ECONOMIC ANALYSIS OF OIL PALM PRODUCTION AND PROCESSING IN EAST GODAVARI DISTRICT OF ANDHRA PRADESH

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B.Sc. (Ag.)

MASTER OF BUSINESS ADMINISTRATION
(AGRIBUSINESS MANAGEMENT)

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BY

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PROJECT REPORT SUBMITTED TO THE ACHARYA N.G. RANGA AGRICULTURAL UNIVERSITY IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF

MASTER OF BUSINESS ADMINISTRATION

(AGRIBUSINESS MANAGEMENT)

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GUNTUR – 522 509, A.P.

2018

DECLARATION

I, **A. SUDHEER VARMA,** hereby declare that the project report entitled **"ECONOMIC ANALYSIS OF OIL PALM PRODUCTION AND PROCESSING IN EAST GODAVARI DISTRICT OF ANDHRA PRADESH"** submitted to the **Acharya N.G. Ranga Agricultural University** for the degree of **MASTER OF BUSINESS ADMINISTRATION (AGRIBUSINESS MANAGEMENT**) is the result of original research work done by me. I also declare that no material contained in this project report has been published earlier in any manner.

Place :
Date :

(A. SUDHEER VARMA)
I.D. No. TMBA/2016-13

CERTIFICATE

Mr. A. SUDHEER VARMA has satisfactorily prosecuted the course of research and that the project report entitled **"ECONOMIC ANALYSIS OF OIL PALM PRODUCTION AND PROCESSING IN EAST GODAVARI DISTRICT OF ANDHRA PRADESH"** 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 neither the project report nor its part thereof has been previously submitted by him for a degree of any University.

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CERTIFICATE

This is to certify that the project report entitled **"ECONOMIC ANALYSIS OF OIL PALM PRODUCTION AND PROCESSING IN EAST GODAVARI DISTRICT OF ANDHRA PRADESH"** submitted in partial fulfillment of the requirements for the degree of **MASTER OF BUSINESS ADMINISTRATION (AGRIBUSINESS MANAGEMENT**) of the Acharya N.G. Ranga Agricultural University, Guntur is a record of the bonafide original research work carried out by **A. SUDHEER VARMA** under our guidance and supervision.

No part of the project report has been submitted by the student for any other degree or diploma. The published part and all assistance received during the course of the investigations have been duly acknowledged by the author of the project report.

Project report approved by the Student's Advisory Committee

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Sudheer Varma..

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LIST OF SYMBOLS AND ABBREVIATIONS

%	:	per cent
&	:	And
<	:	greater than
<	:	Less than
BCR	:	Benefit cost ratio
et al	:	and others
etc.,	:	and so on
IRR	:	Internal rate of return
NPV	:	Net present value
RBD	:	Refined, Bleached and Deodorized
Rs.	:	Rupees
S.No.	:	Serial number

ABSTRACT

Author of the project	:	**A. SUDHEER VARMA**
Title of the project	:	**ECONOMIC ANALYSIS OF OIL PALM PRODUCTION AND PROCESSING IN EAST GODAVARI DISTRICT OF ANDHRA PRADESH**
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The present study **entitled "Economic analysis of oil palm production and processing in East Godavari district of Andhra Pradesh"** was undertaken mainly to study costs and returns, economic viability and processing aspects of oil palm and consumer preference for Ruchi Gold palmolein oil. East Godavari district was purposively chosen for the study as it has considerable area of 26,522 hectares under oil palm. All the mandals in East Godavari district growing oil palm orchards were listed out and and arranged in descending order of their area under oil palm cultivation and the top 2 mandals were selected purposively. Two villages from each mandal based on criterion of highest area under oil palm were purposively selected. The list of farmers in the selected villages was prepared and 40 farmers were randomly selected. The information pertaining to the oil palm processing was collected from the selected processing unit located at East Godavari district for the year 2016-17. The primary data regarding the consumer preference for Ruchi Gold palmolein was collected randomly from the 50 consumers using simple random sampling technique.

Tabular analysis was used to analyse the costs and returns of oil palm. Project appraisal techniques (NPW, BCR and IRR) were employed to test the economic feasibility of oil palm orchards. An opinion survey was conducted to study the processing and marketing constraints of oil palm

processing. Likert's scale and Garrett's ranking techniques were used to know the consumer preference for Ruchi Gold palmolein oil.

Total labour utilization during economic life span of oil palm orchard stood at 1968.18 man days of which harvesting operation took 734.42 man days (37.31 per cent) followed by watch and ward 506.25 man days (25.72 per cent) and fertilizer application 176.9 man days (8.98 per cent).

The oil palm orchadists in the study area spent on an average Rs. 2799460.24 towards the cultivation of one hectare of oil palm during its life span of 25 years. The gross income realized by the oil palm orchardists during its lifespan amounted to Rs. 3916960 per hectare from oil palm fruit bunches from fourth year onwards. The respective net income received by the farmer stood at Rs. 1117499.76.

NPV at 12 per cent and 28 percent discount rate for the entire life period was found to be Rs. 386046 and 9889.73 respectively. The benefit-cost ratios were 1.81, 1.58, 1.38, 1.20 and 1.04 at 12, 16, 20, 24 and 28 per cent discount rates respectively. The internal rate of return was found to be 29.30 per cent indicating that the investment on oil palm orchards was economically viable.

The main constraint in the cultivation of oil palm was harvesting followed by lack of remunerative market price, lack of availability of labour, high input cost, pests and diseases and lack of HYV and early bearing varieties.

The total costs incurred to produce one tonne oil was Rs. 51915.35. The gross and net returns worked out to be Rs. 68,950 and Rs. 17034.65 per tonne of palm oil respectively.

Availability and quality of raw material were major processing constraints faced by the oil palm processing industry. Imitations and negative image on oil palm were the major marketing constraints faced by the processing industry.

With regard to consumer preference for Ruchi Gold palmolein oil, more than 86 per cent of the respondents had a monthly income below Rs. 10,000. About 80 per cent of the respondents were married. 62 per cent of the respondents were daily labour and 34 per cent were doing small business. 72 per cent of the respondents were using Ruchi Gold palmolein oil for more than 3 years and 76 per cent of the respondents have stated their frequency of purchasing Ruchi Gold palmolein as "weekly". For 60 per cent of the consumers, retailer was the source of knowledge for purchasing Ruchi Gold palmolein oil and 52 per cent of the respondents consumed 4-6 kgs/ month. Brand image was the most preferred attribute of the Ruchi Gold palm oil. Price was the next attribute to catch the consumer's attention and then taste element. Colour and aroma were the other attributes that influenced the consumers' choice.

Chapter ~ I

Introduction

Chapter – I

INTRODUCTION

A large variety of oil seeds are produced in India such as groundnut, castor seed, sesame, rapeseed and mustard, linseed, soybean, sunflower, niger seed and safflower. India holds a significant share in world oil seed production. It is second largest producer of groundnut after China and third largest producer of rapeseed after China and Canada.

The policy impetus to oilseed production in India came for the first time in 1986 when the government launched Technology Mission on oilseed. This was a golden period for oilseed production in India when productivity jumped from 670 kg per hectare in the eighties to 835 kg per hectare in the nineties. Today, the major problem in oil seeds production is low productivity.

Of all the known oil yielding crops, oil palm ranks first which can yield 4-6 tonnes of oil compared to less than 1 tonne / hectare from other edible oil crops. Oil palm is a potential source of edible oil expected to contribute significantly towards meeting the growing edible oil demand. (Hegde and Kiresur, 1999).

The African oil palm *Elaeis guineensis* with West Africa as the centre of origin, is known to be the highest edible oil yielding perennial crop. It produces two distinct oils, i.e., palm oil and palm kernel oil, which have culinary and industrial uses. Palm oil is derived from fleshy mesocarp of the fruit, which contains about 45-55% of oil. The palm kernel oil, obtained from the kernel of stony seed, is a potential source of lauric oil. Oil palm produces 4 to 6 tonnes of crude palm oil/ha and 0.4 to 0.6 tonnes of palm kernel oil from 4^{th} to 25^{th} year of its productive life span.

Oil palm is the crop of the present and future vegetable oil economy of world as well as India. Palm oil has good consumer acceptance as cooking medium because of its price advantage. It is a good raw material for manufacturing oleo chemicals used in making soaps, candles, plasticizers etc. Broadly, palm oil is a source of health and nutrition, value addition, waste utilization, eco-friendly, diversification, import substitution, co-generation and sustainability.

The nine edible oilseeds, viz., groundnut, soybean, rapeseed and mustard, sunflower, sesamum, safflower, niger, castor and linseed, presently grown in about 36 million ha are unable to meet the demand for edible oil in India. Consumption of palm oil in India is highest compared to that of other edible oils. India is mainly depending on import of oil from other countries to meet its oil requirements. During the last two decades, efforts have also been made to introduce and exploit a number of new oil bearing tree crops like jojoba. However, only oil palm has shown promise for commercial cultivation under Indian conditions.

Oil palm was first introduced to India at National Royal Botanical Gardens, Kolkata during the year 1886. The Technology Mission on Oilseeds and Pulses (TMOP) implemented by Government of India looks after development of oil palm in the country through Oil Palm Development Programme (OPDP) along with other nine annual oilseed crops. Expert Committees constituted by Ministry of Agriculture, Government of India have identified a total of 19.33 lakh hectares in 16 states of the country as suitable for oil palm cultivation. So far, an area of 2.82 lakh ha only has been covered under oil palm (2015-16). Production of palm oil in India continues to be at a meagre level with respect to its actual requirement. The state wise areas identified are shown in Table 1.1.

Table 1.1. State wise area under oil palm cultivation upto 2015-16

S. No.	State	Area Covered Under Oil Palm			Area uprooted	Net Area (up to March, 2015)
		Prior to OPDP	Under OPDP	Total Cultivated Area		
	(1)	(2)	(3)	(4)	(5)	(6)
1	Andhra Pradesh	1232	149298	150530	5457	145073
2	Karnataka	1114	40317	41431	6842	34589
3	Tamil Nadu	0	29510	29510	5384	24126
4	Gujarat	0	5054	5054	219	4835
5	Odisha	0	18484	18484	0	18484
6	Goa*	0	953	953	42	911
7	Tripura*	0	530	530	0	530
8	Assam	0	570	570	0	570
9	Kerala	3646	2123	5769	0	5769
10	Maharashtra*	1000	474	1474	0	1474
11	Andaman & Nicobar*	1593	0	1593	0	1593
12	Mizoram	0	25741	25741	0	25741
13	Chhattisgarh	0	2162	2162	0	2162
14	Telangana	0	16239	16239	0	16239
15	Arunachal Pradesh	0	330	330	0	330
16	Nagaland	0	140	140	0	140
	Total	8585	291925	300510	17944	282566
Area uprooted (Presumed)		0	17944	17944	0	0
Existing Net Area		8585	273981	282566	17944	282566

*NMOOP is not being implemented

Note: Details information based on input provided by State Govt. and complied by DAC and FW

Problem Statement

India has been reported to have the largest area under oil seed cultivation in the world but the irony is that the domestic production is not adequate to meet the minimal edible oil requirements of the population. Given our population of 1.3 billion people, the total consumption is 21-22

million tonnes of edible oil against 7 million tonnes of domestic production during the year 2016-17. The demand for edible oil consumption is increasing by 5-5.5 per cent annually and to meet the growing demand India need 1 million tonne of additional output every year. To bridge this gap, India is importing 11-12 million tonnes of palm oil annually.

Oil palm (*Elaies guineensis*) is the edible oil perennial crop that can yield 4-6 tonnes of oil crude palm (oil/ha/year) starting from the 4^{th} to 25^{th} year of its productive life span compared to production of less than 1 tonne/ha from other oil seeds. Palm oil remains world's top produced vegetable oil. Indonesia and Malaysia together account for 85 per cent of global population.

Oil palm, like other vegetable oils, could be used to produce biodiesel. First generation biodiesel production from palm oil is in demand globally. A study conducted in 2009 at Malaysian Science University concluded that palm oil, compared to that of other vegetable oils, is a healthy source of edible oil and at the same time, available in quantities that can satisfy global demand for biodiesel. Oil palm planting and palm oil consumption circumvents the Food vs. Fuel debate because it has the capacity to fulfil both demands simultaneously. Being a perennial crop oil palm can stabilize the production of oil for several decades to come. It is therefore necessary to go for cultivation of oil palm extensively to achieve self sufficiency in edible oils. Palm oil could satisfy the India's oil and fats demand without straining the earth's limited land and energy resources. Keeping this in mind it is felt necessary to work on the economic aspects of oil palm production and processing in East Godavari district of Andhra Pradesh as it has considerable area under oil palm.

OBJECTIVES

1. to analyse the cost, returns and economic viability of oil palm orchards
2. to study the economics of select oil palm processing unit
3. to examine the marketing and processing constraints of select oil palm processing unit and
4. to study consumer preferences for Ruchi Gold palmolein oil in study area.

SCOPE OF THE STUDY

The results of the study provide information on the investment required for the establishment of oil palm orchards, cost structure, returns and economic viability of oil palm orchards. It also provides information on cost, returns, marketing and processing problems of oil palm processing industry. It also gives information on consumer preference towards Ruchi Gold palmolein oil. This information is useful to the existing oil palm orchadists in planning for higher returns and to the new orchadists who plan for the establishment of oil palm orchards. The findings of the study are also useful to the institutional financing agencies in estimating the credit requirements for oil palm orchards. It is very helpful in knowing the marketing and processing constraints of the oil palm processing industry so that new entrepreneurs will take necessary remedies in overcoming the problems.

LIMITATIONS OF THE STUDY

Research studies conducted by individuals were always confronted with various bottlenecks and hence the present study is not an exception to such limitations. The study was confined to a particular agro-climatic region

and conclusions drawn are applicable to similar areas only. Further, the primary data regarding production of oil palm and consumer preference towards Ruchi Gold palmolein oil 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 apt.

PLAN OF THE THESIS

The thesis is presented in five chapters. In the introductory chapter, the economic importance of oil palm, 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 oil palm and other related orchards and consumer preference for edible oils. The third chapter deals with 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

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. Since the literature on oil palm is limited, literature on some related perennial crops was also reviewed.

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

2.1 Studies on cost, returns and economic viability

2.2 Studies on processing

2.3 Studies on marketing and processing constraints

2.4 Studies on consumer preferences

2.1 STUDIES ON COST, RETURNS AND ECONOMIC VIABILITY

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

Radhika (1995) while working out economics of oil palm cultivation in Andhra Pradesh concluded that the establishment cost of the crop during first year was Rs. 14286 per hectare of which the planting material accounted for highest expenditure of Rs. 6636 (44.76%). The maintenance cost of oil palm orchards ranged from Rs. 5391 to Rs. 7727 per hectare of which fertilizers accounted for highest expenditure ranging from Rs. 2346 to Rs. 3400 (42 to 49 per cent).

Motilal (1996) worked out the net returns from oil palm cultivation during its life span of 25 to 30 years which ranged from Rs. 40,000 to Rs. 90,000 per hectare depending up on the management of crop.

Chitra *et al.* (1997) evaluated the profitability of ber cultivation around Hyderabad city with different investment appraisal techniques like payback period, net present value, benefit-cost ratio, annuity value and IRR. The payback period was 4.42 years and the benefit-cost ratio was 5.25 indicating the profitability of ber cultivation. The net present value worked out to Rs. 12,061 and the IRR was 73.54 per cent, which was higher than the lending rates of commercial banks. Thus it clearly brought out that production of ber was economically viable.

Gangwar and Singh (1998) in their study on economic evaluation of Nagpur mandarin in Vidharba region of Maharashtra worked out the total establishment cost of orchard at Rs. 35,432. The amortization cost over 26 years at the rate of 12 per cent was Rs. 4490. The maintenance cost from 6^{th} year onwards varied from Rs. 12,667 to Rs. 22,403 per hectare. Gross returns for the same stood at Rs. 30,864 per hectare per year. They also examined the economic viability of Nagpur mandarins by employing project evaluation techniques. The NPW at 12 per cent discount rate varied from Rs. 40,718 to Rs. 45,654 depending upon the size of mandarin orchard. The BCR for overall group was 1.425. The IRR was lowest (25.78 per cent) for large orchards (above 2 hectares).

Shanthi (1999) worked out the establishment costs and returns from sapota orchards in Nellore district of Andhra Pradesh. The total cost per hectare incurred during establishment of sapota orchard amounted to Rs. 17,837 out of which variable costs and fixed costs worked out to Rs. 13,775 (77.30 per cent) and Rs. 4,062.00 (22.70 per cent) respectively. Total net returns of Rs. 31,936 were obtained from 5th to 10th year. She also observed that the economic viability of sapota orchard by using discounted

measures like NPW, B-C ratio and IRR. The NPW values were Rs. 73,515.5 and Rs. 3,223.5 at 12 and 22 per cent discount rates respectively, indicating the profitability of sapota cultivation. The IRR was found to be 22.08 per cent.

Mallika (2002) found that the total labour required to establish and maintain the coconut orchard during the economic life period was 11,627.18 mandays per hectare, of which irrigation, harvesting and watch and ward took major share with 3400 mandays (29.25%), 2789.65 mandays (23%) and 2640 mandays (22.71%) respectively. The commercial cost of cultivation (cost C) for the life span of coconut orchard was Rs. 22,00,456.90. The gross and net income realised for the entire economic life period were Rs. 30,73,116.00 and Rs. 8,72,65.10. She also found that that the net present worth was as high as Rs. 1,13,147.30 at 10 per cent and Rs. 16,562.42 at 24 per cent. The B-C ratio was 1.27 even at higher discount rate of 24 per cent and the IRR was calculated at 66.10 per cent indicating the economic viability of coconut cultivation.

Yadaukumar *et al*. (2003) in their study on economics of establishment and maintenance of cashew plantations under different plant densities found that NPW, B-C ratio and IRR were all higher for cashew orchards with higher plant density compared to orchards with normal plant density (7.5 m × 7.5 m, 175 plants). NPW varied from Rs. 36,883 to Rs. 74,138, BCR from 1.72 to 2.69 and IRR from 28 to 33 per cent for normal and higher plant densities respectively. The payback period was 8 years in the case of normal plant densities, while it was 7 years in high plant density orchards. They also observed that the unit cost of establishment and maintenance of cashew plantations for the first 10 years was high in high density planting system (87 to 120 per cent more than normal plant density). The net income expected from high density planting was 130 to 150 per cent more than normal plant density (7.5 m × 7.5 m, 175 plants per hectare.)

Gawankar *et al*. (2005) conducted a study with a view to assess the economic viability of cultivating improved aonla cultivars under rainfed condition in South Konkan region of Maharashtra. The study revealed that cultivation of aonla as a rainfed crop by providing drip irrigation only during the initial establishment period of three years was found to be remunerative within a period of 6 years after planting as it gave a net return of Rs. 47684/ha. The higher benefit-cost ratio (2.64) suggested that there existed economic viability in cultivation of aonla crop in the region. They concluded that aonla was a fairly profitable crop in Maharashtra because internal rate of return was 30.76 per cent.

Sharma *et al*. (2006) examined the economic feasibility of mango cultivation in Haryana. The net present value per hectare was calculated as Rs.110165 at 12 percent discount rate for the entire life of the orchard. The benefit-cost ratio was 3.12 and internal rate of return was 25 per cent. Based on these results, the authors inferred that mango cultivation was profitable.

Khair (2006) analysed the financial viability of long term investment in date orchards in Balochistan (Pakistan) and found that the return on investment in date orchards was significantly high i.e., the IRR was 17 per cent with Lucerne as intercrop and 15 per cent with wheat as intercrop against the current rate of interest of 12 per cent on agricultural loans. The B-C ratio was 1.71 with Lucerne as intercrop and 1.53 with wheat as intercrop.

Gangwar *et al*. (2008) conducted a study on economics of peach cultivation in North Indian plains. The results showed that the total establishment cost was Rs. 52,817 per hectare. The amortization cost over 25 year at the interest rate of 12 per cent was Rs. 6,734 per hectare. The maintenance cost from fifth year onwards varied from Rs. 8755 to Rs. 17335 per ha. The average gross return was Rs. 28137. They also calculated economic parameters *viz*., NPV (Rs. 44807), BCR (1.409) and IRR (22.20 %), which indicated that peach cultivation in Punjab and Uttarakhand was a profitable venture.

Khushk *et al.* (2008) in their study " analysis of financial viability of long term investment in guava orchards in Sindh province of Pakistan revealed that guava production started from third year after planting of trees and it reached the maximum level during 12th year and remained constant up to 25th year. Return on investment in guava orchards was determined as 26 per cent against the current rate of interest on agricultural loans. The payback period started from 3 years. According to sensitivity analysis, it was found that guava outcomes were more sensitive to variation in prices than the cost of production. Hence, there was a need to put more emphasis on stabilization of guava prices by improving the existing marketing system.

Naveen *et al*. (2010) in their study on feasibility of investment in grapevine orchards observed that the payback period was 3.2 years. The net present value for grapevine orchards was Rs. 16,256, B-C ratio (2.2) and IRR (42.33 per cent) indicating the investment in grapevine orchards was economically viable.

Kumbhar *et al*. (2014) in their study on economics of production and marketing of guava revealed that the gross income received from guava was observed to be Rs. 132567.29, Rs. 140020.97 and Rs. 147395.86 on small, medium and large size groups, respectively, while at the overall level, it was Rs. 144852.29. At the overall level, B-C ratio was 1.56. The B-C ratio was highest on large size group (1.63), followed by medium group (1.41) and small group (1.31), respectively.

Srilatha (2015) from her study in oil palm production in Nellore district reported that the commercial cost of cultivation incurred to raise one hectare of oil palm during its life span of 25 years stood at Rs. 6,17,377.2. The gross income realised by the oil palm orchardists, during its life span amounted to Rs. 9,63,135.09 which included the net income from inter crops during pre- bearing period and from sale of oil palm fresh fruit bunches from third year onwards. The respective net income received by the farmers

was Rs. 3,45,757.89. The net present value was as high as Rs. 65,201.48 at 12 per cent and Rs. 15,103.41 at 24 per cent discount rates. The benefit- cost ratio was 1.166 even at higher discount rate of 24 per cent. The IRR was calculated at 39.19 per cent. All the measures indicated that oil palm cultivation was a profitable proposition.

Surajkumar and Pundir (2016) studied economic analysis of production of pomegranate in middle Gujarat. Their study revealed that the establishment cost of pomegranate orchard was found to be Rs. 81063. The average per hectare net return was found to be Rs. 88686 and the average production was found at 5482 kg per hectare. The value of economic parameters, *viz.,* NPV, BCR, IRR and PBP was found to be Rs. 993842, 3.07, 47.66 per cent and 58 months, respectively at 10 per cent discount rate. This indicated that in varying situations of cost and return, the economic viability of investment on the pomegranate cultivation was stable and certain.

Vinodhini and Deshmukh (2017) observed that an average amount of Rs. 2,28,082.40 was required for establishing one hectare of coconut orchard and it was observed that per hectare cost of cultivation of coconut orchard worked out to Rs. 92272.75. Regarding profitability of coconut cultivation, in study area, cultivation of coconut was a profitable enterprise as indicated by benefit-cost ratio (1.39).

2.2 STUDIES ON PROCESSING

Rao and Krishnaiah (1999) in their study on economics of cashewnut processing in Srikakulam district of Andhra Pradesh divided the processing costs into labour and material costs. The results revealed that an amount of Rs. 366.12 was incurred by the processor to process 80 kg of raw nuts. It was found that material costs accounted for 65.35 per cent and labour cost (34.10%) of the total processing cost. Among labour costs, shelling was the most important operation with Rs. 60.50 (16.52%). Packaging charges

accounted for 65.67 per cent of the total processing cost. The cost of raw nuts, taxes and costs incurred on processing stood at Rs. 366.12 leaving a considerable margin of about 21 per cent to the processors.

Bhavani (2000) found that costs incurred to process one quintal of paddy was Rs. 701.10 of which variable costs were Rs. 688.25 accounting for 98.17 per cent and fixed costs amounted to Rs. 12.85 per quintal forming 1.83 per cent of the total cost. The recovery percentage of rice was found to be 63.66. The net value added through processing of one quintal of paddy was Rs. 72.98.

Balasubramanian (2000) revealed that about 66.67 per cent of cashew industries in Palasa region have capacity utilization between 0.64-1.44 tonnes per day. The average kernel per cent recovery was calculated as 26.06 per cent and the overall cost of processing in this region worked out to be Rs. 3,845 per tonne of rawnut. The benefit-cost ratio was found to be 1.36.

Vaishnavi (2001) in her study on production and processing of tapioca in Salem district of Tamil Nadu estimated the cost of processing of one quintal of tapioca raw tubers at Rs. 288.14 for starch units, Rs. 393.01 for nylon sago units and Rs. 333.55 for roasted sago units. The returns per quintal of tapioca processed into nylon sago, roasted sage and starch amounted to Rs. 406.34, Rs. 359.89 and Rs. 308.64 respectively.

Athavale (2002) in his study on marketing and processing of soybean in Indore district of Madhya Pradesh observed that 79.92 per cent of the total output was sold within the villages. Oil Federation played an important role in procuring soybean. The products obtained from soybean processing were oil and de oiled cake. The net income from processing of a quintal of soybean worked out to be Rs. 150. The real beneficiary in marketing and processing soybean was processor.

Singh *et al*. (2002) in their study estimated per quintal processing cost of rapeseed-mustard at Rs. 151.09 in four bolts, Rs. 115.99 in six bolts and 89.63 in nine bolts expellers. On an average, four bolts expeller processed 93.75 quintals and earned Rs. 15,972, six bolts processor processed 170.28 quintals and received Rs. 46,868 and nine bolts expeller realized Rs. 95,511.19.

Prasad (2002) studied production and processing of gherkin in Kolar district of Karnataka. He estimated that the cost of processing of one tonne of gherkins at Rs. 12,670.40 out of which variable costs and fixed costs were Rs. 12,285.97 and Rs. 384.43 respectively. The major items of expenditure were the cost of gherkin fruits, drums and interest on working capital. The net returns per tonne were Rs. 15,523.70. The break-even output per annum in processing was estimated at 121.07 tonnes accounting for 2.42 per cent of the average output.

Choudhary *et al*. (2005) in their study on economic evaluation of agro based oil industries in Raipur district of Chattisgarh state estimated the total processing cost of crude rice bran oil, soybean, sal and mahua at Rs. 2,391, Rs. 12,126, Rs. 6,966 and Rs. 9,499 per tonne of raw material respectively. Raw materials turned out to be the major item of expenditure accounting for 51.83, 93.90, 87.18 and 93.51 per cent of total cost of processing a tonne of rice bran, soybean, sal and mahua respectively. Benefit-cost ratio was higher in the case of rice bran oil processing (2.46:1) followed by soybean (1.12:1), mahua (1.10:1) and sal (1.01:1)

Wadkar *et al*. (2005) comparing the economics of large scale cashew processing units (HSCPU) found that the costs of processing per quintal of cashewnut was Rs. 1040.80 in LSCPU and Rs. 1175.61 in HSCPU. The per quintal cost of processing exhibited inverse relationship with the scale of production. The major cost was interest on working and fixed capital. At both levels i.e., LSCPU and HSCPU, it was more than 55 per cent. The other important items of processing were salary and wages, handling and

drying and fuel charges. The total cost incurred by the processing units was more in LSUPU (Rs. 81.86 lakhs) than in HSCPU (Rs. 3.19 lakhs). Net returns at LSCPU level worked out to Rs. 8.69 lakhs for cashewnut processed and Rs. 0.14 lakhs in HSCPU. It was observed that cashew processing units of LSCPU category gained profits to the tune of Rs. 8.69 lakhs, i.e., Rs. 1.11 on every rupee of investment. LSCPU processing units gained higher profits (1.11) as compared to HSCPU (1.04). This indicated profitability of higher scale of production.

Olagunju (2008) studied economics of palm oil processing in South western Nigeria. He observed that the total mean annual cost of palm oil processing was 1,477,095.16 naira. The total fixed cost was 624,548.13 naira representing 42 per cent and the total variable cost was 852,547.03 naira representing 57.7 per cent of total costs.

Kumar and Chinnappa (2010) in their study on economic analysis of cashew processing in Karnataka reported that variable cost of processing of cashewnut worked out to Rs. 48,844 per tonne of which the cost of raw material constituted as major item with 81.01 per cent. The working costs and fixed costs were in the order of Rs. 3862 and Rs. 2289 per tonne respectively. The total cost of processing came to Rs. 54,433 per tonne. Processing units realised net returns of Rs. 3880, Rs. 3537 and Rs. 3009 per tonne in large, medium and small size units respectively.

Reddy and Kumar (2010) studied economics of mango processing plants in Chittoor district of Andhra Pradesh. They observed that the IRR of small mango processing firms (19.31 per cent) was the highest followed by that of large firms (17.5 per cent) and medium firms (13.87 per cent). All the three size class of firms were viable as their IRR was greater than the opportunity cost of capital. Thus, the small firms ranked the highest and the medium firms ranked the lowest as per the IRR criterion.

Karthick *et al.* (2013) studied mango pulp processing industry in Tamil Nadu. They observed that net income realized from the industry was Rs.272 lakh and net return per kilogram of pulp was Rs. 3.61. The net present value for mango pulp industry was 836.01 lakhs, benefit-cost ratio (1.42) and IRR (22.93 per cent) indicating that the investment on mango pulp processing plant was financially viable.

Kumar *et al.* (2016) studied mango fruit processing industry in South India. They observed that the Benefit-cost ratio of 1.51 and IRR of 19.50 per cent for mango pulp industries and IRR of 21.0 per cent and Benefit-cost ratio of 1.87 for mango pickle units indicated that the investment on mango pulp and pickle processing industry was financially viable.

Srilatha (2017) studied economic aspects of oil palm processing in Nellore district of Andhra Pradesh. She reported that the total cost incurred to produce one tonne of oil from oil palm fresh fruit bunches was Rs. 18,854.29. In this the variable cost and fixed cost were Rs. 16,846.74 and Rs. 2007.55 accounting for 89.35 and 10.65 per cent of the total costs respectively. Among the variable costs, raw material was the major item amounting to Rs. 16,176.47 (85.80%) followed by casual labour charges amounting to Rs. 380.88 (2.20%). Among the fixed cost, interest on fixed capital was the major item amounting to Rs. 1092.37 (5.79%) per tonne of oil. The gross and net returns worked out to Rs. 38,940 and Rs. 20,086.01 per tonne processing of palm oil respectively.

2.3 STUDIES ON MARKETING AND PROCESSING CONSTRAINTS

Veerkar *et al.* (2001) studied constraints in kokum processing industry. Their study revealed that high capital requirement (80%), non-availability of labour (70 per cent), high transportation charges (60%) and non-availability of labour (60 per cent) were the major constraints faced by kokum processing industries. To overcome the problem, more than 70 per

cent kokum processors suggested that they should be provided with long term financial assistance at lower rate of interest by the financial institutions.

Dinesh and Venkateshwaran (2010) in their study on marketing problems of edible industry revealed that high requirement of working capital, high switching behaviour among the consumers and number of intermediaries were the highly viewed marketing problems among the owners in small units.

Reddy and Kumar (2010) in their study on mango processing plants revealed that the prices of raw fruits and processed products were highly fluctuating in domestic as well as international markets, thereby causing higher risk particularly to small scale processing units. Lack of domestic demand for mango pulp was reported to be a major problem by 75 per cent of the firms followed by inadequate supply of power (60%) and high cost of credit (60%).

Karthick *et al.* (2013) in their study on mango pulp processing industry revealed that frequent power cut in the study area and price fluctuation of mango and unavailability of raw material during off season were the major constraints faced by the processing firms.

Emokaro and Ugbekile (2014) studied economic analysis of oil palm processing in Ovia North East and Ikpoba. Their study revealed that inadequate finance as the major constraint faced by oil palm processors followed by labour shortage, unavailability of land and high maintenance cost.

Theerkapathy and Chandra Kumar (2014) in their study on coconut processing industries observed that the processing entrepreneurs found it difficult to procure required raw materials directly from the coconut farm owners. On the other hand, the coconut copra processing entrepreneurs were suffering with high level of financial crisis for working capital management and the level of tolerance among the workers became very low.

Gunn (2014) studied problems and prospects of small-scale palm oil processing in Delta-State, Nigeria. He observed that high cost of palm oil processing (77.4 per cent) was the major constraint faced by processors followed by lack of access to credit facilities (51.8 per cent) and lack of Government support (34.8 per cent).

Udoh *et al*. (2015) in their study on palm oil processing and marketing revealed that palm oil processing and marketing was a lucrative economic activity of Akwa Ibom people of the South-South, Nigeria. Lack of credit facilities to small holders (30.8%) was the major constraint faced by the processors followed by low prices of palm oil and kernel (24.3%) and transportation (16.2%).

Kumar *et al.* (2016) in their study on mango processing industry revealed that post-harvest losses, availability of raw material and lack of infrastructural facilities were the major problems faced by the processing industries in the study area.

Srilatha (2017) studied economic aspects of oil palm processing in Nellore district of Andhra Pradesh. Her study revealed that non availability of raw material (FFB) throughout the year was the major problem faced by the processing unit which kept the unit idle for most part of the year which was highly uneconomical. The second major problem expressed by the processing unit was the paucity of labour during peak periods.

2.4 STUDIES ON CONSUMER PREFERENCES

Hasan and Khan (2009) studied impact of packaging characteristics on consumer brand preference for edible oils. They identified that packaging characteristics were significant variables for consumer brand preference in edible oils. The study indicated that packaging characteristics had association with consumer brand preference in edible oils.

Sarwade (2011) in his study on brand preferences and consumption pattern of edible oils had revealed that health consciousness and quality of a particular brand were the important factors in decision making. Further he stated that 42 per cent of the respondents used sunflower oil, kardi oil (32%), ground nut (15%), soybean oil (10%) and corn and kardi blend (1%). Majority of the consumers preferred branded oil than loose oil. Dhara oil brand was having maximum awareness among consumers followed by Saffola, Fortune, and Gemini in Maharashtra.

Vyas *et al*. (2013) have conducted a survey to understand the factors affecting the purchase decision for edible oils by consumers. Through the study, authors have found that health factor played an important role in choosing the edible oil brands. Further they have pointed out that, majority of the consumers changed their edible oil for better health and revealed that there was no strong loyalty displayed by the consumers.

Prema (2013) in his study on brand preference towards edible oil found that "price" was the main factor (Rank I) which influenced to buy edible oil, "quality and quantity" was the next factor (Rank II) influenced the respondents, "health" was the next factor (Rank III) influenced the respondents to buy edible oil. Fourth factor was availability followed by packaging as fifth factor influenced the respondents to buy edible oil.

Narayan, *et al*. (2014) in their study on consumers' preference for edible oil brand observed that consumers of 26 to 35 age groups were shopping for their preferred oil brand, and buyers who were shopping to purchase their preferred oil brand were males. Further they found that important factors that influenced the purchasing decision were quality (69.45%) and shop displays (19.45%).

Vishal and Shubangi (2014) in their study on consumer preference for edible oils had revealed that age group of 26-35 years preferred branded

products. However, health (67%) was considered to be an important parameter for the selection of edible oils. Finally it was concluded that, consumers preferred branded products over unbranded products of edible oils. Healthy edible oils were on priority for selection of any brand of edible oil than any other attribute.

Nondzor *et al*. (2015) in their study on preference of edible oil revealed that that majority of consumers (95.6%) generally used refined edible oils in their daily meal and these consumers lacked the requisite knowledge on saturated fats and unsaturated fats content of edible oils. 95 per cent of the consumers purchased the refined edible oils because they perceived them to be healthy to consume, quality blend and nutritious. Moreover, unrefined edible oils were perceived to be substandard in packaging and poor in quality.

Bhuvaneswari (2015) in her study on consumer attitude towards edible oils revealed that majority (63 per cent) of the respondents purchased edible oils once in a month and it was also found that maximum (66 per cent) of the respondents preferred polybags in the purchase of various brands of edible oils.

Kumar (2016) in his study on consumption pattern of cooking oils observed that maximum of 43.5 per cent of the respondent households have stated their monthly consumption of cooking oil as 2-3 litres. Further 53.5 per cent of the respondents have stated their frequency of buying cooking oil as ‘monthly’. Another 18.5 per cent of respondents have stated their buying frequency as ‘once in a fortnight’ and 11.5 per cent have stated it as ‘weekly’.

Kulkarni and Kolhatkar (2017) in their study on buying behaviour of consumers of edible oil observed that easy availability and price of edible oil were the most significant factors which were most influencing on the

decision-making for purchasing particular brand of edible oil. Further 50 per cent of households preferred to purchase in provision stores, 32 per cent preferred super markets and 18 per cent preferred wholesalers. 36 per cent of households preferred sunflower oil, 15 per cent preferred ground nut oil, 9 per cent preferred palmolein oil, coconut oil 5 per cent and 35 per cent preferred other variants of edible oil.

Chapter ~ III

Methodology

Chapter - III

MATERIAL AND METHODS

An attempt has been made in this chapter to describe the sampling procedure, nature of data collection and analytical tools employed in achieving the objectives of the study. This chapter is presented under the following heads.

3.1 Sampling procedure

3.2 Collection of data

3.3 Methods of computation

3.4 Tools of analysis and

3.5 Concepts and terms used in the study

3.1 SAMPLING PROCEDURE

Purposive-cum-random sampling technique was adopted to select the ultimate sample.

3.1.1 Selection of District

East Godavari district was purposively chosen for the study as it has considerable area of 26,522 hectares under oil palm and ranked second in the cultivation of oil palm in Andhra Pradesh.

3.1.2 Selection of Mandals

All the mandals in East Godavari district growing oil palm orchards were listed out and arranged in descending order of their area under oil palm cultivation and the top 2 mandals were selected purposively. The selected mandals along with their area under oil palm are presented in Table 3.1

Table 3.1. Area under oil palm cultivation in selected mandals of East Godavari district

S. No.	Mandal	Area in hectares
1.	Gandepalli	3780.34
2.	Rajanagaram	2811.29

Source: Department of Horticulture, Oil palm seed garden, Rajahmundry.

3.1.3 Selection of villages

All the villages growing oil palm orchards in Gandepalli and Rajanagaram mandals were listed out and arranged in descending order of their area under oil palm cultivation and the top two villages from each mandal were selected purposively.

3.1.4 Selection of Respondents

The list of oil palm growers from the four selected villages was prepared and 40 farmers were randomly selected.

3.1.5 Selection of Processing Unit

In the study area there are two processing units in functioning and one processing unit was randomly selected.

3.1.6 Selection of Respondents for Consumer Preference for Ruchi Gold Palmolein Oil

Ruchi Gold palmolein was the most popular among the consumers in the study area.Simple random sampling technique was used to collect the data from 50 consumers in the study area.

3.2 COLLECTION OF DATA

Survey method was employed to collect the data from the oil palm growers. The data collected for the study related to the agricultural year 2016-2017. The primary data pertaining to the production aspects of oil palm were collected directly from the farmers with the help of a specially designed schedule by personal interview and presented at current prices (2016-2017) to estimate costs and returns.

Regarding the palm oil processing, the information was collected from the selected oil palm processing unit.

Regarding the consumer preference for Ruchi Gold palmolein oil, the information was collected from the selected consumers using a specially devised schedule.

Secondary data pertaining to the oil palm were collected from Department of Horticulture, mandal and village records.

3.2.1 Cost Structure of Oil Palm

Oil palm is a perennial crop with an economic life span of 25-30 years and starts yielding economic benefits from 4^{th} year onwards. Hence the costs incurred can be classified into two categories viz., establishment costs and maintenance costs.

Establishment costs

The establishment costs included all the expenditure incurred during pre-bearing period (1-3 years) on items like land preparation, cost of plant material, manures, fertilizers and plant protection chemicals etc.,

Maintenance costs

All recurring costs required for maintaining the orchard during bearing period such as expenditure on manures, fertilizers; plant protection

chemicals and their application charges and expenditure on leaf cutting and mulching and watch and ward were considered as maintenance costs. Besides this, land revenue was also considered for working out the cost of maintenance of the oil palm orchard.

3.3 METHODS OF COMPUTATION

The economic analysis of production of oil palm 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 oil palm is described below.

3.3.1 Production Aspects

Production aspects of oil palm included cost of cultivation of oil palm and the returns from the same.

3.3.1.1 Cost structure on oil palm orchards

The total costs were divided into variable costs and fixed costs.

3.3.1.1.1 Variable costs

Variable costs included cost of human labour, machine labour, plant material, manures, fertilizers, plant protection chemicals and interest on working capital.

Human labour

Actual days worked in performing various cultural operations in the establishment and maintenance of oil palm orchard were recorded separately for male, female, family and hired labour. The woman days 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.

Machine labour

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

Plant material

The selected oil palm orchardists purchased 15-25 month sold oil palm seedlings from nurseries maintained in East Godavari district. The cost of seedling was computed at the prevailing market rates in the study area.

Manures

Manures included FYM both purchased and produced on farm. The purchased farm yard manure was charged at the prevailing rates. Farm produced manure was evaluated at the local rates as reported by the sample orchadists.

Fertilizers

The fertilizers used were evaluated at the prevailing market prices plus transportation cost if any.

Plant protection chemicals

The Plant protection chemicals were evaluated at the prevailing market prices plus transportation charges if any.

Electricity charges

In the study area, prevailing electricity charges were taken into consideration.

Interest on working capital

The interest on working capital was calculated at the rate of 8 per cent per annum excluding owned labour, farm produced inputs etc.,

3.3.1.1.2 Fixed costs

Fixed costs included land revenue, rental value of owned land, deprecation, interest on fixed capital and annual share of establishment cost.

Land revenue

The actual amount paid by the farmer towards land revenue was taken into account.

Rental value of owned land

Actual rent prevailed in the study area was considered for the calculation of rental value of owned land.

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 oil palm.

Interest on fixed capital

It was calculated at the rate of 7 per cent per annum as the fixed deposits in commercial banks would fetch this rate of interest.

Annual share of establishment cost

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

3.3.1.2 Returns from oil palm orchards

Gross income

The total income received by the oil palm orchardists from the sale of fresh fruit bunches every year during bearing period was considered as gross income in each year.

Net income

It is the surplus income over the total costs.

3.3.2 Processing Aspects

3.3.2.1 Processing costs of oil palm:

The total cost of processing was divided into variable costs and. fixed costs.

3.3.2.1.1 Variable costs

This was obtained by adding cost of raw material in incidental charges wages for casual labourers, power charges, lubricant charges, fuel charges, repairs and maintenance, miscellaneous charges and interest on working capital.

Raw material purchase cost

It is the cost of purchasing oil palm fresh fruit bunches (FFB) from the orchardists.

Transportation charges

The purchased FFB were transported to oil mills within 24 hours after harvesting mostly on contract basis. The charges were evaluated at the prevailing rates per tonne.

Wages for casual labour

Casual hired labour was evaluated at the prevailing wage rates for different operations pertaining to oil palm processing.

Interest on working capital

This was calculated for cost of raw material, incidental charges, wages for casual labourers, power charges, lubricant charges, and fuel charges at 8 per cent rate of interest.

3.3.2.1.2 Fixed costs

Fixed costs in oil palm processing included depreciation on building and machinery, opportunity cost of land, insurance charges, taxes, salaries for permanent staff and interest on fixed capital.

Interest on fixed capital

This was calculated for building and machinery at 7 per cent rate of interest.

3.3.2.2 Returns from oil palm processing

Gross returns

Gross returns are total sales proceeds of one tonne of oil and resultant kernels by the oil mill.

Net returns

Net returns were calculated by subtracting total processing costs from gross returns.

3.4 TOOLS OF ANALYSIS

The data collected were subjected to conventional tabular analysis to work out costs and returns of oil palm production and processing. Discounted cash flow techniques were used to analyse the capital productivity on oil palm orchards.

3.4.1 Capital Productivity of Oil Palm Orchards

The measurement of capital production in agriculture assumes importance as it facilitates the most efficient use of resources. But in the case of perennial crops like oil palm, for the capital invested now, the benefits will be realised as a stream in future. The investment made in oil palm plantation is as follows.

i. There has been continuous investment under establishment cost for the first 3 years with out economic returns.

ii. Maintenance expenditure is incurred from 4^{th} year onwards.

Discounted Techniques

The discounted cash flow method of evaluating long term projects is a process of finding the present worth of an 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. Actual cash inflows and cash outflows are considered in using discounted cash flow techniques for evaluating the capital investment on oil palm orchards. The following discounted cash flow measures were used in the analysis viz., Net present worth, Benefit-cost ratio and Internal rate of return.

Net Present Worth (NPW)

It is some times referred to as net present value. It is the present worth of the incremental net benefits or incremental cash flow stream. The selection criterion of the project depends on the positive value of the net present worth when discounted at the opportunity cost of the capital.

Net present worth of the project (NPW) is estimated using the following formula.

$$\text{Net present worth} = \sum_{j=1}^{n} \frac{B_i - C_j}{(1+i)^j}$$

where B_j = Benefits in j^{th} year

C_j = Costs in j^{th} year

i = Discount rate

n = Number of years

Benefit-cost Ratio (BCR)

This ratio compares the present worth of costs with present worth of benefits. The common procedure of selecting the project is to chose the projects having the B.C ratio of more than one, discounted at opportunity cost of capital. This ratio was arrived by using the following formula.

$$\text{BCR} = \sum_{j=1}^{n} \frac{B_j / (1+i)^j}{C_j / (1+i)^j}$$

Where B_j = Benefits in rupees in j^{th} year

C_j = Costs in rupees in j^{th} year

I = Discount rate

n = Number of years

Internal Rate of Return (IRR):

It represents the average earning capacity of an investment over the economic life period of the project. It is that discount rate which just makes the net present worth of cash flow equal to zero. In other words, the benefit cost ratio calculated at IRR is unity. Mathematically it can be represented as

$$\text{NPW} = \sum_{j=1}^{n} \frac{B_i - C_j}{(1+i)^j} = 0$$

where B_j = Benefits in j^{th} year

C_j = Costs in j^{th} year

I = Discount rate

n = Number of years

IRR is the maximum interest that a project could pay for the resources used if the project is to recover its investment and operating costs and still break even. The IRR is arrived through interpolation technique by using different discount rates so as to see that the net present worth is equal to zero. Therefore, the project costs and benefits are discounted at a certain rate to find out the present worth of the project. Again by selecting a higher discount rate, the costs and returns are discounted throughout the project period to get a negative net present worth. The higher value of IRR indicates the first, while lowest value being the last choice of preference. However, the IRR should be more than the discount rate being considered for economic feasibility and financial soundness.

Internal rate of Return = Lower discount rate + Difference between higher and lower discount rates * {Net present worth at lower discount rate / Absolute difference between present worths at two discount rates}.

When the calculated IRR is greater than the market rate of interest, then the investment is considered viable.

Sensitivity analysis

Sensitivity analysis involves changing one (or) more values in net present worth equation and recalculating the NPV. This analysis provides better insight into the profitability of investment. In the present investigation, the net present value and benefit-cost ratio were calculated at 12, 16, 20, 24 and 28 per cent discount rates covering lending rates of both the institutional and non-institutional financial agencies**.**

3.4.2 Garrett's Ranking Technique

To find out the most significant factor which influences the respondent, Garrett's ranking technique was used. As per this method, respondents have been asked to assign the rank for all factors and the outcomes of such ranking have been converted into score value with the help of the following formula:

$$\text{Per cent position} = \frac{R_{ij} - 0.5}{N_j} \times 100$$

Where,

R_{ij} = rank given for i^{th} factor by j^{th} respondents

N_j = number of factors ranked by j^{th} respondents

With the help of Garrett's Table, the percent position estimated is converted into scores. Then for each factor, the scores of each individual are added and then the total value of scores and mean values of the score are calculated. The factors having highest mean value is considered to be the most important factor.

3.4.3 Likert's Scale Technique

A Likert scale is a psychometric scale commonly involved in research that employs questionnaires. It is the most widely used approach to scaling responses in survey research.

A Likert item is simply a statement which the respondent is asked to evaluate according to any kind of subjective or objective criteria and the level of agreement or disagreement is measured and according the score is given.

S. No.	Response	Score
1	Strongly disagree	1
2	Disagree	2
3	Neutral	3
4	Agree	4
5	Strongly agree	5

The scores were summed up, and the mean of each attribute was calculated and satisfaction levels were ranked based on it. The mean score was used for simple comparison of the level of satisfaction. The mean score was calculated by using the following formula:

$$\text{Mean score} = \frac{\sum_{j=1}^{n} w_i x_i}{\sum_{j=1}^{n} x_i}$$

where,

W_i : Weight of the variable

X_i : Variable

3.5 CONCEPTS AND TERMS USED IN THE STUDY

Concepts and definitions used in the study are presented below.

3.5.1 Consumer

A person who purchases goods and services for personal use.

3.5.2 Factors

A circumstance, fact or influence that contributes to a result.

3.5.3 Consumer Preference

It is the thought process of selecting a logical choice from the available options. When trying to make a good decision, a person must weigh the positives and negatives of each option, and consider all the alternatives. For effective decision making, a person must be able to forecast the outcome of each option and based on all these items, determine which option is the best for that particular situation.

3.5.4 Brand

A brand is a distinguishing symbol, mark, logo, name, word, sentence or a combination of these items that companies use to distinguish their product from others in the market.

3.5.5 Purchasing Pattern

Purchasing pattern refers to the typical way in which consumers buy goods or avail services- encompassing frequency, quantity, duration, timing etc.

Chapter ~ IV

Results & Discussion

Chapter – IV

RESULTS AND DISCUSSION

The present study embodies the results of a field investigation concerning the economic analysis of production and processing of oil palm in East Godavari district. It also consists of consumer preference towards Ruchi Gold palmolein oil. The important findings of the study are presented along with relevant discussion. For easy understanding and convenience, this chapter is divided into following subheads.

4.1 Socio economic profile of the selected respondents

4.2 Human labour and material input utilisation on oil palm orchards

4.3 Cost structure of oil palm orchards

4.4 Returns from oil palm orchards

4.5 Economic viability of oil palm orchards

4.6 Constraints faced by the farmers

4.7 Processing aspects of oil palm

4.8 Marketing and processing constraints of processing industry

4.9 Consumer preference for ruchi gold palmolein oil

4.1 SOCIO-ECONOMIC PROFILE OF SELECTED ORCHADISTS

The socio-economic profile provides a 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 5.69 members consisting of 2.78 males, 1.68 females and 1.23 children. It is also clear from the particulars of the table that the number of family members participating in agriculture was 1.42 which accounted for 24.95 per cent of total family members. The number of male and female workers in the family stood at 1.35 and 0.07 members respectively. The participation of family members in agriculture was less because majority of the oil palm growers belonged to well-to-do families. The average literacy level among the families of sample farmers was 3.64 members.

Table 4.1. Farm family composition of sample farmers

S. No.	Particulars	Number	Percentage
1.	**Size of the family**		
	a. Male	2.78	48.86
	b. Female	1.68	29.52
	c. children	1.23	21.62
	Total	5.69	100
2.	**Farm family workers**		
	a. Male	1.35	95.07
	b. Female	0.07	4.93
	Total	1.42	100
3.	**Literacy level**	**3.64**	**63.97**

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 it could be seen from Table 4.2, the area under oil palm which was the selected enterprise for the economic analysis occupied 9.52 hectares and this constituted 77.49 per cent of the total holding. The area under other crops occupied 3.01 hectares constituting 22.51 per cent of the total holding.

Table 4.2. Land holding pattern of the sample farmers

S. No.	Particulars	Area(Ha)	Percentage
1.	Area under oil palm	9.52	77.49
2.	Area under other crops	3.01	22.51
3.	Total holding	12.53	100

4.1.3 Farm Inventory

The value and composition of farm assets reflect economic background of orchadists. The particulars of farm assets per hectare are presented in Table 4.3. A perusal of the results indicated that the total value of assets including land was Rs. 40,94,623.82 per hectare. It was observed that land, the basic input that supports the production of all farm inputs was the single most valuable asset on the sample farms and accounted for 97.86 per cent of 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. 87,623.82 per hectare. Next in the order was value of implements and machinery and value of livestock accounting for 1.66 per cent and 0.48 per cent of total value of assets respectively.

Table 4.3 Asset structure of sample farmers

S. No	Particulars	Per hectare (Rs.)	Percentage
1.	Value of land	40,07,000	97.86
2.	Value of implements and machinery	67,607.28	1.66
3.	Value of livestock	20,016.54	0.48
4.	Value of total assets		
	a. Without land value	87,623.82	2.14
	b. With land value	40,94,623.82	100

4.2 HUMAN LABOUR AND MATERIAL INPUT UTILISATION ON OIL PALM ORCHARDS

4.2.1 Human Labour Utilisation on Oil Palm Orchards

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 oil palm cultivation.

4.2.1.1 Human labour utilization on oil palm orchard during pre-bearing period (1-3 years)

The operation wise labour use in the cultivation of oil palm during the year of establishment is presented in Table 4.4. The total labour utilized for the establishment of oil palm orchard during the first year was 64.16 man days per hectare. It could be observed that watch and ward was the most labour absorbing operation requiring 20.25 man days and accounting for 31.57 per cent of the total labour used during the first year. Most of the farmers having more than 5 acres employed human labour for watch and ward activity besides engaging them in other activities.

Digging of pits and planting was the next important labour absorbing operation. Oil palm is planted in the main field in a triangular system at a spacing of 9 meters accommodating 143 palms per hectare. The digging of the pits required 9.37 man days (14.60 per cent of the total human labour).

Ploughing, cleaning and levelling were the next important labour absorbing operation. Some farmers went for new planting by removal of age old trees. This operation consumed 8.62 man days accounting for 13.43 per cent of the total labour used.

Weeding was the next labour consuming operation requiring 6.24 man days (9.72%). This operation was done for proper establishment of oil palm seedlings.

Fertilizer application required 5.26 man days because this operation had to be done 3-4 times in a year. Basin preparation for irrigation required 5.23 man days (8.16%). Application of manures required 3.79 man days (5.90%). Since all the sample farmers (100%) were having drip irrigation facility, there was no labour requirement for irrigation operations.

The other important labour absorbing operation during first year was marking of lines and alignment which required 3.12 man days (4.86%), followed by application of plant protection chemicals with 2.28 man days (3.55%).

The total labour requirement during 2nd and 3rd year decreased in comparison to 1st year (64.16 man days) Total labour utilised during 2nd and 3rd year stood at 45.89 and 47.31 man days per hectare respectively. Major item of human labour utilization during 2nd and 3rd year was watch and ward, accounting for 20.25 man days each.

Weeding was the next labour consuming operation requiring 6.56 man days (14.3%) and 7.32 man days (15.48%) in 2nd and 3rd year respectively. This operation was done for proper establishment of oil palm seedlings.

The third important labour consuming operation was basin preparation. Basins allow the tree to absorb the water very effectively with out any wastage. The area of the basin increases with the growth of the plants. This operation required 5.46 man days (11.9%) and 5.78 man days (12.22%) for 2nd and 3rd year respectively.

Manuring was the next labour absorbing operation which required 4 man days (8.72%) and 4.06 man days (8.58%) during 2nd and 3rd years respectively followed by application of plant protection chemicals which required 2.16 man days (4.71%) and 2.32 man days (4.90%) for 2nd and 3rd years respectively.

Ablation was the least labour absorbing operation which required 2.12 man days (4.62%) and 2.26 man days (4.77%) respectively. It involves removal of all inflorescences during the initial three years to gain adequate stem girth, vigour and root system.

During the pre-bearing period, the hired labour contribution in total labour varied from 85.87 per cent in first year to 86.02 per cent in second year and then to 86.24 per cent in third year.

Total labour required during pre-bearing period was about 157.36 man days of which 13.98 per cent comprised of family labour and the remaining 86.02 per cent was met through hired labour.

Table 4.4. Operation wise human labour utilization on oil palm orchards during pre-bearing period (1st year to 3rd year)

S. No.	Operation	1st year	2nd year	3rd year	Total
1	Ploughing, cleaning and leveling	8.62 (13.43)	-	-	8.62 (5.48)
2	Marking of lines and alignment	3.12 (4.86)	-	-	3.12 (1.98)
3	Digging of pits and planting	9.37 (14.60)	-	-	9.37 (5.96)
4	Basin preparation	5.23 (8.16)	5.46 (11.9)	5.78 (12.22)	16.47 (10.47)
5	Weeding	6.24 (9.72)	6.56 (14.3)	7.32 (15.48)	20.12 (12.78)
6	Manuring	3.79 (5.90)	4 (8.72)	4.06 (8.58)	11.85 (7.53)
7	Fertilizer application	5.26 (8.21)	5.34 (11.64)	5.32 (11.25)	15.92 (10.12)
8	Pesticide application	2.28 (3.55)	2.16 (4.71)	2.32 (4.90)	6.76 (4.3)
9	Ablation	-	2.12 (4.62)	2.26 (4.77)	4.38 (2.78)
10	Watch and ward	20.25 (31.57)	20.25 (44.11)	20.25 (42.80)	60.75 (38.6)
	Owned Labour	9.06 (14.13)	6.42 (13.98)	6.51 (13.76)	21.99 (13.98)
	Hired labour	55.10 (85.87)	39.47 (86.02)	40.80 (86.24)	135.37 (86.02)
	Total labour	64.16	45.89	47.31	157.36

4.2.1.2 Human labour utilization per hectare of oil palm orchard during bearing period (4th to 25th year)

The operation wise human labour requirement per hectare of the oil palm orchard from 4th to 25th year is presented in Table 4.5.

The major labour consuming operation was the harvesting which utilized 734.42 man days (40.56%). Yield of the crop increases with age of the orchard thereby the number of labourers required to harvest the fresh fruit bunches was also very high.

Watch and ward was next to harvesting in labour utilization. It required 445.5 man days of labour (24.6%). As the labour for watch and ward is more dependent on area but not on age, there is no difference in labour use for watch and ward.

The important labour consuming operation was fertilizer application which required 160.98 man days accounting for 8.89 per cent of the total labour utilization. The labour required for leaf cutting and mulching was 154.91 man days (8.55%).

Basin preparation required 137.6 man days (7.6%). Manuring utilised 122.14 man days (6.74%).Weeding required 29.17 man days (1.61%). The last labour utilization was pesticide application which required 26.1 man days (1.45%).

Total labour utilization during bearing period was about 1810.82 man days per hectare of which 14.68 per cent was contributed by family labour and the remaining 85.32 per cent by hired labour.

Table 4.5. Operation wise human labour utilization on oil palm orchards during bearing period (4th to 25th year)

S. No.	Operation	4th year	5th year	6th year	7th year	8th – 25th year	Total
1	Basin preparation	6.02 (11.29)	6.48 (9.97)	6.36 (8.69)	6.24 (7.91)	6.25 (7.30)	137.6 (7.6)
2	Manuring	4.52 (8.47)	4.86 (7.48)	5.09 (6.95)	5.43 (6.89)	5.68 (6.64)	122.14 (6.74)
3	Fertilizer application	7.24 (13.57)	7.43 (11.43)	7.34 (10.03)	7.21 (9.14)	7.32 (8.55)	160.98 (8.89)
4	Weeding	1.34 (2.51)	1.28 (1.97)	1.46 (1.99)	1.33 (1.69)	1.32 (1.54)	29.17 (1.61)
5	Pesticide application	1.2 (2.25)	1.32 (2.03)	1.16 (1.58)	1.18 (1.5)	1.18 (1.38)	26.1 (1.45)
6	Leaf cutting and mulching	5.02 (9.42)	5.34 (8.22)	5.56 (7.60)	6.87 (8.71)	7.34 (8.58)	154.91 (8.55)
7	Watch and Ward	20.25 (37.96)	20.25 (31.16)	20.25 (27.67)	20.25 (25.68)	20.25 (23.66)	445.5 (24.6)
8	Harvesting	7.75 (14.53)	18.03 (27.74)	25.98 (35.49)	30.34 (38.48)	36.24 (42.3)	734.42 (40.56)
	Owned Labour	7.82 (14.65)	9.57 (14.72)	11.03 (15.06)	11.83 (15)	12.52 (14.62)	265.83 (14.68)
	Hired Labour	45.52 (85.35)	55.42 (85.28)	62.17 (84.94)	67.02 (85)	73.06 (85.38)	1544.99 (85.32)
	Total	53.34 (100)	64.99 (100)	73.2 (100)	78.85 (100)	85.58 (100)	1810.82 (100)

4.2.2 Material Input Utilization on Oil Palm Orchards

The material inputs utilized in the oil palm cultivation were plant material, manures, fertilizers and plant protection chemicals. Material input utilization was shown in the Tables 4.6 and 4.7.

It is observed from Table 4.6 that a plant population of 143 seedlings per hectare was maintained which is the recommended plant population. The quantity of manures varied from 5.05 tonnes during initial years to 7.56 tonnes per hectare during later stages of the orchard. The total quantity of manures applied during the entire economic life period of oil palm was 178.36 tonnes per hectare.

The use of N, P, K, Mg and B nutrients through chemical fertilizers for the entire 25 years of economic life of oil palm stood at 4121.98, 2051.28, 4082.01, 1699.43 and 338.98 kgs per hectare respectively. The orchadists used 6.39 kgs of plant protection chemicals for the entire life period of oil palm cultivation.

Table 4.6. Material input utilization on oil palm orchards during pre-bearing period (1st to 3rd year)

S. No.	Particulars	1st year	2nd year	3rd year	Total
1.	Plant material	143	-	-	143
2.	Manures (tonnes)	5.05	5.32	5.41	15.78
3.	Fertilizers (kgs)				
	N	57.2	114.4	171.6	343.2
	P	28.6	57.2	85.8	171.6
	K	57.8	113.8	169.72	341.32
	Mg	17.87	35.75	71.5	125.12
	B	3.57	7.15	14.3	25.02
	Plant protection chemicals (gms)	302.35	300.25	308.68	911.28

Table 4.7. Material input utilization on oil palm orchards during bearing period (4th to 25th year)

S. No.	Particulars	4th year	5th year	6th year	7th year	8th -25th year	4th -25th year	Total (1-25 years)
1.	Manures (Tonnes)	6.02	6.47	6.78	7.23	7.56	162.58	178.36
2.	Fertilizers (kgs)							
	N	172.52	171.24	172.58	173.64	171.6	3778.78	4121.98
	P	84.5	85.68	84.76	85.74	85.5	1879.68	2051.28
	K	173.45	171.72	170.84	169.72	169.72	3740.69	4082.01
	Mg	71.85	72.46	70.42	72.58	71.5	1574.31	1699.43
	B	14.98	14.24	13.98	13.36	14.3	313.96	338.98
3.	Plant protection chemicals (gms)	296.75	284.32	268.6	257.5	243.2	5484.77	6396.05

4.3 COST STRUCTURE OF OIL PALM ORCHARDS

Oil palm is a perennial oil seed crop and once established, the crop can be economically cultivated for about 25 years. The gestation period of oil palm orchard is about 3 years. The economic yields are coming from 4th year onwards. Therefore the cost incurred in establishing the orchard during the pre-bearing period was considered as establishment cost. The establishment cost included the expenditure on land preparation, digging of pits, plant material and planting and other operations for the plantation together with orchards. The maintenance costs included the expenditure on manuring, fertilization, plant protection, weeding, watch and ward and harvesting.

The study of costs and returns of oil palm cultivation helps the farmers to maximize profits by adopting efficient resource management practices. The total costs are discussed under two groups viz., variable costs

and fixed costs. Variable costs include expenses on labour utilized for performing cultural operations and expenditure on material inputs like plant material, manures, fertilizers and plant protection chemicals. The fixed costs are depreciation on assets, interest on fixed capital, rental value of owned land, land revenue and annual share of establishment cost.

4.3.1 Cost of cultivation of oil palm during pre-bearing period (1-3 years)

The per hectare costs incurred in establishing oil palm orchards during pre-bearing period (1-3 years) are presented in Table 4.8.

The total costs incurred during its pre-bearing period (1-3 years) stood at Rs. 2,04,914.24 of which Rs. 1,10,922.94 (54.13%) were variable costs and Rs. 93,991.3 (45.87%) fixed costs.

It could be seen from the table 4.8 that among the total costs, the rental value of owned land formed the major item with Rs. 62,037.5 (30.28%) followed by human labour (23.04%), fertilizers (12.23%), manures (7.70%),interest on fixed capital (6.93%), machine labour (5.47%), depreciation (5.08%), annual share of establishment cost (2.85%), interest on working capital (1.92%), pesticides (1.61%), electricity charges (1.46%), land revenue (0.73%) and plant material (0.70%).

The total costs incurred to establish one hectare of oil palm during first year amounted to Rs. 70,072.12 out of which Rs. 41,340.92 (59%) was spent on variable resources and the remaining Rs. 28,731.2 (41.00%) pertained to fixed costs. Among the variable costs, human labour took a lion’s share with Rs. 19,248 which accounted for 27.47 per cent of the total costs incurred during 1st year of establishing oil palm. Oil palm cultivation is highly dependent on labour because there are some specialised operations like planting which can be done only by special teams.

Next to human labour, machine labour was the second major item of variable costs constituting 11.42 per cent of the total cost with an amount of Rs. 8,000 followed by manures (Rs. 5,050), fertilizers (Rs. 4,073.64), interest on working capital (Rs. 1,439.28), plant material (Rs. 1,430), pesticides (Rs. 1,100) and electricity charges (Rs. 1,000)

Among the fixed costs, the rental value of owned land occupied the first place with Rs. 20,026.2 (28.58%) followed by interest on fixed capital with Rs. 4,732.51 (6.75%),depreciation charges accounting to Rs. 3,472.5 (4.96%) and land revenue (Rs. 500).

The cost incurred to maintain one hectare of oil palm orchard during the remaining years of pre-bearing period stood at Rs. 64,389.88 and Rs. 70,452.24 during second and third years respectively. The respective total variable costs on an average during the above said years were Rs. 32,108.68 (49.86%) and Rs. 37,473.34 (53.19%) of the total costs incurred. Among the variable costs again human labour turned out to be major item which worked out to Rs. 13,767 (21.38%) and Rs. 14,193 (20.14%) followed by fertilizers accounting to Rs. 8,170 (12.69%) and Rs. 12,813.4 (18.19%), manures with Rs. 5,320 (8.26%) and Rs. 5,410 (7.68%), machine labour accounting to Rs. 1,600 (2.48%) and Rs. 1,600 (2.27%), interest on working capital accounting to Rs. 1,151.69 (1.78%) and Rs. 1,356.94 (1.92%), pesticides accounting to Rs. 1,100 (1.71%) and Rs. 1,100 (1.56%), electricity charges accounting to Rs. 1,000 (1.56%) and Rs. 1,000 (1.42%) of the total costs during 2nd and 3rd years respectively.

Among the fixed costs, rental value of owned land formed the major part accounting for 32.08 per cent and 30.31 per cent of the total costs respectively during second and third years. The interest on fixed capital, depreciation charges, annual share of establishment cost and land revenue formed other important items of fixed costs in the order.

Table 4.8. Cost structure on oil palm orchards during pre-bearing period (1st to 3rd year)

(Rs.)

S. No	Particulars	1st year	2nd year	3rd year	Total
A.	**VARIABLE COSTS**				
1.	Human Labour	19248 (27.47)	13767 (21.38)	14193 (20.14)	47208 (23.04)
a.	Owned	2719.74 (3.88)	1924.63 (2.99)	1952.96 (2.77)	6599.68 (3.22)
b.	Hired	16528.26 (23.59)	11842.37 (18.39)	12240.04 (17.37)	40608.32 (19.82)
2.	Machine Labour	8000 (11.42)	1600 (2.48)	1600 (2.27)	11200 (5.47)
a.	Owned	1200 (1.71)	240 (0.37)	240 (0.34)	1680 (0.83)
b.	Hired	6800 (9.71)	1360 (2.11)	1360 (1.93)	9520 (4.64)
3.	Plant material cost	1430 (2.04)	-	-	1430 (0.70)
4.	Manures	5050 (7.21)	5320 (8.26)	5410 (7.68)	15780 (7.70)
5.	Fertilizers	4073.64 (5.81)	8170 (12.69)	12813.4 (18.19)	25057 (12.23)
6.	Pesticides	1100 (1.57)	1100 (1.71)	1100 (1.56)	3300 (1.61)
7.	Electricity charges	1000 (1.43)	1000 (1.56)	1000 (1.42)	3000 (1.46)
8.	Interest on working capital	1439.28 (2.05)	1151.69 (1.78)	1356.94 (1.92)	3947.91 (1.92)
	Total variable costs	41340.92 (59)	32108.68 (49.86)	37473.34 (53.19)	110922.94 (54.13)
B.	**FIXED COSTS**				
1.	Land revenue	500 (0.71)	500 (0.78)	500 (0.71)	1500 (0.73)
2.	Rental value of owned land	20026.2 (28.58)	20656.8 (32.08)	21354.5 (30.31)	62037.5 (30.28)
3.	Depreciation	3472.5 (4.96)	3472.5 (5.39)	3472.5 (4.93)	10417.5 (5.08)
4.	Interest on fixed capital	4732.51 (6.75)	4732.51 (7.35)	4732.51 (6.72)	14197.5 (6.93)
5.	Annual share of establishment cost	-	2919.39 (4.54)	2919.39 (4.14)	5838.78 (2.85)
	Total fixed costs	28731.2 (41.00)	32281.2 (50.14)	32978.9 (46.81)	93991.3 (45.87)
	Total costs (A + B)	70072.12	64389.88	70452.24	204914.24

4.3.2 Cost Structure on Oil Palm Orchards during Bearing Period (4-25 years)

The cost of cultivation oil palm per hectare from 4th to 25th year are presented in Table 4.9. From 8th year the yield of the tree is stabilized and also the costs to be incurred also remains constant.

It is revealed from the table that the total cost per hectare increased from Rs. 79,972.13 in 4th year to Rs. 1,20,699.04 in 8th year and remained constant during the remaining period of life. The variable costs increased from Rs. 43,314.13 in 4th year to Rs. 59,674.64 during 8th to 25th year.

Among the variable costs, human labour was the major item occupying 17.68 - 21.27 per cent of the total costs from 5th year to 8th - 25th year. As oil palm is more labour dependent for specialised operations human labour occupies a lion's share.

Fertilizer accounts for maximum expenditure after human labour. As oil palm is a gross feeder, it needs a continuous and balanced supply of nutrients from 4th year onwards with a constant dose. Expenditure on machine labour was the next element after fertilizer. Many operations like transportation of manures, spraying of pesticides and transportation of fresh fruit bunches need machine labour. It increased from Rs. 5032 in 4th year to Rs. 9632 in 8th -25th year.

Manures was the next major item of cost. It increased from Rs. 6020 in 4th year to Rs. 7560 in 8th -25th year. Similar trends were observed for interest on working capital, electricity charges and pesticides during bearing period.

Among the fixed costs rental value of owned land took a lion's share and it remained constant from 5th year. This increase was due to increased yield of oil palm. Interest on fixed capital was 4.01 per cent followed by depreciation charges which accounted for 2.94 per cent. Annual share of establishment cost accounted for 2.48 per cent and land revenue for 0.42 per cent of the total costs.

From the above discussion it could be concluded that 4th to 7th year was considered to be yield increasing period in the economic life of oil palm orchard demanding greater use of all inputs.

The total costs incurred towards the cultivation of oil palm from 4th to 25th year worked out to Rs. 25,94,546.38 per hectare of which variable costs amounted to Rs. 12,76,375.98 (49.19%) and fixed costs amounted to Rs. 13,18,170.4 (50.81%).

Table 4.9. Cost structure on oil palm orchards during bearing period (4th to 25th years)

(Rs.)

S. No.	Particulars	4th year	5th year	6th year	7th year	8th – 25th year	Total
A.	**VARIABLE COSTS**						
1	Human Labour	16002 (20)	19497 (17.68)	21960 (19.21)	23655 (20.14)	25674 (21.27)	543246 (20.94)
a	Owned	2344.29 (2.93)	2869.96 (2.60)	3307.18 (2.89)	3548.25 (3.02)	3753.54 (3.11)	79633.4 (3.07)
b	Hired	13657.71 (17.07)	16627.04 (15.08)	18652.82 (16.32)	20106.75 (17.12)	21920.46 (18.16)	463612.6 (17.87)
2	Machine labour	5032 (6.29)	6800 (6.17)	7944 (6.95)	8840 (7.53)	9632 (7.98)	201992 (7.78)
a	Owned	754.8 (0.94)	1020 (0.92)	1191.6 (1.04)	1326 (1.13)	1444.8 (1.20)	30298.8 (1.17)
b	Hired	4277.2 (5.35)	5780 (5.25)	6752.4 (5.90)	7514 (6.40)	8187.2 (6.78)	171693.2 (6.61)
3	Manures	6020 (7.54)	6470 (5.87)	6780 (5.93)	7230 (6.15)	7560 (6.26)	162580 (6.27)
4	Fertilizers	12813.4 (16.02)	12813.4 (11.62)	12813.4 (11.22)	12813.4 (10.91)	12813.4 (10.62)	281894.8 (10.86)
5	Electricity charges	1000 (1.26)	1000 (0.90)	1000 (0.87)	1000 (0.85)	1000 (0.83)	22000 (0.85)
6	Pesticides	900 (1.12)	900 (0.82)	900 (0.79)	900 (0.77)	900 (0.75)	19800 (0.76)
7	Interest on working capital	1546.73 (1.93)	1743.62 (1.58)	1875.94 (1.64)	1982.57 (1.69)	2095.24 (1.73)	44863.18 (1.73)
	Total variable costs	43314.13 (54.16)	49224.02 (44.64)	53273.34 (46.61)	56420.97 (48.04)	59674.64 (49.44)	1276375.98 (49.19)

Cont…

Table 4.9. Cont…

S. No.	Particulars	4th year	5th year	6th year	7th year	8th – 25th year	Total
B.	**FIXED COSTS**						
1	Land revenue	500 (0.62)	500 (0.46)	500 (0.44)	500 (0.43)	500 (0.41)	11000 (0.42)
2	Rental value of owned land	25033.6 (31.30)	49400 0(44.81)	49400 (43.22)	49400 (42.06)	49400 (40.93)	1062433.6 (40.96)
3	Depreciation	3472.5 (4.34)	3472.5 (3.15)	3472.5 (3.04)	3472.5 (2.96)	3472.5 (2.88)	76395 (2.94)
4	Interest on fixed capital	4732.51 (5.93)	4732.51 (4.29)	4732.51 (4.14)	4732.51 (4.03)	4732.51 (3.92)	104115.22 (4.01)
5	Annual share of establishment cost	2919.39 (3.65)	2919.39 (2.65)	2919.39 (2.55)	2919.39 (2.48)	2919.39 (2.42)	64226.58 (2.48)
	Total Fixed costs	36658 (45.84)	61024.4 (55.36)	61024.4 (53.39)	61024.4 (51.96)	61024.4 (50.56)	1318170.4 (50.81)
	Total	79972.13 (100)	110248.42 (100)	114297.74 (100)	117445.37 (100)	120699.04 (100)	2594546.38 (100)

4.4 RETURNS FROM OIL PALM ORCHARDS

4.4.1 Returns from Oil Palm Orchards during Pre-Bearing Period (1-3 years)

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 oil palm plants during their age. In order to utilize inter space economically the oil palm farmers practice intercropping of crops like brinjal, tomato and sugarcane etc., Intercrops are the source of income during early life of any orchard. some farmers did not go for intercropping because they felt intercropping might show a negative impact on the yield of oil palm. The per hectare gross income, total costs and net income from intercrops during 1st to 3rd year and oil palm during pre-bearing period are presented in Table 4.10.

It is clear from the table 4.10 that the gross income obtained from oil palm orchards during its pre-bearing period, amounted to Rs. 79,028.2 which was contributed by intercrops. It is clear from the table that the oil palm orchadists incurred Rs. 2,28,238.94 towards cost of cultivation of oil palm orchards during pre-bearing period out of which Rs. 23,324.7 was incurred to raise intercrops and Rs. 2,04,914.24 to establish one hectare of oil palm during its pre-bearing period. The income received during pre-bearing period of oil palm orchards could not compensate the costs incurred during the same period resulting in the negative net return of Rs. 1,49,210.69.

Table 4.10. Returns from oil palm orchards during pre-bearing period (1st to 3rd year)

(Rs.)

S. No.	Particulars	1st year	2nd year	3rd year	Total
1	**Gross income**				
	Inter crops	25706.1	28498.4	24823.7	79028.2
	Oil palm	-	-	-	-
	Total	25706.1	28498.4	24823.7	79028.2
2	**Total costs**				
	Inter crops	7259.32	7674.51	8390.82	23324.7
	Oil palm	70072.12	64389.88	70452.24	204914.24
	Total	77331.44	72064.39	78843.06	228238.94
3	**Net Income**				
	Inter crops	18446.78	20823.89	16432.88	55703.55
	Oil palm	-70072.12	-64389.88	-70452.24	-204914
	Total	-51625.34	-43565.99	-54019.36	-149210.69

4.4.2 Returns from Oil Palm Orchards during Bearing Period (5-25 years)

It is clear from the Table 4.11 that there is an increase in yield of 5.17 tonnes to 20.23 tonnes from 4th to 7th year respectively. Then there is a stabilization in yield from 8th year with an average yield of 24.16 tonnes. The gross income also increased from Rs. 41,360 in 4th year to Rs. 1,61,840 in 7th year. The yield, gross and net incomes were increased during this yield increasing period i.e. from 4th to 7th year. As the yield is stabilized from 8th year, there are almost constant returns.

Table 4.11. Returns from oil palm orchards during bearing period (4th to 25th year)

S. No.	Particulars	4th year	5th year	6th year	7th year	8th year-25th year	Total
1	Yield (in tonnes)	5.17	12.02	17.32	20.23	24.16	489.62
2	Gross income (Rs.)	41360	96160	138560	161840	193280	3916960
3	Total costs(Rs.)	79972	110248	114298	117445	120699	2594546
4	Net income (Rs.)	-38612	-14088	24262	44395	72581	1322414

4.4.3 Costs and Returns from Oil Palm Orchards during its Economic Life Period (1-25 years)

The costs and returns from oil palm orchard during the economic life span of 25 years are presented in Table 4.12.

It is clear from the table that the oil palm orchadists in the study area spent on an average Rs. 27,99,460.24 towards the cultivation of one hectare of oil palm during its life span of 25 years. The gross income realized by the oil palm orchardists during its lifespan amounted to Rs. 39,169,60 per hectare from oil palm fruit bunches from fourth year onwards. The respective net income received by the farmer stood at Rs. 11,17,499.76.

Since the costs and returns are spread over a period of 25 years, time element was taken into account and the following analysis was attempted.

Table 4.12. Costs and returns from oil palm orchard during its economic life period (25 years)

S. No	Particulars	Value (Rs.)
1.	Costs	2799460.24
2.	Gross income	3916960.00
3.	Net income	1117499.76

4.5 ECONOMIC VIABILITY OF OIL PALM ORCHARDS

To evaluate the financial feasibility of investment in oil palm orchards the most suitable project evaluation techniques such as net present value (NPV), internal rate of return (IRR) and benefit cost ratio (BCR) were employed and the results presented in Table 4.13.

In the present study the costs and returns had been discounted at 12, 16, 20, 24, and 28 per cent to estimate net present value.

4.5.1 Net present value

Net Present worth of investment is the difference between the present value of series of inflows (returns) and outflows (costs) over economic life period of the oil palm orchard. The results of the financial feasibility analysis in oil palm orchards indicated that the per hectare NPV at 12 per cent and 28 percent discount rate for the entire life period was found to be Rs. 3,86,046 and 9,889.73 respectively. The high positive net present value indicated that oil palm cultivation was economically viable.

4.5.2 Benefit-cost ratio

The benefit-cost ratios were 1.81, 1.58, 1.38, 1.20 and 1.04 at 12, 16, 20, 24 and 28 per cent discount rates respectively. The benefit–cost ratio was more than unity at all the discount rates.

Even at a higher discount rate of 28 per cent, it was 1.04 showing that a rupee invested in oil palm orchard would fetch Rs. 1.04 and this proves the profitability of oil palm cultivation. So the investment on oil palm cultivation was economically viable.

4.5.3 Internal Rate of Return

The internal rate of return was found to be 29.30 per cent which was much higher than the bank rate of interest on long term loans (12%) and hence the oil palm cultivation is highly profitable.

Table 4.13. Estimates of economic viability of oil palm orchards

S. No	Particulars	12%	16%	20%	24%	28%
1.	Net present worth (Rs.)	386046	215399.9	113630.9	50428.2	9889.73
2.	Benefit cost ratio	1.81	1.58	1.38	1.20	1.04
3.	IRR	29.30				

4.6 CONSTRAINTS FACED BY THE FARMERS

Information regarding constraints faced by the farmers in oil palm cultivation was collected from sample farmers. The collected information was analysed using Garrett's ranking technique and the results presented in Table 4.14.

Table 4.14. Constraints faced by farmers in oil palm cultivation

S.No.	Constraints	Total score	Mean score	Rank
1.	High input cost	3082	77.05	IV
2.	Lack of availability of labour	3184	79.6	III
3.	Difficulty in harvesting	3586	89.65	I
4.	Lack of remunerative market price	3338	83.45	II
5.	Adverse climatic factors	2848	71.2	VII
6.	Pests and diseases	2918	72.95	V
7.	Lack of HYV and early bearing varieties	2906	72.65	VI
8.	Lack of credit facilities	2627	65.67	IX
9.	Lack of transportation facilities	2706	67.65	VIII
10.	Lack of subsidies	2596	64.9	X
11.	Lack of technical information	2548	63.7	XI

It could be inferred that harvesting was the major constraint in the cultivation of oil palm with a mean score of (89.65) followed by lack of remunerative market price (83.45), lack of availability of labour (79.6), high input cost (77.05), pests and diseases (72.95), lack of HYV and early bearing varieties (72.65), adverse climatic factors (71.2), lack of transportation facilities (67.65), lack of credit facilities (65.67), lack of subsidies (64.9) and lack of technical information (63.7).

Manual harvesting of fresh fruit bunches was in practice in the study area. With the age, the height of the tree increases and consequently the harvesting becomes that much difficult as the labourers have to exert greater amount of energy. As an alternative, mechanical harvesters were available in the market but the maintenance costs were prohibitive. Therefore farmers continued to struggle with the harvest operation.

Price of the fresh fruit bunches heavily depended on the crude palm oil (CPO) prices. Therefore prices were subjected to heavy fluctuations which made the farmers disappointed with the prices. More often peak harvest periods in the area experienced low prices and this was the farmers' major concern.

Availability of the workers for the respective specialised operations of the crop is yet another problem. There were teams of workers specialised in operations like basin preparation, harvesting etc.

4.7 PROCESSING ASPECTS OF OIL PALM

Sterilization

Fresh fruit bunches in metal cages enter into sterilization chamber where sterilization takes place. Sterilization means the use of high temperature wet-heat treatment of loose fruits. It typically destroys oil-splitting enzymes and arrests hydrolysis and autoxidation which weakens the fruit and makes it easy to remove the fruits from bunches, helps to solidify proteins in which the oil-bearing cells are microscopically dispersed, weakens the pulp structure, softening it and making it easier to detach the fibrous material and its contents during the digestion process, breaks down gums and resins.

Stripping

After sterilization the bunches must be stripped. This process involves the separation of the fruits from the bunches by passing through a rotated rotary drum stripper. The empty bunches are thrown outside through a conveyor belt.

Digestion

After stripping, the fruits will move to the digester with the help of an elevator where digestion takes place. Digestion is the process of releasing the palm oil in the fruit through the rupture or breaking down of the oil-

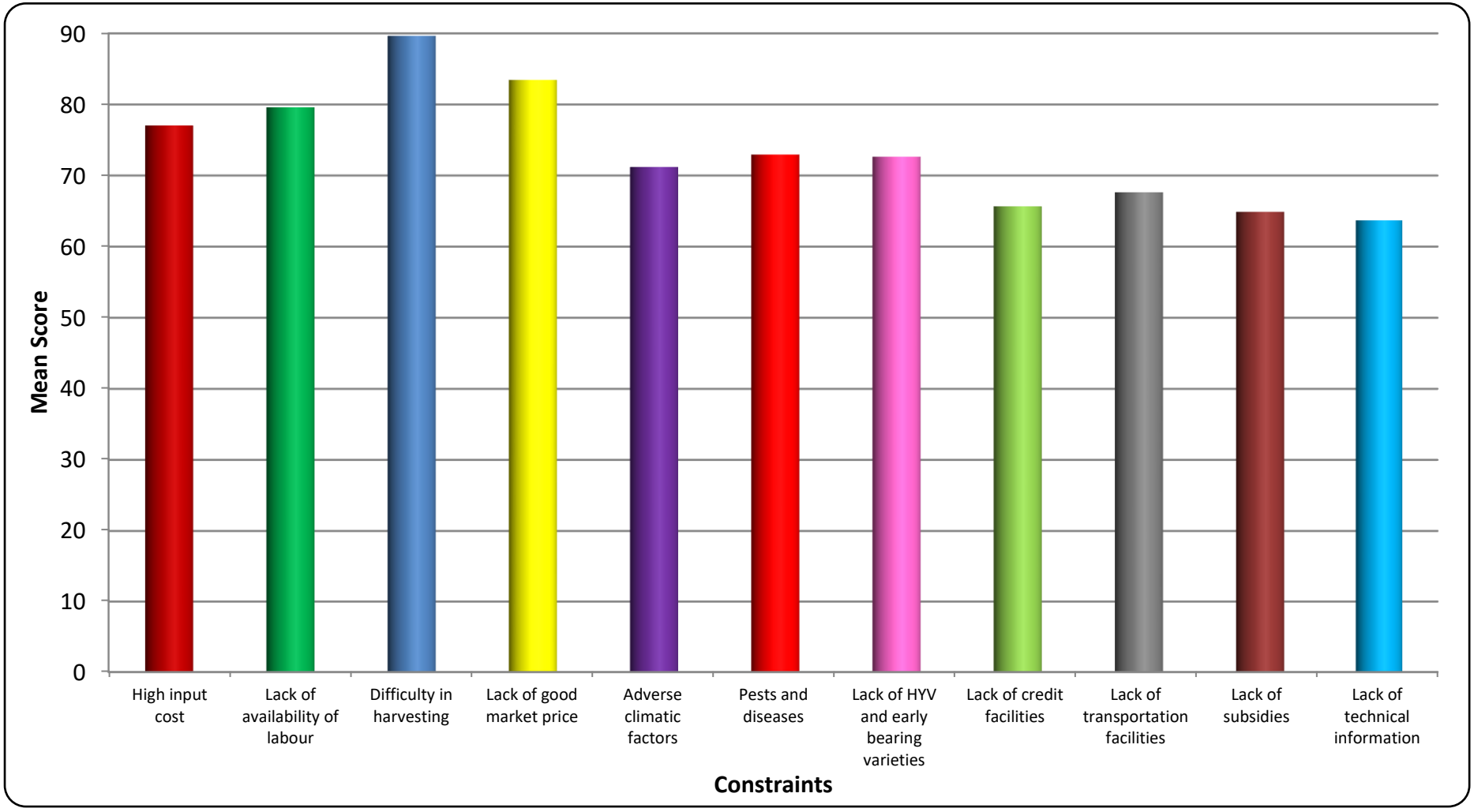

Fig. 4.1. Constraints in oil palm cultivation

bearing cells. The digester commonly used consists of a steam-heated cylindrical vessel fitted with a central rotating shaft carrying a number of beater (stirring) arms. Through the action of the rotating beater arms the fruit is pounded. Pounding, or digesting the fruit at high temperature, helps to reduce the viscosity of the oil, destroys the fruits' outer covering (exocarp), and completes the disruption of the oil cells already begun in the sterilization phase.

Pressing or oil extraction

The digested pulp material automatically passes through the screw press where the liquid component is separated from the solid. The continuous screw press consists of one or more screws turning with a perforated cage through which the oil water mixture is extracted.

Oil clarification

The main objective of clarification is to separate the oil from its entrained impurities. The fluid coming out of the press is a mixture of palm oil, water, cell debris, fibrous material and 'non-oily solids'. Because of the non-oily solids the mixture is very thick (viscous).So the crude oil is first passed through a double vibrating screen to remove particles. Hot water is then added in a ratio of 3:1 and oil is allowed to separate in clarification tanks due to the difference in specific gravity. Palm oil, being lighter than water, will separate and rise to the top. The clear oil is decanted into a reception tank. Then the sludge formed at the bottom was collected.

Oil purification and drying

The oil from the clarification tank still contains traces of water and dirt which were removed by a high speed centrifuge which can bring down the moisture level. Further reduction of moisture to the optimum level of 0.15 to 0.25 was achieved by vaccum drying. Finally the vaccum dried oil is pumped to storage tanks. This oil is called as crude palm oil.

Refining

To produce refined oil, crude palm oil is processed through three refining stages, namely degumming, bleaching and deodourising. In degumming gum and fatty acid in crude palm oil were separated with other impurities such as trace minerals, copper and iron by the application of phosphoric acid. In bleaching, oil is mixed with bleaching earth (bentonite calcium) in a vaccum room to remove impurities and colour pigments in the palm oil. In deodourising, the odour and taste of the oil were removed when the oil was steamed at high temperatures of between 240°C to 260°C and then cooled to room temperature. Thus RBD (Refined, Bleached and Deodorised) palm oil is obtained.

4.7.1 Costs and Returns from Oil Palm Processing

4.7.1.1 Processing Costs of One Tonne of Palm Oil

The processing costs including variable costs and fixed costs incurred in production of one tonne of palm oil by the oil mills were worked out and presented in Table 4.15.

Table 4.15. Costs incurred in oil palm processing (Rs. / one tonne of oil)

S. No.	Particulars	Amount	Percentages
A. Variable Costs			
1	Cost of raw material (5.5 t)	44000	84.75
2	Incidental charges	449.33	0.87
3	Wages for casual labour	1115.97	2.15
4	Power charges	111.6	0.21
5	Lubricant charges	5.87	0.01
6	Fuel charges	167.4	0.32
7	Repairs and maintenance	167	0.32
8	Miscellaneous charges	88.1	0.17

S. No.	Particulars	Amount	Percentages
9	Interest on working capital	100.2	0.20
	Total variable costs	46,205.47	89
B. Fixed Costs			
1	Depreciation on buildings		
	i. Factory building	511.6	0.99
	ii. Administrative building	88.1	0.17
	iii. Workshops	2.94	0.004
2	Depreciation on		
	i. Machinery	960.32	1.85
	ii. Effluent treatment plant	132.15	0.25
	iii. Tractors and accessories	88.1	0.17
	iv. Drums	14.68	0.03
	v. Fire extinguishers and fixtures	3.14	0.006
	vi. Generators	11.75	0.02
	Total depreciation	1812.78	3.49
3	Opportunity cost of land	85.17	0.16
4	Insurance charges	111.6	0.22
5	Taxes	217.32	0.42
6	Salaries for permanent staff	276.06	0.54
7	Interest on fixed capital	3206.95	6.17
	Total fixed costs	5709.88	11
	Total costs	51,915.35	100

It is evident from the table that the total cost incurred to produce one tonne oil was Rs. 51,915.35. Out of this variable costs and fixed costs were Rs. 46,205.47 and Rs. 5,709.88 accounting for 89 and 11 per cent of the total costs respectively.

Among the variable costs, cost of raw material was the major item amounting to Rs. 44,000 and accounted for 84.75 per cent of the total costs per tonne of oil produced by the oil mills. Next to raw material, wages for casual labour formed the major item of variable costs which worked out to Rs. 1,115.97 (2.15%) followed by incidental charges (0.87%), fuel charges (0.32%), repairs and maintenance (0.32%), power charges (0.21%), interest on working capital (0.20%), miscellaneous charges (0.17%) and lubricant charges (0.01%).

Interest on fixed capital was the major item of fixed costs amounting to Rs. 3,206.95 per tonne of oil accounting for 6.17 per cent of the total costs. Next to interest on fixed capital, depreciation formed major item of expenditure in fixed costs which worked out to Rs. 1,812.78 (3.49%). Salaries for permanent staff worked out to be Rs. 276.06 (0.54%) per tonne of oil produced followed by taxes (0.42%), insurance charges (0.22%) and opportunity cost of land (0.16%).

4.7.1.2 Returns from one tonne of palm oil

Returns obtained by the oil mill through the sale of one tonne of palm oil was worked out and presented in Table 4.16.

Table 4.16. Returns from one tonne of palm oil

I.	**Returns from one tonne of oil**	64,000	92.82
	a. Returns from Byproducts	4950	7.18
	b. Gross Returns	68,950	100
II.	**Total costs**	51915.35	
III.	**Net Returns from one tonne of oil**	17,034.65	

It could be observed from the table that on an average palm oil mill crushed 5.5 tonnes fresh fruit bunches of oil palm to obtain one tonne of oil which is valued at Rs. 64,000 and 0.55 tonnes of kernals as byproduct

valued at Rs. 4,950. Thus the gross and net returns worked out to be Rs. 68,950 and Rs. 17,034.65 per tonne of palm oil respectively.

4.8 MARKETING AND PROCESSING CONSTRAINTS OF THE PROCESSING INDUSTRY

4.8.1 Processing constraints faced by the processing industry

The processing constraints encountered by the processors are presented in Table 4.17.

Table 4.17. Processing constraints faced by the processing industry

S. No.	Constraint	Response
1.	Efficiency of machinery	No (100)
2.	Quality of raw material	Yes (100)
3.	Availability of raw material	Yes (100)
4.	Repairs and maintenance in machinery	No (100)
5.	Electric supply	No (100)
6.	Transportation	No (100)
7.	Availability of skilled labour	No (100)
8.	Finance facilities	No (100)
9.	Price fluctuations in palm oil	No (100)

The processing unit studied was examined in order to know constraints if any in processing and marketing of palm oil. Quality and availability of raw material were the constraints as reported by the sample unit. In the months of July, August and September about 55 per cent of fresh fruit bunches arrived and the balance was spread over the remaining months which led to under- utilization of the processing unit during lean period for about 5 months. Among the arrivals from the farmers' field, quality fruits accounted for 75 per cent and the remaining 25 per cent fruits did not suit for oil extraction. This was the phenomenon normally found in the study area.

4.8.2. Marketing Constraints Faced by the Processing Industry

The marketing constraints encountered by the processors are presented in Table 4.18.

Table 4.18. Marketing constraints faced by the processing industry

S. No.	Constraint	Response
1.	Problem with regard to imitations	Yes (100)
2.	Lack of marketing strategies	No (100)
3.	Problem with transportation	No (100)
4.	Problem with wholesalers and retailers	No (100)
5.	Lack of top talent in marketing the brand	No (100)
6.	Lack of training for marketers	No (100)
7.	Absence of market information system	No (100)
8.	Exploitation of middlemen	No (100)
9.	Insufficient market coverage	No (100)
10.	Negative image of palm oil on health aspects	Yes (100)
11.	Heavy competition from other brands	Yes (100)
12.	High cost on publicity and advertisement	No (100)

Imitation in the market was a major problem which the selected processing unit reported. Some small scale units sold imitated palm oil in the market. There were some apprehensions regarding the health aspects of palm oil among the consumers. This was one constraint in marketing. As is the case with any product there was heavy competition from other brands. These were the major issues in the marketing of palm oil.

4.9 CONSUMER PREFERENCE FOR RUCHI GOLD PALMOLEIN OIL

4.9.1 Socio-Economic Profile of the Selected Respondents

Results of the analysis of socio economic factors of the sample respondents is presented in Table 4.19. Analysis of the profile of the sample respondents reveal that about 60 per cent of the respondents were males and 40 of them were females. The sample had the highest percentage of respondents from the age group of 25-35 years. About 80 per cent of the families were having a family size of 3-5 members. Around 66 per cent of the respondents were possessing the educational qualification upto 10th standard. More than 86 per cent of the respondents had a monthly income below Rs. 10,000. About 80 per cent of the respondents were married. About 62 per cent of the respondents were daily labourers and 34 per cent were doing small business.

Table 4.19. Socio-economic profile of the selected respondents

Socio Economic Factor	Categories	No. of Respondent	Percentage
Gender	Male	30	60
	Female	20	40
	Total	50	100
Age	<25 years	5	10
	25-35 years	23	46
	36-45 years	18	36
	More than 45 years	4	8
	Total	50	100

Cont…

Table 4.19. Cont…

Socio Economic Factor	Categories	No. of Respondent	Percentage
Literacy status	Illiterate	12	24
	Up to 10th standard	33	66
	Intermediate	4	8
	Graduation and above	1	2
	Total	50	100
Monthly Income	<10000	43	86
	10000-20000	7	14
	Total	50	100
Marital Status	Married	40	80
	Unmarried	10	20
	Total	50	100
Occupation	Daily labour	31	62
	Business	17	34
	Employed	2	4
	Total	50	100
Family size	<3 members	6	12
	3-5 members	40	80
	6-8 members	4	8
	Total	50	100

4.9.2 Purchase Pattern of Ruchi Gold Palmolein Oil

4.9.2.1 Period of consumption of Ruchi Gold palmolein oil

Information regarding consumption duration of Ruchi Gold palmolein oil by sample respondents was grouped into four categories viz., Since 1 year, 2 years, 3 years and more than 3 years and is provided in Table 4.20.

Table 4.20. Period of consumption of Ruchi Gold palmolein oil by sample respondents

S. No.	Period of consumption	Frequency	Percentage
1.	Since 1 year	2	4.0
2.	2 years	6	12.0
3.	3 years	6	12.0
4.	More than 3 years	36	72.0
	Total	50	100.0

It could be inferred that 72 per cent of the respondents were using Ruchi Gold palmolein oil for more than 3 years followed by 12 per cent each since 3 years and 2 years and only 4 per cent since 1 year.

4.9.2.2 Frequency of buying Ruchi Gold Palmolein Oil:

Information regarding frequency of purchase of Ruchi Gold palmolein oil was collected from sample respondents and grouped into three categories viz., once in a week, once in a fortnight, once in a month and the same is provided in Table 4.21.

Table 4.21. Frequency of purchase of Ruchi Gold palmolein oil by sample respondents

S. No.	Frequency of purchase	Frequency	Percentage
1.	Once in a week	38	76.0
2.	Once in a fortnight	7	14.0
3.	Once in a month	5	10.0
	Total	50	100.0

It is clear from the table 4.19 that 76 per cent of the respondents have stated their frequency of purchasing Ruchi Gold palmolein as “weekly”. Another 14 per cent of the respondents purchased once in a “fortnight” and the remaining 10 per cent purchased on a monthly basis.

4.9.2.3 Source of knowledge for purchasing Ruchi Gold palmolein oil

The source of knowledge plays a critical role in the purchase of Ruchi oil. Information regarding the source of knowledge of Ruchi oil by sample respondents is provided in Table 4.22.

Table 4.22. Source of knowledge for purchasing Ruchi Gold palmolein oil

S. No.	Source of knowledge	Frequency	Percentage
1.	Friends and relatives	6	12.0
2.	Retailers advice	30	60.0
3.	Advertisements	14	28.0
	Total	50	100.0

It was found that for 60 per cent of the consumers, retailer was the source of knowledge for purchasing Ruchi Gold palmolein oil followed by advertisements (28%) and friends and relatives (12%).

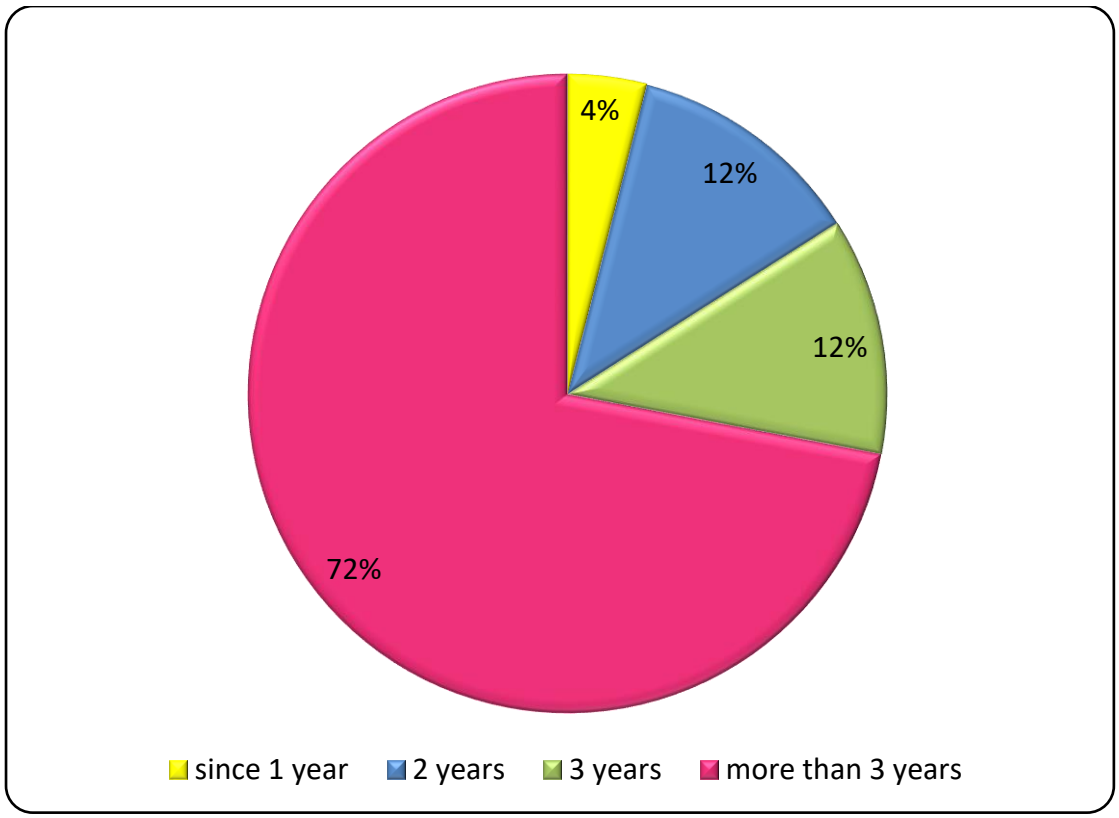

Fig. 4.2. Period of consumption of Ruchi Gold palmolein oil

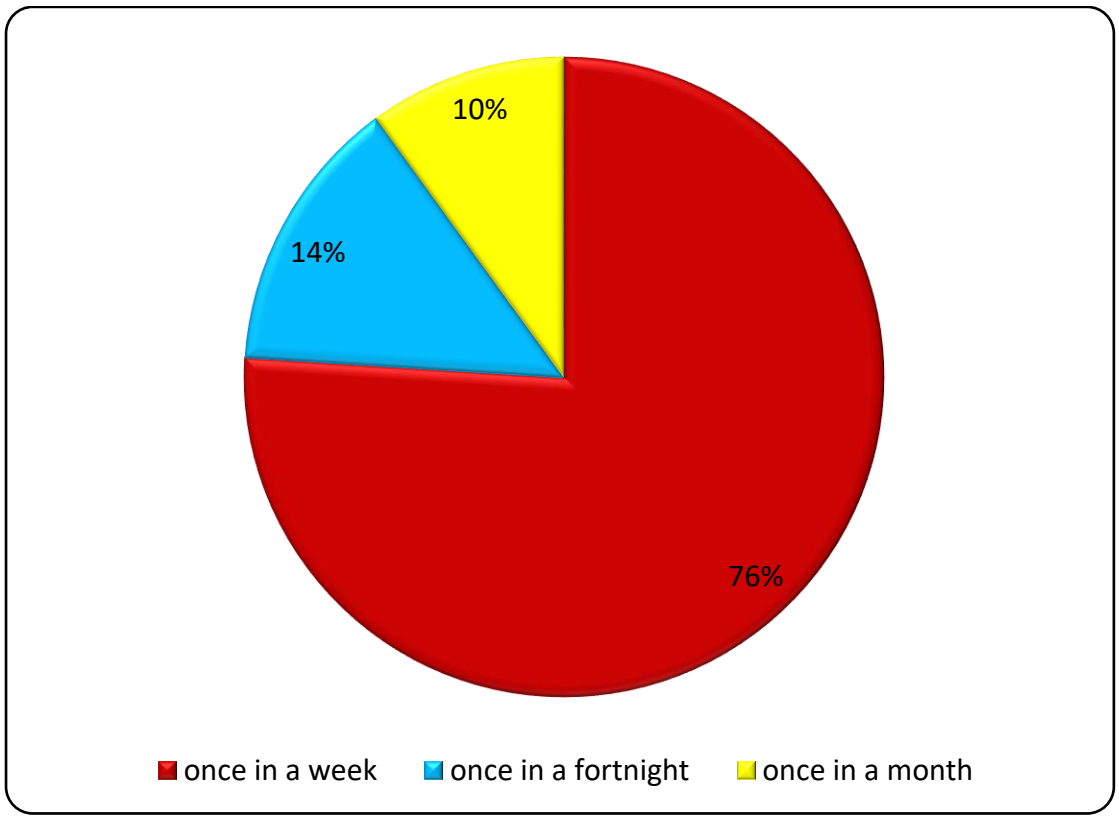

Fig. 4.3. Frequency of consumption of Ruchi Gold palmolein oil

4.9.2.4 Monthly consumption of Ruchi Gold palmolein oil

Monthly consumption particulars are furnished in Table 4.23.

Table 4.23. Monthly consumption of Ruchi Gold palmolein oil

S. No.	Monthly consumption (kgs)	Frequency	Percentage
1.	1-3 kgs	6	12.0
2.	4-6 kgs	26	52.0
3.	7-8 kgs	15	30.0
4.	more than 8 kgs	3	6.0
	Total	50	100.0

About 52 per cent of the respondents consumed 4-6 kgs/ month and 30 per cent used 7-8 kgs/ month. 12 per cent of the respondents consumed 1-3 kgs/ month and more than 8 kgs per month was consumed by 6 per cent of the respondents.

4.9.3 CONSUMER PREFERENCE FOR DIFFERENT ATTRIBUTES OF RUCHI GOLD PALMOLEIN OIL

Consumer preference on the attributes of palm oil is presented in Table 4.24.

Table 4.24. Most Preferred Attribute of Ruchi Gold palmolein oil

S. No.	Attributes	Mean	Rank
1.	Good taste	3.94	III
2.	Colour	2.82	IV
3.	Aroma	2.76	V
4.	Price	4.72	II
5.	Brand	4.74	I

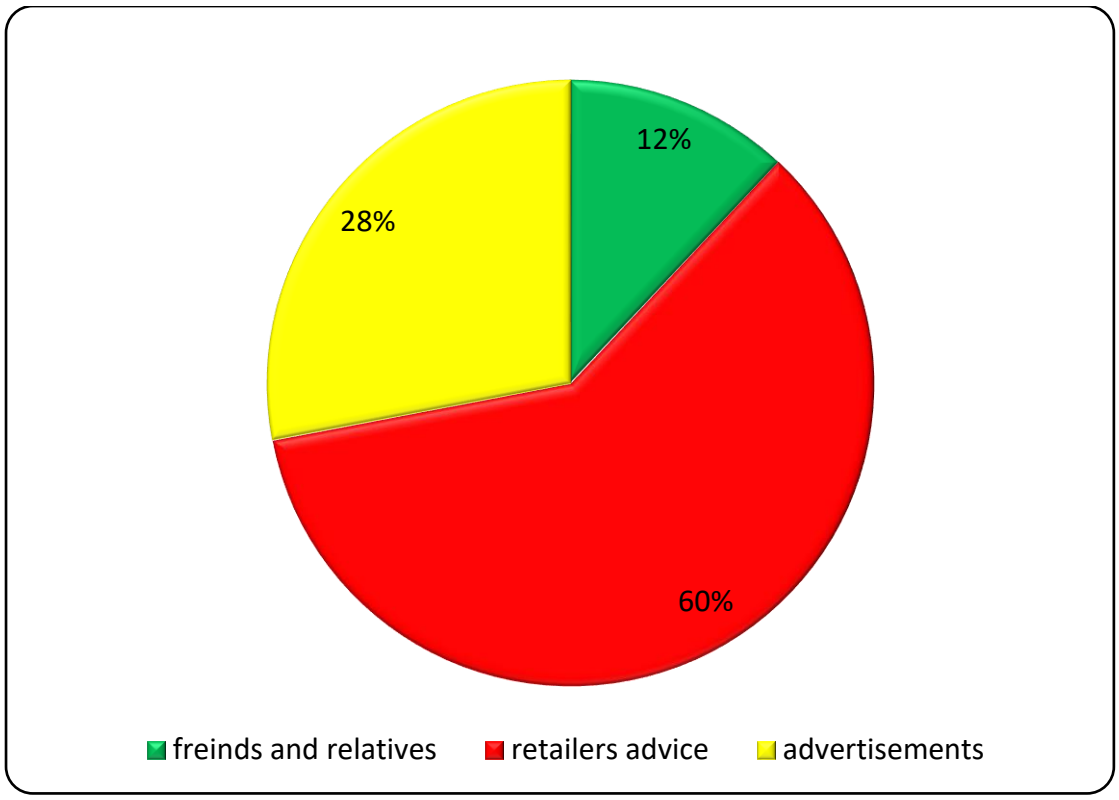

Fig. 4.4. Source of knowledge of Ruchi Gold palmolein oil

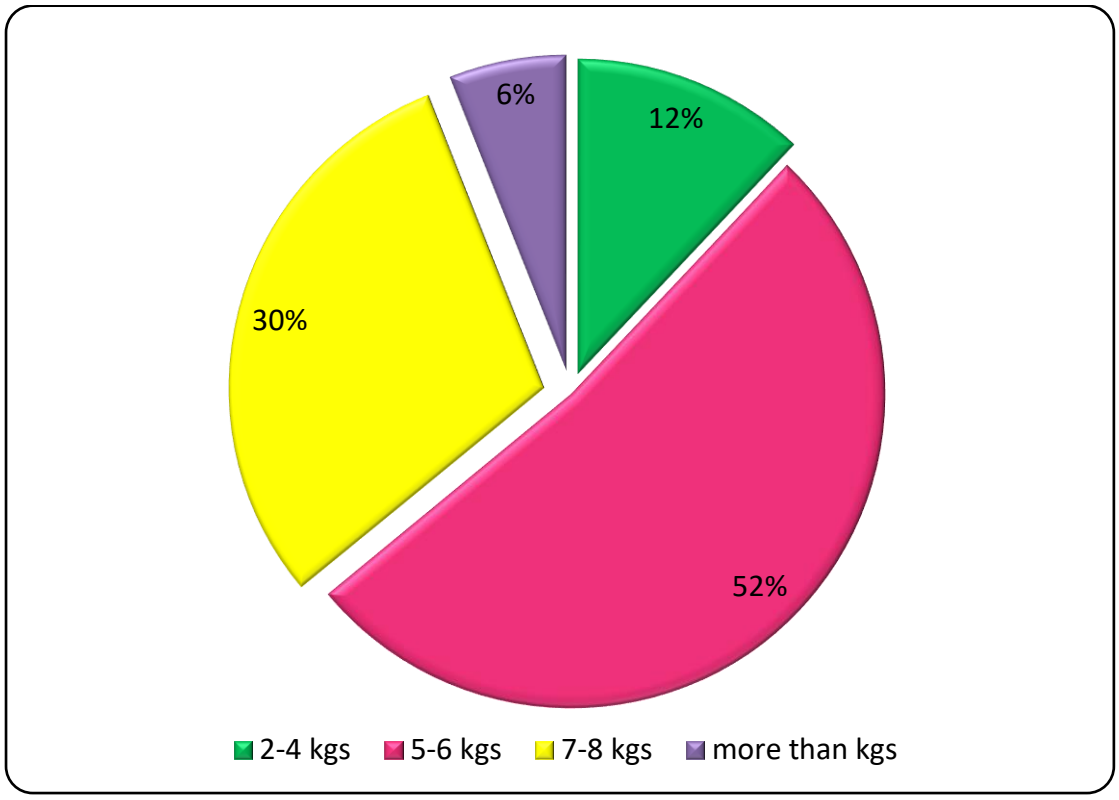

Fig. 4.5. Monthly consumption of Ruchi Gold palmolein oil

Brand image was the most preferred attribute of the Ruchi Gold palm oil. Price was the next attribute to catch the consumer's attention and then taste element. Colour and aroma were the other attributes that influenced the consumers' choice.

Chapter ~ V

Summary & Conclusions

Chapter – V

SUMMARY AND CONCLUSIONS

Oil palm is the crop of the present and future vegetable oil economy of world as well as India. Palm oil has good consumer acceptance as cooking medium because of its price advantage. It is a good raw material for manufacturing oleo chemicals used in making soaps, candles, plasticizers etc. Broadly, it can be mentioned that palm oil is a source of health and nutrition, value addition, waste utilization, eco-friendly, diversification, import substitution, co-generation and sustainability. Oil palm was first introduced to India at National Royal Botanical Gardens, Kolkata during the year 1886. The Technology Mission on Oilseeds and Pulses (TMOP) implemented by Government of India looks after development of oil palm in the country through Oil Palm Development Programme (OPDP) along with other nine annual oilseed crops.

Oil palm (*Elaies guineensis*) is the edible oil perennial crop that can yield 4-6 tonnes of oil crude palm (oil/ha/year) starting from the 4^{th} to 25^{th} year of its productive life span compared to production of less than 1 tonne/ha from other oil seeds. Palm oil remains world's top produced vegetable oil. Indonesia and Malaysia together account for 85 per cent of global population. It is the crop of the future and source of health and nutrition, enables diversification, import substitution, value addition, low cost of cultivation, waste utilization and co-generation (non-conventional energy), besides being eco-friendly and sustainable (Rethinam, 1997). Farmers need to be informed about these benefits so as to increase the area under oil palm.

As East Godavari district is having considerable area under oil palm cultivation, research work has been undertaken on the economic aspects of oil palm production and processing.

The major focus of the present study is to study “Economic analysis of oil palm production and processing in East Godavari district of Andhra Pradesh ” in the present context of increasing acreage under oil palm.

5.1 THE SPECIFIC OBJECTIVES OF THE STUDY ARE

1. to analyse the cost, returns and economic viability of oil palm orchards
2. to study the economics of select oil palm processing unit
3. to examine the marketing and processing constraints of select oil palm processing unit and
4. to study consumer preferences for Ruchi Gold palmolein oil in study area.

East Godavari district was purposively chosen for the study as it has considerable area (26,522 hectares) under oil palm. All the mandals in East Godavari district growing oil palm orchards were listed out and arranged in descending order of their area under oil palm cultivation and the top 2 mandals were selected purposively. Two villages from each mandal based on criterion of highest area under oil palm were purposively selected. The list of farmers in the selected villages was prepared and 40 farmers were randomly selected. The information pertaining to the oil palm processing was collected from the selected processing unit located at East Godavari district for the year 2016-17. The primary data regarding the consumer preference for Ruchi Gold palmolein was collected randomly from the 50 consumers using simple random sampling technique in the study area.

Tabular analysis was used to analyse the costs and returns of oil palm. Project appraisal techniques (NPW, BCR and IRR) were employed to test the economic feasibility of oil palm orchards. An opinion survey was conducted to study the processing and marketing constraints of oil palm processing. Likert's scale and Garrett's ranking techniques were used to know the consumer preference for Ruchi Gold palmolein oil.

5.2 MAJOR FINDINGS OF THE STUDY

The socio economic profile of selected growers revealed that the average size of the family was 5.69 members consisting of 2.78 males, 1.68 females and 1.23 children. The participation of family members in agriculture was less because majority of the oil palm growers belonged to well-to-do families.

The average size of holding was 9.52 hectares with 77.49 per cent of total area under oil palm cultivation. The area under other crops occupied 9.52 hectares constituting 22.51 per cent of the total holding.

The per hectare value of assets stood at Rs. 40,94,623.82. The land value formed 97.86 per cent of total value of assets. The value of farm assets excluding land on the selected gardens was Rs. 87,623.82 per hectare.

The total labour utilized for the establishment of oil palm orchard in the first year was 64.16 man days per hectare. Watch and ward required 20.25 man days (31.57%) followed by digging of pits and planting 9.37 man days (14.6%), ploughing ,cleaning and levelling 8.62 man days (13.43%), weeding 6.24 man days (9.72%) and fertilizer application 5.26 man days (8.21%) in the total labour utilization during 1st year.

About 45.89 and 47.31 man days per hectare were required in 2nd and 3rd years respectively. During this period, watch and ward and weeding, the most labour absorbing operations accounted for more than 58 per cent of the total labour.

In bearing period, human labour utilization increased manifold. In the 4th year, the labour requirement was 53.34 man days which increased to 85.58 man days in 8th year and remained constant in the remaining years. Total labour utilization during bearing period was about 1810.82 man days per hectare. A major share of 734.42 man days (40.56%) was taken by harvesting followed by watch and ward with 445.5 man days (24.6%) and fertilizer application with 160.98 man days (8.89%).

Total labour utilization during economic life span of oil palm orchard stood at 1968.18 man days of which harvesting operation took 734.42 man days (37.31%) followed by watch and ward 506.25 man days (25.72%) and fertilizer application 176.9 man days (8.98%).

The plant population was maintained as per the recommendation which is 143 plants per hectare. The use of N, P, K, Mg and B nutrients through chemical fertilizers for the entire 25 years of economic life of oil palm stood at 4121.98, 2051.28, 4082.01, 1699.43 and 338.98 kgs per hectare respectively. The orchadists used 6.39 kgs of plant protection chemicals for the entire life period of oil palm cultivation.

The total costs incurred during its pre-bearing period (1-3 years) stood at Rs. 2,04,914.24 of which Rs. 1,10,922.94 (54.13%) were variable costs and Rs. 93,991.3 (45.87%) fixed costs.

The total costs incurred to establish one hectare of oil palm during first year amounted to Rs. 70,072.12 out of which Rs. 41,340.92 (59%) was spent on variable resources and the remaining Rs. 28,731.2 (41.00%) pertained to fixed costs. The cost incurred to maintain one hectare of oil palm orchard during 2nd and 3rd years of pre-bearing period stood at Rs. 64,389.88 and Rs. 70,452.24 respectively. The respective total variable costs on an average during the above said years were Rs. 32,108.68 (49.86%) and Rs. 37,473.34 (53.19%) of the total costs incurred.

The total cost per hectare increased from Rs. 79,972.13 in 4th year to Rs. 1,20,699.04 in 8th year and remained constant during the remaining period of life. The variable costs increased from Rs. 43,314.13 in 4th year to Rs. 59,674.64 during 8th to 25th year.

Among the variable costs, human labour was the major item occupying 17.68 - 21.27 per cent of the total costs from 5th year to 8th - 25th year. As oil palm is more labour dependent for specialised operations human labour occupied a lion's share. Among the fixed costs rental value of owned land took a lion's share and it remained constant from 5th year. This increase is due to increased yield of oil palm. Interest on fixed capital was 4.01 per cent followed by depreciation charges which accounted for 2.94 per cent.

The total costs incurred towards the cultivation of oil palm from 4th to 25th year worked out to Rs. 25,94,546.38 per hectare of which variable costs amounted to Rs. 12,76,375.98 (49.19%) and fixed costs Rs. 13,18,170.4 (50.81%).

The net returns from intercrops during pre-bearing period helped to cushion the costs. The orchard started yielding from 4th year, though the economic yield started only from 5th year onwards. The total yield for the entire economic life period was 489.62 tonnes per hectare.

The per hectare gross income increased from Rs. 41,360 in 4th year to Rs. 1,93,280 in 8th year. The yield and returns increased during 4th to 8th year and remained constant from 8th year.

The oil palm orchadists in the study area spent on an average Rs. 27,99,460.24 towards the cultivation of one hectare of oil palm during its life span of 25 years. The gross income realized by the oil palm orchardists during its lifespan amounted to Rs. 39,16,960 per hectare from oil palm fruit bunches from fourth year onwards. The respective net income received by the farmer stood at Rs. 11,17,499.76.

NPV at 12 per cent and 28 percent discount rate for the entire life period was found to be Rs. 3,86,046 and 9,889.73 respectively. The benefit-cost ratios were 1.81, 1.58, 1.38, 1.20 and 1.04 at 12,16,20,24 and 28 per cent discount rates respectively. The internal rate of return was found to be 29.30 per cent indicating that the investment on oil palm orchards was economically viable.

The main constraint in the cultivation of oil palm was harvesting followed by lack of remunerative market price, lack of availability of labour, high input cost, pests and diseases and lack of HYV and early bearing varieties.

The total costs incurred to produce one tonne oil was Rs. 51,915.35. Of this variable costs and fixed costs were Rs. 46,205.47 and Rs. 5,709.88 accounting for 89 and 11 per cent of the total costs respectively. Among the variable costs, cost of raw material was the major item amounting to Rs. 44,000 and accounted for 84.75 per cent of the total costs per tonne of oil produced by the oil mills. Interest on fixed capital was the major item of fixed costs amounting to Rs. 3,206.95 per tonne of oil accounting for 6.17 per cent of the total costs. Next to interest on fixed capital, depreciation formed major item of expenditure in fixed costs which worked out to Rs. 1,812.78 (3.49%). The gross and net returns worked out to be Rs .68,950 and Rs. 17,034.65 per tonne of palm oil respectively.

Availability and quality of raw material were the major processing constraints faced by the oil palm processing industry. Imitations and negative image on oil palm were the major marketing constraints faced by the processing industry.

With regard to consumer preference for Ruchi Gold palmolein oil, about 60 per cent of the respondents were males and 40 of them were females. The sample had the highest percentage of respondents from the age

group of 25-35 years. Maximum of 80 per cent of the families were having a family size of 3-5 members. Around 66 per cent of the respondents were possessing the educational qualification upto 10^{th} standard. More than 86 per cent of the respondents had a monthly income below Rs. 10,000. About 80 per cent of the respondents were married. 62 per cent of the respondents were daily labour and 34 per cent were doing small business.

72 per cent of the respondents were using Ruchi Gold palmolein oil for more than 3 years followed by 12 per cent each since 3 years and 2 years and only 4 per cent since 1 year. 76 per cent of the respondents have stated that their frequency of purchasing Ruchi Gold palmolein was "weekly". Another 14 per cent of the respondents purchased once in a "fortnight" and 10 per cent in "monthly" intervals. For 60 per cent of the consumers, retailer was the source of knowledge for purchasing Ruchi Gold palmolein oil followed by advertisements (28%) and friends and relatives (12%).

About 52 per cent of the respondents consumed 4-6 kgs/ month and 30 per cent used 7-8 kgs/ month. 12 per cent of the respondents consumed 1-3 kgs/ month and more than 8 kgs per month was consumed by 6 per cent of the respondents. Brand image was the most preferred attribute of the Ruchi Gold palm oil. Price was the next attribute to catch the consumer's attention and then taste element. Colour and aroma were the other attributes that influenced the consumers' choice.

5.3 CONCLUSIONS

1. Total labour utilization during economic life span of oil palm orchard stood at 1968.18 man days.

2. Harvesting and watch and ward accounted for major share of total human requirement for entire economic life span of oil palm cultivation.

3. Among the total costs during pre-bearing period variable costs occupied the major portion. Among total costs during pre-bearing period, rental value of owned was the major cost item followed by fertilizer cost.

4. Among the total costs during bearing period, fixed costs occupied major portion than variable costs.

5. The oil palm orchadists in the study area spent on an average Rs. 27,99,460.24 towards the cultivation of one hectare of oil palm during its life span of 25 years. The respective net income received by the farmer stood at Rs. 11,17,499.76.

6. Even at a discount rate 28 per cent, the oil palm cultivation was found economically viable.

7. The major constraints in oil palm cultivation was harvesting followed by lack of remunerative price and and non-availability of labour.

8. The total costs incurred to produce one tonne palm oil was Rs. 51,915.35. The gross and net returns worked out to be Rs. 68,950 and Rs. 17,034.65 per tonne of palm oil respectively.

9. Availability and quality of raw material were major processing constraints faced by the oil palm processing industry. Imitations and negative image on oil palm were the major marketing constraints faced by the processing industry.

10. With regard to consumer preference for Ruchi Gold palmolein oil, about 60 per cent of the respondents were males and 40 of them were females.

11. Maximum of 80 per cent of the families were having a family size of 3-5 members. More than 86 per cent of the respondents had a monthly income below Rs. 10,000. About 80 per cent of the respondents were married. 62 per cent of the respondents were daily labour and 34 per cent were doing small business.

12. 72 per cent of the respondents were using Ruchi Gold palmolein oil for more than 3 years followed by 12 per cent each since 3 years and 2 years and only 4 per cent since 1 year. 76 per cent of the respondents have stated their frequency of purchasing Ruchi Gold palmolein as "weekly". Another 14 per cent of the respondents purchased once in a "fortnight" and 10 per cent in "monthly" intervals.

13. For 60 per cent of the consumers, retailer was the source of knowledge for purchasing Ruchi Gold palmolein oil followed by advertisements (28%) and friends and relatives (12%).

14. About 52 per cent of the respondents consumed 4-6 kgs/ month and 30 per cent used 7-8 kgs/ month. 12 per cent of the respondents consumed 1-3 kgs/ month and more than 8 kgs per month was consumed by 6 per cent of the respondents.

15. Brand image was the most preferred attribute of the Ruchi Gold palm oil. Price was the next attribute to catch the consumer's attention and then the taste element. Colour and aroma were the other attributes that influenced the consumers' choice.

5.4 SUGGESTIONS

1. Research on oil palm should be given necessary priority.

2. The short run measure would be to raise import duty, thus offering some buffer to domestic farmers. That's what exactly the government of India has done in recent months by raising to 44 per cent from 30 per cent for crude palm oil and from 40 to 54 per cent for RBD.

3. With the increase in import duty, daily the prices of oil seeds in the domestic market gets a let up and farmer in turn get a remunerative price. However this is a short term measure.

4. However a long term relation lies in improving the productivity rather than just the price. By improving the productivity, the farmer is insulated from a fall in prices to some extent. Ultimately the aim should be to increase the return per hectare and not price alone.

5. Harvesting of fresh fruit bunches is a cause of concern in view of the height of the palm trees. Even there were instances of casualties while harvesting the fruits. Therefore it calls for the development of farmer friendly mechanical harvesters which would certainly provides a solution to the farmers' nagging problems in harvest.

6. Early bearing varieties in oil palm are desired by the farmers. Attention on this issue by the scientists would certainly meet the farmers' requirement.

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Appendix

APPENDIX

Table 1. Estimation of Benefit-cost ratio at 12 per cent discount rate

Year	Costs	Gross returns	Net income	NPV	Present worth at costs	Present worth of gross returns
1	108008.92	0	-108008.92	-96436.5	96436.54	0
2	31457	0	-31457	-25077.3	25077.33	0
3	36616.36	0	-36616.36	-26062.8	26062.8	0
4	42267.4	41360	-907.4	-576.669	26861.7	26285.0277
5	47980.4	96160	48179.6	27338.4	27225.37	54563.7664
6	51897.4	138560	86662.6	43905.97	26292.84	70198.8082
7	54938.4	161840	106901.6	48356.85	24851.34	73208.197
8	58079.4	193280	135200.6	54605.25	23457.3	78062.5503
9	58079.4	193280	135200.6	48754.69	20944.01	69698.7056
10	125686.68	193280	67593.32	21763.24	40467.75	62230.9872
11	58079.4	193280	135200.6	38866.94	16696.44	55563.3814
12	58079.4	193280	135200.6	34702.63	14907.54	49610.162
13	58079.4	193280	135200.6	30984.49	13310.3	44294.7875
14	58079.4	193280	135200.6	27664.72	11884.2	39548.9174
15	58079.4	193280	135200.6	24700.64	10610.89	35311.5334
16	58079.4	193280	135200.6	22054.15	9474.008	31528.1548
17	58079.4	193280	135200.6	19691.2	8458.936	28150.1382
18	58079.4	193280	135200.6	17581.43	7552.621	25134.052
19	58079.4	193280	135200.6	15697.71	6743.412	22441.1178
20	125686.68	193280	67593.32	7007.181	13029.53	20036.7124
21	58079.4	193280	135200.6	12514.12	5375.807	17889.9217
22	58079.4	193280	135200.6	11173.32	4799.827	15973.1444
23	58079.4	193280	135200.6	9976.176	4285.56	14261.7361
24	58079.4	193280	135200.6	8907.3	3826.393	12733.6929
25	58079.4	193280	135200.6	7952.946	3416.422	11369.3687
				386046	472048.8	858094.863

BCR=1.81

Table 2. Estimation of Benefit-cost ratio at 16 per cent discount rate

Year	Costs	Gross returns	Net income	NPV	Present worth at costs	Present worth of gross returns
1	108008.92	0	-108008.92	-93111.1	93111.14	0
2	31457	0	-31457	-23377.7	23377.68	0
3	36616.36	0	-36616.36	-23458.6	23458.55	0
4	42267.4	41360	-907.4	-501.149	23343.91	22842.7598
5	47980.4	96160	48179.6	22938.93	22844.09	45783.0276
6	51897.4	138560	86662.6	35569.99	21300.89	56870.8788
7	54938.4	161840	106901.6	37824.94	19438.83	57263.7711
8	58079.4	193280	135200.6	41239.62	17715.7	58955.3203
9	58079.4	193280	135200.6	35551.4	15272.15	50823.552
10	125686.68	193280	67593.32	15322.3	28491.11	43813.4069
11	58079.4	193280	135200.6	26420.48	11349.7	37770.1783
12	58079.4	193280	135200.6	22776.28	9784.221	32560.4986
13	58079.4	193280	135200.6	19634.72	8434.673	28069.3953
14	58079.4	193280	135200.6	16926.48	7271.27	24197.7546
15	58079.4	193280	135200.6	14591.8	6268.336	20860.1333
16	58079.4	193280	135200.6	12579.14	5403.738	17982.8735
17	58079.4	193280	135200.6	10844.08	4658.395	15502.4772
18	58079.4	193280	135200.6	9348.347	4015.858	13364.2044
19	58079.4	193280	135200.6	8058.92	3461.946	11520.8659
20	125686.68	193280	67593.32	3473.314	6458.467	9931.78095
21	58079.4	193280	135200.6	5989.09	2572.79	8561.88013
22	58079.4	193280	135200.6	5163.009	2217.922	7380.93115
23	58079.4	193280	135200.6	4450.87	1912.002	6362.87168
24	58079.4	193280	135200.6	3836.957	1648.278	5485.2342
25	58079.4	193280	135200.6	3307.721	1420.929	4728.65018
				215399.9	365232.6	580632.446

BCR =1.59

Table 3. Estimation of Benefit-cost ratio at 20 per cent discount rate

Year	Costs	Gross returns	Net income	NPV	Present worth at costs	Present worth of gross returns
1	108008.92	0	-108008.92	-90007.4	90007.43	0
2	31457	0	-31457	-21845.1	21845.14	0
3	36616.36	0	-36616.36	-21190	21190.02	0
4	42267.4	41360	-907.4	-437.596	20383.58	19945.9877
5	47980.4	96160	48179.6	19362.3	19282.25	38644.5473
6	51897.4	138560	86662.6	29023.13	17380.33	46403.4636
7	54938.4	161840	106901.6	29834.27	15332.3	45166.5738
8	58079.4	193280	135200.6	31443.34	13507.41	44950.7506
9	58079.4	193280	135200.6	26202.78	11256.18	37458.9589
10	125686.68	193280	67593.32	10916.7	20299.1	31215.7991
11	58079.4	193280	135200.6	18196.38	7816.789	26013.1659
12	58079.4	193280	135200.6	15163.65	6513.991	21677.6382
13	58079.4	193280	135200.6	12636.37	5428.326	18064.6985
14	58079.4	193280	135200.6	10530.31	4523.605	15053.9154
15	58079.4	193280	135200.6	8775.259	3769.671	12544.9295
16	58079.4	193280	135200.6	7312.716	3141.392	10454.1079
17	58079.4	193280	135200.6	6093.93	2617.827	8711.75662
18	58079.4	193280	135200.6	5078.275	2181.522	7259.79718
19	58079.4	193280	135200.6	4231.896	1817.935	6049.83099
20	125686.68	193280	67593.32	1763.108	3278.418	5041.52582
21	58079.4	193280	135200.6	2938.816	1262.455	4201.27152
22	58079.4	193280	135200.6	2449.014	1052.046	3501.0596
23	58079.4	193280	135200.6	2040.845	876.705	2917.54967
24	58079.4	193280	135200.6	1700.704	730.5875	2431.29139
25	58079.4	193280	135200.6	1417.253	608.8229	2026.07616
				113630.9	296103.8	409734.696

BCR =1.38

Table 4. Estimation of Benefit-cost ratio at 24 per cent discount rate

Year	Costs	Gross returns	Net income	NPV	Present worth at costs	Present worth of gross returns
1	108008.92	0	-108008.92	-87104	87103.97	0
2	31457	0	-31457	-20458.5	20458.51	0
3	36616.36	0	-36616.36	-19204.8	19204.81	0
4	42267.4	41360	-907.4	-383.806	17877.99	17494.188
5	47980.4	96160	48179.6	16434.43	16366.49	32800.9203
6	51897.4	138560	86662.6	23839.74	14276.29	38116.0391
7	54938.4	161840	106901.6	23715.51	12187.77	35903.2757
8	58079.4	193280	135200.6	24188.29	10390.79	34579.0801
9	58079.4	193280	135200.6	19506.68	8379.671	27886.3549
10	125686.68	193280	67593.32	7864.786	14624.21	22488.9959
11	58079.4	193280	135200.6	12686.45	5449.838	18136.287
12	58079.4	193280	135200.6	10231.01	4395.031	14626.0379
13	58079.4	193280	135200.6	8250.812	3544.379	11795.1919
14	58079.4	193280	135200.6	6653.881	2858.371	9512.25151
15	58079.4	193280	135200.6	5366.033	2305.138	7671.17057
16	58079.4	193280	135200.6	4327.446	1858.982	6186.42788
17	58079.4	193280	135200.6	3489.876	1499.179	4989.05474
18	58079.4	193280	135200.6	2814.416	1209.015	4023.43124
19	58079.4	193280	135200.6	2269.69	975.0123	3244.70262
20	125686.68	193280	67593.32	915.1032	1701.592	2616.69566
21	58079.4	193280	135200.6	1476.125	634.1131	2110.23843
22	58079.4	193280	135200.6	1190.424	511.3815	1701.80519
23	58079.4	193280	135200.6	960.0191	412.4045	1372.42354
24	58079.4	193280	135200.6	774.2089	332.5842	1106.79318
25	58079.4	193280	135200.6	624.362	268.2131	892.575142
				50428.2	248825.7	299253.94

BCR =1.20

Table 5. Estimation of Benefit-cost ratio at 28 per cent discount rate

Year	Costs	Gross returns	Net income	NPV	Present worth at costs	Present worth of gross returns
1	108008.92	0	-108008.92	-84382	84381.97	0
2	31457	0	-31457	-19199.8	19199.83	0
3	36616.36	0	-36616.36	-17460	17460.04	0
4	42267.4	41360	-907.4	-338.033	15745.83	15407.8007
5	47980.4	96160	48179.6	14022.11	13964.13	27986.2434
6	51897.4	138560	86662.6	19704.79	11800.1	31504.8965
7	54938.4	161840	106901.6	18989.54	9759.02	28748.5591
8	58079.4	193280	135200.6	18762.85	8060.136	26822.9883
9	58079.4	193280	135200.6	14658.48	6296.981	20955.4596
10	125686.68	193280	67593.32	5725.377	10646.08	16371.4528
11	58079.4	193280	135200.6	8946.825	3843.372	12790.1975
12	58079.4	193280	135200.6	6989.707	3002.635	9992.3418
13	58079.4	193280	135200.6	5460.709	2345.808	7806.51703
14	58079.4	193280	135200.6	4266.179	1832.663	6098.84143
15	58079.4	193280	135200.6	3332.952	1431.768	4764.71987
16	58079.4	193280	135200.6	2603.869	1118.569	3722.4374
17	58079.4	193280	135200.6	2034.273	873.8817	2908.15422
18	58079.4	193280	135200.6	1589.275	682.7201	2271.99548
19	58079.4	193280	135200.6	1241.621	533.3751	1774.99647
20	125686.68	193280	67593.32	484.9583	901.7577	1386.71599
21	58079.4	193280	135200.6	757.8256	325.5463	1083.37187
22	58079.4	193280	135200.6	592.0512	254.333	846.384272
23	58079.4	193280	135200.6	462.54	198.6977	661.237713
24	58079.4	193280	135200.6	361.3594	155.2326	516.591963
25	58079.4	193280	135200.6	282.312	121.2754	403.587471
				9889.734	214935.8	224825.491

BCR=1.04

Table 6. Estimation of Internal Rate of Return

Year	Net income	Discounted net income at 29%	Discounted net income at 30%
1	-108008.92	-83727.8	-83083.8
2	-31457	-18903.3	-18613.6
3	-36616.36	-17057.1	-16666.5
4	-907.4	-327.672	-317.706
5	48179.6	13486.98	12976.17
6	86662.6	18805.87	17954.43
7	106901.6	17982.76	17036.51
8	135200.6	17630.35	16574.17
9	135200.6	13666.94	12749.36
10	67593.32	5296.716	4903.094
11	135200.6	8212.811	7544.001
12	135200.6	6366.52	5803.078
13	135200.6	4935.287	4463.906
14	135200.6	3825.804	3433.774
15	135200.6	2965.739	2641.364
16	135200.6	2299.023	2031.819
17	135200.6	1782.188	1562.938
18	135200.6	1381.541	1202.26
19	135200.6	1070.962	924.8151
20	67593.32	415.0587	355.6614
21	135200.6	643.5684	547.2279
22	135200.6	498.8902	420.9445
23	135200.6	386.7366	323.8035
24	135200.6	299.7958	249.0796
25	135200.6	232.3999	191.5997
		2169.97	-4791.62

IRR = 29.3008163