ECONOMICS OF PRODUCTION AND MARKETING OF TUBER CROPS IN PALAKKAD DISTRICT

By
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THESIS

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DECLARATION

I hereby declare that the thesis entitled **"Economics of Production and marketing of tuber crops in Palakkad district"** is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, fellowship, associateship or other similar title of any University or Society .

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Certified that this thesis entitled **"Economics of Production and marketing of Tuber crops in Palakkad district"** is a record of research work done independently **by Smt. Sheena, P.A.**, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or other similar titles to her.

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Introduction

INTRODUCTION

Tuber crops constitute one of the most important group of food crops of rural low land tropics. They are consumed mainly by people living close to subsistence level. They form either staple or important subsidiary food crop for one fifth of the world population. Globally they are grown in an area of 50 million hectares producing 560 million tonnes of tubers. In India tuber crops are cultivated in 1.3 million hectares with a production 16.9 million tonnes of tubers *. Since the tubers are rich in starch they are increasingly used as raw materials for many industries and as animal and poultry feeds.

The importance of tuber crops in the national economy was well recognized only after the independence of the country. Tuber crop research in the country was intensified and received a fillip when the Central Tuber Crops Research Institute was established in 1963 by Government of India during the third plan. The important tuber crops cultivated in India are potato (Solanum tuberosum), tapioca or cassava (Manihot alata), colocasia (Colocasia esculenta), xanthosoma (Xanthosoma Sp.) , elephant foot yam (Amorphophallus esculenta),

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* Ghosh, S.P. 1984. Importance of tapioca and sweet potato in Indian Agriculture-Training cum discussion seminar at Regional centre of Central Tuber Crops Research Institute, Bhubeneswar.

sweet potato(Ipomoea batatas),yams (Dioscorea companulatus) and coleus (Coleus parviflorus).

Tapioca has a wide range of diversified use. In most countries its major use is as food. However, a significant part of tapioca is converted into animal feed and a modest proportion goes into industrial usage and starch production. The tubers form an essential raw material for industries and the starch extracted from tubers is used in textile industry for sizing the yarn, finishing of cloth and thickness for printing cloth. Sago, dextrose, glucose, spirit, alcohol etc. are other products of industrial importance made out of tapioca flour. As a subsidiary crop of high calorific value and a source of starch in textile industries the crop assumes unique importance.

India accounts for about three per cent of the world's tapioca area and five per cent of the world's production. Though the area under tapioca and its production does not occupy an important position in the Indian agricultural economy, it is important in the two states in which its production is concentrated viz. Kerala and Tamil Nadu.

The area under tapioca accounted for about 9 per cent of the total food crop area in the state of Kerala in 1993-94. More than half the area of this crop in Kerala is concentrated in the three southern districts viz. Thiruvananthapuram, Kollam and Kottayam. Palakkad district constitutes 7.9 per cent of the area and 8.9

per cent of production. It is true that the state has made tremendous progress in the research field of tuber crops but is not reflected in the area expansion and production. Unless value added products and agrobased processed materials are made and marketed, tapioca cultivation will not be a profitable enterprise.

Sweet potato is an important food crop in many developing countries. The global area under cultivation is estimated to be approximately 9 million hectares with an annual production of around 127 million tonnes *. However, at the outset it must be stressed that reliable statistics on area, production, trade and utilization of sweet potatoes are generally lacking. In developing countries sweet potatoes are usually grown for subsistence, generally in isolated area on small, intercropped parcels of land, and little is marketed outside the immediate area of cultivation. Sweet potatoes are ranked seventh in world staple food production (expressed in dry weight) after wheat, rice, maize potato, barley and tapioca. They are mainly grown by small farmers, on marginal land, as a subsistence crop for immediate consumption.

Sweet potato is one of the world's highest yielding crops and is grown over a wide range of

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* The world sweet potato economy prepared by basic food stuffs service commodities and trade Division, Rome. April 1992.

environmental conditions including land of low fertility and in near drought condition. About 98 per cent of the world output is produced in developing countries of which approximately 92 per cent is cultivated in Asia, nearly five per cent in Africa and three per cent in the rest of the world. Apart from China, other major producers in Asia are Indonesia, India, Japan, Vietnam, Philippines and the Republic of Korea.

Sweet potato are rich in starch, vitamins, sugar, fat and some minerals. Their main use is for human consumption. The starchy tuberous roots are the major source of food but the leaves are also consumed as a vegetable in some countries of Africa and Asia and contain about 24 per cent crude protein on dry weight basis. In many part of the world the crop is fed to livestock and the vines can be important source of fodder. In India sweet potato occupied an area of 164 thousand hectares with a production of 1347 thousand tonnes for the year 1987-88. Orissa is the largest producer of sweet potato accounting 32.9 per cent of national product. In Kerala state, sweet potato occupied an area of 2279 hectares with a production of 18,281 tonnes. Palakkad is the most important sweet potato growing district in the state contributing 1382 hectares with a production of 10150 tonnes for the year 1993-94 *.

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* Farm guide, 1994, Farm Information Bureau, Government of Kerala.

Coleus or Chinese potato is a minor tuber crop of tropical regions of India, Indo-china, Malayasia, Srilanka and Africa. In India the cultivation is mostly confined to the southern states especially Kerala. In Kerala it is commonly known as *Koorka or Cheerakizhangu*. Data on area and production of this crop are not available. The nutritive value of this crop compares favourably with many of the major tuber crops. Coleus tuber contains 20.1-30.0 per cent dry matter, 14.7-20.8 per cent starch, 0.04-0.31 per cent protein and 0.54-0.96 per cent sugar. Coleus tuber with its characteristic flavour has a special preference among consumers. Compared to other crops, it fetches a premium price in the market. The tubers are used for the preparation of various delicious side dishes. Inspite of its high market acceptability, comparatively low importance is given to the crop by farmers. This is a limiting factor for the cultivation.

As per the report of the National Commission on Agriculture, it is possible to increase the general yield level of tapioca to 40 tonnes per hectare and sweet potato to 20 tonnes per hectare by 2000 A.D by intensifying result-oriented research programmes in different aspects like improvement of varieties, formulations of agricultural practices adoption of plant protection measures etc *. It is hoped that with the help of the developmental departments and agencies tuber crop production can be increased considerably in the

* Ghosh S.P. 1984 Importance of tapiocá and sweet potato in Indian Agriculture-Training cum discussion seminar at Regional Centre of Central Tuber Crops Research Institute, Bhubeneswar.

coming years through the adoption of improved production technologies and superior varieties.

Economics of production and marketing aspects of tuber crops had not yet received the attention that it deserves particularly so in Kerala. Lack of enough production statistics for identifying the priorities and gaps in perspective planning and inefficient marketing system are noticed to be the major constraints in tuber crops production. It is necessary to know the present cost of production, returns, price received etc, so that proper planning can be done to make production more remunerative and attractive. Á study on economics of production and marketing of tuber crops would appear very relevant in this context.

The major objectives of the study are the following

1 To estimate the cost of cultivation and returns of coleus, sweet potato and tapioca.
2. To study the marketing system of tuber crops

1.1 Scope of study

Comparative studies on the economics of important tuber crops in Kerala are very limited. The present study will throw light on the economic aspects of tuber crop production. It would help the policy makers in analyzing the supply condition and drawing meaningful inferences.

1.2 Limitations

Results of the study are based on farm level data which was collected from farmers and traders through interview method. Since the farmers do not maintain records on the cultivation practices adopted, responses were drawn from their memory, which may be subjected to recall bias. However every effort was made to minimize the errors by cross questioning and cross checking.

1.3 Plan of work

The thesis is divided into six chapters including the present one. The review of past studies in the related field is presented in chapter II. The third chapter deals with description of the study area and the methodological aspects are discussed in chapter IV. This is followed by presentation of the results and discussion of the findings in chapter V. The last chapter summarizes the findings of the study.

Review of literature

REVIEW OF LITERATURE

A comprehensive review of past studies is important for proper perception of concepts, research design and method of analysis of any research project. Hence an attempt has been made to review the past studies which are relevant to the present study in terms of methodology and subject matter.The literature is reviewed in two sections such as studies pertaining to (i) Economics of production and (ii) Marketing. Since the literature on tuber crops is scanty literature pertaining to the subject on related crops has also been reviewed.

2.1 Economics of production.

Dhondyal (1958) in his study on the input-output relationship between the amount and kind of fertilizer used and yields obtained in the production of maize found that the factors land and capital were scarce and labour was abundant. The study revealed the scope for adjusting factors like amount of irrigation water, fertilizers, improved seeds and number of spraying.

Abraham and Bokil(1966) in their study on resource productivity in agriculture with special references to labour found that human and bullock labour together accounted for nearly 70-85 per cent of prime cost in various crops in Punjab and Gujarat. The results of production function analysis showed an R^2 of above

70 per cent. The coefficients of bullock labour in small farms indicated excess use. Low elasticity coefficients for fertilizers and plant protection measures was found to be due to the low outlay on these factors.

Patel *et al.*(1968) in their study on the productivity and allocation of resources in the produc-tion of hybrid bajra in Delhi used Cobb-Douglas production function and estimated marginal value products of inputs. It was found that variables hired labour, seeds, manure and fertilizers explained more than 50 per cent of variation in the output of hybrid bajra. Marginal value product of human labour, seeds and manure and fertilizers were Rs.8.35 and Rs.10.75 and Rs.84 respectively.

Roncedo *et al.*(1975) in their study on sweet potato production in Tucuman its development and economic analysis emphasized the importance of sweet potato as a food source in the socio-economic development of the province of Tucuman, especially for field workers because of its adoptation to various climate, its hardiness and good returns to growers. They also analyzed the production costs and profitability at different levels of production.

In a study on "Economic analysis of small scale farming in southern Rajasthan", Acharya and Shukla (1976) observed that total labour, hired labour, family labour, non-conventional capital, non-mechanical capital and variable expenses exerted a significant effect on the

output. Marginal value product of labour was 4.42 which was twice the wage rate prevailing during the period indicating that adoption of labour intensive high yielding variety crops would increase the income of small farmers.

Mohankumar & Mandal R.C (1977) conducted a study on production economics of high yielding varieties of tapioca to the application of nitrogen in the research farm attached to the Central Tuber Crops Reasearch Institute. The treatment consisted of 5 levels of Nitrogen viz. 0, 40, 80, 120 and 160 kg/ha and three varieties of cassava viz. H-165, H-97 and M-4 (standard local). Uniform doses of P and K @ 100 kg each per hectare were given as a basal dressing at the time of planting. It was found that increasing levels of nitrogen had increased the tuber yields, but both the hybrids recorded economic yield. The additional income was obtained with the application of nitrogen 120 kg/ha but the difference in additional income was found marginal between 80 kg and 120 kg N levels. In case of H-197 the additional income increased with added nitrogen upto 160 kg per hectare, but substantial increase was noted between 40 and 80 kg N levels, while M-4 did not show any substantial increase between 80 kg N/ha. Thus it appears that for economic production of cassava tubers the level of nitrogen seems to be 80 kg/ha for hybrids and 40 kg/ha for standard local.

Opelanio *et al.*(1978) in their study on cassava industry determined the socio-economic profile of the farmers and their house holds, production costs and returns, marketing practices and the problems that beset the industry.

Puttaswamy (1979) in his study on potato found that all variables considered viz. rental value of land, human labour, seeds, manures and fertilizers and plant protection chemicals were highly significant and explained 76 per cent variation in output. Results also showed that the average labour productivity was Rs.21.80 and Rs.20.88 on medium and large farms respectively.

Sivaramakrishnan (1981) observed that the extent of adoption of recommended practices was least in cassava as compared to rubber, coconut and rice in kerala. When the practice-wise extent of adoption was considered more or less same trend was noticed except organic manure application.

Biradar and Annamalai (1982) worked out the growth rates in area, production and productivity of sweet potato in India. It was found that sweet potato occupied an area of 23,800 hectares in India with an annual production of 1,58,900 tonnes. The bulk of the area under this crop is concentrated in Bihar, Utter pradesh and Orissa which together account for about 73.3 per cent of the total area.

Baksi and Banerjee (1983) studied the economics of potato cultivation in Bundwar district in West Bengal and found that size of holding was directly related to per hectare cost of production, productivity and output ratio irrespective of irrigation facilities. Cost per acre was found to decrease with increase in size of holding. The marketing and storage system were found to be inefficient.

Pal *et al.*(1985) in their study on cost benefit analysis of cassava in Trivandrum district found that the cost of cultivation was Rs.6233 per hectare for high yielding varieties and Rs.4617 per hectare for local varieties. The higher cost of cultivation was mainly due to higher expenditure on labour. The labour expenditure accounted for 58 per cent and 66 per cent respectively for high yielding varieties and local varieties. Expenditure on farmyard manure was more or less the same for high yielding varieties and local varieties.

Lakshmi and Pal (1986) studied the trends in area, production and productivity of cassava in India and found that these trends varied from state to state. However area and production of cassava in Kerala dominated the behaviour of area and production of cassava at the all India level. High growth rates of production in Tamilnadu through rise in productivity and in Andhra Pradesh through area expansion have been offset by negative growth rate of production in Kerala.

Pal *et al.*(1986) conducted a cost benefit analysis of cassava in Trivandrum district.It was noticed that the cassava farmer can earn between Rs.8700-10700 per hectare by cultivating high yielding varieties while the income from local varieties would be about Rs.7900 per hectare.

Anil Kumar and Sasidhar conducted a study on the economic analysis of tapioca based inter cropping system (1987) in the instructional farm attached to College of griculture during 1982-83 to examine the productivity and profitability of a tapioca based inter cropping system where different planting patterns, inter crops and spatial arrangements were in practice. The treatment details are tapioca is planted with groundnut in inter space of paired row, tapioca at normal space with groundnuts on mounds, tapioca at normal spacing with groundnut in inter spaces, tapioca with cowpea as inter crop, tapioca in paired row without inter crop, tapioca at normal spacing without inter crop.The result indicated that higher economic return was obtained from the treatment where tapioca was planted in paired rows and groundnut in the inter spaces of paired rows.

Muraleedharan (1987) conducted a study on resource use efficeincy in Kole land of Thrissur District. Functional analysis was carried out with output of rice as dependent variable and farm size,human labour, bullock labour, fertilizers and manures as explanatory

variables. The results showed an excess use of these variables.

In another study on cost benefit analysis of cassava in Trivandrum district Pal *et al.*(1987) observed that the farmers had used almost the same amount of labour when either high yielding or local varieties were cultivated under their own practices.It was also observed that when high yielding varieties were cultivated with recommended practices more labour was used especially for operation such as land preparation, intercultivation and harvesting.

Ramanathan *et al.*(1987) identified that non-availability of stems of high yielding cassava varieties and high cost of cultivation were the most important constraints in the adoption of high yielding cassava varieties by the farmers. Nearly 57 per cent of the farmers were found applying 50 to 100 per cent of the recommended dose of organic manure to cassava.

Samaratunga (1987) studied the economic appraisal of the position of tropical root and tubers in Srilanka using time series and cross sectional data. The study revealed that the position of roots and tubers (except potatoes) in the present food consumption pattern is that of an inferior substitute to rice and wheat flour. Demand for the above are hence heavily affected by the prices and availability of the said cereals. Consumption of roots and tubers varies across the

population inversely with personal income. One third of the Srilankan population at the lowest income strata were found to be suffering from calorie under nutrition. They were identified as the suitable consumer group at which future expansion of root and tuber consumption should be targeted.

Lakshmi and Pal (1988) analysed growth of crop output in Kerala in terms of the component elements. The compound growth rate of area, production and productivity for the individual crops were worked out. The analysis for the period from 1952-55 to 1982-85 revealed that nearly 50 per cent of the change in crop output in Kerala was due to the change in the total area under ten crops viz. rice, cassava, pepper, arecanut, cashew, ginger, coconut, rubber, tea and coffee and 42 per cent through the change in the yield of the concerned crops. The major changes taking place in Kerala is the gradual shifting of area from food crops like rice and cassava to plantation crops like rubber, cashew , coconut and coffee.

In a study on analysis of changes in area, production and productivity of cassava in Kerala, Elsamma and Asan(1989) found that total volume of change between 1975-76 to 1986-87 for the state amounted to a reduction in area and production to the extent of about 41 per cent and 39 per cent respectively, while productivity showed an increase of 3.51 per cent. Trends during the period indicated that area and production have been on the decline whereas, the productivity has been on the increase. Coefficient of variation indicated that area

and production showed a greater degree of dynamism than productivity. Correlation coefficient analysis revealed that significant positive correlation existed between area and production while there was an absence of correlation between production and productivity.

Pal and Ramanathan (1989) in their study on the economics of sweet Potato cultivation in three districts of Kerala, namely Palakkad,Malappuram and Kasargode found that the cost of cultivation in Palakkad and Malappuram was Rs.5500 per hectare where as it was around Rs.6700 per hectare in Kasargode mainly because of application of higher quantity of manures and fertilizers as compared to other districts. Kasargode district recorded an average tuber yield of about 13 tonnes as against 11 tonnes per hectare in Palakkad and Malappuram.The cost of production of tuber in the three districts was estimated to be 50-51 paise per Kilogram.

Alice and Inasi in their study on performance of sweet potato cultures in Kuttanad (1990) reported that sweet potato can be successfully grown in the interspace of coconut gardens where partially shaded condition exists. In order to identify the best cultivars suitable for intercropping, field trials were undertaken at the Regional Agricultural Research station, Kumarakam during 1985-87 seventeen entries including stabilized varieties, advanced cultures and local check were evaluated in the trial. The results showed that entries exhibited wide variability in tuber yield (1.330 to 8.833 tonnes per hectare). Cul.2421,Kanjangad local,S.30, Cul.4025 and

kalmegh were found to be on par and significantly superior to all other treatments. The superiority of cut 2421 for tuber yield was due to the production of higher number of tubers per plant.

In their study on the analysis of cropping pattern in Kerala over the period of 1974 - 75 to 1986 - 87 Jessy Thomas et al.(1990) reported a declining trend in growth rate of tapioca.

In a study on the cost and returns of grams in Vindhyan and Malwa Plateau Mishra and Sahu (1990) adopted three stage random sampling design (i.e. teshil, village cluster and farmers). Cost accounting method was used for collection of data. Cobb-douglas production function was fitted to study resource use productivity in grams. The functional analysis indicated that the variables were found to be significant in both the regions with slight variation among the size groups. Only fixed costs were found to have significant impact on yield performance of the crop. No other variable revealed significant impact.

Ramanathan et al.(1990) conducted a study on present status and varietal distribution of cassava in Kanyakumari,Salem, South Arcot and Dharmapuri, the major cassava growing districts in Tamil Nadu.The requisite numbers of villages and respondents were selected using stratified random sampling prodcedure.Fifteen cassava cultivators were randomly selected from each of the selected villages, making the total sample of 270 for the

study. The studies indicated that cassava was grown mainly as an irrigated crop under open condition in Tamil Nadu except in Kanyakumari district, where it was taken as a rainfed crop under both upland and lowland in the irrigated tract, more than three fourth of the area was occupied by the high yielding varieties viz. H-165 and H-226 whereas local varieties were raised in about 80 per cent of area under rainfed condition. January, February and April were the main months of cassava planting in the irrigated and rainfed areas respectively.

Randev *et al.*(1990) worked out the economic efficiency of almond production and efficiency of resource use. Two stage stratified random sampling was adopted for the selection of the respondents. Log linear production function was applied for studying the relationship between the output of almond and the various input variables. The analysis showed that for increasing the total returns on all the orchards emphasis should be laid on more use of these variables.

Reddy *et al.*(1990) in their study on the economics of betelvine cultivation in Cuddappah district of Andhra Pradesh worked out resource use efficiency by using Cobb-Douglas production function. Costs and returns per hectare of the crop were worked out. The fitted function revealed the scope for further use of labour, manures and fertilizers. Further investment in seed and miscellaneous costs was not desirable as revealed from their nonsignificant coefficients.

Santha *et al.*(1990) in their study on the adoption of improved technologies for cassava in Kerala state revealed that the adoption was low for almost all the practices of cassava. The variation in the acceptance of improved technologies based on the size of holding was meagre.

Sheela and Kunju (1990) conducted a study on fertilizer and economics of cassava based intercropping system. The results revealed that among the different nutrient levels tried for the cassava based cropping system the fertilizer level of 50:62.5:62.5 Kg N, P_2O_5 and K_2O per hectare was found to be significantly superior to all other nutrient levels. The same level gave the highest mean net return of Rs.12,271.48 per hectare Intercropping at very high nutrient level is less economical than the pure crop of cassava. Even though the intercrops reduced the yield of the main crop cassava, this reduction was compensated by the intercrop yield and further increased the net profit to the farmer.

Thakur *et al.*(1990) in their study on resource use farm size and returns to scale on tribal farms of himachal pradesh observed inefficient use of various factors of production. Cobb-Douglas production function was fitted to estimate the resource use efficiency. The result showed highly remunerative nature of investment on irrigation in these areas and there are significant inefficiencies in the use of inputs on the average tribal farms.

Thomas *et al.*(1990) conducted a study on the growth and output response of tapioca in Kerala for the period 1960-61 to 1986-87. Trends in area, output and productivity were estimated by fitting a semi-logarithmic model. The results showed a declining trend in acreage during `1960-61 to 1986-87. It was also noted that the sharp rise in the production level of tapioca during sixties was associated with greater increase in both acreage and yield. Production had shown a declining trend during the seventies due to negative growth rates of area and yield.

In a study on cost-benefit Analysis of Cassava in southern zone of Kerala, Elsamma and Asan (1991) reported per hectare cost and return of Rs.3545 and Rs.7362 respectively. The net return per hectare was found to be more for small holdings having size upto 50 cents. Input productivity analysis showed constant returns to scale and labour was found to be the most significant factor for cassava cultivation.

Hiremath and Murthy (1991) conducted a study on economic analysis of technical change and resource use efficiency in Bidi tobacco production in Karnataka to evaluate the allocative efficiency in the use of resources in the production of different varieties of Bidi tobacco and also to study the input-output relation-ship. Multistage sampling technique was employed in the selection of districts, taluk and villages. Farmers randomly selected from the villages were stratified into

small, medium and large groups.270 farmers from 15 villages were selected based on the probability proportion to the total number of farmers in each size group keeping the total number of respondent farmers at 18 irrespective of the number of farmers in each size group. Indirect estimates of Cobb-Douglas production function with unitary returns to scale were estimated using the profit function. Marginal value product of land was very high followed by fertilizer and human labour. The new seed variety had brought in additional high production utilizing the same level of inputs as that of the old variety.

Singh *et al.*(1991) in their study on economic analysis of potato cultivation in Jaunpur district of Uttar Pradesh found that the farmers operating at higher level of technology obtained higher level of returns over variable cost.

Devi *et al.*(1992) analyzed the growth and performance of co-operative agricultural credit in Kerala for the period from 1980-81 to 1986-87. The performance of tapioca production, productivity and area in the light of credit supply was analyzed. It was found that though the per hectare credit supply had doubled over years, its effect on production was negative.

Kuchhadiya et al.(1992) studied the cost-benefit analysis of garlic crop in Jamnagar district of Gujarat state. The data were collected by survey method

during the year 1986-87. Three stage stratified random sampling technique was adopted with the district as the strata,taluk within the district as first stage, villages within the taluk as second stage and the farmers within the villages as the ultimate sampling unit. The net income per hectare was to the tune of Rs.38,369 showing higher profitability of the crop. The cost-benefit ratio was 1:1.99.

Pal *et al.*(1992) studied the cost of cultivation of cassava in Kerala. The average cultivation cost worked out to Rs.5500 per hectare for the local varieties. When high yielding varieties were grown following recommended practices, an additional expenditure of Rs.2180 per hectare was needed. Of the various items of cost, labour was the single largest factor accounting for nearly 53-60 per cent of the total production cost under the three systems compared.

Sharma *et al.*(1992) in their study on economics of vegetable farming in mid-hills of Himachal Pradesh examined the input-output relationship in the production of selected vegetable crops and also estimated the profitability of different vegetable crops. For the selection of the sample, two stage simple random sampling technique was adopted. The farmers were classified into two groups i.e. small and large using cumulative cube root frequency method. In order to examine the input-output relationship of selected vegetable crops both the linear and Cobb-Douglas types of production functions

were fitted with yield as dependent variable and human labour, bullock labour and working capital as explanatory variables. The input-output analysis revealed that the farmers can augment their income by enhancing the use of human labour on their farms. The study also brought out that there were increasing returns to scale in lady's finger, potato and brinjal thereby suggesting that more returns could be obtained if the use of inputs like human labour, bullock labour and working capital is enhanced.

Sunandini *et al.*(1992) studied resource productivity and resource use efficiency in paddy farms of Andhra Pradesh. Stratified random sampling was used for selecting the farmers from each village. Cobb-Douglas production function was fitted in order to determine the efficiency of each variable in the production of rice for both kharif and rabi seasons. Explanatory variables such as human labour, bullock labour, tractor power, seeds, manures, fertilizers plant protection chemicals and irrigation were used in value terms. It was observed that none of resources in three regions were used with optimum efficiency since marginal value product to factor cost ratio's were not equal to one. The marginal value product to factor cost ratios for human labour on both small and large farms in both the seasons were less than unity indicating over utilization of these resources. For manures and fertilizers the ratio was higher than unity indicating under utilization of these resources.

Anantharaman *et al.*(1993) in their study on economics of sweet potato cultivation in low land areas and in an upland area observed that the average yield of sweet potato in low land was 17 tonnes per hectare, more than double the yield of uplands. The input-output ratio in lowland area was 3.03 against 1.40 in the upland.

Bhaskaran *et al.*(1993) studied the extent of adoption of scientific cultivation of cassava in Thiruvananthapuram district. It was inferred from the data that only negligible proportion (2 per cent) of respondents had adopted more than 75 per cent of the package of practices of cassava as recommended by Kerala Agricultural University. It was also noted that 45 per cent of the respondents adopted only upto 25 per cent of the recommended cultivation practices of cassava. In general the overall extent of adoption of scientific cultivation practices by the farmers was low.

Dabas *et al.*(1993) in their study on economics of seedling tubers production in Kunlunjan village of Meerut observed that the cost of production of seedling tubers ranged from Rs.2.76 to 3.17 averaging to Rs.2.96. per kilogram.

Velayutham and Zeaudeen (1993) estimated the costs and returns and resource use efficiency in sesamum production. A multistage stratified random sampling technique with taluk as the universe, block as the second stage unit, villages as the third stage unit and farm

households cultivating sesamum as the ultimate sampling unit was adopted. Resource use efficiency was worked out by fitting a Cobb-Douglas production function. The result revealed that the variables, land and labour were found to influence the production of sesamum positively and significantly. The sum of elasticities of production was 1.2355 indicating increasing returns to scale.

Bastine and Palanisami (1994) studied the decadal changes in growth rate of area, production and productivity of major crops of Kerala. Exponential function was fitted to the data to compute the compound growth rates. The compound growth rates of tapioca area showed significant decline along with negative but non-significant production and positive productivity trends.

Sahu *et al.*(1994) analyzed the area, production and productivity of sweet potato in Orissa. During the years 1979-80 to 1989-90, the state registered a positive annual compound growth rate to the extent of 1.58, 2.54 and 0.99 per cent respectively in area, production and productivity. However there existed a greater fluctuation in production in the state than area and productivity during the period.

Sekar *et al.*(1994) analyzed the resource use pattern and efficiency among the different size groups of paddy farms, and estimated the income received by paddy farmers. Three stage stratified random sampling technique with taluk as the primary sampling unit, a cluster of

villages having a minimum of 200 cultivators as secondary sampling unit and ten operational holdings with each village as ultimate sampling unit was adopted. Conventional percentage analysis was used to analyze the resource use pattern, productivity,cost of production and income generation among various size groups of paddy farms. The results of the regression analysis revealed that the human labour, seed cost,fertilizer cost and cost of plant protection chemicals had significant influence.

Thakur *et al.*(1994) examined the resource use pattern,and elasticities of production in important crops in Himachal Pradesh. Two stage stratified random sampling design was followed. Cobb-Douglas production function was fitted to work out the resource use efficiency and marginal value productivities were estimated.

Sucharita *et al.*(1995) in their study on turmeric crop in Nizamabad district of Andhra Pradesh assessed resource productivity, returns to scale, resource use efficiency and opportunity costs of various factors used in production of turmeric. A functional relationship was developed between output and the inputs to study the resource returns, returns to scale and resource use efficiency of turmeric farms. Cobb-Douglas production was fitted with gross returns as dependent variable. The analysis revealed the operation of diminishing factor returns and constant return to scale. The marginal value products indicated high degree of resource use efficiency in different farm size groups.The analysis

further revealed the scope for re-organization of farm resources so as to maximize the returns on turmeric farms.

2.2 Marketing.

Balasubramanium (1960) in his study on the problem of marketable surplus in Indian Agriculture suggested certain concrete measures which could help in augmenting the marketable surplus. The measures proposed by him are mainly steps to raise the agricultural production and collection of land revenue, setting up of more regulated markets, pursuit of a well defined price policy, fixing of floor prices for food grains, assured and stable prices linked up with co-operative marketing, compulsory levy etc.

Bansil (1961) in his study on problems of marketable surplus described that marketable surplus may be less equal to or even more than marketed surplus depending upon the external factors operating on the market economy. Both these are equal only under ideal condition. The process of economic development is accompanied by a faster rate of urbanization or a reduction in the percentage of population engaged in agricultural production. The resultant rise in the standard of living of producer resulted in larger retention on the farm and restricted flow to the market.

Narain (1961) studied the marketed surplus of agricultural produce by size of holding in India. He estimated the proportions in which holding of different size groups contributed to the marketed surplus. He found that holdings on the lowest stratum of size upto 5 acres contributed as much as 25 per cent of marketed surplus and holdings of size upto 15 acres contributed as much as 50 per cent of marketed surplus.

Sinha (1962) in his article on "Marketed surplus in agriculture in under-developed countries discussed the important role of marketable surplus in promoting economic development and examined the various factors influencing the farmers' attitude towards increasing farm production and marketable surplus under different economic conditions. He was of the view that in order to promote marketable surplus, the prices of agricultural commodities must be kept relatively lower than industrial prices, or in other words, the terms of trade should be slightly adverse to the farmers. He has also suggested the need for certain complimentary measures like improving transport facilities, standardisation of weights and measures etc for augmenting the marketed surplus.

Kalhon and Dwivedi(1963) examined the behaviour of marketed surplus in terms of different farm factors like size of the holding and tenurial status, size of the family, consumer habits and relative prices of farm-products. They found that the marketed surplus was directly associated with production and size of the

holding. The size of the family showed a negative relationship.

Shastri(1963) studied the inter-relationship between production, prices and marketable surplus in Bihar with respect to four crops rice, gram, arhar and potato. The study revealed that production exercises a considerable influence on marketed surplus.

Sharma(1967) studied the effect of farm factors on marketed surplus of Bajra in Jaipur district by considering two main factors namely size of family and total production. It was found that the marketed surplus and size of the family were negatively correlated. Total production was found to be directly associated with marketed surplus.

Singh(1975) estimated the price spread and marketing for potato in Secunderabad. It was found that producers received only Rs.88.90 whereas consumer paid Rs.132-150 per quintal. The total marketing cost of producers was more than that of wholesaler and retailer which accounted for 5.65 and 1.88 per cent respectively.

Boonsue and Sinthuprama (1976) in their study on cassava, a potential crop for Thailand found that cassava was Thailand's fourth major export crops, next to rice, maize1 and para rubber. It was also found that production was mainly through increase in acreage rather than improved varieties,fertilizer application and better agronomic practices.

In his study on sweet potato marketing in Philippines Santos (1977) found that sweet potato production remained relatively stable during the study period. Thus price differences mostly reflect location and other factors rather than price changes during the period. He also studied the marketing channels, marketing margins and problems of sweet potato marketing.

Lakshmi (1978) in her study in Kerala on market trend in cassava estimated the long run trend and seasonal fluctuation in price of cassava. She found that agricultural prices were stable because agricultural production remained comparatively constant in the face of great fluctuations in demand. It was also found that growth rate of production was substantially higher in all the districts.

Chatha and Sidhu(1980) studied the production and marketing of potato in Punjab state and examined the problems of potato marketing. It was based on information collected from eighty potato growers, ten commission agents, five primary whole salers and ten peddlers randomly selected from Jalundar city in Punjab in 1978-79. The trends in area cultivated, production, marketable surplus, price behavior, marketing channels, price spread, role of cold storage industries, scope for processing, procurement and price support policy for potato were examined.

Ojha *et al.*(1983) studied the role of middlemen in agricultural marketing.It was found that the middlemen took away the lion's share of the price paid by the consumer and consequently producer got only a poor share of the price. Out of consumers money spent on rice and wheat, the middlemen's share amounted to 33.2 per cent and 31.5 per cent respectively. The study revealed that majority of farmers were selling their produce through traditional channel of commission agents and that at the same time it further revealed a big majority of farmers did not prefer to sell their produce through their commission agents.

Singh *et al.*(1983) conducted a study on economics of production, marketing and storage of potato in Farukhabad district of Uttar Pradesh. It was found that producers share in consumer's price of Farukhabad potato came to 64.66 per cent. Marketing cost incurred by the producers was 18.53 per cent whereas wholesalers and retailers together incurred a marketing cost of 15.04 per cent.

Sen (1984) in his case study on the problems of potato marketing in West Bengal found that the Government or the local bodies had very little control over the business adopted by the private traders at the cost of the growers. Traders' returns from a quintal of the crop was also higher than producers' returns.

Konak and Isikli(1985) in their study on food production, marketing and consumption in Odenius and Izmir found that potato accounted for 82 per cent of total gross income of the farms. It was also observed that 60-68 per cent of the consumer price was received by producers and 30-40 per cent by middlemen of which 78 per cent accrued to retailers and 21 per cent to wholesalers.

Kalyankar and Rajmane (1987) in their study on marketing of potato in Jaina district of Maharashtra showed that March was the peak month for arrivals while minimum arrivals were recorded in November.Seasonal price indices show that the increase in the off-season price compared with the immediate post harvest price was around 30 per cent. The producers share in consumers rupee was 65.71 percent, the remaining 34.29 per cent being spread over different marketing agencies.

Rizvi and Singh(1987) in their study on pattern of production and marketing of potato in Soraon development block of Allahabad found that production of potato increased with farm size.The average per household marketed surplus of potato was found to be 225.36 quintals.

Sidhu(1988) in a study on new thrusts in Agricultural marketing in Punjab found that there should be right type of marketing infrastructure, correct government policies and a sound network of input supply system for marketing of agricultural commodities. It was

found that about 30 per cent of fruits and vegetables production was lost due to lack of processing and cold storage facilities.

In their study on estimation of marketed surplus and utilisation pattern of cassava in Trivandrum district Lakshmi and Pal (1989) found that the per capita consumption of cassava per day is varied between urban (0.17 kg) and rural areas(0.52 kg). Cassava was generally consumed as fresh tubers and the excess was sold in retail for Rs.1.30 per kilogram and some of the farmers in rural area converted the surplus into chips.

In their study on estimation of marketed surplus and utilization patterns of marketed surplus and utilisation patterns of cassava in three villages namely Perumpazhuthur, Sreekaryam, Kundara, Neyyattinkkara Municipal limits and corporation limits of Trivandrum district, Lakshmi and Pal (1990) reported that per day consumption of cassava per person and per household were more in rural area (0.41 kilogram per day per person and 3.67 kilogram per day per household) compared with urban area (0.12 kilogram per day per person and 0.66 kilogram per day per household). Cassava was mostly consumed as fresh tuber after cooking and excess was sold locally in retail price ranging from Rs.1-1.75 per1 kilogram. About 70 per cent of the households in rural area consumed cassava almost daily while in urban area cassava was included in the diet once or twice a week.

Bottema *et al.*(1991) in their study on production and markets of sweet potato in Vietnam evaluated the production and marketing requirements of sweet potato, a staple food for the Vietnamese. The existing production structure was reviewed in North, Central and South Vietnam, followed by proposals for marketing in each region. The role of the village co-operative in the programme was assessed and the socio-economic characteristics of households analyzed.

Lakshmi (1991) in her study on estimation of marketed surplus and utilization pattern of cassava in four villages of Trivandrum district and five villages of Kollam district observed that marketed surplus of fresh tuber from Trivandrum district was 6.2 tonnes per hectare and that of dried chips was 0.15 tonnes per hectare. The corresponding figures from Kollam district is 3.96 tonnes per hectare of fresh tubers and 0.15 tonnes per hectare of dried chips. Per capita consumption of cassava in Trivandrum district (0.29 to 0.43 kilogram per person per day) was higher as compared with that of Kollam district (0.24 to 0.38 kilogram per person per day). In both the districts households depending on agricultural labour consumed more cassava per day.

Saini et al.(1992) in their study on dynamics of production of sweet potato marketing in Himachal Pradesh revealed that production of sweet potato increased at a compound growth rate of 2.59 per cent per annum. The increase in sweet potato production in the

state was mainly attributed to an increase in the area as well as the productivity of the crop.

Sikka and Vaidya (1992) in their study on production and marketing of potatoes in Shimla and Lahaul Spiti districts of Himachal Pradesh found that gross production of potatoes in India has increased by about 70 per cent over the period 1979-80 to 1987-88 thereby registering a growth rate of 5.2 per cent per annum. This increase in production is attributed to increase in both area as well as productivity.

Area of study

AREA OF STUDY

The present study is based on the cultivation of three important tuber crops in six panchayats of Palakkad district. This district has been selected for the study since this is the major tuber crop growing area of the state.

3.1 Location and geographic features

Palakkad district is bounded on the north by the Nilgris,on the east by Coimbatore district of Tamil Nadu, on the south by Thrissur district and on the west by Malappuram district.The district lies between latitude 10° 20'and 11° 14' and east longitude 76° 02'and 76° 54'.

The district is divided into five Taluks, viz. Mannarghat, Ottappalam, Palakkad, Alathur and Chittoor, comprising of 12 blocks, 3 muncipalities, 91 panchayats and 894 wards.

3.2 Population

Palakkad district ranks seventh in popula-tion in Kerala. According to 1991 provisional census report Palakkad supports a total population of 23.82 lakhs of which 11.56 lakhs are males and 12.26 lakhs are females. Growth rate in population during the last decade is 16.52 per cent in the district. Density of population is 532

persons per square kilometer. Sex ratio shows that there are1061 females for every 1000 males. Literacy according to 1991 census report is 81.27 per cent. Literacy was more among males (87.24 per cent) than female (77.09 per cent).

Total working population of the district is 7,86,363 of which 12.37 per cent are cultivators and 44.29 per cent are agricultural labourers. Percentage of household industry workers and other workers are 2.79 per cent and 40.55 per cent respectively.

3.3 Climate and soil

Palakkad district experiences tropical hot summer from mid February to May end, south-west monsoon from June to August, North east monsoon in November and cool climate in December to February. Annual rainfall is 187cms. The average monthly distribution of rainfall for the district during 1994-95 is given in Table 3.1.

The district is headed by rocky hillocks on all the four sides and a major portion of the area is plain. Three types of soil is seen viz. laterite type in the south and west, virgin forest type in the north and central and black type in the eastern part of the district.

Table 3.1. Average monthly rainfall in Palakkad district for the year 1994-95

Months	Rainfall (in mm)
May	53.5
June	668.6
July	824.4
August	264.3
September	186.5
October	358.6
November	95.0
December	0.0
January	11.4
February	4.6
March	9.9
April	176.7

Source: Farm guide, 1994, Farm Information Bureau, Government of Kerala

3.4 Land utilization pattern

The total geographical area of the district is 338980 hectares, which is 11.3 per cent of the area of the state. Land utilization pattern of the district as given in Table 3.2 revealed that area under forest constituted 10.70 per cent while land put to non-agricultural uses occupied 9.41 per cent and cultivable waste land accounted for 6.71 per cent of the total geographical area. The net area sown was 217032 hectares which constituted 64.03 per cent. Out of the total cropped area of 339037 hectares, area sown more than once accounted for 35.98 per cent.

3.5 Water resources

The district has many water resources such as canals,tanks,minor and lift irrigation projects.Important rivers flowing through the district are Bharathapuzha and its tributaries, Malampuzha, Walayar, Mangalam, Meenkara, Gayathri,Pothundi and Kanjirapuzha flowing to the Arabian sea. Two tributaries of Cauvery viz. Bhavani and Siruvani also are flowing through the district. There are two major, five medium and a number of minor lift irrigation projects in the district. Major irrigation projects operating in the district are Malampuzha, Mangalam, Pothundi,Meenkara(Gayathri project),Chaliyar, Chittoor-puzha, Walayar and Kanjirapuzha. Source-wise and crop-wise irrigated area in the district is shown in Table 3.3

Table 3.2. Land utilization pattern for the year 1994 - 95

Description	Area (in hectares)	Percentage
Total geographical area	338980	100.00
Forest	36257	10.70
Land put to non-agricultural uses	31908	9.41
Barren and uncultivable land	9883	2.91
Permanent pastures and other grazing land	103	0.03
Land under miscellaneous tree crop not included in net area	6818	2.01
Cultivable waste	22759	6.71
Fallow other than current fallow	5481	1.62
Current fallow	8739	2.58
Net area sown	217032	64.03
Area sown more than once	122005	
Total cropped area	339037	

Source : Farm guide, 1994, Farm Information Bureau, Government of Kerala.

Table 3.3. Area under irrigation in Palakkad district (source wise)1994

Source	Area irrigated (in hectares)
Government canal	50018
Private canal	224
Government tanks	245
Private tanks	5019
Government wells	59
Private wells	10405
Minor and lift irrigation	1364
Other sources	6586
Total	73920

Sources: Farm guide, 1994, Farm Information Bureau,Government of Kerala

3.6 Cropping pattern

Major crops grown in the district are rice, coconut, rubber, spices and condiments, fruit trees and tuber crops. The cropping pattern of Palakkad district is shown in Table 3.4. Rice is cultivated in 89,769 hectares of land which is 29.63 per cent of the total and is an important foodgrain crop of the district. Coconut is grown in 43,703 hectares of land which is 14.43 per cent of the total cropped area and tubers occupy 4.84 per cent of the total cropped area.

3.7 Study area

Out of 91 panchayats in the district two panchayats each were selected with highest area under the corresponding crops. The selected panchayats were Mundur and Kongad for coleus, Mathur and Kottayi for sweet potato and Vandazhi and Kizhakkencheri for tapioca.

3.7.1 Indicators of development

Major indicators of development of study area are presented in Table 3.5. Among the selected panchayats Kizhakkencheri had the highest population(36215) followed by Vandazhi(28573) and the lowest in Kottayi(19069). However the highest density of population was in Kottayi(955 per sq. km) and lowest in Kizhakkencheri (322 sq. Km). Sex ratio was in favour of females in all the panchayats with highest in Kongad (1083). Literacy

Table 3.4 . Cropping Pattern in Palakkad district for the year 1994 - 95

Crop	Area (In hectares)	Percentage to total cropped area
Paddy	89769	29.63
Other cereals and millets	20200	6.66
Pulses	6862	2.27
Sugar crop	8297	2.74
Spices and condiments	26396	8.71
Fruits	21635	7.14
Vegetables	8634	2.85
Coconut	43703	14.43
Tubers	14665	4.84
Oilseed crops	18170	5.99
Drugs and narcotics	60	0.03
Tea	825	0.27
Coffee	2291	0.76
Rubber	24773	8.18
Cocoa	62	0.02
Fodder grass	200	0.07
Green manure crops	1648	0.54
Other non-food crops	14750	4.87
Total cropped area	302940	100.00

Source: Farm guide, 1994, Farm Information Bureau, Government of Kerala.

Table 3.5. Major indicators of development of the study area

Indicators	Panchayats					
	Mundur	Kongad	Mathur	Kottayi	Vandazhi	Kizhakkencheri
Geographical area (sq.km)	33.04	35.55	24.52	19.96	56.70	112.56
No. of wards	10	10	10	9	11	11
Population	25996	25165	22627	19069	28573	36215
Density of population (per sq.km)	787	708	922	955	504	322
Sex ratio	1077	1083	1068	1069	1042	1021
Literacy rate						
Male	87.42	87.57	84.82	87.58	86.42	87.37
Female	73.31	7.91	68.22	74.30	70.98	72.78

rate was more among males than females in all the selected panchayats, recording more than 80 per cent. Female literacy rate was around 70 per cent in the study area.

3.7.2 Cropping pattern

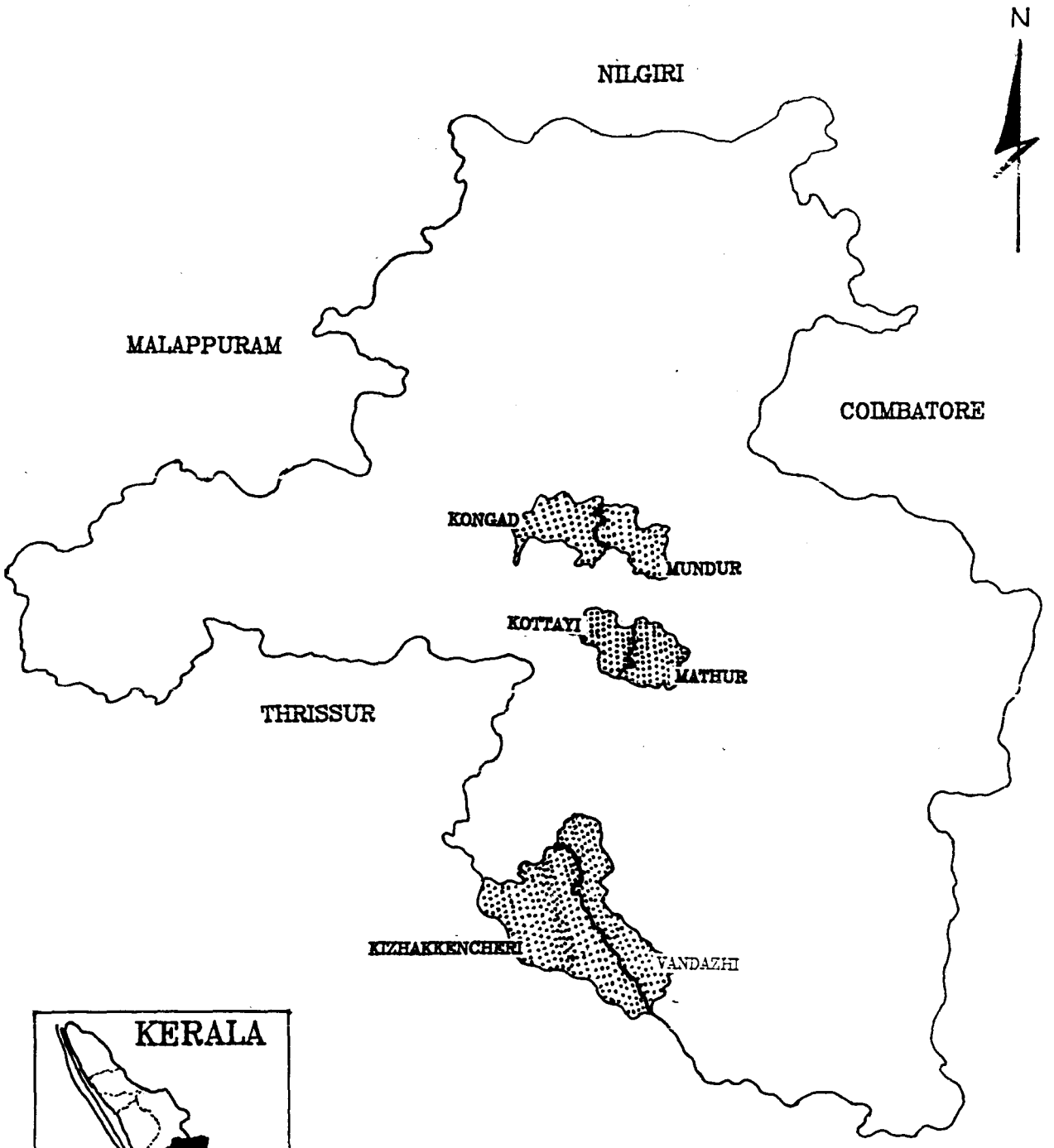
Major crops grown in the area as shown in Table 3.6 are paddy, coconut, banana, rubber, cashew, tapioca, coleus, sweet potato and vegetables. Rice is the most important crop occupying the highest area in all the panchayats followed by coconut and banana.Coleus occupied an area of 92.45 hectares in Mundur and 100 hectares in Kongad. The area under sweet potato was 110 hectares in Mathur and 150 hectares in Kottayi while the area under tapioca was 108 hectares in Vandazhi and 100 hectares in Kizhakkencheri.

Table 3.6. Cropping pattern 0f the study area (in hectares)

Name of crops	Panchayats					
	Mundur	Kongad	Mathur	Kottayi	Vandazhi	Kizhakk-encheri
Paddy	1079.04	756	945	1017	1065	1338
Coconut	812.43	651	60	110	1028	735
Coleus	92.45	100	-	-	-	-
Banana	142.84	200	40	40	50	250
Cashew	82.43	30	8	5	15	20
Sweet potato	-	-	110	150	-	-
Rubber	245.42	25	5	7	504	250
Tapioca	85.92	60	14	30	108	100
Ginger	25.00	20	10	15	30	35
Vegetables	160.00	125	25	30	35	40

Fig.1.

PALAKKAD DISTRICT MAP
SHOWING SELECTED PANCHAYATS



Methodology

METHODOLOGY

The present chapter deals with the materials, methods and tools of analysis adopted in estimating cost and returns and marketing systems of three tuber crops viz. coleus, sweet potato and tapioca. The study was conducted in Palakkad district and data for the study was collected through a sample survey. A brief description of the procedures followed in the selection of sample, data collection as well as analytical techniques employed in this study are presented in this chapter.

4.1 Sampling procedure

A two stage sampling technique was adopted for the selection of sample. Purposive sampling procedure was adopted for the selection of panchayats and simple random sampling technique was followed for the selection of farmers. Two panchayats each with largest area under coleus, sweet potato and tapioca were selected. From each of the selected panchayats 25 farmers were randomly selected. Thus the total number of respondents of each crop came to 50 making a total sample of 150. The sample was post stratified on the basis of the area under particular crop. The size classification adopted is as follows.

Class I 0 - 1 acre
Class II 1 - 2.5 acres
Class III Above 2.5 acres

To study the marketing aspects of the above crops, information were collected from three village traders of selected panchayats. Details were also gathered from three wholesalers and retailers each for the above crop.

4.2 Period of study

Reference period of the study was the agricultural year 1994-95. Data collection was done during the months of June-August 1994.

4.3 Collection of data

Farm level data were collected with the help of a well structured and pre-tested interview schedule through personal interview method. Information on the socio-economic condition of farmers, the level of various inputs used, cost and returns, marketing channels, and marketing costs were collected. Secondary data on land utilization pattern, population, climate and rainfall, land and soil, water resources and cropping pattern were obtained from various government publications and other records.

4.4 Tools of analysis

Percentage analysis was employed for the estimation of the cost and returns of the selected crops.

The concepts used in the present study is explained below.

Cost A_1

Cost A_1 approximates the actual expenditure incurred in cash and kind and it includes the following items of costs.

Value of hired human labour

Human labour employed for various cultural operations like land preparation, sowing, application of manure and fertilizers, weeding and harvesting were included in determining the value of hired human labour. The actual wages paid for labour was considered as value of hired labour. The wage rate was Rs.45/- per day for men and Rs.25/- per day for women.

Value of planting material

Purchased planting materials were evaluated on the basis of the prevailing market price. The same price was used for evaluating farm produced planting materials.

Value of manures and fertilizers (farm produced and purchased)

Expenditure on purchased quantities of manures and fertilizers has been evaluated by multiplying the physical quantities of the different manures and

fertilizers with their respective price. Farm produced items were valued at their market price.

Interest on working capital

Interest on working capital was charged at the rate of 11.5 per cent per annum. This was the rate of interest charged by State bank of Travancore for short term agriculture loans. The interest was charged only for the duration of crops, as all the costs are not incurred at the beginning itself.

Land revenue

This was taken as the actual rate paid to the revenue department which was Rs.10/- per acre in the area.

Miscellaneous expenses

Expenses incurred for temporary dead stocks like baskets were included in this item. Baskets can be used for two years hence cost of the basket is taken as half the cost.

Cost A_2

Cost A_2 consists of cost A_1 plus rent paid for leased in land. It was found that farmers do lease in land for the cultivation of coleus. Based on the prevailing rent in the area an amount of Rs.3500/-

per acre per season was accounted as rent for leased in land.

Cost B_1

Cost B_1 includes cost A_1 plus interest on own fixed capital. There was no fixed capital used in the sample. Hence cost A_1 is same as cost B_1.

Cost B_2

Cost B_2 consists of cost B_1 plus rent paid for leased in land plus rental value of own land. Rental value of land was calculated as equal to one fifth of the value of total produce.

Cost C_1

Cost C_1 includes cost B_1 plus imputed value of family labour. The cost of the family labour was imputed based on the prevailing wage rates paid to hired labour in the area during the period.

Cost C_2

Cost C_2 is computed as cost B_2 plus imputed value of family labour.

The following income measures associated with different cost concepts were also used to measure the efficiency of selected crops.

Gross income

Gross income represents the total value of the produce. This was calculated based on the harvest price prevailing in the area.

Farm business income

Farm business income was calculated by taking the difference between gross income and cost A_1.

Family labour income

It was calculated by adding the imputed wages for family labour to the net income or the difference between gross income and cost B_2.

Net income

This is the difference between the gross income and cost C_2.

Farm investment income

This is the difference between farm business income and imputed value of family labour.

Benefit-cost ratio

Benefit-cost ratio reveals the physical production efficiency. It was calculated by dividing the total benefits by total costs.

4.5 Functional analysis

Functional analysis was carried out using Cobb-Douglas production function on per farm and per unit area basis (per are) and not for different size groups because of limited observations in each group. Generally this function is used because elasticity co-efficients could be obtained directly from the function and there is economy in the degrees of freedom and moreover it is preferred because of computational ease theoretical fitness to agricultural data. In this study the function was fitted with five explanatory variables such as area, human labour, farmyard manure, fertilizer and planting material cost and subsequently with four variables such as labour, farmyard manure, fertilizer and planting material cost in the case of coleus and sweet potato. In the case of tapioca the above function was fitted without taking into consideration the planting material cost. The specifi-cation of the model is given below.

$$Y = a \; x_1^{b1} \; x_2^{b2} \; x_3^{b3} \; x_4^{b4} \; x_5^{b5}$$

where,

Y - Value of output in rupees estimated by multiplying the produce with farm price.

x_1 - Area in cents

x_2 - Labour- This includes both hired and family male and female labour. Wage rate of male is fixed as Rs.45/- and thatof female is fixed as Rs.25/-

x_3 - Farmyard manure-The value of farmyard manure is taken by multiplying the physical quantities with its price which is taken as Rs.1/- per kilogram.

x_4 - Fertilizer-The value of fertilizer is taken by multiplying the physical quantities with the corresponding price.

x_5- Planting material- The value of planting material is taken as the cost incurred in the nursery preparation.

a - Intercept

b_1, b_2, b_3, b_4 and b_5 are the corresponding production elasticities.

Returns to scale and marginal value products were worked out from the above production function.

Marketing

The marketing costs, margins and marketing efficiency were worked out for the three crops studied, using percentage analysis.

Marketing efficiency was estimated using the formula given below.

$$(ME = (V/I)-1)$$

where 'ME' is the marketing efficiency, 'V' is the total value of goods marketed, 'I' is the marketing cost including marketing margin.

Results and Discussion

RESULTS AND DISCUSSION

The study comprises of three crops viz. coleus, sweet potato and tapioca, the results of which along with discussion are presented in three sections. The first section deals with the general socio-economic characteristics of the sample farmers. Section two in three parts covers general cultivation practices adopted by the farmers, operation-wise and input-wise cost of cultivation, cost of cultivation under different cost concepts, income measures in relation to different cost concepts, yield and returns and resource use efficiency. Section three deals with the marketing aspects of tuber crops.

5.1 General economic and social conditions of the sample

A brief idea about the social and economic conditions in which farmers operate would be very useful for proper understanding of their farming activities. Hence an attempt is made to present the salient features of the social and economic conditions of the sample farmers viz. family size, age and sex, literacy occupation, ownership holding and cropping pattern.

The study was conducted in six Panchayats, two each for coleus, sweet potato and tapioca. The selected Panchayats were Mundur and Kongad for coleus, Mathur and Kottayi for sweet Potato and Kizhakkencheri and Vandazhi for tapioca. The selected farmers were classified into

three size groups based on the area under particular crop, with class I having an area upto 1 acre, class II between 1 and 2.5 acre and class III above 2.5 acres. Hereinafter effort was made to class I, class II and class III. The distribution of sample farmers is presented in Table 5.1.

5.1.1. Family size

Distribution of respondents for coleus, sweet potato and tapioca according to family size is given in Table 5.2. In the case of coleus farmers average family size was 4.72 with 64 percent of the respondents having family size between 4 to 6 members, while 20 percent with 1 to 3 members and the remaining 16 per cent with 7 members and above. Class wise analysis shows the same trend with 66 per cent of the farmers in class I having average family size of 4.41. However the average size of the family was higher in class II with 5.63.

Sweet potato farmers have an average family size of 4.68 at the aggregate level with 70 per cent belonging to the family size of 4 to 6 members. Class-wise analysis revealed that 73 per cent of respondents having family size 4 to 6 members were in class I with average family size of 4.65. The average family size was highest in class III (5.0).

Table 5.1. Distribution of sample farmers according to size groups.

	Crop / Panchayats					
	Coleus		Sweet potato		Tapioca	
Size groups	Mundur	Kongad	Mathur	Kottayi	Kizhakkuncheri	Vandazhi
Class I	14	15	12	14	12	12
Class II	4	4	7	7	5	6
Class III	7	6	6	4	8	7
Total	25	25	25	25	25	25

Table 5.2. Classification of respondents according to family size

Name of crop	Family size and number of families				Average size of the family
	1 - 3	4 - 6	7 & above	Total	
Coleus					
Class1	7 (24.14)	19 (65.52)	3 (10.34)	29 (100.00)	4.41
Class II	1 (12.50)	5 (62.50)	2 (25.00)	8 (100.00)	5.63
Class III	2 (15.38)	8 (61.54)	3 (23.08)	13 (100.00)	4.85
Total	10 (20.00)	32 (64.00)	8 (16.00)	50 (100.00)	4.72
Sweet potato					
Class I	5 (19.23)	19 (73.08)	2 (7.69)	26 (100.00)	4.65
Class II	2 (14.29)	10 (71.43	2 (14.28)	14 (100.00)	4.50
Class III	2 (20.00)	6 (60.00)	2 (20.00)	10 (100.00)	5.00
Total	9 (18.00)	35 (70.00)	6 (12.00)	50 (100.00)	4.68
Tapioca					
Class I	3 (12.50)	17 (70.83)	4 (16.67)	24 (100.00)	5.08
Class II	2 (18.18)	7 (63.64)	2 (18.18)	11 (100.00)	4.82
Class III	3 (20.00)	10 (66.67)	2 (13.33)	15 (100.00)	5.33
Total	8 (16.00)	34 (68.00)	8 (16.00)	50 (100.00)	4.90

(Figures in parentheses show percentages to total)

Among tapioca farmers 68 per cent of the total respondents were in the family of 4 to 6 members with average size of family 4.90. The same trend was observed in class-wise analysis with 71 per cent of class I belonging to the family size of 4 to 6 members with the average size of family of 5.08. Here also class III had the highest average family size of 5.33.

5.1.2. Age and sex

Classification of the members of respondent families on the basis of the age and sex is given in Table 5.3. Regarding coleus as much as 44 percent of the total respondents came under the age group 18 to 39 and 31 per cent was below 18 years of age. About 21 per cent was in the age group of 40 to 59 and the rest was in the age group of above 60. Males constituted 52 per cent of the total members and the remaining 48 per cent was females.

As for the case of sweet potato,males accounted for 59 per cent of the total members and females accounted the rest 41 per cent. About 45 per cent was in the age group of 18 to 39. As much as 27 per cent of the total members came under the age group of below 18 years age and 23 per cent came under the age group of 40 to 59. Out of the total family members 5 per cent was above 60 years of age.

Table 5.3. Distribution of family members according to age and sex

Name of crop	Age group (years) 0 - 17		18 - 39		40 - 59		> 60		Total		Grand total
	M	F	M	F	M	F	M	F	M	F	
Coleus											
Class I	30	14	22	35	16	6	1	4	69	59	128
Class II	6	7	11	11	5	5	-	-	22	23	45
Class III	8	9	12	13	8	9	3	1	31	32	63
Total	44	30	45	59	29	20	4	5	122	114	236
	(8.59)	(2.70)	(19.10)	(25.00)	(12.30)	(8.49)	(1.69)	(2.13)	(51.70)	(48.30)	(100.00)
Sweet Potato											
Class I	20	15	36	22	11	11	3	3	70	51	121
Class II	11	8	13	9	10	9	2	1	36	27	63
Clas III	6	4	17	8	5	7	3	-	31	19	50
Total	37	27	66	39	26	27	8	4	137	97	234
	(15.81)	(11.54)	(28.21)	(16.67)	(11.11)	(11.54)	(3.42)	(1.70)	(58.60)	(41.40)	(100.00)
Tapioca											
Class I	18	20	29	17	17	17	1	3	65	57	122
Class II	9	8	9	2	8	5	1	1	27	26	53
Class III	7	6	28	15	10	9	3	2	48	32	80
Total	24	34	66	44	35	31	5	6	130	115	245
	(9.80)	(13.88)	(26.94)	(17.96)	(14.29)	(12.65)	(2.04)	(2.44)	(53.06)	(46.94)	(100.00)

(Figures in parentheses show percentages to total)

For tapioca about 45 per cent of the total members came under the age group of 18 to 39. As much as 27 per cent was in the age group of 40 to 59. About 24 per cent belonged to the size class of below 18 years of age and the rest 4 per cent came under the age group of 60 and above. Males consisted 53 per cent of the total members and the remaining 47 per cent females.

5.1.3 Literacy and educational status

Classification of the farmers according to their educational status is given in Table 5.4. In the case of coleus farmers, analysis showed that 42 per cent was below S.S.L.C. and 30 per cent was illiterate. Out of the total respondents 16 per cent attained secondary school level,6 per cent attained Pre-degree (higher secondary) level and the rest 6 per cent are degree holders.

As regards sweet potato respondents,46 per cent was below SSLC and 26 per cent was illiterate. Out of the total members 20 per cent was upto SSLC, 6 per cent at degree level and 2 per cent attained pre-degree level.

For tapioca out of the total respondents 52 per cent was educated below SSLC, 28 per cent up to SSLC, 16 per cent was illiterate and 4 per cent at degree level.

Table 5.4. Classification of respondents according to literacy

Name of crop	Illiterate	below SSLC	SSLC	PDC	Degree	Total
Coleus						
Class I	9	12	6	2	-	29
Class II	3	3	1	-	1	8
Class III	3	6	1	1	2	13
Total	15	21	8	3	3	50
	(30.00)	(42.00)	(16.00)	(6.00)	(6.00)	(100.00)
Sweet potato						
Class I	7	13	4	-	2	26
Class II	4	7	2	1	-	14
Class III	2	3	4	-	1	10
Total	13	23	10	1	3	50
	(26.00)	(46.00)	(20.00)	(2.00)	(6.00)	(100.00)
Tapioca						
Class I	4	10	9	-	1	24
Class II	2	6	3	-	-	11
Class III	2	10	2	-	1	15
Total	8	26	14		2	50
	(16.00)	(52.00)	(28.00)		(4.00)	(100.00)

(Figures in parentheses show percentages to total)

5.1.4 Occupation

Distribution of respondents according to their occupation is shown in Table 5.5. In the case of coleus 42 per cent of the farmers had agriculture as the main occupation while for 34 per cent agriculture was a subsidiary occupation. For 24 per cent of the farmers agriculture was the sole occupation. Class-wise analysis also revealed the same pattern with majority of the farmers depending on agriculture as the main occupation.

For the respondents of sweet potato 70 per cent had agriculture as main occupation and for 18 per cent it was the only occupation and 12 per cent had agriculture as a subsidiary occupation. Class-wise analysis also revealed that agriculture was the main occupation for majority of respondents but for class III agriculture was the subsidiary occupation for majority of farmers.

Among tapioca growers 40 per cent had agriculture as the main occupation, 32 per cent had agriculture as subsidiary occupation and for the remaining 28 per cent agriculture was the sole occupation. Class-wise analysis also showed that agriculture was the main occupation for majority of farmers.

5.1.5. Ownership holding

The respondents classified based on their ownership holding size are given in Table 5.6. In the case of respondents of coleus 66 per cent were having

Table 5.5 . Classification of respondents according to occupation

Name of crop	Agriculture as the only occupation	Agriculture as main occupation	Agriculture as sub occupation	Total
Coleus				
Class I	7	14	8	29
	(24.14)	(48.28)	(27.58)	(58.00)
Class II	3	3	2	8
	(37.50)	(37.50)	(25.00)	(16.00)
Class III	2	4	7	13
	(15.38)	(30.77)	(53.85)	(26.00)
Total	12	21	17	50
	(24.00)	(42.00)	(34.00)	(100.00)
Sweet Potato				
Class I	10	10	6	26
	(38.46)	(38.46)	(23.08)	(52.00)
Class II	5	6	3	14
	(35.71)	(42.87)	(21.42)	(28.00)
Class III	3	3	4	10
	(30.00)	(30.00)	(40.00)	(20.00)
Total	9	35	6	50
	(18.00)	(70.00)	(12.00)	(100.00)
Tapioca				
Class I	6	10	8	24
	(25.00)	(41.67)	(33.33)	(48.00)
Class II	4	4	3	11
	(36.36)	(36.36)	(27.28)	(22.00)
Class III	4	6	5	15
	(26.67)	(40.00)	(33.33)	(30.00)
Total	14	20	16	50
	(28.00)	(40.00)	(32.00)	(100.00)

(Figures in parentheses show percentages to total)

Table 5.6. Distribution of respondents according to ownership holding

Name of crop	Area (hectares)			Total
	0 - 2	2 - 4	>4	
Coleus	33	7	10	50
	(66.00)	(14.00)	(20.00)	(100.00)
Sweet potato	30	17	3	50
	(60.00)	(34.00)	(6.00)	(100.00)
Tapioca	30	7	13	50
	(60.00)	(14.00)	(26.00)	(100.00)
Total	93	31	26	
	(62.00)	(20.67)	(17.33)	

(Figures in parentheses show percentages to total)

area below 2 hectares,14 per cent having area between 2 and 4 hectares and 20 per cent more than 4 hectares.

As regards to respondents of the crop sweet potato 60 per cent had area below 2 hectares, 34 per cent had between 2 and 4 hectares and 6 per cent with an area above 4 hectares. For tapioca respondents 26 per cent were having an area below 4 hectares, 14 per cent were having area between 2 and 4 hectares and 60 per cent with an area below 2 hectares.

5.1.6 Cropping pattern

Cropping pattern of the respondent farmers is given in Table 5.7. The major crops grown by the coleus farmers are rice, coconut, banana and rubber. Gross cropped area of the total respondents was 112. 92 hectares. Rice was grown in 21.22 per cent of the gross cropped area and is the important food grain crop in the area.

Coleus occupied 33.49 per cent of the gross cropped area. Coconut, banana and rubber were grown in 15.96, 3.47 and 5.07 per cent respectively of the gross cropped area.

The cropping pattern of the sweet potato respondents shows, rice, coconut, banana and rubber were the major crops. Gross cropped area of the total respondents was 197.9 hectares. Rice was grown in 44.82 per cent of the gross cropped area and is the important food grain crop in the area. Sweet potato occupied 17.25

Table 5.7. Cropping pattern of respondent farmers

	Area in Hectares			Percentage to gross cropped area		
Name of crop	Coleus	sweet potato	Tapioca	Coleus	Sweet Potato	Tapioca
Rice	23.96	88.70	50.80	21.22	44.82	34.28
Coconut	18.02	24.31	16.00	15.96	12.28	10.80
Banana	3.92	4.50	3.65	3.47	2.28	2.46
Rubber	5.72	17.60	10.00	5.07	8.89	6.75
Coleus	37.82	-	-	33.49	-	-
Tapioca	-	-	44.91	-	-	30.30
Sweet potato	-	34.14	-	-	17.25	-
Other anual Crops	10.20	16.00	12.35	9.03	8.09	8.33
Other perinial crops	13.28	12.65	10.50	11.76	6.39	7.08
Gross cropped area	112.92	197.90	148.21	100.00	100.00	100.00

per cent of the gross cropped area. Coconut, banana and rubber were grown in 12.28, 2.28 and 8.89 per cent respectively of the gross cropped area.

The major crop grown by the tapioca farmers are rice, coconut, banana and rubber. Gross cropped area of the total respondents was 148.21 hectares. Rice was grown in 34.28 per cent of the gross cropped area and is the important food grain in the area. Tapioca occupied 30.30 per cent of the gross cropped area. Coconut, banana and rubber were grown in 10.80,2.46 and 6.75 per cent respectively of the gross cropped area.

5.1.7 Area under selected crops

Distribution of sample farmers according to area under the selected crops is presented in Table 5.8. In the cased of coleus out of the total respondents, 58 per cent were having an area less than one acre while 26 per cent had more than 2.5 acres and the remaining belongs to class II with area between 1 to 2.5 acres.

For sweet potato 52 per cent of the farmers had area less than 1 acre, 28 per cent between 1 to 2.5 acres and the rest above 2.5 acres. Regarding tapioca 48 per cent of the respondents belong to class I having less than 1 acre, 30 per cent in class III and 22 per cent between 1 to 2.5 acres.

Table 5.8. Distribution of sample farmers according to area under particular crops.

Name of crop	Class I		Class II		Class III		Total	
	No. of farmers	Area (hectares)	No. of farmers	Area (hectares)	No. of farmers	Area (hectares)	No. of farmers	Area (hectares)
Coleus	29 (58.00)	7.02	8 (16.00)	6.4	13 (26.00)	24.40	50	37.82
Sweet potato	26 (52.00)	6.64	14 (28.00)	10.10	10 (20.00)	17.40	50	34.14
Tapioca	24 (48.00)	5.09	11 (22.00)	7.52	15 (30.00)	32.30	50	44.91

(Figures in parentheses show percentages to total)

5.2 Economics Of Production

5.2.1 Coleus

5.2.1.1 Cultivation Practices

Coleus is cultivated in Mundur and Kongad Panchayats of Palakkad district between July and October. It is a rainfed crop and nursery is raised after the first few showers. Farmyard manure of about 60-75 kg is applied in the nursery area. About 100-150 kg tubers are used to raise the nursery. Vine cuttings to a length of about 10-15 cm from the top portion after three weeks of planting are taken and cuttings are planted on ridges at desired spacing. Farmyard manure at the rate of five tonnes per hectare is incorporated into the soil at the time of land preparation. Intercultural operations along with fertilizer application is done 45 days after planting. The crop is harvested five months after planting.

5.2.1.2 Operation-wise cost of cultivation.

Costs and returns are two elements of any business enterprise. Costs represent the value of the inputs used in the production process, while returns represent the value of output achieved or gain to the operator. The relative magnitude of the costs and the returns from the enterprise indicates the success of the business.

Operation-wise cost of cultivation for the different classes and for the sample as a whole were computed and are presented in Table 5.9. The costs are presented in two parts,viz.Operational expenses including

nursery preparation, land preparation, intercu-ltural operation (fertilizer and weeding), harvesting and other expenses which include cost on land revenue, rental value of land, rent on leased in land, interest on working capital and miscellaneous expenses. Interest on working capital was estimated at the rate of 11.5 per cent and rental value of own land was estimated as one fifth of the total produce. Rent on leased in land in coleus cultivating area was fixed as Rs.3500 per acre. Neither depreciation charges nor interest on fixed capital have been included in the cost because the labours generally bring their own implements to the field and the wages they get include the rent for the implements also.

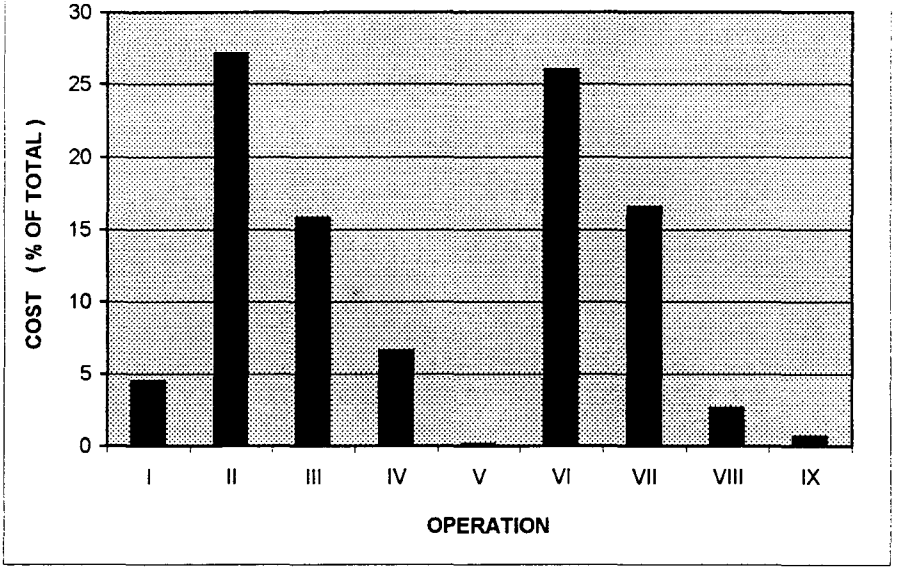
The total cost of cultivation of coleus at the aggregate level was found to be Rs.17593.80. The operati-onal expenses constituted 54.01 per cent while other expenses accounted for 45.99 per cent.Among the different items of cost, land preparation accounted for the highest share (27.16 per cent) followed by rental value of own land (26.01 per cent) and rent on leased in land (16.57 per cent). Land preparation was found to be the major item among the operations contributing 27.16 per cent of the total cost followed by intercultural operations(15.79 per cent), harvesting (6.59 per cent) and nursery preparation(4.47 per cent). Land preparation includes ridge making, basal application of farmyard manure and fertilizers and planting. The farmers generally practice one intercultural operation along with top dressing of fertilizers.

Table 5.9. Operation-wise cost of cultivation of coleus for different size groups (Rs. per hectare)

Sl. no	Operations	Class I	Class II	Class III	Aggregate
A	**Operational expenses**				
1	Nursery preparation	796.97	796.09	78053	78622
		(5.64)	(5.38)	(4.04)	(4.47)
2	Land preparation	4848.82	4713.28	4774.39	4777.86
		(34.31)	(31.87)	(24.72)	(27.16)
3	Intercultural operation	2300.21	1725.78	3192.21	2778.49
		(16.28)	(11.67)	(16.53)	(15.79)
4	Harvesting	1012.29	1217.19	1186.48	1159.34
		(7.16)	(8.23)	(6.14)	(6.59)
	Sub total	8958.29	8452.34	9933.61	9501.91
		(63.39)	(57.15)	(51.43)	(54.01)
B	**Other expenses**				
5	Land revenue	25.00	25.00	25.00	25.00
		(0.18)	(0.17)	(0.13)	(0.14)
6	Rental value of own land	4594.00	4710.94	4536.89	4576.94
		(32.50)	(31.86)	(23.49)	(26.01)
7	Rent on leased in land		1093.75	4159.84	2915.12
			(7.40)	(21.54)	(16.57)
8	Interest on working capital	437.85	410.62	480.51	460.76
		(3.10)	(2.78)	(2.49)	(2.62)
9	Miscellaneous	117.19	94.43	179.49	114.07
		(0.83)	(0.64)	(0.92)	(0.65)
	Sub total	5174.04	6334.74	9381.73	8091.89
		(36.61)	(42.85)	(48.57)	(45.99)
	Total	14132.33	14787.08	19315.34	17593.80
		(100.00)	(100.00)	(100.00)	(100.00)

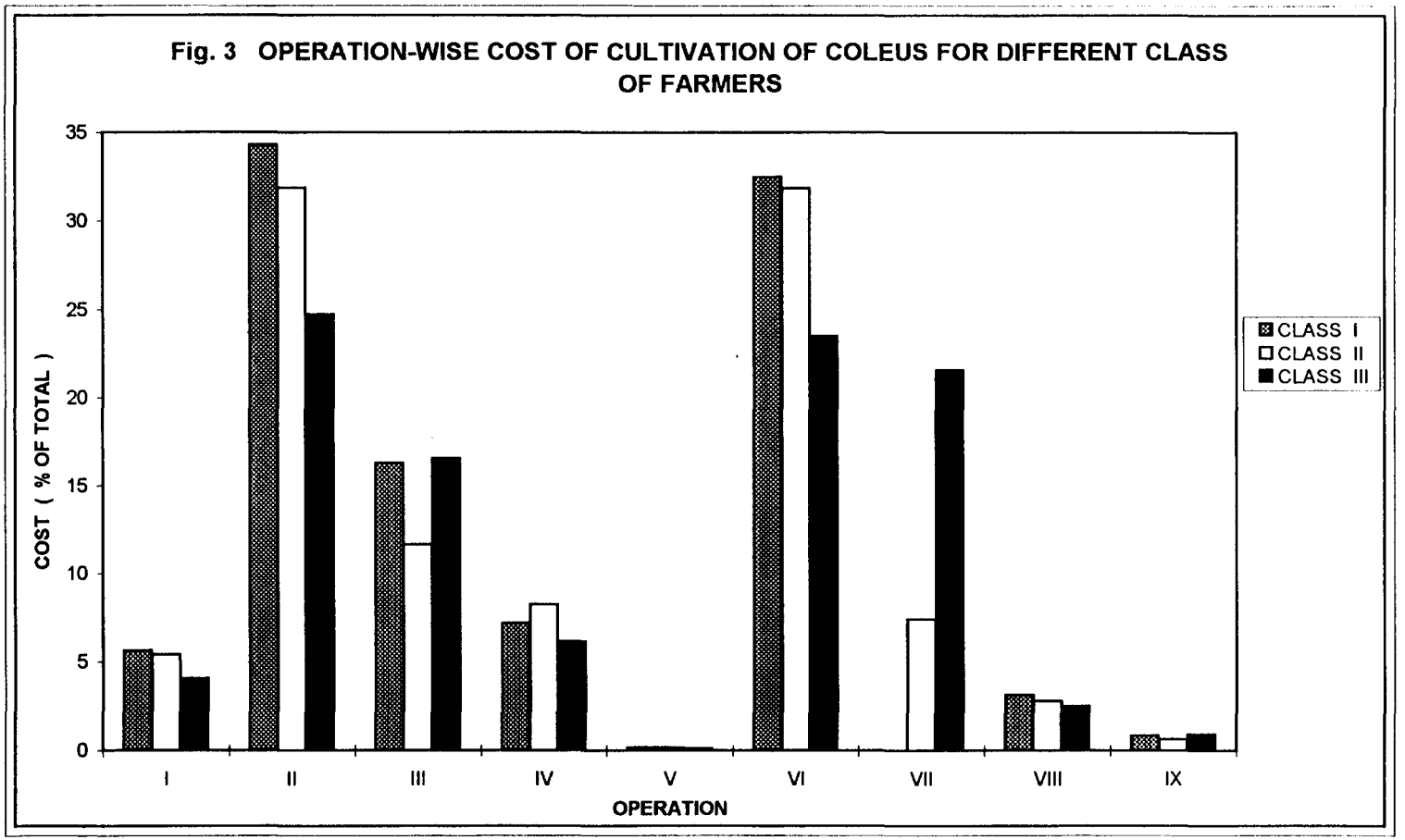
(Figures in parentheses show percentages to total)

Fig. 2. OPERATION-WISE COST OF CULTIVATION OF COLEUS (AGGREGATE)



I	Nursery preparation
II	Land preparation
III	Intercultural operation
IV	Harvesting
V	Land revenue
VI	Rental value of own land
VII	Rent on leased in land
VIII	Interest on working capital
IX	Miscellaneous

Fig. 3 OPERATION-WISE COST OF CULTIVATION OF COLEUS FOR DIFFERENT CLASS OF FARMERS



I	Nursey preparation	IV	Harvesting	VII	Rent on leased in land
II	Land preparation	V	Land revenue	VIII	Interest on working capital
III	Intercultural operation	VI	Rental value of own land	IX	Miscellaneous

Class-wise analysis revealed that the total cost of cultivation was Rs.14132.33, Rs.14787.08 and Rs.19315.34 for class I, II and III respectively showing an increase in cost as holding size increases. Land preparation was found to be the major item for all the size classes contributing 34.31 per cent, 31.87 per cent and 24.72 per cent respectively for class I, II and III respectively. Rental value of own land accounted for 32.5 per cent of total cost in class I, 31.86 per cent in class II and 23.49 per cent in class III. Rent on leased in land was the next item for class III accounting for 21.54 per cent while for class I and II intercultural operations was the third highest expenditure constituting 16.28 per cent and 11.67 per cent respectively followed by harvesting and nursery preparation.

5.2.1.3 Input-wise cost of cultivation

The inputs included in the cultivation of coleus were grouped into three viz. the labour inputs, materials and other items. The labour cost consisted of male and female labour (both family and hired) while the material cost included the cost on seed tubers, farmyard manure and chemical fertilizers. The other items consisted of interest on working capital,leased in land, rental value of own land, land revenue and miscellaneous expenses.

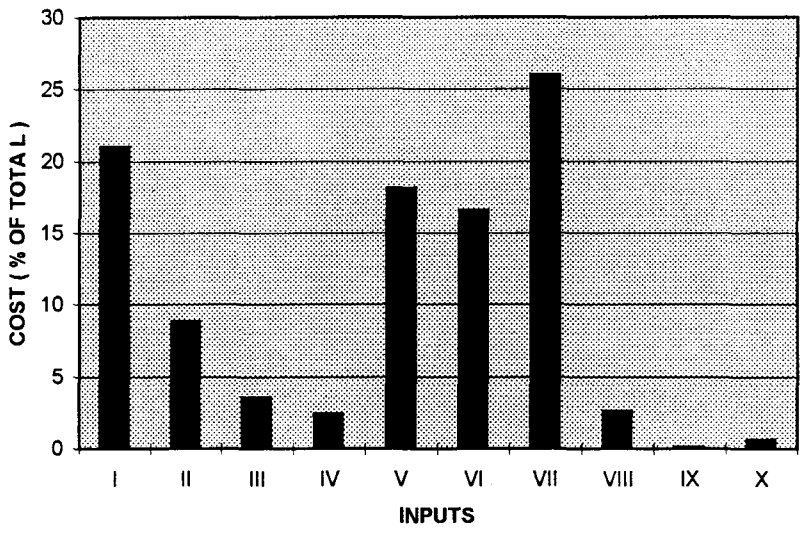
The results as presented in Table 5.10 revealed that the major share of the total cost was accounted for by other items (45.99 per cent) followed by labour cost (29.88 per cent) and material cost (24.13 per cent).

Table 5.10 . Inputwise cost of cultivation of coleus for different size groups (Rs. per hectare)

Sl no.	Inputs	Class I	Class II	Class III	Aggregate
A.	**Labour**				
1	Male labour (family and hired)	3555.09 (25.16)	3782.82 (25.58)	3720.80 (19.26)	3700.54 (21.03)
2	Female labour (family and hired)	1542.03 (10.91)	1628.91 (11.02)	1540.47 (7.98)	1555.72 (8.85)
	Sub total	5097.12 (36.07)	5411.73 (36.60)	5261.27 (27.24)	5256.26 (29.88)
B.	**Materials**				
3	Seed tubers	625.00 (4.42)	625.00 (4.23)	625.00 (3.24)	625.00 (3.55)
4	Farm yard manure	432.15 (3.06)	325.78 (2.20)	451.44 (2.34)	426.59 (2.43)
5	Chemical fertilizers	2804.02 (19.84)	2089.83 (14.13)	3595.90 (18.61)	3194.06 (18.15)
	Sub total	3861.17 (27.32)	3040.61 (20.56)	4672.34 (24.19)	4245.65 (24.13)
C.	**Others**				
6	Leased in land		1093.75 (7.40)	4159.84 (21.54)	2915.12 (16.57)
7	Rental value of own land	4594.00 (32.50)	4710.94 (31.88)	4536.89 (23.49)	4576.94 (26.01)
8	Intrest on working capital	437.85 (3.10)	410.62 (2.77)	480.51 (2.49)	460.76 (2.62)
9	Land revenue	25.00 (0.18)	25.00 (0.17)	25.00 (0.13)	25.00 (0.14)
10	Miscellaneous	117.19 (0.83)	94.43 (0.62)	179.49 (0.92)	114.07 (0.65)
	Sub total	5174.04 (36.61)	6334.74 (42.84)	9381.73 (48.57)	8091.89 (45.99)
	Total	14132.33 (100.00)	14787.08 (100.00)	19315.34 (100.00)	17593.80 (100.00)

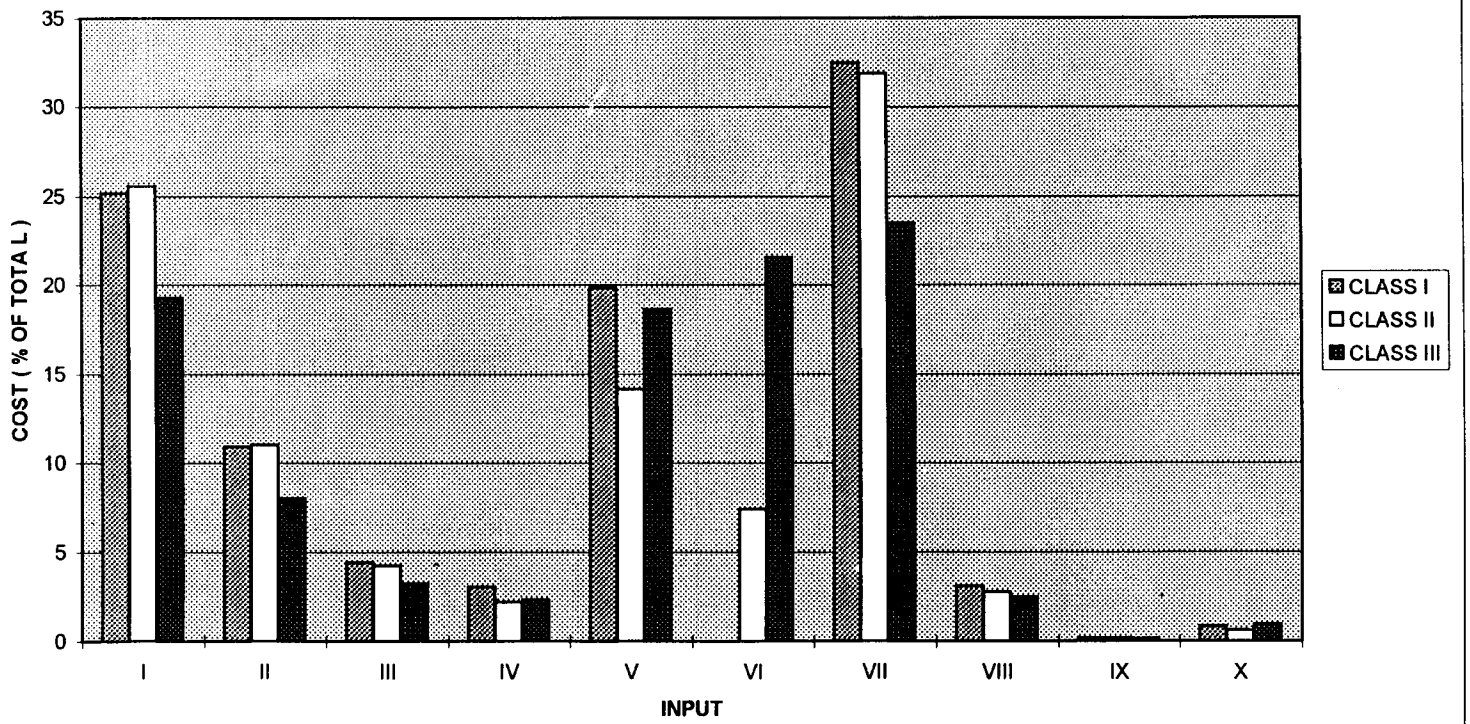
(Figures in parentheses show percentages to total)

Fig. 4. INPUT-WISE COST OF CULTIVATION OF COLEUS (AGGREGATE)



I	Male labour
II	Female labour
III	Seed tubers
IV	Farm yard manure
V	Chemical fertilizers
VI	Leased in land
VII	Rental value of own land
VIII	Interest on working capital
IX	Land revenue
X	Miscellaneous

Fig. 5. INPUT-WISE COST OF CULTIVATION OF COLEUS FOR DIFFERENT CLASS OF FARMERS



I	Male labour	IV	Farm yard manure	VII	Rental value of own land	X	Miscellaneous
II	Female labour	V	Chemical fertilizer	VIII	Interest on working capital		
III	Seed tubers	VI	Leased in land	IX	Land revenue		

It was found that male labour constituted 70.40 per cent of the total labour cost. Allocation of labour cost to different operations is shown in Table 5.11. Labour cost was found to be more in land preparation (Rs.2838.80) followed by intercultural operations (Rs.1159.38), harvesting (Rs.1159.34) and nursery preparation (Rs.98.70). Class-wise analysis revealed that family labour use was the highest in class I followed by class II and class III.

Among the material cost, fertilizers accounted for 75 percent of the total expenses of Rs.4245.65. The fertilizer use pattern of respondents are given in Table 5.12. It was found that more than 94 per cent of farmers used nitrogen above recommened level while 30 per cent and 46 per cent of them used P_2O_5 and K_2O respectively above the recommened level,only 4 per cent and 8 per cent of the farmers adopted the recommened level of P_2O_5 and K_2O. As per package recommendation farmyard manure is 10 tonnes per hectare and nutrients 30:60:50. N P K per hectare.

Class-wise analysis showed that cost on other items accounted the highest share for all the classes constituting 36.61 per cent, 42.84 per cent and 48.57 per cent in class I, II and III respectively followed by labour cost and material cost. Rental value of own land accounted for the highest share of cost in all the classes with 32.50 per cent, 31.88 per cent and 23.49 per cent respectively in class I, II and III. This was followed by male labour, chemical fertilizer and female

Table 5.11. Allocation of labour to different operations (Rs. per hectare)

		Size groups								
		Class I		Class II		Class III		Aggregate		Total
Operations	Type of labour	Male	Female	Male	Female	Male	Female	Male	Female	
Nursery preparation										
	Family	88.1	21.37	77.3	31.25	50.7	19.98	62.2	22.14	84.34
	Hired	-	-	-	-	11.1	11.3	7.14	7.27	14.41
	Total	88.1	21.37	77.3	31.25	61.8	30.3	69.3	29.4	98.7
Land preparation										
	Family	427.9	163.8	182.8	46.9	88.5	26.6	167.5	55.5	223
	Hired	1837.2	475.43	2067.	578.1	2161.48	533.8	2085.33	530	2615.33
	Total	2265.1	639.3	2250	625.01	2250	560.5	2252.80	586	2838.80
Intercultural operation										
	Family	336.54	134.44	119.53	35.16	70.08	25.61	127.9	47.43	175.33
	Hired	384.62	215.46	759.4	296.9	776.4	299.2	700.8	283.25	984.05
	Total	721.16	349.9	878.9	332.04	846.5	334.8	828.7	330.68	1159.38
Harvesting										
	Family	275.64	182.51	98.4	27.34	59.02	23.57	105.9	53.71	159.61
	Hired	205.13	349.0	478.1	613.28	503.5	600.4	443.81	555.92	999.7
	Total	480.8	531.51	576.6	640.62	562.5	623.98	549.71	609.63	1159.3
Total										
	Family	1128.2	502.14	478.12	140.63	268.34	95.80	463.5	178.81	642.3
	Hired	2426.93	1039.9	3304.70	1488.3	3452.46	1444.7	3237.1	1376.91	4613.9
Grand Total		3555.10	1542.03	3782.82	1628.91	3720.80	1540.5	3700.54	1555.72	5255.7

Table 5.12. Frequency distribution of farmers according to level of fertilizer use

Dose of nutrients	No of farmers using the nutrients		
	N	P	K
Less than recommended level	3 (6.00)	27 (54.00)	18 (36.00)
More than recommended level	47 (94.00)	15 (30.00)	23 (46.00)
At the recommended level	-	2 (4.00)	4 (8.00)
Fertilizer not used	-	6 (12.00)	5 (10.00)
Total	50 (100.00)	50 (100.00)	50 (100.00)

(Figures in parentheses show percentages to total)

labour in class I and II while in class III rent on leased in land accounted for 21.54 per cent of total expenses followed by male labour, chemical fertilizer and female labour. Pal et al.(1985) reported that high cost of cultivation was due to higher expenditure on labour which accounted for 58 per cent and 66 per cent for high yielding varieties and local varieties respectively.

5.2.1.4 Cost of cultivation under different cost concepts.

Cost concepts refers to the classification of cost which regroups the components so as to distinguish between constituents that are price determining from those that are price determined.This classification gives some idea of the element of elasticity obtaining in agricultural costs and may be helpful to the price fixing authority *.

The cost concepts used in this study are Cost A_1, Cost A_2, Cost B_1, Cost B_2, Cost C_1, Cost C_2. The costs according to cost concepts were worked out for coleus at the aggregate level as well as for the different classes

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* Kahlon, A.S. and Tyagi, D.S. (1983). Agricultural price policy in India. Allied publishers private Ltd; New Delhi : 104.

and are presented in Table 5.13. Cost A_1, A_2, B_1, B_2, C_1, C_2 per hectare worked out to Rs.10101.71, Rs.13016.86, Rs.10101.74, Rs.17593.80, Rs.10743.99 and Rs.18236.05. For class I the costs were Rs.7908.02, Rs.7908.02, Rs.7908.02, Rs.12502.02, Rs.9538.33 and Rs.14132.33. For class II these costs were Rs.8363.63, Rs.9457.88, Rs.8363.63, Rs.14168.32, Rs.8982.39 and Rs.14787.08. For class III the costs were Rs.10254.47, Rs.14414.31, Rs.10254.47, Rs.18951.20, Rs.10618.61, RS.19315.34. Here cost A_1 and cost B_1 are same because sample farmers do not use any fixed assets for coleus cultivation. Class-wise analysis showed that all the costs were higher in class III except cost C_1.

5.2.1.5 Income measures in relation to different cost concepts.

Estimate of gross returns, although a good measure to gauge the productivity and efficiency of the farm it alone does not indicate the success of the farm business. That is, it gives only a one sided picture of the business until we also examine the other side of business, i.e. cost part and make a comparison between the two. The higher the gross returns over the costs, the more successful is the business and vice versa.

The gross income, farm business income, family labour income and net income were estimated for coleus at the aggregate level and for the different size classes and are presented in Table 5.14. The gross income was found to be Rs.22884.73 at the aggregate level. Among the

Table 5.13. Cost of cultivation of coleus under different cost concepts (Rupees per hectare)

Costs	Class I	Class II	Class III	Aggregate
Cost A_1	7908.02	8363.63	10254.47	9459.49
Cost A_2	7908.02	9457.38	14414.31	12374.61
Cost B_1	7908.02	8363.63	10254.47	9459.49
Cost B_2	12502.02	14168.32	18951.20	16951.55
Cost C_1	9538.33	8982.39	10618.61	10101.74
Cost C_2	14132.33	14787.08	19315.34	17593.80

Table 5.14. Income measures in relation to different cost concepts in coleus cultivation (Rs. Per hectare)

Particulars	Class I	Class II	Class III	Aggregate
Gross income	22970.00	22684.43	23554.68	22884.73
Farm business income	13434.67	12987.85	12936.07	12782.98
Own farm business income	13434.67	11894.10	8776.23	9867.86
Familylabour income	8840.67	7183.16	4239.34	5290.92
Net income	7210.36	6564.40	3875.20	4648.67
Farm investment income	11804.36	12369.09	12571.93	12140.73

classes gross income was the highest in class III (Rs.23554.68) followed by class I (Rs.22970) and II (Rs.22684.43).

Farm business income worked out to Rs.12782.98 at the aggregate level and it was Rs.13434.67, Rs.12987.85 and Rs.12936.07 for class I, II and III respectively. Net income which is the most suitable income measure to judge the profitability of crop production was Rs.7210.36, Rs.6564.40, Rs.3875.20, Rs.4648.67 for classes I, II, III and aggregate level.

5.2.1.6 Yield and returns.

The yield and returns per hectare of coleus as shown in Table 5.15 revealed that yield of coleus for the classes I, II, III and at the aggregate level were 9188 Kg, 9074Kg, 9422Kg and 9154 Kg respectively and the corresponding returns were Rs.22970, Rs.22684.43, Rs.23554.43 and Rs.22884.72 respectively.

5.2.1.7 Cost of production

Cost of production per tonne of coleus was obtained by dividing cost of cultivation by yield in tonnes per hectare. Cost of production of coleus is given in Table 5.16. Cost of production in relation to various cost concepts showed that cost of production per quintal was highest for class III. Cost of production per quintal on cost C_2 basis for classes I, II and III were Rs.172, Rs.178 and Rs.209 respectively. Cost of production per

Table 5.15. Yield and returns of coleus

Size group	Output (kg/ha)	Value (Rs./ha)
Class I	9188.00	22970.00
Class II	9074.00	22684.43
Class III	9422.00	23554.43
Aggregate	9154.00	22884.72

Table 5.16. Cost of production of coleus (Rs. per quintal)

Costs	Class I	Class II	Class III	Aggregate
Cost A_1	104	107	113	110
Cost A_2	104	119	157	142
Cost B_1	104	107	113	110
Cost B_2	154	171	205	192
Cost C_1	122	114	117	117
Cost C_2	172	178	209	199

quintal for the aggregate sample based on costs A_1, A_2, B_1, B_2, C_1, C_2 were Rs.110, Rs.142, Rs.110, Rs.192, Rs.117 and Rs.199 respectively.

5.2.1.8 Benefit-Cost ratio on different cost concepts

Benefit-cost ratio of coleus is given in Table 5.17. Benefit-cost ratio based on costs A_1, A_2, B_1, B_2, C_1, C_2 for the sample as a whole were 2.27, 1.76, 2.27, 1.30, 2.13 and 1.25 respectively. Among the classes, benefit-cost ratio based on various cost concepts were higher for class I except for cost C_1. Returns generated from rupee invested was found to be greater than one for three size classes. Input-output ratio for the sample as a whole showed that a rupee invested returned Rs.2.27, Rs.1.76, Rs.2.27, Rs.1.30, Rs.2.13 and Rs.1.25.

5.2.1.9 Resource use efficiency.

In the present study, resource use efficiency has been estimated using Cobb-Douglas production function. The function can be specified as follows.

$$\text{Log } Y = \text{Log } a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5$$

Where Y = Value of output

a = intercept

Table 5.17. Benefit-cost ratio of coleus based on different cost concepts

Costs	Class I	Class II	Class III	Aggregate
Cost A_1	2.40	2.34	2.20	2.27
Cost A_2	2.40	2.10	1.59	1.76
Cost B_1	2.40	2.34	2.20	2.27
Cost B_2	1.63	1.46	1.22	1.30
Cost C_1	2.06	2.20	2.14	2.13
Cost C_2	1.46	1.41	1.20	1.25

The variables used in the model as explanatory variables are Area(X_1), Labour (X_2), Farmyard manure (X_3), Fertilizer (X_4) and Planting material(X_5)and b_1, b_2, b_3, b_4 and b_5 are the regression coefficients of respective variables. Results of the estimate are given in Table 5.18.

The coefficent of determination (R^2) explains the proportion of variation in the dependent variable (Y) explained by the independent variables included in the function. The results as given in Table 5.18. reveal that 99 per cent variation in Y were explained by the variables used in the function. The estimated regression coefficients (b_i) of independent variables represent the production elasticities of the respective factors(X_i). The regression coefficient "b_i" indicate the percentage by which the output 'Y' would change if input 'X_i' changes by one unit while all other factors remain constant at their geometric mean levels.

Except for the variable area(X_1) all the other variables were found to be non-significant. A very high R^2 with insignificant regression coefficient clearly indicates the presence of multi collinearity. To reduce the presence of multicollinearity in the production function all the explanatory variables were converted into per are basis so that area effect can be reduced considerably. The model was rerun with four explanatory variables viz. Labour (X_2), Farmyard manure (X_3), Fertilizer (X_4) and planting material (X_5) on per area basis and the results are given in Table 5.19.

Table 5.18. The production elasticities of output on various inputs, standard error, 't' values and co-efficient of multiple determination (R^2) in the model fitted for coleus.

Variables	Production elasticities(b_i)	Standard error	't' value
Area (X_1)	0.736 *	0.246	2.993
Labour (X_2)	-0.047	0.136	0.345
Farmyard manure (X_3)	0.620	0.063	0.990
Fertilizer (X_4)	-0.012	0.026	0.465
Planting material (X_5)	0.269	0.182	1.475
Intercept : 1.82 R^2 : 0.99			

* Significant at one percent probability.

Table 5.19. Production elasticities and marginal value product of various inputs for coleus

Variables	Production elasticities(b_i)	Marginal value product
Labour X_2	-0.030 (0.137)	-0.136
Farmyard manure X_3	0.880 (0.830)	59.40
Fertilizer X_4	-0.022 * (0.008)	-0.197
Planting material X_5	0.224 (0.135)	6.983
Intercept : 2.16 R^2 : 0.80		

* Significant at one percent probability
(Figures in parentheses show standard error)

The results revealed that R^2 was reduced to 0.80 indicating that only 80 per cent variation in the output was explained by independent variables. Returns to scale estimated to be 1.05 indicating constant returns to scale since sum of regression coefficients are not significantly different from unity. Among the explanatory variables the coefficient of fertilizer was found to be negative and significant at one per cent level indicating overuse of the input. The production elasticity of labour was negative though insignificant showing excess use. This can be explained by the labour use pattern for different operations. Farmyard manure and planting material were found to be nonsignificant. The results of the cost structure analysis as explained earlier indicated the above trends with labour alone accounting for around 30 per cent of the total cost followed by fertilizer with 18 per cent while farmyard manure contributed only around 2 per cent of the total cost.

Marginal value product is the measure of the increase in total value product, for the addition of one unit of a particular resource above its mean level while other resources are held constant at their respective mean levels. The resource use efficiency has been judged on the basis of the criterion that each factor of production is paid according to its marginal productivity. A significant difference between marginal value product and market price of individual input would indicate whether the farmers are using on an average, their factors of production inefficiently or efficiently. Marginal value products of all inputs were worked out at

their geometric mean levels. For efficient and optimum use of one input in the existing production situation, marginal value productivity to factor price ratio should be equal to price of X_i. Marginal value products for coleus is given in Table 5.19. A negative marginal value product of fertilizer and labour showed that these factors were used in excess quantities. Marginal value product of farmyard manure and planting material were greater than their factor cost ratio indicating that profit can be increased considerably using more units of these variables with considerable reduction in labour and fertilizer application.

5.2.2 Sweet potato

5.2.2.3 Cultivation practices

Sweet potato is generally cultivated during the period June-July to September-October. It is propagated by means of vine cuttings. To obtain vine cuttings nurseries are raised from selected tubers after the first few showers. Farm yard manure is applied depending on the availability. After 15 days, cuttings obtained from the raised tubers are planted in secondary nursery. To ensure better plant growth in the secondary nursery nitrogenous fertilizers are applied. Vines will be ready for planting on the 45th day. Farmyard manure is applied in the main field at the time of land preparation. Vine cuttings of 20-25 cm length on ridges 50 cm apart and at a spacing of 20 - 25 cm between the vines are planted. Nitrogen is applied at the time of planting. After one month weeding

earthing up and top dressing is done. Harvesting is done after 3 1/2-4 months.

5.2.2.2. Operation-wise cost of cultivation of sweet potato

Operation-wise cost of cultivation per hectare of sweet potato for different classes and the sample as a whole were computed and are presented in the Table 5.20. The total cost of cultivation was RS.9657.84 at the aggregate level. Among the different items, expenditure on intercultural operation (fertilizer and weeding) was highest (33.43 per cent) followed by land preparation (24.43 per cent) and rental value of own land (24.30 per cent). The operational expenses contributed 71.32 per cent while other expenses accounted for 28.68 per cent.Among the operational expenses intercultural operation was found to be the major item consistuting 33.43 per cent of the total cost followed by land preparation(24.43 per cent), harvesting (9.59 per cent) and nursery preparation(3.87 per cent).Pal and Ramanathan (1989) reported that cost of cultivation of sweet potato in Palakkad and Malappuram was Rs.5500 per hectare where as it was Rs.6700 per hectare in Kasargode.

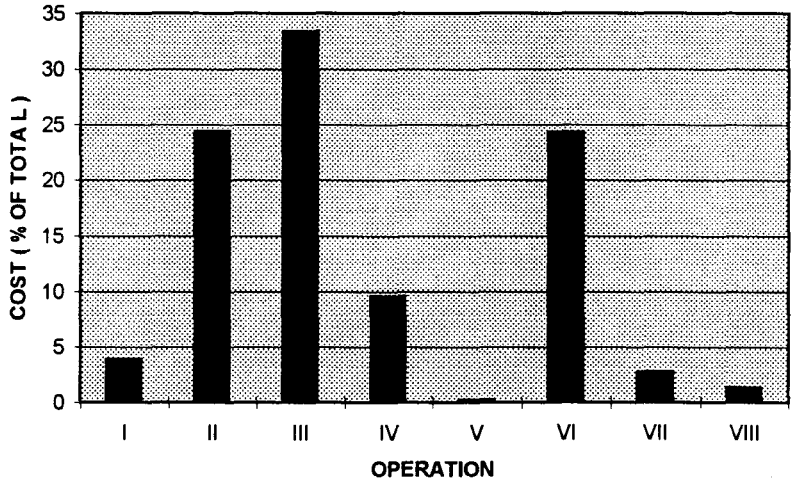
Class-wise analysis showed that the total cost of cultivation was Rs.9523.99, for class I, Rs.10715.71 for class II and RS.9094.94 for class III. Intercultural operation was found to be the major item for all classes I, II and III. Rental value of own land was the most important item of expenditure in class I and class III

Table 5.20. Operation-wise cost of cultivation of sweet potato for different size groups (Rs. per hectare)

Sl. no	Operations	Class I	Class II	Class III	Aggregate
A	**Operational expenses**				
1	Nursery preparation	382.21 (4.02)	379.62 (3.54)	367.33 (4.04)	373.86 (3.87)
2	Land preparation	2233.30 (23.45)	2994.56 (27.95)	2038.81 (22.42)	2359.38 (24.43)
3	Intercultural operation	3252.36 (34.15)	3696.54 (34.50)	2948.23 (32.42)	3228.75 (33.43)
4	Harvesting	869.73 (9.13)	985.15 (9.19)	913.51 (10.04)	926.18 (9.59)
	Sub total	6737.60 (71.00)	8055.87 (75.00)	6267.88 (69.00)	6888.17 (71.00)
B	**Other expenses**				
5	Land revenue	25.00 (0.26)	25.00 (0.23)	25.00 (0.27)	25.00 (0.26)
6	Rental value of own land	2418.67 (25.40)	2259.41 (21.09)	2370.11 (26.06)	2346.80 (24.30)
7	Intrest on working capital	261.39 (2.74)	311.27 (2.90)	247.35 (2.72)	268.99 (2.79)
8	Miscellaneous	81.33 (0.85)	64.16 (0.60)	184.60 (2.03)	128.88 (1.33)
	Sub total	2786.39 (29.00)	2659.84 (25.00)	2827.06 (31.00)	2769.67 (29.00)
	Total	9523.99 (100.00)	10715.70 (100.00	9094.94 (100.00)	9657.84 (100.00)

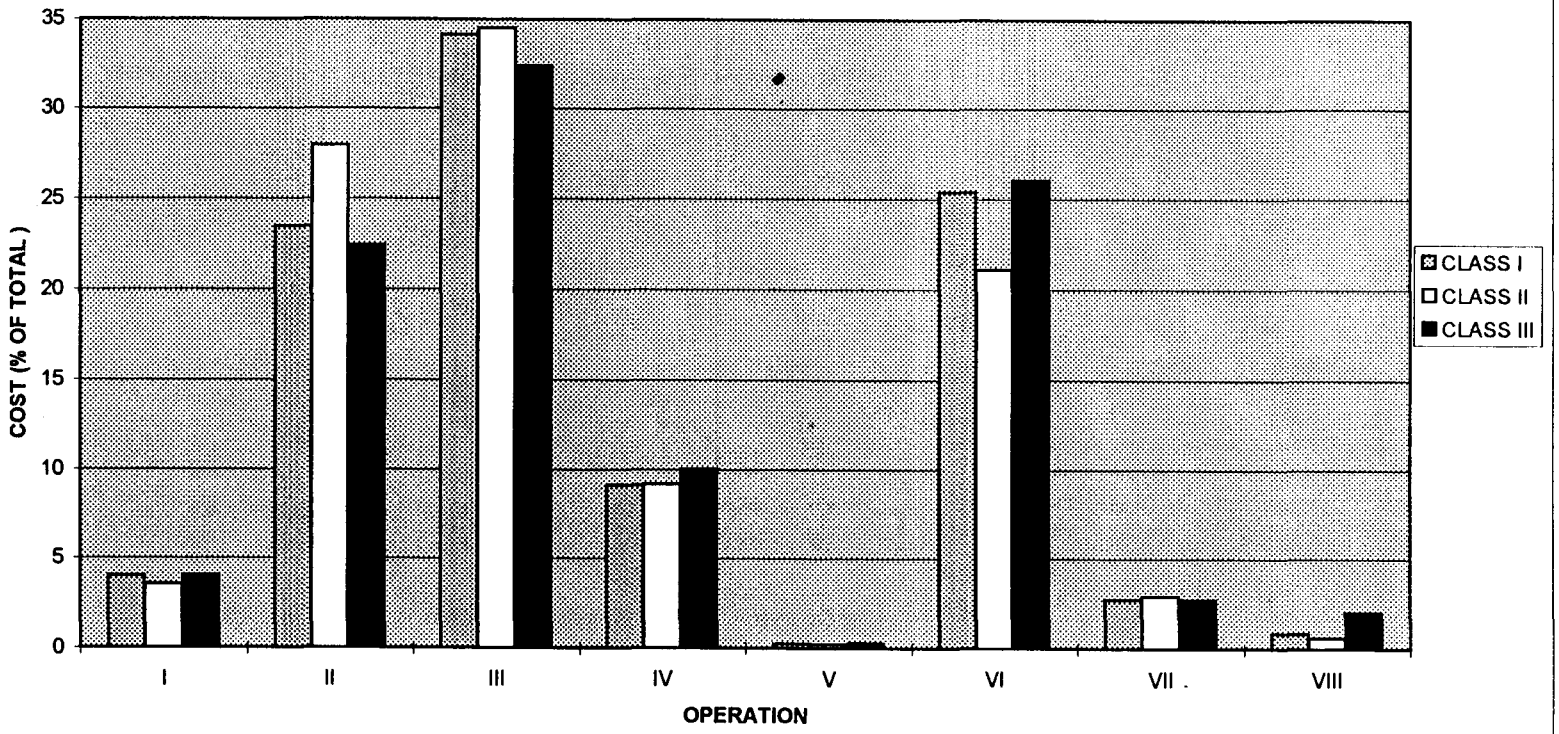
(Figures in parentheses show percentages to total)

Fig.6. OPERATION-WISE COST OF CULTIVATION OF SWEET POTATO (AGGREGATE)



I	Nursery preparation
II	Land preparation
III	Intercultural operation
IV	Harvesting
V	Land revenue
VI	Rental value of own land
VII	Rent on leased in land
VIII	Interest on working capital
IX	Miscellaneous

FIG. 7. OPERATIONAL-WISE COST OF CULTIVATION OF SWEET POTATO FOR DIFFERENT CLASS OF FARMERS



I	Nursery preparation	IV	Harvesting	VII	Interest on working capital
II	Land preparation	V	Land revenue	VIII	Miscellaneous
III	Intercultural operation	VI	Rental value of own land		

which accounted for 25.40 per cent and 26.06 per cent respectively. Harvesting contributed 9.13 per centage in class I and 10.04 per cent in class III. In class II, land preparation accounted for 27.95 per cent of the total cost followed by rental value of own land (21.09 per cent),harvesting and the interest on working capital.

5.2.2.3 Input-wise cost of cultivation of sweet potato

Input-wise cost of cultivation was also worked out for different classes and the results are given in Table 5.21. This will help to have an idea about the relative importance of various inputs in general and among the different classes.

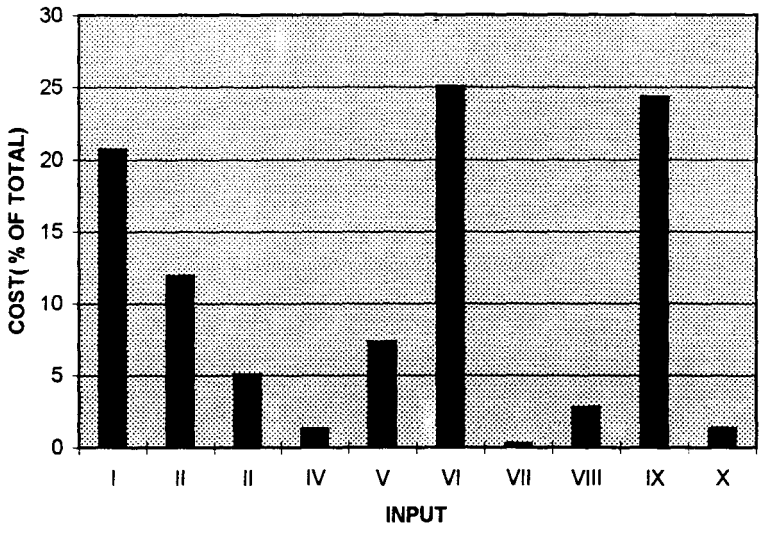
The inputs involved in the cultivation of sweet potato were grouped into three viz. the labour input, materials, and other items. The labour input classified into male labour, female labour (both family and hired) and machine labour. The materials cost include the cost on tubers, fertilizers, and farmyard manure. Other items consisted of land revenue, interest on working capital, rental value of own land and miscellaneous expenses. The results showed that at the aggregate level the major share of the total cost was accounted for labour cost (37.66 per cent)followed by material cost (33.66 per cent). It was found that male labour constituted 54.96 per cent of the total labour cost. The allocation of labour cost to different operations is given in Table 5.22. The labour cost was found to be highest in land preparation (Rs.1233.60) followed by harvesting

Table 5.21. Inputwise cost of cultivation of sweet potato for different size groups (Rs. per hectare)

Sl no.	Inputs	Class I	Class II	Class III	Aggregate
A.	**Labour**				
1	Male labour (family and hired)	2036.52 (21.38)	2098.51 (19.58)	1926.73 (21.18)	1998.90 (20.70)
2	Female labour (family and hired)	1014.32 (10.65)	1292.08 (12.06)	1122.84 (12.35)	1151.81 (11.93)
3	Machine labour	169.72 (1.79)	562.50 (5.25)	562.50 (6.18)	486.05 (5.03)
	Sub total	3220.56 (33.82)	3953.09 (36.89)	3612.07 (39.72)	3636.75 (37.66)
B.	**Materials**				
4	Planting material cost	125.00 (1.31)	125.00 (1.17)	125.00 (1.37)	125.00 (1.29)
5	Farm yard manure	934.75 (9.81)	1206.22 (11.26)	331.12 (3.64)	707.42 (7.32)
6	Chemical fertilizers	2457.29 (25.80)	2771.56 (25.86)	2199.69 (24.19)	2418.97 (25.05)
	Sub total	3517.04 (36.92)	4102.78 (38.29)	2655.81 (29.20)	3251.38 (33.66)
C.	**Others**				
7	Land revenue	25.00 (0.26)	25.00 (0.23)	25.00 (0.27)	25.00 (0.26)
8	Intrest on working capital	261.39 (2.74)	311.27 (2.90)	247.35 (2.73)	268.99 (2.79)
9	Rental value of own land	2418.67 (25.41)	2259.41 (21.09)	2370.11 (26.06)	2346.81 (24.30)
10	Miscellaneous	81.33 (0.85)	64.16 (0.60)	184.60 (2.03)	128.88 (1.33)
	Sub total	2786.39 (29.26)	2659.84 (24.82)	2827.06 (31.08)	2769.68 (28.68)
	Total	9523.99 (100.00)	10715.71 (100.00)	9094.94 (100.00)	9657.84 (100.00)

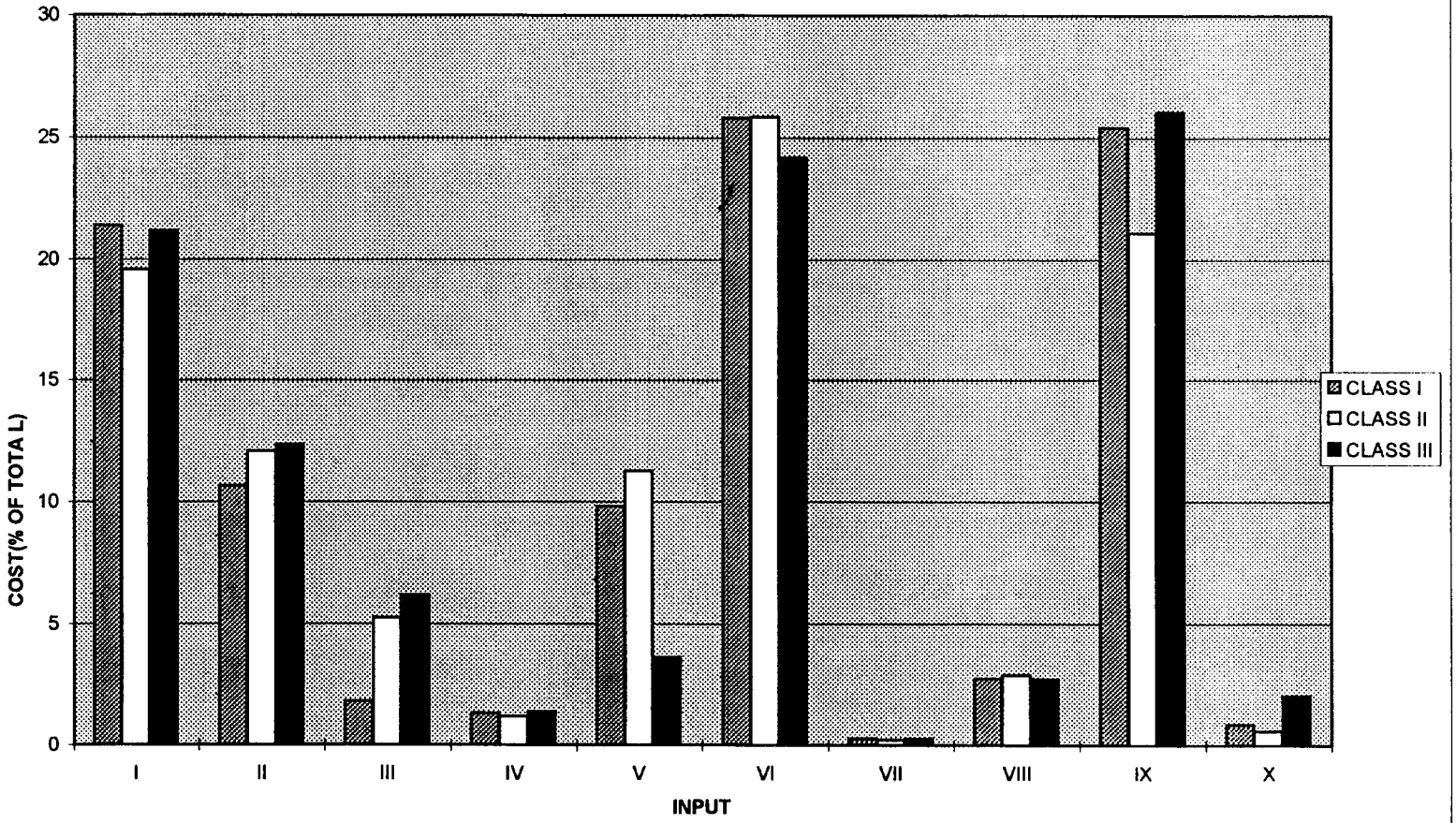
(Figures in parentheses show percentages to total)

FIG.8. INPUT-WISE COST OF CULTIVATION OF SWEET POTATO (AGGREGATE)



I	Male labour
II	Female labour
III	Machine labour
IV	Planting material cost
V	Farm yard manure
VI	Chemical fertilizer
VII	Land revenue
VIII	Interest on working capital
IX	Rental value of own land
X	Miscellaneous

FIG.9. INPUT-WISE COST OF CULTIVATION OF SWEET POTATO FOR DIFFERENT CLASS OF FARMERS



I	Male labour	IV	Planting material cost	VII	Land revenue
II	Female labour	V	Farm yard manure	VIII	Interest on working capital
III	Machine labour	VI	Chemical fertilizer	IX	Rental value of own land
				X	Mscellaneous

Table 5.22. Allocation of Labour to different operations (Rs. per hectare)

		Size groups								
		Class I		Class II		Class III		Aggregate		Total
Operations	Type of labour	Male	Female	Male	Female	Male	Female	Male	Female	
Nursery preparation										
	Family	121.99	50.84	62.37	34.66	31.03	17.23	58.00	28.94	86.94
	Hired	-	-	60.14	11.15	77.59	30.17	57.333	18.67	76.00
	Total	121.99	50.84	45.81	214.1	108.62	47.40	115.3	47.61	162.90
Land preparation										
	Family	196.54	89.98	39.6	198.15	51.72	25.14	89.62	42.03	131.65
	Hired	691.27	218.37	297.02	114.69	848.3	287.36	825.13	276.8	1101.93
	Total	887.81	308.35	336.62	312.84	900.0	312.5	914.8	318.8	1233.60
Intercultural operation										
	Family	410.01	252.25	48.3	-	64.7	21.55	142.4	74.33	216.73
	Hired	108.43	41.42	344.1	-	398.3	283.05	357.21	254.1	611.31
	Total	518.44	293.67	392.33	-	462.9	304.60	499.6	328.43	828.03
Harvesting										
	Family	230.42	86.6	39.6	112.98	62.07	14.37	106.8	35.88	142.68
	Hired	277.86	274.86	477.72	1438.42	393.1	443.97	362.5	421.1	783.60
	Total	508.28	361.46	517.32	1550.56	455.2	458.34	469.3	456.94	926.24
Total										
	Family	958.96	479.67	162.13	376.88	209.5	78.29	396.8	181.18	577.98
	Hired	1077.56	534.65	1129.95	1636.23	1717.25	1044.55	1602.15	970.63	2572.78
Grand total		2036.52	1014.32	1292.08	2011.11	1926.73	1122.84	1998.99	1151.81	3150.80

(Rs926.24),intercultural operation (Rs828.03) and nursery preparation(Rs162.91). Class-wise analysis revealed that family labour use was more in class I as compared to class II and class III.

Among the material cost items as shown in Table 5.21 fertilizers accounted for 74.39 per cent of the total material cost (Rs3251.38). The fertilizer use pattern of respondents is given in Table 5.23. It can be found that 76 per cent of farmers used nitrogen above the recommended level while 72 per cent and 60 per cent of them used P_2O_5 and k_2O respectively above the recommended level. Only 4 per cent, 12 per cent and 8 per cent of farmers adopted recommended level of nutrients such as Nitrogen, P_2O_5 and K_2O at 75 and 50 kg per hectare respectively.

Among the other items (Table 5.21) rental value of own land formed major share (84.73 per cent) followed by interest on working capital, miscellaneous expenses and land revenue.

Class-wise analysis showed that material cost accounted for the highest share in class I and class II consistuting 36.92 per cent and 38.29 per cent respectively, followed by labour cost and cost on other items. For class III labour cost contributed the major share (39.72 per cent) followed by cost on other item (31.08 per cent) and material cost (29.20 per cent).

Table 5.23. Frequency distribution of farmers according to level of fertilizer use

Dose of nutrients	No of farmers using the nutrients		
	N	P	K
More than recommended level	38 (76.00)	36 (72.00)	30 (60.00)
At the recommended level	2 (4.00)	6 (12.00)	4 (8.00)
Less than the recommended level	10 (20.00)	8 (16.00)	9 (18.00)
Fertilizer not used	-	-	7 (14.00)
Total	50 (100.00)	50 (100.00)	50 (100.00)

(Figures in parentheses show percentages to total)

Inputwise analysis revealed that fertilizers accounted for the highest share with 25.80 per cent and 25.86 per cent in class I and II respectively followed by rental value of own land, male labour and female labour. For class III rental value of own land contributed the major share with 26.06 per cent followed by chemical fertilizer, male labour and female labour.

5.2.2.4 Cost of cultivation under different cost concepts

The costs according to cost concepts were worked out for sweet potato at the aggregate level as well as for the different classes and are presented in Table 5.24. Cost A_1, A_2, B_1, B_2, C_1, C_2 per hectare were worked out to Rs6733.13, Rs6733.13, Rs6733.13, Rs9079.94, Rs7311.04, Rs9657.84 respectively. For class I the costs were Rs5666.69, Rs5666.69, Rs5666.69, Rs8085.36, Rs7105.32 and Rs9523.99. For class II the costs were Rs7944.42, Rs7944.42, Rs7944.42, Rs10203.83, Rs8456.30 and Rs10715.71. For class III the costs were Rs6437.05, Rs6437.05, Rs6437.05, Rs8807.16, Rs6724.83 and Rs9094.94. Cost A_1, A_2 and B_1 are the same because in this area leasing in land by the respondents was not observed and also the farmers do not have their own fixed assets for cultivation of sweet potato. Class-wise analysis showed that all the costs were higher in class II.

Table 5.24. Cost of cultivation of sweet potato under different cost concepts (Rs. per hectare)

Costs	Class I	Class II	Class III	Aggregate
Cost A_1	5666.69	7944.42	6437.05	6733.13
Cost A_2	5666.69	7944.42	6437.05	6733.13
Cost B_1	5666.69	7944.42	6437.05	6733.13
Cost B_2	8085.36	10203.83	8807.16	9079.94
Cost C_1	7105.32	8456.30	6724.83	7311.04
Cost C_2	9523.99	10715.71	9094.94	9657.84

5.2.2..5 Income measures in relation to different cost concepts.

Gross income, Farm business income, Family labour income and Net income were estimated for sweet potato at the aggregate level and for the different size classes and are presented in Table 5.25. The gross income was found to be Rs11734.04 at the aggregate level. Among the classes gross income was highest in class II with Rs12093.37 followed by class I with Rs11850.57 and class III with Rs11297.03.

Farm business income was Rs5000.91 at the aggregate level and among the classes class I recorded the highest of Rs6183.88 followed by class III with Rs4859.98 and class II with Rs4148.95. Family labour income worked out to Rs2654.10 at the aggregate level and it was Rs3765.21, Rs1889.54 and Rs2489.87 for class I, II and III. The net income was Rs2076.20 at the aggregate level worked out at cost C_2. On class-wise analysis net income was highest for class I with Rs2326.58 followed by class III (Rs2202.09) and class II (Rs1377.66)

5.2.2.6 Yield and returns

The yield and returns per hectare of sweet potato as shown in Table 5.26 revealed that yield of sweet potato for classes I, II, III and at the aggregate level were 8887kg, 9070kg, 8473kg and 8801kg respectively. Correspondingly the returns per hectare were Rs11850.57, Rs12093.37, Rs11297.03 and Rs11734.04.

Table 5.25. Income measures in relation to different cost concepts in sweet potato cultivation (Rs. per hectare)

Particulars	Class I	Class II	Class III	Aggregate
Gross income	11850.57	12093.37	11297.03	11734.04
Farm business income	6183.88	4148.95	4859.98	5000.91
Own farm business income	6183.88	4148.95	4859.98	5000.91
Familylabour income	3765.21	1889.54	2489.87	2654.10
Net income	2326.58	1377.66	2202.09	2076.20
Farm investment income	4745.25	3637.07	4572.20	4423.00

Table 5.26. Yield and returns of sweet potato

Size group	Output (kg/ha)	Value (Rs./ha)
Class I	8887.93	11850.57
Class II	9070.03	12093.37
Class III	8472.77	11297.03
Aggregate	8800.53	11734.04

5.2.2.7 Cost of production

Cost of production of sweet potato is given in Table 5.27. Cost of production in relation to various concepts showed that cost of production per quintal was highest for class II. Cost of production per quintal on C_2 basis for the three classes were Rs107, Rs118, Rs107 respectively. Cost of production per quintal for the aggregate sample based on costs A_1, A_2, B_1, B_2, C_1 and C_2 were Rs77, Rs77, Rs77, Rs103, Rs83 and Rs110 respectively. Pal and Ramanathan (1989) reported that the cost of production of tuber in Palakkad, Malappuram and Kasargode was estimated to be around 50-51 paise per kilogram.

5.2.2.8 Benefit-Cost ratio

Benefit-cost ratio for sweet potato is given in Table 5.28. Benefit-cost ratio based on costs A_1, A_2, B_1, B_2, C_1, C_2 for the sample as a whole were Rs1.74, 1.74, 1.74, 1.29, 1.60 and 1.21 respectively. Returns generated from a rupee invested was found to be greater than one for three size classes. Anantharaman et al.(1993) observed that the input-output ratio of sweet potato in low land and upland area was 3.03 and 1.40 respectively.

Table 5.27. Cost of production of sweet potato (Rs. per quintal)

Costs	Class I	Class II	Class III	Aggregate
Cost A_1	64	88	76	77
Cost A_2	64	88	76	77
Cost B_1	64	88	76	77
Cost B_2	91	113	104	103
Cost C_1	80	93	79	83
Cost C_2	107	118	107	110

Table 5.28. Benefit-cost ratio of sweet potato based on different cost concepts

Costs	Class I	Class II	Class III	Aggregate
Cost A_1	2.09	1.52	1.76	1.74
Cost A_2	2.09	1.52	1.76	1.74
Cost B_1	2.09	1.52	1.76	1.74
Cost B_2	1.47	1.19	1.28	1.29
Cost C_1	1.67	1.43	1.68	1.60
Cost C_2	1.24	1.13	1.24	1.21

5.2.2.9 Resource use efficiency

In the present study resource use efficiency has been estimated using Cobb-Douglas production function. The result as given in Table 5.29. revealed that 99 per cent variation in the independent variables was explained by the explanatory variables used in the function. Except for the variable area (X_1) and farmyard manure(X_3), all the others were found to be non-significant. A very high R^2 with non-significant regression coefficients clearly indicates the presence of multicollinearity. So as to reduce the presence of multicollinearity in the production function all the explanatory variables were converted into per are basis so that area effect can be reduced considerably. The model was rerun with four explanatory variables viz. labour (X_2), farmyard manure (X_3), fertilizer (X_4) and planting material (X_5) on per are basis and the results are given in Table 5.30

The results revealed that R^2 was reduced to 0.57 showing that only 57 per cent variation in the output was explained by independent variables. Return to scale was 0.286 indicating decreasing returns to scale since sum of regression coefficients was less than unity. Among the explanatory variables labour was found to be negative and significant which indicates over use of this input. This can be explained by labour use pattern for different operations. The production elasticity of fertilizer was found negative though insignificant showing excess use. Farmyard manure and planting material was found to be

Table 5.29. The production elasticities of output on various inputs, standard error, 't' values and co-efficient of multiple determination (R^2) in the model fitted for sweet potato.

Variables	Production elasticities (b_i)	Standard error	't' value
Area (X_1)	0.835 *	0.171	4.884
Labour (X_2)	-0.088	0.240	0.366
Farmyard manure (X_3)	0.102	0.039	2.623
Fertilizer (X_4)	-0.041	0.027	- 1.496
Planting material (X_5)	0.143	0.203	0.705
Intercept	1.76		
R^2	0.99		

* Significant at one percent probability.

Table 5.30. Production elasticities and marginal value product of various inputs for sweet potato

Variables	Production elasticities	Marginal value product
Labour X_2	-0.354 * (0.141)	-1.45
Farmyard manure X_3	0.129 * (0.027)	1.77
Fertilizer X_4	-0.027 (0.019)	-0.12
Planting material X_5	0.478 * (0.093)	14.55
Intercept	2.16	
R^2	0.57	

* Significant at one percent probability
(Figures in parentheses show standard error)

significant. The result of the cost structure analysis as explained earlier indicated the above trends with human labour alone accounting for about 32.63 per cent of the total cost followed by fertilizer with 25.05 per cent while farmyard manure contributed only about 7.32 per cent of the total cost.

Marginal value products of all the inputs were worked out at their geometric mean levels. Marginal value products for sweet potato is given in Table 5.30. A negative marginal value product of labour and fertilizer showed that these factors were used in excess quantities. Marginal value product of farmyard manure and planting material were greater than their factor cost ratio indicating that profit can be increased considerably using more units of these variables with considerable reduction in labour and fertilizer application.

5.2.3 Tapioca

5.2.3.1 Cultivation practices

Tapioca grows well under warm humid tropical conditions where rainfall is well distributed and fairly abundant. The planting season of tapioca is April-May. It is propagated from cuttings. Cattle manure or compost is applied during land preparation. Mound method of planting is adopted with 60 cm x 60 cm spacing. Nitrogen and potash are applied in two split doses. Basal application of fertilizers are done at the time of planting. Top dressing is done at the time of intercultural operation. Setts of about 40 cm length are

planted on mounds after dipping in ashes. Tapioca becomes ready for harvest 9-10 months after planting.

5.2.3.2 Operation-wise cost of cultivation

Operation-wise cost of cultivation per hectare of tapioca for different size groups and sample as a whole were computed and is presented in Table 5.31. The total cost of cultivation of tapioca at the aggregate level was found to be Rs.14031.61. The operational expenses constituted 57.11 per cent while other expenses accounted for 42.89 per cent. Among the operational items land preparation accounted for the highest share (35.25 per cent) followed by drying (10.54 per cent), intercultural operations (8.13 per cent) and harvesting (3.19 per cent). Land preparation includes ploughing, mound making and planting, basal application of farmyard manure and fertilizers. Among the different items of cost, rental value of own land accounted the highest share (36.91 per cent) followed by land preparation (35.25 per cent) and drying (10.54 per cent).

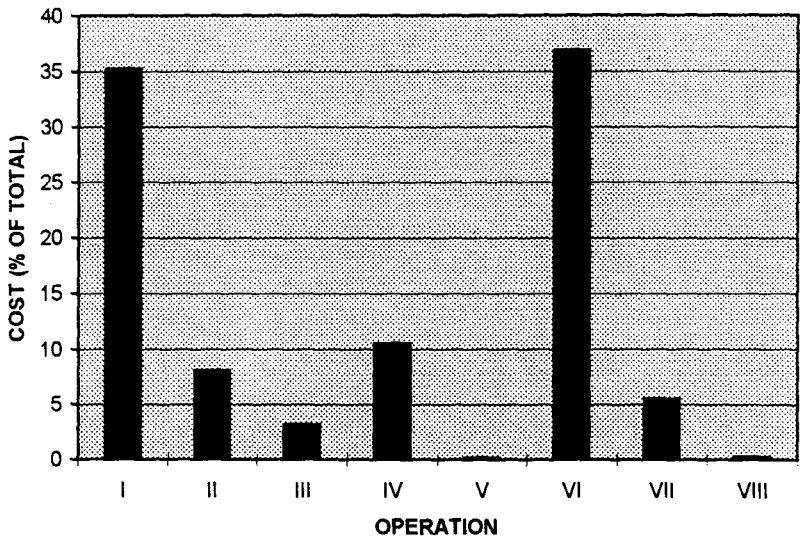
Class-wise analysis revealed that the total cost of cultivation was Rs.13664.18 for class I, Rs.14051.80 for class II and Rs.14366.80 for class III showing an increase in cost as holding size increased. Rental value of land was found to be the major item for all the size classes, contributing 37.64 per cent, 36.72 per cent and 36.12 per cent respectively for class I, II, and III. Land preparation was the next major item accounting for 33.89 per cent of the total cost in class

Table 5.31. Operation-wise cost of cultivation of tapioca for different size groups (Rs. per hectare)

Sl. no	Operations	Class I	Class II	Class III	Aggregate
A	**Operational expenses**				
1	Land preparation	4631.43	4858.29	5016.13	4946.23
		(33.89)	(34.57)	(34.92)	(35.25)
2	Intercultural operation	1220.28	1778.58	1118.73	1140.25
		(8.94)	(8.39)	(7.79)	(8.13)
3	Harvesting	439.83	450.30	448.61	447.90
		(3.22)	(3.20)	(3.12)	(3.19)
4	Drying	1352.46	1552.66	1482.60	1479.58
		(9.90)	(11.05)	(10.32)	(10.54)
	Sub total	7644.00	8039.83	8066.07	8013.96
		(55.95)	(57.21)	(56.15)	(57.11)
B	**Other expenses**				
5	Land revenue	25.00	25.00	25.00	25.00
		(0.18)	(0.18)	(0.17)	(0.18)
6	Rental value of own land	5143.79	5159.65	5189.23	5179.11
		(37.64)	(36.72)	(36.12)	(36.91)
7	Interest on working capital	742.94	775.46	800.43	771.99
		(5.44)	(5.52)	(5.57)	(5.50)
8	Miscellaneous	108.45	51.86	286.07	41.55
		(0.79)	(0.37)	(1.99)	(0.30)
	Sub total	6020.18	6011.97	6300.73	6017.65
		(44.05)	(42.79)	(43.85)	(42.89)
	Total	13664.18	14051.80	14366.80	14031.61
		(100.00)	(100.00)	(100.00)	(100.00)

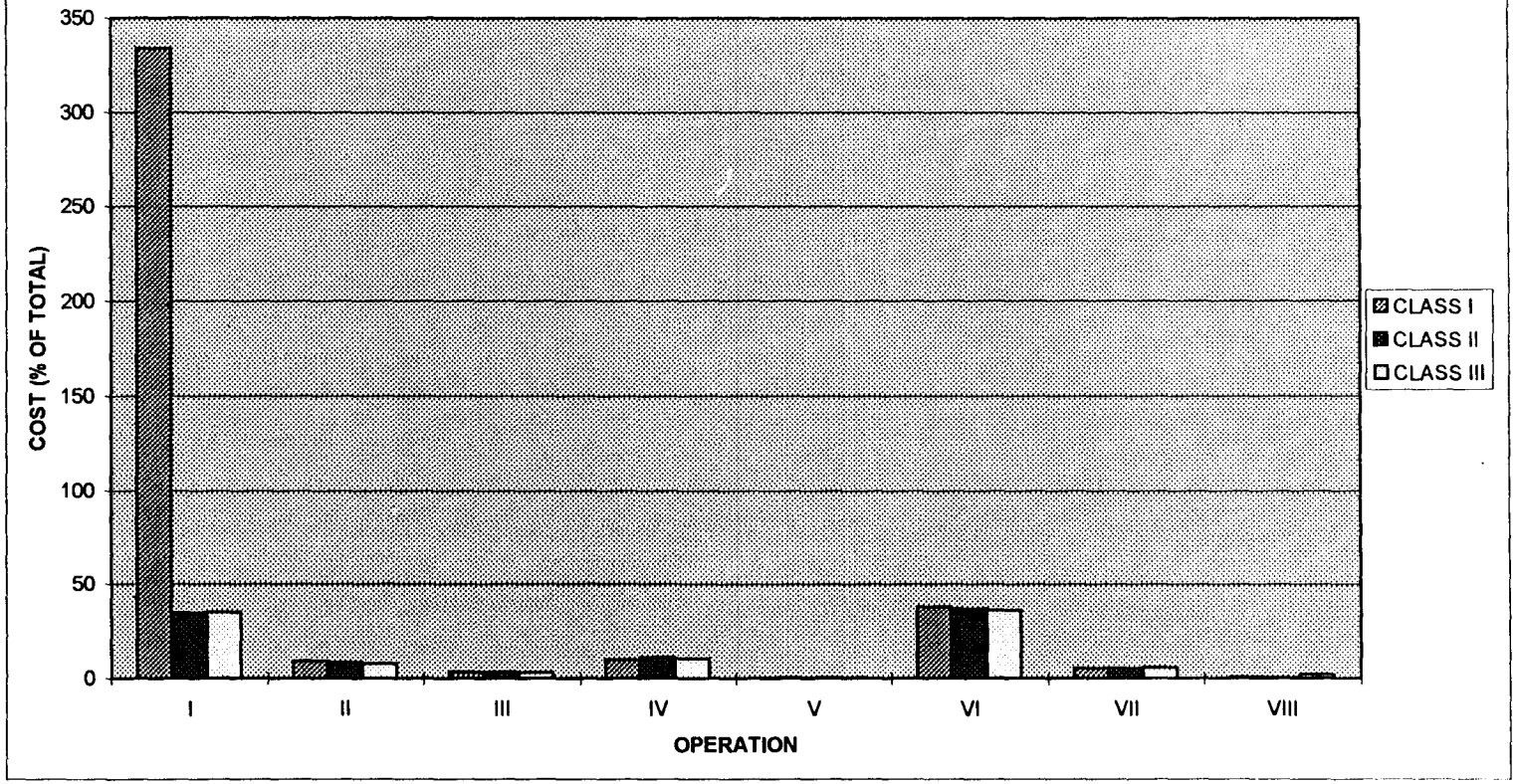
(Figures in parentheses show percentages to total)

FIG.10. OPERATION-WISE COST OF CULTIVATION OF TAPIOCA (AGGREGATE)



I	Land preparation
II	Intercultural operation
III	Harvesting
IV	Drying
V	Land revenue
VI	Rental value of own land
VII	Interest on working capital
VIII	Miscellaneous

FIG.11. OPERATION-WISE COST OF CULTIVATION OF TAPIOCA FOR DIFFERENT CLASS OF FARMERS



I	Land preparation	IV	Drying	VII	Interest on working capital
II	Intercultural operation	V	Land revenue	VIII	Miscellaneous
III	Harvesting	VI	Rental value of own land		

I,34.57 per cent in class II and 34.92 per cent in class III. Elsamma and Asan (1991) reported that per hectare cost and return was Rs.3545 and Rs.7362 respectively.

5.2.3.3 Input-wise cost of cultivation

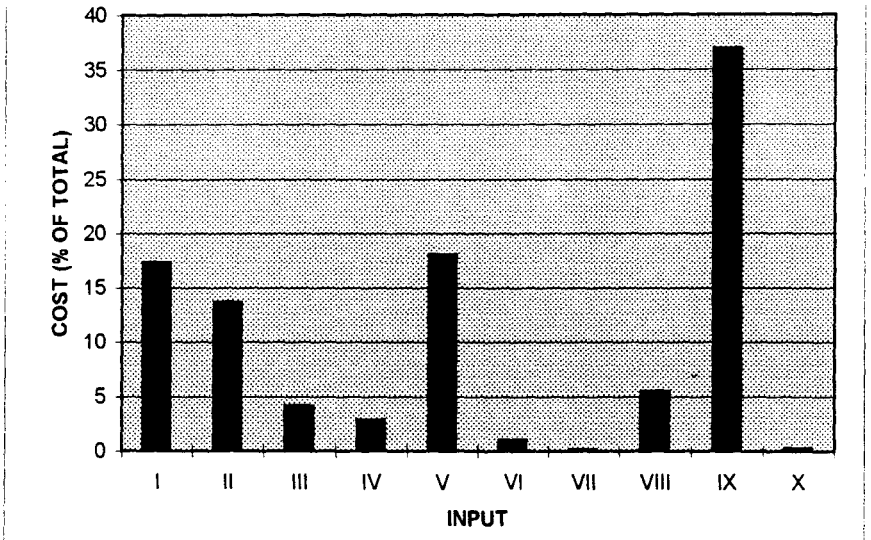
The inputwise cost of cultivation as presented in Table 5.32 revealed that the major share of the total cost was accounted by other items (42.89 per cent) followed by labour cost (35.13 per cent) and material cost (21.98 per cent). It was found that male labour consistuted 55.93 per cent of the total human labour cost. The allocation of labour cost to different operations was given in Table 5.33. The labour cost was found to be highest in drying (Rs.1479.58) followed by land preparation (Rs.1355.70), intercultural operation (Rs.1064.76)and harvesting (Rs.447.90). Class-wise analysis revealed that family labour use was highest in class I as compared to class II and III. Among the material cost items farmyard manure accounted for 82.19 per cent of total material cost (Rs.3084.40). The fertilizer use pattern of respondents are given in Table 5.34. It was found that 86 per cent of the farmers used nitrogen below recommended level while 84 per cent and 88 per cent used P_2O_5 and K_2O respectively below recommended level. About 6 per cent, 4 per cent and 2 per cent of sample farmers used N, P_2O_5 and K_2O at the recommmended level 50: 50:50 kg per hectare.

Table 5.32. Input-wise cost of cultivation of tapioca for different size groups (Rs. per hectare)

Sl no.	Inputs	Class I	Class II	Class III	Aggregate
A	**Labour**				
1	Male labour (family and hired)	2455.55 (17.97)	2478.89 (17.64)	2416.78 (16.82)	2431.61 (17.33)
2	Female labour (family and hired)	1849.75 (13.54)	2011.11 (14.31)	1904.23 (13.25)	1915.95 (13.65)
3	Machine labour	245.58 (1.80)	625.00 (4.45)	625.00 (4.35)	582.00 (4.15)
	Sub total	4550.88 (33.31)	5115.00 (36.40)	4946.01 (34.42)	4929.56 (35.13)
B	**Materials**				
4	Planting material cost	400.00 (2.93)	400.00 (2.85)	400.00 (2.78)	400.00 (2.85)
5	Farm yard manure	2558.64 (18.73)	2411.97 (17.16)	2560.22 (17.82)	2535.21 (18.07)
6	Chemical fertilizers	134.48 (0.98)	112.87 (0.80)	159.96 (1.12)	149.19 (1.06)
	Sub total	3093.12 (22.64)	2924.84 (20.81)	3120.18 (21.72)	3084.40 (21.98)
C	**Others**				
7	Land revenue	25.00 (0.18)	25.00 (0.18)	25.00 (0.18)	25.00 (0.18)
8	Interest on working capital	742.94 (5.44)	775.45 (5.52)	800.43 (5.57)	771.99 (5.50)
9	Rental value of own land	5143.79 (37.64)	5159.65 (36.72)	5189.11 (36.12)	5179.11 (36.91)
10	Miscellaneous	108.45 (0.79)	51.86 (0.37)	286.07 (1.99)	41.55 (0.30)
	Sub total	6020.18 (44.05)	6011.96 (42.79)	6300.61 (43.86)	6017.65 (42.89)
	Total	13664.18 (100.00)	14051.80 (100.00)	14366.8 (100.00)	14031.61 (100.00)

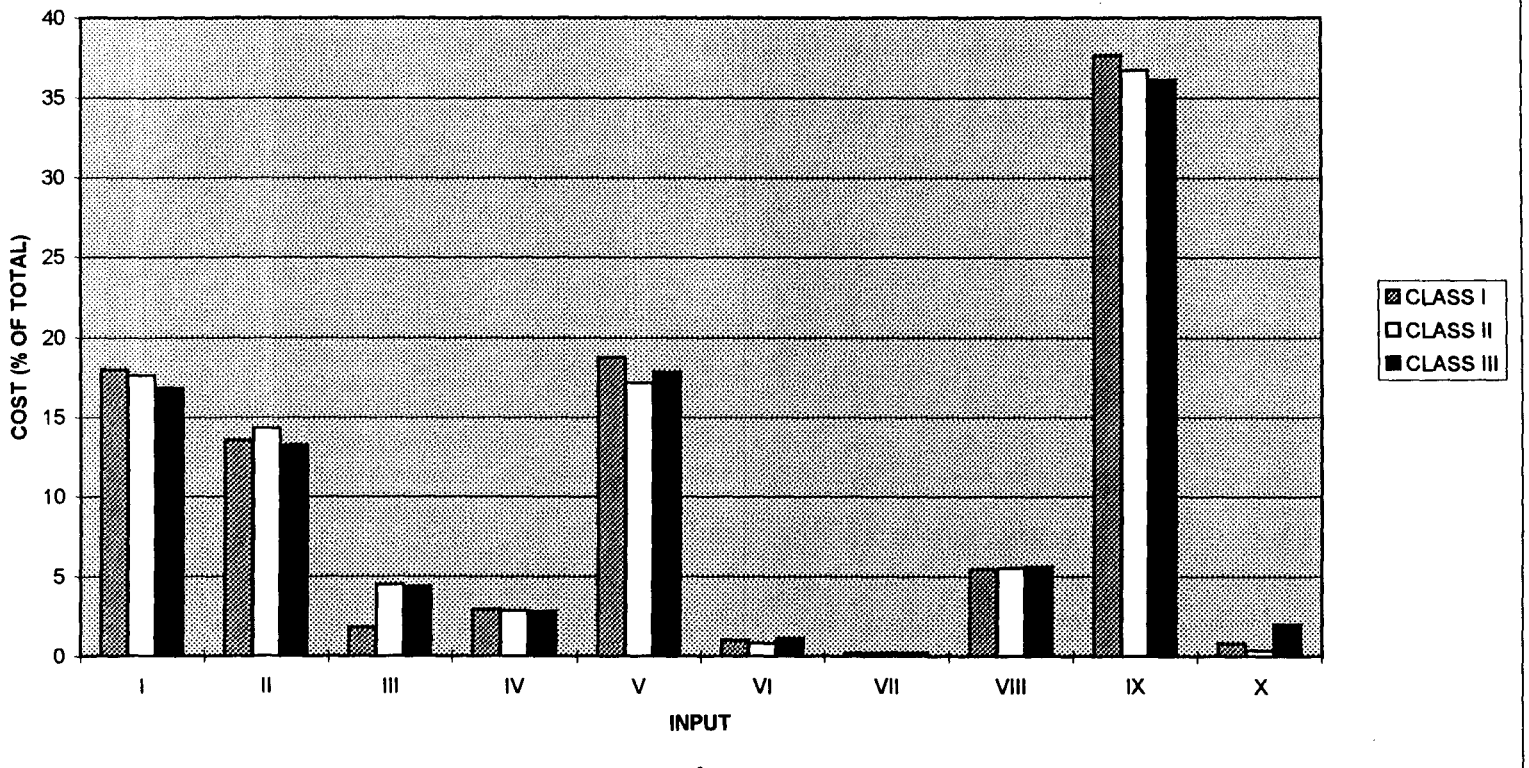
(Figures in parentheses show percentages to total)

FIG.12. INPUT-WISE COST OF CULTIVATION OF TAPIOCA (AGGREGATE)



I	Male labour
II	Female labour
III	Machine labour
IV	Planting material cost
V	Farm yard manure
VI	Chemical fertilizer
VII	Land revenue
VIII	Interest on working capital
IX	Rental value of own land
X	Miscellaneous

FIG.13. INPUT-WISE COST OF CULTIVATION OF TAPIOCA FOR DIFFERENT CLASS OF FARMERS



I	Male labour	IV	Planting material cost	VII	Land revenue
II	Female labour	V	Farm yard manure	VIII	Interest on working capital
III	Machine labour	VI	Chemical fertilizer	IX	Rental value of own land
				X	Miscellaneous

Table 5.33. Allocation of Labour to different operations (Rs. per hectare)

		Size groups								
		Class I		Class II		Class III		Aggregate		Total
Operations	Type of Labour	Male	Female	Male	Female	Male	Female	Male	Female	
Land Preparation										
	Family	545.93	158.39	192.9	66.49	85.33	30.76	155.6	51.21	206.81
	Hired	632.13	19.65	1017	81.12	1122	115.50	1050	98.89	1148.89
	Total	1178.06	178.04	1210	214.1	1208	146.26	1205.60	150.10	1355.70
Intercultural operation										
	Family	736.00	267.68	432.4	198.15	115.6	36.77	238.9	89.62	328.82
	Hired	101.67	51.58	385.9	114.69	644.3	238.51	539.6	196.64	736.24
	Total	837.67	319.26	818.3	312.84	759.9	275.28	778.50	286.26	1064.76
Harvesting										
	Family	404.46	-	192.9	-	62.69	-	123.25	-	123.25
	Hired	35.36	-	257.3	-	385.9	-	324.65	-	324.65
	Total	439.82	-	450.3	-	448.6	-	447.90	-	447.90
Drying										
	Family	-	311.98	-	112.98	-	20.56	-	68.94	68.94
	Hired	-	1040.47	-	1438.42	-	1462.13	-	1408.71	1408.71
	Total	-	1352.45	-	1550.56	-	1482.62	-	1479.58	1479.58
Total										
	Family	1686.39	738.05	818.3	376.88	263.6	88.09	517.4	209.7	727.10
	Hired	769.16	1111.7	1660	1636.23	2153	1816.14	1914	1705.2	3619.20
Grand total		2455.50	1849.75	2978	2011.11	2416	1904.23	2431	1915.95	4346.95

Table 5.34. Frequency distribution of farmers according to level of fertilizer use

Dose of nutrients	No of farmers using the Nutrients		
	N	P	K
Less than recommended level	43 (86.00)	42 (84.00)	44 (88.00)
More than recommended level	4 (8.00)	6 (12.00)	5 (10.00)
At the recommended level	3 (6.00)	2 (4.00)	1 (2.00)
Total	50 (100.00)	50 (100.00)	50 (100.00)

(Figures in parentheses show percentages to total)

The class-wise analysis (Table 5.32) showed that cost on other items accounted the highest share for all the classes, constituting 44.05 per cent, 42.79 per cent and 43.86 per cent in class I, II and III respectively followed by labour cost and material cost. Rental value of own land accounted for the highest cost in all the classes with 37.64 per cent, 36.72 per cent and 36.12 per cent respectively in class I, II and III. This was followed by farmyard manure, male labour and female labour in class I and III. In class II male labour accounted for 17.64 per cent of total expenses followed by farmyard manure and female labour. Pal *et al.* (1985) reported that high cost of cultivation was due to higher expenditure on labour which accounted for 58 per cent and 66 per cent for high yielding variables and local varieties respectively.

5.2.3.4 Cost of cultivation under different cost concepts

The costs according to cost concepts were worked out for tapioca at the aggregate level as well as for the different classes are presented in Table 5.35. Cost A_1, A_2, B_1, B_2, C_1, C_2 per hectare worked out to Rs.8124.94, Rs.8124.94, Rs.8124.94, Rs.13304.05, Rs.8852.50 and Rs.14031.61. For class I the costs were Rs.6095.94, Rs.6095.94, Rs.6095.94, Rs.11239.73, Rs.8520.39 and Rs.13664.18. For class II these costs were Rs.7698.96, Rs.7698.96, Rs.7698.96, Rs.12858.61, Rs.8892.15 and Rs.14051.80. For class III these costs

Table 5.35. Cost of cultivation of tapioca under different cost concepts

Costs	Class I	Class II	Class III	Aggregate
Cost A_1	6095.94	7698.96	8826.00	8124.94
Cost A_2	6095.94	7698.96	8826.00	8124.94
Cost B_1	6095.94	7698.96	8826.00	8124.94
Cost B_2	11239.73	12858.61	14015.11	13304.05
Cost C_1	8520.39	8892.15	9177.69	8852.50
Cost C_2	13664.18	14051.80	14366.80	14031.61

were Rs.8826, Rs.8826, Rs.8826, Rs.14015.11, Rs.9177.69 and Rs.14366.80. Class-wise analysis showed that all the costs were higher in class III followed by class II and class I.

5.2.3.5 Income measures in relation to different cost concepts

Gross income, farm business income, family labour income and net income were estimated for tapioca at the aggregate level and for the different size groups are given in Table 5.36. The gross income was found to be Rs.25895.56 at the aggregate level. Gross income was highest in class III (Rs.25946.05) followed by class II (Rs.25798.24) and class I (Rs.25718.96).

Farm business income was Rs.17770.62 at the aggregate level. Class I recorded the highest farm business income with Rs.19623.02 followed by class II with Rs.18099.28 and class III with Rs.17120.05.

Family labour income worked out to Rs.12591.51 at the aggregate level and it was Rs.14479.23, Rs.12939.63, Rs.11930.94 for class I, II and III respectively. Net income which is the most suitable income measure to judge the profitability of crop production was Rs.12054.78, Rs.11746.44, Rs.11579.25 and Rs.11863.95 for classes I, II, III and aggregate respectively.

Table 5.36. Income measures in relation to different cost concepts in tapioca cultivation (Rs. per hectare)

Particulars	Class I	Class II	Class III	Aggregate
Gross income	25718.96	25798.24	25946.05	25895.56
Farm business income	19623.02	18099.28	17120.05	17770.62
Own farm business income	19623.02	18099.28	17120.05	17770.62
Familylabour income	14479.23	12939.63	11930.94	12591.51
Net income	12054.78	11746.44	11579.25	11863.95
Farm investment income	17198.57	16906.09	16768.36	17043.06

5.2.3.6 Yield and returns.

The yield and returns per hectare of tapioca as shown in Table 5.37 revealed that yields of tapioca for classes I, II, III and at the aggregate level were 7348.27 kg, 7370.93 kg, 7413.16 kg and 7398.73 kg respectively and the corresponding returns were Rs.25718.96, Rs.25798.24, Rs.25946.05 and Rs.25895.56 respectively.

5.3.3.7 Cost of production

Cost of production of tapioca is given in Table 5.38. Cost of production per quintal on various cost concepts was found to increase as the holding size increases. Cost of production per quintal on C_2 basis for class I, II and III were Rs.186, Rs.191 and Rs.194. Cost production per quintal for the aggregate sample on costs A_1, A_2, B_1, B_2, C_1, C_2 were Rs.110, Rs.110, Rs.110, Rs.180, Rs.120 and Rs.190 respectively.

5.2.3.8 Benefit-Cost ratio under different cost concepts

Benefit-cost ratio of tapioca is given in Table 5.39. Benefit cost ratios based on costs A_1, A_2, B_1, B_2, C_1, C_2 for the sample as a whole were 3.19, 3.19, 3.19, 1.95, 2.93 and 1.85. Class-wise analysis indicated the same trends as above with benefit-cost ratio above 1.

Table 5.37. Yield and returns of tapioca

Size group	Output (kg/ha)	Value (Rs./ha)
Class I	7348.27	25718.96
Class II	7370.93	25798.24
Class III	7413.16	25946.05
Aggregate	7398.73	25895.56

Table 5.38. Cost of production of tapioca (Rs. per quintal)

Costs	Class I	Class II	Class III	Aggregate
Cost A_1	83	104	119	110
Cost A_2	83	104	119	110
Cost B_1	83	104	119	110
Cost B_2	153	174	189	180
Cost C_1	116	121	124	120
Cost C_2	186	191	194	190

Table 5.39. Benefit-cost ratio of tapioca based on different cost concepts

Costs	Class I	Class II	Class III	Aggregate
Cost A_1	4.22	3.35	2.94	3.19
Cost A_2	4.22	3.35	2.94	3.19
Cost B_1	4.22	3.35	2.94	3.19
Cost B_2	2.29	2.01	1.85	1.95
Cost C_1	3.01	2.9	2.83	2.93
Cost C_2	1.88	1.84	1.81	1.85

5.3.3.9 Resource use efficiency

The resource use efficiency was estimated using Cobb-Douglas production function as in the case of other two crops. The explanatory variables included in the model are area (X_1), Labour (X_2), Farmyard manure (X_3) and fertilizer (X_4). The results given in Table 5.40 revealed that R^2 of 0.78 indicating that 78 per cent of variation in output was explained by the function. The production elasticities of labour and farmyard manure was found to be negative though significant. The negative sign with respect to labour and farmyard manure may be due to the high level of application of these inputs. This can be confirmed from the result of input-wise cost analysis. The high value of production elasticity of area (3.66) indicates the dominance of these particular factor.

The model was rerun after converting the variables on per are basis. The R^2 was very low (0.008) with an insignificant`f' value indicating that the model with transformed variable is not suitable to explain resource productivity of tapioca. The results of this study is contradictory to the results reported by Elsamma and Asan (1991) which showed a constant returns to scale and significant labour factor.

Table 5.40. The production elasticities of output on various inputs, standard error, 't' values and co-efficient of multiple determination (R^2) in the model fitted for tapioca.

Variables	Production elasticities (b_i)	Standard error	't' value
Area (X_1)	3.660	3.504	1.044
Labour (X_2)	-2.900	3.569	0.813
Farmyard manure (X_3)	-0.073	0.134	0.542
Fertilizer (X_4)	0.186	0.273	0.683
Intercept : 5.98 R^2 : 0.78			

5.3 Marketing

Marketing is as critical to better performance in agriculture as farming itself (Acharya and Agarwal, 1987). An efficient marketing system pays dividend to the producers and safeguards interests of the consumers. Quite often than not, the growers do not get remunerative prices for their produce while consumers have to pay higher price for the same. This is due to the fact that a large number of intermediaries reap the maximum share of consumers' price and the producers' get only a marginal benefit over the costs incurred by them in producing these commodities. In this context, a study of marketing costs and margins as well as marketing efficiency is quite relevant. In the present study an attempt has been made to identify the important marketing channels and also to analyze the marketing efficiency of coleus, sweet potato and tapioca.

5.3.1 Marketing systems of tuber crops

The harvested tubers of coleus and sweet potato are heaped in the farmer's fileds. The village traders undertake the functions associated with packing and transportation of the produce. Generally gunny bags which can hold 100 kilogram of coleus tubers and 75 kilogram of sweet potato tubers are used. The payment are effected at the time of sale itself. The produce is then transported to Thrissur and Pollachi markets.

Tapioca is usually sold after processing at farmer's level. The harvested tubers after peeling off the skin and rind are cut into slices and dried in sun and packed in gunny bags of 60 kilograms each. The produce is then taken to the local trader at Vadakkunchery. The village traders perform the role of a commission agent and the produce received from farmers are taken by wholesalers/mill owners from Salem and Dindigul in Tamil Nadu and converted into tapioca products like tapioca flour, animal feed and starch powder.

5.3.2 Market structure

The term market structure refers to those organizational characteristics of the market which influence the nature of competition and pricing, and affect the conduct of business firms (George and Singh, 1970). It also includes the manner of the operations of the market (Acharya and Agarwal, 1987).

Marketing of tuber crops in these area is mainly through village traders. The method of direct selling of tuber crops to consumers is found to be very rare in the study area. Consumers in general can buy tubers either from the wholesale dealers or from the retailers in the area. Marketing channels are the routes through which products move from producers to consumers. The different marketing channels identified in the marketing of tuber crops in the study are given below.

Producer - Consumer
Producer - Retailers - Consumer
Producer - Commission agent - Wholesalers - Consumer
Producer - Commission agent-Wholesaler-Retailer-Consumer

In the case of coleus and sweet potato the most important marketing channel identified was producer - commission agent - wholesaler - retailer - consumer. It was found that more than 95 per cent of farmers sold their producers to wholesaler through commission agents.

With regard to tapioca, a multipurpose crop, the tubers are either consumed directly or converted into products which can be preserved and consumed later. Moreover, tapioca products are converted into products of industrial use like starch and glucose extraction. It was found that 95 per cent of the farmers market their produce through village traders to wholesalers/mill owners from Salem and Dindigul in Tamil Nadu State as dried tubers. The study on tapioca was limited to marketing of commodity as such and no further study was taken up because of the fact that the product was diversified by the mill owners as flour.

5.3.3 Marketing efficiency

There are two aspects to marketing efficiency. One is technical efficiency and the other is economic efficiency. The latter can be assessed by different methods such as marketing costs and marketing margins, degree of market integration and temporal and spatial

price difference. In the present study marketing efficiency is assessed on the basis of marketing costs and margins.In the marketing of agricultural commodities, the difference between the price paid by the consumer and the price received by the producer for an equivalent quantity of farm produce is often known as farm retail spread to price spread (Acharya and Agarwal, 1983).

There are two concepts of marketing margins such as concurrent margin and lagged margin. The concept of concurrent margins is used in the present study in which the prices prevailing at successive stages of marketing at a given point of time are compared. In the case of coleus and sweet potato the average price received by the sample farmers are compared with prices which prevailed in Thrissur wholesale markets and retail vegetable markets.

Marketing margins for coleus and sweet potato are given in Table 5.41. In the case of coleus producers share was only 34.53 per cent out of Rs.7.24 per kilogram paid by the consumer. The village traders reaped a net margin of Rs.0.91 per kilogram (12.57 per cent) and wholesalers net margin was Rs.1.40 per kilogram (19.34 per cent). The retailers net margin was Rs.1.55 per kilogram(21.41 per cent). Marketing cost incurred by the village trader was higher than retailer and wholesaler. Marketing cost incurred by village traders, wholesaler and retailer was 8.70 per cent, 1.38 per cent and 2.07 per cent respectively on consumers' rupee.

Table 5.41. Marketing margins and costs (in Rupees per kilogram) for coleus and sweet potato in Thrissur market.

Sl.No.	Particulars	Coleus	Percentage	Sweet potato	Percentage
1	Producers' sale price or price paid by village trader	2.50	34.53	1.35	31.76
2	Transportation cost including loading and unloading charges by village trader	0.38	5.25	0.25	5.88
3	Other expenses incurred by village trader	0.15	2.07	0.15	3.53
4	Commission charge paid by village trader	0.10	1.38	0.10	2.35
5	Village trader net margin	0.91	12.57	0.65	15.29
6	Price received by village trader or price paid by wholesaler	4.04	55.80	2.50	58.82
7	Working cost of wholesaler	0.10	1.38	0.10	2.35
8	Wholesalers' net margin	1.40	19.34	0.65	15.29
9	Price paid by retailer or price received by wholesaler	5.54	76.52	3.25	76.47
10	Transportation cost incurred by retailer including loading and unloading charges	0.10	1.38	0.10	2.35
11	Working cost incurred by retailer	0.05	0.69	0.05	1.18
12	Retailers' net margin	1.55	21.41	0.85	20.00
13	Retailers' sale price or consumers' price	7.24	100.00	4.25	100.00

For sweet potato producers share was only 31.76 per cent out of Rs.4.25 per kilogram paid by consumer. The village traders reaped a net margin of Rs.0.65 per kilogram (15.29 per cent) and wholesalers net margin was also Rs.0.65 per kilogram. The net margin of retailers was Rs.0.85 per kilogram (20.00 per cent). Marketing cost incurred by village traders, wholesaler and retailer was 11.76 per cent, 2.35 per cent and 3.53 per cent of the consumers' price respectively.

As to the case of tapioca the marketing cost and margins worked out upto intermediary level are given in Table 5.42. Producers' margin was Rs.3.28 per kilogram and that of intermediate trader was Rs.0.77 per kilogram.

The economic efficiency of marketing system can be measured as the ratio of the total value of goods marketed (V) to the marketing cost (I). (ME = V/I-1). The efficiency is expressed as index of marketing efficiency. The index of marketing efficiency was 0.53 for coleus and 0.47 for sweet potato. The higher the ratio, the higher the efficiency of the marketing system. The ratio was low for coleus and sweet potato indicating the inefficiency of marketing of these crops. It was evident that the net margins realized by the intermediaries were unduly high and marketing cost incurred were low. This is the reason for higher price to be paid by the consumer and the lower price received by the producer.

Table 5.42. Marketing margins and costs (in Rupees per kilogram) for dried tapioca.

Sl.No.	Particulars	Dried tapioca
1	Producers sale price or price paid by intermediate trader	3.50
2	Transportation cost incurred by the producer including loading and unloading charges	0.10
3	Other expenses	0.12
4	Net price received by producer	3.28
5	Fixed cost on investment for intermediate trader	0.08
6	Working cost incurred by intermediate trader	0.25
7	Price received by intermediate trader or price paid by mill owners	4.50
8	Margin of traders	0.77

Summary

SUMMARY

The present study on the production and marketing of selected tuber crops viz. coleus (coleus parviflorus), sweet potato (Inpomoea batatas) and tapioca (Manihot esculenta) in Palakkad district was undertaken during the year 1994-95. The study focussed on the estimation of cost and returns and marketing system.

A two stage sampling technique was adopted for the selection of sample. Two panchayats each with the largest area under coleus, sweet potato and tapioca were selected purposively. The selected panchayats were Mundur and Kongad for coleus, Kottayi and Mathur for sweet potato and Vandazhi and Kizhakkunjeri for tapioca. Simple random sampling was followed for the selection of farmers. From each of the selected panchayats 25 farmers were randomly selected. Thus the total number of respondents of each crop came to 50 thus making a total sample of 150. The data were collected by personal interview method with the help of a well structured interview schedule. To study the marketing aspects of the above crops, information were collected from three village traders, three wholesalers and retailers each for the above crops. The sample was post stratified on the basis of area under particular crops, into class I (0-1acre), class II (1-2.5 acres) and class III (above 2.5 acres).

Tabular analysis was used to study the socio-economic features, to estimate the cost and returns,

marketing cost and margins of above tuber crops. Cost concepts were used to estimate the income measures. Functional analysis was carried out using Cobb-Douglas production function on per farm and per are basis. The function was fitted with five explanatory variables such as area (cents), human labour, farmyard manure, fertilizer and planting material cost as in the case of coleus and sweet potato. In the case of tapioca the above function was fitted without taking into consideration the planting material cost.

Total cost incurred for cultivation of coleus, sweet potato and tapioca were Rs.17593.80, Rs.9657.84 and Rs.14031.61 respectively. Input wise analysis of costs incurred for coleus, sweet potato and tapioca showed that major input for coleus was other items accounting for 45.99 per cent of the total cost followed by labour cost (29.88 per cent) and material cost (24.13 per cent). Other item includes leased in land, rental value of own land, interest on working capital, land revenue and miscellaneous expenses. Among the other items rental value of own land was highest constituting 26.01 per cent. Labour cost includes male labour (family and hired) and female labour (family and hired) of which male labour accounted highest 70.40 per cent of the total labour cost. Among the size groups class II recorded highest labour cost. Material cost comprised of cost of seed tubers, farmyard manure and chemical fertilizer. Cost on chemical fertilizer recorded the highest expenditure constituting 18.15 per cent of the total

material cost. Among the size groups class III accounted for the highest material cost and other expenses.

In the case of sweet potato major cost was on labour (37.66 per cent) of the total cost, followed by material cost and other items. Among the labour cost male labour constituted 54.96 per cent of the total labour cost and expenditure on chemical fertilizers and rental value of own land recorded highest constituting 74.40 per cent and 84.73 per cent respectively of the total material cost and other items. Among the size groups class II recorded the higher labour cost and material cost and class III recorded the highest expenditure on other items.

With regard to tapioca the highest expenditure was on other items (42.89 per cent) followed by labour cost (35.13 per cent) and material cost (21.98 per cent) of the total cost. Among the other items rental value of land was highest constituting 36.91 per cent of the total expenses on the other items and the male labour accounted for 49.33 per cent of the total labour cost and cost on farmyard manure recorded (82.19 per cent) of the total material cost. Among the size groups class II recorded the highest labour cost and class III accounted for the highest material cost and other expenses.

The cost of cultivation per hectare calculated under various cost concepts revealed that costs were higher for coleus than tapioca and sweet potato. Cost A_1, cost A_2, cost B_1, cost B_2, cost C_1 and cost C_2 for coleus were Rs.10101.74, Rs.13016.86, Rs.10101.74, Rs.17593.80,

Rs.10743.99 and Rs.18236.05 respectively, whereas the corresponding figures for tapioca were Rs.8124.94, Rs.8124.94, Rs.13304.04, Rs.8852.50 and Rs.14031.61 and for sweet potato it was Rs.6733.13, Rs.6733.13, Rs.6733.13, Rs.9079.94, Rs.7311.04 and Rs.9654.85 respectively.

A comparison of the yield of coleus, sweet potato and tapioca on per hectare basis showed that the yield was highest for coleus (9154 kg) followed by sweet potato (8801 kg) and tapioca on dry weight basis (7398.73 kg). Cost of production per quintal of coleus based on costs A_1, A_2, B_1, B_2, C_1 and C_2 were Rs.110, Rs.142, Rs.110, Rs.192, Rs.117 and Rs.199 respectively. Corresponding figures for sweet potato were Rs.77, Rs.77, Rs.77, Rs.77, Rs.103, Rs.83 and Rs.110. For tapioca it was Rs.110, Rs.110, Rs.110, Rs.180, Rs.120 and Rs.190.

Farm business income from coleus at cost A_2 for the three classes were Rs.13434.67,Rs.12987.85 and Rs.12936.07 respectively and for sweet potato the corresponding figures were Rs.6183.88, Rs.4148.95 and Rs.4859.98. In the case of tapioca it was Rs.19623.02, Rs.18099.28 and Rs.17120.05 for class I, II and III respectively.

Family labour income in the production of coleus for class I, class II and class III were Rs.8840.67, Rs.7183.16 and Rs.4239.34 respectively. For sweet potato it was Rs.3765.21, Rs.2489.87 and Rs.1377.66. In the case of tapioca it was Rs.14479.23,

Rs.12939.63 and Rs.11930.94. Family labour income for tapioca was found to be highest followed by coleus and sweet potato.

Net income also showed that production of tapioca returned a higher income than coleus and sweet potato. In the case of tapioca net income was Rs.11863.95. Net income of coleus was Rs.4648.67 and for sweet potato it was Rs.2076.20. For the three crops class I had the highest net income.

Benefit-cost ratio for coleus, sweet potato and tapioca showed that returns generated from a rupee invested was always greater than one. For coleus a rupee invested returned Rs.2.27, Rs.1.76, Rs.2.27, Rs,1.30, Rs.2.13 and Rs.1.25 based on costs A_1, A_2, B_1, B_2, C_1 and C_2, whereas the corresponding figures for sweet potato were Rs.1.74, Rs.1.74, Rs.1.74, Rs.1.29, Rs.1.60, and Rs.1.21 respectively for the corresponding costs. In the case of tapioca it was Rs.3.19, Rs.3.19, Rs.3.19, Rs.1.94, Rs.2.93 and Rs.1.85.

The result of the functional analysis showed that for coleus and sweet potato 80 per cent and 57 per cent variation in output were explained by the explanatory variables viz. labour (x_2), farmyard manure (x_3), fertilizer (x_4) and planting material (x_5). In the case of coleus fertilizer was found to be negative and significant indicating over use of this input. The production elasticity of labour was negative and insignificant showing excess use. Farmyard manure and planting material was found to be insignificant.

With regard to sweet potato, labour was found to be negative and significant indicating over use of this input. The production elasticity of fertilizer was found negative though insignificant showing excess use. Farmyard manure and planting material was fount to be significant.

Regarding tapioca the result of the functional analysis revealed that 78 per cent of variation in output was explained by explanatory variables viz. land (x_1), labour (x_2), farmyard manure (x_3), and fertilizer (x_4). The production elasticity of labour and farmyard manure was found to be negative though insignificant. The negative sign with respect to labour and farmyard manure may be due to the over use of these inputs. The high value of production elasticity of area (3.66) indicates the dominance of this particular factor.

Marketing value product of farmyard manure and planting material for coleus and sweet potato were greater than their factor cost ratio indicating that profit can be increased considerably using more units of these variable input with considerable reduction in labour and fertilizer application. A negative marginal value product of labour and fertilizer showed that these factors were used in excess quantities.

The result of the marketing analysis revealed that for coleus and sweet potato the harvested tubers were taken by the village trader from the farmers fields. They performed the role of commission agent and undertook

the functions associated with packing and transportation of the produce and transported the produce to various markets situated in Thrissur and Pollachi. Various marketing channels were identified and more than 95 per cent of the sample farmers sold their produce to wholesalers through commission agents.

The producers share for coleus and sweet potato was 34.53 per cent and 31.76 per cent of the consumer's rupee respectively. The index of marketing efficiency was 0.53 for coleus and 0.47 for sweet potato indicating the inefficiency of the marketing system. Regarding tapioca the harvested tubers are sold by farmers after processing to the local traders. They performed the role of commission agent. The produce is then taken by mill owners from Salem and Dundigul for making flour. Since there is product diversification and it is beyond the scope of this study, marketing of tapioca tubers was studied only upto the intermediary level.

In general, the study revealed that of the tuber crops studied tapioca was the most remunerative though the cost of cultivation was higher, which can be reduced by decreasing the use of labour and farmyard manure. Among the inputs, the cost incurred for other items was found to be dominant because of rent on leased in land and rental value of own land. The cost-income analysis revealed that returns obtained from tapioca was higher compared to the other two crops. The returns from coleus and sweet potato can be enhanced by restricting the use of human labour and fertilizers thereby reducing

the cost of cultivation. Benefit-cost ratio worked for the three crops also indicated tapioca to be more remunerative. The functional analysis carried for the above crops showed the overuse of labour and fertilizer for coleus and sweet potato and labour and farmyard manure for tapioca. The marketing efficiency was low for coleus and sweet potato as is evident from unduly high net margins realized by the intermediaries whereas marketing cost incurred was low. As a result of the price received by the farmers was found to be low.

Policy Suggestions

- The cultivation of tubers can be made more remunerative by the supply and use of high yielding varieties.

** The optimum cultural and fertilizer management practices for different agro-climatic regions have to be worked out so as to improve the efficiency of labour and to reduce the cost of production.

*** The increased use of tubers for industrial and other purposes can be encouraged by the development of better post harvest technology.

**** At Panchayat level farmers societies have to set up for efficient marketing system.

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ECONOMICS OF PRODUCTION AND MARKETING OF TUBER CROPS

PART I

Date of interview

1. Identification :

1.1 Name of the panchayat :

1.2 Name of the farmer :

1.3 Address of the farmer :

1.4 Approximate location of the house :

2. Code No. :

3. Family size and composition :

Name	sex	Relation to the Head of the house-hold	age	Literacy	Occupation		Annual income
					Main-sub	Other-Main	Sub-other

4. Fixed Assets :

4.1 Particulars of land holding (in cents)

Sl.No.	Particulars	Total	Wet	green	Dry	others
1.	i. Area owned					
	ii. Artea leased in					
	iii. Area leased out					
	iv. Operational area (1 + 2) - 3					

			Total	Wet	green	Dry	others
2.	i.	Value of own land (per acre)					
	ii.	Rent of leased out land (per acre)					
	iii.	Rent of leased in land (per acre)					
3.	i.	land tax					
	ii.	Water tax					
	iii.	Panchayat tax					
	iv.	Income tax					
	v.	Others					

4.2 Implements and machineries

Sl.No.	Particulars	No.	Year of purch-ase	Value in Rs.	Expected life	Value at present	Maintenance cost
1.	Plough						
2.	Sprayers						
3.	Dusters						
4.	Mummutties						
5.	Crow bars						
6.	Spades						
7.	Carts						
8.	Others(specify)						

Machineries

Sl.No.	particulars	No.	Value in Rs.	Expected life	Maintenance cost

4.3 temporary dead stock

Item No.	Value	Expected life
1. Baskets		
2. Bags		
3. Others		

5. cropping pattern

Name of crop	Season	Area in cents		no. of fragments
		Total area	Irrigated area	

Cost of cultivation of sweet potato (including harvesting)

Name of crop | Variety: | Sowing period: | Area in cents Pure / intercrop

Details of operation	Materials used			Labour used								
				Family labour								
Hired labour	Name	Qty.	Value	Male			Female			Child		
				No.	Hrs.	Cost	No.	Hrs.	Cost	No.	Hrs.	Cost
Nursery preparation												
Land preparation												
Ridges making												
Sowing												
Manuring & fertilizer												
Irrigation after cultivation												
Plant protection chemicals												
Harvesting												
Cowdung												

	Male			Female			Child		
	No.	HRs.	Cost	No.	Hrs.	Cost	No.	Hrs.	Cost

Particulars of sales

Details of harvest	Total qty.	Actual or approximate date	Mode of sale (in percentage)					Price received per quintal				
			Sale to pre-harvest contractor	Sale to village traders	Sale to consumer	Sale at the market	Others	Pre-harvest contractors	Village traders	consumers	Sale in markets	Others

MARKETING ASPECTS AT THE PRODUCERS' LEVEL

1. Total quantity produced :
2. Quantity retained for home consumption :
3. Quantity spoiled :
   a. During physical handling :
   b. Due to perishability :
4. Methode of sale

Sl.No.	Method of sale	Qty.	Price
1.	Pre-harvest contract		
2.	Sales in local market		
3.	Village marchants		
4.	Direct sale to consumer		
5.	Sales in wholesale market		
6.	Others (specify)		

5. Cost of marketing (per quintal)
   A. Cost incurred by the farmer from farm to market:
      a. Preparation of market :
      b. Loading and unloading :
      c. Transport
         I. Mode of transport :
         ii. Distance from the market :
         iii. Transport / unit / trip :
         iv. Total charges :
      d. Cleaning and grading charges
   B. Cost incurred by the farmer at the market :
      a. Gate fee :
      b. Stall fee :
      c. Commission :
      d. Brockerage :
      e. Taxes :

6. Problems regarding cultivation

a. Price
b. Pest problem
c. Transportation
d. Input cost
e. Marketing problem
f. Others, if any

INTERMEDIARIES

1. Type of intermediary :
2. Name and address :

3. Type of tuber crops handled:

Working cost

Sl.No.	Particulars	Expenditure
1.	Casual labour charges	
	1. Wages paid	
	2. pre-requisites if any	
2.	Electricity / month	
3.	Water charges / month	
4.	Taxes	
	1. Sales tax	
	2. Income tax	
	3. Local tax	
	4. Professional tax	

Volume of business per year (monthwise)

Total purchase			Total sales		
Qty.	Price/unit (Rs.)	Value (Rs.)	Qty.	Price/unit (Rs.)	Value (Rs.)

Source of funds for business :

a. Total amount :

b.

c. Borrowings (Rs.) :

d. From other sources, if anf (Rs.) :

e. Terms on which money is borrowed. :

ECONOMICS OF PRODUCTION AND MARKETING OF TUBER CROPS IN PALAKKAD DISTRICT

By
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ABSTRACT OF THE THESIS

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ABSTRACT

The present investigation on the economics of production and marketing of tuber crops viz. coleus, sweet potato and tapioca in Palakkad district was undertaken during the year 1994-95. The study focussed on estimation of cost and returns and marketing system.

Data for the study was generated through a sample survey of farmers, village traders, wholesalers and retailers. Two stage sampling technique was adopted for the study, with panchayats selected purposively and sample farmers by random sampling method. The sample size for each crop was 50 making a total of 150 sample respondents.

The results of the cost structure analysis revealed that the largest single item of expense was rental value of own land for coleus and tapioca and for sweet potato chemical fertilizer had the highest expense. Among the explicit cost items male labour accounted the highest share in coleus while rental value of own land and farmyard manure were the most important item in sweet potato and tapioca respectively.

Cost A_1, Cost A_2, Cost B_1, Cost B_2, Cost C_1 and Cost C_2 per hectare was Rs.10101.74, Rs.13016.86, Rs.10101.74, Rs.17593.80, Rs.10743.99 and Rs.18236.05 respectively for coleus and Rs.8124.94, Rs.8124.94 Rs.13304.05, Rs.8852.50 and Rs.14031.61 respectively for tapioca and Rs.6733.13, Rs.6733.13, Rs.6733.13 and

Rs.9079.94, Rs.7311.04 and Rs.9654.84 respectively for sweet potato.

The average per hectare yield of coleus, sweet potato and tapioca were 9154 kg, 8801 kilogram and 7398.73 kilogram respectively. Benefit-cost ratio for coleus was Rs.2.27, Rs.1.76, Rs.2.27, Rs.1.30, Rs.2.13 and Rs.1.25 based on costs A_1, A_2, B_1, B_2, C_1 and C_2 where as the corresponding figures for sweet potato were Rs.1.74, Rs.1.74, Rs.1.74, Rs.1.29, Rs.1.60 and Rs.1.21 respectively. In the case of tapioca Benefit cost ratio was Rs.3.19, Rs. 3.19, Rs.3.19, Rs.1.95, Rs.2.93 and Rs.1.85.

The income measures in relation to different cost concepts, in coleus cultivation such as gross income, farm business income, family labour income, net income and farm investment income were Rs.22884.72, Rs.12782.98, Rs.5290.92, Rs.4648.67 and Rs.12140.73 respectively and Rs.11734.04, Rs.5000.91, Rs.2654.10, Rs.2076.20 and Rs.4423.00 respectively for sweet potato and Rs.25895.56, Rs.17770.62, Rs.12591.51, Rs.11863.95 and Rs.17043.06 respectively for coleus.

Functional analysis was carried out using Cobb-douglas production function and the results revealed that for coleus fertilizer was found to be negative and significant. The production elasticity of labour was negative and insignificant. Farmyard manure and planting material were found to be insignificant. With regard to sweet potato labour was found to be negative and

significant and the production elasticity of fertilizer was found to be negative though insignificant. Farmyard manure and planting material was found to be significantly influencing production. Regarding tapioca the production elasticity of labour and farmyard manure was found to be negative though insignificant. The high value of production elasticity of area indicated the dominance of this particular factor. Marginal value product of farmyard manure and planting material for coleus and sweet potato were greater than their factor cost ratio and was negative for labour and fertilizer.

In the case of marketing of coleus and sweet potato more than 95 per cent of the produce was sold to wholesalers through commission agents. The producer's share was only 34.53 per cent and 31.76 per cent of the consumers' rupee for coleus and sweet potato respectively. The index of marketing efficiency was 0.53 for coleus and 0.47 for sweet potato. Regarding tapioca the tubers were sold by farmers after processing to the local traders who performed the role of commission agent and from them produce is taken by mill owners of Salem and Dindigul. Since there is a product diversification the marketing of tapioca tubers was studied only upto the intermediary level.