual human labour use was hovering around 323 mandays per hectare. Plant protection, harvesting, drying and dehusking were the other activities added to the list of cultural operations from 6^{th} year onwards as the arecanut garden came to bearing.

Areca palm is prone to a number of diseases during its different stages of development. Farmers had used 6.95 mandays per hectare per annum for the application of plant protection chemicals to control diseases during the yield increasing period (6^{th} to 25^{th} year).

Harvesting of the arecanut is done by skilled climbers. Mechanical arecanut palm climbing device is available for easy climbing the palm by unskilled persons. Harvesting of arecanut is done during October – December. The total annual labour requirement for harvesting stood at 15 mandays in 6^{th} and 7^{th} year. From 8^{th} year onwards, orchadists employed annually 30 mandays per hectare for harvesting. Drying of nuts required 1.5 mandays per hectare per annum. The annual requirement of human labour for dehusking of the dried nuts increased with the increase in the yield and it stood at 42.16 mandays.

During the yield increasing period, that is right from 6th year to 25th year, the major labour absorbing operations were watch and ward, irrigation, weeding, harvesting and intercultivation.

The total human labour requirement in terms of mandays for the entire yield increasing period was 6,319.64. The breakup of labour employment during the yield increasing period showed that watch and ward was the most important item for which 1,800 mandays (28.48 per cent) were employed. The next important labour absorbing operation was irrigation claiming 1,160 mandays (18.37 per cent). Arecanut cannot withstand drought for a longer time. Being a perennial crop, once affected by water stress, it may require two to three years to regain its normal vigour and yield. The palms should be irrigated once in seven or eight days during November-December, once in six days during January-February and once in three to five days during March-April-May. Hence, watering the garden assumes greater importance. Dehusking was the operation next to follow as it had requirement of 763.78 mandays (12.03 per cent). Closely to follow, it was weeding for which the orchardists had to employ 700 mandays (11.09 per cent). About 570 mandays (9.02 per cent) were employed for harvesting the nuts.

Inter cultivation was the other operation which required less labour in relation to the above operations. For this purpose, arecanut growers employed about 400 mandays (6.33 per cent). The requirement of labour for the maintenance of irrigation channels was 200 mandays (3.17 per cent). The

human labour used for the remaining operations like application of organic manures, chemical fertilizers, and plant protection chemicals and drying was less both in absolute and relative terms.

4.2.2.4 Human labour utilization per hectare of arecanut garden during yield stabilization period (26th to 40th year)

The trend that was observed regarding the human labour employment during yield increasing period was held good during the yield stabilization period as well. On perusal of Table 4.8, it is evident that the total labour requirement for the entire 15 years period was 4,783.75 mandays. Watch and ward had the lion's share with 1,350 mandays (28.22 per cent) followed by irrigation 870 mandays (18.19 per cent), dehusking 577.50 mandays (12.07 per cent), weeding 525 mandays (10.97 per cent), harvesting 450 mandays (9.41 per cent), inter cultivation 300 mandays (6.27 per cent), green manuring 212.25 mandays (4.44 per cent), maintenance of irrigation channels 150 mandays and application of manures 150 mandays. Application of plant protection chemicals, fertilizers, lime and drying required 168 mandays.

4.2.2.5 Human labour utilization per hectare of arecanut garden during yield declining period (41st to 50th year)

It is seen from Table 4.9 that the total labour utilization for the entire 10 years period of the garden was 1,861.54 mandays per hectare which had come down sizable from the labour use during the yield stabilization period.

It was less by more than 61.09 per cent of the labour use during the yield stabilization period. The operation wise labour use indicated that 500 mandays were used for watch and ward and 300 mandays for irrigation.

Dehusking was the next one with 254.24 mandays (13.66 per cent). The orchardists had employed 200 mandays for inter cultivation, 180 mandays for harvesting, 140 mandays for weeding and 100 mandays for the maintenance of irrigation channels. Application of organic and inorganic manures, plant protection chemicals were the other operations which required relatively less human labour.

4.2.2.6 Human labour utilization on arecanut garden during the economic life period of 50 years

The total labour requirement for the cultivation of arecanut orchard during its economic life period was 14,243.43 mandays per hectare (Table 4.10). As said earlier watch and ward was the operation as far as the maximum use of labour was concerned. It was 4,100 mandays. Irrigation followed as the next highest labour absorbing operation. It was 2,620 mandays for this cultural practice. Dehusking was the next to follow with 1,595.52 mandays per hectare. Weeding required 1,540 mandays. Farmers had employed 1,200 mandays per hectare for harvesting. These five operations accounted for 77.61 per cent of the total labour used for the entire life span of the arecanut orchard.

Table 4.10 : Operation – wise Human Labour Utilization during the Economic Life Period of Arecanut Garden (mandays per hectare)

S. No.	Operations	Mandays	Percentage
1	Terracing	100	0.70
2	Digging of pits	32	0.22
3	Planting	17	0.12
4	Gap filling	2	0.01
5	Laying of irrigation channels	500	3.51
6	Inter cultivation	980	6.88
7	Laying of drainage channels	98	0.69
8	Application of manures	427.5	3.00
9	Green leaf manuring	567.01	3.98
10	Fertilizer application	87.95	0.62
11	Application of lime	29	0.20
12	Weeding	1540	10.81
13	Irrigation	2620	18.39
14	Plant protection	285.95	2.01
15	Watch & Ward	4100	28.79
16	Harvesting	1200	8.42
17	Drying	61.5	0.43
18	Dehusking	1595.52	11.20
	Total	14243.43	100
	Owned	4360.58	30.61
	Hired	9882.85	69.39

From the above discussion, it can be inferred that arecanut cultivation generated substantial employment for labour.

4.2.3 Machine labour utilization per hectare of arecanut garden during its economic life period

A perusal of Table 4.11 revealed that the use of machine labour was confined to pre bearing period only. During the year of establishment, a maximum of 4.45 hours were used.

4.3 COST STRUCTURE ON ARECANUT GARDENS

Arecanut is a perennial commercial crop which can be cultivated economically for about 50-60 years. It takes five years to establish itself well and starts giving yields from sixth year. However economical yields are obtained from eighth year onwards. Therefore the costs incurred in establishing the garden during first year of the pre bearing period at current prices of inputs and input services were considered as establishment cost. The establishment costs included the expenditure on land preparation, digging of pits, laying of irrigation and drainage channels, plant material and planting and other subsequent nurturing operations for the garden together with over head costs. The maintenance costs included the expenditure on organic and inorganic manures, plant protection, maintenance of irrigation and drainage channels, inter cultivation, harvesting, dehusking and drying along with overheads from 2nd year onwards.

Table 4.11 : Machine Labour Utilization per hectare of Arecanut Garden During its Economic Life Period (50 Years)

Particulars	Age of the Garden (Years)		
	1	**2 - 5**	**6 - 50**
Machine labour (Hours)	4.45	0.50	1

4.3.1 Cost structure of arecanut garden during 1st year of pre bearing period

The details of establishment costs in the first year of arecanut garden per hectare are presented in Table 4.12.

The total costs incurred during the first year of arecanut garden establishment amounted to Rs. 61,641.87. Out of which operational and fixed costs worked out to Rs. 53,356.97 (86.56 per cent) and Rs. 8,284.90 (13.44 per cent) respectively.

The wage bill of human labour, an operational cost stood out to be the major item of cost component in the establishment of arecanut garden. The wage bill came to Rs. 26,362.50 (42.77 per cent). The cultural practices such as terracing, watch and ward, digging of pits, weeding, laying of irrigation and drainage channels and inter cultivation required more human labour and hence the higher expenditure.

Plant material which was confined to the first year only was the next highest cost component. The number of seedlings recommended per hectare was 1,200 while the selected orchardists planted 1,375 seedling with each costing Rs. 10 on an average. The expenditure that was incurred under this head was Rs. 12,429.85 (20.16 per cent). The expenditure towards manures and fertilizers was Rs. 7,070 (11.47 per cent). Interest on working capital was Rs. 4, 405.62 per hectare accounting for 7.15 per cent of total costs.

Table 4.12 : Cost Structure on Arecanut Garden per hectare During the Year of Establishment (First Year)

S. No.	Particulars	Costs (Rs)	Percentage
I	**Operational costs**		
	a. Human labour	26362.5	42.77
	Owned	8977.5	14.56
	Hired	17385	28.20
	b. Machine labour	1770	2.87
	Owned	-	-
	Hired	1770	2.87
	c. Plant material	12429.85	20.16
	d. Manures & Fertilizers	7070	11.47
	Manures	5136	8.33
	Fertilizers	1934	3.14
	e. Lime	855	1.39
	f. Repairs	464	0.75
	g. Interest on working capital	4,405.62	7.15
	Total operational costs	53356.97	86.56
II	**Fixed costs**		
	a. Depreciation	757	1.23
	b. Land revenue	244.57	0.40
	c. Rental value of owned land	5833.33	9.46
	d. Interest on fixed capital	1450	2.35
	Total fixed costs	8284.9	13.44
	Total costs	61641.87	100

Among the fixed costs, rental value of the owned land (Rs 5,833.33) stood as major item forming 9.46 per cent of the total costs. Interest on fixed capital which was another item of overhead costs accounted for 2.35 per cent of total costs in the first year.

These results are in line with the findings of Chinnappa and Umesh (1996).

4.3.2 Cost structure of arecanut garden per hectare during pre-bearing period (2^{nd} – 5^{th} year).

It is discernible from the particulars furnished in table 4.13 that the total costs per hectare of arecanut garden during the pre-bearing period (2^{nd} to 5^{th} year) were Rs. 1,66,709.79 of which Rs. 1,30,976.58 (78.57 per cent) were variable costs and Rs. 35,733.21 (21.43 per cent) fixed costs.

Operational costs varied from Rs. 30,377.21 in the 2^{nd} year to Rs. 35,530.73 in the 5^{th} year. The total fixed costs ranged from Rs. 7,699.91 in the 5^{th} year to Rs. 9,741.58 in the 2^{nd} year. The total costs varied from Rs. 40,118.79 in the 2^{nd} year to 43,230.64 in the 5^{th} year.

When examined the cost structure for the total period of 2^{nd} to 5^{th} year, it is found that the orchardists had spent maximum amount on human labour with Rs. 69,525 per hectare accounting for 41.70 per cent of the total costs. The operations like watch and ward, irrigation and weeding required more human resource and hence the higher expenditure on human labour. Next

Table 4.13 : Cost Structure on Arecanut Garden per hectare (2nd to 5th Year) (Rupees)

S. No.	Particulars	Years				Total
		2	3	4	5	
I	**Operational costs**					
	a. Human labour	17325 (43.18)	17400 (42.71)	17325 (40.65)	17475 (40.42)	69525 (41.70)
	Owned	7178.25 (17.89)	7253.25 (17.8)	7178.25 (16.84)	7328.25 (16.95)	28938 (17.36)
	Hired	10146.75 (25.29)	10146.75 (24.91)	10146.75 (23.81)	10146.75 (23.47)	40587 (24.35)
	b. Machine labour	250 (0.62)	250 (0.61)	250 (0.59)	250 (0.58)	1000 (0.60)
	Owned	-	-	-	-	-
	Hired	250 (0.63)	250 (0.61)	250 (0.59)	250 (0.58)	1000 (0.60)
	c. Manures & Fertilizers	9830 (24.50)	9830 (24.13)	12858 (30.17)	12858 (29.74)	45376 (27.22)
	Manures	7896 (19.68)	7896 (19.38)	10276 (24.11)	10276 (23.77)	36344 (21.80)
	Fertilizers	1934 (4.82)	1934 (4.75)	2582 (6.06)	2582 (5.97)	9032 (5.42)
	d. Lime	-	855 (2.10)	-	1550 (3.59)	2405 (1.44)
	e. Repairs	464 (1.16)	464 (1.14)	464 (1.09)	464 (1.07)	1856 (1.11)
	f. Interest on working capital	2508.21 (6.25)	2591.91 (6.36)	2780.73 (6.52)	2933.73 (6.79)	10814.58 (6.49)
	Total operational costs	30377.21 (75.72)	31390.91 (77.05)	33677.73 (79.02)	35530.73 (82.19)	130976.58 (78.57)
II	**Fixed costs**					
	a. Depreciation	757 (1.89)	757 (1.86)	757 (1.78)	757 (1.75)	3028 (1.82)
	b. Land revenue	244.57 (0.61)	244.57 (0.60)	244.57 (0.57)	244.57 (0.57)	978.28 (0.59)
	c. Rental value of owned land	6546.3 (16.32)	6153.94 (15.11)	5747.22 (13.48)	4504.63 (10.42)	22952.09 (13.77)
	d. Interest on fixed capital	1450 (3.61)	1450 (3.56)	1450 (3.40)	1450 (3.35)	5800 (3.48)
	e. Annual share of establishment costs	743.71 (1.85)	743.71 (1.83)	743.71 (1.74)	743.71 (1.72)	2974.84 (1.78)
	Total fixed costs	9741.58 (24.28)	9349.22 (22.95)	8942.5 (20.98)	7699.91 (17.81)	35733.21 (21.43)
	Total costs	40118.79 (100)	40740.13 (100)	42620.23 (100)	43230.64 (100)	166709.79 (100)

important input was manures and fertilizers on which an amount of Rs. 45,376 (27.22 per cent) was spent. Interest on working capital was the other item of expenditure with Rs. 10,814.58 (6.49 per cent).

Rental value of owned land was the major item among the overhead cost with Rs. 22,952.09 (13.77 per cent).

4.3.3 Cost structure of arecanut garden per hectare during yield increasing period (6th to 25th year)

An examination of particulars furnished in Table 4.14, it is evident that total costs per hectare increased from 6th year (beginning year of the bearing period) over 5 years continued upto 11th year. The annual total expenditure increased from Rs. 45,261.98 in 6th year to Rs. 88,851.30 in 11th year. From 12th year to 25th year, the annual total cost varied between Rs. 84,550.16 and 88,851.30. When total costs were added up from 6th to 25th year, these were Rs. 16, 35,056.67. The share of working costs constituted 64.56 per cent while the share of fixed costs constituted 35.44 per cent of total costs. Human labour continued to be the major item of expenditure with Rs. 4,73,973 accounting for 28.99 per cent of the total costs during yield increasing period. Harvesting, dehusking and drying were the cultural practices performed during the bearing period in addition to the operations of pre bearing period. Hence, the higher expenditure on human labour. As observed in the pre bearing period, manures and fertilizers remained as the next major item. The

expenditure towards this material input was Rs. 3, 60,372 (22.04 per cent). The expenditure on manures and fertilizers increased from Rs. 12,858 in 6th year to Rs. 18,592 in 8th year, the year from which the orchard started giving economical yields. The expenditure remained the same from 8th year to 25th year. Orchardists felt that it was necessary to apply higher quantities of manures and fertilizers to reap good harvest during the yield increasing period.

The share of fixed costs decreased from 21.43 per cent in 5th year to 11.51 per cent of total costs in 6th year. From 6th year, it increased to 37.01 per cent in 10th year. The share of fixed costs varied between 35.63 and 37.44 per cent during the yield increasing period. The increase in fixed costs could be attributed to the rise in opportunity cost of owned land which was related to the income from the orchard. The rental value of owned land, a major item of fixed costs increased from Rs. 2,025 at the beginning of the bearing period (6th year) to Rs. 28,458 in the 11th year and continued for the rest of the period. The rental value of owned land amounted to Rs. 5,15,551.5 and thus accounting for 31.53 per cent of total costs for the entire yield increasing period.

4.3.4 Cost structure of arecanut garden per hectare during yield stabilization period (26th to 40th year)

As seen from Table 4.15 the annual total costs during this particular period of 26th to 40th year i.e. yield stabilization period hovered around

Rs. 81,780.46 and Rs. 86,081.60. The annual operational costs ranged from Rs. 52,597.68 (64.89 per cent) to Rs. 56,898.82 (66.65 per cent) during the yield stabilization period. The annual total fixed cost was Rs. 29,182.78 during the above said period.

For the entire period of yield stabilization, the total costs that were incurred by the orchardists were Rs. 12,48,212.60 of which operational costs were Rs. 8,10,470.90 (64.93 per cent) and fixed costs Rs. 4,37,741.70 (35.07 per cent).

The major operational costs *viz.,* human labour and manures and fertilizers had a share of 28.74 and 22.34 per cent of total costs. Interest on working capital and plant protection chemicals accounted for 5.36 and 5.14 per cent of total costs. The rental value of owned land touched 31.23 per cent of the total costs.

4.3.5 Cost structure of arecanut garden per hectare during yield declining period (41st to 50th year)

Cost structure on arecanut gardens during yield declining period (41-50 years) is shown in Table 4.16. As the phase signifies, the annual total costs tended to decline from 41st year. It was Rs. 57,459.08 per hectare during this year compared to the total costs of 40th year i.e. the last year of yield stabilization period during which these were Rs. 81,780.46 per hectare. During this particular period of yield declining, the minimum annual cost of Rs. 41,946.25 was recorded in 50th year. Operational costs which were

Rs. 52,597.68 in 40th year came down to Rs. 29,462.97 in 50th year. Human labour which was a major operational cost came down to Rs. 12,014.25 in 50th year from Rs. 23,868.75 in 40th year. The cost of manures and fertilizers declined from Rs. 18,592 in 40th year to Rs. 11,242. The opportunity cost of land declined from Rs. 25,987.50 in 40th year to Rs. 9,288 in 50th year as a result of fall in the yield. The decline in the annual total costs during this period was on account of reduction in the yields with the age of the arecanut garden.

As a result the orchardists pay less attention for the maintenance of the garden leading to considerable reduction in the use of inputs and input services. This ultimately led to the decline in the cost of maintenance of the garden.

The total costs for the entire yield declining period were Rs.5,20,852.36 of which operational costs were Rs.3,21,702.06 (61.76 percent) and fixed costs Rs.1,99,150.3 (38.24 per cent). The interesting feature that was observed is that the proportion of operational costs came down from 78.57 per cent during the pre-bearing period to 61.76 per cent of the total costs during the yield declining period. This can be attributed to gradual rise in the fixed costs more so contributed by the rental value of owned land.

Even in the yield declining period also human labour remained as the major item of operational cost but with reduced share in the total costs over

the previous period. The same trend held good in respect of manures and fertilizers. The opportunity cost of the owned land accounted for 32.10 per cent of the total costs during the yield declining period.

An overview of the cost structure of arecanut garden over various phases revealed that yield increasing period extending over 20 years was the period during which the total costs were highest. It was lesser in the yield stabilization period. Coming to the operational costs, these were less in the yield stabilizing period as the farmers cut down the expenditure on human labour, a major operational cost in arecanut cultivation. Of all the costs, rental value of owned land turned out to be the major item of cost structure accounting for nearly 32 per cent of the total costs during the bearing period. It was only about 14 per cent during pre bearing period.

4.3.6 Cost structure of arecanut garden during its economic life period (50 years)

With respect to perennial crops like arecanut, having a long gestation period and continuous yield for a number of years, calculations of cost should include both the cost of establishing the crop as well as its annual maintenance.

The costs incurred during the first year of establishment of arecanut gardens were regarded as establishment costs. These costs included labour cost incurred on operations such as land preparation, terracing, pitting, laying of irrigation and drainage channels, planting, manuring, inter cultivation,

Table 4.17 : Cost Structure on Arecanut Garden per hectare during its Economic Life Period

S. No.	Particulars	Costs (Rs)	Percentage
I	**Operational costs**		
	a. Human labour	945969.8	27.40
	Owned	318066	9.21
	Hired	723978.8	20.97
	b. Machine labour	17000	0.49
	Owned	-	-
	Hired	17000	0.49
	c. Manures & Fertilizers	797048	23.08
	Manures	655986	19.00
	Fertilizers	141062	4.09
	d. Lime	45329	1.31
	e. Plant protection chemicals	177568	5.14
	f. Repairs	22736	0.66
	g. Transportation	27375	0.79
	h. Interest on working capital	191456.36	5.54
	Total operational costs	2224482.16	64.42
II	**Fixed costs**		
	a. Depreciation	24193	0.70
	b. Land revenue	11986.4	0.35
	c. Rental value of owned land	1095514	31.73
	d. Interest on fixed capital	71050	2.06
	e. Annual share of establishment costs	25677.79	0.74
	Total fixed costs	1228421.19	35.58
	Total costs	3452903.35	100

weeding, irrigation, plant protection, etc. The material costs comprises of planting material, manures, fertilizers, lime, ash, plant protection chemicals etc. and cost of machinery services. The particulars relating to the establishment cost are presented in Table 4.12.

All the costs incurred annually for the maintenance and production on the arecanut gardens from the second year onwards till the life span of 50 years was considered as maintenance costs. It included labour cost on cultural operations like weeding, irrigation, manuring, inter cultivation, maintenance of irrigation channels, plant protection, harvesting and post harvest operations (drying and dehusking), cost of material inputs like fertilizers, manures, lime, ash, etc. and fixed costs like depreciation, land revenue, rent on land, interest on fixed capital and apportioned establishment cost. The particulars of cost of cultivation of arecanut gardens for the entire economic life period were presented in Table 4.17.

The total costs for the entire lifespan of the arecanut garden worked out to Rs.34,52,903.35 per hectare. The breakup of the total costs into operational costs and fixed costs indicated that the operational costs were Rs. 22, 24,482.16 and fixed costs Rs. 12, 28,421.19 per hectare and accounted for 64.42 and 35.58 per cent of the total costs. Of the total costs the opportunity cost on owned land was the highest costing item with Rs. 10, 95,514 accounting for 31.73 per cent of the total costs. The outlay that was incurred on human labour involved in the performance of various cultural practices needed to establish and maintain arecanut gardens was Rs. 9,45,969.80

and accounted for 27.40 per cent of total costs. This was the next costing item after rent on owned land.

The other important factor of production which demands more funds in the cultivation of arecanut was manures and fertilizers. The expenditure incurred towards this input was Rs.7,97,048 (23.08 per cent). Arecanut growers had spent Rs.1,77,568 (5.14 per cent) on plant protection chemicals. The share of these four items in the total costs worked out to 86.35 per cent.

4.3.7 Cost concepts

The cost of cultivation of arecanut gardens also dealt by adopting the cost concepts used in farm management studies *viz.*, Cost A_1, Cost A_2, Cost B and Cost C. The particulars are presented in Table 4.18.

It is noticed that there was no leasing activity among the sample farmers and hence Cost A_1 and Cost A_2 remained the same. The commercial cost of cultivation (Cost C) was Rs. 34, 52,903.35, Cost A_1/A_2 and Cost B were Rs. 19, 68,273.35 and Rs. 31, 34,837.35 respectively.

4.4 RETURNS FROM ARECANUT GARDENS

4.4.1 Costs and returns from intercrops

It is possible to practice intercropping during initial stages of establishment to earn extra income during this period. There will be enough interspaces left in between which remain unutilized by arecanut plants during their tender age. In order to utilize inter space economically the arecanut farmers practice intercropping of banana. Banana provides shade to arecanut

Table 4.18 Cost concepts

S.No	Particulars	Amount (Rs/ha)
1	Cost A_1/A_2	19,68,273.35
2	Cost B	31,34,837.35
3	Cost C	34,52,903.35

Table 4.19 : Costs and Returns from Intercrops per hectare (1st to 5th Year)

(Rupees)

Particulars	**Years**				
	1	**2**	**3**	**4**	**5**
Costs	39580	38650	24540	20850	19868
Gross Income	64780	56930	44000	37075	36450
Net Income	25200	28280	19460	16225	16582

seedlings protecting them against sun scorching. Income from the intercrops helps in reducing requirement of cash for establishment of arecanut plantations. The per hectare cost of cultivation, gross and net returns from inter crops are presented in table 4.19.

It is clear from the table that the net income realized by the arecanut orchardists from inter crops in 1st, 2nd, 3rd, 4th and 5th year was Rs.25,200, Rs. 28,280, Rs. 19,460, Rs. 16,225 and Rs. 16,582 respectively.

4.4.2 Returns from arecanut garden during yield increasing period (6th to 25th year)

The yield in terms of physical units (quintals), gross returns and net returns from arecanut gardens during yield increasing period are presented in Table 4.20.

The gross returns during pre-bearing period (2-5 years) constituted the net income from inter crops. The income from the sale of arecanut was obtained from 6th year onwards when the orchard commenced bearing.

The yield of arecanut was 1.5 quintals in the 6th year which rose to 20.62 quintals in the 10th year and again further raised to 21.08 quintals in the 11th year and continued up to 25th year. The yield was more than doubled from 7th year to 25th year. The gross income which was Rs. 11,250 in 6th year had risen to Rs. 1,58,100 per hectare per annum in 25th year. The net income was negative in the 6th year but became positive from 7th year onwards during the yield increasing period. The annual net income increased from Rs. -34,012 in the 6th year to Rs. 73,549.84 in 25th year. In all the total net

income for the entire yield increasing period was Rs. 12,29,118.30 per hectare.

4.4.3 Returns from arecanut garden during yield stabilization period (26th to 40th year)

During this period, the yield stayed at 19.25 quintals per hectare per annum. So also the gross and net returns (Table 4.21). The annual net income ranged from Rs. 58,293.40 in 26th year to Rs. 62,594.54 during 40th year. In all the orchardists secured a net income of Rs. 9,17,412.40 during the yield stabilizing period. These findings are in agreement with the findings of Chinnappa (2001).

4.4.4 Returns from arecanut garden during yield declining period (41st to 50th year)

Returns from arecanut orchard during yield declining period are presented in Table 4.22. This period is characterized by falling yield and returns. The yield which was 16.04 quintals per hectare per annum in 41st year declined to 6.88 quintals in 50th year. The net income declined from Rs. 62,852.92 in 41st year to Rs. 9,653.75 in 50th year. The total net income derived by the selected orchardists during the entire yield declining period was Rs. 4,08,022.64 per hectare.

4.4.5 Measures of farm income in arecanut cultivation

An important element in the farm business organization relates the manner in which inputs are allocated. A measuring rod is necessary to provide guides and standards for evaluating the use of various inputs. To

achieve this objective, various farm efficiency measure *viz.,* farm business income, family labour income, net income and farm investment income were worked out and presented in Table 4.23.

The gross income realized in the cultivation of arecanut was estimated at Rs. 59, 58,675 per hectare. Though the gross income is a measure to assess efficiency of the farm business, but it alone does not help us to judge the success of the farm business. Therefore, another measure namely, net income which represents surplus over the total costs was estimated. Higher net income reflects the degree of success of farm business. Arecanut farmers realized a net income of Rs. 25,05,771.65 per hectare.

Farm business income is a measure which indicates returns for all the resources like land, family labour and farm operator's labour and capital. On this front, the orchardists earned Rs. 39,90,401.65 per hectare.

Family labour income is another measure of farm efficiency which represents the returns to farmer's own labour and family labour and this amounted to Rs.28,23,837.65 per hectare. Farm investment income is a measure which indicates the returns to fixed capital. It was Rs.36,72,335.65.

The foregoing analysis indicated that arecanut cultivation is quite profitable at existing prices and holds bright promise for future.

4.4.6 Costs and returns per quintal of arecanut production

The contents of Table 4.24 reveal that farmer incurred Rs.4,346.07 to produce a quintal of arecanut and they realized a net income Rs.3,153.93 per quintal. This indicates the profitability of arecanut cultivation.

Table 4.23 Income measures

S.No	Particulars	Amount (Rs/ha)
1	Gross income	59,58,675.00
2	Farm business income	39,90,401.65
3	Family labour income	28,23,837.65
4	Net income	25,05,771.65
5	Farm investment income	36,72,335.65

Table 4.24 Costs and returns per quintal of arecanut

S.No	Particulars	Amount (Rs)
1	**Costs**	
a.	Average variable cost	2799.89
b.	Average fixed cost	1546.18
c.	Average total cost	4346.07
2	**Returns**	
a.	Gross income	7500.00
b.	Net income	3153.93

4.5 ECONOMIC FEASIBILITY OF ARECANUT GARDENS

Before making a choice of any enterprise, it becomes necessary to examine the economic feasibility of that enterprise. The length of the period a particular enterprise bears fruits plays a key role in the selection of indicators that would examine the economic feasibility of the enterprise. Several techniques are available for evaluating the economic feasibility of investment in orchards. For studying the economic viability of arecanut plantations, the project evaluation techniques were employed. Besides, the present value summation method commonly used namely net present value (NPV), benefit-cost ratio (B-C ratio) and internal rate of returns were used to examine economic feasibility of investment. The values are presented in Table 4.25.

In the present study the costs and returns had been discounted at 10, 12, 16, 20, and 24 per cent to estimate the net present value of future returns.

4.5.1 Net present value (NPV)

Net present value (NPV) is the first measure of economic evaluation of any investment proposal. It is the difference between discounted costs and benefits. This indicates the surplus money that could be generated by the investment proposal. As is evident from the table the net present value is positive indicating financial feasibility of investment on arecanut. The net present value is as high as Rs.5,38,049.12 at 10 per cent discount rate. The high positive net present worth (NPW) even at higher discount rate indicated the financial soundness of the investment made in arecanut cultivation.

4.5.2 Benefit-cost ratio (BCR)

It is the second measure of investment appraisal. This indicates returns per rupee of investment. The benefit-cost ratios were 3.1, 2.9, 2.52, 2.18 and 1.87 at 10, 12, 16, 20 and 24 per cent discount rate respectively. The benefit-cost ratio was more than unity at all the discount rates, the investment was found to be economically feasible and financially viable. Even at higher discount rate of 24 per cent, it was 1.87 showing that each rupee of investment made in arecanut cultivation would bring a gross income of Rs. 1.87 or a net income of Rs. 0.87 and this proved profitability of arecanut cultivation.

4.5.3 Internal rate of return (IRR)

It is an indicator of average earning power of investment proposal. It is another tool of discounted cash flow measure to appraise the worthwhileness of investment. It is indeed to estimate the discount rate which makes net present value zero. The internal rate of return was found to be 40 per cent. The internal rate of return was more than the bank rate of interest (15 per cent) and hence arecanut cultivation is economically feasible. An investor cannot borrow capital at higher than IRR for making investment in arecanut. In other words, this is the maximum rate at which prospective arecanut growers can borrow and invest.

The above findings are in confirmity with the findings of Krishna Raja (1981), Chinnappa (2002), Chinnappa and Nagaraj (2009).

Table 4.25 : Estimates of Economic Viability of Arecanut Garden

Particulars	Discount Rate (%)				
	10	**12**	**16**	**20**	**24**
NPW (Rs.)	538049.32	390217.54	215899.84	124071.70	71,810.82
Benefit – Cost Ratio	3.1	2.9	2.52	2.18	1.87
IRR (%)	40	-	-	-	-

4.6 OPINION SURVEY

An opinion survey was carried out for the sample of 60 farmers regarding the problems faced by them in the production and marketing of arecanut. The important problems as indicated by the farmers are presented in Table 4.26 and each constraint is assessed in terms of percentage to the sample farmers who feel it was a limiting factor.

With regard to problems of production, 90 per cent of the arecanut growers felt that the incidence of pests and diseases was an important problem. Inadequate availability of labour was a problem for 80 per cent of the growers. High cost of productive inputs was a problem for 75 per cent of the selected farmers. About 73 per cent of the sample farmers indicated cultivation of poor yielding cultivars as one of the problems in the cultivation of arecanut. Inadequacy of institutional credit was reported by 60 per cent of the growers. Lack of adequate knowledge and skill in the cultivation of arecanut as a problem was expressed by 45 per cent of the farmers.

With respect to problems of marketing, majority of farmers (98 per cent) expressed their concern about price fluctuations. Lack of local markets was a problem for about 60 per cent of the respondents. About 55 per cent of the growers felt the need for machinery to undertake dehusking. 40 per cent of the respondents expressed their concern about the inadequacy of infrastructural facilities like processing.

Table 4.26 Opinion Survey

S. No.	Problem	Percentage to the total respondents
I	**PRODUCTION PROBLEM**	
1	Cultivation of poor yielding cultivar	73
2	Inadequacy of institutional credit	60
3	Costliness and unavailabilityof inputs	75
4	Pests and diseases	90
5	Inadequate labour availability	80
6	Lack of adequate knowledge and skill	45
II	**MARKETING PROBLEM**	
1	Price fluctuation	98
2	Lack of machinery for dehusking	55
3	Lack of local markets	60
4	Lack of by product utilization	25
5	Lack of processing units	40

Table 4.4 Material Input Utilization on Arecanut Gardens per hectare (1 to 50 Years)

Particulars	Age of the Garden (Years)																								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Planting material (Number)	1375	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manures (tonnes)																									
a. FYM	4.28	4.28	4.28	4.68	4.68	4.68	4.68	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
b. Ash	-	1	1	1.33	1.33	1.33	1.33	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
c. Green leaf manure	-	2.2	2.2	4.5	4.5	4.5	4.5	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
Fertilizers (Kg)																									
a. N	61.5	61.5	61.5	103	103	103	103	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153
b. P	121.5	122	122	160	160	160	160	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195
c. K	158.3	158	158	193	193	193	193	233	233	233	233	233	233	233	233	233	233	233	233	233	233	233	233	233	233
Lime(Kg)	171	-	171	-	310	-	-	310	-	-	310	-	-	310	-	-	310	-	-	310	-	-	310	-	-
Plant protection chemicals (L)	-	-	-	-	-	14.4	14.4	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8

Conti…

Particulars	Age of the Garden (Years)																								Total
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	
Planting material (Number)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1375
Manures (tonnes)																										
a. FYM	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98	328.8
b. Ash	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	80.02
c. Green leaf manure	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	239
Fertilizers (Kg)																										
a. N	153	153	153	153	153	153	153	153	153	153	153	153	153	153	153	76.5	76.5	76.5	76.5	76.5	76.5	76.5	76.5	76.5	76.5	6392
b. P	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	97.3	97.3	97.3	97.3	97.3	97.3	97.3	97.3	97.3	97.3	8413
c. K	233	233	233	233	233	233	233	233	233	233	233	233	233	233	233	161	161	161	161	161	161	161	161	161	161	10549
Lime(Kg)	310	-	-	310	-	-	310	-	-	310	-	-	310	-	-	310	-	-	310	-	-	310	-	-	-	4992
Plant protection chemicals (L)	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	732.2

Recommended Doses per hectare

1. Plant material (Number)	1200		
2. Manures (tonnes)			
FYM	16.5		
Ash	5		
Green Leaf Manure	16.5		
3. Fertilizers (Kgs)	N	P	K
1st year	108	110	120
2nd year	217	220	240
3rd year onwards	325	330	360
4. Lime (Kgs)	600		
5. Plant Protection Chemicals (L)	15		

Table 4.7 : Operation – wise Human Labour Utilization in Mandays per hectare of Arecanut Garden during Yield Increasing Period (6th to 25th Year)

Operation	Years																				Total
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Maintenance of irrigation channels	10 (3.89)	10 (3.67)	10 (3.19)	10 (3.16)	10 (3.12)	10 (3.09)	10 (3.11)	10 (3.11)	10 (3.09)	10 (3.11)	10 (3.11)	10 (3.09)	10 (3.11)	10 (3.11)	10 (3.09)	10 (3.11)	10 (3.11)	10 (3.09)	10 (3.11)	10 (3.11)	200 (3.17)
Inter cultivation	20 (7.78)	20 (7.34)	20 (6.37)	20 (6.32)	20 (6.23)	20 (6.17)	20 (6.21)	20 (6.21)	20 (6.17)	20 (6.21)	20 (6.21)	20 (6.17)	20 (6.21)	20 (6.21)	20 (6.17)	20 (6.21)	20 (6.21)	20 (6.17)	20 (6.21)	20 (6.21)	400 (6.33)
Maintenance of drainage channels	2 (0.78)	2 (0.73)	2 (0.64)	2 (0.63)	2 (0.62)	2 (0.62)	2 (0.62)	2 (0.62)	2 (0.62)	2 (0.62)	2 (0.62)	2 (0.62)	2 (0.62)	2 (0.62)	2 (0.62)	2 (0.62)	2 (0.62)	2 (0.62)	2 (0.62)	2 (0.62)	40 (0.63)
Application of manures	7 (2.72)	7 (2.57)	10 (3.19)	10 (3.16)	10 (3.12)	10 (3.09)	10 (3.11)	10 (3.11)	10 (3.09)	10 (3.11)	10 (3.11)	10 (3.09)	10 (3.11)	10 (3.11)	10 (3.09)	10 (3.11)	10 (3.11)	10 (3.09)	10 (3.11)	10 (3.11)	194 (3.07)
Green leaf manuring	9.58 (3.73)	9.58 (3.51)	14.15 (4.51)	14.15 94.47)	14.15 (4.41)	14.15 (4.37)	14.15 (4.40)	14.15 (4.40)	14.15 (4.37)	14.15 (4.40)	14.15 (4.40)	14.15 (4.37)	14.15 (4.40)	14.15 (4.40)	14.15 (4.37)	14.15 (4.40)	14.15 (4.40)	14.15 (4.37)	14.15 (4.40)	14.15 (4.40)	273.86 (4.33)
Fertilizer application	1 (0.39)	1 (0.37)	2.15 (0.69)	2.15 (0.680	2.15 90.67)	2.15 (0.66)	2.15 (0.67)	2.15 (0.67)	2.15 (0.66)	2.15 (0.67)	2.15 (0.67)	2.15 (0.66)	2.15 (0.67)	2.15 (0.67)	2.15 (0.66)	2.15 (0.67)	2.15 (0.67)	2.15 (0.66)	2.15 (0.67)	2.15 (0.67)	40.70 (0.64)
Application of lime	-	-	2 (0.64)	-	-	2 (0.62)	-	-	2 (0.62)	-	-	2 (0.62)	-	-	2 (0.62)	-	-	2 (0.62)	-	-	12 (0.20)
Weeding	35 (13.61)	35 (12.84)	35 (11.15)	35 (11.06)	35 (10.90)	35 (10.81)	35 (10.87)	35 (10.87)	35 (10.81)	35 (10.87)	35 (10.87)	35 (10.81)	35 (10.87)	35 (10.87)	35 (10.81)	35 (10.87)	35 (10.87)	35 (10.81)	35 (10.87)	35 (10.87)	700 (11.09)
Irrigation	58 (22.55)	58 (21.28)	58 (18.48)	58 (18.33)	58 (18.07)	58 (17.91)	58 (18.02)	58 (18.02)	58 (17.91)	58 (18.02)	58 (18.02)	58 (17.91)	58 (18.02)	58 (18.02)	58 (17.91)	58 (18.02)	58 (18.02)	58 (17.91)	58 (18.02)	58 (18.02)	1160 (18.37)
Plant protection	5.6 (2.18)	5.6 (2.05)	6.95 (2.21)	6.95 (2.20)	6.95 (2.17)	6.95 (2.15)	6.95 (2.16)	6.95 (2.16)	6.95 (2.15)	6.95 (2.16)	6.95 (2.16)	6.95 (2.15)	6.95 (2.16)	6.95 (2.16)	6.95 (2.15)	6.95 (2.16)	6.95 (2.16)	6.95 (2.15)	6.95 (2.16)	6.95 (2.16)	136.30 (2.16)
Watch & Ward	90 (34.99)	90 (33.02)	90 (28.68)	90 (28.44)	90 (28.04)	90 (27.79)	90 (27.96)	90 927.96)	90 (27.79)	90 (27.96)	90 (27.96)	90 (27.79)	90 (27.96)	90 (27.96)	90 (27.79)	90 (27.96)	90 (27.96)	90 (27.79)	90 (27.96)	90 (27.96)	1800 (28.48)
Harvesting	15 (5.83)	15 (5.50)	30 (9.56)	30 (9.48)	30 (9.35)	30 (9.26)	30 (9.32)	30 (9.32)	30 (9.26)	30 (9.32)	30 (9.32)	30 (9.26)	30 (9.32)	30 (9.32)	30 (9.26)	30 (9.32)	30 (9.32)	30 (9.26)	30 (9.32)	30 (9.32)	570 (9.02)
Drying	1 (0.39)	1 (0.37)	1.5 (0.48)	1.5 (0.47)	1.5 (0.47)	1.5 (0.46)	1.5 (0.47)	1.5 (0.47)	1.5 (0.46)	1.5 (0.47)	1.5 (0.47)	1.5 (0.46)	1.5 (0.47)	1.5 (0.47)	1.5 (0.46)	1.5 (0.47)	1.5 (0.47)	1.5 (0.46)	1.5 (0.47)	1.5 (0.47)	29 (0.46)
Dehusking	3 (1.17)	18.4 (6.75)	32.08 (10.22)	36.66 (11.59)	41.24 (12.85)	42.16 (13.02)	42.16 (13.10)	42.16 (13.10)	42.16 (13.02)	42.16 (13.10)	42.16 (13.10)	42.16 (13.02)	42.16 (13.10)	42.16 (13.10)	42.16 (13.02)	42.16 (13.10)	42.16 (13.10)	42.16 (13.02)	42.16 (13.10)	42.16 (13.10)	763.78 (12.03)
Total	257.18 (100)	272.58 (100)	313.83 (100)	316.41 (100)	320.99 (100)	323.91 (100)	321.91 (100)	321.91 (100)	323.91 (100)	321.91 (100)	321.91 (100)	323.91 (100)	321.91 (100)	321.91 (100)	323.91 (100)	321.91 (100)	321.91 (100)	323.91 (100)	321.91 (100)	321.91 (100)	6319.64 (100)
Owned	90.26 (35.10)	91.26 (33.48)	91.34 (29.10)	91.34 (28.87)	91.34 (28.77)	91.34 (28.20)	91.34 (28.37)	91.34 (28.69)	91.34 (28.20)	91.34 (28.37)	91.34 (28.37)	91.34 (28.20)	91.34 (28.37)	91.34 (28.37)	91.34 (28.20)	91.34 (28.37)	91.34 (28.37)	91.34 (28.20)	91.34 (28.37)	91.34 (28.37)	1825.64 (28.95)
Hired	166.92 (64.90)	181.32 (66.52)	222.49 (70.90)	225.07 (71.13)	229.65 (71.23)	232.57 (71.80)	230.57 (71.63)	230.57 (71.31)	232.57 (71.80)	230.57 (71.63)	230.57 (71.63)	232.57 (71.80)	230.57 (71.63)	230.57 (71.63)	232.57 (71.80)	230.57 (71.63)	230.57 (71.63)	232.57 (71.80)	230.57 (71.63)	230.57 (71.63)	4494.00 (71.05)

Note : Figure in parenthesis indicate percentage to total labour

Table 4.8 Operation – wise Human Labour Utilization in Mandays per hectare of Arecanut Garden during Yield Stabilization Period (26th to 40th year)

Particulars	Years															Total
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
Maintenance of irrigation channels	10 (3.12)	10 (3.14)	10 (3.14)	10 (3.12)	10 (3.14)	10 (3.14)	10 (3.12)	10 (3.14)	10 (3.14)	10 (3.12)	10 (3.14)	10 (3.14)	10 (3.12)	10 (3.14)	10 (3.14)	150 (3.14)
Inter cultivation	20 (6.25)	20 (6.28)	20 (6.28)	20 (6.25)	20 (6.28)	20 (6.28)	20 (6.25)	20 (6.28)	20 (6.28)	20 (6.25)	20 (6.28)	20 (6.28)	20 (6.25)	20 (6.28)	20 (6.28)	300 (6.27)
Maintenance of drainage channels	2 (0.62)	2 (0.63)	2 (0.63)	2 (0.62)	2 (0.63)	2 (0.63)	2 (0.62)	2 (0.63)	2 (0.63)	2 (0.62)	2 (0.630	2 (0.63)	2 (0.62)	2 (0.63)	2 (0.63)	30 (0.63)
Application of manures	10 (3.12)	10 (3.14)	10 (3.14)	10 (3.12)	10 (3.14)	10 (3.14)	10 (3.12)	10 (3.14)	10 (3.14)	10 (3.12)	10 (3.14)	10 (3.14)	10 (3.12)	10 (3.14)	10 (3.14)	150 (3.14)
Green leaf manuring	14.15 (4.42)	14.15 (4.45)	14.15 (4.45)	14.15 (4.42)	14.15 (4.45)	14.15 (4.45)	14.15 (4.42)	14.15 (4.45)	14.15 (4.45)	14.15 (4.42)	14.15 (4.45)	14.15 (4.45)	14.15 (4.42)	14.15 (4.45)	14.15 (4.45)	212.25 (4.44)
Fertilizer application	2.15 (0.67)	2.15 (0.68)	2.15 (0.68)	2.15 (0.67)	2.15 (0.68)	2.15 (0.68)	2.15 (0.67)	2.15 (0.68)	2.15 (0.68)	2.15 (0.67)	2.15 (0.68)	2.15 (0.68)	2.15 (0.67)	2.15 (0.68)	2.15 (0.68)	32.25 (0.67)
Application of lime	2 (0.62)	-	-	2 (0.62)	-	-	2 (0.62)	-	-	2 (0.62)	-	-	2 (0.62)	-	-	10 (0.21)
Weeding	35 (10.93)	35 (11.00)	35 (11.00)	35 (10.93)	35 (11.00)	35 (11.00)	35 (10.93)	35 (11.00)	35 (11.00)	35 (10.93)	35 (11.00)	35 (11.00)	35 (10.93)	35 (11.00)	35 (11.00)	525 (10.97)
Irrigation	58 (18.11)	58 (18.22)	58 (18.22)	58 (18.11)	58 (18.22)	58 (18.22)	58 (18.11)	58 (18.22)	58 (18.22)	58 (18.11)	58 (18.22)	58 (18.22)	58 (18.11)	58 (18.22)	58 (18.22)	870 (18.19)
Plant protection	6.95 (2.17)	6.95 (2.18)	6.95 (2.18)	6.95 (2.17)	6.95 (2.18)	6.95 (2.18)	6.95 (2.17)	6.95 (2.18)	6.95 (2.18)	6.95 (2.17)	6.95 (2.18)	6.95 (2.18)	6.95 (2.17)	6.95 (2.18)	6.95 (2.18)	104.25 (2.18)
Watch & Ward	90 (28.10)	90 (28.28)	90 (28.28)	90 (28.10)	90 (28.28)	90 (28.28)	90 (28.10)	90 (28.28)	90 (28.28)	90 (28.10)	90 (28.28)	90 (28.28)	90 (28.10)	90 (28.28)	90 (28.28)	1350 (28.22)
Harvesting	30 (9.37)	30 (9.43)	30 (9.43)	30 (9.37)	30 (9.43)	30 (9.43)	30 (9.37)	30 (9.43)	30 (9.43)	30 (9.37)	30 (9.43)	30 (9.43)	30 (9.37)	30 (9.43)	30 (9.43)	450 (9.41)
Drying	1.5 (0.47)	1.5 (0.47)	1.5 (0.47)	1.5 (0.470	1.5 (0.47)	1.5 (0.47)	1.5 (0.47)	1.5 (0.47)	1.5 (0.47)	1.5 (0.47)	1.5 (0.47)	1.5 (0.47)	1.5 (0.47)	1.5 (0.47)	1.5 (0.47)	22.5 (0.47)
Dehusking	38.5 (12.02)	38.5 (12.10)	38.5 (12.10)	38.5 (12.02)	38.5 (12.10)	38.5 (12.10)	38.5 (12.02)	38.5 (12.10)	38.5 (12.10)	38.5 (12.02)	38.5 (12.10)	38.5 (12.10)	38.5 (12.02)	38.5 (12.10)	38.5 (12.10)	577.5 (12.07)
Total	320.25 (100)	318.25 (100)	318.25 (100)	320.25 (100)	318.25 (100)	318.25 (100)	320.25 (100)	318.25 (100)	318.25 (100)	320.25 (100)	318.25 (100)	318.25 (100)	320.25 (100)	318.25 (100)	318.25 (100)	4783.75 (100)
Owed	91.34 (28.70)	91.34 (28.52)	91.34 (28.70)	91.34 (28.70)	91.34 (28.52)	91.34 (28.70)	91.34 (28.70)	91.34 (28.52)	91.34 (28.70)	91.34 (28.70)	91.34 (28.52)	91.34 (28.70)	91.34 (28.70)	91.34 (28.52)	91.34 (28.70)	1370.1 (28.64)
Hired	228.91 (71.48)	226.91 (71.30)	226.91 (71.30)	228.91 (71.48)	226.91 (71.30)	226.91 (71.30)	228.91 (71.48)	226.91 (71.30)	226.91 (71.30)	228.91 (71.48)	226.91 (71.30)	226.91 (71.30)	228.91 (71.48)	226.91 (71.30)	226.91 (71.30)	3413.65 (71.36)

Note : Figure in parenthesis indicate percentage to total labour

Table 4.9 : Operation- wise Human Labour Utilization in Mandays per hectare of Arecanut Garden during Yield Declining Period (41st to 50th Year)

Operations	Years										Total
	41	42	43	44	45	46	47	48	49	50	
Maintenance of irrigation channels	10 (5.57)	10 (4.68)	10 (5.60)	10 (4.72)	10 (5.68)	10 (4.74)	10 (5.95)	10 (5.00)	10 (6.06)	10 (6.24)	100 (5.37)
Inter cultivation	20 (11.14)	20 (9.37)	20 (11.20)	20 (9.44)	20 (11.37)	20 (9.48)	20 (11.900	20 (10.00)	20 (12.12)	20 (12.49)	200 (10.73)
Maintenance of drainage channels	2 (1.11)	2 (0.94)	2 (1.12)	2 (0.94)	2 (1.14)	2 (0.95)	2 (1.19)	2 (1.00)	2 (1.21)	2 (1.25)	20 (1.07)
Application of manures	5 (2.79)	5 (2.34)	5 (2.80)	5 (2.36)	5 (2.84)	5 (2.37)	5 (2.98)	5 (2.50)	5 (3.03)	5 (3.12)	50 (2.69)
Green leaf manuring	4.89 (2.72)	4.89 (2.29)	4.89 (2.74)	4.89 (2.31)	4.89 (2.78)	4.89 (2.32)	4.89 (2.91)	4.89 (2.45)	4.89 (2.96)	4.89 (3.05)	48.9 (2.63)
Fertilizer application	1 (0.56)	1 (0.47)	1 (0.56)	1 (0.47)	1 (0.57)	1 (0.47)	1 (0.60)	1 (0.50)	1 (0.61)	1 (0.62)	10 (0.54)
Application of lime	-	1 (0.56)	-	-	1 (0.47)	-	-	1 (0.60)	-	-	3 (0.16)
Weeding	-	35 (16.39)	-	35 (16.51)	-	35 (16.59)	-	35 (17.50)	-	-	140 (7.52)
Irrigation	30 (16.71)	30 (14.05)	30 (16.81)	30 (14.15)	30 (17.05)	30 (14.22)	30 (17.86)	30 (15.00)	30 (18.18)	30 (18.73)	300 (16.12)
Plant protection	4.54 (2.53)	4.54 (2.13)	4.54 (2.54)	4.54 (2.14)	4.54 (2.58)	4.54 (2.15)	4.54 (2.70)	4.54 (2.27)	4.54 (2.75)	4.54 (2.83)	45.4 (2.44)
Watch & Ward	50 (27.85)	50 (23.42)	50 (28.01)	50 (23.59)	50 (28.42)	50 (23.70)	50 (29.76)	50 (25.00)	50 (30.30)	50 (31.21)	500 (26.86)
Harvesting	18 (10.03)	18 (8.43)	18 (10.08)	18 (8.49)	18 (10.23)	18 (8.53)	18 (10.71)	18 (9.00)	18 (10.91)	18 (11.24)	180 (9.67)
Drying	1 (0.56)	1 (0.47)	1 (0.56)	1 (0.47)	1 (0.57)	1 (0.47)	1 (0.60)	1 (0.50)	1 (0.61)	1 (0.62)	10 (0.54)
Dehusking	32.08 (17.87)	32.08 (15.03)	32.08 (17.97)	29.51 (13.92)	29.51 (16.77)	29.51 (13.99)	18.57 (11.05)	18.57 (9.29)	18.57 (11.25)	13.76 (8.59)	254.24 (13.66)
Total	178.51 (100)	214.51 (100)	178.51 (100)	210.94 (100)	176.94 (100)	210.94 (100)	165 (100)	201 (100)	165 (100)	160.19 (100)	1861.54 (100)
Owned	65.93 (36.93)	65.93 (30.74)	65.93 (36.93)	65.93 (31.26)	65.93 (37.47)	65.93 (31.26)	65.93 (39.96)	65.93 (32.97)	65.93 (39.96)	65.93 (41.16)	659.3 (35.38)
Hired	112.58 (63.07)	148.58 (69.26)	112.58 (63.07)	145.01 (68.74)	111.01 (62.53)	145.01 (68.74)	99.07 (60.04)	135.07 (67.04)	99.07 (60.04)	94.26 (58.84)	1202.24 (64.62)

Note : Figure in parentheses indicate percentage to total labour

Table 4.14 Cost Structure on Arecanut Garden per hectare during Yield Increasing Period (6th to 25th Year)

(Rupees)

Particulars	Years																				Total
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
I. Operational costs																					
a. Human labour	19288.5 (42.62)	20443.5 (35.85)	23537.25 (29.88)	23730.75 (29.52)	24074.25 (28.71)	24293.25 (27.34)	24143.25 (28.55)	24143.25 (28.55)	24293.25 (27.34)	24143.25 (28.55)	24143.25 (28.55)	24293.25 (27.34)	24143.25 (28.55)	24143.25 (28.55)	24293.25 (27.34)	24143.25 (28.55)	24143.25 (28.55)	24293.25 (27.34)	24143.25 (28.55)	24143.25 (28.55)	473973 (28.99)
Owned	6769.5 (14.96)	6844.5 (12.00)	6850.5 (8.70)	6850.5 (8.52)	6850.5 (8.17)	6850.5 (7.71)	6850.5 (8.10)	6850.5 (8.10)	6850.5 (7.71)	6850.5 (8.10)	6850.5 (8.10)	6850.5 (7.71)	6850.5 (8.10)	6850.5 (8.10)	6850.5 (7.71)	6850.5 (8.10)	6850.5 (8.10)	6850.5 (7.71)	6850.5 (8.10)	6850.5 (8.10)	136923 (8.38)
Hired	12519 (27.66)	13599 (23.88)	16686.75 (21.38)	16880.25 (21.19)	17223.75 (20.63)	17442.75 (19.79)	17292.75 (20.63)	17292.75 (20.54)	17442.75 (19.79)	17292.75 (20.63)	17292.75 (20.63)	17442.75 (19.79)	17292.75 (20.63)	17292.75 (20.63)	17442.75 (19.79)	17292.75 (20.63)	17292.75 (20.63)	17442.75 (19.79)	17292.75 (20.63)	17292.75 (20.63)	337050 (20.61)
b. Machine labour	400 (0.88)	400 (0.71)	400 (0.51)	400 (0.50)	400 (0.48)	400 (0.45)	400 (0.48)	400 (0.48)	400 (0.45)	400 (0.48)	400 (0.48)	400 (0.45)	400 (0.48)	400 (0.48)	400 (0.45)	400 (0.48)	400 (0.48)	400 (0.45)	400 (0.48)	400 (0.48)	8000 (0.49)
Owned	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Hired	400 (0.88)	400 (0.71)	400 (0.51)	400 (0.50)	400 (0.48)	400 (0.45)	400 90.48)	400 (0.48)	400 (0.45)	400 (0.48)	400 (0.48)	400 (0.45)	400 (0.48)	400 (0.48)	400 (0.45)	400 (0.48)	400 (0.48)	400 (0.45)	400 (0.48)	400 (0.48)	8000 (0.49)
c. Manures & Fertilizers	12858 (28.48)	12858 (22.54)	18592 (23.62)	18592 (23.14)	18592 (22.16)	18592 (20.10)	18592 (21.18)	18592 (21.18)	18592 (20.10)	18592 (21.18)	18592 (21.18)	18592 (20.10)	18592 (21.18)	18592 (21.18)	18592 (20.10)	18592 (21.18)	18592 (21.18)	18592 (20.10)	18592 (21.18)	18592 (21.18)	360372 (22.04)
Manures	10276 (22.70)	10276 (18.25)	15310 (19.61)	15310 (19.22)	15310 (18.42)	15310 (17.37)	15310 (18.26)	15310 (18.26)	15310 (17.37)	15310 (18.26)	15310 (18.26)	15310 (17.37)	15310 (18.26)	15310 (18.26)	15310 (17.37)	15310 (18.26)	15310 (18.26)	15310 (17.37)	15310 (18.26)	15310 (18.26)	296132 (18.11)
Fertilizers	2582 (5.80)	2582 (4.59)	3282 (4.20)	3282 (4.12)	3282 (3.95)	3282 (3.72)	3282 (3.91)	3282 (3.91)	3282 (3.72)	3282 (3.91)	3282 (3.91)	3282 (3.72)	3282 (3.91)	3282 (3.91)	3282 (3.72)	3282 (3.91)	3282 (3.91)	3282 (3.72)	3282 (3.91)	3282 (3.91)	64240 (3.93)
d. Lime	-	-	1550 (1.99)	- 0.00	- 0.00	3796 (4.31)	- 0.00	- 0.00	3796 (4.31)	- 0.00	- 0.00	3796 (4.31)	- 0.00	- 0.00	3796 (4.31)	- 0.00	- 0.00	3796 (4.31)	- 0.00	- 0.00	20530 (1.26)
e. Plant protection chemicals	3460 (7.77)	3460 (6.15)	4280 (5.48)	4280 (5.37)	4280 (5.15)	4280 (4.86)	4280 (5.11)	4280 (5.11)	4280 (4.86)	4280 (5.11)	4280 (5.11)	4280 (4.86)	4280 (5.11)	4280 (5.11)	4280 (4.86)	4280 (5.11)	4280 (5.11)	4280 (4.86)	4280 (5.11)	4280 (5.11)	83960 (5.13)
f. Repairs	464 (1.04)	464 (0.82)	464 (0.59)	464 (0.58)	464 (0.56)	464 (0.53)	464 (0.55)	464 (0.55)	464 (0.53)	464 (0.55)	464 (0.55)	464 (0.53)	464 90.55)	464 (0.55)	464 (0.53)	464 (0.55)	464 (0.55)	464 (0.53)	464 (0.55)	464 (0.55)	9280 (0.57)
g. Transportation	265 (0.60)	360 (0.64)	650 (0.83)	650 (0.82)	650 (0.78)	650 (0.74)	650 (0.78)	650 (0.78)	650 (0.74)	650 (0.78)	650 (0.78)	650 (0.74)	650 (0.78)	650 (0.78)	650 (0.74)	650 (0.78)	650 (0.78)	650 (0.74)	650 (0.78)	650 (0.78)	12325 (0.75)
h. Interest on working capital	3306.2 (7.43)	3418.7 (6.07)	4452.59 (5.70)	4330.51 (5.44)	4361.42 (5.25)	4722.77 (5.36)	4367.63 (5.21)	4367.63 (5.21)	4722.77 (5.36)	4367.63 (5.21)	4367.63 (5.21)	4722.77 (5.36)	4367.63 (5.21)	4367.63 (5.21)	4722.77 (5.36)	4367.63 (5.21)	4367.63 (5.21)	4722.77 (5.36)	4367.63 (5.21)	4367.63 (5.21)	87159.57 (5.33)
Total operational costs	40041.7 (88.47)	41404.2 (72.61)	53925.84 (68.46)	52447.26 (65.24)	52821.67 (62.99)	57198.02 (64.37)	52896.88 (62.56)	52896.88 (62.56)	57198.02 (64.37)	52896.88 (62.56)	52896.88 (62.56)	57198.02 (64.37)	52896.88 (62.56)	52896.88 (62.56)	57198.02 (64.37)	52896.88 (62.56)	52896.88 (62.56)	57198.02 (64.37)	52896.88 (62.56)	52896.88 (62.56)	1055599.57 (64.56)

Cont...

II. Fixed costs																						
a. Depreciation	757 (1.70)	757 (1.34)	757 (0.97)	757 (0.95)	757 (0.91)	757 (0.86)	757 (0.90)	757 (0.90)	757 (0.86)	757 (0.90)	757 (0.90)	757 (0.86)	757 (0.90)	757 (0.90)	757 (0.86)	757 (0.90)	757 (0.90)	757 (0.90)	757 (0.86)	757 (0.90)	757 (0.90)	15140 (0.93)
b. Land revenue	244.57 (0.55)	244.57 (0.43)	244.57 (0.31)	244.57 (0.31)	244.57 (0.29)	244.57 (0.28)	244.57 (0.29)	244.57 (0.29)	244.57 (0.28)	244.57 (0.29)	244.57 (0.29)	244.57 (0.28)	244.57 (0.29)	244.57 (0.29)	244.57 (0.28)	244.57 (0.29)	244.57 (0.29)	244.57 (0.28)	244.57 (0.29)	244.57 (0.29)	4891.4 (0.30)	
c. Rental value of owned land	2025 (4.55)	12420 (22.06)	21654 (27.74)	24745.5 (31.06)	27837 (33.48)	28458 (32.29)	28458 (33.95)	28458 (33.95)	28458 (32.29)	28458 (33.95)	28458 (33.95)	28458 (32.29)	28458 (33.95)	28458 (33.95)	28458 (32.29)	28458 (33.95)	28458 (33.950	28458 (32.29)	28458 (33.95)	28458 (33.95)	515551.5 (31.53)	
d. Interest on fixed capital	1450 (3.26)	1450 (2.58)	1450 (1.86)	1450 (1.82)	1450 (1.74)	1450 (1.65)	1450 (1.73)	1450 (1.73)	1450 (1.65)	1450 (1.73)	1450 (1.73)	1450 (1.65)	1450 (1.73)	1450 (1.73)	1450 (1.65)	1450 (1.73)	1450 (1.73)	1450 (1.65)	1450 (1.73)	1450 (1.73)	29000 (1.77)	
e. Annual share of establishment costs	743.71 (1.64)	743.71 (1.30)	743.71 (0.94)	743.71 (0.93)	743.71 (0.89)	743.71 (0.84)	743.71 (0.88)	743.71 (0.88)	743.71 (0.84)	743.71 (0.88)	743.71 (0.88)	743.71 (0.84)	743.71 (0.88)	743.71 (0.88)	743.71 (0.84)	743.71 (0.88)	743.71 (0.88)	743.71 (0.84)	743.71 (0.88)	743.71 (0.88)	14874.2 (0.91)	
Total fixed costs	5220.28 (11.51)	15615.28 (27.39)	24849.28 (31.54)	27940.78 (34.76)	31032.28 (37.01)	31653.28 (35.63)	31653.28 (37.44)	31653.28 (37.44)	31653.28 (35.63)	31653.28 (37.44)	31653.28 (37.44)	31653.28 (35.63)	31653.28 (37.44)	31653.28 (37.44)	31653.28 (35.63)	31653.28 (37.44)	31653.28 (37.44)	31653.28 (35.63)	31653.28 (37.44)	31653.28 (37.44)	579457.1 (35.44)	
Total costs	45261.98 (100)	57019.48 (100)	78775.12 (100)	80388.04 (100)	83853.95 (100)	88851.3 (100)	84550.16 (100)	84550.16 (100)	88851.3 (100)	84550.16 (100)	84550.16 (100)	88851.3 (100)	84550.16 (100)	84550.16 (100)	88851.3 (100)	84550.16 (100)	84550.16 (100)	88851.3 (100)	84550.16 (100)	84550.16 (100)	1635056.67 (100)	

Note : Figure in parentheses indicate percentage to total

Table 4.15 : Cost Structure on Arecanut Garden per hectare during Yield Stabilization Period (26th to 40th Year)

(Rupees)

Particulars	Years															Total
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
I. OPERATIONAL COSTS																
a. Human labour	24018.75 (28.14)	23868.75 (29.44)	23868.75 (29.44)	24018.75 (28.14)	23868.75 (29.44)	23868.75 (29.44)	24018.75 (28.14)	23868.75 (29.44)	23868.75 (29.44)	24018.75 (28.14)	23868.75 (29.44)	23868.75 (29.44)	24018.75 (28.14)	23868.75 (29.44)	23868.75 (29.44)	358781.25 (28.74)
Owned	6850.5 (8.45)	6850.5 (8.03)	6850.5 (8.45)	6850.5 (8.45)	6850.5 (8.03)	6850.5 (8.45)	6850.5 (8.45)	6850.5 (8.03)	6850.5 (8.45)	6850.5 (8.45)	6850.5 (8.03)	6850.5 (8.45)	6850.5 (8.45)	6850.5 (8.03)	6850.5 (8.45)	102757.5 (8.23)
Hired	17168.25 (20.11)	17018.25 (20.99)	17018.25 (20.99)	17168.25 (20.11)	17018.25 (20.99)	17018.25 (20.99)	17168.25 (20.11)	17018.25 (20.99)	17018.25 (20.99)	17168.25 (20.11)	17018.25 (20.99)	17018.25 (20.99)	17168.25 (20.11)	17018.25 (20.99)	17018.25 (20.99)	256023.75 (20.51)
b. Machine labour	400 (0.47)	400 (0.49)	400 (0.49)	400 (0.47)	400 (0.49)	400 (0.49)	400 (0.47)	400 (0.49)	400 (0.49)	400 (0.47)	400 (0.49)	400 (0.49)	400 (0.47)	400 (0.49)	400 (0.49)	6000 (0.48)
Owned	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hired	400 (0.47)	400 (0.49)	400 (0.49)	400 (0.47)	400 (0.49)	400 (0.49)	400 (0.47)	400 (0.49)	400 (0.49)	400 (0.47)	400 (0.49)	400 (0.49)	400 (0.47)	400 (0.49)	400 (0.49)	6000 (0.48)
c. Manures & Fertilizers	18592 (21.78)	18592 (22.94)	18592 (22.94)	18592 (21.78)	18592 (22.94)	18592 (22.94)	18592 (21.78)	18592 (22.94)	18592 (22.94)	18592 (21.78)	18592 (22.94)	18592 (22.94)	18592 (21.78)	18592 (22.94)	18592 (22.94)	278880 (22.34)
Manures	15310 (17.93)	15310 (18.89)	15310 (18.89)	15310 (17.93)	15310 (18.89)	15310 (18.89)	15310 (17.93)	15310 (18.89)	15310 (18.89)	15310 (17.93)	15310 (18.89)	15310 (18.89)	15310 (17.93)	15310 (18.89)	15310 (18.89)	229650 (18.39)
Fertilizers	3282 (3.84)	3282 (4.05)	3282 (4.05)	3282 (3.84)	3282 (4.05)	3282 (4.05)	3282 (3.84)	3282 (4.05)	3282 (4.05)	3282 (3.84)	3282 (4.05)	3282 (4.05)	3282 (3.84)	3282 (4.05)	3282 (4.05)	49230 (3.94)
d. Lime	3796 (4.45)	-	-	3796 (4.45)	-	-	3796 (4.45)	-	-	3796 (4.45)	-	-	3796 (4.45)	-	-	18980 (1.52)
e. Plant protection chemicals	4280 (5.01)	4280 (5.28)	4280 (5.28)	4280 (5.01)	4280 (5.28)	4280 (5.28)	4280 (5.01)	4280 (5.28)	4280 (5.28)	4280 (5.01)	4280 (5.28)	4280 (5.28)	4280 (5.01)	4280 (5.28)	4280 (5.28)	64200 (5.14)
f. Repairs	464 (0.54)	464 (0.57)	464 (0.57)	464 (0.54)	464 (0.57)	464 (0.57)	464 (0.54)	464 (0.57)	464 (0.57)	464 (0.54)	464 (0.57)	464 (0.57)	464 (0.54)	464 (0.57)	464 (0.57)	6960 (0.56)
g. Transportation	650 (0.76)	650 (0.80)	650 (0.80)	650 (0.76)	650 (0.80)	650 (0.80)	650 (0.76)	650 (0.80)	650 (0.80)	650 (0.76)	650 (0.80)	650 (0.80)	650 (0.76)	650 (0.80)	650 (0.80)	9750 (0.78)
h. Interest on working capital	4698.07 (5.50)	4342.93 (5.36)	4342.93 (5.36)	4698.07 (5.50)	4342.93 (5.36)	4342.93 (5.36)	4698.07 (5.50)	4342.93 (5.36)	4342.93 (5.36)	4698.07 (5.50)	4342.93 (5.36)	4342.93 (5.36)	4698.07 (5.50)	4342.93 (5.36)	4342.93 (5.36)	66919.65 (5.36)
Total operational costs	56898.82 (66.65)	52597.68 (64.89)	52597.68 (64.89)	56898.82 (66.65)	52597.68 (64.89)	52597.68 (64.89)	56898.82 (66.65)	52597.68 (64.89)	52597.68 (64.89)	56898.82 (66.65)	52597.68 (64.89)	52597.68 (64.89)	56898.82 (66.65)	52597.68 (64.89)	52597.68 (64.89)	810470.9 (64.93)

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II. FIXED COSTS																
a. Depreciation	757 (0.89)	757 (0.93)	757 (0.93)	757 (0.89)	757 (0.93)	757 (0.93)	757 (0.89)	757 (0.93)	757 (0.93)	757 (0.89)	757 (0.93)	757 (0.93)	757 (0.89)	757 (0.93)	757 (0.93)	11355 (0.91)
b. Land revenue	244.57 (0.29)	244.57 (0.30)	244.57 (0.30)	244.57 (0.29)	244.57 (0.30)	244.57 (0.30)	244.57 (0.29)	244.57 (0.30)	244.57 (0.30)	244.57 (0.29)	244.57 (0.30)	244.57 (0.30)	244.57 (0.29)	2445.7 (3.02)	244.57 (0.30)	3668.55 (0.29)
c. Rental value of owned land	25987.5 (30.44)	25987.5 (32.06)	25987.5 (32.06)	25987.5 (30.44)	25987.5 (32.06)	25987.5 (32.06)	25987.5 (30.44)	25987.5 (32.06)	25987.5 (32.06)	25987.5 (30.44)	25987.5 (32.06)	25987.5 (32.06)	25987.5 (30.44)	25987.5 (32.06)	25987.5 (32.06)	389812.5 (31.23)
d. Interest on fixed capital	1450 (1.70)	1450 (1.79)	1450 (1.79)	1450 (1.70)	1450 (1.79)	1450 (1.79)	1450 (1.70)	1450 (1.79)	1450 (1.79)	1450 (1.70)	1450 (1.79)	1450 (1.79)	1450 (1.70)	1450 (1.79)	1450 (1.79)	21750 (1.74)
e. Annual share of establishment costs	743.71 (0.86)	743.71 (0.91)	743.71 (0.91)	743.71 (0.86)	743.71 (0.91)	743.71 (0.91)	743.71 (0.86)	743.71 (0.91)	743.71 (0.91)	743.71 (0.86)	743.71 (0.91)	743.71 (0.91)	743.71 (0.86)	743.71 (0.91)	743.71 (0.91)	11155.65 (0.89)
Total fixed costs	29182.78 (33.35)	29182.78 (35.11)	29182.78 (35.11)	29182.78 (33.35)	29182.78 (35.11)	29182.78 (35.11)	29182.78 (33.35)	29182.78 (35.11)	29182.78 (35.11)	29182.78 (33.35)	29182.78 (35.11)	29182.78 (35.11)	29182.78 (33.35)	29182.78 (35.11)	29182.78 (35.11)	437741.7 (35.07)
Total costs	86081.6 (100)	81780.46 (100)	81780.46 (100)	86081.6 (100)	81780.46 (100)	81780.46 (100)	86081.6 (100)	81780.46 (100)	81780.46 (100)	86081.6 (100)	81780.46 (100)	81780.46 (100)	86081.6 (100)	81780.46 (100)	81780.46 (100)	1248212.6 (100)

Table 4.16 Cost Structure on Arecanut Garden per hectare during Yield Declining Period (41st to 50th Year)

(Rupees)

Particulars	Years										Total
	41	42	43	44	45	46	47	48	49	50	
I. OPERATIONAL COSTS											
a. Human labour	13463.25 (23.73)	16013.25 (27.48)	13388.25 (24.16)	15895.5 (28.23)	13195.5 (25.32)	15820.5 (28.780	12600 (27.25)	15000 (31.50)	12375 (27.65)	12014.25 (29.14)	139765.5 (27.21)
Owned	4944.75 (8.71)	4944.75 (8.48)	4944.75 (8.92)	4944.75 (8.78)	4944.75 (9.49)	4944.75 (8.99)	4944.75 (10.69)	4944.75 (10.38)	4944.75 (11.05)	4944.75 (11.99)	49447.5 (9.63)
Hired	8518.5 (15.01)	11068.5 (18.99)	8443.5 (15.24)	10950.75 (19.45)	8250.75 (15.83)	10875.75 (19.78)	7655.25 (16.56)	10055.25 (21.12)	7430.25 (16.60)	7069.5 (17.15)	90318 (17.34)
b. Machine labour	200 (0.35)	200 (0.34)	200 (0.36)	200 (0.36)	200 (0.38)	200 (0.36)	200 (0.43)	200 (0.42)	200 (0.45)	200 (0.49)	2000 (0.38)
Owned	-	-	-	-	-	-	-	-	-	-	-
Hired	200 (0.35)	200 (0.34)	200 (0.36)	200 (0.36)	200 (0.38)	200 (0.36)	200 (0.43)	200 (0.42)	200 (0.45)	200 (0.49)	2000 (0.39)
c. Manures & Fertilizers	11242 (19.81)	11242 (19.29)	11242 (20.29)	11242 (19.97)	11242 (21.57)	11242 (20.45)	11242 (24.31)	11242 (23.61)	11242 (25.12)	11242 (27.27)	112420 (21.58)
Manures	9386 (16.54)	9386 (16.10)	9386 (16.94)	9386 (16.67)	9386 (18.01)	9386 (17.07)	9386 (20.30)	9386 (19.71)	9386 (20.97)	9386 (22.77)	93860 (18.02)
Fertilizers	1856 (3.27)	1856 (3.18)	1856 (3.35)	1856 (3.30)	1856 (3.56)	1856 (3.38)	1856 (4.01)	1856 (3.90)	1856 (4.15)	1856 (4.50)	18560 (3.56)
d. Lime	1138 (1.91)	-	-	1138 (1.91)	-	-	1138 (1.91)	-	-	-	3414 (0.66)
e. Plant protection chemicals	2760 (4.86)	2760 (4.74)	2760 (4.98)	2760 (4.90)	2760 (5.30)	2760 (5.02)	2760 (5.97)	2760 (5.80)	2760 (6.17)	2760 (6.69)	27600 (5.29)
f. Repairs	464 (0.82)	464 (0.80)	464 (0.84)	464 (0.82)	464 (0.89)	464 (0.84)	464 (1.00)	464 (0.97)	464 (1.04)	464 (1.13)	4640 (0.89)
g. Transportation	650 (1.15)	650 (1.12)	650 (1.17)	650 (1.15)	650 (1.25)	650 (1.18)	350 (0.76)	350 (0.74)	350 (0.78)	350 (0.85)	5300 (1.02)
h. Interest on working capital	2692.55 (4.75)	2819.63 (4.84)	2583.38 (4.66)	2911.46 (5.17)	2566.04 (4.92)	2802.29 (5.10)	2587.86 (5.60)	2701.44 (5.67)	2465.19 (5.51)	2432.72 (5.90)	26562.56 (5.09)
Total operational costs	32609.8 (57.47)	34148.88 (58.59)	31287.63 (56.46)	35260.96 (62.63)	31077.54 (59.63)	33938.79 (61.73)	31341.86 (67.78)	32717.44 (68.71)	29856.19 (66.71)	29462.97 (71.46)	321702.06 (61.76)

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II. FIXED COSTS											
a. Depreciation	757	757	757	757	757	757	757	757	757	757	7570
	(1.33)	(1.30)	(1.37)	(1.34)	(1.45)	(1.38)	(1.64)	(1.59)	(1.69)	(1.84)	(1.47)
b. Land revenue	244.57	244.57	244.57	244.57	244.57	244.57	244.57	244.57	244.57	244.57	2445.7
	(0.43)	(0.42)	(0.44)	(0.43)	(0.47)	(0.44)	(0.53)	(0.51)	(0.55)	(0.59)	(0.48)
c. Rental value of owned land	21654	21654	21654	18562.5	18562.5	18562.5	12420	12420	12420	9288	167197.5
	(38.16)	(37.15)	(39.07)	(32.97)	(35.62)	(33.76)	(26.86)	(26.08)	(27.75)	(22.53)	(32.10)
d. Interest on fixed capital	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	14500
	(2.56)	(2.49)	(2.62)	(2.58)	(2.78)	(2.64)	(3.14)	(3.05)	(3.24)	(3.52)	(2.78)
e. Annual share of establishment costs	743.71	743.71	743.71	743.71	743.71	743.71	743.71	743.71	743.71	743.71	7437.1
	(1.29)	(1.26)	(1.32)	(1.30)	(1.40)	(1.33)	(1.58)	(1.53)	(1.63)	(1.77)	(1.43)
Total fixed costs	24849.28	24849.28	24849.28	21757.78	21757.78	21757.78	15615.28	15615.28	15615.28	12483.28	199150.3
	(42.53)	(41.41)	(43.54)	(37.37)	(40.37)	(38.27)	(32.22)	(31.29)	(33.29)	(28.54)	(38.24)
Total costs	57459.08	58998.16	56136.91	57018.74	52835.32	55696.57	46957.27	48332.85	45471.60	41946.25	520852.36
	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)

Table 4.20 : Returns per hectare of Arecanut Garden during Yield Increasing Period (6th to 25th Year)

Particulars	Years										
	6	7	8	9	10	11	12	13	14	15	16
Yield (Quintals)	1.5	9.2	16.04	18.33	20.62	21.08	21.08	21.08	21.08	21.08	21.08
Gross Income (Rs.)	11250	69000	120312	137475	154650	158100	158100	158100	158100	158100	158100
Total Costs (Rs.)	45261.98	57019.48	78775.12	80388.04	83853.95	88851.30	84550.16	84550.16	88851.30	84550.16	84550.16
Net Income (Rs.)	-34012	11980.52	41536.88	57086.96	70796.05	69248.7	73549.84	73549.84	69248.70	73549.84	73549.84

Particulars	Years									Total
	17	18	19	20	21	22	23	24	25	
Yield (Quintals)	21.08	21.08	21.08	21.08	21.08	21.08	21.08	21.08	21.08	381.89
Gross Income (Rs.)	158100	158100	158100	158100	158100	158100	158100	158100	158100	2864175
Total Costs (Rs.)	88851.30	84550.16	84550.16	88851.30	84550.16	84550.16	88851.30	84550.16	84550.16	1635056.70
Net Income (Rs.)	69248.70	73549.84	73549.84	69248.70	73549.84	73549.84	69248.70	73549.84	73549.84	1229118.30

Table 4.21 : Returns per hectare of Arecanut Garden during Yield Stabilization Period (26th to 40th Year)

Particulars	Years							
	26	**27**	**28**	**29**	**30**	**31**	**32**	**33**
Yield (Quintals)	19.25	19.25	19.25	19.25	19.25	19.25	19.25	19.25
Gross Income (Rs.)	144375	144375	144375	144375	144375	144375	144375	144375
Total Costs (Rs.)	86081.6	81780.46	81780.46	86081.6	81780.46	81780.46	86081.6	81780.46
Net Income (Rs.)	58293.4	62594.54	62594.54	58293.4	62594.54	62594.54	58293.4	62594.54

Particulars	Years							Total
	34	**35**	**36**	**37**	**38**	**39**	**40**	
Yield (Quintals)	19.25	19.25	19.25	19.25	19.25	19.25	19.25	288.75
Gross Income (Rs.)	144375	144375	144375	144375	144375	144375	144375	2165625
Total Costs (Rs.)	81780.46	86081.6	81780.46	81780.46	86081.6	81780.46	81780.46	1248212.6
Net Income (Rs.)	62594.54	58293.4	62594.54	62594.54	58293.4	62594.54	62594.54	917412.4

Table 4.22 : Returns per hectare of Arecanut Garden during Yield Declining Period (41st to 50th Year)

Particulars	Years										Total
	41	42	43	44	45	46	47	48	49	50	
Yield (Quintals)	16.04	16.04	16.04	13.75	13.75	13.75	9.2	9.2	9.2	6.88	123.85
Gross Income (Rs.)	120312	120312	120312	103125	103125	103125	69000	69000	69000	51600	928875
Total Costs (Rs.)	57459.08	58998.16	56136.91	57018.74	52835.32	55696.57	46957.27	48332.85	45471.60	41946.25	520852.36
Net Income (Rs.)	62852.92	61313.84	64175.09	46106.26	50289.68	47428.43	22042.73	20667.15	23528.4	9653.75	408022.64

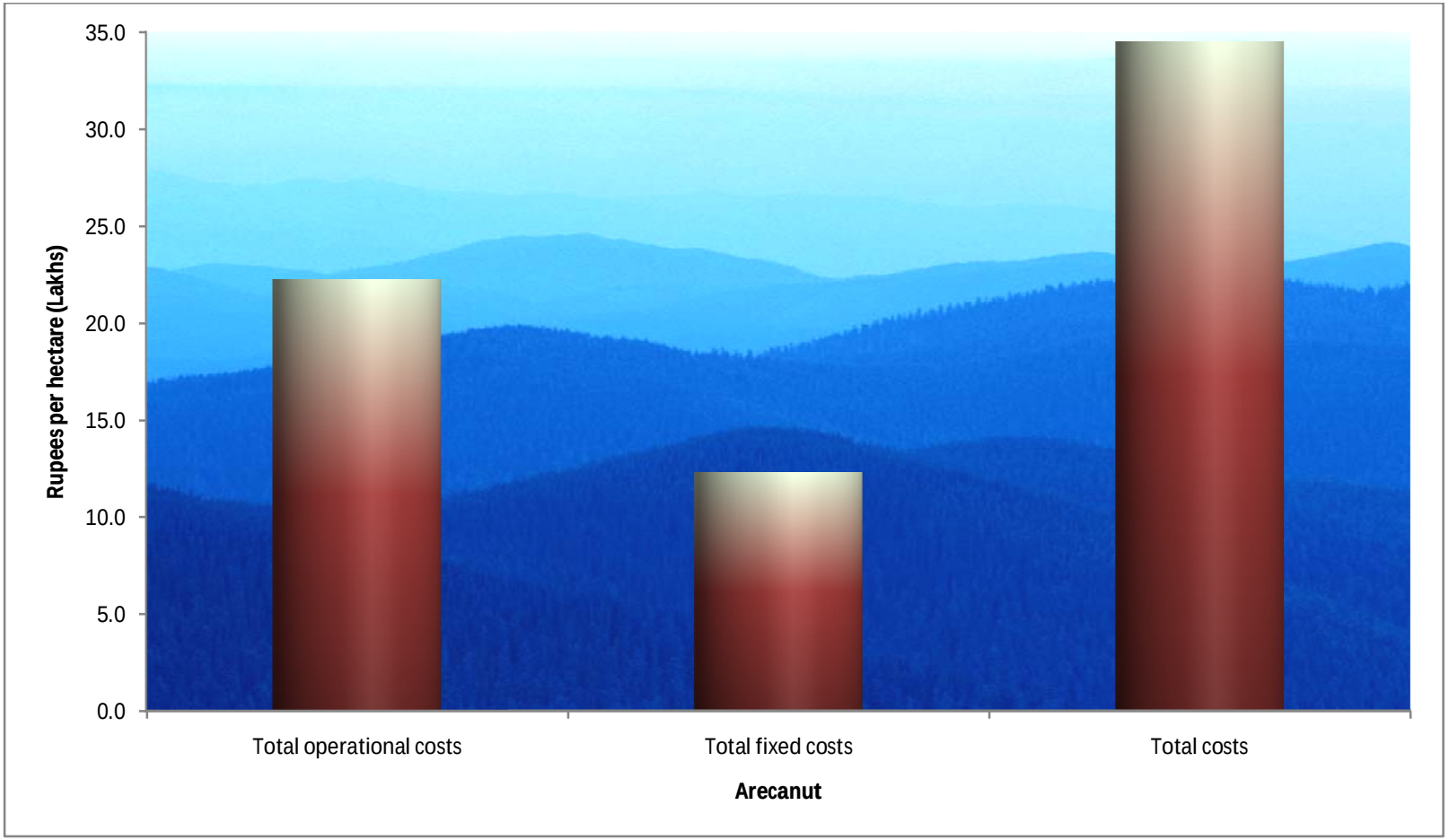

Fig. 4.1: Cost structure of Arecanut garden during its economic life period

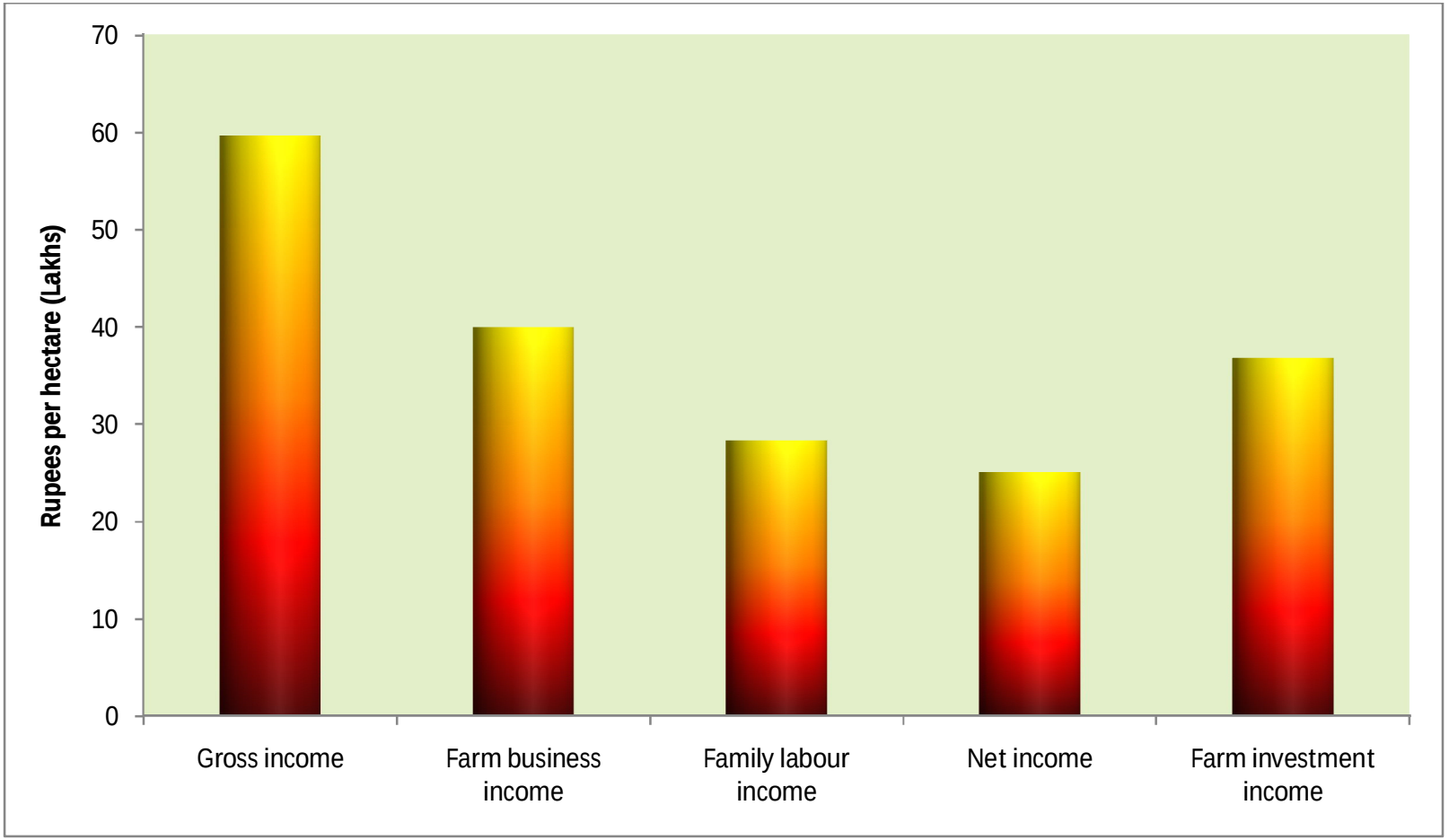

Fig. 4.2: Measures of farm income

CHAPTER – V

SUMMARY AND CONCLUSION

Arecanut (*Areca catechu L.*) is an important commercial crop in India. Arecanut is the seed of the arecanut palm. It plays a prominent role in the religious, social and cultural functions and economic life of people in India. The economic produce is the fruit called betel nut. In many areas arecanuts are also known as supari. It is estimated that nearly ten million people depend on arecanut industry for their livelihood in India. The quality, variety and types of arecanut vary from one place to another.

India dominates the world production of arecanut, producing almost half of the nuts produced in the world. It has also got the maximum area covered under the betel nut. India has an annual production figure of around 4.81 lakh tonnes during 2008-09 and the plantation is cultivated over 3,87,100 hectares in the country. Productivity wise, the country stands fourth in the world (1.243 tonnes per hectare). The states producing the maximum output of the arecanut plantation are Karnataka, Kerala, Assam, Tamil Nadu, Maharashtra, Andhra Pradesh, West Bengal and Orissa. Karnataka is the leading betel nut producing state in India involved in the production of 40 per cent of the country's produce. Kerala follows the topper on the second place and Assam on the third place with one-fourth and one-fifth share in the total production respectively. Karnataka, Kerala and Assam are also the

leaders if the area under the betel nut cultivation and productivity in India are considered. The states have an area of 1.68, 1.017, 0.74 lakh hectares respectively.

In Kerala, during 2008-09, arecanut was cultivated in an area of 101700 hectares with a production of 116900 tonnes. Major arecanut producing districts are Malappuram, Kasargod, Kannur, Kozhikode and Wayanad. Malappuram district ranks first in area (20,020 hectares) and second in production (15,620 tonnes) of arecanut in Kerala.

The present study entitled “An economic analysis of arecanut production in Malappuram district of Kerala” was intended to examine the cost structure and economic viability in the cultivation of arecanut.

5.1 OBJECTIVES

1. To estimate the investment required for the establishment of arecanut garden.
2. To work out the costs and returns of bearing gardens.
3. To examine the economic feasibility of investment on arecanut gardens.
4. To identify production and marketing problems and to suggest remedial measures.

Malappuram district that ranks first in area and second in production of arecanut in Kerala was purposively selected for the study. Two taluks namely Nilambur and Ernad which rank first and second in area under arecanut cultivation were purposively chosen. Three villages from each taluk having maximum area under arecanut plantation were selected. All the arecanut growers in the selected villages were listed out and sixty farmers were selected at random. The sample so selected was subjected to post classification into pre-bearing orchards (1^{st} – 5^{th} year) and bearing orchards (6^{th} – 50^{th} year) which comprised of three stages *viz.*, yield increasing period (6^{th} – 25^{th} year), yield stabilization period (26^{th} – 40^{th} year) and yield declining period (41^{st} – 50^{th} year). The required data pertaining to cultivation of arecanut plantations were collected from the selected respondents on well structured survey schedule designed for the purpose for the year 2008 – 2009. The data were analyzed to fulfil the objectives by using conventional and project evaluation techniques.

5.2 MAJOR FINDINGS OF THE STUDY

The socio – economic profile of the arecanut orchardists revealed that the average size of the family was 6.56 members consisting of 2.33 males, 2.75 females and 1.48 children. The participation of family members in agriculture was less (23.32 per cent to total family members) because majority of the members belonged to well–to–do families.

The average size of the holding was 1.66 hectares with 39.16 per cent of total area under arecanut cultivation.

The per hectare value of assets was Rs.2,79,545.69 on the selected arecanut gardens. The land value was to the extent of 89.43 per cent of the total value of the farm assets. As regards, magnitude and pattern of non–land assets, the value of farm buildings, livestock, machinery and equipment and irrigation equipment accounted for 6.01, 1.83, 1.67 and 1.06 per cent of total value of farm assets respectively.

A plant population of 1,375 seedling per hectare was planted in the garden which is more than the recommended population of 1,200 seedlings. The total quantity of manures applied during the entire economic life period of arecanut was 328.76 tonnes per hectare which is less than the recommended dose of 825 tonnes. The use of plant nutrients *viz.,* N, P and K through chemical fertilizers for the entire 50 years of economic life of arecanut stood at 6,392, 8,413.30 and 10,548.80 Kgs per hectare respectively. The orchardists used 80.02 tonnes of ash, 4,992 Kg of lime and 732.23 litres of plant protection chemicals for the entire life period of arecanut cultivation.

The total labour used for the establishment of arecanut garden in the first year was 351.50 mandays per hectare. Terracing was the most labour absorbing operation with 100 mandays per hectare. Watch and ward, irrigation, weeding and digging of pits used 90, 58, 35 and 32 mandays per hectare respectively.

From 2nd year to 5th year of orchard, a total of 927 mandays per hectare were required. A major share of 38.83 per cent (360 mandays) was taken by watch and ward followed by irrigation (25.03 per cent), weeding (15.10 per cent) and intercultivation (8.63 per cent).

About 6,319.64 mandays of labour were used from 6th to 25th year of arecanut gardens. Major labour absorbing operation was watch and ward with 1,800 mandays (28.48 per cent) followed by irrigation 1,160 mandays (18.37 per cent), dehusking 763.78 mandays (12.03 per cent) and weeding with 700 mandays (11.09 per cent).

A total of 4,783.75 mandays of labour was required from 26th to 40th year. Watch and ward took lion's share in labour requirement with 1,350 mandays (28.22 per cent) followed by irrigation with 870 mandays (18.19 per cent), dehusking with 577.50 mandays (12.07 per cent) and weeding with 525 mandays (10.9 per cent) per hectare.

About 1,861.54 mandays per hectare were used by the orchardists during the yield declining period i.e. from 41st to 50th year. Watch and ward, irrigation, dehusking and intercultivation were the major labour absorbing operations accounting for 26.86, 16.12, 13.66 and 10.73 per cent of total labour respectively.

The total labour requirement during economic life span (50 years) of arecanut garden stood at 14,243.43 mandays per hectare of which watch and

ward, irrigation, dehusking, weeding, harvesting and intercultivation took major share of 4,100 mandays (28.79 per cent), 2,620 mandays (18.39 per cent), 1,595.52 mandays (11.20 per cent), 1,540 mandays (10.81 per cent), 1,200 mandays (8.42 per cent) and 980 mandays (6.88 per cent) respectively.

The per hectare total cost incurred during 1st year of arecanut garden stood at Rs.61,641.87 of which operational costs and fixed costs amounted to Rs.53,356.97 (86.56 per cent) and Rs.8,284.90 (13.44 per cent) respectively. Among the total costs, human labour charges formed major cost item with Rs.26,362.50 (42.77 per cent) followed by plant material with Rs.12,429.85 (20.16 per cent), manures and fertilizers with Rs.7,070 (11.47 per cent) and rental value of owned land with Rs.5,833.33 (9.46 per cent).

An amount of Rs.1,66,709.79 was incurred from 2nd to 5th year. Operational costs amounted to Rs.1,30,976.58 (78.57 per cent) with human labour and manures and fertilizers as major costs at Rs.69,525 and Rs.45,376 respectively. Fixed costs amounted to Rs.35,733.21 (21.43 per cent) in which rental value of owned land was the major cost item which stood at Rs.22,952.09 (13.77 per cent).

From 6th to 25th year of garden about Rs.16,35,056 per hectare were incurred in which operational costs worked out to Rs.10,55,599 (64.56 per cent) and fixed costs Rs.5,79,457.10 (35.44 per cent). As in the previous years of garden, cost of human labour turned out to be the most important variable cost (28.99 per cent) followed by manures and fertilizers (22.04 per

cent), plant protection chemicals (5.13 per cent). However, rental value of owned land was the major item of total costs accounting for 31.53 per cent during the yield increasing period.

The per hectare cost of cultivation of arecanut garden from 26th to 40th year worked out to Rs.12,48,212.26. There was no much variation in the cost of maintenance in each year during yield stabilization period. The operational and fixed costs were Rs.8,10,470.90 (64.93 per cent) and Rs.43,774.70 (35.07 per cent) respectively. Rental value of owned land, human labour and manures and fertilizers accounted for 31.23, 28.74 and 22.34 per cent of the total costs respectively. These were the major items of costs both in yield increasing and yield stabilization periods.

During 41st to 50th year, the total costs per hectare declined from Rs.57,459.08 in 41st year to Rs.41,946.25 in 50th year. Rental value of owned land (32.10 per cent), human labour (27.21 per cent) and manures and fertilizers (21.58 per cent) were the most important items of cost in the cultivation of arecanut.

The commercial cost of cultivation (Cost C) for the life span of arecanut garden was Rs.34,52,903.35 per hectare. Cost A_1/A_2 and Cost B worked out to Rs.19,68,273.35 and Rs.31,34,837.35 respectively.

The cost of producing a quintal of arecanut was estimated at Rs.4,346.07. The arecanut growers realized a gross income of Rs.7,500 and a net income of Rs.3,153.93 per quintal.

The net returns from intercrops during the pre-bearing period helped to cushion the costs. The yield from arecanut orchard was obtained from 6th year onwards. The total yield for the entire economic life period was 794.49 quintals per hectare.

The per hectare gross income from 6^{th} to 25^{th} year, 26^{th} to 40^{th} year and 41^{st} to 50^{th} year was Rs.28,64,175, Rs.21,65,625 and Rs.9,28,875 respectively. The respective net returns in the above said age groups were Rs.12,29,118.38, Rs.9,17,412.40 and Rs.4,08,022.60 respectively. The gross and net income realized for the entire economic life period were Rs.59,58,675 and Rs.25,05,771.65 per hectare respectively.

The farm business income, family labour income and farm investment income were in the order of Rs.39,90,401.65, Rs.28,23,837.65 and Rs.36,72,335.65 respectively.

Net present worth for the arecanut garden was Rs.5,38,049.32, Rs.3,90,217.54, Rs.2,15,899.84, Rs.1,24,071.70 and Rs.71,810.82 at 10, 12, 16, 20 and 24 per cent discount rates respectively. Benefit – cost ratios at the corresponding discount rates were 3.1, 2.9, 2.52, 2.18 and 1.87 respectively. The internal rate of return (IRR) was found to be 40 per cent.

5.3 CONCLUSIONS

1. The total labour requirement for the cultivation of arecanut during its economic life period was 14,243.43 mandays per hectare.

2. Watch and ward, irrigation, dehusking, weeding and inter cultivation accounted for the major share of total human labour requirement for the entire economic life of arecanut garden.

3. Rental value of land, human labour and manures and fertilizers were the major items of total costs in the cultivation of arecanut.

4. The total costs per hectare was Rs.34,52,903.35 with a net income of Rs.25,05,771.65 during the economic life span.

5. Arecanut cultivation was found to be economically viable even at higher discount rate of 24 per cent

It was clear from the study that the arecanut growers were unaware of the importance of maintaining optimum plant population, application of nutrients in required doses and hence the Department of Agriculture has to pay an important role in educating the growers in adopting the package of practices.

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Estimates of Economic Viability of Arecanut Garden (10 per cent discount rate)

Years	Costs	Benefits	Net Benefits	Discount Rate Factor	Present Worth of Costs	Present Worth of Benefits	Net Present Worth
1	23995.92	0	-23995.92	0.9091	21814.47	0.00	-21814.47
2	-166.43	0	166.43	0.8264	-137.55	0.00	137.55
3	9583.57	0	-9583.57	0.7513	7200.28	0.00	-7200.28
4	14916.57	0	-14916.57	0.6830	10188.22	0.00	-10188.22
5	16259.57	0	-16259.57	0.6209	10095.91	0.00	-10095.91
6	24302.57	11250	-13052.57	0.5645	13718.17	6350.33	-7367.84
7	25552.57	69000	43447.43	0.5132	13112.51	35407.91	22295.40
8	37040.32	120300	83259.68	0.4665	17279.58	56120.84	38841.26
9	35683.82	137475	101791.18	0.4241	15133.42	58302.82	43169.40
10	36027.32	154650	118622.68	0.3855	13890.09	59624.27	45734.18
11	40042.32	158100	118057.68	0.3505	14034.59	55413.09	41378.50
12	36096.32	158100	122003.68	0.3186	11501.40	50375.53	38874.13
13	36096.32	158100	122003.68	0.2897	10455.82	45795.94	35340.12
14	40042.32	158100	118057.68	0.2633	10544.39	41632.67	31088.28
15	34096.32	158100	124003.68	0.2394	8162.39	37847.88	29685.50
16	34096.32	158100	124003.68	0.2176	7420.35	34407.17	26986.81
17	38042.32	158100	120057.68	0.1978	7526.47	31279.24	23752.77
18	34096.32	158100	124003.68	0.1799	6132.52	28435.67	22303.15
19	34096.32	158100	124003.68	0.1635	5575.02	25850.61	20275.59
20	38042.32	158100	120057.68	0.1486	5654.75	23500.56	17845.81
21	34096.32	158100	124003.68	0.1351	4607.46	21364.14	16756.69
22	34096.32	158100	124003.68	0.1228	4188.60	19421.95	15233.35
23	38042.32	158100	120057.68	0.1117	4248.50	17656.32	13407.82
24	34096.32	158100	124003.68	0.1015	3461.65	16051.20	12589.55
25	34096.32	158100	124003.68	0.0923	3146.95	14592.00	11445.04
26	33821.81	144375	110553.19	0.0839	2837.83	12113.85	9276.02

27	37767.82	144375	106607.18	0.0763	2880.84	11012.59	8131.75
28	33821.81	144375	110553.19	0.0693	2345.32	10011.45	7666.13
29	33821.81	144375	110553.19	0.0630	2132.11	9101.31	6969.21
30	37767.82	144375	106607.18	0.0573	2164.42	8273.92	6109.50
31	33449.32	144375	110925.68	0.0521	1742.67	7521.75	5779.08
32	33449.32	144375	110925.68	0.0474	1584.24	6837.95	5253.71
33	37395.32	144375	106979.68	0.0431	1610.12	6216.32	4606.20
34	33449.32	144375	110925.68	0.0391	1309.29	5651.20	4341.91
35	33449.32	144375	110925.68	0.0356	1190.26	5137.45	3947.19
36	37395.32	144375	106979.68	0.0323	1209.71	4670.41	3460.71
37	33449.32	144375	110925.68	0.0294	983.69	4245.83	3262.14
38	33449.32	144375	110925.68	0.0267	894.26	3859.85	2965.58
39	37395.32	144375	106979.68	0.0243	908.87	3508.95	2600.08
40	33449.32	144375	110925.68	0.0221	739.06	3189.96	2450.89
41	18828.82	120300	101471.18	0.0201	378.20	2416.38	2038.18
42	22666.82	120300	97633.18	0.0183	413.90	2196.71	1782.81
43	18828.82	120300	101471.18	0.0166	312.56	1997.01	1684.45
44	21261.07	103125	81863.93	0.0151	320.85	1556.27	1235.42
45	19849.07	103125	83275.93	0.0137	272.31	1414.79	1142.48
46	21261.07	103125	81863.93	0.0125	265.17	1286.18	1021.01
47	17515.57	69000	51484.43	0.0113	198.59	782.34	583.74
48	21353.57	69000	47646.43	0.0103	220.10	711.21	491.11
49	17515.57	69000	51484.43	0.0094	164.13	646.56	482.43
50	17154.82	51600	34445.18	0.0085	146.13	439.56	293.42
Total	1481938.07	5958675	4476736.93	9.9148	256180.62	794229.94	538049.32

Estimates of Economic Viability of Arecanut Garden (12 per cent discount rate)

Years	Costs	Benefits	Net Benefits	Discount Rate Factor	Present Worth of Costs	Present Worth of Benefits	Net Present Worth
1	23995.92	0	-23995.92	0.8929	21424.93	0.00	-21424.93
2	-166.43	0	166.43	0.7972	-132.68	0.00	132.68
3	9583.57	0	-9583.57	0.7118	6821.40	0.00	-6821.40
4	14916.57	0	-14916.57	0.6355	9479.75	0.00	-9479.75
5	16259.57	0	-16259.57	0.5674	9226.12	0.00	-9226.12
6	24302.57	11250	-13052.57	0.5066	12312.44	5699.60	-6612.84
7	25552.57	69000	43447.43	0.4523	11558.68	31212.10	19653.41
8	37040.32	120300	83259.68	0.4039	14959.96	48587.15	33627.19
9	35683.82	137475	101791.18	0.3606	12867.94	49574.86	36706.92
10	36027.32	154650	118622.68	0.3220	11599.83	49793.16	38193.33
11	40042.32	158100	118057.68	0.2875	11511.21	45449.97	33938.76
12	36096.32	158100	122003.68	0.2567	9265.03	40580.33	31315.31
13	36096.32	158100	122003.68	0.2292	8272.34	36232.44	27960.09
14	40042.32	158100	118057.68	0.2046	8193.45	32350.39	24156.94
15	34096.32	158100	124003.68	0.1827	6229.27	28884.28	22655.01
16	34096.32	158100	124003.68	0.1631	5561.85	25789.53	20227.69
17	38042.32	158100	120057.68	0.1456	5540.65	23026.37	17485.72
18	34096.32	158100	124003.68	0.1300	4433.87	20559.26	16125.39
19	34096.32	158100	124003.68	0.1161	3958.81	18356.48	14397.67
20	38042.32	158100	120057.68	0.1037	3943.72	16389.72	12445.99
21	34096.32	158100	124003.68	0.0926	3155.94	14633.67	11477.73
22	34096.32	158100	124003.68	0.0826	2817.81	13065.78	10247.98
23	38042.32	158100	120057.68	0.0738	2807.07	11665.88	8858.81
24	34096.32	158100	124003.68	0.0659	2246.34	10415.96	8169.62
25	34096.32	158100	124003.68	0.0588	2005.66	9299.96	7294.31
26	33821.81	144375	110553.19	0.0525	1776.35	7582.69	5806.34

27	37767.82	144375	106607.18	0.0469	1771.07	6770.26	4999.19
28	33821.81	144375	110553.19	0.0419	1416.09	6044.88	4628.78
29	33821.81	144375	110553.19	0.0374	1264.37	5397.21	4132.84
30	37767.82	144375	106607.18	0.0334	1260.61	4818.94	3558.33
31	33449.32	144375	110925.68	0.0298	996.85	4302.62	3305.78
32	33449.32	144375	110925.68	0.0266	890.04	3841.63	2951.59
33	37395.32	144375	106979.68	0.0238	888.43	3430.02	2541.60
34	33449.32	144375	110925.68	0.0212	709.54	3062.52	2352.99
35	33449.32	144375	110925.68	0.0189	633.51	2734.39	2100.88
36	37395.32	144375	106979.68	0.0169	632.37	2441.42	1809.06
37	33449.32	144375	110925.68	0.0151	505.03	2179.84	1674.81
38	33449.32	144375	110925.68	0.0135	450.92	1946.29	1495.37
39	37395.32	144375	106979.68	0.0120	450.11	1737.76	1287.65
40	33449.32	144375	110925.68	0.0107	359.47	1551.57	1192.10
41	18828.82	120300	101471.18	0.0096	180.67	1154.32	973.65
42	22666.82	120300	97633.18	0.0086	194.19	1030.64	836.45
43	18828.82	120300	101471.18	0.0076	144.03	920.22	776.19
44	21261.07	103125	81863.93	0.0068	145.21	704.32	559.11
45	19849.07	103125	83275.93	0.0061	121.04	628.86	507.82
46	21261.07	103125	81863.93	0.0054	115.76	561.48	445.72
47	17515.57	69000	51484.43	0.0049	85.15	335.43	250.28
48	21353.57	69000	47646.43	0.0043	92.68	299.49	206.81
49	17515.57	69000	51484.43	0.0039	67.88	267.40	199.52
50	17154.82	51600	34445.18	0.0035	59.36	178.55	119.19
Total	1481938	5958675	4476736.93	8.3045	205272.13	595489.67	390217.54

Estimates of Economic Viability of Arecanut Garden (14 per cent discount rate)

Years	Costs	Benefits	Net Benefits	Discount Rate Factor	Present Worth of Costs	Present Worth of Benefits	Net Present Worth
1	23995.92	0	-23995.92	0.8621	20686.14	0.00	-20686.14
2	-166.43	0	166.43	0.7432	-123.68	0.00	123.68
3	9583.57	0	-9583.57	0.6407	6139.79	0.00	-6139.79
4	14916.57	0	-14916.57	0.5523	8238.29	0.00	-8238.29
5	16259.57	0	-16259.57	0.4761	7741.39	0.00	-7741.39
6	24302.57	11250	-13052.57	0.4104	9974.80	4617.48	-5357.33
7	25552.57	69000	43447.43	0.3538	9041.25	24414.24	15372.98
8	37040.32	120300	83259.68	0.3050	11298.24	36694.56	25396.32
9	35683.82	137475	101791.18	0.2630	9383.17	36149.46	26766.29
10	36027.32	154650	118622.68	0.2267	8166.80	35056.62	26889.82
11	40042.32	158100	118057.68	0.1954	7824.95	30895.41	23070.47
12	36096.32	158100	122003.68	0.1685	6080.89	26633.98	20553.09
13	36096.32	158100	122003.68	0.1452	5242.15	22960.32	17718.18
14	40042.32	158100	118057.68	0.1252	5013.11	19793.38	14780.27
15	34096.32	158100	124003.68	0.1079	3679.91	17063.26	13383.35
16	34096.32	158100	124003.68	0.0930	3172.34	14709.71	11537.37
17	38042.32	158100	120057.68	0.0802	3051.27	12680.78	9629.51
18	34096.32	158100	124003.68	0.0691	2357.57	10931.71	8574.14
19	34096.32	158100	124003.68	0.0596	2032.38	9423.89	7391.50
20	38042.32	158100	120057.68	0.0514	1954.82	8124.04	6169.22
21	34096.32	158100	124003.68	0.0443	1510.39	7003.48	5493.09
22	34096.32	158100	124003.68	0.0382	1302.06	6037.49	4735.42
23	38042.32	158100	120057.68	0.0329	1252.37	5204.73	3952.36
24	34096.32	158100	124003.68	0.0284	967.64	4486.84	3519.19
25	34096.32	158100	124003.68	0.0245	834.18	3867.96	3033.79
26	33821.81	144375	110553.19	0.0211	713.33	3044.98	2331.65

27	37767.82	144375	106607.18	0.0182	686.68	2624.98	1938.30
28	33821.81	144375	110553.19	0.0157	530.12	2262.92	1732.80
29	33821.81	144375	110553.19	0.0135	457.00	1950.79	1493.79
30	37767.82	144375	106607.18	0.0116	439.93	1681.71	1241.79
31	33449.32	144375	110925.68	0.0100	335.88	1449.75	1113.87
32	33449.32	144375	110925.68	0.0087	289.56	1249.79	960.23
33	37395.32	144375	106979.68	0.0075	279.06	1077.40	798.34
34	33449.32	144375	110925.68	0.0064	215.19	928.80	713.61
35	33449.32	144375	110925.68	0.0055	185.51	800.69	615.18
36	37395.32	144375	106979.68	0.0048	178.78	690.25	511.46
37	33449.32	144375	110925.68	0.0041	137.86	595.04	457.18
38	33449.32	144375	110925.68	0.0036	118.85	512.97	394.12
39	37395.32	144375	106979.68	0.0031	114.54	442.21	327.67
40	33449.32	144375	110925.68	0.0026	88.32	381.22	292.90
41	18828.82	120300	101471.18	0.0023	42.86	273.83	230.98
42	22666.82	120300	97633.18	0.0020	44.48	236.06	191.59
43	18828.82	120300	101471.18	0.0017	31.85	203.50	171.65
44	21261.07	103125	81863.93	0.0015	31.01	150.39	119.38
45	19849.07	103125	83275.93	0.0013	24.95	129.64	104.69
46	21261.07	103125	81863.93	0.0011	23.04	111.76	88.72
47	17515.57	69000	51484.43	0.0009	16.36	64.46	48.10
48	21353.57	69000	47646.43	0.0008	17.20	55.57	38.37
49	17515.57	69000	51484.43	0.0007	12.16	47.91	35.75
50	17154.82	51600	34445.18	0.0006	10.27	30.89	20.62
Total	1481938	5958675	4476736.93	6.2463	141847.01	357746.85	215899.84

Estimates of Economic Viability of Arecanut Garden (20 per cent discount rate)

Years	Costs	Benefits	Net Benefits	Discount Rate Factor	Present Worth of Costs	Present Worth of Benefits	Net Present Worth
1	23995.92	0	-23995.92	0.8333	19996.60	-	-19996.60
2	-166.43	0	166.43	0.6944	-115.58	-	115.58
3	9583.57	0	-9583.57	0.5787	5546.05	-	-5546.05
4	14916.57	0	-14916.57	0.4823	7193.56	-	-7193.56
5	16259.57	0	-16259.57	0.4019	6534.36	-	-6534.36
6	24302.57	11250	-13052.57	0.3349	8138.88	3,767.60	-4371.28
7	25552.57	69000	43447.43	0.2791	7131.25	19256.63	12125.38
8	37040.32	120300	83259.68	0.2326	8614.39	27977.94	19363.54
9	35683.82	137475	101791.18	0.1938	6915.76	26643.58	19727.81
10	36027.32	154650	118622.68	0.1615	5818.61	24976.84	19158.23
11	40042.32	158100	118057.68	0.1346	5389.22	21278.36	15889.15
12	36096.32	158100	122003.68	0.1122	4048.44	17731.97	13683.52
13	36096.32	158100	122003.68	0.0935	3373.70	14776.64	11402.94
14	40042.32	158100	118057.68	0.0779	3118.76	12313.87	9195.11
15	34096.32	158100	124003.68	0.0649	2213.04	10261.56	8048.52
16	34096.32	158100	124003.68	0.0541	1844.20	8551.30	6707.10
17	38042.32	158100	120057.68	0.0451	1714.69	7126.08	5411.39
18	34096.32	158100	124003.68	0.0376	1280.69	5938.40	4657.71
19	34096.32	158100	124003.68	0.0313	1067.24	4948.67	3881.42
20	38042.32	158100	120057.68	0.0261	992.30	4123.89	3131.59
21	34096.32	158100	124003.68	0.0217	741.14	3436.57	2695.43
22	34096.32	158100	124003.68	0.0181	617.62	2863.81	2246.19
23	38042.32	158100	120057.68	0.0151	574.25	2386.51	1812.26
24	34096.32	158100	124003.68	0.0126	428.90	1988.76	1559.86
25	34096.32	158100	124003.68	0.0105	357.42	1657.30	1299.88
26	33821.81	144375	110553.19	0.0087	295.45	1261.19	965.74

27	37767.82	144375	106607.18	0.0073	274.93	1050.99	776.06
28	33821.81	144375	110553.19	0.0061	205.17	875.82	670.65
29	33821.81	144375	110553.19	0.0051	170.98	729.85	558.88
30	37767.82	144375	106607.18	0.0042	159.11	608.21	449.11
31	33449.32	144375	110925.68	0.0035	117.43	506.84	389.42
32	33449.32	144375	110925.68	0.0029	97.86	422.37	324.51
33	37395.32	144375	106979.68	0.0024	91.17	351.97	260.81
34	33449.32	144375	110925.68	0.0020	67.96	293.31	225.36
35	33449.32	144375	110925.68	0.0017	56.63	244.43	187.80
36	37395.32	144375	106979.68	0.0014	52.76	203.69	150.93
37	33449.32	144375	110925.68	0.0012	39.33	169.74	130.41
38	33449.32	144375	110925.68	0.0010	32.77	141.45	108.68
39	37395.32	144375	106979.68	0.0008	30.53	117.88	87.34
40	33449.32	144375	110925.68	0.0007	22.76	98.23	75.47
41	18828.82	120300	101471.18	0.0006	10.68	68.21	57.53
42	22666.82	120300	97633.18	0.0005	10.71	56.84	46.13
43	18828.82	120300	101471.18	0.0004	7.41	47.37	39.95
44	21261.07	103125	81863.93	0.0003	6.98	33.84	26.86
45	19849.07	103125	83275.93	0.0003	5.43	28.20	22.77
46	21261.07	103125	81863.93	0.0002	4.84	23.50	18.65
47	17515.57	69000	51484.43	0.0002	3.33	13.10	9.78
48	21353.57	69000	47646.43	0.0002	3.38	10.92	7.54
49	17515.57	69000	51484.43	0.0001	2.31	9.10	6.79
50	17154.82	51600	34445.18	0.0001	1.89	5.67	3.79
Total	1481938	5958675	4476736.93	4.9995	105307.27	229378.97	124071.70

Estimates of Economic Viability of Arecanut Garden (24per cent discount rate)

Years	Costs	Benefits	Net Benefits	Discount Rate Factor	Present Worth of Costs	Present Worth of Benefits	Net Present Worth
1	23995.92	0	-23995.92	0.806452	19351.55	-	-19,351.55
2	-166.43	0	166.43	0.650364	-108.24	-	108.24
3	9583.57	0	-9583.57	0.524487	5026.46	-	-5,026.46
4	14916.57	0	-14916.57	0.422974	6309.32	-	-6,309.32
5	16259.57	0	-16259.57	0.341108	5546.27	-	-5,546.27
6	24302.57	11250	-13052.57	0.275087	6685.32	3,094.73	-3,590.59
7	25552.57	69000	43447.43	0.221844	5668.69	15,307.25	9,638.56
8	37040.32	120300	83259.68	0.178907	6626.76	21,522.47	14,895.71
9	35683.82	137475	101791.18	0.144280	5148.45	19,834.83	14,686.39
10	36027.32	154650	118622.68	0.116354	4191.94	17,994.22	13,802.28
11	40042.32	158100	118057.68	0.093834	3757.34	14,835.20	11,077.86
12	36096.32	158100	122003.68	0.075673	2731.51	11,963.87	9,232.36
13	36096.32	158100	122003.68	0.061026	2202.83	9,648.28	7,445.45
14	40042.32	158100	118057.68	0.049215	1970.68	7,780.87	5,810.19
15	34096.32	158100	124003.68	0.039689	1353.26	6,274.90	4,921.63
16	34096.32	158100	124003.68	0.032008	1091.34	5,060.40	3,969.06
17	38042.32	158100	120057.68	0.025813	981.97	4,080.97	3,099.00
18	34096.32	158100	124003.68	0.020817	709.77	3,291.10	2,581.33
19	34096.32	158100	124003.68	0.016788	572.39	2,654.12	2,081.72
20	38042.32	158100	120057.68	0.013538	515.03	2,140.42	1,625.38
21	34096.32	158100	124003.68	0.010918	372.26	1,726.14	1,353.88
22	34096.32	158100	124003.68	0.008805	300.21	1,392.05	1,091.84
23	38042.32	158100	120057.68	0.007101	270.13	1,122.62	852.49
24	34096.32	158100	124003.68	0.005726	195.25	905.34	710.09
25	34096.32	158100	124003.68	0.004618	157.46	730.11	572.65
26	33821.81	144375	110553.19	0.003724	125.96	537.69	411.73

27	37767.82	144375	106607.18	0.003003	113.43	433.62	320.18
28	33821.81	144375	110553.19	0.002422	81.92	349.69	267.77
29	33821.81	144375	110553.19	0.001953	66.06	282.01	215.94
30	37767.82	144375	106607.18	0.001575	59.49	227.43	167.93
31	33449.32	144375	110925.68	0.001270	42.49	183.41	140.92
32	33449.32	144375	110925.68	0.001024	34.27	147.91	113.64
33	37395.32	144375	106979.68	0.000826	30.90	119.28	88.39
34	33449.32	144375	110925.68	0.000666	22.29	96.20	73.91
35	33449.32	144375	110925.68	0.000537	17.97	77.58	59.60
36	37395.32	144375	106979.68	0.000433	16.20	62.56	46.36
37	33449.32	144375	110925.68	0.000349	11.69	50.45	38.76
38	33449.32	144375	110925.68	0.000282	9.43	40.69	31.26
39	37395.32	144375	106979.68	0.000227	8.50	32.81	24.31
40	33449.32	144375	110925.68	0.000183	6.13	26.46	20.33
41	18828.82	120300	101471.18	0.000148	2.78	17.78	15.00
42	22666.82	120300	97633.18	0.000119	2.70	14.34	11.64
43	18828.82	120300	101471.18	0.000096	1.81	11.56	9.75
44	21261.07	103125	81863.93	0.000078	1.65	7.99	6.35
45	19849.07	103125	83275.93	0.000063	1.24	6.45	5.21
46	21261.07	103125	81863.93	0.000050	1.07	5.20	4.13
47	17515.57	69000	51484.43	0.000041	0.71	2.81	2.09
48	21353.57	69000	47646.43	0.000033	0.70	2.26	1.56
49	17515.57	69000	51484.43	0.000026	0.46	1.82	1.36
50	17154.82	51600	34445.18	0.000021	0.37	1.10	0.73
Total	1481938	595865	4476736.93	4.166578	82288.18	1,54,099.0	71,810.82