

**PRODUCTION AND PROCESSING OF TAPIOCA  
IN SALEM DISTRICT OF TAMILNADU -  
AN ECONOMIC ANALYSIS**

*By*

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ACHARYA N. G. RANGA AGRICULTURAL UNIVERSITY  
IN PARTIAL FULFILMENT OF THE REQUIREMENTS  
FOR THE AWARD OF THE DEGREE OF  
MASTER OF SCIENCE IN AGRICULTURE  
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**JULY, 2001**

## CERTIFICATE

Miss. S.D. VAISHNAVI, has satisfactorily prosecuted the course of research and that the thesis entitled "PRODUCTION AND PROCESSING OF TAPIOCA IN SALEM DISTRICT OF TAMILNADU - AN ECONOMIC ANALYSIS" submitted is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination. I also certify that the thesis or part thereof has not been previously submitted by her for a degree of any University.

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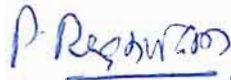
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## CERTIFICATE


This is to certify that the thesis entitled "PRODUCTION AND PROCESSING OF TAPIOCA IN SALEM DISTRICT OF TAMILNADU - AN ECONOMIC ANALYSIS" submitted in partial fulfilment of the requirements for the degree of 'MASTER OF SCIENCE IN AGRICULTURE' of the Acharya N.G.Ranga Agricultural University, Hyderabad is a record of the bonafide research work carried out by Miss. S.D. VAISHNAVI, under my guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee.

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

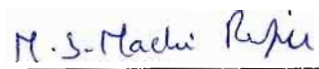
  
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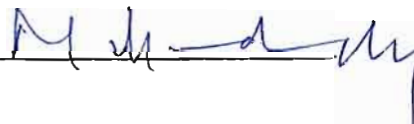
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## DECLARATION

I, Miss. S.D. VAISHNAVI, hereby declare that the thesis entitled "PRODUCTION AND PROCESSING OF TAPIOCA IN SALEM DISTRICT OF TAMILNADU - AN ECONOMIC ANALYSIS" is a result of original research work done by me. It is further declared that no thesis or any part thereof has not been published earlier in any manner.

Date : 20.9.2001

*Vaishnavi S.D.*  
( S.D. VAISHNAVI )

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## ABSTRACT

Name of the Author : **S.D. VAISHNAVI**

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The present study entitled "**Production and Processing of Tapioca in Salem District of Tamilnadu - An Economic Analysis**" was undertaken mainly to study the costs and returns of production and processing. The study covered two taluks, six villages and a sample of 60 farmers representing 31 large and 29 small farmer. The study also covered 15 processing and five each from starch, nylon sago and roasted sago units. The data pertained to 1999-2000 agricultural year, which were collected through survey method with the help of pre-tested schedule. Tabular and break-even analysis were used to analyse the data and to arrive at valid conclusions

The total human labour use in tapioca cultivation in terms of mandays per hectare was 191.05, 210.65 and 201.17 on small, large and pooled farms respectively indicating the prevalence of direct relationship between the size of holding and human labour utilisation.

The total cost of cultivation of tapioca per hectare worked out on an average to Rs. 31,513.93 of which operational costs and fixed costs accounted for 59.17 per cent and 40.83 per cent respectively.

The income measures viz., gross, net, farm business, family labour and farm investment income were higher on large farms compared to small farms. The return per rupee of investment was Rs. 1.67, Rs. 1.83 and Rs. 1.76 on the corresponding farms respectively.

The total investment was of the order of Rs. 26,35,000, Rs. 40,88,000 and Rs. 36,29,000 on starch, nylon sago and roasted sago units respectively.

Cost incurred to process one quintal of tapioca raw tubers was Rs. 288.14 for starch units, Rs. 393.01 for nylon sago units and Rs. 333.55 for roasted sago units.

The starch units on an average realised 11,430 quintals of starch and nylon sago units 6,075 quintals of nylon sago and roasted sago units 6,374.98 quintals of roasted sago.

The returns per quintal of tapioca processed into nylon sago amounted to Rs. 406.34 and to roasted sago amounted to Rs. 359.89 and to starch amounted to Rs. 308.64

The break-even output of starch units was 3,896.76 quintals, for nylon sago units it was 2,911.42 quintals and for roasted sago units it was 1,668.55 quintals. The margin of safety which was surplus over break even output was 7,533.24 quintals for starch units, 3,163.58 quintals for nylon sago units and 4,706.44 quintals for roasted sago units.

INTRODUCTION

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# *Introduction*

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# CHAPTER I

## INTRODUCTION

Tuber crops are plants which produce structures that are used as human or animal feed. They are the third important food crops of human beings after cereals and grain legumes and constitute either staple or subsidiary food for about a fifth of the world population. Tropical root and tuber crops (TRC) have their own role as an important staple in several countries in South America, Africa, South east Asia etc.

In spite of the near satisfactory level of production of cereals and grain legumes, the socio-economic conditions of small and marginal farmers in most countries in the above regions, necessitated them to depend on the tropical root and tuber crops (TRC) as their staple.

Tuber crops have a higher biological efficiency as food producers and show the highest rate of dry matter production per day per unit area among all the crops. They are also recognised as the most efficient converters of solar energy. Tuber crops are known to supply cheap source of energy especially for the weaker sections of the population. They have the capacity to withstand adverse biotic and abiotic stresses. These crops are very important in the context of food and nutrition security and assume greater relevance due to the ever increasing population.

Tapioca is unparalleled in its usefulness since all parts of the crop are beneficial in one way or the other. Tapioca tubers can produce  $250 \times 10^3$  calories / hectare / day, compared to  $176 \times 10^3$  for rice and  $110 \times 10^3$  for wheat, indicating the superiority over cereals in terms of energy yield.

Tapioca (Cassava) can be used as raw material for a number of value added industrial products such as starch, sago, liquid glucose, dextrin, Vitamin C, gums and high fructose syrups. Industrial starch finds its application in various fields. The major consuming industries are the cotton textile, jute textile industry and paper and hard board industry. Cassava starch which possesses the advantageous, physio-chemical and structural properties can be easily converted into liquid glucose and dextrose which are widely used in food and pharmaceutical industries.

Cassava can serve as a nucleus for many industries with the application of biotechnology especially fermentation industries. In India two companies have already started building up the infrastructural facilities for the production of alcohol from tapioca. Sorbitol and Vitamin C, plants using tapioca as a raw material have been established in Madhya Pradesh. Tapioca continues as the unchallenged monopolised raw material for sago production in India.

The enormous potentialities of tapioca as a raw material for industry will be an insurance for the thousands of marginal farmers for their produce. The prosperity of Indian villages depends mainly on the farming community and the reasonable income generated from their produce. Tapioca, the crop of the poor is not an exception to this.

Globally 58 per cent of tapioca produced is used as food, 28 per cent as feed, 4 per cent in alcohol and starch based industries and 10 per cent is spoiled.

Considering the importance of the tuber crops, the Central Tuber Crops Research Institute (CTCRI) was established in 1963 at Thiruvananthapuram to carry out research on all aspects of tuber crops. The tapioca market expansion board came up in 1972. In Tamil Nadu, tapioca research station was established in 1971 at Salem and it was later shifted to Mulluvadi in Attur taluk in May, 1977. Under the state industries department, a sago testing and research laboratory has been functioning at Salem since 1964. Under the Ministry of agriculture and irrigation, Government of India, started sago fortification project at Salem to develop fortified products based on sago. The Salem District, Starch and Sago Manufacturers Service Industrial Co-operative Society known popularly as SAGOSERVE was established by the Government of Tamil Nadu, in February 1982 with a view to safeguard the

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interests of starch and sago manufacturers by arranging the sale of products on a daily closed tender sale system.

Tapioca is grown in an area of 16.37 million ha globally with annual output of 164.75 million tonnes of tubers. Nigeria occupies first position in area under tapioca accounting for 16.50 per cent of the world area producing 18.50 per cent of the world tapioca. Congo (2.1 million ha), Brazil (1.91 million ha), Thailand (1.26 million ha), and Indonesia (1.3 million ha) are the other major tapioca growing countries, constituting 50 per cent of the area, producing 64 per cent of the world tapioca. The world average productivity is 10 tonnes / ha.

In India tapioca is cultivated in 0.24 million ha producing 6. million tonnes. The area and production followed the global trends in the early nineties but stagnation has set in. Kerala, where the crop was first introduced in India accounted for 50 per cent of the area under tapioca (0.13 million ha), Tamilnadu accounts for 32 per cent of the area (0.08 million ha) and 9 per cent of area in Andhra Pradesh (20,000 ha). It is interesting to note that though India does not have a major area under this crop, its productivity is the highest in the world (24.50 tonnes / ha)

Though Kerala ranks first in the cultivation and production, Tamilnadu stands first in the processing of tapioca into starch and sago, meeting 80% demand at national level in food and non-food areas. Salem district ranks first in the area (37,000 ha) and production (11,84,000 tonnes) of tapioca in Tamil Nadu. Salem, South Arcot, Dharmapuri, Periyar and Trichy are the important districts of Tamil Nadu, where tapioca processing has made great strides by establishing about 800 small scale sago and starch industrial units. Out of 800 units in the state, about 750 units are operating in Salem district alone.

Processing implies the work which changes raw materials into finished product. Many agricultural products such as milk, eggs, fruits, and vegetables may be consumed in the form in which they leave the farm. But greater part of the produce sold by farmers is now subject to further processing or even manufacture, before it reaches the final consumer into a consumable form. Therefore, the study of processing industries in agriculture commodities is of vital importance. It is important both for producer and the consumer. The farmer is interested in getting a higher share in the consumer's rupee and the latter is interested in offering as low a price as possible for the quality and form derived by him.

Tapioca has to undergo several stages after the harvest to get converted into starch and sago. These stages constitute the post-harvest technology

stages viz., peeling and washing, rasping, screening, dewatering, pulverization, globulation, sizing, roasting, drying, polishing, dry screening and packing. Processing units enter into the picture precisely at this juncture. They undertake the risk of performing all the above vital functions and forms an important link between producers and consumers. The processing units play an important role in accelerating the country's socio-economic development. Establishment of processing units in large numbers has a direct bearing on the area under crops which require processing before reaching the end users. The growth of processing units will contribute to the increase in acreage and production of tapioca and gives the scope for increasing the productivity levels of this crop. It also provides scope for development of rural areas by generating employment avenues and income.

In this context, it is felt necessary to conduct a micro level study and examine the economic aspects of production, and processing of tapioca.

### **1.1 OBJECTIVES :**

The study has been undertaken with the following objectives:

1. to estimate the costs and returns in tapioca production.
2. to estimate the investment required for different types of processing units and recovery performance of the processing units.
3. to study the costs and returns in tapioca processing and
4. to study the utilization pattern of byproducts in tapioca processing.

## **1.2 SCOPE OF THE STUDY :**

The study provides information on the cost structure, productivity and returns from tapioca cultivation. These particulars help the farmers to plan their input use in a better way for higher production. The economic aspects of processing throw light on costs and returns from tapioca processing. The information would be useful to the entrepreneurs interested in establishing processing units and also help in introducing changes in the production strategy to increase output and returns.

## **1.3 LIMITATIONS OF THE STUDY :**

The study has been conducted over a limited period of time in a limited area of particular agro-climatic and socio-economic situation and hence suffers from drawbacks. The conclusions drawn are applicable to that area and the areas with similar conditions. The necessary primary data regarding the cultivation of tapioca were collected from the farmers based on their recall memory by survey method and hence has inherent limitations. The necessary data required to compute costs and returns from processing were obtained from the processors who are generally suspicious of the motives of any investigator for fear of taxation. However, they are told about the purpose of the study and obtained accurate information.

#### **1.4 PLAN OF THESIS :**

The thesis is presented in five chapters. The first Chapter deals with the introduction highlighting the importance of tuber crops in general and tapioca in particular along with the objectives, scope and limitations of the study. The second Chapter is devoted to review the past research work done. The third Chapter deals with sampling procedure, collection of data and analytical tools employed. The fourth Chapter encompasses a critical analysis of the results and discussion. The final Chapter presents the summary and conclusion of the study.

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*Review of Literature*

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## **CHAPTER - II**

### **REVIEW OF LITERATURE**

For any investigation the findings of earlier studies may possibly give indications of the problems and provide guidelines for present study. In addition, the earlier studies provide the lacunae in the existing information and form the basis for formulating new studies. In this chapter a review of related studies pertaining to the economics of production and processing of tapioca and other related crops is presented under following heads.

#### **2.1 STUDIES ON PRODUCTION ASPECTS and**

#### **2.2 STUDIES ON PROCESSING ASPECTS**

#### **2.1 STUDIES ON PRODUCTION ASPECTS**

Singh and Singh (1960) reported in their study that the average cost of production of potatoes giving an average out turn of 197.57 mounds of tubers per acre came to Rs. 889.92, largest single share of which namely 34.8 per cent was accounted for by seed. Of all the operations, cultivation and sowing required the largest single amount of expenditure which accounted for 23.8 per cent of all manual labour and 37.2 per cent of all bullock labour followed by watering which required 14.4 per cent of manual labour and 50.1 per cent of bullock labour. Average gross income stood at Rs. 1360.68 per

acre. On an average the gross income was 150 per cent of expenditure, the profit thus being 50 per cent.

Sriraman and Srinivasan (1965) worked out the cost of production of tapioca under both irrigated and rainfed conditions in the districts of Salem and Kanyakumari for the year 1963. The cost of production per quintal of rainfed tapioca in Kanyakumari district ranged from Rs. 6.10 to Rs. 9.60 per quintal. The difference was due to variation in the yield. The yield per acre of rainfed crop in Kanyakumari district varied from 1450 kgs to 3600 kgs. The cost of production of irrigated tapioca in Salem district varied from Rs. 6.00 to Rs. 6.84 per quintal. The average cost of production of tapioca for the state as a whole worked out to Rs. 7 per quintal for the year 1963.

Shukla (1968) reported in his study that the average cost of cultivation per acre of potato was Rs. 687.62 while the value of gross produce was Rs. 1740 giving a net profit of Rs. 1052.38 per acre even with the traditional mode of cultivation.

Tayab (1976) estimated the total yield of protein from tapioca leaves per hectare as 90 kilograms and the value of this protein at the rate of Rs. 3 per kilogram was Rs. 270 which was more or less equal to 18 per cent of the income from tubers. He also observed that the stem yielded Rs. 1000

worth of paper per hectare with 50 per cent recovery. This was equal to about 70 per cent of saleable value of tubers.

Pandian and Pillai (1978) worked out the cost of cultivation of irrigated tapioca in Kalkulam taluk of Kanyakumari district at Rs. 662 per acre. The average yield was 8.3 tonnes and the tubers were valued at a price of Re. 0.20 per kilogram. Thus the profit margin was 152 per cent.

Naik and Patnaik (1986) observed that average gross returns with investment of one rupee per hectare of potato in Orissa during period 1975-76 to 1981-82 worked out to Rs. 2.02, Rs. 1.91, Rs. 1.36 and Rs. 1.08 respectively at Cost A<sub>1</sub>, Cost A<sub>2</sub>, Cost B and Cost C. The potato growers received Re. 0.80 to Rs. 1.93 of gross returns per rupee of investment at Cost C.

Rezvi and Singh (1987) reported in their study that per hectare production of potatoes stood at 256.63 quintals and per hectare production of potato has been noted higher in case of the large potato growers followed by medium potato growers.

Nath (1988) in his study on economic aspects of maize production in Karimnagar district of Andhra Pradesh reported that the proportion of paid

out costs in irrigated maize ranged from 61.50 per cent to 65.95 per cent of total costs. The proportion of paid out costs in rainfed maize has indicated a direct relationship with farm size and ranged from 54.10 per cent to 59.99 per cent. In both irrigated and rainfed maize, the break even analysis revealed the profitable nature of maize cultivation since the average yield was more than the break even output in both the cases.

Balakrishnan and Shanmugam (1990) studied the economics of tapioca production in irrigated and rainfed conditions and revealed that in irrigated farms among the variable costs, the cost of manure and manuring ranked first with 20.69 per cent followed by expenditure on after cultivation with 14.18 per cent. In rainfed farm cost of manures and manuring ranked first with 19.67 per cent of total cost followed by cost of setts and planting with 17.48 per cent. The net returns per hectare for irrigated crop and rainfed crop were Rs. 6429.70 and Rs. 3078.15 respectively. The cost benefit ratio was 1:1.58 for irrigated crop and 1:1.49 for rainfed tapioca.

Gopikrishna (1991) revealed in his study that the total cost of production of tapioca per hectare stood at Rs. 7,446. There is a direct relationship between farm size and cost of production. Maximum expenditure was on human labour (Rs. 2440) followed by manure, fertilizer, rental value of owned land and setts. Productivity per hectare was 189 quintals per hectare

with Rs. 39 per quintal. Productivity was highest on large farms. The average net income was Rs. 1350. Farm business income was Rs. 1710 per hectare.

Elsamma and Balakrishnan (1991) conducted the cost-benefit analysis in cassava and reported that most important input in terms of cost was hired human labour which accounted for 54.19 per cent of total cost. The next expensive item was organic manure which contributed 18.81 per cent to total cost. The total returns were found to be Rs. 7362 per hectare. The benefit cost ratio worked out to 2.07. While comparing the cost between small and large farmer they observed that the total cost of cultivation was 51.15 per cent higher on small farms than that of large farms.

Pal *et al.* (1992) in their study about cost of cultivation of cassava in Kerala observed that nearly 53-60 per cent of the total production cost was due to labour. Farm yard manure and fertilizers were next in order of importance and around 24-32 per cent of the cost was spent towards the purchase of these inputs. They also compared the costs and returns by cultivating local varieties, high yielding variety-I and high yielding variety-II and found that cost of cultivation for the local varieties stood at Rs. 5,500 per hectare and an additional expenditure of Rs. 2180 per hectare was incurred for high yielding varieties grown under recommended conditions. The net income for local variety, HYV-I and HYV-II were Rs. 8188, Rs. 7604

and Rs. 5362 per hectare respectively. From the study it was concluded that a mere replacement of local varieties by high yielding varieties could benefit the cassava farmers to the extent of Rs. 2242 per hectare.

Sharma *et al.* (1992) revealed in their study that small farmers received from Zaid-Rabi potato cultivation a gross return of Rs. 38,250 while large farmers received Rs. 30,469 and all farms Rs. 35,189. Variable cost worked out to Rs. 9,785, Rs. 8,815 and Rs. 9,156 for small, large and all farm respectively. The respective net returns stood at Rs. 28,465, Rs. 21,654 and Rs. 26,033 on small, large and all farms.

Sikka and Vaidya (1992) reported in their study that Cost  $A_1$  was about Rs. 10,107 per hectare. The Cost  $A_1$  and  $A_2$  were found to be the same in the absence of leasing in activity. The cost C was worked out to be about Rs. 17,698 per hectare for the overall sample. The cost of production calculated was Rs. 123.33 per bag.

Balakrishnan and Thamburaj (1993) found that the benefit - cost ratio of tapioca intercropped with blackgram recorded the maximum of 1.98 followed by tapioca + groundnut (1.88) and tapioca + cowpea (1.85).

Dahiya and Pandey (1993) reported the cost of cultivation of potato and net returns at Rs. 18,475 and Rs. 2,998 per hectare respectively, based on a case study of Matiana block of Shimla district conducted in 1989-90. The input-output ratio was 1.16.

Singh and Kishore (1995) in their study on production performance of potato in district Furrukhabad observed that the average yield of Kufri Chandramukhi and Kufri Badshah varieties of potato was 206 and 228 quintals per hectare respectively. The gross income amounted to Rs. 33,008 and Rs. 36,119 and net income came to Rs. 13,300 and Rs. 15,206 per hectare for these two varieties of potato respectively. The average cost of production per quintal for the former variety was higher, at Rs. 96 as compared to Rs. 92 for Kufri Badshah. The average gross income and net income of Kufri Badshah were higher than those of the Kufri Chandramukhi variety, due to the higher yield of the former.

Dahiya and Singh (1997) in their study on horticultural development in Himachal Pradesh. Profitability, policy and prospects observed that the total cost per hectare for potato cultivation was Rs. 7,932 and gross returns per ha stood at Rs. 11,845. Net returns per hectare was Rs. 3,913 and input-output ratio came to 1.49.

Gupta *et al.* (1997) found out in their study that the average cost per hectare of potato was Rs. 25,455 which was consistent in all the size-groups. The output per hectare was Rs. 57,621 and the average net return per hectare was Rs. 32,166. In potato cultivation sowing operation was found to be labour intensive. Therefore the item seed and sowing constituted 43 per cent of the total cost. Fertilizer cost, marketing charges and cold storage charges accounted for 9, 9.35 and 8 per cent respectively of the total cost. The proportion of cold storage charges increased with the increase in the size of holdings. Comparative figures on cost, output and profit per hectare of potato, soybean and wheat showed that the profit per hectare of potato was much higher than that of soybean and wheat. Labour days requirement per hectare was the highest (223 days) for potato.

Verma and Rajput (1998) revealed in their study that the average input - output ratio in potato production varied from 1:1.86 at cost  $C_2$  to 1:206 at cost  $A_2$ .

## 2.2 STUDIES ON PROCESSING ASPECT :

Sriraman and Srinivasan (1965) while preparing a report on marketing of tapioca in Madras state found that sago and starch factories in Salem district were the important assembling points for tapioca tubers whereas in Kanyakumari district there were separate assembling centres for tapioca. They

worked out the share of the producer in the consumer price as 65 to 70 per cent for tapioca.

Brown's (1966) study revealed that when 4 per cent bran was removed, the modern rice mills were producing 72-74 per cent out turn of rice compared with 65-68 per cent out turn with traditional huller and sheller type mills. The rice had less broken grains and unhusked paddy and availability of rice for human use increased by 6 to 12 per cent.

Kahlon and George (1966) indicated that the percentage of value addition to the total value produced by processing at the farm level varied from nearly 7 per cent with respect to rice and 86 per cent for tea. It was generally higher for commercial crops compared to food crops.

Chandrachud (1966) in his study on co-operativization of groundnut processing concluded that each oil mill expected to run for 300 days is rated to process about 1,200 tonnes of groundnut valued at Rs. 18 lakhs to give about 360 tonnes oil and 40 tonnes oil cake valued at Rs. 16 lakhs and Rs. 3 lakhs respectively.

Shukla and Pandey (1966) in their study on location and role of mustard and rape seed processing industry in Hissar observed that the margin

of profit on one quintal of mustard and rape seed in large, medium and small sized mills was Rs. 7.02, Rs. 4.86 and Rs. 3.43 respectively.

Mukherjee (1973) pointed out that, rubber roll sheller (modern) rice mill gave an overall increase in total rice out turn averaging 2.5 per cent over that of under - run disc sheller mills and 6.6 per cent over than of the huller mills.

Singh and Sidhu (1974) in their study on economics of groundnut processing industry in Punjab worked out the per quintal fixed costs in large, medium and small mills at Rs. 0.50, Rs. 1.14 and Rs. 0.58 respectively. The variable costs on per quintal basis for decortication and crushing were found to be Rs. 118.72, Rs. 119.74 and Rs. 118.27 in large, medium and small mills respectively. The respective per quintal total cost in the above sized mills was Rs. 119.23, Rs. 120.87 and Rs. 118.85. The net profit margin for processing one quintal of ground nut pods in large, medium and small mills was found to be Rs. 31.16, Rs. 24.85 and Rs. 23.33 respectively. In large sized mills the fixed costs were saddled on the greater number of units produced and the resultant unit cost of production of oil was found to be low as compared to the smaller unit.

Uthamalingam (1979) computed the total return from tapioca processing units as the total value of the output (starch or sago) and the value of by-products viz, tippi and peeled skin.

Ipte and Borude (1982) in their study on economic study of marketing and processing of cashewnut showed that the wages and salaries had taken the largest share of cost of processing.

Rao *et al.* (1982) observed that oil palm nuts have been processed using conventional oil mill equipment. It deshelled and the fractions with 80 per cent kernel and 20 per cent shell was expelled giving 32 per cent oil. Palm kernel oil is refined and bleached to light colour.

Keddie *et al.* (1983) considered three main stages of processing viz., pre-processing stage (drying, crushing and scorching), the oil extraction stage and the post treatment stage filtering, cake breaking, packing and bagging). They suggested various policy measures for the promotion of the right mix of the oil extraction techniques that will minimize production costs and improve the quality of the oil produced

Kahlon and George (1985) putforth that, milling recovery rate of rice was 67.71 per cent for modern rice mills. It was about 60 per cent for hand pounding, 61-65 per cent for hullers and 62-63 per cent for shellers.

Rajeswari (1986) in her study on performance analysis of cashew industry indicated that the estimated expenditure on processing of raw material (raw cashewnuts) was Rs. 246/- per 80 kg of raw cashewnuts. Packing and shipping charges amounted to Rs. 53.27.

Reddy *et al.* (1986) in their study on harvesting, processing, grading and marketing of cashewnut reported that the approximate expenditure for processing of one tonne of raw nuts was Rs. 12,350/-. Expenditure on processing included the costs incurred on drying / roasting, shelling, peeling, grading and packing, the different stages of processing of raw cashew nuts.

Hasan and Raghuram (1987) observed that the processors were to incur a processing cost of Rs. 87.06 per 80 kgs of raw material of which major share was on payments to labour (56.60%). The share of material cost stood at 42.5%. They found that the shelling and peeling were the two operations which were observed to be highly labour intensive.

Acharya and Agrwal (1987) observed that the cost of processing per quintal of ground nut shell/sesame stood at Rs. 20.50 with a 6 bolt expeller.

Pal *et al.* (1987) conducted a techno-economic survey of small scale cassava based starch units in Kerala and reported that, at tubers prices of Rs.

500/- per tonne and starch at Rs. 197/ bag of 90 kg at 20 tonnes per day, starch unit operating at 100 per cent capacity received a net profit of about Rs. 31,000. The net cost of production of starch after deducting the value of tippi from the total cost was Rs. 2.15 / kg . The break - even percentage of a 20 t / day unit was 66.

Chauhan and Ali (1988) reported in their study that cost of processing of gram was Rs. 31.21 Break - even value for processing units was estimated to be 5842.45 quintals.

Arora *et al.* (1988) observed that the co-operative sector plant was found to be most inefficient having a processing cost of Rs. 90.16 per quintal against a private sector plant where the processing cost was Rs. 54.20 only, for soybean processing in Uttar Pradesh. Further they concluded that the processing cost of soybean could be reduced by increasing the use of available installed capacity, optimum use of input (Hexane), power and fuel.

Rajgopal (1988) found that, the losses due to equipment as percentage of paddy fed was higher in the case of hand pounding units when compared to hullers and other rice mills in organised sector. The breakage of grains was also found to be more in hand pounded rice and hence the demand for hand pounded rice was found to be low in rural area.

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Rajagopal (1989) revealed that efficiency of paddy processing varied according to the type of milling and its capacity utilisation. He also observed that the preference for the huller type rice mills was found higher than sheller type as they were easily accessible to the farms, while the sheller type mills were found in the co-operative sector.

Sikka *et al.* (1989) studied the economics of potato processing at village level in Nainital district of Uttar Pradesh and found that 480 quintals of potatoes were processed during the entire season of about three months. The operating cost was Rs. 53,850 and after including interest on fixed and working capital at 12 per cent per annum and rental value of land at Rs. 2,000 per acre. The total cost of production came to Rs. 66,299. The processing of 480 quintals of potatoes yielded only 77.52 quintals of potato chips. The recovery being only 17 per cent. The sale of that at Rs. 11 per kg fetched a gross income of Rs. 85,272 and thus a net profit of Rs. 2.45 per kg and the profit over total cost of production was 28.65 per cent.

Agarwal (1989) estimated the profit margins earned from processing of one quintal of rape and mustard oil seeds at Rs. 19 and Rs. 21 in six bolt and nine bolt expellers respectively and Rs. 22 in oil mills. Dal mill owners earned a profit margin of Rs. 22 from processing of one quintal of gram and Rs.27 from moong. It was also found that all processing units of oil seeds

were operated at a level higher than their break even quantity but lower than intake capacity due to lack of availability of raw material.

Jagadiswar (1989) observed that the processing costs per quintal of groundnut oil production was highest in case of category - IV (Rs.2525.09) compared to all other categories because of higher repair (6.14 per cent of total processing costs) and depreciation charges (1.59 per cent) per quintal of oil produced. In all categories of oil mills, the variable costs constituted maximum proportion of total costs, which ranged from nearly 97 per cent to 99 per cent. The reason for this might be due to higher cost of raw material in all categories of oil mills which accounted for nearly 77.57 per cent.

Bawa and Kanth (1989) found that expenses on raw material (paddy) constituted the major item of the total cost (85 per cent) of processing. Running expenditure on machinery and repairs and maintenance constituted 1.96 per cent and 1.10 per cent respectively and also observed that, depending upon the quality of paddy its moisture content and polishing limits required, the recovery rate varied significantly

Naik and Patnaik (1989) examined the impact of agro-based industries like rice mills, turmeric mills and cold storage for storage of vegetables on farm prices, marketing costs and margins. The operation of rice mill in the

producing area increased the producer's price from Rs. 159 to Rs. 163 per quintal of paddy. Further, the establishment of rice mill has significantly reduced the total marketing costs and margins from Rs. 80 to Rs. 65.50 per quintal. However, the producer's share over the cost of production was marginal, being only Rs 2.14 per quintal in the case of marketing channel with three middlemen (situation II). The turmeric growers received the highest share in situation II due to the operation of turmeric milling industry in the primary market. The growers in situation II marginally gained by Rs. 2.72 over cost B and the loss incurred was lowest being Rs. 103.50 per quintal over cost c as compared to other situations. Due to the operation of cold storage in the primary markets the producer's share was maximum and stood at 43.34 per cent per quintal of potatoes in direct selling.

Sharma and Rajkumar (1989) estimated the processing cost per quintal of mustard at Rs. 26 and Rs. 23 in the case of six blot and nine bolt expellers respectively. On an average six bolt expeller processed 140 quintals of mustard and realized a net income of Rs. 11,406 during a year. The employment created by six blot and nine bolt expellers in the district, during the year was to the extent of 3,675 and 51,100 days respectively.

Srivastava (1989) in his study on agro-processing industries-Potential constraints, identified the major problems in agro-processing viz. the

inadequacy and availability of raw material, short period of raw material availability and excessive costs of raw material. The constraints on processing and marketing were related to technology, market development and financial aspects.

Dalvi (1989) observed in his study that per quintal cost of processing of cashewnuts was Rs. 331 of which major share was taken by interest on capital (51 per cent). Overall rate of capital turn over was 122.53 per cent and the returns to investment was 28.30 per cent. The overall gross and net returns per worker per day were Rs. 269 and Rs. 48 respectively, while per day worker quantity of nuts processed was 0.11 quintals.

Natesh and Zeandeer (1991) in their study on an economic analysis of groundnut oil processing reported that groundnut oil processing has been profitable which could be increased by crushing more. They also observed that all the processing units were producing high above the break-even point of production even though they were producing very low when compared to their total installed capacity.

Srinivas (1991) estimated the total processing costs per bag (80 kg) of cashewnuts at Rs. 124.22 which involved various stages. The cost of drying, roasting and, shelling of nuts, drying of shelled kernels, peeling, grading and

conditioning of graded kernels and packing of graded kernels stood at Rs. 3.80, Rs. 7.82, Rs. 3074, Rs. 1.00, Rs. 21.82, Rs. 5.80, Rs. 0.64 and Rs. 52.60 respectively.

Kumar and Rai (1994) estimated that for raw paddy milling, shaft power requirement constituted the major portion of energy consumption in a modern rice mill. Proper maintenance and operation of various equipment of a modern rice mill was considered to conserve substantial amount of energy which would result in higher recovery of white rice and reduction in broken percentage.

Kurup *et al.* (1995) reported in their study that for elimination of drudgery involved in the traditional way of slicing the cassava tubers, the pedal operated cassava machine can be used. Assuming that the average capacity of the machine is 300 kg/hr (40 per cent of maximum capacity) and the farms run the machine on custom basis @ Rs. 10 per quintal, the profit obtained per year would be Rs. 5376.00

Thangavel *et al.* (1996) in their study on performance of stress mechanism in starch settling tanks of cassava reported that the operational cost of the stirrer for one batch of settling was found to be Rs. 80/- and 46.7 per cent savings in cost were observed.

Malliswari (1996) estimated processing costs of one tonne of mango pulp at 8455 for totapuri variety. Cost of packing stood at Rs. 6,774. At sale price of Rs. 17,000 the net profit was Rs. 1,771.

Sakia and Talukdar (1996) observed that powder recovery was the highest in chilli and turmeric and the lowest in coriander. The feasible normal capacity varied from 1.5 quintals in turmeric to 3.5 quintals in chilli. The highest net capacity utilisation of 53.33 per cent was in turmeric processing. All the spice processing units operated below the feasible normal capacity. The average capital investment in commercial processing units was Rs. 1.20, Rs. 0.94 and Rs. 0.78 lakh respectively. The net value added per quintal was Rs. 140.24, Rs. 106.37 and Rs. 128.65 for chilli, coriander and turmeric respectively. BEO was 92.67, 82.88 and 67.28 quintals for the corresponding products.

Singh and Hussain (1996) studied costs and returns of processing of wheat in Jammu district. The net return per quintal of wheat flour worked out to be Rs. 6.24 and Rs. 4.40 for 20 H.P. and 10 H.P. flour mills respectively.

Srinivas *et al.* (1998) observed that out of the total cost of processing of tapioca, material cost accounted for 86 per cent and labour cost 14 per cent. Among the labour costs major share was taken by roasting of sago

followed by peeling operation. Among the material costs, raw material cost took lion's share followed by expenditure on fuel wood, gunny bags and roasting oil. The total expenditure for producing one quintal of sago stood at Rs. 782.71.

Kombairaju and Rajesh (1998) indicated that the processing unit should process atleast 504.20 tonnes of paddy per annum to cover the total cost, if the price of rice / tonne was Rs. 9000. If the price of rice was reduced to Rs. 8,500 and Rs. 8000, the break-even quantity estimated was 694 tonnes and 1111 tonnes respectively. The average net return / tonne of paddy processed was Rs. 990 when the processing unit was operated at full capacity while the profit was reduced to Rs.921 and Rs. 790 respectively per tonne under 75 per cent and 50 per cent capacity. In the case of farmers who sold rice, the marketing cost including processing worked out to Rs. 737 per tonne of paddy. The output of rice per tonne of paddy on an average was 650 kg the value of which was Rs. 5,850 while the value of by products obtained was Rs. 660.

Srinivasa *et al.* (1999) employed capital budgeting techniques for the banana processing units. NPW was Rs. 250.54 lakhs, benefit cost ratio 1.59 and IRR 59.35% for the project period of 10 years. Break-even analysis showed that the processing plant was commercially viable at 120 tonnes per annum as against the targeted production of 150 tonnes per annum.

Rai *et al.* (1999) observed that the food processing sector ranked fifth in the contribution to value addition and employed 19 per cent of the industrial labour force. This sector accounted for only 5.2 per cent of the total investment. The establishment of agro-processing industries in rural areas appeared to be necessary not only to meet the ever increasing demand for processed products but also to enhance real farm income in future.

Srilatha (2000) observed in her study that the total costs incurred to produce one tonne of oil from oil palm was Rs. 18,854.29. Of this the variable costs and fixed costs were Rs. 16,846.74 and Rs. 2,007.55 accounting for 89.35 and 10.65 per cent of the total costs respectively. Among the variable costs raw material was the major item amounting to Rs. 16,176.47 (85.80 per cent) of the total costs per tonne of oil produced by oil mills followed by casual labour charges (2.20 per cent). Interest on fixed capital was the major item of fixed costs amounting to Rs. 1,092.37 (5.79 per cent) per tonne of oil. The gross and net returns were worked out to Rs. 38,940 and Rs. 20,086.01 per tonne of palm oil respectively.

Bhavani (2000) reported in her study that costs incurred to process one quintal of paddy was Rs. 701.10, variable costs constituted to Rs. 688.25 which accounted for 98.17 per cent of total costs. Fixed costs amounted to Rs. 12.85 per quintal accounted for 1.83 per cent of the total cost. The

recovery percentage of rice was found to be 63.66 per cent. The net value added through processing of one quintal of paddy was Rs. 72.98.

Prapoorna (2000) conducted a study on production, marketing and processing of groundnut in Kalyandurg mandal of Anantapur district and revealed that the quantity of groundnut oil and oilcake obtained from washing 96 quintals of groundnut pods was 2,688 kg and 3,897.6 kg valued at Rs. 99,456 and Rs. 38,976 respectively. The total value of main and byproduct worked out to Rs.1,38,432. After deducting the variable and fixed costs from the rate of main and byproducts, the profit margin for processing of quintals of groundnut pods per day was found to be Rs. 4,906.19.

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# *Methodology*

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## CHAPTER III

### METHODOLOGY

This chapter presents procedural details adopted in sampling, design, method of data collection and analytical techniques employed in attaining the stated objectives of the study. The contents of this chapter are presented under the following heads.

- 3.1 Sampling design**
- 3.2 Collection of data**
- 3.3 Methods of computation**
- 3.4 Techniques of analysis**
- 3.5 Concepts and terms.**

#### **3.1 SAMPLING DESIGN**

Three stage stratified purposive cum random sampling technique was used for the selection of districts, mandals, villages and respondents.

##### **3.1.1 Selection of the district**

Salem district was purposively selected for the present study as it ranks first in the area (37,000 ha) and production (11,84,000 tonnes) of tapioca in Tamilnadu. Further, in Salem, tapioca is largely grown as an irrigated crop and more than 750 tapioca based processing units are concentrated in the district offering assured market.

### 3.1.2 Selection of Taluks

Out of six taluks of Salem district, Attur (15,946 ha) and Salem (5,548 ha) taluks which ranked first and second in the area under irrigated tapioca cultivation were chosen for the present study.

### 3.1.3 Selection of villages

All the villages growing tapioca in each of the selected taluks were arranged in descending order of the area under tapioca and the first three villages from each taluk having maximum area under tapioca were chosen for the study. The selected villages were Kuralnatham, Achankuttapatty, Veeranam, Mullaivadi, Seliampatty, Keeripatty.

### 3.1.4 Selection of cultivators

The list of farmers cultivating tapioca in the selected villages was obtained from their respective village records. The farmers were stratified into small and large groups on the basis of operational holding as per the criterion adopted by IRDP. Those farmers with 2 hectares or less of dry land were considered as small and the farmers with more than 2 hectares of dry land were regarded as large. In this classification 2 acres of dry land was considered equal to one acre of wet land in accordance with income generating capacity of dry and wet lands.

A sample of 29 small and 31 large farmers was selected at random in probability proportion to their number in each size group. The total number of tapioca growers selected for the purpose of study was 60.

### **3.1.5 Selection of tapioca processing units**

From the list of tapioca processing units in the selected taluks, 15 processing units were randomly selected. In the study area the various categories of processing units namely nylon sago units, starch units, roasted sago units are present. The list of processing units under each category was prepared and five units from each category were randomly selected for the purpose of study. The processing unit thus selected stood at 15.

## **3.2 COLLECTION OF DATA**

Primary data were collected from the selected tapioca growers and processors through personal interview with the aid of pre tested schedule designed for the purpose. The data on socio-economic profile, technical coefficients and input and output prices were collected from the cultivators.

From the processors, the details like ownership, pattern of investment, labour use, processing costs, methods of purchase of tapioca tubers, techniques of production, recovery of sago and starch etc were collected. Every effort was made at the time of interview to convince the respondents

purely for research and not for any other purpose. The data collected is pertaining to agricultural year 1999-2000.

### **3.3 METHODS OF COMPUTATION**

An economic analysis of any enterprise necessitates proper estimation of the cost of inputs, input services and the valuation of output. The procedures followed in computing the production and processing costs of tapioca are described below.

#### **3.3.1 Human labour**

Actual days worked in performing different cultural operations in the production of tapioca were recorded separately for male, female, family and hired labour. The women-days were converted into man equivalent day. Human labour was quantified in terms of productive man-work units (usually about 8 hours of productive work). Wages whether paid in cash or kind or combination of both were computed in rupee equivalent. Family labour was valued at the prevailing wage rates of casual labour employed for similar operations in the study area.

#### **3.3.2 Bullock labour**

It included both owned and hired bullock labour. The wage rates of both hired and owned bullock labour were estimated at the prevailing rates in the locality.

### **3.3.3 Tractor services**

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

### **3.3.4 Setts**

The cost of both farm produced and purchased setts was evaluated at the prevailing market prices.

### **3.3.5 Farm Yard Manure**

The cost of FYM per tonne was calculated on the basis of existing market price both for owned and purchased.

### **3.3.6 Fertilizers and plant protection chemicals**

Market price formed the basis to estimate the cost of fertilizers and plant protection chemicals.

### **3.3.7 Transportation cost**

The expenditure incurred in transporting the material inputs from home to farm and the produce from farm to processing unit was considered as transportation cost. It varies according to distance and mode of transportation.

### **3.3.8 Repairs and maintenance charges**

Repairs and maintenance charges of machinery, implements and tools used in the cultivation of tapioca were computed on the basis of actual amount incurred by the farmers. Then the amount was apportioned according to the acreage under the selected crop.

### **3.3.9 Interest on working capital**

It was estimated at the rate of 12 per cent per annum (the rate at which commercial banks advance short term loans) for half of the amount for full crop period and for the remaining amount for half of the crop period since the capital was used at different stages of crop production.

### **3.3.10 Depreciation**

Annual amount of depreciation on each working asset owned by the farmers was calculated following the straight line method. Later it was apportioned based on the acreage under tapioca.

### **3.3.11 Land revenue**

Land revenue actually paid by the farmer was considered.

### **3.3.12 Rental value of owned land**

It was charged at the prevailing lease rates for the selected crop in the locality.

### **3.3.13 Interest on fixed capital**

It was charged at the rate of 10 per cent on the value of fixed assets (excluding land) such as farm buildings, implements, machinery, irrigation equipment and livestock. Then the amount so calculated was apportioned on crop acreage.

### **3.3.14 Processing**

The data regarding the costs and returns from tapioca processing were collected from the processors through a schedule and personal discussion. The processing costs were categorised into variable costs and fixed costs.

#### **3.3.14.1 Variable costs**

The costs incurred on the purchase of raw tubers, human labour, gunny bags, diesel and lubricants, electricity charges, repairs and maintenance charges, incidental charges and interest on operating capital were considered as variable costs.

#### **3.3.14.2 Fixed costs**

Depreciation on buildings, machinery and equipment, salaries to permanent employees, taxes, insurance and interest on fixed capital formed the fixed costs.

### 3.4 TOOLS OF ANALYSIS

Conventional analysis was employed to analyse the data to arrive at valid conclusions. Simple arithmetic averages and percentages were worked out to find out costs, returns and farm efficiency measures. Break - even analysis was employed to examine the profitability of tapioca processing.

#### 3.4.1 Conventional analysis

##### 3.4.1.1 Cost concepts

These were used to estimate the cost of cultivation and to derive the farm efficiency measures. The cost concepts viz., cost  $A_1$ , cost  $A_2$ , cost B and cost C were used in the present study and these are derived as follows.

##### 3.4.1.1.1 Cost $A_1$

This cost includes value of (1) hired human labour (2) owned and hired bullock labour (3) owned and hired machinery services (4) setts (5) FYM (6) fertilizers (7) plant protection chemicals (8) repairs and maintenance charges (9) depreciation (10) land revenue and (11) interest on working capital.

##### 3.4.1.1.2 Cost $A_2$

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

### 3.4.1.1.3 Cost B

Cost  $A_2$  + rental value of owned land + interest on owned fixed capital (excluding land).

### 3.4.1.1.4 Cost C

Cost B + imputed value of family labour. It gives the total cost of cultivation.

### 3.4.1.2 Farm efficiency measures

Farm business income	=	Gross income - Cost $A_1$
Family labour income	=	Gross income - Cost B
Net income	=	Gross income - Cost C
Farm Investment income	=	Net income + rental value of owned land and interest on owned fixed capital.

Returns per rupee of investment = Gross income / Total cost

### 3.4.2 Break-even analysis

A break-even analysis is the determination of the functional relationship of revenue and costs to output rate and the derivation of functional relation of profit to output as a residual. A break-even chart is a diagram of the short run relation of total cost and total revenue to the rate of

output. When actual costs are segregated into fixed and variable costs, any variation in volume will cause a change in variable costs and in turn on the contribution and profit. The management has, therefore, to know the effect of such an increase in output on its profits, and a study of cost-volume profit relations enables management to plan profits. A break-even analysis chart can be defined as a chart which shows profit or loss at various levels of activity. The level at which neither profit nor loss is shown being called the break-even point. A firm is said to be at break-even point when its costs are equal to revenue ie. when the contribution margin is exactly equal to the fixed costs. Thus, break-even analysis is the methodology used to calculate that level of output at which the firm neither makes profit nor suffers a loss. The appropriate formula to estimate break-even output is

$$\text{Break-even output} = \frac{\text{Total fixed costs}}{\text{Selling price per unit} - \text{Variable costs per unit}}$$

### 3.5 CONCEPTS AND TERMS USED IN THE STUDY

#### 3.5.1 Small farmers

Farmers having upto 2 hectares of dry land or 1 hectare of irrigated land.

### 3.5.2 Large farmers

Farmer having more than 2 hectares of dry land or 1 hectare of irrigated land.

### 3.5.3 Cattle pair day

It refers to the work accomplished by a pair of bullocks in six hours of a day.

### 3.5.4 Farm assets

The physical property that has value and owned by the farm businesses. Land, farm buildings, machinery, implements, livestock etc., were included under farm assets.

### 3.5.5 Cost of cultivation

Cost of various resources and resource services used for raising a crop on an unit area.

### 3.5.6 Cost of production

The expenses incurred on material inputs and input services used producing a unit quantity of output.

### **3.5.7 Variable costs**

Costs associated with using variable resources viz., seeds, fertilizers, plant protection chemicals, FYM, human labour, bullock labour and tractor services.

### **3.5.8 Fixed Costs**

Costs associated with the owning of fixed resources. Depreciation on capital assets, land revenue, and interest on fixed capital were considered as fixed costs.

### **3.5.9 Tapioca processing**

It involves the process by which tapioca tubers are ground into starch and then made into globules (Sago).

### **3.5.10 Starch**

It is the flour obtained by grinding the raw tapioca tubers. The characteristic feature of tapioca starch is that it has high viscosity.

### **3.5.11 Sago**

It is the final product obtained by globulizing the tapioca starch.

### 3.5.12 Nylon sago

The sago obtained by the technique of boiling the globules in specially designed baking oven.

### 3.5.13 Roasted sago

The sago obtained by the technique of roasting the globules with oil in frying pans.

### 3.5.14 Sago broken

At the time of processing some quantity of sago is broken, which is called Sago broken.

### 3.5.15. Tippi

It is the by-product obtained from processing of tapioca tubers into starch or sago. It is used as poultry feed or cattle feed.



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# *Results and Discussion*

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## CHAPTER - IV

### RESULTS AND DISCUSSION

In this chapter an attempt is made to discuss critically the results obtained from the study. The important findings are presented and discussed under the following sections.

#### **4.1 Basic characteristics of the selected respondents**

#### **4.2 Economic aspects of tapioca production and**

#### **4.3 Economic aspects of tapioca processing**

#### **4.1 The basic characteristics of the sample respondents**

These include family size, availability of family labour, size of the holding and farm inventory.

##### **4.1.1 Family composition and family labour contribution on selected farms :**

The composition of the family in respect of male, female and children and family labour availability in both the size groups and pooled farms is presented in Table 4.1.

It is observed from the table that the family size on an average ranged from 7.8 members on small farms to 9.95 members on large farms with an

**Table 4.1 : Family composition and family labour contribution on selected farms**

(in number)

S.No.	Particulars	Small	Large	Pooled
<b>1. Family composition</b>				
	a. Male	2.30 (29.49)	3.20 (32.16)	2.77 (31.09)
	b. Female	2.10 (26.92)	3.15 (31.660)	2.64 (29.63)
	c. Children	3.40 (43.59)	3.60 (36.18)	3.50 (39.28)
	<b>Total</b>	<b>7.80</b> <b>(100.00)</b>	<b>9.95</b> <b>(100.00)</b>	<b>8.91</b> <b>(100.00)</b>
<b>2. Family farm workers</b>				
	a. Male	2.10 (63.64)	2.50 (100.00)	2.31 (79.93)
	b. Female	1.20 (36.36)	-	0.58 (20.07)
	c. Children	-	-	
	<b>Total</b>	<b>3.30</b> <b>(100.00)</b>	<b>2.50</b> <b>(100.00)</b>	<b>2.89</b> <b>(100.00)</b>

Figures in parantheses indicate percentages to the total

overall average of 8.91 members on pooled farms. The composition of family with respect to male, female and children was marginally larger on large farms compared to small farms.

It is evident from the table that the participation of family members in agriculture decreased with the increase in size of the farm. It implies that the participation of members of well to do families in agriculture was relatively less. On the whole the number of family workers varied from 2.5 members on large farms to 3.30 members on small farms. The participation of family female workers was found on small farms only.

#### **4.1.2 Average size of land holding of sample farms**

The scale and efficiency of production and income earning capacity depends upon the size of the holding.

Table 4.2 presents the land holding particulars of the sample farmers. The average size of holding varied from 0.90 hectares in the case of small farms to 2.39 hectares on large farms with an overall average of 1.67 hectares. The area under irrigated tapioca which was a selected enterprise for an economic analysis ranged from 0.74 hectares on small farms to 2.17 hectares on large farms. This constituted 82.22 per cent of the total area on small farms and 90.79 per cent on large farms. The reason for specialisation

**Table 4.2 : Average size of land holding of sample farms**

(area in hectares)

S.No.	Particulars	Small	Large	Pooled
1.	Irrigated land area	0.90	2.39	1.67
2.	Total area	0.90 (100.00)	2.39 (100.00)	1.67 (100.00)
3.	Area under irrigated tapioca	0.74 (82.22)	2.17 (90.79)	1.48 (88.62)

Figures in parantheses indicate percentages to the total area

in tapioca production is due to the presence of 750 tapioca based processing units located in Salem district offering assured market for tapioca growers.

#### 4.1.3 Asset structure of sample farms

The study of the farm assets reveals the economic background of the farmer. The risk bearing ability of the farmer largely depends on the value of the assets owned by the farmer. The particulars of farm assets per hectare according to size groups are presented in Table 4.3.

The per hectare value of assets ranged from Rs. 3,05,553 on small farms to Rs. 3,43,576 on large farms with an average of Rs. 3,25,198.22 on pooled farms. Further it was noticed that land, basic resource which supports the production of all farm commodities was the single most valuable assets on the sample farms. The share of land value decreased from 74.62 per cent on small farms to 69.85 per cent on large farms. The per hectare land value was higher on large farms (Rs. 2,40,000) as compared to small farms (Rs. 2,28,000). Lands of large farmers might be having better accessibility and more physical amenities and hence their values were higher. An assessment of value of assets excluding land revealed that the value of assets other than the land varied from Rs. 77,553 on small farms to Rs. 1,03,576 on large farms while the same was Rs. 90,998.22 on pooled farms. It is observed that the value of assets other than land showed a positive relationship with the

Table 4.3 : Asset structure of sample farms

(in rupees per hectare)

S. No.	Particulars	Small	Large	Pooled
1.	Value of land	2,28,000 (74.62)	2,40,000 (69.85)	2,34,200 (72.02)
2.	Wells	45,172 (14.78)	66,129 (19.25)	55,999.78 (17.22)
3.	Value of farm buliding	2,620 (0.86)	3,129 (0.91)	2,882.98 (0.89)
4.	Value of machinery and implements	17,438 (5.71)	28,520 (8.30)	23,163.70 (7.12)
5.	Value of livestock	12,323 (4.03)	5,798 (1.69)	8,951.75 (2.75)
<b>6.</b>	<b>Value of total assets</b>			
	a. With land value	3,05,553 (100.00)	3,43,576 (100.00)	3,25,198.22 (100.00)
	b. Without land value	77,553	1,03,576	90,998.22

Figures in parantheses indicate percentages to the value of total assets with land value

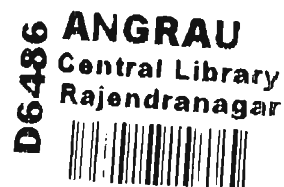
size of the holding. It is also interesting to note that small farmers had invested more on livestock compared to large farms. This might be due to maintenance of milch cattle which is a supplementary enterprise on small farms. Large farms owned relatively more machinery and implements over small farms exhibiting their inclination towards mechanisation. The value of machinery and implements was of the order of Rs. 17,438 and Rs. 28,520 on small and large farms respectively. As already said tapioca being irrigated crop in the study area through well irrigation both the categories of farmers invested on this item of farm assets. But between the two categories, large farmers stood out with Rs. 66,129 against small farmers who made an investment of Rs. 45,172. The higher investment on wells by the large farmers is relatively due to more number of wells per unit area.

## 4.2 COSTS AND RETURNS FROM TAPIOCA PRODUCTION

The profitability of any enterprise depends upon the cost structure, output and price realised by the farmer. Costs include the expenditure on various inputs and input services employed in the production process.

### 4.2.1 Human labour utilisation :

Human labour is one of the important cost components influencing the cost structure. Every cultural operation requires human labour for its successful completion. The use of human labour depend on type and size of



the farm commodity. The operation wise human labour utilisation in tapioca cultivation is presented in Table 4.4.

The total human labour utilised was 191.05 mandays per ha on small farms, 210.65 mandays per ha on large farms and 201.17 mandays per ha on pooled farms. The human labour utilisation exhibited inverse relationship with the size of the holding.

It is evident from the table that family labour use was maximum (114.63 man days per ha) on small farms and minimum (73.73 mandays per ha) on large farms. The family labour used on pooled farms was 93.49 mandays per hectare accounting for 46.67 per cent of the total labour use.

It is observed from the table that major labour consuming operations were weeding, planting, irrigation and harvesting and irrespective of farm size on an average they contributed upto 35 per cent, 10 per cent, 18 per cent and 10 per cent respectively.

Weeding was the single largest operation in terms of labour requirements because three to five weeding were undertaken to keep the field weed free. The employment of human labour for weeding on small, large and pooled farms was 65.00, 75.20 and 70.27 mandays per hectare. Next,

**Table 4.4 : Human labour utilisation - operation wise**

(in mandays per hectare)

S.No.	Particulars	Small	Large	Pooled
1.	Land preparation	15.20 (7.96)	5.60 (2.66)	10.24 (5.09)
2.	Manurial application	5.15 (2.70)	7.20 (3.42)	6.21 (3.09)
3.	Planting the setts	20.75 (10.86)	25.75 (12.22)	23.33 (11.60)
4.	Removal of excess sprouts	15.00 (7.85)	13.50 (6.41)	14.22 (7.07)
5.	Fertilizer application	4.25 (2.22)	4.75 (2.25)	4.51 (2.24)
6.	Weeding	65.00 (34.02)	75.20 (35.70)	70.27 (34.93)
7.	Irrigation	35.00 (18.32)	38.75 (18.40)	36.93 (18.36)
8.	Harvesting	20.50 (10.73)	25.80 (12.25)	23.23 (11.55)
9.	Transporting	10.20 (5.34)	14.10 (6.69)	12.22 (6.07)
	<b>Total labour</b>	<b>191.05</b> <b>(100.00)</b>	<b>210.65</b> <b>(100.00)</b>	<b>201.17</b> <b>(100.00)</b>
	Owned labour	114.63 (60.00)	73.73 (35.00)	93.49 (46.47)
	Hired labour	76.42 (40.00)	136.92 (65.00)	107.67 (53.53)

Figures in parantheses indicate percentages to the total labour

irrigation requires more labour because proper water distribution should be carried out, as water requirement influences the yield of tapioca. This operation consumed 35.00 mandays on small farms, 38.75 mandays on large farms and 36.93 mandays on pooled farms. Removal of excess sprouts required 15 mandays, 13.50 mandays and 14.22 mandays per ha on small, large and pooled farms respectively. This operation involves removal of excess sprouts leaving only two sprouts per plant.

Harvesting operation involves pulling the tubers out and separating it from the stakes and this used 20.50, 25.80 and 23.23 mandays on small, large and pooled farms respectively. Harvesting index is the cracking of soil at the time of maturity of tubers.

#### **4.2.2 Bullock labour utilisation**

Bullock labour use is indispensable cost component on small farms. Bullock labour was employed in land preparation and transportation of farm yard manure.

Bullock labour particulars in terms of cattle pair days per hectare are presented in Table 4.5. The total bullock labour utilisation was 20.35, 4.82, 12.32 cattle pair days on small, large and pooled farms respectively. Bullock labour use was more on small farms and the proportion of owned bullock

**Table 4.5 Bullock labour utilisation - operation wise in tapioca cultivation**

(cattle pairdays per hectare)

S.No.	Particulars	Small	Large	Pooled
1.	Ploughing	15.25 (74.94)	4.82 (100.00)	9.86 (80.03)
2.	Transportation	5.10 (25.06)	-	2.46 (19.97)
	<b>Total</b>	<b>20.35</b> <b>(100.00)</b>	<b>4.82</b> <b>(100.00)</b>	<b>12.32</b> <b>(100.00)</b>
	Owned	17.29 (84.97)	2.43 (50.41)	9.61 (78.00)
	Hired	3.06 (15.04)	2.39 (49.59)	2.71 (22.00)

Figures in parantheses indicate percentages to the total



labour was 84.97 per cent while on large farms it was 50.41 per cent of the total bullock labour use. In pooled farms the proportion of owned bullock labour was 78 per cent. Bullock labour is used for performing mostly tillage operations. On small farms upto 74.94 per cent bullock labour was used for ploughing while on large farms the entire bullock labour was used for ploughing operation. Bullock labour was used for transportation purpose upto 25.06 per cent by small farmers and 19.97 per cent by pooled farmers.

#### 4.2.3. Machine labour utilisation :

Machine labour use is an important cost component on large farms. Machine labour was employed in land preparation, transportation of farm yard manure and the products.

Machine labour use particulars in terms of hours per hectare are presented in Table 4.6. The machine labour was not found in the case of small farms. While on large farms the ploughing operation was mainly carried out by use of tractor services. Out of total machine labour service, 66.67 per cent was used for ploughing on large farms. The proportion of owned machine labour was 34.93 per cent on large farms. The large farms utilized 2.5 hrs of machine labour out of the total machine labour for transportation purpose while pooled farms utilized 1.29 hrs.

**Table 4.6 : Machine labour utilisation - operation wise in tapioca cultivation**

(hrs / ha)

S.No.	Particulars	Small	Large	Pooled
1.	Ploughing	—	5.00 (66.67)	2.58 (66.67)
2.	Transportation	—	2.50 (33.33)	1.29 (33.33)
	<b>Total</b>	—	<b>7.50</b> <b>(100.00)</b>	<b>3.87</b> <b>(100.00)</b>
	Owned	—	2.62 (34.93)	1.35 (34.88)
	Hired	—	4.88 (65.07)	2.52 (65.12)

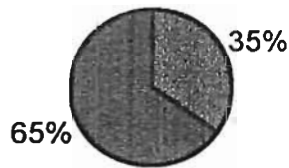
Figures in parantheses indicate percentages to the total

### Human labour utilization-Small farmers



Owned labour Hired labour

### Human labour utilization - Large farmers



Owned labour Hired labour

### Human labour utilization-Pooled farmers



Owned labour Hired labour

#### 4.2.4. Material inputs :

Production of a commodity not only requires input services viz., human labour, bullock labour, and machine labour but also material inputs like setts, farm yard manure, N, P, K and plant protection chemicals etc. that form major component of cost. Table 4.7 presents details on material inputs used per hectare of tapioca on different size groups.

The setts were prepared by discarding 1/3 of the total length of the stem from the top and about 5 cm from bottom. A sett length of 25-30 cm was found advantageous. The number of setts used per ha was 15,000 on small farms and 13,750 on large farms while the recommended number being 18,750 setts per ha. The spacing adopted was 90 x 90 cm or 75 x 75 cm.

Manures use was also lesser than that of recommended quantity. The actual use was 2.5 tonnes and 4.0 tonnes by small and large farms against the recommended quantity of 20 tonnes.

Regarding fertilizer on small farms, the use of N was less but less than that of recommended dose while the quantities of P and K applied were larger than the recommended in terms of levels. On the other hand the situation was totally different on large farms as N, P, K application was larger than the recommended levels.

Table 4.7 : Material input utilization

(per ha)

S. No.	Particulars	Small		Large		Pooled	
		A	R	A	R	A	R
1	Setts	15,000	18,750	13,750	18,750	14,375	18,750
2	FYM (t)	2.5	20	4	20	3.25	20
3.	<b>Fertilizer (kg)</b>						
	N	52.50	57.50	80.00	57.50	66.25	57.50
	P	52.50	50.00	80.00	50.00	66.25	50.00
	K	125.00	120.00	125.00	120.00	125.00	120.00
4.	Plant protection chemicals (litres)	1.87	2.50	2.50	2.50	2.19	2.50

A = Actual

R = Recommended

The use of plant protection chemicals was less on small farms against the recommended quantity. The large farmers used plant protection chemicals as per the recommendation.

#### 4.2.5 Cost of cultivation of irrigated tapioca

The profitability of an enterprise depends upon income generating capacity and cost structure. Generally in any economic investigation total costs are discussed under two categories viz., variable costs and fixed costs, the widely accepted norm. In general variable costs alone are reckoned to be the cost of cultivation by the farming community ignoring fixed costs. The profit and loss too are worked out accordingly. But in any economic analysis of business enterprise, the fixed costs are also taken into account to arrive at total costs and thereby to compute the income.

Variable costs include human labour, bullock labour and machinery service employed for performing different agricultural operations and expenses incurred on material inputs like seeds, FYM, fertilizers, plant protection chemicals etc., The fixed costs are depreciation on working assets, rent on land, land revenue and interest on fixed capital. The particulars of cost of cultivation of tapioca according to size groups are presented in Table 4.9.

On an average, the total cost of cultivation of tapioca was estimated at Rs. 31,513.93 per hectare. The cost of cultivation increased with the size of holding from Rs. 30,178.32 on small farms to Rs. 32,763.38 on large farms. It was observed that operational costs accounted for major share in the total cost on all the categories of farms. The total operational costs varied from Rs. 17,526.94 on small farms to Rs. 19,692.07 on large farms with an overall average of Rs. 18,645.59 for the sample as a whole. The operational costs accounted for 58.08, 60.10 and 59.17 per cent of the total costs on small, large and pooled farms respectively.

Among the operational costs human labour was the major item amounting to Rs. 9,552.50, Rs.10,532.50 and Rs. 10,058.83 on small, large and pooled farms respectively. It accounted for 31.65, 32.15 and 31.92 per cent of the total cost on the corresponding farms. Tapioca is an enterprise for which large labour input need to be employed for weeding which was done thrice in the crop growth period along with operations like planting, irrigation and harvesting which required sizeable number of man days.

The cost of setts was Rs. 2,250, Rs. 2,062.50 and Rs. 2,153.13 on small large and pooled farms constituting 7.46, 6.29 and 6.83 per cent respectively. The number of setts used per hectare was 15,000, 13,750 and 14,375 on the respective farms. The practice is to use the farm produced

tapioca as seed material for ensuing season which speaks the farmer's attitude to maintain the quality seed material. Fertilizers were the next input factor in terms of expenditure. The amount spent on them ranged from Rs. 1,752.75 to Rs. 1,900.50 on small and large farms with an overall average of Rs.1,829.09 on pooled farms. The percentage expenditure on this input was 5.81, 5.80 and 5.81 for the said farms respectively.

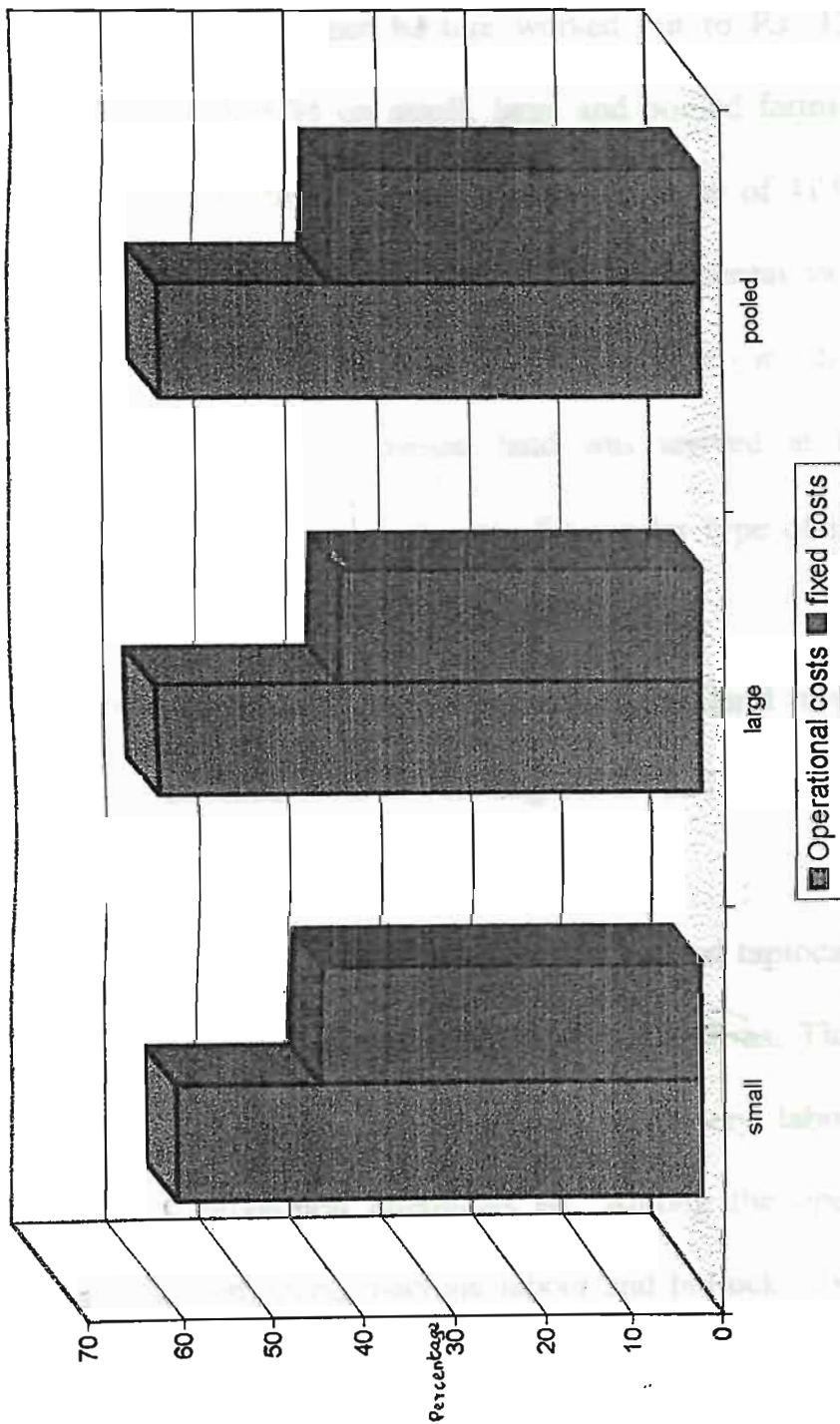
Machine labour could be found only on large farms, the expenditure on which was Rs. 1,875. Large farmers only exhibited interest to mechanise land preparation, apart from using tractors for transportation of FYM and the products. On the contrary, small farmers preferred to employ bullock labour for tillage operations. The expenditure under this head was Rs. 2,035 on small farms and Rs. 482 on large farms. The percentage expenditure on plant protection chemicals was more or less closer between small and large farms with the former category spending 1.36 per cent and the latter category incurring 1.68 per cent. The plant protection measures were taken to control major diseases like cassava mosaic, cassava bacterial blight and major pests like red spider mites, white grubs, termites etc. The interest on working capital was Rs. 569.79, Rs. 855.15 and Rs. 717.23 on small, large and pooled farms respectively. The operational costs were higher on large farms compared to small farms and hence the interest on working capital was also higher on large farms. An important cost component which was not found in

**Table 4.8 : Cost of cultivation of tapioca according to farm size and component wise**

S.No.	Particulars	Small	Large	Pooled
<b>I. OPERATIONAL COSTS</b>				
a.	Human Labour	9,552.50 (31.65)	10,532.50 (32.15)	10,058.83 (31.92)
	Owned	5,731.50 (18.99)	3,686.50 (11.25)	4,674.92 (14.83)
	Hired	3,821.00 (12.66)	6,846.00 (20.90)	5,383.92 (17.08)
b.	Bullock labour	2,035.00 (6.74)	482.00 (1.47)	1,232.62 (3.91)
	Owned	1,729.00 (5.73)	243.00 (0.74)	961.23 (3.05)
	Hired	306.00 (1.01)	239.00 (0.73)	271.38 (0.86)
c.	Machinery labour	-	1,875.00 (5.72)	968.75 (3.07)
	Owned	-	655.00 (2.00)	338.42 (1.07)
	Hired	-	1220.00 (3.72)	630.33 (2.00)
d.	Setts	2,250.00 (7.46)	2,062.50 (6.29)	2,153.13 (6.83)
e.	Manures	502.75 (1.67)	810.20 (2.47)	661.60 (2.10)
f.	Fertilizers	1,752.75 (5.81)	1,900.50 (5.80)	1,829.09 (5.81)
g.	Plant protection chemicals	411.40 (1.36)	550.00 (1.68)	483.01 (1.53)
h.	Repair and Maintenance	452.75 (1.50)	624.22 (1.91)	541.34 (1.72)
i.	Interest on Working Capital	569.79 (1.89)	855.15 (2.61)	717.23 (2.28)
j.	<b>Total operational costs</b>	<b>17,526.94 (58.08)</b>	<b>19,692.07 (60.10)</b>	<b>18,645.59 (59.17)</b>
<b>II. FIXED COSTS</b>				
a.	Land revenue	625.00 (2.07)	625.00 (1.91)	625.00 (1.98)
b.	Depreciation	755.75 (2.50)	910.55 (2.78)	835.73 (2.65)
c.	Rental value of owned land	10500.00 (34.79)	10500.00 (32.05)	10500.00 (33.32)
d.	Interest on fixed capital	770.63 (2.55)	1035.76 (3.16)	907.61 (2.88)
	<b>Total Fixed Costs</b>	<b>12,651.38 (41.92)</b>	<b>13,071.31 (39.90)</b>	<b>12,868.34 (40.83)</b>
	<b>Total costs</b>	<b>30,178.32 (100.00)</b>	<b>32,763.38 (100.00)</b>	<b>31,513.93 (100.00)</b>

Figures in parantheses indicate percentages to the total costs.

### Cost of cultivation of Tapioca



operational costs was the electricity charges. As electricity is being provided at free of cost for agricultural purposes in Tamilnadu, this component was not included in operational costs.

The total fixed costs per hectare worked out to Rs. 12,651.38, Rs. 13,071.31 and Rs. 12,868.34 on small, large and pooled farms respectively. The share of fixed costs, in total costs was of the order of 41.92, 39.90 and 40.83 per cent respectively. Among the fixed costs, rental value of owned land represented 34.79, 32.05 and 33.32 per cent on the said farms respectively. Rental value of owned land was arrived at based on the prevailing lease amount in the study area for similar type of land.

The interest on fixed capital, depreciation and land revenue were the other components of fixed costs accounting for 2.88, 2.65 and 1.98 per cent on pooled farms respectively.

The overall analysis of cost structure of irrigated tapioca revealed that the large farms had incurred higher costs than small farms. This was mainly because of intensive use of human labour, machinery labour, fertilizers, manures and plant protection chemicals etc. Among the operational costs human labour, setts, fertilizers, machine labour and bullock labour accounted for more than 50 per cent of the total costs. The operational and fixed costs were in the ratio of 59.17 : 40.83.

#### **4.2.6 Output and returns from tapioca production**

The details of physical output and gross returns per hectare are presented in Table 4.9. The productivity was found to be higher on large farms against small farms. Large farms obtained output equivalent to 250 quintals per hectare while small farms could able to realise 210 quintals only. This yield differential could be attributed to better irrigation practices and other input management practices. The respective gross returns obtained through the sale proceeds were Rs. 50,400, Rs. 60,000 and Rs. 55,360 on the above said farms.

#### **4.2.7 Costs and returns per quintal of tapioca production**

The particulars in Table 4.10 reveal that the cost of producing a quintal of tapioca exhibited inverse relationship with the size of the holding as it was Rs. 143.70 on small farms and Rs. 129.46 on large farms. The same was Rs. 136.63 on pooled farms. There was a difference of Rs. 14.24 per quintal in the production costs between small and large farms. A quintal of tapioca yielded a net return of Rs. 96.55 and Rs. 121.29 on small and large farms respectively and the same was Rs. 103.88 on pooled farms.

#### **4.2.8 Cost concepts**

The cost of cultivation of tapioca also dealt by adopting the cost concepts used in farm management studies Cost  $A_1$ , Cost  $A_2$ , Cost B and

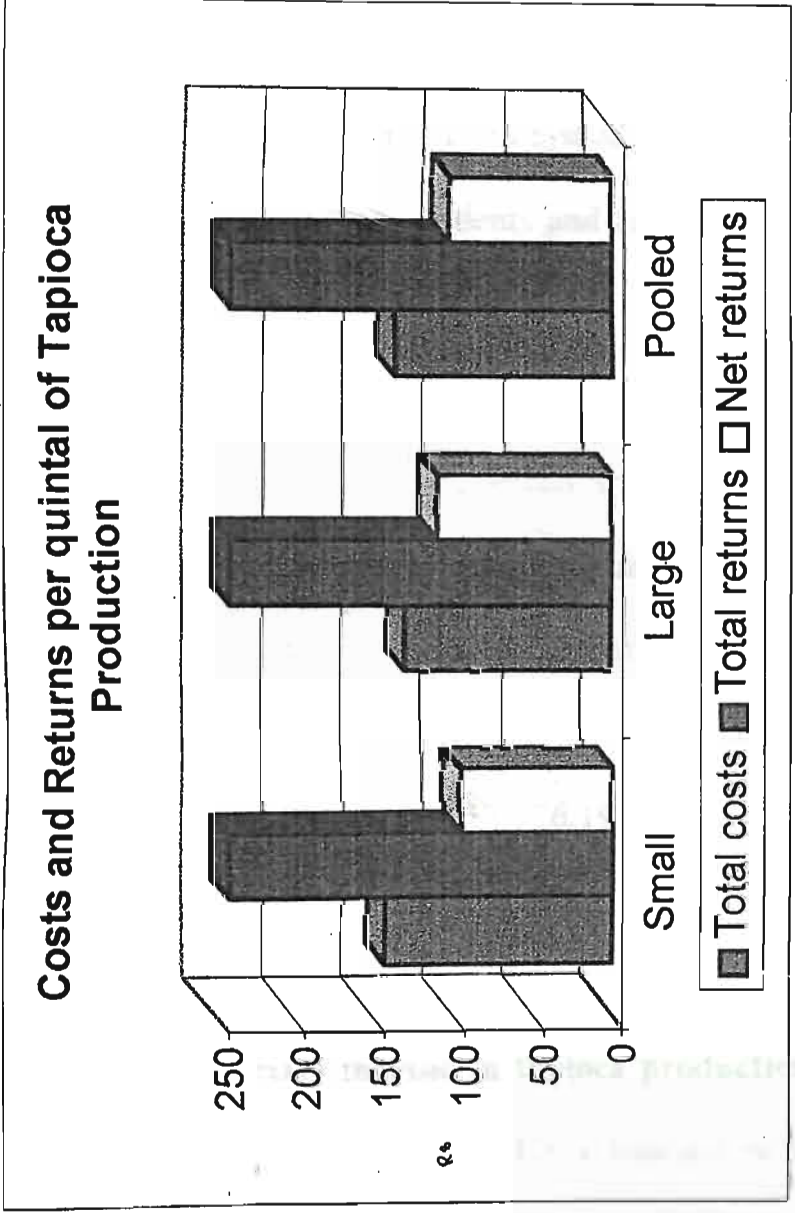
**Table 4.9 : Output and returns per hectare of tapioca**

S.No.	Particulars	Small	Large	Pooled
1.	Yield (in Qtls)	210	250	230.66
2.	Gross returns (in Rs.)	50,400.00	60,000.00	55,360.00

**Table 4.10 : Costs and returns per quintal of tapioca production**

(Rs. per quintal)

S.No.	Particulars	Small	Large	Pooled
<b>1.</b>	<b>Costs</b>			
a.	Variable costs	83.46	77.17	80.84
b.	Fixed costs	60.24	52.29	55.79
c.	Total costs	143.70	129.46	136.63
<b>2.</b>	<b>Returns</b>			
a.	Gross returns	240.25	240.75	240.51
b.	Net returns	96.55	111.29	103.88



Cost C were adopted in the present study. The concept of Cost C is the most comprehensive one. It includes all costs, both fixed and variable and hence provides a basis for comparison between different types of operational holdings. The cost of cultivation of tapioca according to cost concepts was worked out and presented in Table 4.11.

It is clear from the details furnished in the table that there was no leasing activity among the respondents and hence Cost A<sub>1</sub> and Cost A<sub>2</sub> remained the same.

#### Tapioca production

Small	Large	Pooled
30178.32	32763.38	31470.85
17541.12	29076.88	23309.00
13176.19	24446.82	18811.50

It is noticed that the commercial cost of cultivation (Cost C) was higher at Rs. 32,763.38 on large farms compared to small farms (Rs.30,178.32) indicating a positive relationship with the farm size. Cost A<sub>1</sub> (Rs. 17,541.12) and Cost B (Rs. 29076.88) was found to be higher on large farms than on small farms (Rs. 13,176.19 and Rs. 24,446.82) reflecting a direct relationship with the size of holding.

#### 4.2.9 Measures of farm income in tapioca production :

The two important elements of any business enterprise are costs and returns. Cost represents the value of inputs used in the production process, whereas returns represent the value of output achieved. The success of farm business is indicated by the relative magnitude of the costs and returns. An

**Table 4.11 : Cost concepts in tapioca production**

S.No.	Particulars	Small	Large	Pooled
1.	Cost A <sub>1</sub> / A <sub>2</sub>	13,176.19	17,541.12	15,431.40
2.	Cost B	24,446.82	29,076.88	26,839.02
3.	Cost C	30,178.32	32,763.38	31,513.93

important element in the farm business organisation relates the manner in which the inputs are allocated. A measuring rod is necessary to provide guides and standards for evaluating the use of various resources. To achieve this objective, various farm efficiency measures viz., farm business income, family labour income, net income, farm investment income and returns per rupee of investment were worked out and presented in Table 4.12.

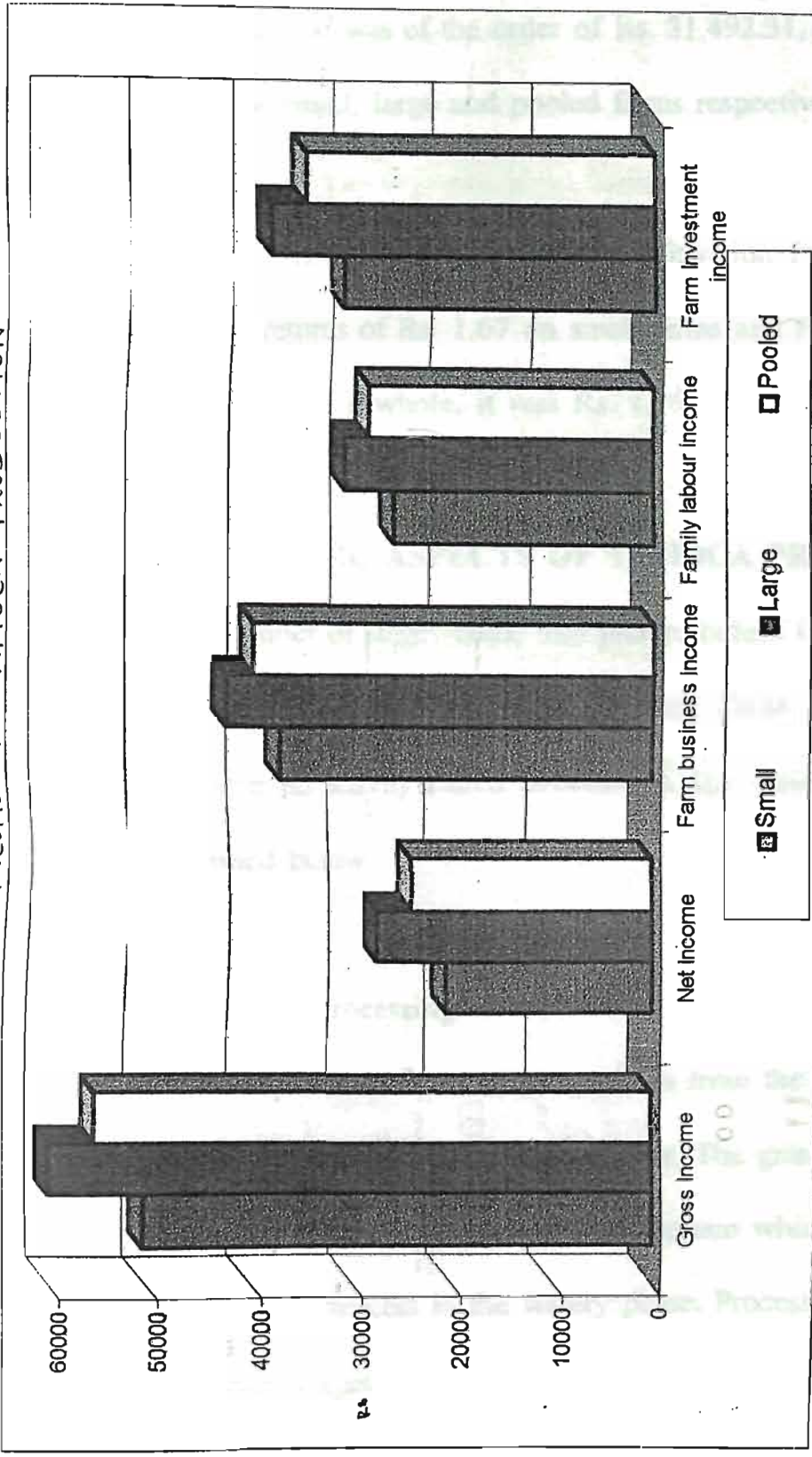
On an average the selected tapioca growers realised a gross income of Rs. 55,360. Size-wise analysis revealed that gross income increased with the size of the holding. It ranged from Rs. 50,400 on small farms to Rs. 60,000 on large farms. The higher income on large farms was evidently due to higher productivity on large farms. Although gross income is a good measure to gauge the efficiency of the farm but it alone does not tell the success of farm business. Hence net income was worked out to make comparison between the two categories of selected farms. Higher the net income, more success is the business and vice-versa. On an average, the net income was Rs. 23,846.07 for the sample as a whole. The net income increased from Rs. 20,221.68 on small farms to Rs. 27,326.62 on large farms indicating a positive relationship with the farm size. It was found that small farmers realised a farm business income of Rs. 37,223.81, while large farmers derived Rs. 42,458.88, thereby establishing a positive relationship with the farm size. Pooled farms secured farm business income to the tune of Rs. 39,928.60. Family labour income

**Table 4.12 : Measures of farm income in tapioca production**

(Rupees per ha)

S.No.	Particulars	Small	Large	Pooled
1.	Gross income	50,400.00	60,000.00	55,360.00
2.	Net income	20,221.68	27,326.62	23,846.07
3.	Farm business income	37,223.81	42,458.88	39,928.60
4.	Family labour income	25,953.18	30,923.12	28,520.98
5.	Farm investment income	31,492.31	38,772.38	35,253.68
6.	Returns per rupee of investment	1.67	1.83	1.76

MEASURES OF FARM INCOME IN TAPIOCA PRODUCTION



received by small and large farmers was Rs. 25,953.18 and Rs. 30,923.12 respectively indicating a direct relationship with the size of holding. Farm investment income was of the order of Rs. 31,492.31, Rs. 38,772.38 and Rs. 35,253.68 on small, large and pooled farms respectively.

Every rupee invested in tapioca cultivation facilitated the farmers to obtain gross returns of Rs. 1.67 on small farms and Rs. 1.83 on large farms. For the sample as a whole, it was Rs. 1.76.

**4.3 ECONOMIC ASPECTS OF TAPIOCA PROCESSING**

A number of stages come into picture before tapioca is converted into starch, sago (roasted), and sago (nylon). These consumable forms are obtained after an activity called **processing**. The various stages of processing are explained below.

**4.3.1 Steps in processing of tapioca**

The separation of the starch granules from the tuber in a pure form is essential in the manufacture of tapioca flour. The granules are locked in cells together with all other constituents of protoplasm which can only be removed by a purification process in the watery phase. Processing can be divided into the following stages.

**1. Peeling and Washing :**

Roots are peeled manually or in the mechanical root washers. The tubers are peeled and washed and the peeled roots are deposited in cement basins where they remain immersed in water until taken out for rasping. There is a loss of starch upto 5 per cent in manual peeling.

**2. Rasping or pulping :**

It is necessary to rupture all cell walls in order to release starch granules. This is usually carried out by processing the roots against a swiftly moving surface provided with sharp protrusions. During this process the cell walls get ruptured and the whole of the root is turned into a mass in which substantial portion of the starch granules are released. The pulp is subjected to a second rasping process after screening. Starch recovery from tubers depends on the efficient crushing operation.

**3. Screening :**

In separating the pulp from the starch a liberal amount of water must be added to the pulp. The screen is mounted close to the rasper at a slightly lower level in order to ease the flow of the crude pulp. The shaking screen consists of a slightly inclined horizontal frame and covered with gauze which is put into length wise shaking motion in short strokes by means of a eccentric rod.

It is advantageous to let the suspensions pass a series of increasing fineness (60, 100, 150, 200, 250) the first one retaining the coarse pulp, the others the fine particles. The pulp remaining on the first of these screens is often subjected to a second rasping operation and then returned to the screens.

#### 4. **Settling and purification of starch :**

Because of the rapid chemical changes that take place in the solution of starch suspension, fermentation takes place resulting in the production of alcohol and organic acids. Hence it is necessary to hasten the process of separation of pure starch from starch milk.

Settling and purification of starch is being done by settling in tanks, in small and medium sized plants. The upper layer of sedimented flour, which have a yellowish green tint, contains many impurities and is generally scrapped off and rejected. The remaining moist flour is then stirred up with water and left to settle again.

#### 5. **Drying :**

The removal of free water from the starch sediment obtained from settling tank must be dried by evaporation in the open air (sun drying). The drying is usually carried out for one day.

#### 6. **Starch finishing :**

Crude dry tapioca flour is consisting of hard lumps of starch. As it cannot be used as such, it has to be subjected to a pulverising process

followed by dry screening. Roller crushers can be employed for pulverising and a sieve size of 100 to 200 mesh is used for screening. It is finally packed in jute bags.

#### 7. **Manufacture of sago - roasted :**

The raw material for the manufacture of sago is the flour scooped from the sedimentation tanks after the excess water or supernatant has been drained. The operations involved are pulverization, globulization, sizing, roasting, drying, polishing, screening and packing. Pulverization is done by subjecting the wet starch to vibratory units provided with gunny cloth surfaces forming two pouches. The globulated starch powder is graded in oscillation screens.

Shallow iron pans coated with coconut oil heated to moderate temperature serve the purpose of gelatinizing the globules. The sago is roasted at about 100°C for about 6 to 8 min. The roasted sago is then dried on the cemented floor for about 8 to 12 hours, depending on the intensity of sunshine. During roasting, sago lumps are formed which are broken down by passing the material through disintegrator.

#### 8. **Nylon Sago Manufacture :**

In case of nylon sago manufacturing the difference comes in use of baking oven instead of using roasting pans. The raw globules are placed in trays in oven and the baked globules are removed after 45 minutes. The other operations are same as that of manufacture of roasted sago.

## I. Process flow sheet for starch

Tapioca tubers



Peeling and Washing



Rasp



Screening



Dewatering



Pulverization

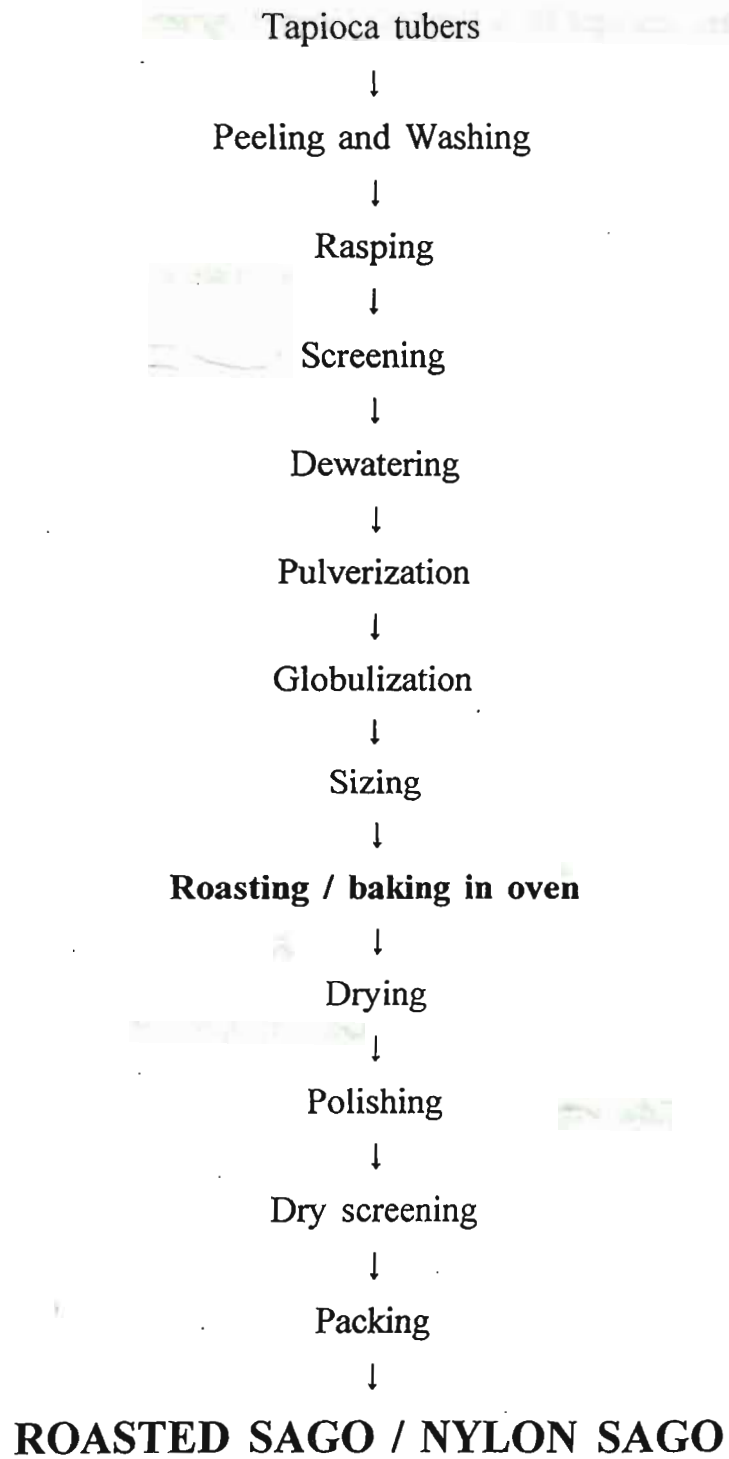


Dry screening



**STARCH**

## II. Process flow sheet for production of sago



The processing units are infact the links between producers and consumers. An examination of the various processes that take place help us to know the economics of conversion of tapioca into starch, sago (roasted) and sago (nylon). As such an attempt is made here to look into the economic aspects of tapioca processing. Processing aspects of tapioca are studied as per the following sub heads.

Investment particulars of tapioca processing units

**4.3.2 Investment particulars of tapioca processing units** (Value in Rs.)

It is observed from the Table 4.13 that the total investment was of the order of Rs. 26,35,000, Rs. 40,88,000 and Rs. 36,29,000 on starch, nylon sago and roasted sago units respectively.

	starch units	nylon sago units	roasted sago units
Total Investment	26,35,000	40,88,000	36,29,000
Machinery	9,35,000	14,38,000	13,79,000
Buildings	6,00,000	13,50,000	13,50,000
Other	10,00,000	12,60,000	8,00,000

The major item of investment was on machinery on which the amount spent was Rs. 9,35,000 by starch units, Rs. 14,38,000 by nylon sago units and Rs. 13,79,000 by roasted sago units. The difference in the technology employed by the each processing unit accounted for the difference in the costs. Starch units do not require machinery for sizing and polishing. In sago units, roasted sago units used iron- made frying pans while nylon sago units required baking ovens.

The next item of importance was the investment on buildings, on which amount spent was Rs. 6,00,000 by starch units, Rs. 13,50,000 by nylon

**Table 4.13 : Investment particulars of tapioca processing units**

(Value in Rs.)

S. No.	Particulars	Starch units	Nylon sago units	Roasted sago units
1.	Land value	6,00,000 (22.77)	8,00,000 (19.57)	7,00,000 (19.29)
2.	Buildings	6,00,000 (22.77)	13,50,000 (33.02)	10,50,000 (28.93)
3.	Machinery	9,35,000 (35.49)	14,38,000 (35.18)	13,79,000 (38.00)
4.	Effluent treatment plant	5,00,000 (18.97)	5,00,000 (12.23)	5,00,000 (13.78)
5.	<b>Total</b>	<b>26,35,000 (100.00)</b>	<b>40,88,000 (100.00)</b>	<b>36,29,000 (100.00)</b>

Figures in parantheses indicate percentages to total

sago units and Rs. 10,50,000 by roasted sago units. The proportion to total cost was higher in nylon sago units than the other two categories. The building costs included the drying yard cost also and different units constructed different number of drying yards based on the space available. Usually sago units required larger drying yards.

The next item was the land value which accounted for 22.77 per cent for starch units, 19.57 per cent for nylon sago units and 19.29 per cent for roasted sago units of the total investment cost.

The next important and indispensable item of investment is the investment on effluent treatment plant (ETP) which amounted to Rs. 5,00,000 uniformly for all the three categories. The construction of ETP is a must for running the processing unit. Pollution Control Board has to certify that the water let out after treating in the plant was pollution free. On an average, the sago industry would generate 22,000 litres of effluents per tonne of sago produced. The effluents from the industry are discharged intermittently which are acidic and highly organic in nature.

In the study area there existed processing units which exclusively produced starch only. But starch is an intermediary product in the sago production i.e. starch is further processed to obtain sago. Roasted sago is the oldest product, while nylon sago is relatively recently introduced product.

### 4.3.2. Production capacity of processing units

Table 4.14 gives the details about the production capacity of processing units. The processing units were categorised into starch, nylon sago and roasted sago units. The average working days were highest for nylon sago units (250 days per year) followed by roasted sago units (200 days per year) and then by starch units (180 days per year). The more number of working days for the sago producers was due to the fact that during the off-season the starch stored in the tank was converted into sago and sold. Some units work during the season only i.e. from October to February, while many units work during off-season also.

The phenomenal growth of this industry can be attributed to the several advantages being offered by Salem district i.e. favourable weather conditions for the manufacturing of starch and sago ; good sunshine and dry weather for a longer period of the year ; availability of raw material of reasonably good quality and the fairly cheap labour besides the incentives offered by the Government.

Average quantity of raw tubers processed per day in quintals was 350, 230 and 250 for starch, nylon sago and roasted sago units respectively. As starch units required less number of operations to produce the output they

**Table 4.14 : Production capacity of tapioca processing units**

S. No.	Category of units	Average working days per year	Average quantity processed per day (Qtls)	Average output per day (Qtls)
1.	Starch	180	350	70
2.	Nylon Sago	250	230	47
3.	Roasted sago	200	250	50

processed more quantity. On the other hand, sago units involved more operations than starch units and the quantity processed per day was relatively less. Average output per day in quintals was 70, 47 and 50 for starch, nylon sago and roasted sago units respectively.

#### 4.3.3 Average recovery performance of tapioca processing units

Apart from the main product recovered, the byproducts like sago broken and tippi were recovered. Tippi was mainly used as poultry feed and cattle feed. Recovery performance of tapioca units was assessed and the results are presented in Table 4.15. It was observed from table, that on an average 65.52 per cent of starch was recovered and byproduct was 34.78 per cent of total quantity. In nylon sago units the main product recovered was 63.27 per cent and byproducts namely sago broken contributed 2.53 per cent and tippi 34.20 per cent to the total quantity. In roasted sago units, the main product recovered was 64.66 per cent and byproducts viz., sago broken contributed 1.94 per cent and tippi 33.40 per cent to the total quantity.

#### 4.3.4 Cost of tapioca processing

The processing costs included the variable costs and fixed costs in processing tapioca tubers into starch and sago. These costs and their components have been presented in the Table 4.16.

**Table 4.15 : Average recovery performance of tapioca processing units**

S.No.	Average quantity of processed products (Qtls)			
	Particulars	Starch	Nylon Sago	Roasted Sago
1.	Main product	11430.00 (65.22)	6374.99 (63.27)	6374.98 (64.66)
2.	By products	6094.50 (34.78)	3526.13 (36.73)	3484.98 (35.34)
	a. Sago broken	-	243 (2.53)	191.25 (1.94)
	b. Tippi	6094.50 (34.78)	3283.13 (34.20)	3293.73 (33.40)
3.	Total quantity	17524.50 (100.00)	9901.12 (100.00)	9859.96 (100.00)

Figures in parantheses indicate percentages to total

The total variable costs were found to be considerably higher in starch units (Rs. 1,04,67,011.25) than that of roasted sago units (Rs. 79,25,833.77) and nylon sago units (Rs. 87,29,752.85). The cost of raw tubers was the major component of the variable costs in all three types of processing units and it accounted for nearly 73.85 per cent of the total cost in starch units, 70.13 per cent in nylon sago units and 68.67 per cent in roasted sago units. The next important component was the interest on working capital which occupied 10.89 per cent of the total cost in starch units, 10.45 per cent in nylon sago units and 10.62 per cent of roasted sago units. The other cost component was the casual labour charges which accounted for 3.69 per cent in nylon sago units and 4.67 per cent in roasted sago units and 3.70 per cent in starch units. The labour involving operations were peeling, walking in the circulating channels, sizing, polishing, packing and loading. Cost of gunny bags was higher in starch units, even more than the casual labour charges. This is due to the larger annual production while the same cost for nylon sago units contributed 2.16 per cent and 3.29 per cent in the case of roasted units. Electricity charges were Rs. 2,03,000 in starch units occupying 1.90 per cent, Rs. 2,56,250 in nylon sago units contributing 2.76 per cent and Rs. 3,08,333.30 in roasted sago units forming 3.72 per cent in total cost. The higher amount of electricity charges was due to the use of number of 10 HP, 20 HP, 7.5 HP and 5 HP motors. Transportation charges accounted for 1.74 per cent, 0.29 per cent and 0.83 per cent in starch, nylon sago and roasted

sago units. These charges varied according to the output produced and distance of the market centres. Repairs and maintenance charges stood at 0.69 per cent, 2.04 per cent and 1.82 per cent in starch, nylon sago and roasted sago units respectively. Repairs and maintenance works were carried out during off-season.

Expenditure on stationary items and telephone charges was 0.41 per cent, 0.56 per cent, 0.63 per cent of the total cost for starch, nylon sago and roasted sago units respectively. Cost of baskets was the least cost item showing 0.01 per cent, 0.04 per cent and 0.03 per cent of the total cost for the three units under study. These are used for carrying the sago globules from and to the drying yard.

The total fixed costs were higher in nylon sago units (Rs. 5,56,080) followed by roasted sago units Rs. 3,62,893. The same for starch units was Rs. 2,16,582. The higher fixed costs in nylon sago units were due to greater investment in machinery and buildings. Salary to permanent staff was of the order of Rs. 32,160 in starch units, Rs. 60,600 in nylon sago units and Rs. 56,366 in roasted sago units. Depreciation on buildings was higher for nylon sago units than other two categories. Both in absolute and relative terms depreciation was higher in nylon sago than the other two categories. The next important component is depreciation on machinery which was Rs. 1,10,181.25

Table 4.16 : Cost of tapioca processing

(Value in Rs.)

S.No.	Particulars	Starch	Nylon Sago	Roasted Sago
<b>I. VARIABLE COST</b>				
1.	Raw tubers	78,90,000.00 (73.85)	65,12,500.00 (70.13)	56,91,666.07 (68.67)
2.	Casual labour charges	3,95,350.00 (3.70)	3,42,910.00 (3.69)	3,87,350.80 (4.67)
3.	Gunny bags	4,82,680.00 (4.52)	2,01,014.00 (2.16)	2,68,695.00 (3.24)
4.	Oil & Fuel	-	1,45,150.00 (1.56)	1,04,254.17 (1.26)
5.	Baskets	1,400.00 (0.01)	3,318.80 (0.04)	2,666.67 (0.03)
6.	Electricity charges	2,03,000.00 (1.90)	2,56,250.00 (2.76)	3,08,333.30 (3.72)
7.	Diesel & Lubricants	27,800.00 (0.260)	30,450.00 (0.33)	11,116.67 (0.13)
8.	Transportation Charges	1,86,800.00 (1.74)	27,575.00 (0.29)	68,469.00 (0.83)
9.	Repairs & Maintenance	73,400.00 (0.69)	1,89,012.50 (2.04)	1,50,333.30 (1.82)
10.	Stationary, Telephone etc.	43,580.00 (0.41)	51,600.00 (0.56)	52,300.00 (0.63)
11.	Interest on working capital	11,63,001.25 (10.89)	9,699,72.53 (10.45)	8,80,648.19 (10.62)
12.	<b>Total variable costs</b>	<b>1,04,67,011.25 (97.97)</b>	<b>87,29,752.85 (94.01)</b>	<b>79,258,33.77 (95.62)</b>
<b>II. FIXED COSTS</b>				
1.	Salary to permanent staff	32,160.00 (0.30)	60,600.00 (0.65)	56,366.67 (0.68)
2.	Depreciation on buildings	21,861.00 (0.20)	78,651.75 (0.85)	38,666.67 (0.47)
3.	Depreciation on machinery	80,746.40 (0.76)	1,10,181.25 (1.19)	1,01,122.17 (1.22)
4.	Urban tax & other taxes	33,000.00 (0.31)	2,09,000.00 (2.25)	1,01,666.67 (1.23)
5.	Depreciation on effluent treatment plant	24,750.00 (0.23)	24,750.00 (0.27)	24,750.00 (0.29)
6.	Interest on fixed capital	24,064.68 (0.23)	72,897.88 (0.78)	40,321.52 (0.49)
II.	<b>Total Fixed Costs</b>	<b>2,16,582.08 (2.03)</b>	<b>5,56,080.87 (5.99)</b>	<b>3,62,893.70 (4.38)</b>
III.	<b>Total Costs</b>	<b>1,06,83,593.30 (100.00)</b>	<b>92,85,833.72 (100.00)</b>	<b>82,88,727.47 (100.00)</b>

Figures in parantheses indicate percentages to total cost

for nylon sago units, Rs. 1,01,122.17 for roasted sago units and Rs. 80,746.40 for starch units. Depreciation on effluent treatment plant was Rs. 24,750 for all three categories. This was because the same investment was made by all the three categories in the construction of ETP. Interest on fixed capital was a major cost component in nylon sago units. The same for starch units was Rs. 24,064.68 and Rs. 40,321.52 for roasted sago units. Urban taxes and other taxes were highest in nylon sago units (Rs. 2,09,000) followed by roasted sago units (Rs. 1,01,666.67) and starch units (Rs. 33,000).

Total costs stood at Rs. 1,06,83,593.30, Rs. 92,85,833.72 and Rs. 82,88,727.47 on starch, nylon sago and roasted sago units respectively.

#### **4.3.5 Processing costs per quintal of raw tubers**

The details of processing costs per quintal of raw tubers of tapioca is presented in Table 4.17. It is evident from the table that the total costs incurred to process one quintal of tapioca into starch was Rs. 288.14, into nylon sago was Rs. 393.01 and into roasted sago was Rs. 333.55. Variable costs constituted Rs. 282.13 in starch units, Rs. 369.51 in nylon sago units, Rs. 318.95 in roasted sago units. Among the variable costs, the major item was cost of raw tubers which amounted to Rs. 212.27 in starch units, Rs. 275.67 in nylon sago units and Rs. 229.04 in roasted sago units. The next important component was interest on working capital which amounted to

Rs. 31.35, Rs. 41.06 and Rs. 35.44 in starch, nylon sago and roasted sago units respectively. The next major item was casual labour charges which amounted to Rs. 10.66, Rs. 14.51 and Rs. 15.59 on the aforesaid processing units respectively. The next item was cost of gunny bags which depended on annual production and it amounted to Rs. 13.01, Rs. 8.51 and Rs. 10.81 in starch, nylon sago and roasted sago units respectively. The other item of importance was transportation charges which amounted to Rs. 5.04, Rs. 1.17, Rs. 2.76 for starch, nylon sago and roasted sago units respectively. Transportation charges depended upon distance to the market. Repairs and maintenance charges amounted to Rs. 1.98, Rs. 8.0, Rs. 6.05 in starch, nylon sago and roasted sago units towards repairing, replacement and maintaining various machineries and buildings. Electricity charges were Rs. 5.47, Rs. 10.85, Rs. 12.41 in starch, nylon sago and roasted sago units respectively. Power charges basically dependent upon motors used and number of machinery involved and also average number of working days in a year. Lubricants, baskets and expenditure on stationary and telephone were the other costs of minor importance.

Fixed costs amounted to Rs. 6.01, Rs. 23.50, and Rs. 14.60 in starch, nylon sago and roasted sago units respectively. Among the fixed costs depreciation on machinery was the major cost component with Rs. 2.34, Rs. 4.66 and Rs. 4.07 in starch, nylon sago and roasted sago units respectively.

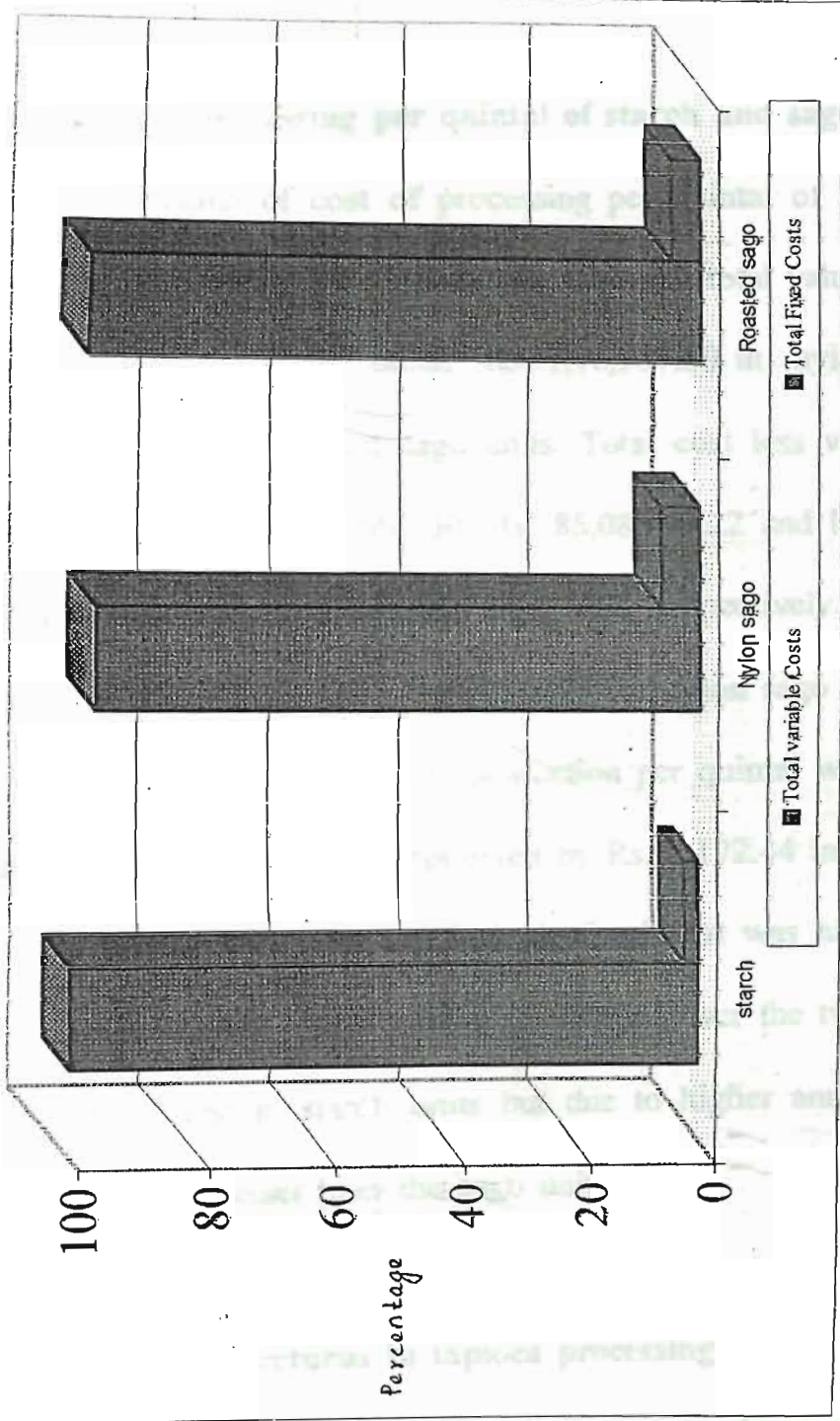
Table 4.17 : Cost of processing per quintal of raw tubers

(Value in Rs.)

S.No.	Particulars	Starch		Nylon Sago		Roasted Sago	
		Rs. / Qtl	Per-centage	Rs / Qtl	Per-centage	Rs / Qtl.	Per-centage
<b>I. VARIABLE COSTS</b>							
1	Raw tubers	212.27	73.67	275.67	70.14	229.04	68.67
2	Casual labour charges	10.66	3.69	14.51	3.69	15.59	4.67
3	Gunny bags	13.01	4.58	8.51	2.17	10.81	3.24
4	Oil & Fuel	-	-	6.14	1.56	4.19	1.26
5	Baskets	0.38	0.13	0.14	0.36	0.11	0.33
6	Electricity charges	5.47	1.89	10.85	2.76	12.41	3.72
7	Diesel & Lubricants	0.75	0.26	1.29	0.33	0.45	0.13
8	Transportation Charges	5.04	1.74	1.17	0.30	2.76	0.83
9	Repairs & Maintenance	1.98	0.69	8.00	2.04	6.05	1.81
10	Stationary, telephone etc.	1.17	0.41	2.18	0.55	2.10	0.63
11	Interest on working capital	31.35	10.88	41.06	10.45	35.44	10.63
12	<b>Total variable costs</b>	<b>282.13</b>	<b>97.91</b>	<b>369.51</b>	<b>94.02</b>	<b>318.95</b>	<b>95.62</b>
<b>II. FIXED COSTS</b>							
1.	Salary to permanent staff	0.87	0.30	2.56	0.65	2.27	0.68
2.	Depreciation on building	0.59	0.20	3.29	0.84	1.56	0.47
3.	Depreciation on machineries	2.34	0.81	4.66	1.19	4.07	1.22
4.	Urban tax & other tax	0.89	0.31	8.85	2.25	4.09	1.23
5.	Depreciation on effluent treatment plant	0.67	0.24	1.05	0.27	0.99	0.29
6.	Interest on fixed capital	0.65	0.24	3.09	0.78	1.62	0.49
<b>II</b>	<b>Total Fixed Costs</b>	<b>6.01</b>	<b>2.09</b>	<b>23.50</b>	<b>5.98</b>	<b>14.60</b>	<b>4.38</b>
<b>III</b>	<b>Total Costs</b>	<b>288.14</b>	<b>100.00</b>	<b>393.01</b>	<b>100.00</b>	<b>333.55</b>	<b>100.00</b>

... were depreciation on building and salary to permanent staff ...  
 ... in Rs. 0.59 and Rs. 0.87 in starch units, Rs. 3.29 and Rs. ...  
 ... units, and Rs. 1.56 and Rs. 2.27 in roasted sago units.

**Cost of processing per quintal of raw tubers**



... per quintal of starch and sago is ...  
 ... of starch and sago is ...  
 ... of byproduct is ...  
 ... sago units and ...  
 ... value of byproducts ...  
 ... 85.08 ... and Rs. 74,71,306.61 is ...  
 ... Annual output is ...  
 ... units, and 6,374.98 ...  
 ... highest in nylon ...  
 ... roasted sago units. ...  
 ... higher in nylon sago ...  
 ... the two categories ...  
 ... after annual output, cost of ...

... typical processing

... products and byproducts and net returns are presented ...  
 ... value of main product was Rs.

The other items were depreciation on building and salary to permanent staff which amounted to Rs. 0.59 and Rs. 0.87 in starch units, Rs. 3.29 and Rs. 2.56 in nylon sago units, and Rs. 1.56 and Rs. 2.27 in roasted sago units.

#### **4.3.6 Cost of processing per quintal of starch and sago**

The details of cost of processing per quintal of starch and sago is presented in Table 4.18. From the table the total value of byproduct is Rs. 5,97,500 in starch units, Rs. 7,76,937.50 in nylon sago units and Rs. 7,64,420.86 in roasted sago units. Total cost less value of byproducts amounted to Rs. 1,00,86,093.30, Rs. 85,08,896.22 and Rs. 74,74,306.61 in starch, nylon sago and roasted sago units respectively. Annual output in quintals in starch units was 11,430, 6075 for nylon sago units, and 6,374.98 for roasted sago units. Cost of production per quintal was highest in nylon sago units with Rs. 1,400.64 followed by Rs. 1,172.44 in roasted sago units, then by starch units with Rs. 882.42. Total cost was higher in nylon sago units and hence the higher cost of processing over the two categories. Total cost was highest in starch units but due to higher annual output, cost of processing was lesser than the sago units.

#### **4.3.7 Costs and returns in tapioca processing**

Value of main products and byproducts and net returns are presented in Table 4.19. From the table it is evident that value of main product was Rs.

and returns in sago processing

(Value in Rs.)

**Table 4.18 : Cost of processing per quintal of starch and sago**

S.No.	Particulars	Starch	Nylon Sago	Roasted Sago
1.	Total cost (Rs.)	1,06,63,593.30	92,85,833.72	82,88,727.47
2.	Total value of byproduct (Rs.)	5,97,500.00	7,76,937.50	7,64,420.86
	a. Tippi	5,97,500.00	6,11,562.50	6,40,469.61
	b. Sago broken	-	1,65,375.00	1,73,951.25
3.	Annual output (Qtls)	11,430.00	6,075.00	6,374.98
4.	Total cost less value of byproducts (Rs.)	1,00,86,093.30	85,08,896.22	74,74,306.61
5.	Cost of production per quintal (Rs.)	882.42	1,400.64	1,172.44

Table 4.19 : Costs and returns in tapioca processing

(Value in Rs.)

S.No.	Particulars	Starch	Nylon sago	Roasted sago
1.	Value of main product	1,07,31,500.00	91,12,500.00	84,99,996.00
2.	Value of byproducts	5,97,500.00	7,76,937.50	7,64,420.86
	a. Sago broken	-	1,65,375.00	1,23,951.25
	b. Tippi	5,97,500.00	6,11,562.50	6,40,469.61
3.	Total revenue	1,13,29,000.00	98,89,437.50	92,64,416.86
4.	Total costs	1,06,83,593.30	92,85,833.72	82,88,727.47
5.	Net return	6,45,406.70	6,03,603.78	9,75,689.39
6.	Rate of return per rupee of investment	1.06	1.07	1.12

84,99,996 in roasted sago units, Rs. 91,12,500 in nylon sago units and Rs. 1,07,31,500 in starch units.

Value of byproducts was of the order of Rs. 5,97,500.00 Rs.7,76,937.00 and Rs. 7,64,420.86 for starch, nylon sago and roasted sago units. This value was highest for nylon sago units due to higher sago broken obtained during the processing operation. Also the quantity of sago broken depended upon the size of the globules formed. For smaller sized globules more broken would be formed. Total revenue was highest in starch units which amounted to Rs. 1,13,29,000 followed by nylon sago units with Rs. 98,89,437.50 and then by roasted sago unit with Rs. 92,64,416.86. The net revenue was highest in roasted sago units with Rs. 9,75,689.39, followed by starch unit with Rs. 6,45,406.70 and then by nylon sago units with Rs. 6,03,603.78.

#### 4.3.8 Returns per quintal of tapioca processed

The returns from main product and byproducts are presented in Table 4.20.

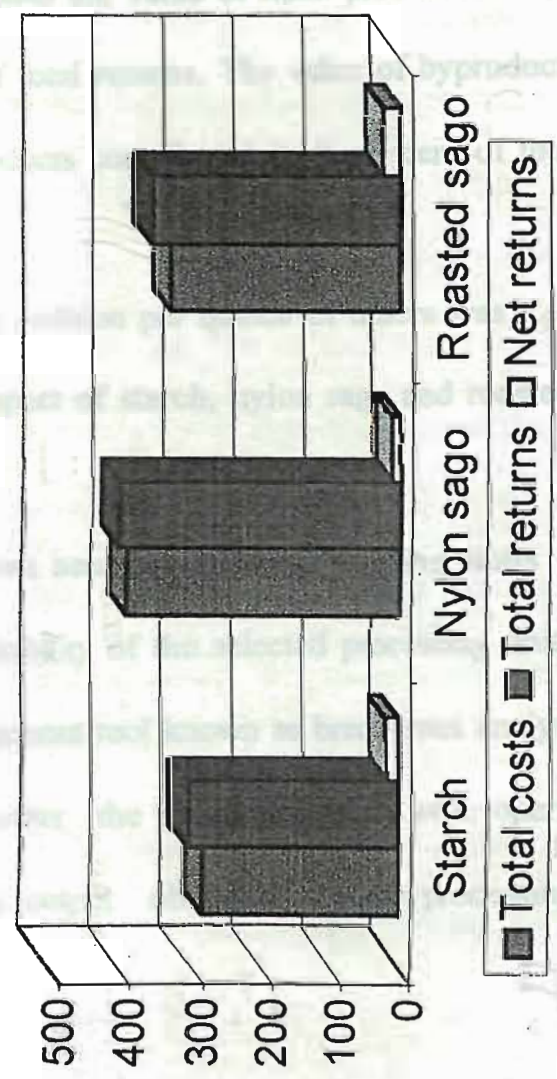
In the nylon sago units the value of main product was Rs. 385.65 which accounted for 94.91 per cent of total returns. The value of byproducts was Rs. 6.69 from sago broken and Rs. 14 from tippi. Totally byproducts contributed 5.1 per cent of total returns.

Table 4.20 : Returns per quintal of tapioca processed

S. No.	Particulars	Starch units			Nylon Sago units			Roasted Sago units		
		Physical quantity (kg)	Returns (Rs.)	Net Returns (Rs.)	Physical quantity (kg)	Returns (Rs.)	Net Returns (Rs.)	Physical quantity (kg)	Returns (Rs.)	Net Returns (Rs.)
<b>1. SAGO NYLON</b>										
<b>a. Main product</b>										
	Nylon Sago	-	-	-	25.71 (63.70)	385.65 (94.91)	-	-	-	-
<b>b. By product</b>										
	i. Sago broken	-	-	-	1.03 (2.55)	6.69 (1.65)	-	-	-	-
	ii. Tippi	-	-	-	13.62 (33.75)	14.00 (3.45)	-	-	-	-
	<b>Total</b>	-	-	-	40.36 (100.00)	406.34 (100.00)	13.33	-	-	-
<b>2. SAGO ROASTED</b>										
<b>a. Main Product</b>										
	Roasted Sago	-	-	-	-	-	-	25.65 (65.09)	341.91 (95.00)	-
<b>b. By product</b>										
	i. Sago broken	-	-	-	-	-	-	0.77 (1.95)	4.98 (1.38)	-
	ii. Tippi	-	-	-	-	-	-	12.99 (32.96)	13.00 (3.61)	-
	<b>Total</b>	-	-	-	-	-	-	39.41 (100.00)	359.89 (100.00)	26.34
<b>3. STARCH</b>										
<b>a. Main product</b>										
	Starch	31 (66.37)	292.64 (94.82)	-	-	-	-	-	-	-
<b>b. By product</b>										
	Tippi	15.71 (33.63)	16.00 (5.18)	-	-	-	-	-	-	-
	<b>Total</b>	46.71 (100.00)	308.64	20.50	-	-	-	-	-	-

Note : Figures in parantheses indicate percentages to the total

Costs and returns per quintal of tapioca processed



...sago units, the value of main product was Rs. 141.91  
 ... per cent of total returns. The value of byproduct was  
 ...sago broken and Rs. 13 from tippi. Totally byproducts  
 ... per cent of total returns

...the value of main product was Rs. 292.64 contributing  
 ... of total returns. The value of byproducts was Rs. 16.80 from  
 ... returns.  
 ...0.50, Rs. 13.33 and  
 ...sago unit.

...with the  
 ... This analysis helps  
 ... profitably or not  
 ... is processed in

...quantity of 3,896.76 quintals of  
 ...quintals of nylon sago and 1,668.55 quintals of roasted sago  
 ...without incurring

In roasted sago units, the value of main product was Rs. 341.91 contributing 95 per cent of total returns. The value of byproducts was Rs. 4.98 from sago broken and Rs. 13 from tippi. Totally byproducts contributed 4.99 per cent of total returns.

In starch units the value of main product was Rs. 292.64 contributing 94.82 per cent of total returns. The value of byproducts was Rs. 16.00 from tippi. The byproducts contributed 5.18 per cent of total returns.

The value addition per quintal of tubers was Rs. 20.50, Rs. 13.33 and Rs. 26.34 in respect of starch, nylon sago and roasted sago units.

**4.3.9 Break even analysis of the processing units**

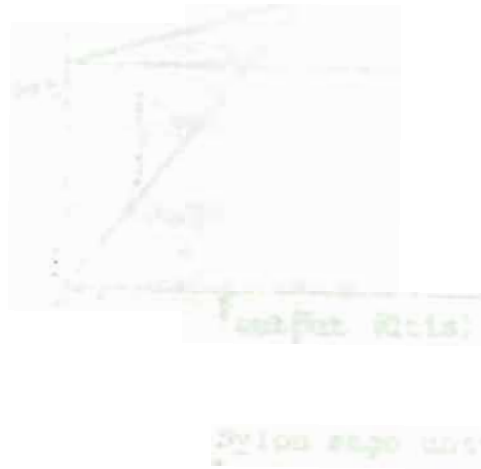
The profitability of the selected processing units was studied with the help of a management tool known as break-even analysis. This analysis helps to assess whether the processing units were operating profitably or not. The break even output obtained for the processing units is presented in Table 4.21.

The results revealed that a minimum quantity of 3,896.76 quintals of starch, 2,911.42 quintals of nylon sago and 1,668.55 quintals of roasted sago should be produced to continue in the production process without incurring

losses. The average output was 11,430 quintals of starch, 6,075 quintals of nylon sago and 6,374.99 quintals of roasted sago. The margin of safety which was the surplus over break-even output was 7,533.24 quintals for starch, 3,163.58 quintals for nylon sago and 4,706.44 quintals for roasted sago.

Economic analysis of processing of tapioca revealed that the tapioca tubers were converted into starch, nylon sago and roasted sago. There were exclusive starch units as well as sago units. However starch is an intermediary product for sago production. Total costs of processing a quintal of raw tubers including the cost of raw tubers were Rs. 288.14, Rs. 393.01 and Rs. 333.55 in starch, nylon sago and roasted sago units respectively. The value addition per quintal of tubers was Rs. 20.50, Rs. 13.33 and Rs. 26.34 in starch, nylon sago and roasted sago units respectively. The value addition for the annual turnover of the tapioca tubers for the three units was of the order of Rs. 6,45,406.70, Rs. 6,03,603.78 and Rs. 9,75,689.39 respectively. Among the three units, roasted sago units recorded the highest net income of Rs. 9,75,689.39 followed by starch units with Rs. 6,45,406.70 and nylon sago units with Rs. 6,03,603.78.

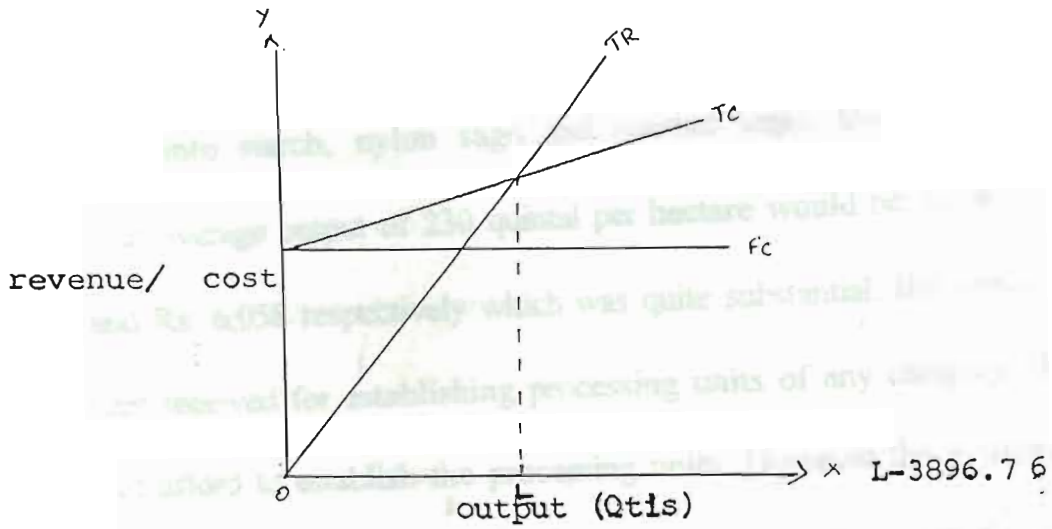
In terms of returns per rupee of investment roasted sago units could generate an amount of Rs. 1.12 against Rs. 1.06 by starch units and Rs. 1.07 by nylon sago units. Given the value addition per quintal of tapioca tubers



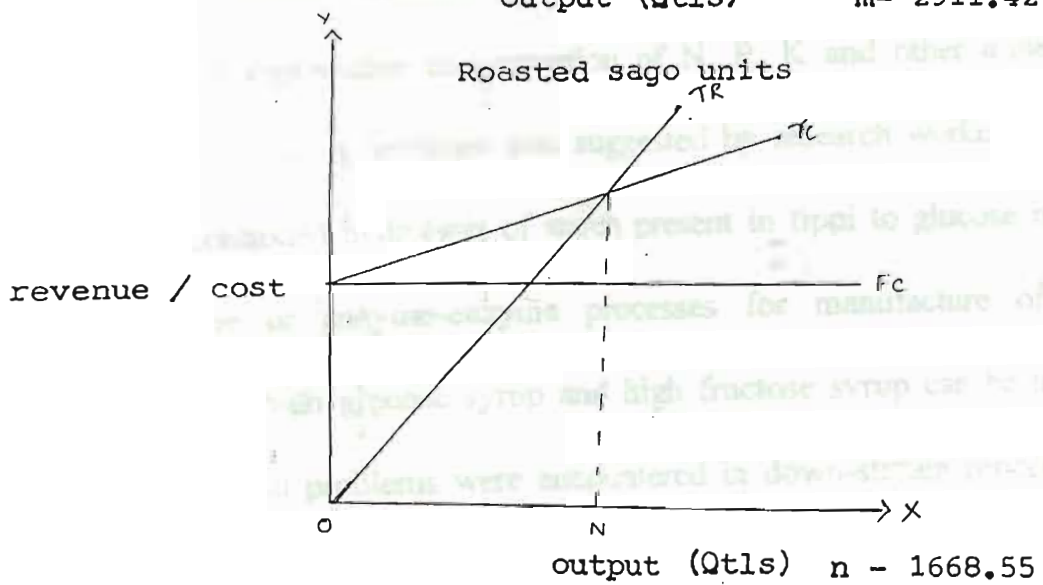
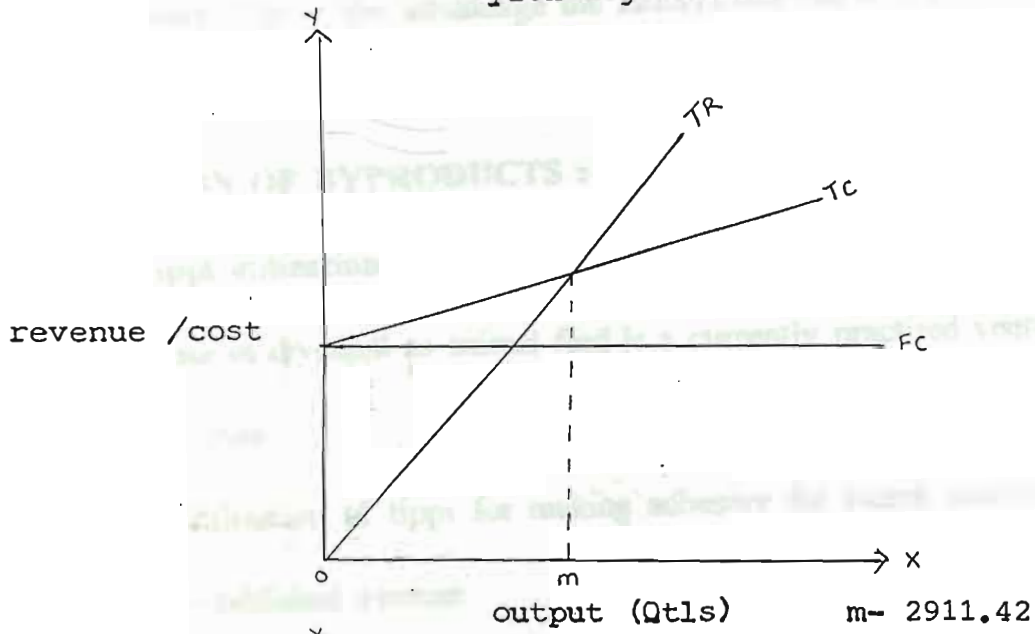
**Table 4.21 : Break - Even analysis of the tapioca processing units**

S.No.	Particulars	Starch	Nylon Sago	Roasted Sago
1.	Fixed costs (Rs.)	2,16,582.07	5,56,080.67	3,62,893.70
2.	Variable costs (Rs.)	1,06,83,593.30	87,29,752.84	79,25,833.77
3.	Price per quintal (Rs.)	938.00	1,500.00	1,333.33
4.	Break - even output (Qtls.)	3,896.76	2,911.42	1,668.55
5.	Average output (Qtls.)	11,430.00	6,075.00	6,374.99
6.	Margin of safety (Qtls.)	7,533.24	3,163.58	4,706.44





Nylon sago units



BREAK - EVEN ANALYSIS OF  
TAPIOCA PROCESSING UNITS

by converting into starch, nylon sago and roasted sago, the total value addition for an average output of 230 quintal per hectare would be Rs. 4,715, Rs. 3,066 and Rs. 6,058 respectively which was quite substantial. But keeping the investment received for establishing processing units of any category, the farmer cannot afford to establish the processing units. However the existence of processing units in the study area ensured an assured market for the tapioca growers. This is the advantage the farmers derived in the study area.

#### **UTILIZATION OF BYPRODUCTS :**

##### **Areas of tippi utilization :**

1. The use of dry tippi as animal feed is a currently practised venture by many units.
2. The utilization of tippi for making adhesive for match industry is a well established avenue.
3. Due to appreciable concentration of N, P, K and other minerals in tippi, its use as fertilizer was suggested by research workers.
4. The controlled hydrolysis of starch present in tippi to glucose by acid-enzyme or enzyme-enzyme processes for manufacture of liquid glucose, high glucose syrup and high fructose syrup can be achieved but several problems were encountered in down-stream processing.

5. The partially dewatered tippi, after enrichment with minerals, acids and nutrients, can be used as a substitute to wheat bran in solid state fermentation processes for production of hydrolytic enzymes such as alpha amylase, amyloglucosidase, pectinase etc.
6. Production of potable ethanol from tippi is not only viable but also economical and attractive venture. This process has the advantage of producing better quality ethanol as compared to that produced from molasses ; probably because of the lower concentration of higher alcohols and other undesirable volatile compounds. The process can be easily adopted by starch / sago manufacturers or the existing distilleries with marginal addition and modifications of the plant machinery.

## *Summary and Conclusions*

## CHAPTER - V

### SUMMARY AND CONCLUSIONS

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# *Summary and Conclusions*

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## CHAPTER - V

### SUMMARY AND CONCLUSIONS

Tuber crops are plants which produce structures that are used as human or animal feed. They are the third important food crops of human beings after cereals and grain legumes and constitute either staple or subsidiary food for about a fifth of the world population. Tropical root and tuber crops (TRC) have their own role as an important staple in several countries in South America, Africa, South east Asia etc.

In India tapioca is cultivated in 0.24 million ha producing 6. million tonnes. The area and production followed the global trends in the early nineties but stagnation has set in. Kerala, where the crop was first introduced in India accounted for 50 per cent of the area under tapioca (0.13 million ha), Tamilnadu accounts for 32 per cent of the area (0.08 million ha) and 9 per cent of area in Andhra Pradesh (20,000 ha). It is interesting to note that though India does not have a major area under this crop, its productivity is the highest in the world (24.50 tonnes / ha)

The present study entitled "**Production and Processing of tapioca in Salem district of Tamilnadu - An Economic Analysis**" was intended to examine the costs and returns in production and processing of tapioca.

## 5.1 The objectives of the study

1. to estimate the costs and returns in tapioca production.
2. to estimate the investment required for different types of processing units and recovery performance of the processing units.
3. to study the costs and returns in tapioca processing and
4. to study the utilization pattern of byproducts in tapioca processing.

The study was carried out in Salem district of Tamil Nadu. Based on the dominance of the area under tapioca in the district, two taluks namely Attur and Salem were selected. From the selected taluks six villages having maximum area under tapioca production were selected for the study. The sample farmers were stratified into two size groups viz., small (upto 1 hectare of irrigated land and large (above 1 ha of irrigated land). Altogether 60 farmers were selected at random for the detailed study taking 29 from small farmers and 31 from large farmers in probability proportion to their number in each size group. From the list of tapioca processing units in the selected taluks, five units under each category viz., starch, sago (nylon) and sago (roasted) were randomly selected for the purpose of study. The processing units thus selected stood at 15. The required data were collected from selected farmers and processing units through personal interviews with the help of a well structured schedule for the agricultural year 1999-2000. The data were analysed using tabular analysis to fulfill the objectives of the study.

## Major findings of the study

The family composition revealed that the average size of the family was 7.8, 9.95 and 8.91 members in case of small, large and pooled farms respectively indicating direct relationship with the size of the holding. However the participation of family members in agriculture decreased with farm size.

The average size of the holding for the sample as a whole was 1.67 hectares with 88.62 per cent of area under irrigated tapioca. The area under irrigated tapioca was 82.22 per cent and 90.79 per cent of the operational holding of small and large farms respectively.

The per hectare value of assets ranged from Rs. 77,553 on small farms to Rs. 1,03,576 on large farms with an average of Rs. 90,998 on the pooled farms. The land value was to the extent of 72.02 per cent of the total value of farm assets.

The total human labour utilised was 191.05, 210.65 and 201.17 mandays per hectare on small, large and pooled farms. The maximum labour absorption was in weeding (34.93 per cent) followed by irrigation (18.36 per cent), planting the setts (11.60 per cent) and harvesting (11.55 per cent) on pooled farms. Family labour use was maximum (114.63 mandays) on small farms and minimum (73.73 mandays) on large farms.

The bullock labour utilisation on small, large and pooled farms was 20.35, 4.82 and 12.32 cattle pair days per hectare respectively. Tractor power utilisation was found only on large farms.

Farmers used 14,375 setts, 3.25 tonnes of FYM, 66.25 kg of nitrogen, 66.25 kg of phosphorus and 125 kg of potassium on pooled farms as against the recommended dose of 18,750 setts per ha, 20 tonnes of FYM, 57.50 : 50 : 120 kg of N, P and K.

The average total cost of cultivation per hectare worked out to Rs. 31,513.93 of which operational costs and fixed costs accounted for 59.17 per cent and 40.83 per cent respectively. Among the operational costs, human labour, setts and fertilizers were the major items.

Rental value of owned land was the major cost component under fixed costs accounting for 33.32 per cent of the total costs on pooled farms. On an average, the total costs per hectare were higher on large farms (Rs. 32,763.38) than that of small farms (Rs. 30,178.32).

On an average the tapioca yield per hectare was 210, 250, 230.66 quintals on small, large and pooled farms respectively. The productivity of tapioca exhibited direct relationship with the farm size.

The cost of producing a quintal of tapioca tubers exhibited inverse relationship with the size of the holding as it was Rs. 143.70 on small farms and Rs. 129.46 on large farms. A quintal of tapioca tubers yielded a net income of Rs. 96.55 and Rs. 121.29 on small and large farms respectively and the same was Rs. 103.88 on pooled farms.

For the sample as a whole Cost A<sub>1</sub>, Cost B and Cost C worked out to Rs. 15,431.40, Rs. 26,839.02 and Rs. 31,513.93 respectively. Cost A<sub>1</sub> / A<sub>2</sub> and Cost B were found to be higher on large farms than on small farms (Rs. 13,176.19 and Rs. 24,446.82) reflecting a direct relationship with the size of holding. Cost C also indicated a positive relationship with the farm size.

The farm business analysis revealed that the gross income, farm business income, family labour income, net income and farm investment income showed direct relationship with the size of holding. The returns per rupee investment was 1.67, 1.83 and 1.70 on small, large and pooled farms respectively. The gross income ranged from Rs. 50,400 on small farms to Rs. 60,000 on large farms. The net income increased from Rs. 20,221.68 on small farms to Rs. 27,326.62 on large farms.

The total investment was of the order of Rs. 26,35,000, Rs. 40,88,000, and Rs. 36,29,000 on starch, nylon sago and roasted sago units respectively.

The major items of investment in tapioca processing units were investment on machinery and buildings on which the amount spent was Rs. 9,35,000 and Rs. 6,00,000 by starch units, Rs. 14,38,000 and Rs. 13,50,000 by nylon sago units and Rs. 13,79,000 and Rs. 10,50,000 by roasted sago units.

Production capacity of tapioca processing units was 350, 230 and 250 quintals per day for starch, nylon sago and roasted sago units respectively.

Cost incurred to process one quintal of tapioca raw tubers was Rs. 288.14 for starch units, Rs. 393.01 for nylon sago units and Rs. 333.55 for roasted sago units variable costs accounted for 97.91 per cent, 94.02 per cent and 95.62 per cent of the total cost for starch, nylon sago and roasted sago units.

On an average starch units realised 65.22 per cent of starch and 34.78 per cent of tippi. Nylon sago units realised 63.27 per cent of nylon sago, 2.53 per cent of sago broken and 34.20 per cent of tippi. Roasted sago units realised 64.66 per cent of roasted sago and 1.94 per cent of sago broken and 33.40 per cent of tippi.

Total cost of tapioca processing amounted to Rs. 1,06,83,593.30 for starch units, Rs. 92,85,833.72 for nylon sago units and Rs. 82,88,724.47 for roasted sago units in which variable cost contributed to 97.97 per cent, 94.01 per cent and 95.62 per cent for the aforesaid units respectively.

Cost of processing per quintal of starch amounted to Rs. 882.42 and for nylon sago Rs. 1400.64 and roasted sago Rs. 1,172.44.

The starch units under study realised 11,430 quintals of starch, nylon sago units 6,075 quintals of nylon sago and roasted sago units 6,374.98 quintals of roasted sago which valued at Rs. 1,07,31,500, Rs. 91,12,500 and Rs. 84,99,996 for starch, nylon sago and roasted sago units respectively.

The value of byproducts amounted to Rs. 5,97,500, Rs. 7,76,937.50 and Rs. 7,64,420.86 for starch, nylon sago and roasted sago units respectively.

The net returns were found to be highest in roasted sago units with Rs. 9,75,689.39 followed by starch units with Rs. 6,45,406.70 and then by nylon sago units with Rs. 6,03,603.78.

The returns per quintal of tapioca processed into nylon sago amounted to Rs. 406.34 and to roasted sago amounted to Rs. 359.89 and to starch amounted to Rs. 308.64.

The break even output of starch units was 3,896.76 quintals, for nylon sago unit it was 2,911.42 quintals and for roasted sago units it was 1,668.55 quintals. The margin of safety which was the surplus over the break-even output was 7,533.24 quintals for starch units 3,163.58 quintals for nylon sago units and 4,706.44 quintals for roasted sago units.

**CONCLUSIONS :**

The following conclusions have been emerged from the study :

1. Family size was directly related with the size of holding.
2. Human labour utilisation decreased with increase in the size of the farm.
3. Family labour employment was more on small farms compared to large farms.
4. Large farmers were found to apply higher doses of material inputs viz., FYM, N, P, K, and plant protection chemicals, compared to small farmers.

5. The costs and returns per ha exhibited a direct relationship with the farm size.
6. Cost of production of tapioca tubers was inversely related with the farm size.
7. On an average, the tapioca yield per ha was more on large farms than that of small farms.
8. All the income measures viz., farm business income, family labour income, net income, farm investment income and returns per rupee of investment showed positive relationship with the size of holding.
9. The total investment in tapioca processing was highest in nylon sago, followed by roasted sago and starch units respectively.
10. Production capacities of tapioca processing units were 350, 230 and 250 quintals per day for starch, nylon sago and roasted sago units respectively.
11. Cost of processing per quintal of tapioca raw tubers was more in the case of nylon sago units compared to starch and roasted sago units.
12. On an average starch, nylon sago and roasted units realised 65.22 per cent of starch, 63.27 per cent of nylon sago and 64.66 per cent of roasted sago.
13. The returns per quintal of tapioca processed into nylon sago, roasted sago and starch amounted to Rs. 406.34, Rs. 359.89 and Rs. 308.64 respectively.

14. The break-even output of starch, nylon sago and roasted sago units was 3,896.72, 2,911.42 and 1,668.55 quintals respectively.
15. The margin of safety which was the surplus over the break-even output was 7,533.24, 3,163.58 and 4,706.44 quintals for starch, nylon sago and roasted sago units respectively.

### **SUGGESTIONS :**

In the study area the application of FYM was less than the recommended quantity for want of its availability. It is understandable that in the light of decline in the cattle population FYM shortage remains a problem. As an alternative, farmers can grow trees on the bunds which supply green manure. The productivity of tapioca is found to be 23 tonnes / ha which is less than the average yield of Salem district (32 tonnes / ha) possibilities do exist to raise the productivity of tapioca in the study area through better management of irrigation mainly and other cultural practices on the recommended lines. The present practice is to store raw tubers in the pits dug in the premises of processing units and the tubers are processed within a period of 2 to 3 days For any reasons like sudden break down of power, machinery etc. the processing may be delayed leading to decline in the starch content. Therefore, there is a immediate need to develop storage technology for the storage of tubers to over come any time lag between the days of arrivals and processing.



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