ECONOMICS OF BANANA CULTIVATION IN TRICHUR DISTRICT

By

INDIRA DEVI P.

THESIS

Submitted in partial fulfilment of
the requirement for the degree of

Master of Science in Agriculture

Faculty of Agriculture
Kerala Agricultural University

Department of Agricultural Economics
COLLEGE OF HORTICULTURE
Vellanikkara, - Trichur

1983

D E C L A R A T I O N

I hereby declare that this thesis entitled "Economics of Banana Cultivation in Trichur District" is a bonafide record of research work done by me during the course of research and the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

Vellanikkara,
5 12 83

INDIRA DEVI, P.

C E R T I F I C A T E

Certified that this thesis entitled "Economics of Banana Cultivation in Trichur District", is a record of research work done independently by Kum. Indira Devi, P., under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

Vellanikkara,
5.12.83

Dr. K. Mukundan,
Chairman,
Advisory Committee,
Associate Professor of
Agricultural Economics.

C E R T I F I C A T E

We, the undersigned, members of the Advisory Committee of Kum. Indira Devi, P., a candidate for the degree of Master of Science in Agriculture with major in Agricultural Economics, agree that the thesis entitled "Economics of Banana Cultivation in Trichur District" may be submitted by Kum.Indira Devi,P. in partial fulfilment of the requirement for the degree.

Dr. K. Mukundan,
Chairman of the Advisory Committee.

Dr. V. Radhakrishnan,
Member

Shri. P.V. Prabhakaran,
Member

Shri. K.P. Ramachandran Nair,
Member

ACKNOWLEDGEMENTS

I hereby express my heartfelt thanks to Dr. K. Mukundan, Associate Professor of Agricultural Economics and Chairman of my Advisory Committee for his sustained interest, valuable guidance and encouragement during the whole course of investigation and preparation of this thesis.

I wish to express my deep sense of gratitude to Dr. V. Radhakrishnan, Professor and Head, Department of Agricultural Economics for the valuable suggestions and guidance rendered by him.

My sincere thanks are also due to Mr.P.V. Prabhakaran, Associate Professor, Department of Agricultural Statistics for his whole hearted help extended to me in the analysis of data and interpretation of the results.

The constant encouragement and help extended by Mr. K.P. Ramachandran Nair, Associate Professor, Department of Agricultural Extension, are greatefully acknowledged.

I am thankful to Kerala Agricultural University for the award of research fellowship during the period of study.

I am greateful to my parents and my brothers for their sincere help and constant encouragement.

INDIRA DEVI, P.

C O N T E N T S

LIST OF TABLES

LIST OF FIGURES

Introduction

INTRODUCTION

Banana (*Musa spp.*) is one of the most important fruit-cum-vegetable grown in the world. It is used in various forms. Banana can be consumed either as a raw fruit or in cooked or preserved form. The unripe fruit is also used for culinary purposes. The banana flour made from fully matured unripe banana forms an ideal baby food and is a rich source of carbohydrates, minerals and proteins. Banana fig, a well known preservation is also prepared from banana. In addition to this the leaves are also of much economic importance.

Nendran is unrivalled among bananas. Banana chips now widely used in and outside the country form a unique preparation from nendran variety. The fibre extracted from leaf sheaths of nendran plant is now-a-days widely used in making a variety of goods in cottage industries.

Of all the fruits in India banana requires the most urgent attention as a matter of highest priority for initiating developmental schemes with special objective of export to earn the much needed foreign exchange of the country. First and foremost there is

hardly any country in the world in which banana is not a popular fruit among people secondly, with no other fruit is there a possibility of such full control over planning for production in relation to export demands as in banana. While most fruits are seasonal, in the case of banana production can be obtained in almost all season of the year from some state or other, growing banana in the country. Again, no other fruit produces such heavy tonnage. As a field crop nendran is more paying than any other cereals and field crops. It is reported to yield an edible matter of 17500 to 20,000 kg per hectare which is several fold higher than the average yield of rice or other field crops.

The annual production of banana in the world is 20 million tonnes. Of the total area under banana in the world nearly fifty per cent is in Africa followed by Asia and America. Among Asian countries India occupies an important position in banana production.

The important states growing banana in the country are Tamil Nadu, Kerala, Maharashtra, Assam, Andhra Pradesh, Orissa and Karnataka. Of the total area under

cultivation of banana in the country the southern states account for a major part.

Among the different states in the country Kerala occupies the second position in respect of area under banana. According to the estimates of Bureau of Economics and Statistics in 1981-82 the total area under banana in the state was 49640 hectares producing 37230 tonnes of output. The yearwise area and production of banana in Kerala for the last seventeen years is given in Table 1.1.

The three year average of the area under banana for the year ending 71-72 was 50966 hectares and the same for the year ending 81-82 was 52300 hectares. The corresponding figures for production was 378430 tonnes and 313380 tonnes respectively. Though area under banana shows a slight increase during this decade its production has come down. This reveals that due care is not taken in the development of this crop. An important crop like banana seems neglected. In that case an investigation to throw light on the volume of cost involved in cultivation and production of nendran banana, the pattern and efficiency of resource use etc

Table 1.1 Yearwise area and production of banana in Kerala.

	Area ('000 hectares)	Production ('000 tonnes)
65-66	47.77	361.12
66-67	45.60	344.90
67-68	49.42	374.00
68-69	51.58	300.00
69-70	53.50	404.00
70-71	48.80	369.00
71-72	47.90	362.30
72-73	47.29	358.00
73-74	46.70	353.60
74-75	47.14	356.58
75-76	47.16	356.70
76-77	51.70	390.61
77-78	51.65	394.07
78-79	50.10	322.92
79-80	53.60	310.34
80-81	53.70	317.40
81-82	49.60	312.40

Source: Agricultural Situation in India.
Farm Guide 1983.

will be of paramount importance and hence this study is undertaken with the following objectives.

1. To estimate the cost and returns.

2. To evaluate resource use efficiency in production.

3. To study the problems of banana growers.

Review of Literature

REVIEW OF LITERATURE

Though banana occupies an enviable position among the fruits the studies pertaining to its economics are limited. In this chapter a survey of the literature published on the economics of banana as well as other relevant studies are presented.

Burns and Dani (1920) worked out the cost of cultivation and the return from banana crop, based on the data collected from the records of two plantations in the Ganeshkund Botanical Garden and they reported that the net profit from one acre of banana cultivation per year was Rs.265/-.

Nayar, N.P. (1941) estimated the cost of cultivation and the return of Nendran banana in the Malabar area and found that there was a net profit of Rs.225 per acre.

Jacob (1942) estimated the cost of cultivation of nendran in Travancore state as Rs.150/- per acre with a net income of Rs.200/- per acre.

Naik (1949) reported that the net profits from banana cultivation ranged from Rs.537/- to Rs.1000/- per acre.

Roy (1950) gave figures showing the expenses for the first and second years of banana cultivation in Bihar as Rs.505/- and Rs.367/- respectively with incomes of Rs.711/- and Rs.1658/- per acre.

Nayar, T.G. (1962) estimated the cost of cultivation receipt and net profit per acre of nendran banana in parts of the West Coast as Rs.810/-, Rs.1450/- and Rs.640/- respectively.

A study based on the cultivation of nendran banana in Tellicherry block has revealed that, the cost involved on an average to produce crop in one acre of land was Rs.1598/-. The cost of production of one tonne of banana was Rs.230/-. Cost of manures and fertilizers was found to be the most expensive item in nendran production followed by the labour cost. The profit from the nendran cultivation was worked out to be Rs.1308/- per acre. A Cobb-Douglas type of production function was fitted to study the resource use efficiency in banana production taking land (cents) labour (mandays) and cost of manures and fertilisers as the input variables and output as the dependent

variable. The factors land and manures and fertilizers were found to have a positive significant influenze on output. The enterprise operated in a constant returns to scale (Achuthan, 1965).

Krishnamoorti (1966) worked out the cost of cultivation of Dwarf Cavendish banana in North Arcot District to Rs.1250/- per acre. The gross returns from its cultivation was reported to be Rs.2144/- per acre, thus giving a net income of Rs.894/- per acre.

Analysing the economic benefits of rural electrification to banana growers Bore et al (1969) pointed out that a reduction of Rs.643/- per acre in banana production cost can be achieved by the use of electric pumps. They observed that the gross income per acre were the same for the users of electric pumps and oil engines. But the net returns were considerably higher for the former group.

Peter (1974) reported that an increase in total expenditure upto optimum level can even double the net income from the banana cultivation of the Kanyakumari district. A shift of resources from labour to manure

would assure more of net income as well as gross income with existing level of expenditure.

A comparative study of resource productivities and resource allocation on a sample of sugarcane and banana farms in Maharashtra State indicated that the net profits were more in the case of sugarcane. The study revealed that resource allocation on human labour and seed should be increased and that of manures and fertilizers decreased to get a higher yield in banana (Patil and Acharya, 1974).

A study on the economics of production of robusta banana in single and double planting revealed that the production cost per hectare was Rs.7900/- in single planting and Rs.13340/- in double planting. Estimated receipts from these were Rs.28820/- per hectare and Rs.51080/- per hectare respectively. ie. a net profit of Rs.20920/- and Rs.37740/- per hectare respectively. The double planting of robusta had increased the returns by 79.40 per cent. (Alagiamanavalan and Balakrishnan, 1976).

Studying the economics of weed control in banana, it was found that at least three weedings are absolutely necessary in an year to keep weeds under control. It was calculated that savings ranging from Rs.500/- to

Rs.1100/- per hectare could be expected if herbicides are sprayed depending on dosage and variety of herbicide used (Annual report, 1978).

An analysis of costs and returns of banana cultivation in Girna irrigation project area in Jalgon district has revealed that the total per hectare cost of cultivation came to Rs.7492.97 where Rs.5011.84 was cost A alone. Fertilizers, manures, irrigation and seed were observed to be more expensive items and these items together comprised nearly 49.82 per cent of total cost. The crop gave a per hectare net profit of Rs.4876.54. The per hectare farm business income was Rs.7357.67 and the figure for family labour income was Rs.5193.41 per hectare. The net income from banana cultivation was Rs.4876.54 per hectare with a farm investment income of Rs.7040.00 per hectare (Patel et al, 1978).

Application of an additional dose of 500 gm urea per plant in five equal split doses of 100 gm each during fifth month of planting of Zanzibar variety has resulted in an increase in bunch weight and number of fingers per bunch. This resulted in an attractive

net profit of Rs.5500/- per hectare (Gopimony et al. 1979).

Rao (1982) reported that the average cost of cultivation (Cost C) of banana on sample farms of Ollukkara Block worked out to Rs.34554.95 per hectare of which cost A and Cost B constituted 64.22 per cent and 91.58 per cent respectively. The average yield was 16316.5 kg per hectare with gross returns Rs.46982.44 per hectare.

Bastine (1982) worked out the cost of cultivation of banana in Irinjalakuda Block in Trichur district. It was Rs.36249/- per hectare. The most important item of expenditure was reported to be manures and manuring which formed 23.46 per cent of the total expenditure. On an average the benefit cost ratio at Cost C worked out to 1.24.

Materials and Methods

MATERIALS AND METHODS

This study on the economics of banana cultivation is based on data collected from a sample of farmers in the Chalakudy Block in Trichur district. Chalakudy block is selected purposively for the study as it has the highest area under banana in the district. For the sake of uniformity the study was confined only to irrigated banana and Chalakudy block has ample facilities for irrigation. Most of the farmers in Chalakudy block depend on canal water for irrigation of banana and other crops. The supply of water through these canals are fairly assured.

Sampling procedure

Two stage stratified random sampling was adopted for the study. The strata consisted of six Panchayats and one Municipal area under the Chalakkudy block. One ward selected at random from each of the seven strata form the first stage units. In the second stage, 14 farm families were selected randomly from each of the ward selected. The total size of sample was thus limited to 98 viz. 14 x 7. The 98 holdings were further classified

into four strata based on the number of banana plants in their holdings as follows.

Strata	No. of plants
I	100 and below
II	101 - 250
III	251 - 500
IV	501 and above

Collection of data

The data were collected using a well structured and pretested schedule. A copy of the schedule is given as Appendix. Personal interview method was adopted for the collection of information. The information was gathered for the period from August 1981 to June 1982. The collected data include area under banana, the various expenses incurred for its cultivation, problems faced by banana growers etc. The data were collected during the period from March to May 1983.

Concepts used in the study

1) Human Labour

a) Family labour: The actual work done by the members of the family on crop production was taken as family labour. It was evaluated on the basis of wage rates prevailed in the

locality.

b) Hired labour: The actual paid wage labour engaged in crop production was considered as hired labour. It was evaluated on the basis of actual wages paid by the farmer.

2) Rental value of leased in land

This is the actual rent paid by those farmers who had leased in land for banana cultivation. On an average this came to Rs.1.16 per pit.

3) Imputed rental value of owned land

Rental value of owned land was imputed on the basis of the rate which was prevalent in the region. This as stated above was Rs.1.16 per plant.

4) Interest on working capital

Interest on working capital was calculated at 12 per cent per annum. This was the rate of interest charged by the co-operative societies for short term agricultural loans. Since banana is an annual crop, on the assumption that costs were spread uniformly through the year, interest for only a period of 6 months were taken into account.

5) Land revenue

Land revenue was taken at the actual rate paid to the revenue department which was Rs.2/- per acre.

6) Cost concepts

Cost A_1

1) Value of hired human labour
2) Value of hired bullock labour
3) Value of owned bullock labour
4) Value of seeds (Farm produced and purchased)
5) Value of manures and fertilizers
6) Expenditure on irrigation
7) Expenditure on crop protection
8) Depreciation of implements and machinery, sprayers etc.
9) Interest on working capital
10) Hired machinary charges
11) Land revenue, cesses and other taxes
12) Depreciation on farm buildings, and irrigation structure
13) Miscellaneous expenses

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

Cost B Cost A_2 + Rental value of owned land.

Cost C Cost B + Imputed value of family labour.

7) Cost of cultivation

Cost of cultivation refers to the total expenses incurred in cultivating one hectare of banana. Cost of

cultivation, input-wise and operation-wise and their percentages to total were worked out.

8) Cost of production

Cost of production is the cost of producing one bunch of banana. The returns from the byproduct was accounted for while calculating the cost of production.

9) Measures of income

a) Gross income: Income obtained by the sale of main product and byproduct comprises the gross income and it was taken as the actual income received by the farmer. The value at the prevailing rate was imputed for that part of the product taken for home consumption. Income based on different cost concepts were calculated as follows.

b) Farm business income: It is the difference between gross income and cost A.

c) Family labour income: It is the difference between gross income and cost B. This gives the income of the farmer on account of his own and family labour.

d) Net income: It is difference between gross returns and cost C.

e) Farm investment income: It was computed by deducting the imputed value of family labour from farm business income.

Benefit-cost ratio: It is the ratio of benefits to costs. This has been worked out on cost A, cost B and cost C.

Resource use efficiency: The efficiency in the use of resources can be measured by fitting a production function. Both linear and Cobb-Douglas production functions were tried seperately for each stratum and for the sample as a whole, to describe the relationship between the output obtained and the various inputs used in the production of banana. The mathematical model for the Cobb-Douglas function is,

$$Y = b_o \; X_1^{b1} \; X_2^{b2} \quad ..... \quad X_n^{bn} + Error \qquad (1)$$

The model for linear function is,

$$Y = b_o + b_1 X_1 + b_2 X_2 + \ldots + b_n X_n + Error \qquad (2)$$

Where 'X_i's are various inputs used and 'b_i's are the elasticities for (1) and marginal products for (2)

The significance of 'b_i's are tested by using 't' test.

$$t = \frac{b_i}{SE(b_i)} \quad \text{where } SE(b_i) = \sqrt{C_{ii}\ S^2}$$

The percentage variability explained by the fitted mathematical model can be found out by calculating the coefficient of multiple determination (R^2) which is the square of the multiple correlation coefficient. The variables used in the study were,

1) Y = Value of output (Rs)
   X_1 = No. of plants per acre
   X_2 = Value of human labour (Rs)
   X_3 = Cost of fertilizers (Rs)
   X_4 = Cost of organic manures (Rs)
   X_5 = Expenditure on plant protection chemicals (Rs)
   X_6 = Irrigation expenses (Rs)
   X_7 = Percentage loss of plants
   X_8 = Cost of supports and ropes (Rs)

2) Y = Revenue per plant (Rs)
   X_1 = Value of human labour (Rs)
   X_2 = Cost of fertilizers (Rs)
   X_3 = Cost of organic manures (Rs)
   X_4 = Expenditure on plant protection chemicals (Rs)
   X_5 = Irrigation expenses (Rs)
   X_6 = Cost of ropes and supports (Rs)

The dependent variable is the output in Rs. which is the income from the main product and by product.

Explanatory variables

X_1 - The actual number of banana plants cultivated by each farmer (per acre). Mostly the farmers refer to the cultivated area under banana in terms of number of plants.

X_2 - Expenditure on human labour include both the expenditure on hired and family labour employed for different operations. Family labour was evaluated on the basis of prevailing wage rates in the locality.

X_3 - The cost of fertilizers include the cost of all N, P & K fertilizers, lime and dolomite.

X_4 - Cost of organic manures is the cost of ash, farm yard manures, green manures and green leaf manures. The farm produced manures are evaluated at prevailing prices.

X_5 - Cost of plant protection chemicals represent the cost of pesticides and insecticides.

X_6 - Irrigation charges include the water taxes for use of canal water, and hire charges for water in the case of farmers who hire water from neighbours.

X_7 - This is calculated as

$$\frac{\text{Total No. of suckers planted} - \text{No. of plants which yielded the bunches}}{\text{Total No. of suckers planted}} \times 100$$

X_8 - Cost of supports and ropes used for propping. The cost of supports was apportioned on the basis of the average number of years for which they were used.

For the second function fitted with Y as revenue per plant, each of the inputs were used on a per plant basis and hence the variables, number of plants and percentage loss of plants were deleted here. So the second function comprises only six independent variables.

Area of Study

AREA OF STUDY

Trichur district is located at the centre of the State of Kerala. It is bounded on the North by Malappuram and Palghat districts, on the East by part of Palghat district and Coimbatore district of Tamil Nadu, on the South by Idukki and Ernakulam Districts and on the West by the Arabian Sea. The district lies between North Latitude 10° and 10° $4'$ and East Longitude 75° $57'$ and $76^{\circ}54'$. The total geographical area of the district is 2993.90 sq.km which forms 7.8% of the total area of the state. Trichur is divided into 17 NES blocks spreading over 98 panchayats. Altogether there are 251 revenue villages and 10 towns in the district. The district can also be divided into three natural divisions viz. Highland, Lowland and Midland.

The climate of Trichur district is tropical and humid with an oppressive hot season. The rainfall is seasonal and fairly assured. The district receives a total rainfall of 3177.4 mm with high rainfall from May to October - November. The distribution of normal monthly rainfall for the District is given in Table 4.1

Table 4.1 Normal rainfall in Trichur district

	(in mm)
July	761.4
August	458.6
September	250.3
October	307.5
November	158.3
December	30.3
January	9.3
February	8.8
March	28.6
April	86.6
May	274.3
June	803.4
Total	3177.4

Source: Farm Guide, 1983 pp. 33

Heavy rainfall is obtained during the South West monsoon from May-June to July-August. The North East monsoon starts by September and continues till November-December. The average daily maximum temperature in March and April which are generally the hotest months

is about 31°C to 32°C in the coastal regions and about 36°C in the interior.

The soil of the district is broadly divided into four types namely sandy, alluvial, laterite and forest soil. The soil of the coastal taluks of Kodungallur and Chavakkad vary from almost pure sand to sandy loam. Alluvial soil occur in the low lying areas of Trichur and Mukundapuram taluks and are well enriched with organic matter, nitrogen and potash, but are deficient in phosphorous and calcium. Soil of Trichur and Talappilly taluks are mostly laterite in nature. Forest soil is confined to the eastern region comprising of Talappilly, Mukundapuram and Trichur taluks.

The main crops cultivated in the district are paddy, coconut, arecanut, rubber, tea, vegetables, banana, and other plantains. Of the food crops rice occupies the most important position, with an area of 110314 hectares ie. 47.66 per cent of the total cropped area. Coconut is the predominant perennial crop grown in the sandy belt. Seasonal crops like tapioca, banana and vegetables are grown in the mid land regions where laterite soil is present. Chalakudy block has the largest

area under banana. Different varieties of plantains are available there. Since banana cultivation requires intensive watering it is intensively cultivated in areas having irrigation facilities. Plantation crops like tea, coffee and rubber are grown in the highland regions. The cropping pattern and land use pattern for the district are given in table 4.2.

Table 4.2 Cropping pattern in Trichur district for the year 1980-81

Crop	Area (ha)	Percentage to total cropped area
Rice	110314	47.66
Other cereals and millets	148	0.06
Pulses	3313	1.43
Palmirah/sugarcane	944	0.41
Pepper	4010	1.73
Chillies	2	0.01
Ginger	168	0.07
Turmeric	169	0.07
Arecanut	6633	2.87
Tamarind	1468	0.63
Other condiments and spices	424	0.18
Mango	4973	2.15
Jack	3784	1.63
Banana	1549	0.67
Other plantains	3259	1.41
Pine-apple	434	0.19
Other fruits	2658	1.15
Cashew	7163	3.09
Vegetables	10795	4.66
Oil seeds	55647	24.04
Betel leaves	75	0.03
Lemongrass	36	0.02
Tea	441	0.19
Coffee	33	0.01
Rubber	9386	4.06
Cocoa	1380	0.60
Fodder crops	90	0.04
Green manure crops	480	0.21
Other nonfood crops	1679	0.73
Total cropped area	231455	100

Source: Farm Guide 1983, pp. 11.

Table 4.3 Land utilisation in Trichur district 1980-81 (hectares)

Total geographical area	299390
Forest	103619
Land put to non-agricultural uses	21642
Barren and uncultivable land	2492
Permanent pasteures and grazing lands	187
Land under miscellaneous tree crops	1307
Cultivable waste land	5452
Fallow other than current fallow	3021
Current fallow	4860
Net area sown	156810
Area sown more than once	74645
Total cropped area	231455

Source: Farm Guide, 1983. pp. 10

The district has comparatively well developed system of roads to the main centres of production and trade. NH 47 in Trichur consists of Trichur Vaniampara road and Trichur Chalakudy road. The Trichur Vaniampara road has a length of 24.6 km and it leads to Coimbatore via Palghat. Trichur Chalakudy road (39 km) leads to Trivandrum via Ernakulam. NH 17 stretches from Chavakkad to Kottappuram. The district has 186.27 km of State Highway, 588 km of district roads, 974 km of Village roads and 278 km of Muncipal and Panchayat roads.

The Ernakulam Calicut railway line (70.27 km) passes through the district. The district is well served by chain of lagoons, backwaters, canals and rivers. Cheap water transport facility is available for transporting industrial and agricultural products. The lagoons and backwaters run parallel to the sea from one end of the district to the other. The main canals of the district are 1) Canoli canal lying between Chavakkad and Mukundapuram taluks (2) Shanmughom Canal in Mukundapuram Taluk and (3) Puthenthode in Trichur Taluk. Mala Parur and Kundoor Pullut are the two important roots where passenger motor boats are operated. Bharathapuzha the longest river flows westwards at the northern boundary and Periyar also flows westwards at the southern boundary

of the district.Chalakudy river, Karuvannur river and Kecheri river are the other important rivers.

According to 1981 census Trichur district has a total population of 24.37 lakhs of which 11.60 lakhs are males and 12.77 lakhs are females. 7.27 lakhs are workers (including marginal workers) and 17.09 lakh nonworkers. The density of population per square km was reported to be 804. The literacy rate on an average was 72.32 per cent with a higher male literacy rate of 75.98 per cent and a lower 68.99 per cent for females.

Chalakudy block is selected for the study purposively as it has the highest area under banana in the district. The block has a total area of 596.32 square km with 6 Panchayat and one Municipal area. The Panchayats are

1. Kodassery
2. Pariyaram
3. Melur
4. Koratty
5. Kallur Vadakkumuri
6. Vettilappara

Municipal area comprise of Perambra, Potta and Padinjare Chalakudy.

The principal crops grown in the block are Paddy, Coconut, Arecanut, Banana, Rubber, Tea etc. The cropping pattern of the block for the year 1981 is given in Table 4.4.

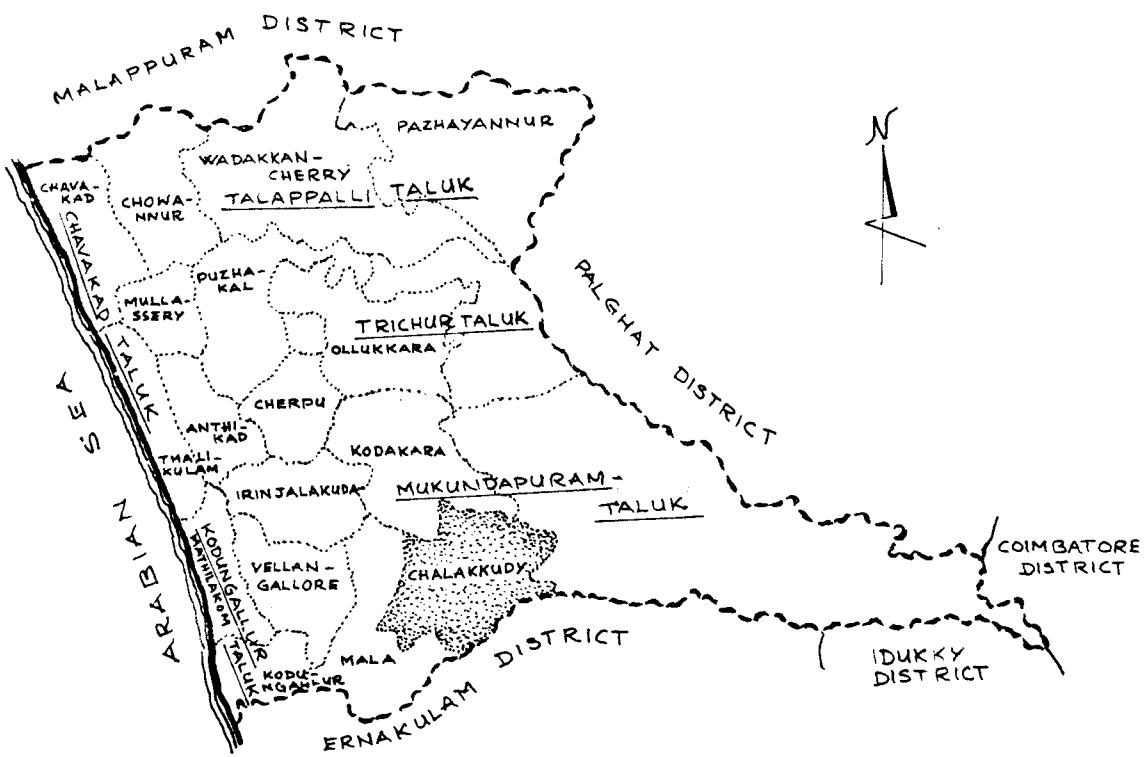
The block is rich in water resources and has ample irrigation facilities. Chalakudy river diversion scheme diverts the water in Chalakudy river for supporting the existing paddy cultivation and for convertion of large area of drylands on either sides of the river cultivable. There are two main canals one on each side of the river. The right bank canal is 37 km long with 18 branch canals and left bank canal is 19.3 km long with 16 branch canals. The scheme help to irrigate a total area of 24260 hectare.

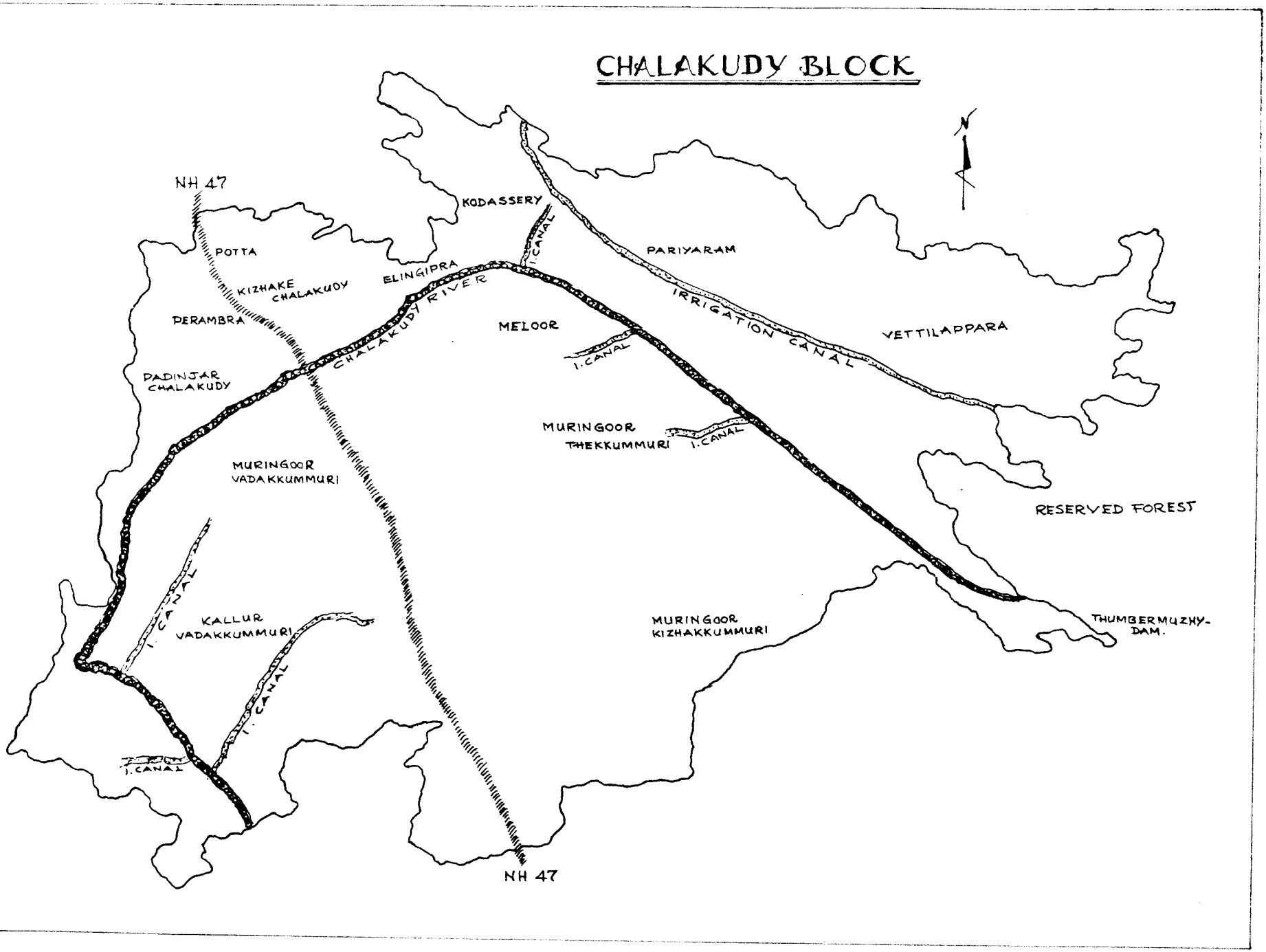
Table 4.4. Cropping pattern in Chalakkudy Block for the year 1981.

Crops	Area in hectares
Paddy:-	
Virippu	2887
Mundakan	4860
Puncha	1703
Coconut	620
Arecanut	250
Banana	640
Pepper	105
Rubber	480
Ginger	80
Gingely	20
Cocoa	120
Coffee	30
Tea	1000

Source: Block Development Office, Chalakudy.

TRICHUR DISTRICT MAP




CHALAKUDY BLOCK
N
NH 47
KODASSERY
I.CANAL
PARIYARAM
POTTA
KIZHAKE CHALAKUDY
ELINGIPRA
CHALAKUDY RIVER
IRRIGATION CANAL
VETTILAPPARA
PERAMBRA
MELOOR
I.CANAL
PADINJAR CHALAKUDY
MURINGOOR THEKKUMMURI
I.CANAL
MURINGOOR VADAKKUMMURI
RESERVED FOREST
I.CANAL
KALLUR VADAKKUMMURI
MURINGOOR KIZHAKKUMMURI
THUMBERMUZHY-DAM.
I.CANAL
I.CANAL
I.CANAL
NH 47

Results and Discussion

RESULTS AND DISCUSSION

General economic and social condition in the sample farms

In order to obtain some background information regarding the sample farmers some of the socio economic aspects have been presented here.

As has been mentioned in the previous chapter, the whole sample has been divided into four strata based on the number of banana plants cultivated by the farmers. The proportion of the farmers who had cultivated 100 or less than 100 banana plants was 35.71 per cent, 38.78 per cent cultivated 101 - 250 plants, 19.39 per cent had 251 - 500 plants and the rest 6.12 per cent had more than 500 plants.

1. Size of operational holding

Of the total respondents, 32.65 per cent had less than 0.4 hectare under cultivation. 33.67 per cent had 0.41 to 0.8 hectare area, 24.49 per cent had 0.81 - 1.6 hectare and the remaining 9.19 per cent had more than 1.6 hectare under cultivation. The distribution of respondents according to size of operational holding in different strata is given in the Table 5.1.1.

Table 5.1.1. Distribution of respondents according to size of operational holding.

Holding size / Strata	Below 0.4 hectare	0.41 - .8 hectare	0.81 - 1.6 hectare	1.61 hectare and above	Total
I	20 (57.14)	8 (22.86)	7 (20)	0 (0)	35 (100)
II	(211 (28.95)	21 (55.26)	4 (1053)	2 (5.26)	38 (100)
III	1 (5.26)	4 (21.05)	12 (63.16)	2 (10.53)	19 (100)
IV	0 (0)	0 (0)	1 (15.67)	5 (83.33)	6 (100)
Total	32 (32.65)	33 (33.67)	24 (24.49)	9 (9.19)	98 (100)

*Figures in parantheses are percentage to the total

2. Family Size

The average size of family for the sample was six. Of the total 98 respondents, 24 had 3 - 5 members in their family, 39 had 6 - 8 members, and 35 had 9 and above members. The distribution of respondents based on family size is given in Table 5.1.2.

3. Age and sex

Members of families of respondents have been classified on the basis of age and sex and the same presented in Table 5.1.3. The sex ratio was observed to be almost equal to 1:1. Nearly 50 per cent of the population was under the age group of 15 - 60 years of which 51.41 per cent were males and 48.59 per cent were females. The percentage of infants was 13.80 per cent of total population.

Similarly the percentage of members above 60 years was 18.15 per cent of the total population and 43.75 per cent of them were males and the rest females.

4. Education

29.30 per cent of the sample farmers had university

Table 5.1.2. Distribution of respondents family based on family size

Family size Strata	3 - 5 members	6 - 8 members	9 and above members	Total
I	8 (22.86)	10 (28.57)	17 (48.57)	35 (100)
II	12 (31.58)	15 (39.47)	11 (28.95)	38 (100)
III	0 (0)	12 (63.16)	7 (36.84)	19 (100)
IV	4 (66.67)	2 (33.33)	0 (0)	6 (100)
Total	24 (24.49)	39 (39.80)	35 (35.71)	98 (100)

*Figures in parantheses are percentage to the total.

Table 5.1.3. Classification of respondents based on age and sex.

Strata Age & Sex		I	II	III	IV	Total
Above 60 years	M	12 (8.96)	18 (8.91)	8 (8.16)	4 (4.21)	42 (7.94)
	F	18 (13.43)	21 (10.40)	8 (8.16)	7 (7.37)	54 (10.21)
15 - 60 years	M	28 (20.90)	53 (26.24)	20 (20.40)	27 (28.42)	128 (24.20)
	F	25 (18.66)	48 (23.76)	26 (26.53)	22 (23.16)	121 (22.87)
6 - 14 years	M	8 (5.96)	24 (11.88)	12 (12.24)	13 (13.68)	57 (10.78)
	F	14 (10.45)	17 (8.42)	15 (15.31)	8 (8.42)	54 (10.21)
0 - 6 years	M	13 (9.70)	10 (4.95)	5 (5.12)	7 (7.37)	35 (6.62)
	F	16 (11.94)	11 (5.44)	4 (4.08)	7 (7.37)	38 (7.18)
Total	M	61 (45.52)	105 (51.98)	45 (45.92)	51 (53.68)	262 (49.53)
	F	73 (54.48)	97 (48.02)	53 (54.08)	44 (46.32)	267 (50.47)
Total		134 (100)	202 (100)	98 (100)	95 (100)	529 (100)

*Figures in parantheses are percentage of the total.

education, and 45.18 per cent had different levels of schooling while 8.51 per cent had eventhough no formal education were able to read and write but 5.10 per cent were not able to read and write. It was also noticed that all these illiterate people belonged to the older age group. The illiteracy rate was highest in the Ist stratum (10.44 per cent) and was least in the IVth stratum (2.10 per cent). The classification of the sample farmers based on level of education is given in Table 5.1.4.

5. Occupation

Occupationwise distribution of respondents (Table 5.1.5) has revealed that a large per cent of them (42.86 per cent) depended on agriculture along with labour either permanent or temporary for their livelihood. 28.57 per cent had Government jobs or similar services along with agriculture. Only 18.37 per cent of farmers depend solely on agriculture. 10.21 per cent engaged in agriculture along with business as a subsidiary source of income. The remaining 6.12 per cent had three sources of income ie. agriculture, business and services.

In the Ist and IInd strata most of the farmers

Table 5.1.4. Classification of respondent's family based on level of education

Strata / Level of education	I	II	III	IV	Total
Below 5 years	25 (18.66)	18 (8.91)	8 (8.16)	12 (12.63)	63 (11.91)
Primary	20 (14.93)	35 (17.33)	15 (15.31)	6 (6.32)	71 (13.42)
Middle school	15 (11.19)	61 (30.20)	11 (11.22)	10 (10.53)	97 (18.34)
High School	18 (13.43)	31 (15.35)	11 (11.22)	11 (11.58)	71 (13.42)
Under-graduate	12 (8.96)	28 (13.86)	14 (14.29)	21 (22.11)	80 (15.12)
Graduate/ Post-graduate	10 (7.46)	14 (6.93)	23 (23.47)	28 (29.47)	75 (14.18)
Literate with no formal education	20 (14.93)	9 (4.46)	11 (11.22)	5 (5.26)	45 (8.51)
Illiterate	14 (10.44)	6 (2.96)	5 (5.11)	2 (2.10)	27 (5.10)
Total	134 (100)	202 (100)	98 (100)	95 (100)	529 (100)

*Figures in paranthesis are percentage of the total.

Table 5.1.5. Distribution of respondents based on occupation.

Occupation Strata	Agri-culture	Agricul-ture + labour	Agricul-ture + Service	Agricul-ture + Business	Agricul-ture + Business+ Service	Total
I	9 (25.71)	15 (42.86)	11 (31.43)	-	-	35 (100)
II	7 (18.42)	16 (42.11)	9 (23.68)	5 (13.16)	1 (2.63)	38 (100)
III	2 (10.53)	5 (26.32)	6 (31.58)	4 (21.05)	2 (10.52)	19 (100)
IV	-	-	2 (33.33)	1 (16.67)	3 (50)	6 (100)
Total	18 (18.37)	36 (36.73)	28 (28.57)	10 (10.21)	6 (6.12)	98 (100)

*Figures in parantheses are percentages of the total

were labourers. In the IIIrd and IVth strata a major per cent of the farm families had government jobs as a source of income in addition to agriculture.

Family Income

Of the total 98 respondents, 32 had a family income between Rs.5000/- and Rs.10,000/-per annum and 35 had an income below Rs.5,000/- per annum. There were 21 families having an income between Rs.10,000/- and Rs.20,000/-. Only 10 families had greater than Rs.20,000/- income per annum. It was observed that there is an increase in the level of income of farmers as we come to the higher strata. In the Ist stratum 48.57 per cent of the families had an income below Rs.5,000/- per annum. In the IIIrd stratum 52.63 per cent had an income between Rs.10,000/- and Rs.20,000/- per annum. Half of the families in the IVth stratum belonged to the highest income group ie. greater than Rs.20,000/- per annum. Distribution of respondents based on level of family income per annum is given in Table 5.1.6.

Table 5.1.6. Distribution of respondents based on level of family income per annum (Other than from agriculture)

Income Strata	Upto Rs.5000/-	Rs.5001/- to 10,000/-	Rs.10,001/- to 20,000/-	More than Rs.20,000/-	Total
I	17 (48.57)	10 (28.57)	5 (14.29)	3 (8.57)	35 (100)
II	16 (42.11)	16 (42.11)	4 (10.53)	2 (5.25)	38 (100)
III	2 (10.53)	5 (26.32)	10 (52.62)	2 (10.53)	19
IV	0 (0)	1 (16.67)	2 (33.33)	3 (50)	6 (100)
Total	35 (35.71)	32 (32.65)	21 (21.43)	10 (10.21)	98 (100)

Cost of cultivation

Banana (*Musa* spp) is cultivated either as mono culture or as intercrop in coconut or arecanut gardens. The present study is confined to nendran banana cultivated as a pure crop. There are slight variations in the cultivation practices followed in different regions of the district. The various steps in the cultivation of banana followed by the farmers of the Chalakudy block can be summarised as follows:-

Preparation of land

The land is prepared by taking trenches. The practice of taking pits was not observed in any of the sample farms.

Planting

Selected suckers were smeared with cowdung solution and dried in the sun for 3 - 4 days and stored in the shade for about two weeks before planting. None of the sample farmers used chemicals for seed treatment.

The most widely followed spacing was that of 2 x 2 mt which is also the recommendation for nendran banana by Kerala Agricultural University. Thus it was

observed that there were 2500 plants in one hectare.

The planting season is between June and August.

Manures and fertilizers

Application of green manures, green leaf manures, farm yard manure and ash was very common in all the sample farms. The manures and fertilizers were applied in two split doses usually. A few of the farmers applied the fertilizers in three split doses also. The first dose of manures comprising of farm yard manure, ash and green leaf manures were applied at the time of planting. Only 21 out of 98 sample farmers used sunhemp or daincha as green manures. The rest of the farmers used only green leaf manures.

Fertilizers were found to be applied in equal split doses, first about two months after planting and the other between 4 - 5 months of planting. Most of the farmers used 17 : 17 : 17 or 8 : 8 : 16 mixtures and a few used straight fertilizers like ammonium sulphate, super phosphate, muriate of potash etc. The N, P and K nutrient application through chemical fertilizers is given in table 5.2.1. Generally fertilizer use was lower than recommended levels and

Table 5.2.1. Nutrient use in different strata (gm per plant).

Nutrients	Recommend dose	Actual quantities used by sample farmers				
		Strata I	Strata II	Strata III	Strata IV	Sample average
N	190	135.42	120.75	179.3	224.38	168.73
P_2O_5	115	122.79	95.52	105.44	141.88	113.33
K_2O	300	130.85	185.11	245.20	127.41	185.82

the deficiency was most pronounced in respect of K_2O. However, it was found that farmers in the largest holding size stratum applied N at higher than recommended levels. In all the other three strata it was below the recommended dose of 190 gm/plant. Except in the IInd and IIIrd strata the use of P_2O_5 was in excess of what is recommended. The average P_2O_5 for the sample (113.33 gm/plant) came very closely to the recommended dose of 115 gm P_2O_5/plant.

Irrigation

Banana is a crop which is highly responsive to irrigation. It is irrigated during the months from December to April - May. The main source of irrigation in the sample farms was the canal water. More than 80 per cent of the sample farms depended upon the canal water. The rest 20 per cent were found to use well water which they hired from the neighbours. The lands in these cases were situated above the canal level and that was the reason which prevented them from using canal water. The cost of irrigation using hired water was calculated to be 13 per cent higher than that of using the canal water.

All of the farmers irrigated the banana twice in a week. Mostly family labour was employed for the irrigation. Usually desuckering was also done while diverting the water. No separate labour was employed for that purpose.

Weeding

Generally weeding was done twice ie. prior to the application of manures and fertilizers. None of the sample farmers used weedicides and hand weeding was found to be the common practice.

Plant protection

It was noticed that the cultivators adopted the plant protection measures mostly as a curative measure rather than a preventive measure. Of the total farmers 26.13 per cent of the farmers in the Ist stratum used plant protection chemicals in their field. The corresponding figure for the IInd, IIIrd and IVth stratum were 42.10, 89.47 and 66.67 respectively.

It was observed that the cost of cultivation increased by about Rs.367.87 per hectare by the adoption of plant protection practices and this added to the

output by an amount equal to Rs.1954.90 per hectare. The percentage loss of plants has also declined to 10.67 per cent from 13.98 per cent by the adoption of plant protection practices.

The most widely used chemicals were Bordeaux mixture, Furadan, Ekalux, Sevin etc.

Supporting

After the emergence of inflorescence and start of fruit setting banana plants were given supporting with bamboo or arecanut poles. The bamboo poles were reported to be very scarce and hence costly. But it has an additional advantage that it can be used for 4 - 5 years. On the other hand arecanut poles are less costly but can be used only for 2 years at the maximum.

It was noticed that in the Ist stratum 60.44 per cent of total supports used were arecanut poles and the figures for IInd, IIIrd and IVth strata were 74.60 per cent, 57.67 per cent and 43.36 per cent respectively. Only in the IVth stratum a higher proportion of bamboo poles were used than that of the arecanut poles.

Harvesting

All the bunches were not harvested at the same time as all of them did not come to maturity uniformly. After the harvesting, the suckers were removed from the field cleaned and this was used as seed material for the next season.

Banana cultivation is highly labour intensive. On an average 33 per cent of total cost of cultivation was cost of labour (including hired and family labour). The operation wise labour use in mandays for different strata is given in table 5.2.2. Eight hours of work by a labourer was taken as equivalent to one manday. The mandays were worked out on the basis of two female labour days as equivalent to one male labour day as this was approximately the wage rate ratio. In the Ist and IInd stratum manuring demanded highest quantum of labour ie. 158.76 mandays per hectare and 175.57 mandays per hectare respectively. But in IIIrd and IVth strata the after cultivation and irrigation accounted for greatest labour use. Labour use for plant protection operations steadily increased from the Ist to IVth stratum. The labour used for preparatory

cultivation and planting was almost same for all the strata ie. around 30 per cent of total labour requirement. Same was the case with harvesting and handling operations. The figure for this came to around 20 per cent of the total labour use. The total labour requirement increased from 658.52 mandays per hectare in the Ist stratum to 732.14 mandays per hectare in the IVth stratum. On an average this worked out to 702.96 mandays per hectare. The use of female labour was very insignificant in banana cultivation. Female labour was employed only in transportation of manures and weeding. Hence sexwise classification of labour was not attempted in the analysis.

Considering the family and hired labour contribution in each stratum, it was noticed that the amount of family labour declined from the Ist stratum to the IVth and the reverse was the trend of hired labour. Hired labour utilization more than doubled in the IVth stratum compared to the Ist. The employment of family labour in the IVth stratum was only 1/3rd of that in the Ist. In the IVth stratum family labour was used mainly for irrigation which consisted

Table 5.2.3. Family and hired labour contribution of each strata (Mandays)

	I	II	III	IV	Sample average
Hired	210.13 (31.91)	326.21 (45.85)	418.30 (58.35)	580.91 (79.34)	401.87 (57.79)
Family	448.39 (66.09)	385.23 (54.15)	298.63 (41.65)	151.23 (20.66)	301.09 (42.21)
Total	658.52 (100)	711.44 (100)	716.93 (100)	732.14 (100)	702.96 (100)

Figures in parenthesis are percentages to total.

of guiding canal water (Table No.5.2.3).

Cost of cultivation (input wise)

Data on cost of cultivation of banana (input wise) for different strata is given in tables 5.2.4 to 5.2.8.

In stratum I the average total cost of cultivation (Cost C) of sample farms worked out to Rs.38750.86 per hectare. Of it cost A1, Cost A2 and Cost B constituted 69.80, 70.32 and 77.29 per cent respectively. The most important input of expenditure was the labour which constituted 33.35 per cent of total cost. This was followed by manures, fertilizers and propping constituting Rs.7820/- (20.18 per cent), Rs.6100/- (15.74 per cent) and Rs.4350/- (11.23 per cent) respectively. Seed material, irrigation, interest on working capital and land revenue constituted 6.13 per cent, 1.79 per cent 3.94 per cent and 0.01 per cent respectively. The rental value of land accounted for 7.48 per cent of the total cost. Total cost excluding the rental value of land worked out to Rs.35850.86 per hectare. (Table 5.2.4).

Coming to the IInd stratum the total cost of

Table 5.2.4. Cost of cultivation of banana (Inputwise) (per hectare) (Stratum I)

	Rs.
Hired human labour	4124.85 (10.64)
Seed material	2375 (6.13)
Manures	7820 (20.18)
Fertilizers	6100 (15.74)
Plant protection chemicals	53 (0.14)
Propping	4350 (11.23)
Irrigation	693.41 (1.79)
Interest on working capital	1527.80 (3.94)
Land revenue	5.00 (0.01)
Cost A1	27049.06 (69.80)
*Rent paid for leased in land	203.00 (0.52)
Cost A2	27252.06 (70.32)
*Imputed rental value of owned land	2697 (6.67)
Cost B	29949.06 (77.29)
Imputed value of family labour	8801.80 (22.74)
Cost C	38750.86 (100)
Total cost excluding rental value of land	35850.86

* The average rent paid per banana pit worked out to Rs.1.16. Thus the rent per hectare is 2900. This is distributed proportionately between rent paid for leased in land and rental val e of owned land based on the number of plants for which the rent was actually paid in each stratum.

(Figures in parenthesis are percentages to total)

cultivation was Rs.42660.82 per hectare. Here cost A1, A2 and B accounted for 75.48 per cent, 76.29 per cent and 82.27 per cent of the total cost. Here also the major item of expenditure was the labour (32.74 per cent) followed by manures (19.24 per cent), fertilizers (13.65 per cent) and propping (11.43 per cent). The rest of the cost was accounted for seed material (8.79 per cent), irrigation (2.70 per cent), interest on working capital (4.27 per cent), plant protection (0.36 per cent) and land revenue (0.01 per cent). The rental value was 6.8 per cent of the total cost. Total cost excluding rental value was Rs.39760.82 per hectare (Table 5.2.5).

In the IIIrd stratum the total cost increased to Rs.43335.35 per hectare and this was the highest among different strata. As in the case of the first two strata, the largest item of cost was labour (32.48 per cent) followed by manures (19.34 per cent), fertilizers (18.69 per cent), and propping (10.56 per cent). Seed material, irrigation, interest on working capital and land revenue constituted 6 per cent, 1.49 per cent, 4.51 per cent and 0.01 per cent respectively. Total cost excluding the rental value of land came to Rs.40435.35 per hectare (Table 5.2.6).

Table 5.2.5. Cost of cultivation of banana (Inputwise) (per hectare) (Stratum II)

	Rs.
Hired human labour	6403.5 (15.01)
Seed materials	3750 (8.79)
Manures	8210 (19.24)
Fertilizers	5825 (13.65)
Plant protection	152.5 (0.36)
Propping	4875 (11.43)
Irrigation	1156.07 (2.70)
Interest on working capital	1822.32 (4.27)
Land revenue	4.37 (0.01)
Cost A1	32198.76 (75.48)
*Rent paid for leased in land	348.00 (0.82)
Cost A2	32546.76 (76.29)
*Imputed rental value of owned land	2552 (5.98)
Cost B	35098.76 (82.27)
Imputed value of family labour	7562.06 (17.73)
Cost C	42660.82 (100)
Total cost excluding rental value of land	39760.82

*The average rent paid per banana pit worked out to Rs.1.16. Thus the rent per hectare is Rs.2900/- This is distributed proportionately between rent paid for leased in land and rental value of owned land based on the number of plants for which the rent was actually paid in each stratum.

(Figures in parenthesis are percentages to total)

Table 5.2.6. Cost of cultivation of banana (Inputwise) (Per hectare) (Stratum III)

	Rs.
Hired human labour	8211.23 (18.95)
Seed material	2600 (6.00)
Manures	8380 (19.34)
Fertilizers	8100 (18.69)
Plant protection	100 (0.23)
Propping	4575 (10.56)
Irrigation	646 (1.49)
Interest on working capital	1956.73 (4.51)
Land revenue	4.28 (0.01)
Cost A1	34573.24 (79.78)
*Rent paid for leased in land	493 (1.14)
Cost A2	35066.24 (80.92)
*Imputed rental value of owned land	2407 (5.55)
Cost B	37473.24 (86.47)
Imputed value of family labour	5862.11 (13.53)
Cost C	43335.35 (100)
Total cost excluding rental value of land	40435.35

*The average rent paid per banana pit worked out to Rs.1.16. Thus the rent per hectare is Rs.2900/- This is distributed proportionately between rent paid for leased in land and rental value of owned land based on the number of plants for which the rent was actually paid in each stratum.

In the IVth stratum the total cost worked out to Rs.40734.85 per hectare which was lower than that of IInd and IIIrd strata. The total expenditure on labour was Rs.14371.90 per hectare which was 35.28 per cent of the total cost. In this stratum the expenditure on fertilizers (19.83 per cent) was more than that on manures (14.36 per cent) unlike in the first two strata. The expenditure on propping was Rs.4675/- per hectare ie. 11.48 per cent of the total cost. Cost A and Cost B worked out to Rs.34866.21 per hectare (85.59 per cent) and Rs.37766.21 (92.71 per cent) respectively. As there was no leased in land in this stratum costs A_1 and A_2 were the same (Table 5.2.7).

On an average the total cost of cultivation came to Rs.41814.13 per hectare of which Rs.33003.73 was cost A_1, 33298.09 cost A_2 and 35903.73 cost B. The major items of expenditure were labour, manures, fertilizers and propping constituting Rs.13799.11 (33.00 per cent), Rs.7625.42 (18.24 per cent), Rs.7205.42 (17.23 per cent), Rs.4673.12 (11.18 per cent) respectively. Seed material, irrigation, interest on working capital and land revenue together constituted 13.11 per cent of total cost. Expenditure on plant protection was only a

Table 5.2.7. Cost of cultivation of banana (Inputwise) (Per hectare) (Stratum IV)

	Rs.
Hired human labour	11403.26 (27.99)
Seed material	2500 (6.14)
Manures	5850 (14.36)
Fertilizers	8075 (19.83)
Plant protection	160 (0.39)
Propping	4675 (11.48)
Irrigation	225 (0.55)
Interest on working capital	1973.30 (4.84)
Land revenue	4.65 (0.01)
Cost A1	34866.21 (85.59)
*Rent paid for leased in land	-
Cost A2	34866.21
*Imputed rental value of owned land	2900 (7.12)
Cost B	37766.21 (92.71)
Imputed value of family labour	2968.64 (7.29)
Cost C	40734.85 (100)
Total cost excluding rental value of land	37854.85

* The average rent paid per banana pit worked out to Rs.1.16. Thus the rent per hectare is Rs.2900/- This is distributed proportionately between rent paid for leased in land and rental value of owned land based on the number of plants for which the rent was actually paid in each stratum.

(Figures in parenthesis are percentages to total)

Table 5.2.8. Cost of cultivation of banana (Inputwise) (per hectare)(Average)

	Rs.
Hired human labour	7888.71 (18.87)
Seed material	2910.16 (6.96)
Manures	7625.43 (18.24)
Fertilizers	7205.42 (17.23)
Plant protection	128.27 (0.30)
Propping	4673.12 (11.18)
Irrigation	700.17 (1.67)
Interest on working capital	1867.88 (4.47)
Land revenue	4.57 (0.01)
Cost A1	33003.73 (78.93)
*Rent paid for leased in land	294.36 (0.71)
Cost A2	33298.09 (79.64)
*Imputed rental value of owned land	2605.64 (6.23)
Cost B	35903.73 (85.87)
Imputed value of family labour	5910.4 (14.13)
Cost C	41814.13 (100)
Total cost excluding rental value of land	38914.13

*The average rent paid per banana pit worked out to Rs.1.16. Thus the rent per hectare is Rs.2900/. This is distributed proportionately between rent paid for leased in land and rental value of owned land based on the number of plants for which the rent was actually paid in each stratum.

(Figures in parenthesis are percentages to total)

negligible part of total cost (0.30 per cent). Total cost excluding rental value of land worked out to Rs.38914.13 per hectare (Table 5.2.8).

As a whole, proportion of expenditure on seed material remained more or less constant in all the strata. The proportion of expenditure on propping was some what steady on all the strata. Proportion of expenditure on plant protection was less than one per cent of total cost in all strata. Irrigation expenses varied between 0.55 per cent and 2.70 per cent of the total cost. This variation may be due to the variation in number of farmers who hired water in each strata. Land revenue constituted 0.01 per cent of the total cost in all the strata.

Cost of cultivation (Operation wise)

Cost of cultivation of banana (operation wise) for different strata is given in tables 5.29 to 5.2.13.

Of the different operations manures and manuring had the largest share of the total cost ie. Rs.17036.46 per hectare (43.97 per cent) in stratum I. This was followed by expenditure of Rs.5022.00 per hectare (12.96 per cent) on planting material and planting. Rs.4958.00 per

hectare (12.80 per cent) on propping and Rs.2704.79 per hectare (6.98 per cent) on harvesting and handling. Imputed rental value of owned land amounted to Rs.2697 per hectare (6.96 per cent), after cultivation and irrigation expenses amounted to Rs.2656.41 per hectare (6.86 per cent) and preparatory cultivation amounted to Rs.1789.67 per hectare (4.62 per cent). The rest was shared by interest on working capital (3.94 per cent) land revenue (0.01 per cent) and rent on leased in land (0.52 per cent) and plant protection expenses (0.38 per cent) (Table 5.29).

In the IInd strata though manures and manuring continue to be the major operation demanding highest expenditure its proportion to total cost had declined (40.98 per cent) compared to the Ist stratum. Planting material and planting, propping, after cultivation and irrigation and harvesting and headling constituted Rs.6481.12 (15.19 per cent), Rs.5346.71 (12.53) per cent, Rs.3119.06 (7.31 per cent) and 2745.06(6.44 per cent) respectively. Expenditure on plant protection operations was only 0.86 per cent of total expense. Interest on working capital, land revenue, and rental

Table 5.2.9. Cost of cultivation of banana (Operationwise). (Stratum I)

		Rs.
1.	Preparatory cultivation	1789.67 (4.62)
2.	Planting material & planting	5022 (12.96)
3.	Manures & Manuring	17036.46 (43.97)
4.	Propping	4958.73 (12.80)
5.	After cultivation & irrigation	2656.41 (6.86)
6.	Plant protection	149 (0.38)
7.	Harvesting & Landing	2704.79 (6.98)
8.	Interest on working capital	1527.80 (3.94)
9.	Land revenue	5.00 (0.01)
* 10.	Rental value of leased in land	203 (0.52)
* 11.	Imputed rental value of owned land	2697 (6.97)
	Total cost	38750.86 (100)
	Total cost excluding rental value of land	35850.86

* The average rent paid per banana pit worked out to Rs.1.16. Thus the rent per hectare is 2900. This is distributed proportionately between rent paid for leased in land and rental value of owned land based on the number of plants for which the rent was actually paid in each stratum.

(Figures in parenthesis are percentages to total)

Table 5.2.10. Cost of cultivation of banana (Operationwise) (Stratum II)

		Rs.
1.	Preparatory cultivation	2394.86 (5.61)
2.	Planting material & planting	6481.12 (15.19)
3.	Manures & Manuring	17481.44 (40.98)
4.	Propping	5346.71 (12.53)
5.	After cultivation & irrigation	3119.06 (7.31)
6.	Plant protection	365.88 (0.86)
7.	Harvesting & handling	2745.06 (6.44)
8.	Interest on working capital	1822.32 (4.27)
9.	Land revenue	4.37 (0.01)
*10.	Rental value of leased in land	348 (0.82)
* 11.	Imputed rental value of owned land	2552 (5.98)
	Total cost	42660.82 (100)
	Total cost excluding rental value of land	39760.82

* The average rent paid per banana pit worked out to Rs.1.16. Thus the rent per hectare is 2900. This is distributed proportionately between rent paid for leased in land and rental value of owned land based on the number of plants for which the rent was actually paid in each stratum.

(Figures in parenthesis are percentages to total)

value together constituted Rs.4432.8 (11.45 per cent) (Table 5.2.10).

In the IIIrd stratum, the total cost worked out to Rs.43335.35 per hectare which accounted for various operations like manures and manuring Rs.19198.76 (44.3 per cent), propping Rs.5096.37 (11.76 per cent), after cultivation and irrigation Rs.4572/- (10.55 per cent), planting material and planting 4097.18 (9.45 per cent), harvesting and handling Rs.2512.64 (5.8 per cent), preparatory cultivation Rs.2459.64 (5.68 per cent) in the descending order. The expenditure on plant protection increased to 1.24 per cent. This increased in absolute terms also (Table 5.2.11).

In the IVth stratum total cost was Rs.40374.85 per hectare which was less than that in IInd and IIIrd strata. Expenditure on propping Rs.6096.60 (14.97 per cent) was highest in this stratum both in absolute terms and proportionately. So also the expenditure on plant protection operations Rs.1149.35 (2.82 per cent). The proportion of expenditure on manures and manuring was least in this stratum (40.48 per cent) when compared to other three strata. The harvesting and handling expenses worked out to Rs.2570.16 (6.31 per cent). When compared

Table 5.2.11. Cost of cultivation of banana (Operationwise) (Stratum III)

		Rs.
1.	Preparatory cultivation	2459.64 (5.68)
2.	Planting material & planting	4097.18 (9.45)
3.	Manures & manuring	19198.76 (44.3)
4.	Propping	5096.37 (11.76)
5.	After cultivation & irrigation	4572 (10.55)
6.	Plant protection	537.75 (1.94)
7.	Harvesting & handling	2512.64 (5.80)
8.	Interest on working capital	1956.73 (4.52)
9.	Land revenue	4.28 (0.01)
*10.	Rental value of leased in land	493 (1.14)
*11.	Imputed rental value of owned land	2407 (5.55)
	Total cost	43335.35 (100)
	Total cost excluding rental value of land	40435.35

* The average rent paid per banana pit worked out to Rs.1.16. Thus the rent per hectare is 2900. This is distributed proportionately between rent paid for leased in land and rental value of owned land based on the number of plants for which the rent was actually paid in each stratum.

(Figures in parenthesis are percentages to total)

Table 5.2.12. Cost of cultivation of banana (Operationwise) (Stratum IV)

		Rs.
1.	Preparatory cultivation	2560.34 (6.29)
2.	Planting material & planting	4803.97 (11.79)
3.	Manures & manuring	16488.48 (40.48)
4.	Propping	6096.60 (14.97)
5.	After cultivation & irrigation	2188 (5.37)
6.	Plant protection	1149.35 (2.82)
7.	Harvesting & handling	2570.16 (6.31)
8.	Interest on working capital	1973.30 (4.84)
9.	Land revenue	4.65 (0.01)
*10.	Rental value of leased in land	-
* 11.	Imputed rental value of owned land	2900 (7.12)
	Total cost	40734.25 (100)
	Total cost excluding rental value of land	37834.85

* The average rent paid per banana pit worked out to Rs.1.16. Thus the rent per hectare is 2900. This is distributed proportionately between rent paid for leased in land and rental value of owned land based on the number of plants for which the rent was actually paid in each stratum.

(Figures in parenthesis are percentages to total)

to the Ist and IInd and IIIrd strata the after cultivation and irrigation expenses were least in this strata. It was only Rs.2188.00 per hectare. Interest on working capital and land revenue together constituted 4.85 per cent of total cost. The total cost excluding rental value of land was Rs.37834.85 per hectare (Table 5.2.12).

For the sample as a whole, operation wise manuring was the highest single item of cost which worked out to Rs.17771.62 per hectare ie. 42.5 per cent of the total cost. The figures for propping, planting material and planting after cultivation and irrigation, harvesting and handling and preparatory cultivation were Rs.5696.24 (13.62 per cent), Rs.5102.05 (12.2 per cent), 3055.77 (7.31 per cent), Rs.2627.87 (6.28 per cent) and 2404.09 (5.75 per cent) respectively. Plant protection expenses were only 0.92 per cent of the total cost. Imputed rental value of owned land came to as much as Rs.2605.64 per hectare which was 6.23 per cent of total cost. So also the interest on working capital worked out to a considerable amount ie. Rs.2627.87 per hectare (6.28 per cent) (Table 5.2.13).

Table 5.2.13. Cost of cultivation of banana (Operationwise) (Average)

		Rs.
1.	Preparatory cultivation	2404.09 (5.75)
2.	Planting material & planting	5102.05 (12.20)
3.	Manures & manuring	17771.62 (42.50)
4.	Propping	5696.24 (13.62)
5.	After cultivation and irrigation	3055.77 (7.31)
6.	Plant protection	384.04 (0.92)
7.	Harvesting & handling	2627.87 (6.28)
8.	Interest on working capital	1867.88 (4.47)
9.	Land revenue	4.57 (.01)
*10.	Rental value of leased in land	294.36 (0.71)
*11.	Imputed rental value of owned land	2605.64 (6.23)
	Total cost	41814.13 (100)
	Total cost excluding rental value of land	38914.13

*The average rent paid per banana pit worked out to Rs.1.16. Thus the rent per hectare is 2900. This is distributed proportionately between rent paid for leased in land and rental value of owned land based on the number of plants for which the rent was actually paid in each stratum.

(Figures in parenthesis are percentages to total)

The expenditure on preparatory cultivation showed a steady increase from the lowest to highest stratum. The after cultivation and irrigation expenses also showed the same trend in respect of the first three strata but it was lowest in the last stratum. Plant protection operation expenses and interest on working capital also increased from the Ist to last stratum.

On a per plant basis, the average cost per bunch was Rs.12.70 in the Ist stratum, Rs.14.69 in the IInd, Rs.15.20 in the IIIrd and Rs.13.60 in the IVth stratum. Taking the overall average it came to Rs.14.31 per bunch. The cost per bunch excluding the rental value of land for each stratum was Rs.11.54, Rs.13.53, Rs.14.04, Rs.12.44 respectively. The average was Rs.13.15 per bunch. The inputwise expenditure per plant is given in table 5.2.14 and the same operationwise is given in table 5.2.15.

Yield and returns

The per hectare output in different strata are given in table 5.2.16. The output was represented in terms of number of bunches and in the method of enquiry it was impossible to know how much each bunch weighed. Neither the producer nor the buyer knew it. The prices were fixed on per bunch basis and not on the basis of

Table 5.2.14. Inputwise expenditure per plant in different strata.

	I	II	III	IV	Average
1. Hired human labour	1.65	2.56	3.28	4.56	3.16
2. Seed material	0.95	1.5	1.04	1.00	1.16
3. Manures	3.13	3.28	3.35	2.34	3.05
4. Fertilizers	2.44	2.33	3.24	3.23	2.88
5. Plant protection	0.02	0.061	0.04	0.064	0.05
6. Propping	1.74	1.95	1.83	1.87	1.87
7. Irrigation	0.28	0.46	0.23	0.09	0.28
8. Interest on working capital	0.61	0.73	0.78	0.79	0.75
9. Land revenue	.002	.002	.002	.002	.002
10. Cost A	10.80	12.88	13.83	13.95	13.20
11. Rental value of land	1.16	1.16	1.16	1.16	1.16
12. Cost B	11.96	14.04	14.99	15.11	14.36
13. Imputed value of family labour	3.52	3.02	2.34	1.19	2.36
14. Cost C	15.50	17.06	17.33	16.30	16.72

Table 5.2.15. Operationwise expenditure per plant in different strata.

	I	II	III	IV	Average
Preparatory cultivation	0.73	0.96	0.98	1.02	0.96
Planting material & planting	2.01	2.59	1.64	1.92	2.04
Manures & manuring	6.81	6.99	7.68	6.60	7.11
Propping	1.98	2.14	2.04	2.44	2.28
After cultivation & Irrigation	1.06	1.25	1.83	0.88	1.22
Plant protection	0.06	0.15	0.22	0.46	0.15
Harvesting & handling	1.08	1.10	1.00	1.03	1.05
Interest on working capital	0.61	0.72	0.78	0.79	0.75
Land revenue	.002	.002	.002	.002	.002
Rental value of land	1.16	1.16	1.16	1.16	1.16
Total cost	15.50	17.06	17.33	16.30	16.72

actual weight. The total number of bunches obtained by cultivating a hectare of banana was 1813 in the Ist stratum, 2159 in the IInd 2273 in the IIIrd and 2288 in the IVth. The average was 2199 bunches per hectare. The number of suckers obtained from a hectare was 5672 in the Ist stratum 4532 in the IInd 5578 in the IIIrd and 6504 in the IVth. On an average it came to 5500 sucker per hectare (Table 5.2.16). The better returns in the higher strata may be due to the adequate and timely application of manures and fertilizers and prompt adoption of plant protection practices by them. This was possible as most of the farmers in the higher strata had a better financial position and educational status.

The per hectare total returns in Rs. was calculated and given in table 5.2.17. This included both the returns from main product as well as the by-product ie.the suckers. Total returns was highest in the IVth stratum and lowest in the Ist stratum. It was Rs.53845.14 per hectare in the Ist stratum and Rs.68807.52 per hectare in the IVth stratum. On an average this came to Rs.65011.90 per hectare of which 90.72 per cent was contributed by main product and the rest by the sale of

Table 5.2.16. Output per hectare in different strata(Nos.)

	I	II	III	IV	Average
Bunches (Nos.)	1813	2159	2273	2288	2199
Suckers (Nos.)	5672	4532	5678	6504	5500

Table 5.2.17. Output per hectare in different strata (Rs)

	I	II	III	IV	Average
Main product	46850.12 (87.01)	56521.66 (90.48)	62128.17 (92.10)	62081.86 (90.23)	58980.64 (90.72)
Byproduct	6995.02 (12.99)	5944.84 (9.52)	5328.33 (7.90)	6725.66 (9.77)	6031.26 (9.27)
Total returns	53845.14 (100)	62466.50 (100)	67456.50 (100)	68807.52 (100)	65011.90 (100)

Figures in parenthesis are percentages to total.

suckers. For the sample as a whole revenue from sale of suckers averaged to Rs.6031/- per hectare. It was thus evident that income from the sale of suckers, contributed a some what significantly to the total revenue.

On a per plant basis the average total returns was Rs.26 per plant. The price received for a bunch varied between Rs.18.74 to Rs.24.83. The average for the whole sample was Rs.23.59 per bunch. The per plant returns was lowest in the I stratum and highest in the last one (Table No.5.2.18). This variation was due to the difference in physical yield in each strata.

Per hectare income at different costs was calculated and is given in table 5.2.19. The average farm business income was Rs.31713.81 per hectare and the corresponding figure for farmily labour income was Rs.29108.17. Net income showed a sharp increase in the IVth stratum, by an amount of Rs.12925.39, when compared to the Ist stratum.

There was not much interclass variation in the benefit cost ratio at cost A_1, A_2 and B. It was

Table 5.2.18. Per plant output in different strata (kg)

	I	II	III	IV	Average
Main product	18.14	22.61	24.85	24.83	23.59
Byproduct	2.80	2.38	2.13	2.69	2.41
Total	21.54	24.99	26.98	27.52	26.00

around 1.97, 1.95 and 1.81 respectively in all the strata. But on the other hand the benefit cost ratio at cost C showed wide variation ranging from 1.39 in the Ist stratum to 1.69 in the last. The average benefit cost ratio at cost C was 1.67.

Table 5.2.19. Per hectare income at different costs (Rs)

	I	II	III	IV	Average
Gross returns	53845.14	62466.50	67456.50	68807.52	65011.90
Farm business income	26646.08	29919.74	32390.26	33941.31	31713.81
Family labour income	23949.08	27367.74	29983.26	31041.31	29108.17
Net income	15147.28	19805.68	24121.15	28072.67	23197.77
Farm investment income	17844.28	22357.68	26528.15	30972.67	25803.41
Benefit cost ratio					
at cost A1	1.99	1.94	1.95	1.97	1.97
at cost A2	1.98	1.92	1.92	1.97	1.95
at cost B	1.80	1.78	1.80	1.82	1.81
at cost C	1.39	1.46	1.56	1.69	1.55
At cost C excluding rental value of land	1.50	1.57	1.67	1.82	1.67

Resource use efficiency

The efficiency in the use of resources are best measured by fitting a production function. A production function is an algebraic expression describing the relationship between the output and each of the inputs. In the present study both the Cobb-Douglas type and linear type of production functions were tried and linear function was found to give a better fit. Linear function is of the form,

$$Y = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + b_5 x_5 + b_6 x_6 + b_7 x_7 + b_8 x_8$$

Where,

Y = Value of output (Rs)

X_1 = Number of plants

X_2 = Value of human labour (Rs)

X_3 = Cost of fertilizers (Rs)

X_4 = Cost of manures (Rs)

X_5 = Expenditure on plant protection chemicals (Rs)

X_6 = Irrigation expenses (Rs)

X_7 = Percentage loss of plants

X_8 = Cost of supports and ropes (Rs)

This function was fitted separately for each stratum and for the sample as a whole. The IIIrd and IVth strata were combined and was considered as a single class for fitting the function. This was done as there were only a few observations in the IVth stratum.

The coefficient of multiple determination (R^2) and corresponding 'F' ratios for testing their significance are given in Table 5.3.1.

72 per cent of variations in the dependent variable was explained by the independent variables in the Ist stratum and in stratum II and III it was 65 per cent and 90 per cent respectively. For the sample as a whole the independent variables explained about 83 per cent of the variations in the dependent variable. The unexplained portion may be due to sampling errors and other factors not considered in this study. The 'F' ratios were found to be highly significant (at one per cent level of probability).

The partial regression coefficient of the output on various inputs, standard error of partial regression coefficients and corresponding 't' values are given in Tables 5.3.2, 5.3.3, 5.3.4 and 5.3.5.

Table 5.3.1. The coefficient of multiple determination (R^2) and corresponding 'F' ratios.

Stratum	R^2	'F'
I	0.72	8.53
II	0.65	6.73
III	0.90	17.99
Total sample	0.83	7.5

Table 5.3.2. The partial regression coefficients of output (Total returns) on various inputs, standard error of partial regression coefficients and 't' values in linear model. Stratum I.

Partial regression coefficients(bi)		SE(bi)	't' values
b_1	22.1313	9.8896	2.2378*
b_2	0.2886	0.9955	0.2899
b_3	0.9387	1.20	0.7823
b_4	-1.0742	2.1162	0.5076
b_5	-6.0585	14.8258	0.4086
b_6	+0.5481	2.2634	0.2421
b_7	-9.0874	9.7292	0.9340
b_8	-0.5473	2.5598	0.2138

*Significant at 5 per cent level of probability.

Table 5.3.3. The partial regression coefficients of output (Total returns) on various inputs, standard error of partial regression coefficients and 't' values in linear model. Stratum II.

Partial regression coefficient (bi)		SE(bi)	't' values
b_1	30.1684	8.5141	3.5433*
b_2	-0.6045	0.8667	-0.6974
b_3	0.0596	0.7632	0.9781
b_4	0.6918	0.7113	0.9726
b_5	0.3100	1.0955	0.2830
b_6	-0.1080	1.3644	0.0791
b_7	-30.8813	27.5697	0.8192
b_8	-0.0124	1.3563	0.00917

*Significant at 5 per cent level of probability.

Table 5.3.4. The partial regression coefficients of output (Total returns) on various inputs, standard error of partial regression coefficients and 't' values in linear model. Stratum III.

Partial regression coefficient (bi)	SE (bi)	't' values
b_1	28.8044	4.3663	6.5970*
b_2	-0.1872	0.4841	0.3868
b_3	0.0788	0.0685	1.1500
b_4	-0.4169	0.3645	1.1438
b_5	-4.5152	8.3127	0.5432
b_6	-2.0813	1.8709	1.1125
b_7	-48.2462	55.3414	0.8718
b_8	-0.0865	0.4146	0.2086

*Significant at 5 per cent level of probability

Table 5.3.5. The partial regression coefficients of output (Total returns) on various inputs, standard error of partial regression coefficients and 't' values in linear model for the sample as a whole .

Partial regression coefficient (bi)		SE (bi)	't' values
b_1	24.4625	1.5254	16.08*
b_2	-0.6681	0.3191	2.0938*
b_3	0.2295	0.3092	0.7421
b_4	-0.2768	0.2961	0.9348
b_5	-5.0958	0.0703	0.5618
b_6	0.4595	1.3291	0.3457
b_7	1.0263	1.034	0.9926
b_8	0.2404	0.5985	0.4017

*Significant at 5 per cent level of probability.

Plant population was found to have a significant positive influence on total returns in all the strata and for the sample as a whole. For the sample as a whole the factor expenditure on labour also was found to be exerting considerable influence on total production. An increase in expenditure on this item resulted in a corresponding decrease in total returns. The remaining six variables did not exert any significant influence on production. The nonsignificance of these inputs may be due to the presence of multicollinearity existing between various input factors.

As a method of eliminating multicollinearity the same data was analysed on a per plant basis and linear and Cobb-Douglas models were fitted. The variables used in the analysis were,

Y = Revenue per plant (Rs)

X_1 = Value of human labour per plant (Rs)

X_2 = Per plant expenditure on fertilizers (Rs)

X_3 = Per plant expenditure on manures (Rs)

X_4 = Per plant expenditure on plant protection chemicals (Rs)

X_5 = Per plant irrigation expenses (Rs)

X_6 = Per plant expenditure on supports and ropes (Rs)

The coefficient of multiple determination (R^2) was very low for the Cobb-Douglas model fitted and hence the linear model was chosen for explaining the variations in dependent variable.

The coefficient of multiple determination (R^2) and corresponding 'F' ratios for testing their significance are given in Table 5.3.6.

The linear model explained about 57 per cent, 42 per cent and 43 per cent of total variability in the three groups. The corresponding figure for sample as a whole was 44 per cent.

The regression coefficients, their standard errors and 't' values for various inputs are given in Table 5.3.7, 5.3.8, 5.3.9 and 5.3.10. In stratum I an increase in expenditure on plant protection chemicals and that on propping materials caused a corresponding decline in revenue. So to get a higher per plant revenue one has to reduce the expenditure on these two items. As has been mentioned earlier, most of the farmers who had adopted plant protection practices did it as a curative

measures rather than a preventive measure. A major part of loss in banana occur due to bunchy top disease for which there is no remedy once it is noticed. But most of the farmers resorted to plant protection practices only after its presence is noticed, which is of no use. That perhaps explains the reason why this factor (expenditure on plant protection chemicals) have a negative effect.

In stratum II, none of the factors of production were noticed to have a considerable influence on revenue. In class III, effect of fertilizers was found to be positive and significant where as that of organic manures was significant but negative. It implied that higher quantities of fertilizer are to be used for increasing the revenue per plant. The farmers in this strata may be applying the manures over and above the optimum requirement level. The soil of Chalakudy region was reported to be high in organic matter due to its proximity to forest. So to get a higher returns the use of organic manures has to be restricted.

The analysis of the data for sample as a whole revealed the excessive use of labour over and above the optimum level. This resulted in a negative significant influence of labour on revenue. So the expenditure on this items has to be controlled to receive a better revenue.

Table 5.3.6. Coefficient of multiple determination (R^2) and corresponding 'F' ratios.

Stratum	Coefficient of multiple determination (R^2)	'F' ratio
I	0.57	6.19**
II	0.42	3.74**
III	0.43	2.26
$S_a$mple	0.44	4.36**

** Significant at one per cent level of probability.

Table 5.3.7. Partial regression coefficients of output (Revenue per plant) on various inputs, standard error of partial regression coefficients and 't' values. Stratum I

Partial regression coefficient (bi)		SE (bi)	't' values
b_1	-0.6272	2.1529	0.2913
b_2	-0.0644	1.1364	0.0566
b_3	-0.2486	1.2303	0.2021
b_4	-6.3941	2.9858	2.1415*
b_5	-4.28132	2.5274	1.6989
b_6	-1.5040	0.5286	2.8506*

*Significant at 5 per cent level

Table 5.3.8. Partial regression coefficient of output (Revenue per plant) on various inputs, standard error of partial regression coefficients and 't' values. Stratum II.

Partial regression coefficient (bi)		SE (bi)	't' values
b_1	-0.5152	0.4918	1.0477
b_2	0.0422	0.5197	0.0812
b_3	0.1189	0.4669	0.2547
b_4	0.4975	0.6414	0.7756
b_5	0.5834	0.8574	0.6804
b_6	-0.1962	0.7620	0.2575

Table 5.3.9. Partial regression coefficients of output (Revenue per plant) on various inputs, standard error of partial regression coefficients and 't' values model. Stratum III.

Partial regression coefficient (bi)		SE(bi)	't' values
b_1	-0.1960	0.2468	0.7939
b_2	0.1109	0.0461	2.4077*
b_3	-0.5662	0.2278	2.4855*
b_4	3.6297	6.4009	0.5671
b_5	2.2039	1.6928	1.3019
b_6	-0.2784	0.3918	0.7105

*Significant at 5 per cent level

Table 5.3.10. Partial regression coefficients of output (Revenue per plant) on various inputs, standard error of partial regression coefficients and 't' values (for the sample as a whole.)

Partial regression coefficient (bi)		SE (bi)	't' values
b_1	-0.7630	0.2043	3.7347*
b_2	0.5845	0.3044	1.9202
b_3	0.1828	0.3872	0.4721
b_4	-2.4756	5.2303	0.4733
b_5	0.8439	0.7503	1.1248
b_6	0.2728	0.5335	0.5113

*Significant at 5 per cent level

Problems of banana growers

Though banana is an important crop cultivated in our state, occupying about 1.77 per cent of the gross cropped area in the state, the banana cultivators are still a neglected group. Banana cultivation was considered as a highly profitable enterprise and hence more and more of farmers were entering in this field. Now its cultivators are to face a number of problems both during its production and marketing.

The average area under cultivation of nendran banana was only 0.22 acres. The reasons for the smallness was reported to be three fold. More than 90 per cent of the farmers complained of difficulty in securing the large Working Capital required for its cultivation and of nonavailability of easy and cheap credit. It was observed that 35.13 per cent of farmers borrowed the capital from the contractors to whom they sell their produce. These contractors fix the price of the produce well in advance of the harvesting season which was very much lower than the market price at the harvesting season. Twentysix per cent of the farmers depended on Cooperative societies for their Working Capital and 8.33 per cent on private

money lenders. Commercial banks advanced loan to about 11.25 per cent of farmers and 9.25 per cent borrowed from friends and relatives. The rest depended on their own capital.

Another reason for smallness of area under cultivation was the difficulty in getting suitable land for nendran cultivation. Twentysix per cent of the cultivators could not expand the area under cultivation due to this problem.

Yet another problem standing in the way of expanding the area was the scarcity of labour and high wages as reported by about 53 per cent of the farmers. This problem was mostly raised by the better section of farmers and who were reluctant to employ family labour for crop production. The availability of alternative avenues of employment in brick manufacturing or construction units with better wages explained the scarcity of labour.

Nonavailability of green leaf manures was reported as a very serious problem. Farmers who cultivated lesser number of banana somehow met their demand from their own farms. Many of the farmers in the higher holding strata complained of this problem.

Only a few used sunhemp or daincha as green manure crops as recommended by the Kerala Agricultural University.

The farmers were critical of the increasing trend of the price of fertilizers and pesticides. As already pointed out, though all of the farmers were found to be applying chemical fertilizers, the extent of use was not enough to meet the nutrient requirements of the plant. On an average, more than 50 per cent of the farmers adopted plant protection practices.

Farmers of the lower strata were mostly reluctant to use plant protection chemicals. This was partly due to high cost of pesticides and partly due to conventional attitude towards it.

Another serious problem was that of nonavilability of props. Bamboo poles which are used as supports are becoming more and more scare due to increasing deforestation. So they have become very costly and the farmers are forced to use other materials like arecanut poles, for the purpose. On an average, bamboo poles cost 25 per cent more than that of arecanut poles. These arecanut poles have a major disadvantage that they can be used for a maximum

period of two years as against four to five years in the case of bamboo poles.

On an average, in normal situations, 12.03 per cent of crop loss is common. This loss occur in various stages and to due to various reasons. Sometimes the suckers may be faulty or infected. A major part of the loss was due to the occurrence of bunchy top disease. Sometimes the whole of the cultivation is lost due to heavy wind. This year it was reported that about 2 lakh banana plants were destructed on account of high velocity wind in the Chalakudy area. In this case the money, energy and time used in its cultivation turns out to a mere waste without any return, leaving the farmers in a miserable condition.

In the marketing of banana also there are so many problems. Surprisingly it was noticed that more than 90 per cent of the cultivators sold their produce to the contractors and it is reported that price received by farmers in such deals are generally lower. As stated above the middlemen advance loans to the farmers for meeting the cultivation expenses and thus farmers become indebted to these traders.

Thus the middlemen are able to make substantial profits in these deals.

Those who take the bunches to the market complained of high transportation and handling charges. Farmers much away from the Chalakudy market experienced this problem.

Yet another problem reported by the farmers was the influence of bananas from Trichi in the market. These bananas are brought here during the harvesting season and sold at a very low price. This adversely affected the local nendran producers.

Almost all of the farmers complained that the loan for the cultivation is not disbursed from the institutional agencies at the time when it is mostly needed. So they are forced to borrow funds from private money lenders giving very high rate of interest.

Suggestions for improvement

The only possible remedy for high labour charges and scarcity of labour is employment of family labour as far as possible. Popularisation of green manures like sunhemp and daincha will solve the problem

of shortage of green leaf manures. Some attempts should be made to persuade the farmers adopt plant protection chemicals as a preventive measure especially against the bunchy top disease. The farmers should be made aware of the various aspects of this cancerous disease, and the steps to be taken against its occurrence and what to do once it is noticed.

Against the severe loss due to heavy winds, there is need for some consolation programme like crop insurance. In the initial stages it can be started as group insurance as in the case of paddy in our state.

Steps should also be taken to simplify the procedures for obtaining the loan and for timely disbursement of required amount.

Improvements in marketing and transportation facilities are necessary for solving the marketing problems. Introduction of regulated markets will be a good remedy to most of the marketing problems. This will also reduce the over influence of middlemen in the marketing of banana.

Summary

S U M M A R Y

Banana is one of the most important tropical fruits grown in India and in Kerala. Demand for the banana is growing and with increasing real incomes, it is expected to grow faster. Many of the cultivators in Kerala are taking up its cultivation as a commercial proposition rather than as a subsistence activity, in spite of the tiny holdings they possess. Therefore it is a crop of economic importance to a large number of farmers. Yet, there is very little scientific information on the economics of banana cultivation in Kerala. Hence a study on the economics of banana cultivation in Kerala was considered very useful. The specific objectives of the study are the following:-

To estimate the costs and returns; to evaluate the resource use efficiency; and to identify problems of banana growers.

On account of the limitations of time and other resources the study was confined only to irrigated Nendran banana in Chalakudy Block in Trichur district. Chalakudy Block has the highest area under banana in the district and has ample facilities for irrigation.

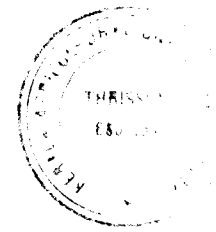
Two stage stratified random sampling was used for the selection of growers. Six panchayats and one municipal area in the Block were considered as different strata and one ward selected at random from each of these strata formed the first stage units. Fourteen farm families were selected randomly from each of the selected ward. Thus the sample size was 98. The selected holdings were further stratified into four, based on number of Nendran banana plants in the holdings.

Primary data were collected from 98 households during the period March to May 1983 through personal interview technique with the aid of a well structured schedule. The information gathered was for the period August 1981 to June 1982. Information regarding social educational and economic conditions of farmers, the various items of operation and inputs used and their costs for the cultivation of banana, the price at which farmers sold banana etc. were collected.

The average size of family in the sample households was six. The sex ratio of the members of sample households was almost equal to 1 : 1. Illiterate people

were present in all the four groups mentioned above. But most of these people belonged to the older age group. It was found that most of the respondents had two main sources of income viz. agriculture and wage labour. Only 18.37 per cent of the families depended solely on agriculture for their living. The rest had other sources of income like service, business or both along with agriculture. Of the total respondents 32.65 per cent had an annual family income (excluding the income from agriculture) between Rs.5,000/- to Rs.10,000/-, 35.71 per cent had an income below Rs.5,000/-, 21.43 per cent had an income between Rs.10,000/- and Rs.20,000/-. Only 10.21 per cent had more than Rs.20,000/- income.

An inputwise accounting of cost of banana cultivation has shown that the average total cost (Cost C) was Rs.41,814.13 per hectare. The total labour use for banana cultivation worked out to 702.96 mandays per hectare. This formed the main item of expenditure ie. 33 per cent of the total cost. Of this total labour use, 401.87 mandays 57.79 per cent per hectare was hired labour and the rest 301.09 mandays per hectare was contributed by family labour. The family labour contribution to total labour



input decreased in the higher strata. Manures along with fertilizers comprised about 35.45 per cent of total cost. All of the farmers applied chemical fertilizers and lime, but not upto the quantity recommended in the Package of Practices of Kerala Agricultural University. Only a few farmers raised green manure crops in their own fields and all of the other farmers applied green leaf manures and other organic manures. The next important item of expenditure, propping, constituted about 11.18 per cent of total cost of cultivation. This included the expenditure for both ropes and supports. All of the cultivators used either bamboo poles or arecanut poles as propping material. On an average, around 60 per cent of total supports used were arecanut poles. Only in the IVth stratum a major part was bamboo poles. Seed material accounted for 6.96 per cent of total cost. The suckers were treated with cowdung solution and dried in the sun before planting. None of the farmers followed recommended methods of seed treatment with chemicals. Interest on working capital was ₹.1867.88 ~~per cent~~ per hectare which was 4.47 per cent of total cost. As banana is a crop highly responsive

to irrigation, the farmers had taken utmost care in irrigating the banana timely. Because of assured water supply through canals more than 80 per cent of sample farmers depended on canal water for irrigation which is very cheap. So the cost of irrigation was only Rs.700.17 per hectare ie. 1.67 per cent of total cost. The expenditure on plant protection chemicals worked out to Rs.128.27 per hectare. The remaining part of total cost was shared by land revenue and rental value of land. On an average cost A_1 was Rs.33003.73 per hectare. Cost A_2 was Rs.33298.09 per hectare and cost B was Rs.35903.73 per hectare.

Operationwise analysis of the total cost of cultivation revealed that manures and manuring operations accounted for the lion's share of total cost ie. about 42.50 per cent. This was followed by the expenditure on propping (13.62 per cent), planting material and planting (12.20 per cent) after cultivation and irrigation (7.31 per cent), harvesting and handling (6.28 per cent) and preparatory cultivation expenses (5.75 per cent). Expenditure on plant protection operations was about 0.92 per cent of the total cost.

By cultivating a hectare of banana an average

output of 2199 bunches and 5500 suckers worth Rs.65011.90 per hectare was recorded.

On a per plant basis, the average cost of producing a bunch was Rs.14.31 and average returns were Rs.26 per plant. The average farm business income was Rs.29108.17 per hectare. The net income from banana cultivation was Rs.23197.77 per hectare with a benefit cost ratio, at cost C of Rs.1.55. If one excludes the rental value of owned land from cost, the benefit cost ratio would rise to 1.67.

In order to understand the efficiency of resource use in banana cultivation, production function analysis was attempted, using a linear model. Plant population was the factor which was found to have a significant positive influence on total returns. Expenditure on labour exerted a significant negative influence on total returns. The same data was analysed on a per plant basis. As expenditure on labour exerts a negative influenze, the banana growers has to restrict the use of labour to receive a better revenue.

References

REFERENCES

Achuthan, V. (1965). Studies on the Economics of Production of Nendran Banana. M.Sc.(Ag) Dessertation submitted to the University of Madras.

Achari, T.K.T. (1969). Resource Productivity and Optimum Resource Allocation on a Sample of Queensland Sugarcane Farms. Indian J. Agric. Econ. 24(4): 255.

Alagiamanavalan, K.S., Balakrishnan, R. (1976). Double Planting in Robusta Banana. Madras Agric. J. 63(4): 46-49.

Bastine, L. (1982). Socio Economic Study of Farmers in Irinjalakuda Block of Peechi Irrigation Project. M.Sc.(Ag) thesis submitted to Kerala Agricultural University.

Bore, D.P., Patil, T.V., Sohoni, D.K. (1969). Economic Benefits of Rural Electrification to Banana growers. Indian J. Agric. Econ. 24(4): 196.

*Burns, W.D., Dani, P.G. (1920). Some facts and figures regarding Banana cultivation. Agric. Jour. India. 15: 386.

Farm Information Bureau (1983). Farm Guide. Department of Agriculture, Government of Kerala.

Gopimony, R., Marykutty, K.C., Kannan, K. (1979). Effect of top dressing with Urea and Flower initiation in Zanzibar variety of banana. Agri. Res. J. Kerala. 17(2): 293-295.

Government of India (1970). All India Final Estimate of Banana. Agricultural Situation in India 24(10): 963.

Government of India (1970). Districtwise Area and Production of banana for 65-66 and 66-67. Agricultural Situation in India. 24(11):1027

Government of India (1972). Districtwise area and production of banana. Agricultural Situation in India. 27(3): 181-184.

Government of India (1973). Districtwise Area and Production of Arecanut and Banana 1970-71 (final) and 69-70 (partially revised). Agricultural Situation in India. 27(12): 867.

Government of India (1973). All India Final estimate of Banana. Agricultural Situation in India 28(6): 452.

Government of India (1975). Districtwise Area and Production of Guar Seed and Banana. Agricultural Situation in India. 29(10): 782.

Government of India (1975). All India Final Estimate of Banana 73-74. Agricultural Situation in India. 30(1): 70.

Government of India (1977). Districtwise Area and production of Tobacco and Banana 75-76. Agricultural Situation in India. 32(4): 226.

Government of India (1977). Districtwise Estimates of Area and Production of Banana 74-75. Agricultural Situation in India, 32(7): 433.

Government of India (1979). Districtwise Estimate of Area and Production of Arecanut, Banana and Tapioca, 77-78. Agricultural Situation in India, 34(7): 500.

Government of Kerala (1980). Status paper - Trichur District. District Planning Office, Trichur.

Government of India (1981). All India Final Estimate of Banana. Agricultural Situation in India, 34(1): 185.

Government of India (1981). Districtwise Estimates of Area and Production of Banana 79-80. Agricultural Situation in India, 34(3): 223.

Government of Kerala (1982). Kerala at a Glance. Directorate of Economics and Statistics.

Government of India (1982). All India Final Estimate of Banana 80-81. Agricultural Situation in India, 34(12): 940.

Jacob Cheeran, K. (1941). Banana figs and Banana flower with special reference to Madras varieties. Madras Agric. J. 24(6): 217-221.

* Jacob, C.K. (1942). Bananas of the Travancore State. Madras Agric. J. 30(9)

Krishnamoorti, S. (1966). Export problems of Bananas and Planting for Production. Madras Agric. J. 53(11): 435-452.

Kerala Agricultural University (1976). Annual report. Banana and Pineapple Research Station, Kannara, pp. 38.

Kerala Agricultural University (1981). Package of Practices recommendations. Extension Division.

*Naik, K.C. (1949). South Indian Fruits and their Culture. P. Varadhachari and Co.

*Nair, N.P. (1941). The Nendran or Malabar Plantain. Madras Agric. J. 29(12).

*Nair, T.G. (1962). Banana in India. The Fact Technical Society, Udyogamandal, pp. 157.

Patil, S.M. , Acharya, T.K.T. (1974). A Comparative Study of Resource Productivities and Resource Allocation on a Sample of Sugarcane and Banana Farms in Nasik in Jalgon Districts of Maharashtra. Indian J. Agric. Econ. 24(3): 186.

Patil, R.J., Suryawanshi, S.D., Kapase, P.M. (1978). The Socio-Economic Survey of Girna Irrigation Project area in Jalgon district (Maharashtra). Department of Agricultural Economics. Mahatma Pant Krishi Vidyapeeth, Ahmed Nagar. pp.117, 141-147.

Peter, D. (1974). Input-Output Relations of Banana Plantations in Kanyakumari district. Indian J. Agric. Econ. 24(2): 59-64.

Radhakrishnan, V. (1983). Economics of Paddy Cultivation and its Impact on production. Paper presented at the seminar on stagnation of Rice production in Kerala, conducted at College of Agriculture, Vellayani.

Rao, V. (1982). Socio-Economic Study of Farmers in Ollukkara Block of Peechi Irrigation Project. M.Sc.(Ag). Thesis submitted to Kerala Agricultural University.

*Roy, R.S. (1950). Cultivation of Banana in Bihar. Ind. Fmg. 11: 182-197.

Rosamma, C.A. (1982). Biometrical studies in Banana. M.Sc.(Ag). Thesis submitted to Kerala Agricultural University.

*Originals not seen

Appendix

APPENDIX

Department of Agricultural Economics
College of Horticulture
Kerala Agricultural University

Questionnaire for data collection
Economics of banana cultivations in Trichur District

1. Name and Address of cultivator:

   Village : Block:

   Taluk : Ela :

2. Distance to the nearest marker:
3. Total area owned by the cultivator:
4. Total area cultivated :
5. Number of fragments :

Fragment No.	area

6. Family details

Sl. No.	Name	Age	Sex	Relation with the head	Edu-ca-tion	Occupation		Income		
						Main	Subsidiary	Main	Subsidiary	Others

7. Cropping pattern

Crop	Area					
	Mundakan		Puncha		Virippu	
A. Seasonal crops	Owned	Leased	Owned	Leased	Owned	Leased
1. Paddy						
2. Pulses						
3. Vegetables						
4. Others						

B. Annual crops	No.of plants/trees	Area	
		Owned	Leased
1. Tapioca			
2. Banana			
3. Other plantains			
4. Others			
C.Perennial trees			
1. Coconut			
2. Arecanut			
3. Fruit trees			
4. Others			

8. Source of irrigation

Source	Net area	Paddy			Banana	Coconut	Vegetables
		Virippu	Mundakan	Puncha			
1. Canals							
2. Tanks							
3. Wells							
4. Others (specify)							

Hours required for the irrigation of banana plot.

Frequency of irrigation in a week. Total number of months during which irrigation was undertaken.

9. Implements and Machinaries

I.

Item	No./year of purchase	Purchase price	Maintenance cost (fuel charges/repairs)
1. Sprayers			
2. Pumpset			
3. Ploughs			
4. Tractors			
5. Tillers			
6. Mammotties			
7. Others			

II. Temporary deadstock

1. Baskets
2. Ropes
3. Supports

Type of support used:

Whether used more than once?

If so how many time ?

III. Taxes

a) Land revenue
b) Water tax
c) Panchayat tax
d) Income tax
e) Others (Specify)

Cost of cultivation of Banana (Nendran)

Area: Time of planting
Time of harvest

Operation	Labour - Men								Women								Total Cost of labourers	Inputs		Total cost
	Hired				Family				Hired				Family							
	No.	Days	Hrs	Rs.	No.	Days	Hrs	Rs.	No.	Days	Hrs	Rs.	No.	Days	Hrs	Rs.		Qty.	Cost	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
I. Preparatory cultivation																				
Digging the pits																				
II. Planting material and planting.																				
1. Cost of suckers																				
2. Selection & preparation of suckers																				
3. Cost of cowdung and ash																				
4. Drying and storing of suckers																				
5. Planting of suckers																				

(1)	(2)(3)	(4)(5)	(6)	(7)	(8)	(9)	(10)(11)	(12)(13)	(14)	(15)	(16)	(17)	(18)(19)	(20)
III. Manures and Fert.														
1. Cost of wood ash														
2. Application charges														
3. Cost of organic/ green manures														
4. Application charges Fertilizers														
A. First dose of fertilizers														
1. Cost of fertilizers														
Types A														
B														
C														
2. Application charges														
B. II dose of fert.														
1. Cost of fert.														
Types A														
B														
C														
2. Application charges														

(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
Sowing sun hemp or daincha																			
1. Cost of seeds																			
2. Sowing charges																			
3. Incorporation into the soil																			
IV. After cultivation																			
1. Intercultivation/ Desuckering																			
2. Supporting																			
3. Irrigation charges																			
4. Wrapping/Propping																			
V. Plant protection																			
1. Cost of chemical (Specify the chemical)																			
2. Application charges																			
a) Cost of herbicide																			
b) Application charges																			
VI. Harvesting and handling																			
1. Harvesting charges																			
2. Removing the suckers																			

	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
VII. Miscellaneous expenses																				
1. Rent on land																				
2. Hire charges on equipment																				

VIII. Marketing practices followed

Name of material sold	Qty. sold	Price	Distance	Mode of tran.	Name of market	Qty. sold	Price	Dist.ance	Mode of Trans. cost	Name of market	Qty. sold	Price	Dist-ance	Transp. cost

IX. Borrowings

Source
1. Money lenders
2. Commercial banks
3. Co-op: Society
4. Others

X. Production and income :

1. Total production :
2. Price received per unit :
3. Income :
4. Income through sale of suckers :
5. Price per unit :
6. Total income :

Summary of cost of cultivation

1. Preparatory cultivation :
2. Planting material/ planting :
3. Manures and fertilizers :
4. After cultivation :
5. Plant protection :
6. Harvesting and handling :
7. Miscellaneous expenses :

Total

Profit and Loss statement

1. Gross income :
2. Total expenditure :
3. Net profit/loss :

Problems of banana cultivators

Practices	Recommendation	Variations	Reasons
Pit size	50 x 50 x 50 cm		
Treating the suckers	Smear with Cowdung solution and, ash, drying in the sun for 3-4 days and stored in shade for 15 days		
Spacing	2 x 2 mit.		
Manures/ Fert.			
1. Wood ash	5 kg/plant before or at the time of planting		
2. Compost/cattle manure/ green leaves	10/kg/plant one month after planting		
3. Nitrogen	190 gm/plant/ 95 gm 2 months after planting. 95gm 4 months after planting		
4. Phosphorus (P_2O_5)	115gm/plant/ann. 2 spht dozes as before.		
5. K_2O	300 gm/plant/anm. 2 spht dozes as before irrigation immediately after application.		
Sowing sun-hamp or daincha/ cowpea	50 kg/ha Incorporate 40 days after sowing Repeat the process once more		
Irrigation	Once in 3 days in summer (60-100 irrigations/plant)		

Mulching weeding	Diuron (2-3 kg/ha) + Grammazone (1.5 lit/ha)

Plant protection

	Dipping in 0.2% BHC
1. Treatment of seed material	Aldrin 5% durt (50 gm/pit) before planting
2. Control of aphids	a) 25 gm phorate in the pit at the time of planting
	b) After 75 days apply 12.5 gm in axils
	c) After 90 days 12.5 gm in axils
	Watering after application of granular insecticides
3. Control of bunchy top disease	1. Tolerant varieties
	2. Use of phorate as explained above
	1% Bordeaux mixture

Whether possible to increase the area under banana Yes/No

If no what are the constraints?

ECONOMICS OF BANANA CULTIVATION IN TRICHUR DISTRICT

By

INDIRA DEVI P.

ABSTRACT OF THE THESIS

Submitted in partial fulfilment of
the requirement for the degree of

Master of Science in Agriculture

Faculty of Agriculture
Kerala Agricultural University

Department of Agricultural Economics
COLLEGE OF HORTICULTURE
Vellanikkara, - Trichur

1983

ABSTRACT

This investigation on economics of banana cultivation in Trichur district was conducted during 1983. The study confined to irrigated nendran banana in Chalakudy block with the following objectives viz. to estimate cost and returns; to evaluate resource use efficiency in production; and to study the problems of banana growers.

Ninetyeight holdings were selected by following the stratified two stage random sampling technique and the information was collected using a pretested schedule, through personal interview.

The total cost of cultivation (Cost C) of banana worked out to Rs.41814.13 per hectare. Of this, the most important item of expenditure was human labour. Average labour requirement for banana cultivation was 702.96 mandays per hectare. This was followed by expenditure on manures, fertilizers, propping materials, suckers and irrigation. All of the farmers in the locality applied chemical fertilizers though not upto the recommended level. Plant protection expenses

were only 0.30 per cent of total cost.

In the operationwise expenditure, manures and manuring operations demanded highest investment and formed 42.50 per cent of total cost. Propping, planting, after cultivation and irrigation, harvesting and handling and preparatory cultivation in that order were the other operations which needed investment. Plant protection operations accounted for 0.92 per cent of total cost.

The average returns from banana cultivation were Rs.65011.90 per hectare. The net income from banana cultivation was Rs.23,197.77 per hectare with a benefit cost ratio of 1.55.

On a per plant basis, the average cost of producing a bunch was Rs.14.31 and it gave a return of Rs.26.

In the linear production function model fitted, plant population and expenditure on labour were the factors which had significant influence on the dependent variable viz. total returns. The former had a positive influence and for the latter the influence was negative.

The same model was fitted for the data converted to a per plant basis. The analysis revealed that the farmers were using labour over and above the optimum level. So its use has to be restricted.