AN EVALUATION OF INVESTMENT IN ARECANUT GARDENS IN DAKSHINA KANNADA DISTRICT, KARNATAKA

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CERTIFICATE

This is to certify that the thesis entitled "AN EVALUATION OF INVESTMENT IN ARECANUT GARDENS IN DAKSHINA KANNADA DISTRICT, KARNATAKA" submitted by Mr. E. Krishnaraja, B.Sc.(Agri.), for the degree of MASTER OF SCIENCE (AGRICULTURE) in AGRICULTURAL ECONOMICS of the University of Agricultural Sciences, Bangalore, is a record of research work done by him during the period of his study in this University under my guidance and supervision and the thesis has not previously formed the basis for the award of any degree, diploma, associateship, fellowship or other similar titles.

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CHAPTER I

INTRODUCTION

Arecanut (Areca catechu Linn.) is an important commercial crop which occupies a special position in the cultural and social life of the people of India. Eventhough its cultivation is localised, its consumption is spread throughout the country. It is used for chewing purpose in tender, ripe or processed form from pre-historic time. It is estimated that nearly 4 million people are engaged in the production, processing and trade of arecanut in India. In India it is grown over 1.7 lakh hectares producing about 1.6 lakh tonnes (Velappan and Paulose, 1974).

Arecanut is essentially a tropical crop, the cultivation of which is mostly confined to India, Bangaladesh, Sri Lanka, Malaysia and to a smaller extent in East Indies and Burma. India ranks first in the world as a producer of arecanut, Sri Lanka and Bangaladesh occupying second and third positions, respectively, among the major producing countries in the world.

As in the case of other countries, even in India very often coconut, jack, mango, banana and spices are considered as mixed crops with areca.

The major arecanut growing States in India are Karnataka, Kerala and Assam, these three States accounting for 93 per cent of the total production in the country. In other States like Maharastra, Tamil Nadu, Meghalaya, West Bengal and Andhra Pradesh arecanut is grown in small areas only (Table 1.1).

India is traditionally an arecanut growing country. At the time of partition of the country in 1947, nearly 50 per cent of the total area under arecanut was lost to Pakistan. Thus the production in the remaining area restored with India was insufficient to meet the demand and the country was regularly importing large quantities of arecanut from Sri Lanka, Malaysia and other countries. However, the unrestricted import of arecanut was found to have depressing effect on the economy of arecanut growing areas and the Government of India fixed quantitative and monetary ceilings on the volume of imports and also levied a duty on all qualities of arecamut imported after 1950s. The present policy of the Government is to have no imports of arecanut (Velappan and Paulose, 1974).

At present, India has attained self sufficiency with regard to arecanut production and the production accounts for 60 per cent of the total world production. Major part of the production is consumed in the domestic market and the remaining is exported to countries like Nepal, Singapore, Kenya and U.K. in various forms. The exports increased steadily after 1957-58 (Appendix 1).

Table 1.1

Area and production of arecanut in different States in the country (1978-79)

States	Area (hectares)	Production (in tons)
Andhra Pradesh	211	155
Assam	46410	44467
Maharastra	2100	2499
Karnataka	49971	61457
Kerala	62700	51061
Meghalaya	4160	2947
Tripura	640	410
West Bengal	3100	800
Goa, Daman & Diu	1367	1450
Total	1,70,659	1,65,246

Source: Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.

Arecanut contains fats and fatty acids, tannins and polyphenols, alcaloids, arecanut lignins and traces of free amino acids like proline, tyrosine, phenyl alanine etc. Watt (1881) listed the uses of various parts of areca palm like the stem, root and leaves and others for medicinal purposes among the rural population of Malaya. In India, [redacted], Bhadevas et al. (1902), indicated that the fruit has important uses in leather industry. Raghavan and Baruah (1957) indicated the possibility of preparing standard inks from the endosperm of the fruits. Raghavan and Baruah (1957) concluded that all possible uses of arecanut had not been exploited to the same extent as had been done in case of coconut or other fruit trees, because of the inadequate knowledge regarding the cultivation, processing of the husk and the chemistry of the nuts. Banergee and Bhatt (1959) indicated that the arecanut tannins, besides their use in the tanning of leather hides also could be used in plastics, resins, ion exchange resins etc., since the tannins are phenolic materials. Bavappa and Moorthy (1959) said that due to the hardness of stem and golden yellow colour it imparts to the finished products, it was ideally suited for making variety of elegant utility articles like stationary articles, such as scales, rulers, paper cutter, book-shelves and could be used in other furniture industries. The leaf sheaths could be used to make containers to carry vegetables, fishes etc. The spathe and leaf sheath are being used as cattle feed. Kukla et al. (1965) indicated the possibility of extracting

dyes from arecanut which could be used as a dye for cotton, wool and paper. Also it could be used to prepare permanent adhesives. The exploitation of arecanut on the above lines holds promise of a bright market for arecanut in the coming years.

Karnataka occupies a unique position in the country with respect to arecanut. Karnataka producing about 61457 tons per annum (37 per cent of the total arecanut produced in the country) stands first with respect of arecanut production in the country. Although Kerala has got an area of 62700 hectares under arecanut (about 37 per cent of total area under arecanut in the country) as against 49971 hectares (29 per cent of the total area under arecanut in the country) in Karnataka, the average yield per hectare is only 814 kg as against 1230 kg in Karnataka. Consequently, the total production and productivity in Kerala appears to be less than that of Karnataka. Unlike in Kerala, arecanut is cultivated more intensively and with better care in Karnataka.

The cultivation of arecanut in Karnataka is concentrated in heavy rainfall districts of Dakshina Kannada, Shimoga, Uttara Kannada and Chickmagalur. These districts account for more than 75 per cent of the total area in the State. Arecanut is also grown in maidan districts of Tumkur, Chitradurga and Hassan, and comparatively to a lesser extent in the districts of Mysore, Coorg, Bangalore and Mandya (Table 1.2).

Table 1.2

District-wise estimates of area and production of arecanut in Karnataka (1978-79).

District	Area (hectares)	Production (in tons)
Bangalore	594	856
Belgaum	2	3
Bellary	10	14
Chickmagalur	6869	8413
Chitradurga	3036	3014
Dakshina Kannada	12923	16441
Dharwar	226	326
Hassan	1422	1615
Kodagu	539	691
Mandya	636	916
Mysore	678	504
Shimoga	9741	14339
Tumkur	5393	6657
Kolar	62	89
Uttara Kannada	7820	7579
Other districts	-	-
Total	49971	61457

Source : Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.

The development of arecanut would also help the development of important food and cash crops like plantains, betelvine, pepper and cocoa which are grown as inter crops in the areca gardens. The report of the Arecanut Development Programme in Karnataka State published by the Directorate of Planning and Evaluation (1968) has estimated that 25 to 50 thousand acres of land which was then uncultivated would be available for raising this crop in the State. The report further added that on an average an acre of bearing areca garden creates an employment potential of 203 man days and an acre of non bearing gardens creates 125 man days in a year.

Karnataka is a surplus State in regard to arecanut production. The revenue in the form of sales tax from this crop was estimated at Rs.1.22 crores annually in Karnataka.

The recent trend among farmers is to go in for perennial crops like arecanut, coconut and grapes despite the relatively higher risk involved in these enterprises compared to annual food or commercial crops. The area under arecanut has been increasing over years even in the non areca growing regions of the State. This clearly reflects the importance and benefits of the perennial crop like arecanut. The crop is being preferred by small, medium and large farmers.

It is well known that these perennial crops require huge amount of establishment and maintenance expenditure compared to annual crops. Thus, it is important to know the benefits derived or desirable from such huge investments which are spread over a long period of time. This is more true when the farmers depend for heavy investment on external sources as majority of the farmers seems to have very limited savings of their own from the traditional food crop farming.

Obviously, this calls for an evaluation of investment in perennial crops both from the point of view of farmers who undertake these investments and financial intermediaries who provide necessary funds to facilitate the farmers for investment.

The investment evaluation in coffee, grapes etc., have already been covered in order to provide the necessary information for farmers and lenders. There is no study done in Karnataka for arecanut and hence the present study is proposed in one of the largest arecanut growing districts of the State viz., Dakshina Kannada District with the following objectives;

1. To estimate the recurring and non-recurring investments in different size groups of areca gardens.

2. To assess the economic feasibility and financial soundness of investment in areca gardens.

3. To evaluate the benefits of "purfo irrigation" system against the conventional method of surface irrigation in areca gardens.

REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

In this chapter an attempt is made to review various studies done by researchers of the past and to develop concepts for the present study. The past work done is reviewed in this chapter in the following order.

1. Studies related to economic aspects of arecanut and related perennial crops.
2. Studies related to the intercrops in areca gardens.
3. Studies related to techniques of investment evaluation.

1. ECONOMIC ASPECTS OF ARECANUT AND RELATED PERENNIAL CROPS:

1.0 Economic aspects of arecanut:

Nambiar and Srinivasan (1954) conducted a survey to study the economic aspects of arecanut cultivation in West Bengal, Karnataka and Kerala States. In this study costs were classified into two categories.

1) Cost of cultivation to bring the garden upto the bearing stage (upto the 7th year after planting), and 2) maintainance charges in the subsequent years.

In West Bengal it cost Rs.1200 to plant one acre with areca and to raise it to maturity upto the 7th year and that the cost of subsequent annual maintenance was about Rs.175 per acre. The average yield obtained was 50,000 nuts per acre (approximately 500 kgs per acre). In Karnataka the cost of planting and raising a garden upto maturity worked out to Rs.8000 per acre and the subsequent maintenance charges came to Rs.1200 per acre per year. The yield in a good garden was about 750 kgs per acre. In a very well maintained garden the yield ranged from 1000 kgs to 1250 kgs per acre. The cost of cultivation to bring the garden up to the maturity period and the subsequent maintenance costs were Rs.4400 and Rs.750 per acre respectively in South Malabar region of Kerala. The average yield obtained was 850 kgs per acre.

The Report on the Cost of Cultivation of Arecanut in Mysore State (1961) published by the Indian Central Arecanut Committee, Calicut, Kerala estimated the average cost of cultivation of one acre of arecanut at Rs.973 for large sized holdings, Rs.1010 for medium sized holdings and Rs.1083 for small sized holdings in the districts of Shimoga, Chickmagalur and North Kanara of Malnad region, Karnataka. The holdings in the sample were classified as large sized if they were 70 guntas and above, medium sized if 27 to 70 guntas and small sized holdings if they were less than 27 guntas.

Naidu (1962) estimated the cost of cultivation of one acre of arecanut in maidan region of Karnataka State and it was Rs.10255 to establish an acre of areca garden upto the maturity stage (8 years) and Rs.1100 was required as recurring expenditure every year thereafter. The annual gross returns and net profits were Rs.2250 and Rs.1150 per acre.

The report on the arecanut development programme in Karnataka State (1968) published by the Directorate of Man Power and Evaluation, Government of Karnataka, assessed the different arecanut development schemes and their progress. The report studied various aspects, such as present area, available area, initiation and progress of various areca development schemes, cultivation practices, employment potential of areca gardens in the coming plan period and others. The report however, concluded that arecanut cultivation should be reduced rather than extended. Further, it recommended that in tracts where paddy and coconuts could be grown the cultivation of arecanut should be discouraged. However, what is presently happening is contrary to this recommendation. It further added that the cultivation of arecanut could only be extended when no other crops of good value could be grown. The report opined that the cultivation of arecanut on an increasing scale no doubt contributed to the personal gain of the farmer, but from the larger point of view of the community and the real good to the economy, its cultivation should be curtailed.

Vidyashankar (1973) in a survey in the villages of Kasaragod taluk of Kerala observed that no scientific cultivation was followed for areca. The main stumbling block was the farmers' poor financial condition. The survey also revealed that nearly 75 per cent of the arecanut growers were in debt. The commercial banks were the most popular source of credit. As high as 60 per cent of the indebted cultivators had taken loans, mostly short-term crop loans from commercial banks. It was also observed that there were no adequate market facilities and majority of the growers sold their produce to the middlemen and traders. The yield per acre ranged from 5 to 8 quintals and the cost of production varied from Rs.3 to 6 per kilogram. Because of the steep fall in the prices of arecanut during the study period, the cultivators found that the cost of cultivation was hardly covered by the then existing price which was about Rs.3 per kilogram.

Vijayarajan et al. (1974) calculated the cost of cultivation of one hectare of arecanut in the regional and substations of Central Plantation Crop Research Institute (CPCRI) in Karnataka State. At Vittal the results showed that the cost of cultivation was Rs.5033 per hectare, while the yield of chali (husked kernel) was 2308.90 kg. per hectare.

Mruthyunjaya (1975) estimated the total crop expenditure for arecanut farmers of Malnad region in Karnataka. He classified the

holdings into three categories viz., large farmers having 4.50 acres and above, medium farmers having 1.75 to 4.49 acres and small farmers having less than 1.75 acres. The estimated crop expenditure were Rs.1350 for large farms, Rs.1544 for medium farms and Rs.1550.80 for small farmers per acre.

1.1 Cost of production of related crops:

The review of related perennial crops is done with a view to get an idea on the cost and returns as well as techniques that may be useful for the present study on arecanut which is also a perennial crop.

Gopalan and Venkataraman (1949) in their study on cost of cultivation of coconut in Cochin State divided the cost into two groups viz., cost upto bearing stage (upto 8th year of planting) and cost of maintenance (after 8th year). The cost upto bearing included cost of land, land tax, cost of seedlings, digging the pits and planting, fencing, watering, cultivation, manuring, cleaning of channels and cost of levelling and bunding. The cost of maintainance included cost of cultivation, manuring, cleaning of channels, harvesting and collection of nuts, land tax and others. The average cost upto bearing was Rs.1380 per acre and the average cost of maintainance was Rs.153 per acre. The average annual yield per acre was Rs.3200 and average cost of production per acre was Rs.256.

Perkins (1949) classified the costs incurred in coffee estates into four groups such as:

1) Essential maintenance cost which included expenditure on cultivation, handling, pruning, spraying, shade regulation etc.

2) Cost of field treatments aimed at increasing yields which included green manuring, cover cropping, mulching and compost application.

3) Crop costs included expenditure on picking and processing.

4) General overhead costs included, expenditure on estate maintenance, management, implements and tools.

Bose (1961) found the cost of establishing an acre of Anab-e-shahi on the mandhwanea (pandal) to be Rs.17,973. The cost components were split into items such as preparation of land, digging and filling the pits and costs of manure, plants and planting, cost of mandhwanea, cultivation expenses in the first year and cultivation expenses in the second year. The net profit worked out to Rs.5000 per acre per year.

Badenhop and Sharma (1964) classified costs into two main divisions - 1) those required to establish a vine yard, and 2) those

required to maintain and operate a producing vine yard. All the costs incurred in the first two years, that is, upto the time it came into bearing, as establishment cost, and found that 87 per cent of the total costs in establishing a vine yard was incurred during the first year. The cost required to maintain and operate a producing vine yard included all costs incurred annually in the operation of the producing vine yard.

Venkataram (1964) in his study on the economics of grape cultivation in Bangalore South taluk classified costs into establishment cost and maintenance cost. The expenditure in the first year of planting was taken as establishment cost and the cost incurred in the subsequent years was the maintenance cost. The establishment cost was apportioned over the productive life of the vine yard which was taken as 25 years.

Madappa (1970) estimated the cost of production of coffee by survey method in Aldur of Chickmagalur district in Karnataka. It was observed that the size of estate had no direct bearing on the cost of production of coffee, except perhaps on the cost of spraying and pesticide application. The total cost of production was about Rs.900 per acre. Out of this, cultivation cost was about Rs.500 (55 per cent). The cost of preparing the produce for the market

was 10 per cent and other costs worked out to be 35 per cent of the total cost. Labour and material costs accounted for 40 and 20 per cent, respectively. The cash cost accounted for 75 per cent of the total cash cost per acre.

Sadat Ali Khan (1972) studied the production and marketing of coconuts in Tiptur taluk of Tumkur district. The study revealed that for establishing one acre of coconut upto bearing stage required on an average Rs.1533.43 in small farms and Rs.1491.54 in large farms. The average per acre total cost of production of coconut in the bearing stage was Rs.623.62 in small and Rs.656.05 in large farms.

Hokman and Nunno (1972) estimated the cost of establishing 500 acres of tea to be 500,000 dollars in Brisbane, Australia. Further, they attempted to analyse the profitability of a tea enterprise by considering the cost and returns of clonal tea at two yield levels and one price, and seedling tea at one yield level and three price levels for a period of 30 years.

Singh (1974) worked out the economics of guava plantation from the establishing stage to declining stage in Allahabad district of Uttar Pradesh. In order to cover all the stages of growth, that is, from establishment, fully grown and declining stage, the guava plantations in different growth stages were studied. The total investment on the

establishment of guava orchard upto the age of 3 years was Rs.5107.32 per hectare. The initial investment for the first year was Rs.2705.17 per hectare, of which layout and fencing accounted an highest expenditure of 28.55 per cent followed by labour charges used on maintainance (17.45 per cent) and digging of pits (13.94 per cent). In the second and third years the investments were less than half of those made in the first year. By inter cropping programme, the planters got a per hectare net income of Rs.2865.20 for the total period of 3 years. The investment per hectare for the same period was Rs.2,452.71. From 3 to 6 years the per hectare net income was lower due to lower production in the initial stages of fruiting. The net income of Rs.25,216.23 per hectare was highest in the fully growing stage from 9th to 12th year. More or less the same level of income was received from 9th to 20th year and later on it started to decline. The study indicated an average return of Rs.5.74 per rupee invested.

Chengappa (1975) studied the cost of production of coffee in Coorg district of Karnataka. The life of the coffee estate was divided into two stages - the establishment stage (5 years) and the yielding stage (35 years). The cost of establishing an acre of Arabica and Robusta was estimated at Rs.3885.08 and Rs.3803.75, respectively, which were spread over a period of 40 years in order to arrive at the annual share. The total cost of production was Rs.1909 and Rs.1697.07 per acre in Arabica and Robusta estates, respectively.

The net returns in the respective Arabica and Robusta estates were Rs.756.55 and Rs.1186.31 per acre.

Hebbar (1976) in his study on the economics and resource productivity of small coffee holdings in Sakaleshpur and Belur taluks of Hassan district, indicated that the pattern of cultivation in small holdings was less efficient meaning an imbalance in the use of resources and capital investment. Thus recognised, a need for readjustment in resource use depending upon the productivity potentials. It was also observed that there was a decline in the intensity of intercropping as the size of the holdings increased, showing a tendency towards specialization in coffee production.

Romney (1977) employed the cost accounting methods on a 8.5 acre farm to study the cost and return of Malayan dwarf variety of coconut in Jamaica. The results indicated that bearing Malayan dwarf became profitable within 6 years of planting.

Lalith Achoth (1978) in his study on the economics of tea production in Nilgiris district, classified the sample into 3 main categories viz., large, medium and small, estates. Further, each group was classified into two sub groups viz., estates in low grown area and estates in high grown area. The study revealed that the returns per rupee invested was highest in the small group of the low

grown area at Rs.1.71, followed by the high grown small group (1.46), high grown medium group (1.38), high grown large group (Rs.1.26), low grown large group (Rs.1.20) and low grown medium group (Rs.1.08).

Menon (1979) conducted a study on the economics and resource productivity of grape cultivation in Bangalore North taluk of Bangalore district. The initial establishment cost was amortized over the model life of the vine yard, to arrive at the annual share of the establishment cost which was included in the annual cost of production. The annual cost of production was classified into fixed and operational costs. For the purpose of analysing the economics of grape cultivation, cost concepts commonly used in farm management studies were used. The study indicated the possibility of securing higher yield per unit area on smaller farms rather than on large farms, thus pointing out the more efficient operation of small farms. Further, the cost-return analysis of grape cultivation based on the cost, size and income criteria revealed that higher yields at disproportionately higher costs resulted in a lower unit of cost of production, thereby emphasizing the importance of management factor in grape cultivation.

Nagaraja (1980) studied the economics of coconut production in Tumkur district of Karnataka. The study revealed that the average investment on an acre of coconut farm was Rs.7503.21. The data was classified into borrower's and non-borrowers. Average investment in

non-borrowers farm was found to be a little higher at Rs.7952.19 per acre, than that of borrowers farm which was at Rs.6887.78 per acre. Average cost of producing coconut was Rs.1923.73 per acre, out of which nearly 50 per cent accounted for cost of cultivation. The study indicated a net return of Rs.950.47 per acre and it was also noticed that the net returns were higher in non-borrowers farms.

Shivarama (1980) evaluated the investment in coffee in Coorg district of Karnataka. The costs were divided into cost of establishment (upto 5th year) and cost of maintenance (after 5th year upto 35 years). The two varieties of coffee viz., Arabica and Robusta were compared and found that the average per hectare total cost of establishment were Rs.32,272.24, Rs.31,300.76, Rs.22,765.83 in small, medium and large Arabica gardens, respectively, while for Robusta estates the total costs were Rs.23,607.34, Rs.25,619.50 and Rs.23,468.66 for small, medium and large gardens, respectively. The average maintenance cost for Arabica estates was Rs.5390.90, Rs.4600.58 and Rs.5180.63 per hectare of small, medium and large estates, respectively, while it was Rs.3989.07, Rs.4504.53 and Rs.4300.21 per hectare of small, medium and large Robusta estates, respectively. The study revealed that the Robusta estates fetched higher net returns than that of Arabica.

2. Inter crops in arecanut gardens

Govindan Kutty and Kurup (1955) said that the stem splitting disease of arecanut due to the exposure of stem to the afternoon sun in summer months could be avoided by growing intercrops in the areca gardens. The opinion was that the young arecanut trees could be given protection from the sun by growing a fairly, closely spaced intercrop of banana. But they doubted about the banana plant giving full protection to the fully grown areca palms since, by the time the arecanut palms reached the bearing stage, not only the intercrop of banana would almost extinct, but even if the banana plants continue to grow, gave only a limited protection to the stem of arecanut trees. It was suggested pepper as the best alternative which could protect the palms against stem splitting as well as a good intercrop. It was found that pepper was often trained to areca in the taluks of Ennad and Walluvanad in Malabar district of Kerala and also in South Kanara and North Kanara districts of Karnataka. It was further argued that the yield of arecanut trees trained with pepper was not found to be affected to any appreciable extent, instead it would add to the income.

Abraham (1974) in an experiment conducted at CPCRI Sub-Station, Palod of Kerala observed that by growing intercrops such as pepper, tapioca, elephant foot yam, dioscoria, sweet potato and pineapple,

an additional net returns of Rs.255, Rs.591, Rs.1700, Rs.1824, Rs.61 and Rs.847 respectively could be obtained from one hectare of arecanut garden with these intercrops.

Bhandari (1974) conducted an experiment at Arecanut Research Station, Thirthahalli from 1961 to 1965 using 5 intercrops viz., banana, pineapple, pepper, cardamom and betelvine. The experiment showed that growing intercrops did not pull down the yields of arecanut. Based on the general performance of intercrops, betelvine and pepper were found to be the most suitable for Malnad regions.

Bhat (1974) reported about the profitability of growing intercrops with arecanut based on number of field experiments conducted at CPCRI, Vittal of South Kanara district, Karnataka. The results showed that by growing banana, pineapple, elephant foot yam, arrow root and cocoa, the additional incomes that could be expected were Rs.1500 to 1800, Rs.700 to 1000, Rs.1400 to 1700, Rs.1000 to 1200 and Rs.3000 to 3500, respectively. Further, it was suggested that if the intention of the grower was to get additional income in view of the fall in price of arecanut, a mixed crop like pepper or cardamom could be chosen based on the agro-climatic conditions which would fetch an additional income of Rs.800 to 1000. However, it was indicated that inter or mixed cropping with a perennial crop like areca was to be considered primarily

as a safeguard against the uncertainities of income from the produce of pure or monoculture gardens due to the reasons beyond the control of the planters.

Another study conducted by Nagaraj (1974) revealed that an additional net return of Rs.1500, Rs.1000, Rs.620 and Rs.500 could be derived by growing betelvine, banana, tapioca and pineapple, respectively by intercropping one hectare of areca garden in maidan areas of Karnataka.

In a field experiment conducted at CRCRI Sub-Station, Andamans by Sadanandan (1974), it was found that growing intercrops in areca gardens had no significant adverse effect on the yield of areca palms. The cost accounting analysis had shown that amongst the intercrops, pepper, ginger, pineapple and elephant foot yam, which were tried in the experiments, yam stood first which showed an additional net income of Rs.1395 per hectare followed by ginger with Rs.905 per hectare and pineapple with Rs.703 per hectare.

3. Techniques of investment evaluation

Prest and Turvey (1965) defined cost-benefit analysis as a practical tool of assessing the desirability of projects which are of long term in nature and wherein the long view in the sense of looking at repurcussions in the future is important. The cost-benefit

analysis implies a complete enumeration and evaluation of all relevant costs and benefits from the project.

Upton (1966) illustrated the importance of discounting the future returns from investment on tree crops by comparing the discounted returns per acre from tree crops with that of annual crops in West Nigeria. Those results were used in evaluating the proposals. By discounting the expected future margins per acre from new varieties of cocoa, oil palm and rubber over a period of 32 years, 35 years and 30 years, respectively, the present worth was calculated in order to compare the returns with those of annual crops such as cotton, rice, maize, dwarf-sorghum and tobacco. It was concluded that except rubber, the returns from tree crops were lower than those from most of the annual crops, and that the use of land for improved varieties of cocoa and oil palm would not compare favourably with the use of land for annual crops.

/ Dalton (1967) explained that the discounted cash flow technique could be used by the farmers as a guiding aid for an investment. The method has an advantage that future variable cash flows are reduced to a single sum at one moment of time, thereby facilitating comparison between various alternatives.

Commenting on the Upton's article (1966), Persaud (1967) said that it was inappropriate to compare margins for one crop from annual crop with the discounted margins for several years from tree crops. Persaud opined that Upton did not treat adequately the determination of correct length of the period over which the margins from tree crops should be discounted. The fact was that it was wrong to use estimates for one crop's return from annual crops for comparisons with discounted returns from tree crops; instead it was more appropriate to compare the discounted return from annual crops for the period of discounting used in the case of tree crops. It was necessary to take into account the personal discount rate of the farmers which might be more relevant than the artificially low rates of interest which were used in the underdeveloped countries on credit provided by the public sector. The author stressed about the importance of appropriate life period length as it influences the maximum average annual margins.

Replying to Persaud's comment (1967), Upton (1967), defended the comparisons made between the tree crops and annual crops. It was argued that computation of the costs and returns from annual crops was not done just for one year, but for the life of the tree crop in question, and comparison was being made "like with like" and supported the argument by giving an example of comparing the continuous growing of cotton with cocoa production. Regarding the comment on correct length of period over which the margins from the tree crops should be discounted, it was

argued that if the annual margin for the terminal year exceeds the equivalent annual margins for the whole of the crop, then its inclusion was justified as its omission would decrease the equivalent annual margins. However, there was no agreement between Upton and Persaud on this issue.

Naylor (1970) pointed out the difficulties arising in the specification of the benefits and costs to use in any particular instance. The difficulties are 1) those associated with identifying and quantifying the capital input whose productivity are to be measured, 2) those associated with identifying and quantifying the increases in production which could genuinely be attributed to the capital factor.

It was found that internal rate of return was relatively sensitive to the time period over which the analysis was made. If the life span of investment turned out to be less than assumed, then the internal rate of return would be reduced. Due to this it was pointed out that three elements of uncertainity in the productivity of capital viz.,

1) The element of uncertainity over the rate of return due to time lag in realising the returns. However, the uncertainity was important only in the case of investment with a relatively short life.

2) Arised from the necessity to predict what would have happened to farm output if the investment had not been made.

3) Arised because of the value of output resulting from the investment was likely to change over the life of the investment because of changing price level.

Peters (1970) said that in private appraisals, the choice of discount rate should be based on the rate at which the capital would be raised. The project could be accepted only when the internal rate of returns exceeded the interest rate or when the net present worth of project was positive or when the benefit cost ratio exceeded unity. It was stressed that such measures would be applied while making comparisons between different projects.

Cracknel (1971) opined that the project appraisal was a continuous process and should be applied at every successive level of decision making. Project appraisal techniques could help in establishing priorities when there are a number of projects that could be carried out. It was felt that the analysis being more of a subjective nature due to lack of quantification of the social factors.

George and Joseph (1973) adopted discounted cash flow technique to estimate the present value of future returns from investment in tree crops viz., coconut, rubber and oilpalm in Kerala State. The

worthiness of the project was determined by computing the internal rate of return on capital investment on tree crops. The study revealed that the investment in coconut cultivation had a payback period of 16 years with an internal rate of return of 9.5 per cent, benefit-cost ratio of 1.07. In the case of rubber, the pay back period was 14 years with an IRR of 10 per cent and benefit-cost ratio of 1.2. Investment on oilpalm had a payback period of 10 years with an internal rate of return of 18 per cent and benefit-cost ratio of 2.71. So, oil palm appeared to provide higher returns to capital at a shorter period than the other two competing crops. Regarding the economic gains of replanting the old trees with high yielding new varieties, the study revealed that, so long as the returns from the old growth is higher than the average annual discounted net returns for respective crops which was Rs.80 for coconut, Rs.88 for rubber and Rs.743 for oil palm, it was found better to retain the old growth rather than replanting it. The age at which the tree crops became non economic depended upon the rate of decline in their profitability.

Gupta and George (1974) estimated the profitability of santra (orange) cultivation in Nagpur district of Maharastra by using the conventional measures of project appraisal for the data of 60 orange growers. According to the study the orange had a pay back period of 7 years with a net present value of Rs.64,381 per acre, internal rate of

return of 39 per cent and benefit cost ratio of 2.5. The discount rate used was 12 per cent.

Gittinger (1974) stated that two types of discount rates could be chosen for the purpose of computing benefit cost ratio in agricultural projects. They are:

1) The opportunity cost of capital, which was doubted in practical applicability, because none was certain about what the opportunity cost of capital really was and there were practical problems of establishing this rate.

2) The borrowing rate of capital. It was indicated that this had an undesirable result in selection of projects as it would be influenced by the financing terms available rather than being based solely upon their relative economic impact.

Arputharaj and Rajagopalan (1978) attempted to appraise prevailing farm financial management practices and the scope for further improvement in a study conducted at West Ramanathapuram district of Tamil Nadu. The farmers were classified into three groups viz., beneficiaries of long term credit, beneficiaries of medium term credit and beneficiaries of short term credit. Further the farmswere grouped into wet, dry and garden, wet dry + garden and wet + dry holdings. All the financial

ratios showed that the projects were financially sound. The benefit cost ratios and internal rate of return were computed and concluded that if projects were implemented the beneficiaries were shown to gain in profit, farming intensity and employment of human labour.

Basu (1978) said that, identification, appraisal and evaluation of agricultural projects had special feature distinguishing them from project in other sectors. Estimation of cost and benefits was a complicated for agricultural projects as it was often impossible to associate output in agricultural sector to a particular investment project. This was because a large proportion of investment in terms of labour (and material) in agriculture is usually undertaken (donated) by farm families and unpaid help was involved. It was indicated that this might lead to under estimation of cost component. For benefits also there were chances of under estimation as induced benefits resulting from multiplier effects were difficult to assess.

Bokataky and Neog (1978) were of the opinion that, agricultural projects had certain distinctive characteristics, which might not necessarily be present in non agricultural projects, since in the former relatively a large proportion of land and labour was used and further the land was fixed in supply and the labour was abundant in a country like India. It was opined that the productivity and efficiency of the

factors as used in agricultural projects suffer from heterogenity. Hence, the choice of objective for agricultural projects was to optimise the returns to labour and land rather than to capital. In the study conducted by the authors in the area covered by Mayong Left Irrigation Project, it was found that an agricultural project might perhaps tend to bring about equitable distribution of income in the short run to some extent as compared to its other counterparts. The results showed that the generation of income by agricultural projects increased the income elasticity of demand in a country like India. Hence such projects might not create durable assets unless additional income is sizeable.

Joseph (1978) made a comparison of profitability of rubber cultivation with a life span of 32 years, with that of tapioca, an annual crop. The conclusion was that for medium and large farmers the choice depended on the stability of income, absence of risks, immunity from land reforms etc., and hence even with a discount rate of 11 per cent they would go for rubber plantations. At this level of discount rate the income from rubber was far more than that of tapioca. To a small farmer, tapioca was preferable to rubber at 11 per cent discount rate, but if the discount rate was brought down to 6 per cent at which level income from rubber exceeded tapioca, the small farmers would also prefer rubber cultivation, provided an additional land was made available.

Rahim and Singh (1978) discussed about the special characteristics of agricultural projects such as externalities, collective goods, intangible benefits, and risks and uncertainities which distinguish agricultural projects from the projects in other sectors. It was argued that these should be given due consideration in the formulation and realisation of agricultural projects. It was concluded that:

1) The problems of externalities could be tackled by the Government either by undertaking the management of the project or by means of taxes, subsidies, regulations etc.

2) Collective goods produced by agricultural projects create problems in project formulations and evaluation and even in financing. By imposing tax in the project area, the problem of financing could be tackled.

3) Intangible benefits produced by the project should be given due weightage, either explicitly or implicitly.

4) Risk and uncertainities could be handled by sensitivity analysis, mathematical expectations, shortening the period of analysis, adjustment in the rate of interest and safety allowance.

Umakesan and Rajagopalan (1978) conducted a study with the objective to determine the optimum area to be replanted every year and the optimum time of replacement. The net present value indicated that the initial

cost of establishment of coffee crop could be fully paid back in a period of 14 years. The internal rate of return was 18.42 per cent and higher than the market rate of interest of 12.5 per cent. It was found that the investment in coffee production was an economically feasible. The argument was that a strategy of staggering initial planting and judicial replanting appeared to pay a rich dividend by way of higher present value of net benefit and smaller variance in the annual flow of income.

Menon (1979) studied the feasibility of investment in grape gardens in Bangalore North taluk of Bangalore district. Two varieties of grapes, viz., Bangalore blue and Anab-e-shahi were considered. The estimated modal life of the vine yards were 30 and 25 years in Bangalore blue and Anab-e-shahi, respectively. The study demonstrated the remunerativeness of grape enterprise with the net present worth of Rs.38,228.28 per hectare, benefit cost ratio of 1.42 and internal rate of return of 40 per cent in the case of Bangalore blue and in the case of Anab-e-shahi the same were Rs.92,460.96 per hectare, 1.76 and 49.06 per cent, respectively. The study also revealed that the additional cost of Rs.1.00 incurred annually by shifting over to Anab-e-shahi, which was more profitable than Bangalore blue would result in an additional benefit of Rs.1.07 per annum.

Misra (1979) attempted to study the overdue position in long term credit structure, including both tribal and non-tribal cultivators in Dhar district of Madhya Pradesh and examined the generation of incremental income, consequent to investment. It was observed that there was adequate generation of incremental income, due to change in cropping pattern and use of more of improved seeds and fertilizers, which was adequate to pay back the loan instalments. The non-tribal cultivators faired better with respect of generation of incremental income. The results revealed that the incremental income generated was adequate to pay back the loan instalment of well and pump set loan which was Rs.1820. The cash flow statement prepared on the basis of the field study showed a net present worth of Rs.774 and an internal rate of return of 17 per cent (at 15 per cent discount rate) which was higher than the opportunity cost of capital, thereby the feasibility of investment was justified.

Raghupathy et al. (1979) evaluated the relative profitability of producing coconut with neither cultivation practices nor manure/ fertilizer application (Project I), producing with only cultivation practices (Project II) and producing with cultivation practices as well as manures/fertilizer application (Project III). Measures of project evaluation such as net present worth, benefit cost ratio and internal rate of returns were employed for the quantitative assessment of the objective with the data from CPCRI, Kasaragod, Kerala State. The

results showed that it was financially viable to produce coconuts with all the three defined processes. But in terms of viability ranking, Project I was the least and the decision makers could perhaps be indifferent between projects II and III. With the assumption of uniform size, quality and product price with respect to all the projects, there was probably a downward bias in the benefits obtained from Project III. So, Project III was ranged above Project II in terms of financial viability. The discount rate chosen was the lending rate of co-operatives for long term loans.

Venkataram (1979) evaluated the Karnataka Agricultural Credit Project which provided long term loans to farmers for minor irrigation, land development and tractorization in Karnataka. The study dealt with the benefits realised and the feasibility of such investments. The benefit cost ratio (B : C ratio) and internal rate of return (IRR) were calculated to examine the feasibility of these investments. The project life of dugwell, land development and tractors was assumed to be 27 years, 25 years and 10 years, respectively. The discount rate considered was 15 per cent as per the World Bank's recommendation. The results indicated that in case of dug wells the B : C ratio was 1.71 per unit of investment for small beneficiaries and 1.80 for large beneficiaries with an IRR of 26.99 per cent for small beneficiaries and 26.71 per cent for large beneficiaries. In case of dug well with

pumpset composite investment the B : C ratios were 1.58 and 1.30, for small and large beneficiaries, respectively, and the IRR was 27.20 per cent and 20.08 per cent, respectively. In the case of land development, the large beneficiaries realised better benefits than small beneficiaries because of more efficient use of resources. The B : C ratio was 2.48 and the IRR was 43.29 per cent in case of large beneficiaries, while they were 1.06 and 17.33 per cent for small beneficiaries in land development investments. So, it was argued that land development investments should be preferred to large farmers than small farmers. In the case of tractorization the investment was found to be marginally remunerative with a B : C ratio of 1.03 and IRR of 15.82 per cent. Among the three investments, tractorization was considered the least profitable, unless the beneficiaries had taken up high yielding varieties in their farm. Investment in all the three types of projects were considered justifiable, but tractorization being the least preference.

Shivarama (1984) evaluated the investment in coffee estates in Coorg district, Karnataka. The two varieties of coffee, viz., Arabica and Robusta were compared by using the discounted cash flow technique. The results indicated a net present worth of Rs.756.49, Rs.1539.59 and Rs.8704.32 for small, medium and large Arabica estates, respectively, while it was Rs.10,056.15, Rs.9685.63 and Rs.15,295.22 for small, medium and large Robusta estates, respectively. The benefit-cost ratios were 1.03 for small, 1.05 for medium and 1.27 for large Arabica

estates, respectively, while for the small, medium and large Robusta estates, the benefit-cost ratios were 1.36, 1.32 and 1.46, respectively. The internal rate of return for coffee was 17.83 per cent for small, 17.40 per cent for medium and 23.70 per cent for large Arabica estates and 25.05 per cent, 24.29 per cent and 25.95 per cent, for small, medium and large Robusta estates, respectively. The results indicated that investment on both the varieties was worthwhile. However, the study indicated that the returns per rupee investment on large Robusta estates was the highest.

METHODOLOGY

CHAPTER III

METHODOLOGY

The Dakshina Kannada district occupies first place with an areca area of 12,923 hectares, thus claiming about 26 per cent of the total area under arecanut in Karnataka (49,971 hectares). Hence the district was selected purposively for the study.

This chapter deals with a brief description of the study area, sampling design, collection of data, and computation of costs and returns along with the techniques adopted for the analysis.

A brief description of the study area:

Location: The district Dakshina Kannada is situated on the western coast of India, about half way between Bombay and Cape Comerin. From north to south it is a long strip of territory and from east to west it is a broken low plateau which spreads from Western Ghats to the Arabian Sea.

The district lies between $12^{o}27'$ and $13^{o}58'$ north latitude, and $74^{o}35'$ and $75^{o}40'$ east longitude. The geographical area of the district is 8436 square kilometers, which accounts for 4.4 per cent of the total area of the State. The population of the district according to the 1971 census was 19,39,315.

Dakshina Kannada district consists of 8 taluks with a total of 662 villages. The details of taluks, number of villages and area under arecanut in each taluk is presented in Table 3.1.

Further, the district can be divided into 6 natural divisions. The portion lying between Kumaradhara to south west and Netravati to north east comprises the first. The second is the region between the Netravati and Gurupur rivers. The third dividion would be roughly to south of Netravati and Kumaradhara. The fourth consists of the land to the north of Gurupur upto Sitanadi and the fifth lies between Sithanadi and the Chakranadi rivers. The portion lying beyond Chakranadi upto the border of the district may be taken as the sixth division.

Climate:

Temperature: Being a coastal district the seasonal variations in the temperature is small. The south west monsoon season is the coolest part of the year with the mean daily temperature below 29°C. Although April and May may be considered to be the hottest months of the year both day and night temperatures are higher than in rest of the year, the day temperature remains higher even during December to February. The oppressive heat is often being relieved by the comparatively cool breezes which blow in the afternoons.

Table 3.1

Details of taluks, number of villages and area under arecanut in each taluk in Dakshina Kannada District (1977-78)

Name of the taluk	No. of villages	Area under arecanut in hectares	Production (in tonnes)
1. Bantwal	84	2753	4606
2. Belthangady	81	1627	2722
3. Coondapur	100	721	1206
4. Karkala	77	990	1656
5. Mangalore	102	614	1027
6. Puttur	67	3428	5735
7. Sullia	41	2380	3982
8. Udupi	110	385	644
Total	662	12,898	21,578

Source : Talukwise plan statistics, Dakshina Kannada District, District and Regional Planning Unit, Planning Department (1979)

Humidity: The air is highly humid althrough the year and particularly in the south west monsoon months. The sky is heavily clouded or overcast on most of the days in the south west monsoon season. In the rest of the year, skies are generally lightly clouded or clear.

Rainfall: The average rainfall in the district amounts to about 3930 millimetres per year. The south west monsoon begins generally in the first week of June and extends upto September. The rainfall during these months is abundant and unfailing. The north east monsoon rains commence in the early part of October, a major portion falling in that month itself. A few showers may be expected in the month of November. The period from December to March is generally dry. A few premonsoon showers fall during April and May. Nearly 87 per cent of the annual rainfall is received during the south west monsoon period. The rainfall increases as one proceeds from the coast to the Western Ghats.

Soils: The soil is of a laterite type characterised by high iron and aluminium content. The soils are suitable for the cultivation of crops like paddy, arecanut, sugarcane and plantation crops like cardamom and plantains. The soil pH ranges from 5.6 to 6 on the acidic side.

The district is essentially an agricultural district with about 62.2 per cent of the population being dependent on agriculture for their livelihood. Horticultural crops grown in the districts are a helpful economic balancing factor for a number of agriculturists. Among the garden trees in the district, the most important are arecanut, coconut, pepper and jack.

Sample design:

The cultivation of arecanut is carried on mainly near the ghats in the deep narrow valleys where perennial streams and abundance of shade prevails. There are two distinct parts in the district which are famous for arecanut. The first is 'Vittal magane' in the north west of Puttur taluk and the other is 'Honnai magane' in Coondapur taluk[1]. The nuts from the former region are sent to Mangalore, while from the latter are sent to Shimoga.

Out of the 8 taluks in the district, Puttur taluk which occupies the first position with respect of total area under arecanut (3428 hectares) and accounting for 26.6 per cent of the total area in the district was selected for the study. From this taluk, first 5 villages were selected for the study on the basis of magnitude of the area under arecanut. The list of farms under different category were prepared. The farmers were classified as small, medium and large farmers depending upon their

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1. The word 'magane' refers to the local region comprising of certain geographical area.

total land holding. The farmers having an area upto 1 hectare, 1.01 to 2 hectares and above 2 hectares of irrigated land were classified as small, medium and large farmers, respectively. The standardisation was done on the basis that 2 acres of dry/garden land equals one acre of irrigated land. A pre-determined sample of 20 farmers in each category were selected from the list at random. Besides, another set of 15 more farmers who had adopted the 'purfo' irrigation method in the areca gardens was chosen for the purpose of analysing the advantage of 'purfo' irrigation method over the conventional surface irrigation method. So, a total 75 sample farmers were selected at random. The list of arecanut growers was obtained from the Department of Horticulture of Puttur taluk. The details of villages and number of respondents in different size groups are presented in Table 3.2.

Collection of data:

The data were collected by personal interview method using a pre-tested questionnaire prepared for the purpose. Data for the agricultural year 1979-80 was collected during October and November of 1980 by personal interview method with the help of structured questionnaires. During the survey it was observed that majority of the respondents were not maintaining proper records about expenditure and income from their farms. Hence, the data collected were purely based on the memory of the respondents.

Table 3.2

Details of villages and number of respondents in different size groups.

Village	Small farmers	Medium farmers	Large farmers	Purfo irrigation
Aryapu	6	5	3	4
Nettanike madnoor	4	4	4	-
Kodippady	3	5	5	2
Olamogru	5	2	5	-
Ramakunja	2	4	3	1
Other villages	-	-	-	8
Total	20	20	20	15

The data collected included the particulars regarding:

1) General characteristics such as size of holdings area under arecanut, intercrops etc.

2) Fixed capital which included the values of the pumpsets, sprayers, implements, permanent investments in wells, ponds etc.

3) Details on cost of establishment of arecanut till its maturity period.

4) Details on cost of cultivation of arecanut as well as yield and returns.

5) Details about the cost of cultivation of inter crops and their yields.

6) Details about other expenses such as land revenue, marketing charges, transportation charges, maintenance of pumpsets, machinery, wells and ponds.

The area under arecanut was taken directly as expressed by the growers, which included both areca palms and intercrops such as banana, pepper, cocoa etc. So, in the study one hectare of areca garden meant one hectare with areca palms as well as inter crops (if any) in the garden.

The area under both non-bearing and bearing areca garden was considered for determining the size of areca garden. The area under non-bearing areca garden with banana as the main intercrop was

considered for computation of establishment cost. The area under bearing areca garden with pepper as the main intercrop was considered for computation of costs of and returns from the bearing areca garden. Since, cocoa was being introduced recently and it was observed that in majority of the gardens the cocoa plants had not come for regular bearing, this inter crop was not considered for the purpose of analysis.

Computation of costs and returns:

The costs incurred in establishment and cultivation of the areca garden were broadly classified into 1) investment or fixed costs, and 2) operational costs.

1. Investment or fixed costs: Since arecanut is an irrigated crop in the district, irrigation wells, ponds, pumpsets are essential. So, the investment on these items and other machinery and equipments such as sprayers were included in the fixed costs. In addition to this, the practice of putting fresh soil to areca gardens was also observed. Further, this practice was taken up once in 10 years as expressed by the growers. Hence, the investment on this item was considered as fixed cost.

The growers opinion was elicited regarding the life span of pumpsets and sprayers. Majority of the growers felt that the life span of these equipments could be considered to be 20 years since they were

being used for only a part of the year. However, it is difficult to assess the actual life span of wells and ponds, and it was assumed that the life span of these items coincides with that of areca gardens which was assumed as 50 years. The costs on wells, ponds etc., were apportioned between the area under areca garden and other irrigated areas based on the area under each category. Thus, the fixed investments on wells, ponds and pumpsets were taken as fixed investments during the first year of establishment. Further, since the life of the pumpsets was considered to be 20 years the apportioned cost of pumpset was added to 21st year and 41st year. The investment on putting the fresh soil was considered once in 10 years till the 50th year and thus accounts for 4 times during the life of the orchard (10th, 20th, 30th and 40th year). Investment on sprayers was found to be made during the 7th year of the orchard, that is, after it started to yield economically and again the amount was included in the 28th year and the 48th year with a life span of 20 years.

2. Operational cost: The expenditures on items like fertilizers, manures, plant protection chemicals, irrigation charges and other items were considered as material costs. While computing the costs of fertilizers and chemicals, the actual price paid by the grower along with the transportation cost incurred were used. For estimating the costs of farm yard manure and green leaves, the price prevailing in the locality was used eventhough many a times these were produced on the farm itself.

The labour costs, both unskilled as well as skilled labourers were computed based on the actual wages paid by the growers. Since there was not much difference between the wages paid for permanent and hired labourers, and also it was difficult to get data separately for these two, no distinction was made. The child labour was not generally used on areca gardens.

The labour employed, both men and women were taken into account. In arecanut gardens some operations like spraying and harvesting require skilled labourers, since these operations require the special skill to climb the palms which is a tedious job. The wage rate of these labourers was found to be almost double of the ordinary unskilled workers. The actual wage paid by the growers was used for computing the labour cost for each of these operations.

It was observed that some of the operations like cover digging, manuring the palms were done on contract basis in some of the gardens. In such cases, it was difficult to obtain the actual labour used. However, for computing the labour cost in such cases, the actual amount paid by the grower was taken as it is.

To estimate the potential of employment in the areca gardens, all the labour used was converted into man-days, based on the ratio of their wage to a man-day of 8 hours of work. In case of contracts, the

labour used was calculated based on the wages prevailing in the locality. Further, the labour requirement was classified as unskilled and skilled labourers.

The expenditure incurred in the upkeep and maintenance of the drying yard, wells, ponds, pumpsets and other equipments were taken based on the actual payment made by the grower towards these items and recorded as maintenance cost of permanent items.

The operational cost also included the costs incurred after harvesting the nuts like the costs on drying, dehusking, cleaning and measuring etc., along with the transportation and marketing cost of the produce. It was observed that many of the growers borrowed loans and in such cases the interest paid on that was included in the operational cost and however was not included while evaluating the investment.

Cost of intercrop: The cost of intercrop banana was accounted for calculating the establishment cost of areca garden. Since banana is planted as a shade plant in the early stages of establishment, the cost incurred in the planting of banana suckers was considered. However, it was observed that after planting not much care was taken to cultivate it. In the case of inter crop pepper, the main costs incurred were those of harvesting, tying the pepper vines to the areca palm, drying, curing etc. Manuring, irrigation etc., were not done

separately for pepper since it is planted at the base of the areca palm. So, the costs of harvesting, tying the pepper vines, drying, curing etc., were accounted for computing the total operational cost incurred in the established gardens.

Thus, the establishment cost included the cost incurred in the first year, such as cost of levelling the land and after care operations and the maintenance cost till the garden comes to maturity (till the 7th year after planting). It also included the fixed costs on wells, pumpsets and other items till the 7th year of the orchard. The cost incurred on the intercrop banana during the early period of the areca gardens was also taken into account while computing the establishment cost of areca garden. The returns from banana till the 7th year of the areca garden was considered as cash inflows, during the period when there was no returns from the main crop. Thus, the cost incurred on the cultivation of areca palms and banana plants minus the returns from banana as well as arecanut, if any, till the 7th year totally constituted the actual cost of establishment of areca garden.

The costs incurred after 7th year till the 50th year of the garden including both maintenance and fixed cost formed the cash out flows during that period.

A general observation indicated that there was no much variation in the prices paid by different agencies engaged in marketing of arecanut. While computing the income, the actual price received by the grower was taken.

There are two cooperative marketing agencies in the taluk, viz., the Central Arecanut Marketing and Processing Cooperative Limited (CAMPCO) and the South Kanara Agriculturists' Cooperative Marketing Society (SKACMS). There are also a number of trader-middlemen operating in the taluk.

Arecanut is normally prepared as 'chali' (dry kernels). The growers generally make 3 classes in arecanut, viz., 1) clean unbroken well dried kernels without any epicarp attaching to the nuts considered as class first, 2) nuts which are broken or cracked and devoid of epicarp considered as class second, and 3) dried nuts with the epicarp attaching to them is grouped under class third. The price received for these classes were obtained from the grower along with the yield and the income received was computed. The yield and price received for pepper was also taken and thus the total income derived from the areca garden was computed.

Method of Analysis:

Many studies conducted earlier (Prest and Tarvey, 1965; Upton, 1967; Dalton, 1967; Gittinger, 1974) illustrated the usefulness of

discounted cash flow techniques in evaluating the long term projects in agriculture. Also in a few studies (George and Joseph, 1973; Gupta and George, 1974; Umakesan and Rajagopalan, 1978; Menon, 1979; Raghupathy et al., 1979; Venkataram, 1979; Shivarama, 1980); these techniques were successfully employed to evaluate the long term investment in agricultural projects. Hence, for evaluating the investment and to find out the feasibility and economic viability of investment in areca gardens a few measures of project evaluation by using the discounted cash flow technique was used. These techniques are advocated as an aid to evaluate and find out the worthiness of an investment, especially those of long term projects or enterprises.

The concept underlying in this technique is that, a rupee invested today is worth more than a rupee in future years. On the other hand, it is a process of finding the present worth of an amount received or paid out in the future. This technique has an advantage that, future variable cash flows are reduced to a single sum at one specific point of time, thereby facilitating comparison between alternatives.

The discounted cash flow measures used in the analysis were, net present worth (NPW), benefit-cost ratio (B : C ratio) and the internal rate of return (IRR). Besides these, the pay back period of the areca garden was also computed.

Net present worth: It is simply the present worth of net benefits of a project discounted at the opportunity cost of capital. The criterion assesses the present net worth of acrued benefits over costs. The criterion ranks the investments for selecting the alternatives. Generally, higher the net present worth, better would be the preference. In calculating the net present worth, the difference between the present value of the cost stream and present value of benefit stream were considered at a discount rate of 15 per cent. This is the rate that is being advocated by the World Bank for agricultural projects in developing countries. The general mathematical form of net present worth criterion is presented below:

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

Where, Bn = benefits in each year

Cn = Costs in each year

n = number of years

d = discount rate

In order to consider the project investment worthyness, the net present worth should be positive before the magnitude of alternative opportunities are considered.

2. Benefit - Cost ratio:

The ratio of discounted cash inflows (project benefits) to discounted cash out flows (project costs), which must be unity or more for an enterprice to be considered worthwhile. This technique also ranks the project investment for selection. The minimum ratio required is 1 : 1. This 1 : 1 indicates the coverage of costs without any surplus benefits. But usually the ratio has to be more than unity in order to provide some additional return over the costs for clear decision. The benefit-cost ratio can be stated mathematically as -

$$B : C \text{ ratio} = \frac{\sum_{1}^{n} \frac{Bn}{(1+d)^{n}}}{\sum_{1}^{n} \frac{Cn}{(1+d)^{n}}}$$

Where, Bn = benefits in each year

Cn = Costs in each year

n = number of years

d = discount rate.

3. Internal rate of return:

It is the rate of return which equates the discounted (or compounded) benefits with the discounted (or compounded) costs. In other words, it is the discount rate which equates the present worth of benefits to present worth of costs, that is, the net present worth

is zero. It represents the average earning capacity of an investment from the project.

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

Where, Bn = benefits or returns in each year

Cn = Costs in each year

n = number of years or life period of investment

d = discount rate.

The internal rate of return is arrived at through interpolation technique by using different discount rates so as to see that the net present worth is equated to zero. The project costs and returns/ benefits were discounted at opportunity cost of capital (15 per cent), in this study as explained earlier. The two discount rates used were 15 per cent and 30 per cent for determining the IRR. The 30 per cent discount rate was used to get a negative net present worth which is essential for mathematical interpolation to determine IRR. The interpolation formula employed in this study is as follows:

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

The internal rate of return was used to rank the different investment proposal. The highest value of IRR indicates the first, while the lowest value being the least choice of preference. However, the internal rate of return should be more than the discount rate being considered for selection.

4. Pay back period:

The pay back period is the length of time taken to liquidate the investment from the beginning of the project. In the analysis, the time taken for the recovery of the establishment cost incurred till the 7th year of the garden was considered as the pay back period. The pay back period was calculated by summing up all the net benefits over the years (without discounting) to make up the initial investment incurred during the first 7 years.

The following assumptions were made for calculating the net present worth, benefit-cost ratio and internal rate of return.

1. The economic life of the areca gardens was assumed to be 50 years.

2. The investment made in the first 7 years, that is, till the crop comes for economic bearing, was considered as establishment cost. The costs incurred from 8th year onwards were considered as operating costs. The fixed costs on wells, ponds, sprayers etc., with the operating costs in each year together formed the cash out flows.

3. The data from sample areca farmers were spread over 40 years of the orchard with some years gap. The age of the garden upto the 40th year was grouped into 8 groups of 5 years each and the actual averages of costs and returns was taken to arrive at the cost and return in each year. For the years for which the data was not available, it was assumed that the costs and returns do not change very much. This assumption was based on the data for the other years during the 5 years in each group. Further it was assumed that the cost remaining the same, while the returns decreased by 15 per cent during the period from 41st to 45th year and by 30 per cent during the period from 46th to 50th year of the orchard. This is justified since as the orchard becomes aged its yielding capacity decreases.

4. The life span of the fixed investments on pumpsets was considered to be 20 years and the apportioned costs of these items were added during the 1st, 21st and 41st year.

The life span of sprayers was taken to be 20 years and its cost was included in the 7th, 28th and 48th years.

The life span of wells and ponds was assumed to be same as that of the orchard.

The salvage value of the fixed investments on pumpsets and sprayers was added to the returns at the end of the project life if it has not completed the full life span.

5. The returns or the income generated in the garden over years from areca as well as pepper (inter crop) were recorded in monetary terms and these constituted the cash inflow of the project.

6. A discount rate of 15 per cent was assumed to be the opportunity cost of capital of the areca farmers and the stream of cash inflows and cash outflows was discounted at this rate.

Sensitivity Analysis:

Gittinger (1974) said that the careful economic and financial analysis of a project could be used to analyse the sensitivity of the project's internal economic or financial returns to the uncertainities such as increased costs or a fall in product prices. Rahim and Singh (1978) opined that risk and uncertainities could be handled by sensitivity analysis.

For the sensitivity analysis used in this study the costs were increased by 10 per cent and returns were decreased by 10 per cent and the net present worth, cost benefit ratio and internal rate of return were calculated by discounting the stream of cash flows at 15 per cent.

RESULTS

CHAPTER IV

RESULTS

The results of the study are presented in this chapter. The main objective of the study was to evaluate the investment in arecanut gardens in Dakshina Kannada district. The study was undertaken with the following specific objectives:

1. To estimate the recurring and non-recurring investment in different sizes of areca gardens.
2. To assess the economic feasibility and financial soundness of investment in areca gardens.
3. To evaluate the benefits of 'purfo' irrigation and conventional surface irrigation in areca gardens.

The results are presented in the following heads:

1. General characteristics of the sample
2. Investment in areca gardens
3. Average yield and returns
4. Investment evaluation
5. Employment potential
6. Comparison of conventional surface irrigation and 'purfo' irrigation in areca gardens.

1. General characteristics of the sample

The investigation covered 60 areca gardens in the five randomly selected villages of Puttur taluk in Dakshina Kannada district. Twenty gardens each in small, medium and large farm category were selected. The average size of the farm was 0.89 hectares, 1.88 hectares and 3.79 hectares (all in standard hectares, in terms of irrigated hectares) in small, medium and large farms, respectively. The average area under arecanut was 0.56 hectares in small size farms, 1.28 hectares in medium size farms and 2.29 hectares in large size farms. Hereafter the details will be mainly on areca gardens and for convenience the areca gardens under small farms will be referred as 'small garden' (0.56 hectares), under medium farms as 'medium garden' (1.28 hectares) and gardens under large farms as 'large garden' (2.29 hectares).

The average number of areca palms per garden were 683 (1219 per hectare), 1477 (1154 per hectare) and 2572 (1123 per hectare) in small, medium and large gardens, respectively. In majority of the gardens growing of inter crops was observed. The aftercare operations were same for both the main crop and the intercrop like pepper. Cocoa being recently introduced had not started to yield regularly. So, this inter crop was not considered for the analysis purpose. The other inter crops - banana and pepper were taken into account in the analysis. In small, medium and large gardens, 16, 15 and 18 gardens

had banana as inter crop and in 6, 10 and 14 gardens pepper was grown as inter crop respectively, in small, medium and large gardens.

For comparing the benefits of 'purfo' irrigation with conventional surface irrigation 15 sample areca gardens with 'purfo' irrigation method were selected. The average size of areca garden with 'purfo' irrigation method was 2.013 hectares and the average number of areca palms per garden was 2506 (1245 per hectare). The details are presented in Table 4.0.

2. Investment in areca gardens

Investment in areca garden was classified into establishment cost and operational cost. The cash expenses, labour cost and expenses on inputs were essential both for establishing the garden and thereafter to maintain the garden.

Establishment cost:

It included the labour and material cost for operations such as fencing the land, digging the pits, planting the seedlings, after-care operations during the first year and all the costs incurred to maintain the garden till it comes to bearing (7th year).

The details of cost of establishment for small gardens is presented in Tables 4.1 and 4.2. The total labour and input material cost was

Table 4.0

General characteristics of different categories of areca farms

Sl. No.	Particulars	Small	Medium	Large
	A. For investment evaluation			
1.	Number of sample farms	20	20	20
2.	Total area (standard hectare)	17.53	37.61	75.90
3.	Average size of holding (standard hectares)	0.89	1.88	3.79
4.	a) Total area under bearing arecanut (hectares)	8.95	22.79	40.85
	b) Total area under non-bearing arecanut (hectares)	2.35	2.81	4.87
	c) Total area under arecanut (hectares)	11.30	25.60	45.72
5.	Average area under arecanut (hectares)	0.56	1.28	2.29
6.	Average number of areca palms			
	a) per hectare	1219	1154	1123
	b) per garden	683	1477	2572
7.	Number of areca gardens with banana inter crop	16	15	18
8.	Average number of banana plants per hectare	476	372	512
9.	Number of gardens with pepper intercrop	6	10	14
10.	Average number of pepper vines per garden	40	127	367
	B. Areca gardens with 'purfo' irrigation			
1.	Number of sample farms	-	-	15
2.	Average size of holding (standard hectares)	-	-	5.04
3.	Average size of areca garden	-	-	2.013
4.	Average number of areca palms			
	a) per hectare	-	-	1245
	b) per garden	-	-	2506

Note: One standard hectare = 1 irrigated hectare = 2 dry hectares.

Table 4.1

Establishment cost for small gardens (per garden)

Particulars of operation	I year	II year	III year	IV year	V year	VI year	VII year	Total
A. Labour cost (in Rs.)								
1. Fencing the land	-	-	-	-	43.09	-	145.40	189.49
2. Line marking	16.37	-	-	-	-	-	-	16.37
3. Opening up drains + pits + closing the pits	579.13	-	-	-	-	-	-	579.13
4. Planting	220.32	-	-	-	-	-	-	220.32
5. Manuring and fertilizer application	358.39	151.41	213.27	175.42	161.59	199.36	193.88	1,453.32
6. Weeding	195.14	66.47	60.93	73.24	92.33	182.00	124.64	794.75
7. Cover digging	-	-	38.77	-	-	112.00	121.18	271.95
8. Cleaning and widening the drains	-	51.69	38.77	58.88	86.17	39.20	48.44	323.15
9. Developing irrigation channels	-	-	-	-	184.65	-	-	184.65
10. Irrigation	308.45	517.02	581.65	517.71	484.70	486.08	727.06	3,622.67
11. Providing shade	108.27	77.55	-	-	-	-	-	185.82
12. Plant protection	-	-	-	-	-	-	95.82	95.82
13. Harvesting, collecting, transporting to the drying yard	-	-	-	-	-	55.22	48.47	103.69
14. Spreading and drying	-	-	-	-	-	-	48.47	48.47
15. Dehusking	-	-	-	-	-	-	8.40	8.40
16. Cleaning, measuring, bagging etc.	-	-	-	-	-	-	24.24	24.24
Total	1786.07	864.14	933.39	825.25	1052.53	1073.86	1586.00	8,120.24 (64.73)
B. Material cost (in Rs.)								
1. Fencing material	-	-	-	-	138.48	-	-	138.48
2. Seedling material	692.16	-	-	-	-	-	-	692.16
3. Manures + FYM	399.93	336.52	363.53	310.29	230.81	315.00	346.22	2,302.30
4. Fertilizers	107.01	-	55.39	-	84.63	75.60	242.36	564.99
5. Plant Protection chemicals	-	-	-	-	-	-	211.19	211.19
6. Others	78.68	92.33	73.85	70.02	107.71	70.00	173.11	665.70
Total	1277.78	428.85	492.77	380.31	561.63	460.60	972.88	4,574.82 (35.27)
Total (A + B)	3064.85 (23.77)	1292.99 (10.23)	1426.16 (11.29)	1205.56 (9.54)	1614.16 (12.78)	1534.46 (12.14)	2558.88 (20.25)	12,697.06 (100.00)

Figures in paranthesis indicate the percentages to the total.

Table 4.2

Establishment cost for small gardens (per hectare)

Particulars	I year	II year	III year	IV year	V year	VI year	VII year	Total
A. Labour cost (in Rs.)								
1. Fencing the land	-	-	-	-	76.94	-	259.65	336.59
2. Line marking	29.23	-	-	-	-	-	-	29.23
3. Opening up drains, pits and closing the pits	1034.16	-	-	-	-	-	-	1034.16
4. Planting	393.43	-	-	-	-	-	-	393.43
5. Manuring and fertilizer application	639.98	270.38	380.84	813.25	288.52	356.00	346.22	2,595.19
6. Weeding	348.47	118.70	108.81	130.79	164.87	325.00	222.57	1,419.21
7. Cover digging	-	-	69.24	-	-	200.00	216.39	485.63
8. Cleaning and widening the drains	-	92.33	69.24	105.15	153.88	70.00	86.50	577.10
9. Developing irrigation channels	-	-	-	-	329.73	-	-	329.73
10. Irrigation	550.80	923.25	1038.66	924.49	865.55	868.00	1298.32	6,469.07
11. Providing shade	193.34	138.48	-	-	-	-	-	331.82
12. Plant protection	-	-	-	-	-	-	173.11	173.11
13. Harvesting, collecting, transporting to the drying yard	-	-	-	-	-	98.62	86.56	185.18
14. Spreading and drying	-	-	-	-	-	-	86.56	86.56
15. Dehusking	-	-	-	-	-	-	15.00	15.00
16. Cleaning, measuring, bagging etc.	-	-	-	-	-	-	43.28	43.28
Total	3189.41	1543.14	1666.99	1473.68	1879.49	1917.92	2834.16	14,504.29
B. Material cost (in Rs.)								
1. Fencing material	-	-	-	-	247.30	-	-	247.30
2. Seedling material	1236.00	-	-	-	-	-	-	1,236.00
3. Manures	607.01	600.94	649.16	554.09	412.17	562.50	618.25	4,004.12
4. Fertilizers	191.10	-	98.92	-	151.13	135.00	432.78	1,008.93
5. Plant Protection chemicals	-	-	-	-	-	-	377.13	377.13
6. Others	140.51	164.87	131.89	125.03	192.34	125.00	309.13	1,188.77
Total	2174.62	765.81	879.97	679.12	1002.94	822.50	1737.29	8,062.25
Total (A + B)	5364.03	2308.95	2546.96	2152.80	2882.43	2740.42	4571.45	22,567.04

Rs.12,637.06 per garden, out of which the total labour costs accounted for Rs.8,121.24 (64.73 per cent) and material costs of Rs.4574.82 (35.27 per cent) for the establishment period of first 7 years. The cost incurred during the first year of establishment accounted for 23.77 per cent (Rs.3,064.85 per small garden) and the maintenance cost till the 7th year remained almost unchanged ranging from 10 to 13 per cent except during the 7th year, when it increased to 20 per cent out of the total labour and material costs. The per hectare total cost of labour and materials came to Rs.22,567.04, of which the total labour cost was Rs.14,504.79 and the total material cost was Rs.8062.25 for 7 years.

The cost of establishment for medium gardens is given in Tables 4.3 and 4.4. The medium areca garden growers on an average invested Rs.26,779.01 per garden for establishing the garden. The labour cost incurred was Rs.16,038.75, which accounted for 59.89 per cent of the total labour and material cost, and the cost incurred on materials was Rs.10,739.86 (40.11 per cent). Of the 7 years of establishment, the first year claimed 28.72 per cent of the total cost. In the remaining years, the percentage share to the total cost varied from 10 to 14 per cent. The per hectare establishment cost in case of medium gardens came to Rs.20,920.55, while the total labour cost accounted for Rs.12,519.98 and the material cost was Rs.8390.57.

Table 4.3

Establishment cost for medium gardens (per garden)

Particulars of operation	I year	II year	III year	IV year	V year	VI year	VII year	Total
A. Labour cost (in Rs.)								
1. Fencing the land	675.29	-	-	-	32.58	-	-	707.87
2. Line marking	45.02	-	-	-	-	-	-	45.02
3. Opening up drains, pits and closing the pits	1575.68	-	-	-	-	-	-	1,575.68
4. Planting	225.10	-	-	-	-	-	-	225.10
5. Manuring and fertilizer application	337.65	388.29	374.09	383.23	387.30	358.40	379.85	2,608.81
6. Weeding	211.03	253.23	138.12	194.38	191.78	230.40	237.41	1,456.35
7. Cover digging	-	-	221.58	-	159.20	-	189.86	570.44
8. Cleaning the drains	-	105.51	100.72	109.99	121.04	89.60	75.97	602.63
9. Developing irrigation channels	-	-	-	-	260.68	-	-	260.68
10. Irrigation	562.74	1434.99	1007.18	1082.49	805.32	1075.20	1519.41	7,487.33
11. Providing shade	225.10	111.14	-	-	-	-	-	336.24
12. Plant protection	-	-	-	-	-	-	37.99	37.99
13. Harvesting, collecting, transporting to the drying yard	-	-	-	-	-	-	50.65	50.65
14. Spreading and drying	-	-	-	-	-	-	25.32	25.32
15. Dehusking	-	-	-	-	-	-	38.40	38.40
16. Cleaning, measuring, bagging etc.	-	-	-	-	-	-	10.24	10.24
Total	3857.61	2293.16	1841.69	1770.09	1957.90	1753.60	2565.10	16,038.75 (59.89)
B. Material cost (in Rs.)								
1. Fencing material	562.74	-	-	-	121.02	-	-	683.76
2. Seedlings	2110.29	-	-	-	-	-	-	2,110.29
3. Manures	703.44	580.33	719.42	628.76	586.53	711.68	712.23	4,642.39
4. Fertilizers	281.37	316.54	201.43	270.41	293.25	194.37	237.41	1,794.78
5. Plant protection	-	0	-	-	-	-	165.12	165.12
6. Others	175.85	211.03	215.82	204.35	186.20	192.00	158.27	1,343.52
Total	3833.69	1107.90	1136.67	1103.52	1187.00	1098.05	1273.03	10,739.86 (40.11
Total (A + B)	7691.30 (28.72)	3401.06 (12.70)	2978.36 (11.12)	2873.61 (10.72)	3144.90 (11.74)	2851.65 (10.65)	3838.13 (14.34	26,778.61 (100.00)

Figures in paranthesis indicate percentages to the total

Table 4.4

Establishment cost for medium gardens (per hectare)

Particulars of operation	I year	II year	III year	IV year	V year	VI year	VII year	Total
A. Labour cost (in Rs.)								
1. Fencing the land	527.57	-	-	-	25.45	-	-	553.02
2. Line marking	35.17	-	-	-	-	-	-	35.17
3. Opening up drains, pits and closing the pits	1231.00	-	-	-	-	-	-	1,231.00
4. Planting	175.86	-	-	-	-	-	-	175.86
5. Manuring and fertilizer application	263.79	303.35	292.26	299.40	302.58	280.00	296.76	2,038.14
6. Weeding	164.87	197.84	107.91	151.86	149.83	180.00	185.48	1,137.79
7. Cover digging	-	-	173.11	-	124.38	-	148.38	445.87
8. Cleaning the drains	-	82.43	78.69	85.23	94.56	70.00	59.35	470.26
9. Developing irrigation channels	-	-	-	-	203.66	-	-	203.66
10. Irrigation	439.64	1121.09	786.86	845.70	629.16	840.00	1187.04	5,849.49
11. Providing shade	175.86	86.83	-	-	-	-	-	262.69
12. Plant protection	-	-	-	-	-	-	29.68	29.68
13. Harvesting, collecting, transporting to the drying yard	-	-	-	-	-	-	39.57	39.57
14. Spreading and drying	-	-	-	-	-	-	19.78	19.78
15. Dehusking	-	-	-	-	-	-	30.00	30.00
16. Cleaning, measuring, bagging etc.	-	-	-	-	-	-	8.00	8.00
Total	3013.76	1791.54	1438.83	1382.19	1529.62	1370.00	2004.04	12,529.98
B. Material cost (in Rs.)								
1. Fencing material	439.64	-	-	-	94.55	-	-	534.19
2. Seedlings	1648.67	-	-	-	-	-	-	1,648.67
3. Manures	549.56	453.38	562.05	491.22	458.23	556.00	556.43	3,626.87
4. Fertilizers	219.82	247.30	157.37	211.26	229.12	151.85	185.48	1,402.20
5. Plant Protection chemicals	-	-	-	-	-	-	129.00	129.00
6. Others	137.39	164.87	168.61	159.65	145.47	150.00	123.65	1,049.64
Total	2995.08	865.55	888.03	862.13	927.37	857.85	994.56	8,390.57
Total (A + B)	6008.84	2657.09	2326.86	2244.32	2456.99	2227.85	2998.60	20,920.55

In the large areca gardens, the growers on an average invested Rs.47,337.31 per garden (Rs.20,672.07 per hectare) for establishing the garden. The results are presented in Tables 4.5 and 4.6. The share of total labour cost was 58.41 per cent (Rs.27,650.74 per garden and Rs.12,074.58 per hectare) and that of the total material cost was 41.59 per cent (Rs.19,686.57 per garden and Rs.8597.49 per hectare). Out of the total cost of establishment (labour + material cost) for 7 years, the first year of establishment was the major share with 34.00 per cent and the share of the remaining years varied from 7 to 15 per cent.

Thus, the cost of establishment in the first year was the highest share of the total establishment cost and the remaining amount was shared by the maintenance cost till the 7th year of establishment in all the size groups. The per hectare results indicated that growers with large gardens incurred a lower cost of Rs.20,672.07 than the medium gardens (Rs.20,920.55) and small gardens (Rs.22,567.04).

The investment on permanent items like wells, ponds and pumpsets which were incurred during the establishment period of the orchard is presented in Table 4.7. The small growers invested a total of Rs.4241.29 (Rs.7573.74 per hectare), while the medium growers invested Rs.11,477.26 (Rs.8966.61 per hectare) and the large growers invested Rs.16,784.16 (Rs.7329.33 per hectare) on permanent items. Out of the total investment on permanent items, investment on wells and ponds,

Table 4.5

Cost of establishment of large gardens (per garden)

Particulars of operation	I year	II year	III year	IV year	V year	VI year	VII year	Total
A. Labour cost (in Rs.)								
1. Fencing the land	1547.92	-	-	-	-	-	-	1,547.92
2. Line marking	115.78	-	-	-	-	-	-	115.78
3. Opening up of drains, pits and closing the pits	3322.40	-	-	-	-	-	-	3,322.40
4. Planting	584.68	-	-	-	-	-	-	584.68
5. Manuring and fertilizer application	805.42	702.23	913.18	571.24	441.72	528.55	515.34	4,477.68
6. Weeding	390.12	317.14	552.14	246.22	283.16	453.05	509.62	2,751.45
7. Cover digging	-	-	118.92	-	271.82	-	336.95	727.69
8. Cleaning the drains	-	188.76	325.61	86.17	169.89	158.66	99.08	1,028.17
9. Developing irrigation channels	251.69	-	-	-	-	-	-	251.69
10. Irrigation	1220.73	943.87	1762.65	1071.08	2038.74	1982.10	2378.53	11,397.70
11. Providing shade	481.99	377.55	-	-	-	-	-	859.54
12. Plant protection	-	-	-	-	-	-	181.23	181.23
13. Harvesting, collecting, transporting to the drying yard	-	-	-	-	-	52.85	118.92	171.77
14. Spreading and drying	-	-	-	-	-	52.85	39.64	92.49
15. Dehusking	-	-	-	-	-	34.35	106.20	140.95
16. Cleaning, measuring, bagging etc.	-	-	-	-	-	-	-	-
Total	8720.73	2529.55	3672.50	1974.71	3205.33	3262.41	4285.51	27,650.74 (58.41)
B. Material costs (in Rs.)								
1. Fencing material	1132.63	-	-	-	-	-	-	1,132.63
2. Seedlings	3647.97	-	-	-	-	-	-	3,647.97
3. Manures	1352.86	1038.24	1005.22	738.68	764.54	1132.63	1203.42	7,235.59
4. Fertilizers	845.69	377.55	460.13	590.93	736.21	566.31	849.47	4,426.29
5. Plant Protection chemicals	18.87	-	-	-	-	-	878.92	897.79
6. Others	377.52	283.16	353.94	246.22	424.75	377.55	283.16	2,346.30
Total	7375.54	1698.95	1819.29	1575.83	1925.50	2076.49	3214.97	19,686.57 (41.59)
Total (A + B)	16096.27 (34.00)	4228.50 (8.93)	5491.79 (11.60)	3550.54 (7.50)	5130.82 (10.84)	5338.90 (11.28)	7500.48 (15.85)	47,337.31 (100.00)

Figures in the paranthesis indicate percentages to the total

Table 4.6

Cost of establishment for large gardens (per hectare)

Particulars of operation	I year	II year	III year	IV year	V year	VI year	VII year	Total
A. Labour costs (in Rs.)								
1. Fencing the land	675.95	-	-	-	-	-	-	675.95
2. Line marking	50.56	-	-	-	-	-	-	50.56
3. Opening up drains, pits and closing the pits	1450.83	-	-	-	-	-	-	1,450.83
4. Planting	255.32	-	-	-	-	-	-	255.32
5. Manuring and fertilizer application	351.71	306.65	398.77	249.45	192.89	230.81	225.04	1,955.32
6. Weeding	170.36	138.49	241.11	107.52	123.65	197.84	222.57	1,201.54
7. Cover digging	-	-	51.93	-	118.70	-	147.14	317.77
8. Cleaning the drains	-	82.43	142.19	37.63	74.19	69.24	43.27	448.95
9. Developing irrigation channels	109.91	-	-	-	890.28	-	-	1,000.19
10. Irrigation	533.07	412.17	769.72	467.72	-	865.55	1038.66	4,086.89
11. Providing shade	210.48	164.87	-	-	-	-	-	375.35
12. Plant protection	-	-	-	-	-	-	79.14	79.14
13. Harvesting, collecting and transporting to the drying yard	-	-	-	-	-	23.08	51.93	75.01
14. Spreading and drying	-	-	-	-	-	23.08	17.31	40.39
15. Dehusking	-	-	-	-	-	15.00	46.37	61.37
16. Cleaning, measuring, bagging etc.	-	-	-	-	-	-	-	-
Total	3808.19	1104.61	1603.72	862.32	1399.71	1424.60	1871.43	12,074.58
B. Material costs (in Rs.)								
1. Fencing material	494.60	-	-	-	-	-	-	494.60
2. Seedlings	1593.71	-	-	-	-	-	-	1,593.71
3. Manures	590.77	453.38	438.96	322.57	333.86	494.60	525.51	3,159.65
4. Fertilizers	369.30	164.87	200.93	258.05	321.49	247.30	370.95	1,932.89
5. Plant Protection chemicals	8.24	-	-	-	-	-	383.81	392.05
6. Others	164.86	123.65	154.56	107.52	185.48	164.87	123.65	1,024.59
Total	3221.48	741.90	794.45	688.14	840.83	906.77	1403.92	8,597.49
Total (A + B)	7029.67	1846.57	2398.17	1550.46	2240.54	2331.37	3275.35	20,672.07

Table 4.7

Investment on permanent items in areca gardens (in rupees)

Sl. No.	Particulars	Small gardens		Medium gardens		Large gardens	
		Per garden	Per hectare	Per garden	Per hectare	Per garden	Per hectare
1.	Wells, ponds etc.	1930.39 (45.50)	3447.13	6126.12 (53.40)	4786.03	8711.43 (51.90)	3804.12
2.	Pumpset and pumphouse	2144.42 (50.50)	3829.32	4791.15 (41.70)	3743.09	7483.67 (44.60)	3267.98
3.	Sprayers	166.48 (4.00)	297.29	559.99 (4.90)	437.49	589.06 (3.50)	257.23
	Total	4241.29 (100.00)	7573.74	11477.26 (100.00)	8966.61	16784.16 (100.00)	7329.33

Figures in paranthesis indicate percentages to the total

pumpsets and pumphouses, and sprayers accounted for 45.50 per cent, 50.50 per cent and 4.0 per cent, respectively in small gardens; 53.40 per cent, 41.70 per cent and 4.9 per cent respectively in medium gardens and 51.9 per cent, 44.60 per cent and 3.5 per cent, respectively in large gardens.

The cost incurred for banana intercrop during the establishment period of areca garden is given in Table 4.8. Since banana was planted mainly to provide shade to the young arecanut plants, not much care was provided after it was planted. The cost of planting banana during the first year was Rs.203.74 (Rs.363.82 per hectare), Rs.253.24 (Rs.197.84 per hectare) for medium gardens and Rs. 990.95 (Rs.432.73 per hectare) for large gardens.

The total cost of establishment including the labour cost, material cost, costs on permanent items and the cost incurred for banana was Rs.17,041.09 (Rs.30,505.09 per hectare) for small gardens, Rs.38,509.51 (Rs.30,085.00 per hectare) for medium gardens and Rs.66,097.33 (Rs.28,864.22 per hectare) for large gardens (Table 4.9). The establishment cost during the first year which includes labour and material costs, investment on permanent items like wells, ponds, pumpsets and the cost of banana inter crop was Rs.7479.17 (Rs.13,302.69 per hectare), Rs.19,421.80 (Rs.15,173.29 per hectare) and Rs.33,856.20 (Rs.14,791.73 per hectare) for small, medium and large gardens,

Table 4.8

Cost and returns from inter crop of banana and return from areca during the period of establishment of areca gardens (rupees per garden)

Particulars	I year	II year	III year	IV year	V year	VI year	VII year	Total
1. Cost of planting of banana for								
small gardens	203.74 (363.82)	-	-	-	-	-	-	203.74 (363.82)
Medium gardens	253.24 (197.84)	- -	-	-	-	-	-	253.24 (197.84)
Large gardens	990.95 (432.73)	-	-	984.91 (430.09)	-	-	-	1,975.86 (862.82)
2. Returns from banana								
Small gardens	409.16 (730.65)	461.62 (824.33)	784.76 (1401.36)	523.85 (935.45)	461.62 (824.33)	533.81 (953.23)	517.74 (924.53)	3,692.56 (6593.86)
Medium gardens	844.12 (659.47)	926.08 (723.50)	1151.06 (899.27)	973.76 (760.75)	977.56 (763.72)	974.51 (761.34)	947.78 (740.45)	6,794.87 (5308.49)
Large gardens	2768.66 (1209.02)	8775.43 (1648.66)	1557.38 (680.08)	1600.46 (698.89)	2831.58 (1236.50)	1468.58 (641.30)	1649.14 (720.15)	15,651.23 (6834.60)
3. Return from areca								
Small gardens	-	-	-	-	-	842.13 (1503.80)	3325.27 (5937.99)	4,167.40 (7441.79)
Medium gardens	-	-	-	-	-	2173.00 (1697.66)	5865.66 (4582.55)	8,038.66 (6280.21)
Large gardens	-	-	-	-	-	5098.23 (2226.30)	11093.06 (4844.14)	16,191.29 (7070.43)

Figures in the paranthesēs indicate rupees per hectare

Table 4.9

Total establishment cost (Rs.) of areca gardens

Sl. No.	Particulars	Small garden		Medium garden		Large garden	
		Per garden	Per hectare	Per garden	Per hectare	Per garden	Per hectare
1.	Total labour cost in the first year	1786.07	3189.41	3857.61	3013.76	8720.73	3808.19
2.	Total labour cost in the remaining years	6335.17	11315.38	12181.54	9516.22	18930.01	8266.39
3.	Total labour cost	8120.24	14504.79	16039.15	12529.98	27650.74	12074.58
4.	Total material cost in the first year	1218.78	2175.53	3833.69	2995.08	7375.54	3221.48
5.	Total material cost in the remaining years	3297.04	5887.21	6906.17	5395.49	12311.03	5376.01
6.	Total material cost	4575.82	8062.74	10739.86	8390.57	19686.57	8597.49
7.	Investment on permanent items	4241.29	7573.74	11477.26	8966.61	16784.16	7329.33
8.	Cost incurred for banana	203.74	363.82	253.24	197.84	1975.86	862.82
9.	Total establishment cost in the first year (1+4+7+8)	7449.88	13302.50	19421.80	15173.29	34856.29	14791.73
10.	Maintainance cost in the remaining years (2+5)	9632.21	17202.59	19087.71	14911.71	31241.04	13642.40
11.	Total establishment costs (9 + 10)	17081.09	30505.09	38509.51	30085.00	66097.33	28864.22

respectively. This accounted for 43.61 per cent, 50.43 per cent and 51.24 per cent of the total establishment cost for 7 years period for small, medium and large gardens in that order. The remaining amount was the maintenance cost till the 7th year after planting.

The total establishment cost for the period of 7 years in case of large gardens was higher by Rs.27,587.82 than medium gardens and Rs.49,016.04 higher than small gardens. On per hectare basis, the large gardens had slightly lower investment for establishment than small and medium gardens. Even during the period of establishment (first 7 years) of the areca gardens, it was observed that a little income was possible from the banana inter crop and from areca particularly during the 6th and 7th year. The average total returns (gross returns) realised from banana accounted for Rs.3692.56 (Rs.6593.86 per hectare) among small, Rs.6794.87 (Rs.5308.49 per hectare) among medium and Rs.15,651.23 (Rs.6834.60 per hectare) among large areca farmers for the period of 7 years. The average gross returns from areca during the 6th and 7th years were Rs.4167.40 (Rs.7441.79 per hectare) in small gardens, Rs.8038.66 (Rs.6280.21 per hectare) in medium gardens and Rs.16,191.29 (Rs.7070.43 per hectare) in large gardens (Table 4.9).

Operational costs:

The operational cost of bearing areca garden included the various cultivation costs such as, cost of labour for cultural operations, cost of inputs used, cost of maintenance of permanent items like wells, ponds and machinery, and other costs incurred in each year after the garden comes to regular bearing.

The four types of costs used in computing the operational cost are:

A. Cost of labour employed for cultural operations

B. Cost of inputs (material cost)

C. Other expenses like land revenue, transportation cost, marketing charges, maintenance of permanent items etc.

D. Cost of cultivation of inter crop in the gardens with pepper as inter crop.

Total cost of labour for cultural operations is presented in Table 4.10. On an average, a labour cost of Rs.2271.92, Rs.4506.38 and Rs.9194.10 was incurred by small, medium and large gardens, respectively. The per hectare labour costs were Rs.4057.03, Rs.3520.59 and Rs.4014.89, respectively among small, medium and large gardens. Generally, the labour cost for irrigation had the maximum share in all the three size groups and it was 32.62 per cent, 31.65 per cent and 28.26 per cent of the total labour cost in small, medium

Table 4.10

Particulars of annual labour cost incurred in cultivation of bearing areca gardens

Particulars	Small gardens		Medium gardens		Large gardens	
	Per garden	Per hectare	Per garden	Per hectare	Per garden	Per hectare
A. Labour cost						
1. Cover digging	92.91 (4.09)	165.91	178.79 (3.97)	139.68	337.59 (3.67)	147.42
2. Widening & cleaning of drains	30.86 (1.36)	55.10	78.03 (1.73)	60.96	128.03 (1.39)	55.91
3. Weeding	96.54 (4.25)	172.39	224.93 (4.99)	175.13	620.34 (6.75)	270.89
4. Manuring & fertilizer application	285.65 (12.57)	510.09	575.64 (12.77)	449.72	1759.50 (19.14)	768.34
5. Fencing & maintainance	50.57 (2.23)	90.31	77.43 (1.72)	60.49	125.68 (1.37)	54.88
6. Plant protection	122.47 (5.39)	218.71	268.68 (5.96)	209.91	676.63 (7.36)	295.47
7. Irrigation	741.20 (32.62)	1323.57	1426.12 (31.65)	1114.16	2598.37 (28.26)	1134.66
8. Harvesting						
a)Picking the naturally fallen nuts	151.24 (6.66)	270.08	271.85 (6.03)	212.38	396.93 (4.32)	173.33
b)harvesting	73.40 (3.23)	131.07	126.23 (2.80)	98.62	270.47 (2.94)	118.11
c)Collecting & transporting to drying yard	122.35 (5.39)	218.49	205.91 (4.57)	160.84	523.61 (5.70)	228.65
9. Spreading & arranging and drying	54.33 (2.39)	97.02	103.91 (2.31)	81.18	302.76 (3.29)	132.21
10. Dehusking	139.60 (6.14)	249.28	375.99 (8.34)	293.74	684.23 (7.44)	298.79
11. Cleaning, sorting measuring etc.	51.33 (2.26)	91.67	115.42 (2.56)	90.17	228.95 (2.49)	99.98
12. Watch & Ward	259.47 (11.42)	463.34	477.41 (10.59)	372.98	541.01 (5.88)	236.25
Total	2271.92 (100100)	4057.03	4506.38 (100.00)	3520.59	9194.10 (100.00)	4014.89

Figures in paranthesis are percentages to total

and large gardens, respectively. The manuring and fertilizer application is one of the main cultural operations. It accounted, out of the total labour cost, for 12.57 per cent among small, 12.77 per cent among medium and 19.14 per cent among large gardens. Plant protection, out of the total labour cost, had a share of 5.39 per cent, 5.96 per cent and 7.36 per cent in small, medium and large gardens, respectively. The remaining amount in the labour cost was shared by operations such as weeding, cover digging, post harvest operations and others.

The total material (input) cost among small, medium and large gardens was Rs.1388.08 (Rs.2478.73 per hectare), Rs.2980.31 (Rs.2328.37 per hectare) and Rs.5223.99 (Rs.2281.22 per hectare), respectively (Table 4.11). Of this, the cost of farm yard manure, ash and green leaves accounted for a maximum percentage of 28.08, 38.10, and 34.17 for small, medium and large gardens, respectively, indicating it as the major input in areca gardens. This was followed by the material cost like plant protection chemicals, fertilizers, irrigation charges and others in the three size groups of gardens.

The other expenses were Rs.529.83 (Rs.946.12 per hectare) in small gardens, Rs.1512.91 (Rs.1186.96 per hectare) in medium gardens and Rs.3236.95 (Rs.1413.51 per hectare) in large gardens (Table 4.11). These costs included interest on borrowed capital, maintenance cost for pumpsets, wells, ponds etc., and land revenue paid.

Table 4.11

Annual material cost and other expenses incurred in bearing areca garden

Particulars	Small gardens		Medium gardens		Large gardens	
	Per garden	Per hectare	Per garden	Per hectare	Per garden	Per hectare
B. Material cost						
1. Fencing material	42.07 (3.03)	75.13	35.53 (1.19)	37.75	54.36 (1.04)	23.74
2. Green leaves	108.89 (7.84)	194.45	223.26 (7.49)	174.42	283.43 (5.43)	123.77
3. Farm yard manure	392.79 (28.30)	701.42	847.49 (28.44)	662.10	1375.19 (26.32)	600.52
4. Ash	26.88 (1.94)	48.00	64.58 (2.17)	50.45	126.18 (2.42)	55.10
5. Fertilizers	212.39 (15.30)	379.26	634.85 (21.30)	495.98	1181.27 (22.65)	515.84
6. Plant protection chemicals	368.25 (26.53	657.59	670.78 (22.50)	524.05	1461.55 (27.98)	638.23
7. Irrigation charges	166.05 (11.96)	296.57	342.94 (11.51)	267.92	553.36 (10.59)	241.64
8. Gunny bags	29.81 (2.15)	53.24	81.98 (2.75)	64.05	77.93 (1.49)	34.03
9. Miscellaneous	40.95 (2.95)	73.13	78.91 (2.65)	61.55	110.72 (2.12)	48.35
Total	1388.08 (100.00)	2478.73	2980.31 (100.00)	2328.37	5223.99 (100.00)	2281.22
C. Other expenses						
1. Land revenue	35.20 (6.64)	62.86	65.10 (4.30)	50.86	121.28 (3.75)	52.96
2. Transportation cost	110.23 (20.80)	196.84	193.65 (12.80)	151.25	348.22 (10.76)	152.06
3. Marketing charges	97.26 (18.36)	173.67	577.72 (38.19)	451.34	1382.27 (42.70)	603.61
4. Interest on borrowed capital	197.33 (37.25)	352.38	493.54 (32.62)	385.58	952.46 (29.42)	415.92
5. Maintenance cost for wells, tanks, pumpsets etc.	89.91 (16.95)	160.37	182.90 (12.08)	142.89	432.72 (13.37)	188.96
Total	529.83 (100.00)	946.12	1512.91 (100.00)	1181.96	3236.95 (100.00)	1413.51
Total cost (A+B+C)	4189.83	7481.88	8999.60	7030.92	17655.04	7709.62

Figures in the parentheses are percentages to total

Thus, the total operational cost for a bearing areca gardens included (a) labour costs, (b) material costs, and (c) other expenses and accounted for Rs.4189.83 (Rs.7481.88 per hectare), Rs.8999.50 (Rs.7030.92 per hectare) and Rs.17,655.04 (Rs.7709.62 per hectare), among small, medium and large gardens, respectively. Out of the total cost, the labour cost was the highest amount forming 54.42 per cent, 50.07 per cent and 52.08 per cent, respectively, for small, medium and large gardens.

The growers who had areca gardens with pepper as an inter crop incurred an additional cost of Rs.47.50 (Rs.84.82 per hectare) in small gardens, Rs.91.30 (Rs.71.33 per hectare) in medium gardens and Rs.164.22 (Rs.69.49 per hectare) in large gardens, for harvesting, tying the vines, drying and cleaning and transportation (Table 4.13).

3. Average yield and returns in areca gardens

The yield and returns are presented in the Table 4.12. The total costs does not include the depreciation on permanent items like wells, ponds, pumpsets and machinery. Hence, the net returns represent the returns after deducting the cash costs of production from the gross returns.

Arecanut is generally marketed in the form of dried kernels in the district. Further, the dried kernels are classified into 3 classes

Table 4.12

Yield and returns of areca gardens

Particulars	Small garden		Medium garden		Large garden	
	Per garden	Per hectare	Per garden	Per hectare	Per garden	Per hectare
A. yield (dried kernels in kg)						
Class I*	850.47	1518.69	1939.66	1515.36	3501.98	1529.25
Class II	199.06	355.47	511.95	399.96	1060.91	263.28
Class III	53.75	95.98	111.18	86.86	205.18	89.60
Total	1103.28	1970.14	2562.53	2001.98	4768.07	2082.13
B. Value by sale (Rs.)						
Class I	11312.97	20201.73	27184.33	21238.34	56949.20	24861.72
Class II	1690.16	3018.14	4531.12	3539.94	9656.40	4217.10
Class III	301.17	537.17	634.84	495.96	1149.21	510.93
Total	13304.30	23757.68	32350.29	25274.24	67754.81	29588.75
C. Average price realised per kg(Rs.)						
Class I	-- 13.30 --		-- 14.01 --		-- 16.26 --	
Class II	-- 8.49 --		-- 8.85 --		-- 9.10 --	
Class III	-- 5.60 --		-- 5.71 --		-- 5.60 --	
D. Value of the quantity used for home consumption (Rs.)	90.00	160.72	154.56	120.67	219.22	95.73
Total Returns (B+D)	13394.30	23918.40	32504.75	25394.91	67974.03	29684.48
Total cash costs of production (in Rs.)	4189.63	7481.88	8999.60	7030.92	17655.04	7709.62
Net Returns (in Rs.)	9204.47	16436.52	23505.15	18363.99	50318.99	21974.86

*The details of Class I, II & III refer to the different qualities of dry kernels of arecanut and is explained in the text.

Table 4.13

Cost and returns from pepper in areca gardens

Particulars	Small garden		Medium garden		Large garden	
	Per garden	Per hectare	Per garden	Per hectare	Per garden	Per Hectare
Costs						
1. Harvesting, tying the pepper vine, cleaning, drying etc.	41.67	77.41	81.60	63.75	144.43	63.07
2. Transportation cost	5.83	10.41	9.70	7.58	19.77	6.42
Total cost (in Rs.)	47.50	84.82	91.30	71.33	164.22	69.49
Yield and Returns						
1. Total yield (kg)	40.33	72.02	82.00	64.06	181.07	79.07
2. Price per kg	-- 13.19 --		-- 14.29 --		-- 14.30 --	
3. Gross returns (in Rs.)	532.00	950.00	1172.00	915.63	2604.29	1137.24
4. Net returns (in Rs.)	484.50	865.18	1080.70	844.30	2440.07	1064.75

based on their quality, viz., Class I, Class II and Class III. The properly dried, clean and unbroken nuts without any epicarp attaching to the nuts are classified as Class I, dried nuts which are cracked or broken and devoid of epicarp are grouped under Class II and dried nuts with epicarp attaching to them are classified as Class III.

The average yield of arecanut in small gardens was 1103.28 kg (1970.14 kg per hectare) of which 850.47 kg (1518.69 kg per hectare) was of Class I, 199.06 kg (356.47 kg per hectare) was of Class II, and 53.75 kg (95.78 kg per hectare) was of Class III. In the case of medium gardens which realised a higher total average yield per hectare, the yield of arecanut per garden was 2562.53 kg (2001.98 kg per hectare). Out of this, the Class I accounted for 1939.66 kg (1515.36 kg per hectare), Class II for 511.95 kg (399.96 kg per hectare), and Class III for 111.18 kg (86.86 kg per hectare). The yield among large gardens was the highest among the three size groups which was 4768.07 kg (2082.13 kg per hectare). Out of this, the share of Class I, II and III were 3501.98 kg (1529.25 kg per hectare), 1060.91 kg (463.28 kg per hectare) and 205.18 kg (89.60 kg per hectare) respectively. Thus, the per hectare total yield in large garden was 80.15 kg more than that of medium garden and 111.99 kg more than the small garden.

The average price realised per kg for different classes of areca in different size groups also varied. Among the three size groups, the growers with large gardens realised the highest price per kg for the first two classes of arecanut. Areca large farmers realised a price of Rs.16.26, Rs.9.10 and Rs.5.60 per kg for Class I, Class II and Class III, respectively; the medium areca growers received Rs.14.01, Rs.8.85, and Rs.5.70 per kg for the three classes and the small areca farmers received a slightly lower price of Rs.13.30, Rs.8.49 and Rs.5.60 per kg for the three classes of arecanut. Because of this variation in yield and price received per kg, the total value realised from the sale of areca also varied among different sizes of areca gardens. The total value realised by large areca growers was the highest at Rs.67,754.81 (Rs.29,588.75 per hectare) followed by medium areca growers at Rs.32,350.29 (Rs.25,274.24 per hectare) and Rs.13,304.30 (Rs.23,757.68 per hectare) by small areca growers. Thus, the results showed that the large areca growers got Rs.4314.51 and Rs.5831.07 per hectare more than the medium and small growers, respectively.

The value of arecanut quantity used for home consumption accounted for Rs.90.00 (Rs.160.72 per hectare), Rs.154.46 (Rs.120.67 per hectare) and Rs.219.22 (Rs.95.73 per hectare) for small, medium and large gardens, respectively.

The net returns from areca, which is the difference between gross returns and operational costs, was highest in case of large gardens with Rs.50,318.99 (Rs.21,974.86 per hectare) followed by medium gardens with Rs.23,505.15 (Rs.18,363.99 per hectare) and the small gardens with Rs.9204.47 (Rs.16,436.52 per hectare).

In addition to the net returns from main crop of arecanut, the small, medium and large gardens with inter crop pepper realised an additional net return of Rs.484.50 (Rs.865.18 per hectare), Rs.1080.70 (Rs.844.30 per hectare) and Rs.2440.07 (Rs.1064.75 per hectare), respectively.

4. Investment evaluation in areca gardens

To evaluate the feasibility of investment in areca gardens, the evaluation criteria such as net present worth, benefit-cost ratio, internal rate of return and pay back period were employed. Analysis was done both on per garden and per hectare basis in each size groups and the results are presented in Table 4.14.

Net present worth:

The difference between the present value of costs and returns gives the net present worth of investment in areca gardens. The net present worth was Rs.10,171.78, Rs.28,362.72 and Rs.59,538.43 for

Table 4.14

Investment evaluation in areca gardens

Size of the garden	Total discounted costs for 50 years		Total discounted returns for 50 years	
	Per garden	Per hectare (in Rs.)	Per garden	Per hectare (in Rs.)
Small	23,509.35	41,981.45	33,681.13	60,145.45
Medium	49,553.43	38,714.36	77,916,15	60,871.85
Large	89,883.63	39,250.49	1,49,422.06	65,249.80

Size of the garden	Net present worth (Rs.)		Benefit-cost ratio	Internal rate of return (%)	Pay back period
	Per garden	Per hectare			
Small	10,171.78	18,164.00	1.43	26.28	10
Medium	28,362.72	22,157.49	1.57	26.68	11
Large	59,538.43	25,999.31	1.66	27.53	10
Sensitivity analysis on investment in areca gardens*					
Small	4,535.99	8,099.98	1.17	19.95	11
Medium	15,425.93	12,051.51	1.28	21.39	11
Large	35,588.66	15,540.90	1.35	22.48	11

*10 per cent increase in costs and 10 per cent decrease in returns.

small, medium and large areca gardens, and on per hectare basis the net present worth was Rs.25,999.31 for large farmers followed by Rs.22,157.49 for medium farmers and Rs.18.164.00 for small farmers. The net present worth was positive in all the cases, which clearly indicates that the investment in areca gardens is a feasible proposition. However, in terms of ranking, large farmers ranked first followed by medium and small farmers in that order.

Benefit-cost ratio:

This criterion indicates the returns per rupee invested in the areca gardens. The benefit-cost ratio was 1.43, 1.57, and 1.66 for small, medium and large gardens, respectively. The results showed that investment in big gardens was more profitable than the other two size groups. However, since all the size groups had a benefit-cost ratio of more than unity, it can be concluded that the investment in areca gardens is financially sound and economically feasible.

Internal rate of return:

This criterion measures the rate of return that can be earned by investing in areca gardens. The investment and consequent returns are considered in this criterion. This technique has been indicated as important and scores over other techniques of evaluation, since, it considers the reinvestment opportunities which are absent in other techniques.

The internal rate of return was 26.28 per cent, 26.68 per cent and 27.53 per cent, respectively for small, medium and large gardens. Thus, the large gardens stand first in earning capacity, followed by medium and small gardens in that order. However, in all the size groups of areca gardens investment was found to be feasible since the internal rate of return was more than 15 per cent, which is the rate of return expected in agriculture as per the specification of the World Bank. Thus, the investment in areca gardens was found feasible with priority to large gardens as indicated above.

Pay back period:

The period taken to repay the initial investment on establishment of the orchard (the cost upto 7th year after planting) was 10 years, 11 years and 10 years for small, medium and large gardens, respectively.

Sensitivity analysis:

The cost flow was increased by 10 per cent and returns flow was decreased by 10 per cent and then the evaluation criteria were used to test the feasibility of investment. This was done mainly to accommodate certain margin for risks and uncertainities in areca investments. The results of sensitivity analysis showed that the investment in areca gardens was economically feasible and financially sound.

5. Employment potential in areca gardens:

Arecanut enterprise plays an important role in providing employment for rural people in the Dakshina Kannada district. The gardens provide work almost throughout the year, since various operations need to be carried out in all the three seasons of the year. The labourers employed are almost permanent except those skilled who are required only for operations like spraying, harvesting and dehusking the dried nuts. Since some of the operations like dehusking and watch and ward were done on contract basis, the actual labour required for these operations was difficult to obtain and was excluded from the total labour requirement. The operation-wise labour use on different gardens is presented in Table 4.15.

The total labour employment in man-days in small, medium and large gardens were 253.14, 469.11 and 1122.39, respectively. Out of the total labour employed, the irrigation claimed the lion's share with 40.43 per cent in small and medium gardens and 33.13 per cent in large gardens. The skilled labour employed for spraying and harvesting in areca gardens was 9.72 (3.86 per cent), 18.52 (3.94 per cent) and 45.98 (4.09 per cent) man days, respectively, in small, medium and large gardens. The per hectare labour employment was highest in large gardens (490.13 man days) followed by small gardens (454.15 man days) and medium gardens (366.49 man-days).

Table 4.15

Labour employment in arecanut gardens (man-days)

Particulars	Small garden		Medium garden		Large garden	
	Per garden	Per hectare	Per garden	Per hectare	Per garden	Per hectare
1. Cover digging	12.81 (5.06)	22.88	23.71 (5.05)	18.52	49.66 (4.41)	21.60
2. Widening & cleaning the drains	4.75 (1.83)	8.48	9.59 (2.04)	7.49	18.34 (1.63)	8.01
3. Weeding	13.47 (5.32)	24.06	30.52 (6.51)	23.84	92.99 (8.28)	40.61
4. Manuring and fertilizer application	48.02 (16.60)	75.03	76.07 (16.22)	59.49	262.32 (23.37)	114.55
5. Fencing and maintainance	7.06 (2.79)	12.61	10.32 (2.20)	8.06	17.79 (1.59)	7.77
6. Plant protection						
a) skilled	4.60 (1.82)	8.21	9.78 (2.00)	7.64	25.19 (2.24)	11.00
b) unskilled	9.10 (3.59)	16.25	17.57 (3.75)	13.73	51.53 (4.59)	22.50
7. Irrigation	102.34 (40.42)	182.85	189.64 (40.43)	148.16	371.90 (33.13)	162.40
8. Harvesting						
a) Removing the naturally fallen nuts	20.88 (8.25)	37.29	36.57 (7.79)	28.57	59.40 (5.29)	25.94
b) Harvesting (skilled)	5.12 (2.02)	9.15	8.74 (1.86)	6.83	20.79 (1.85)	9.08
c) Collecting & transporting to drying yard	16.80 (6.64)	30.00	2757 (5.88)	21.54	76.35 (6.80)	33.34
9. Spreading, arranging and drying	7.18 (2.84)	12.83	13.80 (2.94)	10.78	43.72 (3.90)	19.09
10. Cleaning, sorting, measuring, bagging etc.	7.01 (2.77)	12.51	15.23 (3.25)	11.90	32.61 (2.91)	14.24
Total	253.14 (100.00)	454.15	469.11 (100.00)	366.49	1122.39 (100.00)	490.13
11. For intercrop pepper: Harvesting, tying the vine, cleaning, drying of pepper	5.66	10.11	11.00	8.67	20.78	9.07

12. Average wage rate for man labour (unskilled) Rs.7.17 per day
13. Average wage rate paid for woman labour: Rs.5.60 per day
14. Wage rate for skilled labour per day ranged from Rs.12 to 15.

Figures in parantheses indicate the percentage to the total.

The labour man days utilized for pepper intercrop in small, medium and large areca gardens was 5.66 (10.11 per hectare), 11.10 (8.67 per hectare) and 20.78 (9.07 per hectare), respectively.

6. A comparison of 'purfo' irrigation and conventional surface irrigation in areca gardens:

In the surface irrigation systems, water is made to flow in the channels in between the alternative rows of areca palms and water is splashed manually to the either sides of the channel. In the 'purfo' irrigation system, water is pumped through the perforated pipes and made to sprinkle uniformly on the land. The only additional cost involved in 'purfo' irrigation is the investment on perforated pipes. This type of irrigation system or method minimises the soil erosion and facilitates uniform irrigation throughout the garden. Thus, the land can retain the moisture for a longer period if water is made to sprinkle through perforated pipes.

All the 15 sample areca farmers with 'purfo' irrigation were large farmers with an average size of 2.013 hectares of areca gardens.

The investment on permanent items in the gardens with 'purfo' irrigation and surface irrigation is given in Table 4.16. The total investment on permanent items like wells, ponds, pumpsets, sprayers came to Rs.29,454.66 (Rs.14,727.29 per hectare) in the gardens with

Table 4.16

Investment on permanent items in areca gardens with 'purfo' and surface irrigation (Rs.)

Sl. No.	Particulars	'Purfo' irrigation		Surface irrigation	
		Per garden	Per hectare	Per garden	Per hectare
1.	Wells, ponds etc.	8690.24	4345.12	8711.43	3804.12
2.	Pumpset & pump house	7005.09	3502.50	7483.67	3267.98
3.	Sprayers	709.33	354.67	589.06	257.23
4.	Perforated pipes, valves etc.	13050.00	6525.00	-	-
	Total	29454.66	14727.29	16784.16	7329.33

'purfo' irrigation and Rs.16,784.16 (Rs.7329.33 per hectare) in the gardens with conventional surface irrigation*. Pumpsets and other permanent investments finding a place in both types of gardens, the extra investment on 'purfo' irrigation is the investment on the purforated pipes and valves. This accounted for Rs.13,050.00 per garden (Rs.6025.00 per hectare) in case of 'purfo' irrigation.

The annual cost of irrigation in the two methods of irrigation is presented in Table 4.17. The annual cost of irrigation included the fixed costs such as depreciation on machinery and other permanent items, interest on fixed and working capital and the annual variable costs like operation and maintenance cost of pumpsets and machinery, perforated pipes, wells, ponds, labour charges for irrigation and irrigation charges.

The total fixed costs per garden in the 'purfo' irrigated gardens was Rs.5415.44 (Rs.2694.85 per hectare), out of which, the interest on fixed and variable capital accounted for 66.22 per cent. The depreciation on permanent items accounted for 33.78 per cent. Considering the life span of perforated pipes to be 10 years, the annual depreciation on it was Rs.1306.00 per garden. The total annual variable cost was

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* Since the garden with 'purfo' irrigation comes under the 'large garden' size group, here the comparison is made with large areca gardens with surface irrigation which had an average size of 2.29 hectares.

Table 4.17

Annual cost of purfo and surface irrigations (in Rupees)

Sl. No.	Particulars	'Purfo' irrigation		Surface irrigation	
		Per garden	Per hectare	Per garden	Per hectare
A.	Fixed costs				
1.	Depreciation on machinery				
	a) Pumpset	350.26	175.12	374.18	176.26
	b) Pipes (perforated)	1305.00	656.50	-	-
2.	Depreciation on wells, ponds etc.	173.80	70.05	174.23	76.08
3.	Interest on fixed capital (10.5%)	1648.01	824.00	1762.34	759.08
4.	Interest on working capital (13.5%)	1938.37	969.18	2200.68	960.72
	Sub-Total	5415.44	2694.85	4511.43	1972.14
B.	Annual variable costs:				
1.	Maintainance of				
	a) Wells & ponds and pumpsets	372.13	186.07	432.72	188.96
	b) Perforated pipes	121.67	60.84	-	-
2.	Labour charges for irrigation	529.33	264.67	2598.37	1134.66
3.	Irrigation charges	597.33	298.67	553.36	241.64
	Sub-Total	1620.46	810.25	3584.45	1565.26
	Total cost	7035.90	3505.10	8095.88	3537.40

Rs.1620.46 (Rs.810.25 per hectare), of which, the labour charges for irrigation accounted for 32.66 per cent and irrigation charges for 36.86 per cent. The remaining 31.48 per cent was constituted by the cost of maintenance of machinery and wells or ponds. Thus, the annual cost of 'purfo' irrigation came to Rs.7035.90 per garden (Rs.3505.10 per hectare).

The growers with the conventional surface irrigation method incurred a total irrigation cost of Rs.8095.88 (Rs.3537.40 per hectare). In that, the fixed cost component accounted for Rs.4511.43 per garden (Rs.1972.14 per hectare) and annual variable costs accounted for Rs.3584.45 (Rs.1565.26 per hectare). The annual fixed cost was slightly less than that of gardens with 'purfo' irrigation, whereas the annual variable costs was higher than that of 'purfo' irrigated gardens. The other costs being almost the same for both methods and the only difference that accounted for higher annual variable cost in case of gardens with surface irrigation was the labour charges for irrigation. The labour charge for irrigation in the 'purfo' irrigated garden was only Rs.264.67 per hectare, while it was Rs.1134.66 per hectare in the case of surface irrigated gardens. Thus, labour cost for irrigation was higher by Rs.869.99 per hectare with conventional surface irrigation than with 'purfo' irrigation.

The annual cost of cultivation for gardens with the two types of irrigation is given in Tables 4.18 and 4.19. The comparison of per hectare labour cost for different operations indicated a considerable difference in the labour cost for irrigating the areca garden. The labour costs for irrigation was Rs.264.67 per hectare with 'purfo' irrigation, while it was Rs.1134.66 per hectare in the case of surface irrigation. The total labour costs per hectare was Rs.3207.44 for 'purfo' irrigation and Rs.4014.89 for conventional surface irrigation. Thus, the labour cost was higher by Rs.807.45 per hectare in surface irrigated gardens than 'purfo' irrigation method.

The growers on an average incurred a total material cost of Rs.5275.03 (Rs.2637 per hectare) and Rs.5223.99 (Rs.2281.22 per hectare) in 'purfo' irrigation and surface irrigation, respectively. Out of this, the share of irrigation charge was slightly high (11.32 per cent) in the case of 'purfo' irrigated gardens than surface irrigated gardens (10.50 per cent).

The total other expenses which included the items such as land revenue, transportation cost, marketing charges, maintainance charges, depreciations on permanent items and interest on capital, both fixed and working, are presented in Table 4.19. The total other expenses was more in the case of 'purfo' irrigation (Rs.3947.94 per hectare)

Table 4.18

Annual labour cost of cultivation with surface irrigation and purfo irrigation in areca (Rs.)

Particulars	Purfo irrigation		Surface irrigation	
	Per garden	Per hectare	Per garden	Per hectare
1. Cover digging	366.67	183.34	337.59	147.42
2. Widening and cleaning the drains	75.07	37.54	128.03	55.91
3. Weeding	574.67	287.34	620.34	270.89
4. Manuring & fertilizer application	1348.93	674.46	1759.50	708.34
5. Fencing & maintainance	575.63	287.82	676.63	295.47
6. Plant protection	575.63	287.82	676.63	295.47
7. Irrigation	529.33	264.67	2598.37	1134.66
8. Harvesting				
a) Picking the naturally fallen nuts	402.33	201.17	396.93	173.33
b) Harvesting (skilled)	259.60	129.80	270.47	118.11
c) Collecting & transporting to the yard	564.53	282.26	523.61	228.65
9. Spreading, arranging and drying	180.20	90.10	302.76	132.21
10. Dehusking	671.50	335.75	684.23	298.79
11. Cleaning, sorting, measuring, bagging etc.	233.07	116.54	228.95	99.98
12. Watch and Ward	516.67	258.34	541.01	236.25
Total	6414.87	3207.44	9194.10	4014.89

Table 4.19

Annual material cost and other expenses with purfo and surface irrigations in areca gardens (in Rs.)

Particulars	Purfo irrigation		Surface irrigation	
	Per garden	Per hectare	Per garden	Per hectare
Material cost:				
1. Fencing material	-	-	54.36	23.74
2. Green leaves + FYM	1814.10 (34.39)	907.05	1658.62 (28.74)	724.29
3. Fertilizers	1394.33 (26.43)	697.17	1181.27 (27.93)	515.84
4. Ash	-	-	126.18 (2.42)	55.10
5. Plant protection chemicals	1261.98 (23.92)	630.97	1461.55 (27.93)	638.23
6. Irrigation charges	597.33 (11.32)	298.67	553.36 (10.59)	241.64
7. Gunny bags	100.67 (1.91)	53.84	77.93 (1.49)	34.03
8. Miscellaneous	106.67 (2.02)	53.34	110.72 (2.12)	48.35
Total	5275.03 (100.00)	2637.54	5223.99 (100.00)	2281.22
Other expenses:				
1. Land revenue	83.10	41.55	121.28	52.96
2. Transportation cost	353.67	176.84	348.22	152.06
3. Marketing charges	1467.72	733.86	1382.27	603.61
4. Interest on borrowed capital	-	-	952.46	415.92
5. Maintainance of wells, pumpsets etc.	372.13	186.07	432.72	188.96
6. Maintainance cost for perforated pipes	121.67	60.84	-	-
7. Depreciation on pumpset and sprayers	385.73	195.92	403.63	176.26
8. Depreciation on wells, tanks	173.80	70.05	174.23	76.08
9. Depreciation on perforated pipes	1305.00	652.50	-	-
10. Interest on fixed capital (at 10.5%)	1722.48	861.33	1762.34	759.08
11. Interest on working capital (at 12.35%)	1938.00	969.18	2200.68	960.72
Total	7923.67	3947.94	7777.83	3385.65

than in surface irrigation (Rs.3385.65 per hectare) and it was due to the extra amount of depreciation on perforated pipes in 'purfo' irrigation.

The total cost of cultivation including the labour cost, material cost and other expenses accounted for Rs.19,613.57 per garden with 'purfo' irrigation system (Rs.9792.92 per hectare) and Rs.22,195.92 per garden with conventional surface irrigation (Rs.9681.76 per hectare).

The areca growers with pepper as inter crop incurred an additional cost of Rs.221.66 (Rs.110.66 per hectare) for 'purfo' irrigation and Rs.164.22 (Rs.69.49 per hectare) for conventional surface irrigation (Table 4.20).

The yield and returns from arecanut with 'purfo' and conventional surface irrigation are presented in Table 4.21. The total average yield of arecanut (dried kernels) was 4785.00 kg per garden (2377.05 kg per hectare) and 4768.07 kg per garden (2082.13 kg per hectare), in the 'purfo' and conventional surface irrigation, respectively. On per hectare basis the yields were better by 294.92 kg in the 'purfo' irrigation system than the conventional surface irrigation system. The total returns were Rs.70,240.58 (Rs.34,893.48 per hectare) and Rs.67,754.81 (Rs.29,588.75 per hectare) in 'purfo' and conventional

Table 4.20

Cost and returns from pepper in the gardens with surface and 'purfo' irrigations (in Rs.)

Particulars	Purfo irrigation		Surface irrigation	
	Per garden	per hectare	Per garden	Per hectare
Costs				
1. Harvesting, cleaning, drying the seeds and tying the pepper vines	190.83	94.75	144.43	63.07
2. Transportation cost	30.83	15.31	19.79	6.42
Total	221.66	110.06	164.22	69.49
Yield and returns				
1. Total yield (kgs)	303.33	150.68	181.07	79.07
2. Value got (Rs.)	4289.09	2130.69	2604.29	1137.24
3. Price realised per kg	--	14.14 --	--	14.38 --
4. Net returns (Rs.)	4067.43	2020.63	2432.97	1067.75

Table 4.21

Yield and returns from areca in the gardens with 'purfo' and surface irrigations

Particulars	Purfo irrigation		Surface irrigation	
	Per garden	Per hectare	Per garden	Per hectare
A. Yield: (Dried kernels in kgs)				
Class I	3715.00	1845.50	3501.98	1529.25
Class II	931.67	462.83	1060.91	463.28
Class III	138.33	68.72	205.18	89.60
Total yield	4785.00	2377.05	4768.07	2082.13
B. Value got at the time of sale (in Rs.)				
Class I	61274.33	30439.31	56949.20	24869.72
Class II	8161.67	4054.48	9656.40	4217.10
Class III	804.58	399.69	1149.21	501.93
Total value	70240.58	34893.48	67754.81	29588.75
C. Average price realised per kg (in Rs.)				
Class I	-- 16.49 --		-- 16.26 --	
Class II	-- 8.77 --		-- 9.10 --	
Class III	-- 5.78 --		-- 5.60 --	
D. Value of the quantity used for home consumption (in Rs.)	220.00	109.29	219.22	95.73
E. Total Returns: (B + D) (in Rs.)	70460.58	35002.77	67974.03	29684.48
F. Total average cost of production (in Rs.)	19613.57	9792.92	22195.92	9681.76
G. Net Returns (Rs.)	50847.01	25209.85	45778.11	20002.72

surface irrigation systems, respectively. Thus, the total net returns were Rs.50,847.01 (Rs.25,209.85 per hectare) in 'purfo' method and Rs.45,778.11 (Rs.20,002.72 per hectare) in the conventional surface irrigation method.

The inter crop pepper yielded an additional net returns of Rs.4067.43 (Rs.2020.63 per hectare) and Rs.2432.97 (Rs.1067.75 per hectare) in the 'purfo' irrigation system and conventional surface irrigation system, respectively (Table 4.20).

The labour employment in the two types of gardens is presented in Table 4.22. The labour employed was less for irrigation by 'purfo' irrigation method with 37.44 man days per hectare out of the total of 345.46 man days per hectare in the garden and thus, constituting about 10.34 per cent of the total labour employed in the garden. While in surface irrigation system the labour employment for irrigation was 162.40 man days per hectare out of the 490.13 man days per hectare in the garden forming 33.13 per cent of the total labour employed. The labour employed for other operations remained almost same without much difference among the two types of irrigation gardens. The additional labour man days employed for the inter crop amounted to 26.58 man days (13.20 per hectare) and 20.78 man days (9.07 per hectare) in the gardens with pepper in 'purfo' and conventional surface irrigation systems, respectively.

Table 4.22

Labour employment in areca gardens with 'purfo' and surface irrigations (in man-days)

Particulars	Purfo irrigation		Surface irrigation	
	Per garden	Per hectare	Per garden	Per hectare
1. Cover digging	48.42 (6.96)	24.05	49.46 (4.41)	21.60
2. Widening and cleaning the drains	11.40 (1.64)	5.66	18.34 (1.63)	8.01
3. Weeding	82.81 (11.91)	41.14	92.99 (8.28)	40.61
4. Manuring and fertilizer application	192.85 (27.73)	95.80	262.32 (23.79)	114.55
5. Fencing & maintainance	16.67 (2.40)	8.28	17.79 (1.59)	7.77
6. Plant protection:				
a) Skilled	21.00 (3.02)	10.43	25.19 (2.24)	11.00
b) Unskilled	42.80 (6.15)	21.26	51.53 (4.59)	22.50
7. Irrigation	75.88 (10.34)	37.44	371.90 (33.13)	162.40
8. Harvesting				
a) Picking up the naturally fallen nuts	56.00 (8.05)	27.81	59.40 (5.29)	25.94
b) Harvesting (skilled)	18.80 (2.70)	9.34	20.79 (1.85)	9.08
c) Collecting and transporting to the drying yard	80.15 (11.52)	39.81	76.35 (6.80)	33.34
9. Spreading, arranging and drying	25.20 (3.62)	12.52	43.72 (3.90)	19.09
10. Cleaning, sorting, measuring, bagging etc.	24.00 (3.45)	11.92	32.61 (2.91)	14.24
Total	695.48 (100.00)	345.46	1122.89 (100.00)	490.13
11. For inter crop, pepper: Harvesting, tying the pepper vines, cleaning, drying the pepper etc.	26.58	13.20	20.78	9.07
Total	722.06	358.66	1143.17	499.20

Figures in paranthesis give percentage to the total

DISCUSSION

CHAPTER V

DISCUSSION

The results of the investigation made with a sample of 20 each of small, medium and big areca growers and a sample of 15 farmers with 'purfo' irrigation system are discussed in this chapter. The main objective of the study as stated earlier was to examine the feasibility of investment in areca and economics of 'purfo' irrigation system in areca gardens. The presentation of discussion has been organised as below:

1. Establishment cost
2. Operational cost
3. Yield and returns in areca gardens
4. Feasibility of investment in areca gardens
5. Employment potential
6. Comparison of gardens with 'purfo' and conventional surface irrigation methods.

1. Establishment cost

The first 7 years of the areca gardens, which is considered to be the 'gestation period' of the garden, during which time huge capital is needed to establish the orchard till the bearing period,

was considered as an establishment period of the garden. The capital costs which included the labour costs to plant the garden, after care operations in the first year, the material costs, such as cost of seedlings and other inputs in the first year, the cost incurred for both labour and material to maintain the garden in the successive years till the 7th year and the cost of banana inter crop in the early stages of areca garden were considered to arrive at the total establishment cost of areca gardens. Initially the growers have to have huge capital investment on permanent items such as wells, ponds, pumpsets to irrigate and other machinery needed for other operations in the gardens and the share of these items of expenditures are included under establishment cost.

The amount of investment for establishment varied among the size groups. It is quite evident that as the areca area in gardens increases, the cost of establishment also increases. Hence, the growers with large gardens required a higher capital to establish than medium and small gardens.

The total establishment cost (Table 4.9) in the case of large gardens was Rs.66097.38 per garden which was higher by Rs.27,587.82 per garden than medium gardens (Rs.38,509.51 per garden) and Rs.48,956.29 higher per garden than small gardens (Rs.17,041.09 per garden). Since garden size and costs are directly proportional,

costs per hectare of the garden in different size groups were analysed to have better information of the managerial ability of growers as well as economies of scale.

The per hectare total establishment cost was the highest in the case of small gardens with Rs.30,505.09 followed by the medium gardens with Rs.30,085.00 and the least being among large gardens with Rs.28,864.22. The economic principle operating here is the 'economy of scale' which is mainly responsible for the less costs per hectare in the case of large gardens. This could also be observed in case of different components of the establishment cost among the three size of gardens.

The per hectare total labour cost accounted for the maximum amount in the total establishment cost (43.61 per cent, 50.43 per cent and 51.24 per cent) in small, medium and large gardens, respectively.. In the case of small gardens, for the period of first 7 years the growers incurred a total labour cost of Rs.14,504.79 per hectare (Rs.8121.24 per garden) which was higher than that of medium gardens cost of Rs.12,529.98 per hectare (Rs.16,039.15 per garden) and large gardens cost of Rs.12,074.58 per hectare (Rs.27,650.74 per garden). Out of the total labour cost for first 7 years, the first year had the major share of 21.99 per cent, 24.05 per cent and 31.54 per cent in small, medium and large gardens, respectively. The high per centage

of labour costs in the first year was mainly because of inclusion of labour cost for planting and after care operations unlike in the subsequent years after first year where only after care operations were included. The labour cost for maintaining the garden till the 7th year ranged from 9 to 20 per cent in each year in each size groups. The per hectare planting costs included the line marking, opening up of drains and pits, closing the pits and planting the seedlings in the first year and this accounted for Rs.1457.09, Rs.1442.00 and Rs.1726.71 for small, medium and large gardens, respectively. The small, medium and large gardens had 1219, 1154 and 1123 areca palms per hectare, respectively. Thus, the planting cost per areca plant in the three size groups was Rs.1.19, Rs.1.25, and Rs.1.54, in small, medium and large gardens, respectively. The planting cost per areca plant was higher in the large gardens and is probably due to the fact that majority of the growers in this size group did the operations like opening up drains, pits and closing the pits on contract basis, for which the grower had to pay a little higher charges. Out of the total labour cost, irrigation claimed the highest share of 44.63, 47.74 and 39.90 per cent, in small, medium and large gardens, respectively, thus indicating it as one of the important after care operations.

The per hectare total material cost was the highest in large gardens followed by medium and small gardens with Rs.8597.49 (Rs.19,686.57 per garden) in large gardens, Rs.8390.57 (Rs.10,739.86

per garden) in medium gardens and Rs.8062.74 (Rs.4515.02 per garden) in small gardens. Of the total per hectare material cost of inputs, manures and fertilizers together mainly accounted for a maximum amount of Rs.5013.05, Rs.5029.07 and Rs.5092.54, respectively in small, medium and large gardens. Even though the growers in all the size groups incurred almost the same amount on these items, it is interesting to note that the small growers incurred more on manures and green leaves than the other two size groups. The medium and large growers used more of fertilizers than the small growers. This may be due to the purchases of fertilizers which included cash costs, while the manure and green leaves were produced mostly on the farms.

The first year of establishment cost accounted for 26.97 per cent, 25.69 per cent and 37.46 per cent of the total material cost for the period of first 7 years, in small, medium and large gardens, respectively. The remaining percentage amount was utilized for maintaining the garden till the 7th year. The higher cost in medium and large gardens was due to the fencing of the gardens done in the first year, unlike the small gardens who did this during the fifth year. The cost of seedling material used was also more in the medium and large gardens than small gardens.

The investment on permanent items such as wells, ponds, pumpsets and machinery which are necessary since arecanut is mostly an irrigated

crop and highly sensitive for drought conditions. The total involvement on permanent items (Table 4.7) was the highest in large gardens (Rs.16,784.16 per garden) followed by medium gardens (Rs.4477.26 per garden) and small gardens (Rs.4241.16 per garden). It may be indicated that the small gardens required a comparatively smaller wells/ponds and pumpsets with a lower capacity than medium and large gardens who required bigger or more number of wells, ponds and pumpsets of higher capacity. However, the per hectare analysis revealed that investment on permanent items in large gardens was the lowest with Rs.7529.33 followed by small gardens with Rs.7573.74 and medium gardens with Rs.8966.61 and is probably due to the operation of scale economies in areca gardens.

Banana was considered to be the main inter crop in the areca garden during the period of establishment and was planted mainly to provide shade to the young areca plants. Generally, not much care was given for banana after its planting. The per hectare costs incurred on planting banana during the first year came to Rs.462.72 in large, Rs.342.32 in medium and Rs.197.84 in small gardens (Table 4.8). The establishment cost for pepper inter crop was not considered, as pepper is not usually planted in the initial stages of areca gardens. It is planted in the later stages after areca palms attain 15 to 20 feet height. However, the annual costs and returns of bearing pepper vines were included for computing the annual cost of cultivation in the bearing areca gardens.

Thus, of the total establishment cost for first 7 years, the investment during the first year of establishment which included as indicated earlier, the labour and material cost in the first year, cost on permanent items and cost of planting banana came to Rs.7449.17 (Rs.13,302.09 per hectare), Rs.19,421.80 (Rs.15,173.29 per hectare) and Rs.33,871.38 (Rs.14,791.73 per hectare), in small, medium, and large gardens, respectively (Table 4.9).

The investment incurred after the second year till the 7th year to maintain the garden added upto Rs.9632.12 (Rs.17,202.59 per hectare), Rs.19,087.71 (Rs.14,911.71 per hectare) and Rs.31,241.04 (Rs.13,642.40 per hectare) in small, medium and large gardens, respectively.

The variation in the above discussed components of establishment cost, viz., the investment during the first year which included the labour and material costs during the first year, investment on permanent items and the cost of planting banana inter crop and the cost incurred to maintain the young areca gardens from second year till the bearing stage (7th year) contributed to the variation in the total establishment cost for the period of first 7 years.

A little amount of income was realised by the growers during the establishment period of areca gardens from banana inter crop and arecanut (particularly in the 6th and 7th year from areca). The small,

medium and large gardens realised a gross return of Rs.3692.56 (Rs.6593.86 per hectare), Rs.6794.87 (Rs.5308.49 per hectare) and Rs.15,651.23 (Rs.6834.60 per hectare) in the respective gardens from banana inter crop. Besides, a small amount of Rs.4367.40 (Rs.7441.79 per hectare), Rs.8038.66 (Rs.6280.21 per hectare) and Rs.16,191.29 (Rs.7070.42 per hectare), respectively in small, medium and large gardens was realised from areca during the 6th and 7th years (Table 4.8). This return from banana and areca facilitated the growers to meet part of the total establishment cost incurred in areca gardens.

2. Operational cost:

Generally, the areca gardens in the study area start regular bearing of arecanut from 8th year of planting. The costs incurred in the cultivation of bearing areca garden was considered as the operational cost and included cash costs on a) labour and other operations, b) cost of inputs, c) other expenses incurred, and d) the cost of cultivation of pepper inter crop, every year from 8th year onwards.

The total labour and other operational costs were Rs.2271.92 for small, Rs.4506.38 for medium and Rs.9194.10 for large gardens (Table 4.10) and thus accounting for 53.62 per cent, 49.57 per cent and 51.60 per cent of the total operational cost for small, medium and large gardens, respectively. This clearly reflects that in all

the three size groups of gardens, the cultural operations were being carried out with almost the same intensity. This is further justified based on the per hectare labour costs which were Rs.4057.03, Rs.3520.59 and Rs.4014.89 in small, medium and large gardens, respectively. Thus, it can be inferred that there is not much difference in the per hectare labour cost incurred in small and large gardens. However, the costs in medium gardens were a little lower than small and large gardens.

The results indicated that the labour cost for irrigation had the highest share in the total labour costs which accounted for 32.62 per cent (Rs.1323.57 per hectare), 31.05 per cent (Rs.1114.16 per hectare) and 28.26 per cent (Rs.1134.66 per hectare) for small, medium and large gardens, respectively. The method of irrigation followed was the conventional surface irrigation which generally required 4 to 5 labourers for each irrigation in the areca farms. Irrigation was done once in 6 to 8 days for 6 to 7 months in the year (December to June). The labour use (Table 4.15) for irrigation was 182.85, 148.16 and 162.40 mandays per hectare, in small, medium and large gardens, respectively. The cost of labour per irrigation was Rs.37.62, Rs.31.83 and Rs.32.42 for small, medium and large gardens, respectively, based on an average of 30 irrigations.

Growers with large areca gardens incurred more labour cost for application of manures and fertilizers (19.14 per cent) followed by

medium gardens (12.74 per cent) and small gardens (12.57 per cent) and is probably because that the large gardens used a larger quantities of manures and fertilizers than the other two size groups. It is interesting to note that there was not much difference in the per hectare labour costs incurred for other cultural operations among the three size groups.

The growers on an average invested a material cost of Rs.2478.73, Rs.2328.37 and Rs.2281.22, respectively in the small, medium and large gardens per hectare for cultural operations (Table 4.11). The share of the total material cost in the total operational cost was 33.13 per cent in small, 33.12 per cent in medium and 29.59 per cent in large gardens. Of this, the cost incurred on green leaves and farm yard manure accounted for 38.08, 38.10 and 34.17 per cents in small, medium and large gardens, respectively, indicating that these were the major inputs used in all the three size groups. It may be noted that the small gardens used more of green leaves and farm yard manure per hectare than the medium and large gardens. The per hectare cost was Rs.895.87, Rs.836.52 and Rs.724.29, respectively in small, medium and large gardens.

The investment in fertilizers was Rs.379.26 (15.30 per cent) Rs.495.98 (21.30 per cent) and Rs.515.84 (22.61 per cent) per hectare in small, medium and large gardens, respectively, thus revealed that the large and medium gardens growers purchased more of fertilizers.

Areca palms are susceptible for the attack of pests and diseases. The 'Koleroga of arecanut' has been the major disease which may result in a loss of 30 to 40 per cent yield. Hence, growers took enough care to prevent this deadly disease. The cost incurred on the plant protection chemicals (especially lime and copper sulphate sulphate which are used to prepare bordeaux mixture) was obviously as high as Rs.657.59 (26.53 per cent), Rs.524.05 (22.50 per cent) and Rs.638.23 (27.98 per cent) per hectare, in small, medium and large arecanut orchards, respectively.

The other expenses (Table 4.11) such as land revenue, transportation cost, marketing charges, maintenance cost for permanent items and interest on borrowed capital accounted for Rs.946.12, Rs.1181.96 and Rs.1413.51 per hectare in small, medium and large gardens, respectively and thus formed 12.65 per cent, 16.81 per cent and 18.33 per cent of the total cost in small, medium and large gardens, respectively. The total other expenses incurred by the large growers was the highest followed by medium and small growers. Majority of the areca farmers borrowed either short term or medium term loan or both (Appendix 2), and the interest amount paid on these loans was one of the major items in the other expenses. On an average, small growers paid Rs.197.33, medium growers Rs.493.54 and large growers Rs.952.46 as interest amount per garden and it constituted 37.25 per cent, 32.62 per cent and 29.42 per cent of the total other expenses, respectively in the three size groups.

The per hectare marketing charges were the highest in large gardens at Rs.603.61 (42.70 per cent) followed by medium gardens at Rs.451.34 (38.59 per cent) and small gardens at Rs.173.67 (18.30 per cent). Majority of the small growers sold their produce to the local merchants and hence no marketing charges were paid, while the medium and large growers marketed their produce through the cooperative societies and paid a commission charge of 2 per cent as marketing charges. The transportation cost and other costs did not show any difference among the three size groups.

Thus, the total operational cost which included the labour cost, material cost and other expenses was the highest per hectare in the large gardens with Rs.7709.62 (Rs.17,655.04 per garden) followed by the small gardens with Rs.7481.88 (Rs.4189.83 per garden) and the medium gardens with Rs.7030.92 (Rs.8999.50 per garden). Even though the per hectare operational costs varied slightly among the different size groups of areca farms, the difference was not much and hence it could be inferred that size of the garden had no much influence on the total operational cost incurred every year. The results of this study are in confirmation with the findings of Muddappa (1967) in the cost of cultivation of coffee.

The additional cost incurred in the areca gardens with pepper as an inter crop varied among the size groups. Pepper is being

planted near the base of the areca palms and utilizes the nutrients and moisture supplied to the main crop. Hence, the extra cost is in terms of cost of harvesting, tying the pepper vines to the palm (to avoid falling) and transportation cost. This accounted for a small amount of Rs.41.67, Rs.81.60 and Rs.144.43 per garden in small, medium and large gardens, respectively.

3. Yield and returns in areca garden:

The net returns here represent the return after deducting the cash costs of production from the gross return. The gross return was obtained by multiplication of yield (in kgs) and average price per kg. However, the cost does not include the depreciation on permanent items. The yield and returns are presented in Table 4.12 in Chapter IV.

The average total yield was the highest in large gardens with 2082.13 kgs per hectare followed by medium gardens with 2001.13 kg per hectare and small gardens with 1970.14 kg per hectare. Despite the fact that the number of palms were lesser in large gardens (1123 per hectare) and medium gardens (1154. per hectare) than the small gardens (1219 per hectare), the yield obtained was more per hectare in large and medium gardens than the small gardens. It may be indicated that the variation in yields was due to the variation in

the use of manures and fertilizers in small, medium and large gardens. The cost incurred per palm on manures and fertilizers was Rs.1.20, Rs.1.15, and Rs.1.08 respectively in large, medium and small gardens.

The average market price realised varied among the three size groups for all the three classes of dried kernels. The large growers received Rs.2.25 per kg more price for Class I arecanut than the medium growers and Rs.2.96 per kg more than the small growers. The medium growers realised a higher price of Rs.0.71 per kg than the small growers. These differences in prices may be due to the capacity of the medium and large growers to store the arecanut for a longer period, as old (or choll) arecanuts fetch a higher price than that of 'arecanut new'[1]. Generally, the 'arecanut old' fetches a higher price because of well dried and good quality. Further the storing of arecanut (after drying properly) in the closed godowns imparts a special aroma to the nuts. However, the variations in the price realised for the other two classes (Classes II and III) was not much among small, medium and large growers.

It is obvious that the variation in prices and yields resulted in the variation in the gross returns realised by the growers. The

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[1] Arecanuts are classified in the market as 'old (or choll)' and 'New' based on the stored time. If the fresh arecanuts (dried kernels) are marketed in the same season of harvest it is called 'arecanut new' and if marketed in the next season it is called 'arecanut old (or choll)'.

growers with large gardens realised a net return of Rs.50,318.99 (Rs.21,974.86 per hectare), medium gardens Rs.23,505.15 (Rs.18,363.99 per hectare) and small gardens Rs.9204.47 (Rs.16,436.62 per hectare). The per hectare net returns of large growers were more by Rs.3610.87 than medium growers, and Rs.5538.34 than the small growers.

The growers with pepper as an inter crop realised from pepper an additional net returns of Rs.484.50 (Rs.865.18 per hectare), Rs.1080.70 (Rs.844.30 per hectare) and Rs.2440.07 (Rs.1064.75 per hectare) in small, medium and large gardens, respectively (Table 4.13). The variation in the additional net return was due to the variation in the number of pepper vines in the different size groups of gardens.

4. Feasibility of investment:

In calculating the net present worth (NPW), benefit-cost ratio (B : C ratio) and internal rate of return (IRR), the establishment cost, operational cost and the gross returns were considered. In addition the pay back period for the orchard was also calculated. The analysis was done both on per garden and per hectare basis for each size group (Table 4.14).

The results revealed that, the total discounted investment over the life period of 50 years was Rs.89,883.63 (Rs.39,250.49 per hectare)

for large gardens, Rs.49,553.43 (Rs.38,714.36 per hectare) for medium gardens and Rs.23,509.35 (Rs.41,981.45 per hectare) for small gardens. Thus, the per hectare discounted investment in small gardens over the life period of 50 years was the highest, followed by large gardens and medium gardens. Variation was also observed in the total benefits realised by different size groups. Large gardens realised the highest total benefits with respect to both per garden and per hectare at Rs.1,49,422.66 per garden and Rs.65,249.80 per hectare, medium gardens realised a total benefit of Rs.77,916.15 (Rs.60,871.85 per hectare), and the small gardens realised a total benefit of Rs.33,681.13 per garden (Rs.60,145.45 per hectare) over 50 years of life span. Thus, the total benefits per hectare were higher in the case of large gardens by Rs.4377.95 and Rs.5104.35 than the medium and small gardens, respectively.

Net present worth:

The large areca gardens indicated the highest net present worth both on per garden and per hectare basis, and were Rs.59,538.43 per garden and Rs.25,999.31 per hectare, followed by the medium gardens (Rs.28,362.72 per garden and Rs.22,157.49 per hectare) and small gardens (Rs.10.171.78 per garden and Rs.18,164.00 per hectare). Since, the NPW was positive in all the categories, it can be inferred that investment in areca gardens is sound in general (irrespective of the

size group). However, for future investments, the priority of preference would be large gardens, medium gardens and small gardens in that order.

Benefit-cost ratio:

The B : C ratios were 1.43, 1.57 and 1.66 for small, medium and large gardens, respectively. The discounted B : C ratio indicates the net return per rupee of investment in projects or enterprises. The magnitude of the ratio also indicates the priority to be assigned for each of the alternative investment choice. Thus, it can be inferred that the investment in the large gardens should be the first priority followed by medium and small areca gardens in that order. However, since the ratios were greater than unity for all the three categories of areca farms under consideration, the investment in areca gardens irrespective of the size group was financially sound and economically feasible. If any priority to be assigned for phased investment in the development of areca gardens, the first priority goes to the large gardens followed by the medium and small gardens.

Internal rate of return (IRR):

The internal rate of return which is another tool for analysing the feasibility of a project, indicates the rate of return that can be earned by reinvestment. The IRR was 26.28, 26.68, and 27.53 per cent for small, medium and large gardens, respectively. The IRR was higher

than the discount rate (15 per cent) considered in the analysis. Thus, this criterion also ranked the large gardens at the top in its profitability, closely followed by medium and small gardens.

Pay back period:

The pay back period refers to the time to repay the initial investment in the garden (upto 7th year). In the case of small and large gardens, the pay back period was 10 years and for the medium gardens it was 11 years. It may be indicated here that the growers could partially cover the costs from the returns generated by banana intercrop and arecanut during the 6th and 7th years. These gross returns were Rs.13,905.02, Rs.11,588.70 and Rs.14,035.65 per hectare in small, medium and large areca gardens, respectively.

The time taken to recover back the initial investment which was 10 years for small and large and 11 years for medium gardens, clearly indicated that there is no much difference in the time needed by different size of areca farms. However, this criterion does not bring about the difference in priority unlike the discounted cash flow measures.

Thus, all the three criteria of project evaluation, viz., the net present worth, benefit-cost ratio and internal rate of return, indicated that irrespective of the size of the areca gardens, investment

in areca gardens was economically feasible and a financially sound proposition in the Dakshina Kannada district of Karnataka. The inferences drawn based on the several criteria for evaluation of investment, except the pay back period revealed that the results are in conformity with the general belief that the large areca gardens are more profitable followed by the medium and small gardens.

The results of the evaluation of investment in areca gardens could be compared with those of perennial crops like coconut, coffee, tea and grapes. The study conducted by George and Joseph (1973) revealed that investment in tree crops such as coconut, oil palm, and rubber were economical and profitable based on the IRR and B : C ratio criteria (at 9 per cent discount rate). However, the higher IRR and B : C ratio for arecanut in the present study indicated that investment in areca garden was more profitable despite higher discount rate than in coconut, oil palm and rubber. Further, a comparison with coffee and coconut by Umakesan and Rajagopalan (1978), Shivarama(1981) on coffee and Raghupathy and Bisaliah (1979) on coconut, indicated a lower IRR and B : C ratio (despite lower discount rates) than that of the present study.

The study conducted by Menon (1979), on the feasibility of investment in grapes, indicated a higher B : C ratio and IRR than the present areca study, thus indicating that investment in grapes as a

more profitable proposition than arecanut. However, the locality and the discount rates in the above studies were different from the present study.

The results of all the studies on tree plantation and fruit crops indicated that investment in perennial crops is economically feasible and financially sound.

Sensitivity analysis:

Gittinger (1974) and Rahim and Singh (1978) opined that due allowance should be given for risk and uncertainties which are the special features of agricultural projects. In the current study, this was done through sensitivity analysis, wherein allowance was made for increased cost (10 per cent) and decreased returns (10 per cent) and then the worthiness of the investment in areca gardens was evaluated (Table 4.14). The results clearly indicated that despite 10 per cent changes in either costs or returns or both, the investment in areca gardens immaterial of the size groups was economical and financially sound. It also implies that in future, if there are escalations in cost by 10 per cent and or decrease in product price of areca by 10 per cent, it would still be worthwhile considering an investment in areca gardens.

5. Labour employment potential in areca gardens:

The labour employment potential was estimated based on the number of labourers presently employed in different size groups of areca gardens.

The cultural operations though similar in all the size groups, it was observed that the amount of labour employed varied among the size groups (Table 4.15). The small gardens employed a total of 452.15 mandays per hectare, while the medium and large gardens employed 366.49 and 490.13 mandays per hectare, respectively. Of this total labour employment, irrigation had a share of 40.43 per cent in small and medium gardens, and 33.13 per cent in large gardens. Generally, irrigation was done once in 6 to 8 days for 6 to 7 months of the year (December to June). Thus, the labour used per irrigation was 5.22 mandays in small, 4.23 mandays in medium and 4.64 mandays in large gardens. The labour utilized per hectare for manures and fertilizer application was the highest in large gardens (114.55 mandays) followed by small gardens (75.03 mandays) and medium gardens (59.43 mandays). It may be indicated that farm yard manure and green leaves were applied manually (FYM in baskets) and majority of the growers with big gardens purchased the FYM from outside (from neighbouring farmers) which might have resulted in the increased use of labourers for this operation in the large gardens.

The employment of skilled labour for the operations like spraying was 8.21, 7.64 and 11 mandays in small, medium and large gardens, respectively. It was observed that in large gardens the number of sprays given was more (4 to 5 times) than the other gardens. However, the growers opined that, since spraying was done mainly during the rainy season, wherein many a times heavy rains interrupt the spraying operation, it was difficult to assess the correct amount of labour required for this operation.

The number of skilled labour employed for harvesting the riped nuts from the areca palms was 9.15, 6.83 and 9.08 mandays per hectare, in small, medium and large gardens, respectively.

The average wage rate paid was Rs.7.17 per day for man and Rs.5.60 per day for woman labour for 8 hours work in the areca gardens. The wage rate paid for skilled labourer varied from Rs.12 to 15 per day in the study area.

The areca gardens with pepper as an inter crop, used an additional labour of 10.11, 8.67 and 9.07 mandays per hectare in small, medium and large gardens, respectively, for the operations like harvesting, tying the pepper vines, drying and cleaning pepper etc.

Thus, on an average, the total labour employed per hectare was more in the small and big gardens than the medium gardens, and reflected the intensity of cultivation.

6. Comparison between conventional surface irrigation and 'purfo' irrigation

A separate set of 15 areca sample farmers was chosen for this as explained earlier in the methodology.

The areca growers who were adopting the 'purfo' irrigation method were generally large areca garden farmers. Hence, a comparison was made with the large areca garden farmers following the conventional surface irrigation.

The additional investment on 'purfo' irrigation was the cost incurred on the perforated pipes through which water was made to sprinkle in the areca garden. This average investment on perforated pipes was Rs.13,050.00 (Rs.6025.00 per hectare). The investment on other permanent items which were common in both the gardens like pumpsets, wells and ponds amounted to Rs.16,404.66 per garden (Rs.8202.29 per hectare) with 'purfo' irrigation and Rs.16,784.16 (Rs.7329.33 per hectare) with conventional surface irrigation (Table 4.16).

The annual cost of 'purfo' irrigation was Rs.7035.90, while it was Rs.8095.88 per garden for conventional surface irrigation (Table 4.17).

However, the per hectare cost of irrigation did not vary much among the two types of irrigation systems (Rs.3505.10 in gardens with 'purfo' and Rs.3537.40 in the gardens with surface irrigation). Out of the total cost of irrigation, the fixed costs such as depreciation on wells, ponds, pumpsets and machinery used for irrigation and interest on fixed and working capital accounted for Rs.5115.44 (Rs.2694.85 per hectare) and Rs.4511.43 (Rs.1972.14 per hectare) in the 'purfo' and surface irrigations, respectively. The difference was due to the depreciation and the extra amount of interest on fixed investment on perforated pipes in 'purfo' irrigation system. The variable costs were Rs.810.25 and Rs.1565.26 per hectare with 'purfo' and conventional surface irrigation, respectively. The variable costs included the maintenance cost for pumpsets, wells, ponds and other machinery, labour charges for irrigation and irrigation charges.

The labour charges for irrigation with the 'purfo' irrigated garden was only Rs.264.67 per hectare and with surface irrigated gardens it was 1134.66 per hectare. Thus, labour charges for irrigation was more by Rs.869.99 per hectare in surface irrigation than 'purfo' irrigation system. The labour use was 37.44 and 162.40 mandays with 'purfo' and conventional surface irrigation, respectively (Table 4.22).

The irrigation charges which included cost of oil, electricity etc., was more for 'purfo' irrigation system (Rs.298.67 per hectare)

than with surface irrigation system (Rs.241.64 per hectare). This was because the number of hours required per irrigation was observed to be more in 'purfo' system than the surface system. The respondents opined that, to irrigate one acre of garden, 4 hours were needed in case of 'purfo' method, while it was 1 to 2 hours in case of conventional surface method.

Thus, the irrigation cost which included both the annual fixed as well as variable costs, for 'purfo' irrigation amounted to Rs.3501.10 per hectare and it was Rs.3537.40 per hectare for surface irrigation system.

Besides the cost of irrigation, the annual costs and returns were also worked out for these two types of gardens.

The total labour cost (Table 4.18) for different cultural operations in arecanut orchards was Rs.3207.44 and Rs.4014.89 per hectare, with the 'purfo' and surface irrigation systems, respectively.

Thus, it can be inferred that the conventional surface irrigation system requires more labour expenses as well as higher irrigation costs than the 'purfo' irrigation system. This proves the superiority of 'purfo' over surface irrigation system in terms of reduction in costs besides other technical advantages.

The results of annual material cost (Table 4.19) revealed that the use of manures and fertilizers was more in the gardens with 'purfo' irrigations than the conventional surface irrigation (Rs.1604.22 and Rs.1295.23 per hectare in 'purfo' and surface irrigation, respectively). The growers following the 'purfo' and conventional surface irrigation invested Rs.2637.54 and 2281.22 per hectare, respectively, on inputs in the cultivation of arecanut.

The total other expenses which included the annual fixed costs such as depreciation on wells, ponds and machinery, interest on fixed and working capital, maintenance cost of permanent items, land revenue, transportation cost was also higher for gardens with 'purfo' irrigation (Rs.3947.94 per hectare) than the gardens with conventional surface irrigation (Rs.3385.65 per hectare) (Table 4.19). The difference in other expenses was due to the extra amount of depreciation the grower had to incur in case of 'purfo' irrigation.

Thus, the total cost of cultivation including the labour cost, material cost and other expenses was Rs.9792.92 and Rs.9681.76, in the gardens having 'purfo' and conventional surface irrigations, respectively. Hence, it was found that the annual total cost of cultivation was less by Rs.111.16 per hectare in the case of gardens irrigated by conventional surface method. However, when an examination

of yield and returns was done, the results showed that in the 'purfo' irrigation systems farmers got higher per hectare yields than the surface irrigation system (Table 4.21). This was probably due to the higher investment in manures and fertilizers by 'purfo' irrigation system farmers than surface irrigation.

The net returns for growers with 'purfo' irrigation were also higher than that of surface irrigation farmers. The per hectare net returns of 'purfo' irrigation system were higher by Rs.5207.13 than the surface irrigation system. Thus, it could be concluded that with an additional total cost of Rs.111.16 per hectare, the 'purfo' irrigation system enabled the farmers to realise an additional amount of Rs.5207.13 per hectare. This again reiterates the superiority and benefits of the 'purfo' irrigation system over surface irrigation in Puttur taluk of Dakshina Kannada district, Karnataka.

Further, the purfo irrigation method helps for labour saving (or capital intensive) irrigation system. The labour employment in 'purfo' and surface irrigation system is presented in Table 4.22 in Chapter IV. Thus, the purfo irrigation system which saves labour paves way for venturing other allied alternative enterprises like poultry, dairy etc., which could act as supplementary or complementary to the main areca enterprise to provide more cash inflows in the year by employing the surplus labour resulting from 'purfo' irrigation system.

SUMMARY AND CONCLUSIONS

CHAPTER VI

SUMMARY AND CONCLUSION

The investigation was undertaken in the Dakshina Kannada district, Karnataka State, with the view of evaluating the investment in areca gardens in the district. The main objective was to find the feasibility, profitability and worthiness of investment in different size groups of areca farms. The specific objectives were:

1. To estimate the recurring and non-recurring investment in different size groups of areca gardens.

2. To assess the economic feasibility and financial soundness of investment in areca gardens.

3. To evaluate the benefits of 'purfo' irrigation system against the conventional surface irrigation in areca gardens.

Data were collected from a total of 60 areca farmers who were selected at random at the rate of 20 each in small, medium, and large farmers from Puttur Taluk in Dakshina Kannada district of Karnataka. Besides this, an additional sample of 15 areca farmers were selected for the purpose of comparing the two types of irrigation systems viz., 'purfo' and conventional surface irrigation in areca gardens.

Discounted cash flow technique was used to find out the worthyness of investment in areca gardens. The benefits of purfo irrigation system against conventional surface irrigation were evaluated based on the costs and returns from each.

The main findings of the investigations are as follows:

1. The average size of the areca gardens was 0.56 hectares, 1.28 hectares and 2.29 hectares, in the case of small, medium and large areca farmers, respectively. Average size of the areca garden in the case of purfo irrigation was 2.015 hectares.

2. The establishment cost in the areca gardens included the expenditure on labour, materials, investment on permanent items and the cost of banana inter crop. The small, medium and large growers required Rs.17,041.09 (Rs.30,505.09 per hectare), Rs.38,509.51 (Rs.30,085.00 per hectare), and Rs.66,097.33 (Rs.28,864.22), respectively to establish the areca gardens. The per hectare establishment costs revealed that large gardens required a lesser amount for establishment than the medium and small gardens.

The investment during the first year of establishment which included the labour and material cost during the first year, investment on permanent items such as wells, ponds, pumpsets and other machinery,

and the cost of planting banana inter crop came to Rs.7449.17 (Rs.13,302.50 per hectare) in small gardens, Rs.19,421.80 (Rs.15,173.29 per hectare) in medium gardens, and Rs.34,856.29 (Rs.14,791.73 per hectare) in large gardens. The total cost of maintaining in the successive years till the bearing stage (7th year) of areca garden amounted to Rs.9632.12 (Rs.17,202.59 per hectare), Rs.19,087.71 (Rs.14,911.71 per hectare) and Rs.31,241.04 (Rs.13,642.40 per hectare) in small, medium and large areca gardens, respectively.

3. The operational cost incurred to maintain the bearing areca gardens included the expenditures on annual cultural operations (both labour and material) and other expenses. The annual total labour costs were Rs.2271.92 (Rs.4057.03 per hectare), Rs.4506.38 (Rs.3520.50 per hectare) and Rs.9194.10 (Rs.4014.38 per hectare) in small, medium and large areca gardens, respectively.

The growers incurred a cost of Rs.1300.00 (Rs.2470.73 per hectare), Rs.2980.31 (Rs.2328.37 per hectare) and Rs.5223.99 (Rs.2281.22 per hectare) on input materials in small, medium and large gardens, respectively.

The other expenses, which included the items like land revenue, maintainance cost of permanent items, transportation charges, marketing charges etc., amounted to Rs.529.83 (Rs.946.12 per hectare), Rs.1512.91

(Rs.1181.96 per hectare) and Rs.3236.95 (Rs.1413.51 per hectare) in small, medium and large gardens, respectively.

Thus, the average total operational costs were Rs.4189.83 (Rs.7481.88 per hectare) in small gardens, Rs.8999.60 (Rs.7030.92 per hectare) in medium gardens and Rs.17,655.04 (Rs.7709.62 per hectare) in large gardens.

The areca growers with pepper inter crop incurred an additional cost of Rs.47.50 (Rs.84.22 per hectare), Rs.91.80 (Rs.71.33 per hectare) and Rs.164.22 (Rs.69.49 per hectare) in small, medium and large gardens, respectively.

4. The average yields of arecanut were 1103.28 kg (1970.14 kg per hectare) in small, 2562.53 kg (2001.98 kg per hectare) in medium and 4768.07 kg (2082.13 kg per hectare) in large areca gardens.

The study indicated that the large growers realised higher net returns from areca, than the small and medium growers. The net returns among the small, medium and large gardens were Rs.9204.47 (Rs.16,436.52 per hectare), Rs.23,505.15 (Rs.18,363.99 per hectare) and Rs.50,318.99 (Rs.21,974.86 per hectare), respectively. The gardens with pepper inter crop fetched an additional net returns of Rs.484.50

(Rs.865.18 per hectare), Rs.1080.70 (Rs.844.30 per hectare) and Rs.2440.09 (Rs.1064.75 per hectare) in small, medium and large gardens, respectively.

5. The discounted cash flow technique was employed for evaluating the investment in areca gardens. A discount rate of 15 per cent was chosen in this study. The results indicated a net present worth of Rs.10,171.78 (Rs.18,164.00 per hectare), Rs.28,363.72 (Rs.22,157.49 per hectare) and Rs.59,538.43 (Rs.25,999.31 per hectare) for small, medium and large gardens, respectively.

The discounted B : C ratio was 1.43 for small gardens, 1.57 for medium gardens and 1.66 for large gardens.

The large gardens indicated the highest internal rate of return of 27.53 per cent closely followed by the medium gardens with 26.68 per cent and small gardens with 26.28 per cent.

Thus, the large gardens had the highest NPW, B : C ratio and IRR followed by the medium and small areca gardens.

In addition to the discounted cash flow measures, the pay back period for the three size groups of areca gardens was also calculated.

The results indicated that for small and large areca gardens, the pay back period was 10 years, while for medium gardens it was 11 years.

The investment on all the three size groups of areca gardens was found feasible and financially sound. However, the return per rupee of investment in the large gardens was the highest and therefore should be preferred for future new investment over medium and small areca gardens.

The sensitivity analysis at 10 per cent variation in cost (increase) and returns (decrease) also revealed that investment in areca gardens, immaterial of the size groups was economically feasible and financially sound.

6. The labour mandays employed in areca gardens was 253.14 (452.15 per hectare), 469.11 (366.49 per hectare) and 1122.39 (490.13 per hectare) in small, medium and large areca gardens, respectively.

7. The comparative study of 'purfo' and conventional surface irrigation systems in areca gardens revealed that 'purfo' irrigation was superior to conventional surface irrigation, both in terms of lower irrigation costs and the labour costs. The irrigation cost which included both annual fixed and variable costs was Rs.7035.90 (Rs.3501.10 per hectare) in purfo irrigation, and Rs.8095.88 (Rs.3537.40 per hectare) in conventional surface irrigation.

The cost of cultivation incurred under the purfo irrigated garden was Rs.19,613.57 (Rs.9792.92 per hectare) and for the conventional surface irrigation it was Rs.22,195.92 (Rs.9681.76 per hectare).

The average yield was higher in 'purfo' irrigation with 4785.00 kg (2377.05 kg per hectare) than the conventional surface irrigation with 4768.07 kg (2082.13 kg per hectare).

The 'purfo' irrigation is a labour saving technique and the total labour mandays employed in the garden was 695.48 (345.46 per hectare), while the labour mandays employed in the conventional surface irrigated garden was 1122.39 (490.13 per hectare).

The net returns realised were Rs.50,847.01 (Rs.25,209.85 per hectare) and Rs.45,778.11 (Rs.20,002.72 per hectare), in the 'purfo' and surface irrigations, respectively. Thus, with an additional cost of Rs.111.16 per hectare, the 'purfo' irrigation system enabled the growers to realise an additional amount of Rs.5207.13 per hectare.

CONCLUSIONS

1. The results of the study indicated that the investment in arecanut enterprise is economically feasible and financially sound, irrespective of the size group. However, the results of discounted

cash flow measures revealed that, if any priority to be assigned in the development of areca gardens, the first preference goes to the large gardens, followed by the medium and small gardens.

2. The results of pay back period which is a common rough means of chosing between investment in business enterprises, especially where there is a high degree of risk and low capital base, indicated that the preference may be for small and large gardens who had a pay back period of 10 years rather than the medium gardens who have 11 years of pay back period. This might be due to the fact that, in small and large areca gardens, the growers realised a higher returns from areca as well as banana inter crop during the establishment period than in the case of medium gardens, and thus helped to recover the initial establishment cost in a shorter period in the case of small and large gardens than the medium gardens.

3. The areca gardens with pepper inter crop produced a higher net returns and thus, it could be indicated that inter crops in areca gardens help to build up farmers' economy.

4. The study revealed the possibility of getting higher net returns per unit area in case of large gardens than the small and medium gardens, thus indicated more efficient management of large gardens which is contrary to the general understanding.

5. Arecanut enterprise provides employment for both skilled and unskilled labourers. The large gardens provided the highest mandays of employment followed by medium and small gardens. The enterprise provides employment throughout the year and the employment could be increased further by adopting inter cropping in the gardens with inter crops such as pepper, banana, cocoa etc.

6. With regard to the two irrigation systems in areca gardens, the 'purfo' irrigation system was found superior over the conventional surface irrigation syste m in terms of less cost of irrigation and more net returns. Further, 'purfo' irrigation method is labour saving technique and hence could be adopted wherever labour is scarce. However, the 'purfo' irrigation system requires huge investment and it was observed that only big farmers (who have more capital base) adopted this system of irrigation. Hence, efforts should be made to provide adequate financial facilities for the needy farmers who wish to adopt the 'purfo' irrigation method.

7. The study, on the whole, indicated the remunerativeness of the arecanut enterprise in the Dakshina Kannada district of Karnataka and hence there is a scope for extending financial facilities through institutional agencies to encourage arecanut production.

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CHAPTER VII

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APPENDICES

Appendix 1

Arecanut exports between 1957-58 and 1978-79

Year	Quantity exported (tons)	Value earned (Rs.crores)	Arecanut export as a percentage to the total exports
1957-58	199	0.09	0.014
1959-60	200	0.12	0.019
1964-65	210	0.14	0.017
1966-67	210	0.15	0.012
1970-71	220	0.20	0.013
1975-76	560	0.66	0.013
1977-78	520	0.68	0.011
1978-79	580	0.79	0.013

Source: Directorate of Arecanut Development, Calicut.

Appendix 2

Details of borrowings of areca growers

Particulars	Growers with		
	Small gardens	Medium gardens	Big gardens
1. Total number of farmers borrowed loans	15 (75)	12 (60)	11 (55)
2. Number of farmers borrowed:			
a) Short term loans	14 (70)	12 (60)	11 (50)
b) Medium term loans	4 (20)	3 (15)	2 (10)
c) Long term loans	-	1 (5)	3 (15)
3. Amount borrowed per borrower (Rs.)			
a) Short term	3160.71	4666.67	6363.64
b) Medium term	3250.00	3666.67	10000.00
c) Long term	-	2400.00	6500.00
4. Total area of areca garden (hectares) served by:			
a) Short term	7.08	12.92	20.63
b) Medium term	2.07	3.92	3.86
c) Long term	-	0.81	5.48
5. Amount borrowed per hectare:			
a) Short term	6250.00	4334.36	3393.12
b) Medium term	6280.19	2806.12	5181.35
c) Long term	-	2962.96	3558.39

Figures in the paranthesis indicate percentages to the total number of sample farmers.