ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF VEGETABLES IN THIRUVANANTHAPURAM DISTRICT

BY

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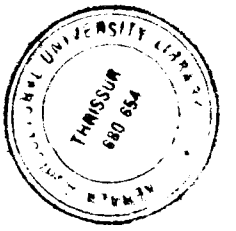

THESIS
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2001

DECLARATION

I hereby declare that this thesis entitled **"Economic analysis of production and marketing of vegetables in Thiruvananthapuram district"** is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award of any degree, diploma, associateship, fellowship or other similar title, of any other university or society.

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1. INTRODUCTION

Indian agriculture, has over the years witnessed a shift from traditional subsistence nature to commercial farming, assisted by the much-lauded green revolution. However, these changes were mostly confined to certain geographical location and few cereal crops like wheat, paddy, jowar, bajra etc. The production of vegetables and fruits, which form major dietary supplements, however received little attention during this period.

Though we boast of food self-sufficiency, the low-income group in India still suffers from chronic undernutrition and malnutrition because of their unbalanced diet. The challenging task of improving the quality of food to meet the nutritional requirements of the people remains unaccomplished. In this context, added thrust has to be placed on fruit and vegetable production, preservation as well as storage to meet the growing requirements of the people. Vegetable cultivation also assumes significance as it can provide continuous and gainful employment opportunities and income to the farmers, thus paving way for their livelihood security.

Vegetables are the cheapest and richest sources of natural protective foods contributing proteins, carbohydrates, minerals, vitamins and roughages, which constitute the essentials of a balanced diet. The Indian Medical Council has estimated that for proper maintenance of body

health a person needs to consume at least 310 grams of vegetables. An average Keralite's consumption is as low as 50 gram per day, mainly due to the low availability and high price of vegetables.

Though blessed abundantly by nature with favorable soil and climatic conditions, Kerala remains as consumer state apropos vegetable production. Most of the vegetables, which we need for daily consumption, come from neighboring states like Tamil Nadu, Karnataka, Andhra Pradesh and Maharashtra. It is estimated that vegetables worth Rs. 850 crores come to Kerala every year from other states. The adverse conditions arising out of this situation affect the availability of vegetables and thus the price of vegetables increase exorbitantly.

Now the situation is gradually changing, thanks to the implementation of two schemes, the Kerala Horticulture Development Programme (KHDP) and the Intensive Vegetable Development Programme (IVDP).

The Kerala Horticultural Development Programme (KHDP), a joint venture of European Union and the State Government began in 1993 with a total outlay of Rs. 131.45 crores. The programme envisages an overall development of the cultivation of vegetables and fruits in the state. Under this programme, the farmers are organised into Self Help Groups (SHGs). According to KHDP officials the scheme covers 32,500 farmers organised into 1,550 SHGs. It has covered an area of 7,650 ha of vegetables and achieved a production of 95,000 tonnes during 1999. The major activities of the KHDP include arrangement of credit facilities, training and

The disorganized system of marketing service is a threat to vegetable production. Major constraints in vegetables are perishability, bulkiness and seasonality in production. Marketing of vegetables in India is largely uncontrolled, unorganized and generally inefficient. There is no proper grading and standardization of agricultural produce. Because of the involvement of a large number of middlemen, producer's share in consumers' rupee is very low.

The production and marketing aspects of vegetables has not yet received the attention they deserve, particularly so in Kerala. It is necessary to know the present cost of production, output, price received, profit etc., so that proper planning can be done to make production more remunerative and attractive. It will also be beneficial to get a comprehensive idea of the production efficiency. A study on the economics of production and marketing of vegetables would appear very relevant in this context.

Thiruvananthapuram district has been one among the major vegetable growing districts of Kerala. The present study was taken up in Thiruvananthapuram district. The major objectives of the study were:

1.To examine the cost and returns of vegetable cultivation and employment generation.

2.To find out the marketing efficiency.

3.To identify the major problems encountered in the production and marketing of vegetables.

4.To examine the technical efficiency of vegetable cultivation.

marketing. The KHDP has introduced group marketing through the concept of field centres. On the basis of Memorandum of Understanding executed by KHDP with the State Bank of India, the State Bank of Travancore, the Union Bank of India, the Canara Bank and the South Malabar Grameen bank, credit facilities are being extended to member vegetable farmers.

On the other hand the State Department of Agriculture has also launched a programme, the Intensive Vegetable Development Programme (IVDP). It aims at finding out suitable areas for intensive production of vegetables and to help the farmers carry out cultivation in a better way. It envisaged vegetable cultivation in seven districts viz., Thiruvananthapuram, Alappuzha, Thrissur, Idukki, Palakkad, Kozhikode and Kannur. Here also the vegetable farmers are grouped into Self Help Groups (SHGs). These SHGs have been registered under the Charitable Societies Act with minimum area of cultivation of five hectares. Through the IVDP scheme, the Department of Agriculture supplies 50 per cent of the expenditure incurred for seeds, plant protection chemicals, irrigation and panthalling. The maximum amount is restricted to Rs. 10,000 for a hectare as subsidy to the cultivator.

In the case of vegetables, quality and quantity loss can occur at all stages from harvesting, handling, storage and marketing. Transporting, storage and processing facilities have to be developed in order to reduce the post-harvest losses.

The results obtained from the study would be useful in locating the weak spots in the production and marketing of vegetables. The results regarding cost structure, marketing and technical efficiency would be useful in formulating appropriate policy decisions related to vegetable production and marketing.

However, this study is confined to a small particular region, and therefore the conclusions are restricted by the conditions prevailing in the study area. Any attempt at generalization is difficult and must be done with utmost care. Further, the survey method adopted for collecting data on production and marketing has its limitations. Respondent – farmers and traders do not maintain records of accounts and give the data from their memory. Therefore, information gathered is not free from recall bias. But care has been taken to minimise the bias through cross checks and to make the results reliable for drawing conclusions relevant to the universe of study and to conditions similar to it. However, these limitations are to be stated explicitly to avoid ambiguity.

This thesis is divided into seven chapters including the present one. A brief account of the relevant literature is given in the second chapter. Chapter three deals with the methodologies adopted for the present study. In chapter four a detailed account of the study area is given, while chapter five deals with the various results obtained. Chapter six is the discussion chapter, which gives interpretation to the results obtained. The final chapter deals with the summary of major findings of the study.

Review of Literature

2. REVIEW OF LITERATURE

This section intends to review the relevant and recent investigations and deliberations on the production and marketing of vegetables in India, with an emphasis on input-output relationship and technical efficiency. A logical sequence of concepts and related explanations has been attempted to the maximum extent possible, to integrate the available inferences with the conceptualization of the research undertaken here.

This chapter is divided into two parts

2.1 Review of concepts

2.2 Review of past studies

2.1 Review of concepts

Cost of Cultivation

Cost of cultivation forms an important component of any study on production and marketing as it basically determines the magnitude of production. To be more specific, cost of cultivation is the actual cost incurred in the production of a particular quantity of output. Production cost, in general is made up of two components, namely (i) the fixed cost and (ii) the variable cost. The sum of these two cost components would give the total cost of production. Fixed cost represents the total expenses that are incurred even when no output is produced. It is often called overhead cost and usually included contractual commitments for rental,

maintenance, depreciation, overhead, salaries, wages etc. It is otherwise termed as sunk cost as it is quite unaffected by any variation in the level of output, in the prescribed period of time.

ABC cost concept and percentage analysis were used for analysing and interpreting the data. Both input wise and operation wise costs of cultivation and various income efficiency measures were worked out separately for each crop.

Cost concepts

The Estimation Committee on Cost of Cultivation (Government of India, 1981) has categorized farm costs into six groups viz., Cost A_1, Cost A_2, Cost B_1, Cost B_2, Cost C_1, and Cost C_2. Cost C_3 has been added later in 1991 to account for the management input of the farmer (Acharya and Agarwal, 1994). The various components of the above costs are outlined below.

(i) Cost A_1

Cost A_1 approximates all actual expenses in cash and kind incurred in production by the owner operator. It includes the following items.

(a) Value of hired human and machine labour

b) Value of material inputs

c) Interest on working capital

d) Land Revenue

e) Depreciation on farm implements/machinery

(ii) Cost A_2

Cost A_2 is equal to cost A_1 plus rent paid for leased in land.

(iii) Cost B_1

Cost B_1 is cost A_1 plus interest on own fixed capital, including iron and wooden implements, machinery such as diesel and electric motors etc.

(iv) Cost B_2

Cost B_1 plus rental value of own land plus rent paid for leased in land gives Cost B_2.

(v) Cost C_1

Cost C_1 is Cost B_1 plus imputed value of family labour.

(vi) Cost C_2

Cost B_2 plus imputed value of family labour gives Cost C_2.

(vii) Cost C_3

It is equal to Cost C_2 plus 10 per cent of Cost C_2 to account for the value of management input of the farmer.

Marketing

Some theoretical concepts regarding marketing used in the present investigation are presented in this section.

As stated by Thomsen (1951) the study of agricultural marketing comprises all the operations and the agencies involved in the movement of farm produced foods, raw materials and their derivatives, such as

textiles, from the farms to the final consumers, and the effects of such operations on farmers, middle men and consumers.

Agricultural marketing can be defined as comprising of all activities involved in the supply of farm inputs to the farmers and movement of agricultural products from the farm to the consumers. Agricultural marketing system includes the assessment of demand for farm-inputs and their supply, post harvest handling of farm products, performance of various activities required in transferring farm products from farm gate to processing industries and to ultimate consumers, assessment of demand for farm products and public policies and programmes relating to the pricing, handling and purchase and sale of farm inputs and agricultural products (Acharya and Agarwal, 1998).

Marketing efficiency

According to Kohls and Uhl (1980) marketing efficiency is the ratio of market output (satisfaction) to market input (cost of resources). An upsurge in this ratio symbolizes improved efficiency and a decline denotes a trim down in the efficiency. A drop in the cost for the identical level of satisfaction or an augment in the satisfaction at a specified cost gives rise to the improvement of efficiency.

Marketing efficiency is the efficacy of the marketing system with which it functions (Ravikesh and Singh,1996). In order to workout the efficiency of marketing a variant of Shepherd formula as suggested by (Acharya and Agarwal, 1998) can be made use of.

$$ME = V/I - 1$$

where,

ME = Marketing efficiency

V = Value of the foods sold or price paid by the consumer.

I = Total marketing cost

An efficient marketing system can help in augmenting the income levels of the vegetable growers on the one hand and escalating the customer satisfaction on the other. Acharya and Agarwal (1998) described marketing efficiency as the degree of market performance.

Efficiency of the marketing system as we have discussed earlier depends on the interplay of various factors inside the system and outside the system. Marketing channels are one such category.

Marketing channels

As indicated by Acharya and Agarwal (1998) marketing channels are routes through which agricultural products shift from producers to consumers. They further illustrated that marketing channels for fruits and vegetables vary from commodity to commodity and from producer to producer. In rural areas and small towns, many producers execute the functions of retail sellers. Some of the widespread marketing channels for vegetables and fruits are

(i) Producer to consumer

(ii) Producer to primary wholesaler to retailer or hawkers to consumers.

(iii) Producer to processors

(iv) Producer to primary wholesalers to processors

(v) Producers to primary wholesalers to secondary wholesalers to retailers or hawkers to consumers.

(vi) Producers to local assemblers to primary wholesalers to retailers or hawkers to consumers.

Technical efficiency

Efficiency in economics is mainly defined in terms of optimality conditions associated with the perfectly competitive firm. Put at the briefest the optimality condition is that the marginal rates of substitution between any two commodities or factors must be the same in all their different uses (Hayek, 1945).

Farrel (1957) in his seminal paper elaborated the concept of technical efficiency. It involves the farmer's ability to obtain the maximum output from a given set of resources. Clearly, a farm, which uses the best practice methods, achieves a similar bundle of inputs and technology. Then it is likely to be superior to another farm or section that does not do the same. Farrel also observed that the input per unit of output values for such farms would lie on or above the unit isoquants. He divided technical

efficiency and allocative efficiency as the components, which contribute to economic efficiency.

Pasour and Bullock (1975) considered a situation to be efficient when the decision maker has no preferred alternative, given the circumstances. Further, they added, "Efficiency is a relative concept. Hence, judgments about the efficiency of an observed situation can be made only by comparing the observed situation with some defined efficiency norm..."

Schmidt and Lovell (1979) showed how the factor demands implied by a Cobb-Douglas model could be used to study allocative efficiency. They defined technical inefficiency as the inability to produce the maximum output from a given set of inputs and allocative inefficiency as the inability to combine inputs in optimum proportions when the input price is given.

The measurement of efficiency appears to be a difficult task, both conceptually and operationally, than has generally been recognized. The difficulties arise because of the inability of researchers to define the 'optimal' situation in a world of uncertainty. Broek *et al.*,(1980) in his study to compare the results with various techniques for estimating deterministic frontiers opined that the choice between deterministic and stochastic frontiers must be made on the basis of information about the quality of data, or how the data are generated and above all, the purpose of study. The frontier is called deterministic if all observations lie on or

below the frontier and stochastic if observations lie above the frontier due to random events.

As described by Ureta and Rieger (1990) the stochastic production frontier possess a distinct feature. The disturbance term is composed of two parts, a symmetric and a one-sided component. The symmetric component describes the random effects outside the control of the decision-maker including the statistical noise contained in empirical relationship. The one sided component captures deviations from the frontier due to inefficiency. The main advantage of the stochastic frontier production model is the introduction of the disturbance term representing the statistical noise comprising of measurement error and exogenous shocks beyond the control of the production unit in addition to the efficiency component. In this way technical efficiency measures obtained from stochastic frontier are expected to be efficient than those from deterministic models.

1.2 Review of Past Studies

Production

Ramasamy (1981) conducted a study on production aspects of major vegetables in Coimbatore district and found that the realised yield of brinjal varied from 2.66 tonnes to 23.78 tonnes per hectare. Estimated cost elasticity indicated increasing returns to scale in brinjal production. The yield of bhindi varied from 1.80 tonnes per hectare to14.56 tonnes

per hectare, the average being 9.60 tonnes. The coefficient of variation in yield was estimated to be 19.26 percent for the same crop.

Sivakumar (1981) conducted a study on economics of production and marketing of brinjal and tomato in Thiruchirapally. Comparative analysis of brinjal and tomato showed that the gross income realised for brinjal was higher than tomato.

Components in cost of production of vegetables have been found to follow certain remarkable trends, particularly with regard to labour charges, cost of fertilizers and cost of seeds and cost of manures. Subrahmaniyam and Doss (1981) estimated the cost of cultivation of vegetables in Mallur and Chickballapur taluks of Kolar district of Karnataka. Manures and manuring accounted for nearly 70 to 75 per cent of total cost. Input–output ratios of tomato and brinjal were 3.92 and 3.16 respectively.

Srivastava. (1993) in his study on the production, marketing and export potential of fruits and vegetables in Bihar, observed that fresh vegetables had relatively higher net return as compared to potato and onion. The highest per hectare net return was observed in cowpea (Rs. 21,274.32) followed by sponge gourd (Rs. 19,262.50). The capital output ratio was estimated to be highest at 1: 2.68 for sponge gourd followed by cowpea.

Reiterating the inferences mentioned earlier, an economic analysis of production of vegetables in Himachal Pradesh, conducted by

Thakur *et al.* (1994) showed that vegetable production was highly cost intensive or expensive but at the same time highly remunerative. Among the total variable costs for five vegetables viz., tomato, capsicum, cauliflower, cabbage and peas, human labour (hired and family labour combined) occupied the lion's share. The average was 25.40 per cent of the variable costs. They found that the intensive cropping system of tomato-tomato-cauliflower was the most remunerative one.

Preeti (1997) in her study on Economics of production and marketing of vegetables in Chittur taluk (Palghat district) reported that manure formed the third largest input constituting 15.92 per cent of the total cost in Okra cultivation.

In a study on economic analysis of winter tomato crop around Ludhiana city, Indersain *et al.*, (1999) opined that hired labour occupied the highest share in production cost i.e., 38.40 per cent. It was found to be highest in the case of small farms (39.10 per cent). Of the total variable cost 60 to 75 percent was spent on production inputs and the remaining 24 to 40 per cent on items such as packing, transportation and marketing charges. Fertilizer and manure cost formed 12.28 per cent of the total variable cost.

With regard to the economics of production and marketing of cauliflower in Ranchi district of Bihar, Madan *et al.* (1999) observed that the medium size farmers had the advantage of both more family labour and better capacity to make capital expenditure on fertilizer, pesticides and irrigation. Small farmers had the advantage of more family labour

relating to land size, but they lacked capital. While the large farmers had a greater capacity to make capital expenditure, compared to small and medium farmers they had less family labour in relation to land. Farm yard manure constituted 30.53 per cent of the total cost. Chemical pesticides occupied 5.31 per cent of the total cost for off-season cauliflower. He also opined that efforts must be made for easy availability of crop loans.

On the production aspects of chillies, Mishra *et al.* (1999) observed that on an average human labour accounted for 16.56 per cent of the cost of production of chillies. Similarly seed cost accounted for seven per cent and manures and fertilizers formed the largest share of cost of 28.19 per cent. For marginal farms the share of cost of manure was the highest. The cost of production per quintal has been estimated to be Rs. 360.93. The cost benefit ratio on Cost C basis in this case was 1: 2.27.

Marketing

In India we produce substantial quantities of agricultural commodities. But the farmers or the producer does not get adequate remuneration for his produce or he is unable to sell his produce. Where does the problem lie? Analysing critically, the major bottleneck is the problem in the marketing of the commodities. Marketing is as critical to better performance in agriculture as farming itself. Therefore, market reform ought to be an integral part of any policy for agricultural development. Although considerable progress has been achieved in technological improvements in agriculture by the use of HYVs and chemical fertilizers, and by the adoption of plant protection measures, the

rate of growth in farming in developing countries has not reached the expected levels. This is in fact due to the inadequacies in the marketing sector. To feed the population of over one billion, we have to produce adequate amount of food, as well as distribute it equitably. The former aim has almost been satisfied (the food grain production is surplus by 40 million tonnes) but the latter stands unfulfilled.

The comparison of vegetable market with fruit market and other perishable agricultural products have been the subject of study for many researchers. Nagaraj *et al.*, (1992) observed that the vegetable market is relatively more efficient than the fruit market. The study also reiterated that the supply in vegetable market is relatively less inelastic than that of fruits.

Sandhya (1992) studied the economics of production and marketing of vegetables in Thrissur district. The wholesaler's margin accounted for 16.45 per cent of the consumer's price of bittergourd and 23.76 per cent of the consumer's price of ashgourd whereas marketing costs incurred by wholesalers accounted for 4.02 and 7.26 percent of the consumer's price respectively for bitter gourd and ash gourd. The producer's net share in consumer's rupee was Rs.3.24 per kilogram (59.23 per cent) for bitter gourd and Rs.1.16 per kilogram (38.28 per cent) for ash gourd.

Prasad (1993) conducted a study on vegetable marketing in two agricultural markets of Bihar. A high level of village sales was observed in Jamshedpur market, whereas co-operative marketing institutions

accounted for a high proportion of vegetable marketing in Ranchi market. The estimation of price spread for four major vegetables indicated high marketing costs and large price spread due to the high margins charged by intermediaries.

Nowadays the researchers in the field of marketing are looking for improved ways to effective marketing.

Srivastava (1993) opined that marketing efficiency can be improved in two ways, viz.,

(i) by increasing operational efficiency and

(ii) through pricing efficiency

The former relates to the input – output ratio and focus on reducing costs in the performance of physical marketing functions, that is, storage, transportation etc. The latter refers to the situation where the sellers get the value of their produce and the consumers receive the value of their money and the marketing system is responsive to the consumer direction.

Devi (1996), in a study on marketing of fruits and vegetables in Kerala estimated the producer's share in consumer's rupee to vary between 51-57 per cent in fruits and 49-53 percent in vegetables. The share of marketing margins in consumer's rupee was much higher than the share of cost incurred by them in the case of vegetables.

Co-operative marketing societies play a major role in the marketing of vegetables in some areas. Nowadays, co-operative marketing societies

have been looked upon as an alternative marketing agency in vegetable trade. Bilonikar *et al.* (1998) found that efficiency of marketing system particularly dealing with agricultural commodities, depended on its capability to provide remunerative prices to the producers and fair prices to the consumers. The study also found that, marketing efficiency index was higher for all the vegetables for the farmers who sold the vegetables through co-operative marketing societies. Co-operative marketing societies operated more efficiently than the other agencies in marketing the vegetables of their member growers.

For agrarian economies, it is not important to merely increase agricultural production, but simultaneously marketable surplus must also increase. In most cases, marketed surplus may be less than the marketable surplus because of hoarding of a part of the commodity in anticipation of rise in prices. Contrary to this, no difference between marketable surplus and the marketed surplus of vegetables could be observed in some studies. This is evident from the study conducted by Shiyani *et al* (1998). They studied the marketing of vegetables in South Saurashtra zone of Gujarat. The study revealed that the overall marketed surplus was more than 90 per cent of the total vegetable production in all the different sizes of holding in the selected villages of south Saurashtra zone of Gujarat. The study revealed that the percentage of spoilage was high (5.17 per cent). This also points to the inadequacy of storage facilities for vegetables. They also opined that, in the Saurashtra region of Gujarat, the values of marketing efficiency for all vegetables under study

were found greater than unity, indicating the efficient functioning of the selected vegetable market. The index of marketing efficiency was the highest in the case of chillies (5.53), followed by cabbage (5.05), bottlegourd (3.89), tomato (3.86) and brinjal (3.56). The marketing efficiency was found to be satisfactory for all the vegetables studied.

Sen and Maurya (1999) worked out the producer's share in consumer's rupee on a study of vegetables based on the analysis of the data collected from ten villages in Sewapuri block of Varanasi district. They found that the price spread between the price received by producers in the selected villages and that paid by the consumers in Varanasi city included all the marketing charges (including transport charges) paid by the producers, wholesalers and retailers as well as the margins of wholesalers and retailers. The producer's share in consumer's rupee for vegetables was lowest for tomato and highest for brinjal in Kamacheha and Chandwa markets in Varanasi. On the whole, the price spread accounted for more than 33 per cent of the price paid by the consumers for the ten vegetables under study in both the markets.

Problems in marketing

Marketing of vegetables possessed more problems compared to other agricultural commodities as they have a high degree of perishability, bulkiness, higher proportion of retailers' margin and concentration of trade in a few hands. The vegetable industry can immensely be expanded provided that the producers are assured of better marketing facilities and reasonable prices for their production. The lion's share of producer's

rupee is mostly swept away by marketing costs and margins in case of agricultural products in general and perishable products like vegetables in particular.

In Kerala, vegetable marketing in general and marketing of snakegourd, bittergourd and amaranthus in particular is mainly in the hands of middlemen like moneylender, village merchants and wholesalers. Hence, the producer is only a price receiver. Therefore, many a time vegetable growers have to resort to distress sales due to uncertain situations in the marketing of vegetables particularly when the market supply is more. In the process of marketing the producer has to incur various marketing costs. The costs are determined by the performance and efficiency of different marketing functionaries in different channels, which in turn influence the return to the producer. The government offers a host of subsidies to production sector. While this is indeed a laudable initiative, it fails to achieve the desired objectives, because the crucial factor of marketing is highly neglected. Thakur *et al.* (1994) studied the vegetable revolution and economics of vegetable cultivation in Himachal Pradesh. He opined that the major problems in marketing were,

(a) Un-organised marketing and low prices paid to farmers

(b) Malpractice, high and undue marketing margins and costs in the markets

(c) Lack of mechanical grading, packing and proper storage facilities

(d) Lack of village roads and sufficient and low cost transportation facilities

(e) Lack of market information and market news.

(f) Lack of processing units and co-operative societies.

Of these the major problem is unorganized marketing and low prices paid to farmers due to lack of mechanical grading, packing and proper storage facilities.

Marketing channels

Ravikesh and Singh (1996) explored the various marketing channels for brinjal. There were three channels for marketing of brinjal. They were

Channel I – Producer → Consumer

Channel II – Producer → Retailer → Consumer

Channel III – Producer → Wholesaler → Retailer → Consumer

The various channels for marketing of chillies were studied by Mishra *et al.*, (1999). The major marketing channels for marketing of chillies in block Ahranla in the Azamgarh district were as follows.

Channel I – Producer → Consumer

Channel II – Producer → Retailer → Consumer

Channel III – Producer → Wholesaler → Retailer → Consumer

Technical efficiency

Chennarayadu *et al.* (1990) studied the land use efficiency of banana applying the frontier production function. Although banana is an important crop in Andhra Pradesh, with an acerage of 23,200 hectares and production of 23.39 lakh tonnes, its cultivation is subjected to high degree of risk and uncertainties. The frontier or the optimum values of land represented an average of 65 per cent of the actual land used in banana cultivation. He also noted that the farmers below one acre were better utilizing the land than others in the study area. The land use inefficiency was more in large farms compared to marginal farms. They also suggested that introduction of crop insurance might encourage investments on modern inputs.

Ali and Chaudhary (1990) studied the technical, allocative and economic efficiency in the Punjab region of Pakistan. The average technical efficiency ranged from 0.80 in the rice cropped region to 0.87 in the sugarcane region. This meant that there existed 13-20 per cent potential for increasing farmers' income at the existing level of their resources. There was no statistical difference in the technical efficiency in various regions studied and these regions performed similarly in utilizing the given resources. They also found out that the production gap between 'average' and 'best practice' farmer could be narrowed.

Dawson *et al.*, (1991) calculated single measures of farm specific technical efficiency for rice farms in Central Luzor, the Philippines from the residuals of a stochastic frontier production function. Panel data from

International Rice Research Institute's periodic 'loop survey' were used. They opined that the responsibility of technical inefficiency rests mainly with management.

Technological package via its efficient utilization may accelerate the pace of agricultural development and raise the living standards of the population. This is relevant in developing agricultural economies, where resources are meagre and opportunities for developing better technologies are not widespread. Banick (1994) studied the technical efficiency of irrigated farms in a village of Bangladesh using the stochastic production frontier. The results exhibited a wide variation in the levels of technical efficiencies across farms. Out of 99 farms, 88 had technical efficiency of 71 per cent or more. Thirteen farms showed technical efficiency in the range of 91 per cent to 100 per cent. The average technical efficiency for the entire sample of farms was 78 per cent indicating that there was considerable scope for increasing the technical efficiency of the sample farms as a group. A very interesting finding was that 10 out of 13 most efficient farms belonged to the category of small farms. It was also observed that the average technical efficiency of owner-tenant or tenant farms is higher than that of owner farms. The median values of technical efficiencies were 82 per cent for small farms, 80 per cent for large farms, 83 per cent for owner farms and 79 per cent for owner-tenant and tenant farms. The least efficient farm (being also a small and owner farm) relied heavily on hired labour as the head of the farm was employed in some non-farm activities.

On measurement of technical efficiency in the North-West Frontier Province of Pakistan, Parikh and Shah (1994) made the following conclusions. Greater family size increased efficiency perhaps due to a shortage of labour in the North-Western province of Pakistan. Education had a positive and significant impact on technical efficiency. Credit improved farmer's liquidity and facilitated the purchase of inputs. For determining efficiency it was found that farm assets, wealth, contact with extension workers and the size of the holdings were important factors. On inefficient farms, farm size was low, fragmentation was high and there were no extension visits. All these farms were located far away from village and Tehsil markets. They also found that land fragmentation was a consequence of technical inefficiency rather than a cause of it. The study also revealed that younger farmers with easier access to credit, more education and larger assets were most likely to operate efficiently.

Battesse and Coelli (1995) proposed a model, in which the technical inefficiency effects in a stochastic production function are a function of other explanatory variables. They were analysing panel data on the production of wheat in four districts of Pakistan. The technical efficiency of the sample wheat farmers were defined by the following equation

TE_{it} = exp (-Uit) where;

TE_{it} = The technical efficiency of production for the i^{th} firm at the t^{th} time.

U_{it} = Random error term.

The technical efficiency effects were significant in all four districts and the technical efficiencies of the sample farmers were less than one. The mean technical efficiencies for wheat farmers in Faisalabad, Attock, Badin and Dir were estimated to be 0.789, 0.584, 0.570 and 0.775 respectively. Their work indicated that technical efficiency effects associated with the production of wheat in Faisalabad are significantly related to the age and schooling of farmers and that they had decreased over time. This analysis also indicated the potential usefulness of the modeling of technical inefficiency effects in stochastic frontiers and also highlighted the desirability of obtaining data on an extensive range of variables explaining technical inefficiency effects, in addition to the appropriate input – output data for production function analysis.

Area of Study

3. AREA OF STUDY

A description of the area of study enables to present a comprehensive picture of the region where the study was actually located. In this chapter, the relevant information concerning various aspects of Thiruvananthapuram district along with details pertaining to the panchayats under study are described.

Thiruvananthapuram, the southern most district of Kerala has four taluks viz., Thiruvananthapuram, Nedumangad, Neyyattinkara and Chirayinkeezhu and 94 villages, 12 development blocks and 78 panchayats. The district has a total area of 2192 square kilometers.

3.1 Topography and climate

Bordered on the east and the north-east by mountain ranges of Western ghats, the south by the fertile rice bowl district of Kanyakumari of Tamil Nadu state and west by Arabian sea, Thiruvananthapuram district is positioned in between three major rivers, the Neyyar, Karamana and Vamanapuram. Thiruvananthapuram taluk lies in the coastal strip, Nedumangad is generally hilly, Neyyattinkara extend from the Western Ghats to the Arabian sea and Chirayankeezhu is hilly on the east and enclosed by backwaters and lagoons on the west. The district may be largely classified into three natural divisions viz., high land, mid land and low land. The land area, which lies 7.62 meters below the mean sea level is classified as lowland, the region between 7.62 m and 76.2 m above mean

sea level is mid land and the residual region, which is covered by forests and mountain is considered as high land. Chirayinkeezhu and Thiruvananthapuram taluks lie in the mid land and low land region, while Nedumangad and Neyyattinkara fall in the high land and mid land region. The ghats maintain an average elevation of 914 m rising to peaks upto 1829 m above sea level. The chief backwaters of the district from south to north are the Veli, the Kadinamkulam, the Anjengo and the Edava-Nadayara kayals. Besides these systems of backwaters and canals, there is a fresh water lake at Vellayani in Thiruvananthapuram taluk.

The large forest reserves advantageously affect climate and induce more rain. It is also noteworthy that the district gets rainfall both from the southwest and northeast monsoons. The annual variation of temperature is small. Humidity is high and rises to about 90 per cent during the southwest monsoon.

3.2 Population of the district

As per the 1991 census report, the population of Thiruvananthapuram district is 2946650 of which 66.12 per cent is rural population.

3.3 Literacy rate and education

As indicated by the 1991 census, the total literacy rate is 89.22 per cent, with a male literacy rate of 92.84 per cent and a female literacy rate of 85.76 per cent. Within Thiruvananthapuram district there are 500 lower

primary schools, 216 upper primary schools and 240 high schools (Economic review, 1999).

3.4 General agricultural situation in Thiruvananthapuram district

A comprehensive description of the agricultural situation in the chosen panchayats is given in this section.

Table 3.1 Rainfall pattern of Thiruvananthapuram district for the year 1999

Month	Rainfall (mm)
January	12.9
February	65.5
March	16.4
April	148.7
May	376.0
June	410.9
July	166.0
August	91.6
September	36.8
October	485.5
November	99.8
December	15.2
Average rainfall	160.44

The month of October recorded the highest rainfall of 485.5 mm. The other months of greater rainfall were June and July. The month of January recorded the lowest rainfall of 12.9mm. The average rainfall in the region was 160.44 mm.

3.4.1 Land utilization – Thiruvananthapuram district

The data pertaining to the classification of area, according to the land utilization is given in Table 3.2. This district with a total geographical area of 218600 ha has a gross cropped area of 195829 hectares and a net sown area of 14663 ha.

Table 3.2 Classification of area based on land utilization – Thiruvananthapuram district

Sl.No.	Type of land	Area (in hectares)
1.	Forest	49861
2.	Land put to non-agricultural use	19716
3.	Barren and uncultivable land	618
4.	Permanent pastures and other grazing land	19
5.	Land under miscellaneous tree crops	90
6.	Cultivable waste	409
7.	Fallow other than current fallow	426
8.	Current fallow	828
9.	Net area sown	146633
10.	Area sown more than once	49196
11.	Total cropped area	195829
12.	Total geographical area	218600

(Source: Farm guide-2000, Government of Kerala)

3.4.2 Area and production of crops in Thiruvananthapuram district

A report regarding the area and production of different crops in the study region will facilitate the study of the agricultural situation prevailing in the district.

Table 3.3 Area under crops – Thiruvananthapuram district (1996-97)

	Crop	Area (ha)
1.	Paddy	
	1) Autumn	6959
	2) Winter	6890
	3) Summer	112
	Total area under paddy	**13961**
2.	Other cereals/millets	46
3.	Pulses	2460
	Total food grains	16467
4.	Sugar crops	162
5.	Spices and condiments	7850
6.	Fresh fruits	20363
7.	Cashew	2411
8.	Vegetables	29198
9.	Oil seeds	89096
10.	Fibre, drugs and narcotics	37
11.	Plantation crops	27585
12.	Fodder grass	90
13.	Green manure crops	387
14.	Other non-food crops	2183

(Source: Farm guide-2000, Government of Kerala)

3.4.3 Area under different crops

A large variety of crops are cultivated in the area. Paddy, fruits, vegetables, oilseeds (including coconut) and plantation crops occupy the major share of the total cropped area. The area under vegetables is 29198 hectares of the gross cropped area. A number of vegetables like bittergourd, snakegourd, amaranthus, brinjal, cowpea, and ladies' finger are cultivated in this zone. Total food grains occupy 16467 hectares. The data are presented in Table 3.3.

Table 3.4 Production of important crops (1996-97)

Sl.No.	Crop	Production (tonnes)
1.	Rice	
	a) Autumn	13207
	b) Winter	11497
	c) Summer	173
	Total production of rice	24877
2.	Arecanut	432
3.	Banana	10800
4.	Other plantains	31467
5.	Tapioca	365396
6.	Coconut (million nuts)	530
7.	Rubber	29046

(Source: Farm guide-2000, Government of Kerala)

The production of some important crops in the study area is portrayed in Table 3.4. The aggregate production from paddy was 24,877 tonnes. Banana has an overall production of 10,800 tonnes. Rubber is another crop of significance, which yields 29,046 tonnes. Coconut has a production of 530 million nuts. The authorized statistics concerning the production of vegetables is not available.

3.5 Gross area under irrigation

Table 3.5 Gross area under irrigation (1996-97)

Sl.No.	Crop	Area (hectares)
1.	Paddy	3060
2.	Tubers	22
3.	Vegetables	588
4.	Coconut	659
5.	Arecanut	6
6.	Cloves & nutmeg	36
7.	Other spices condiments	51
8.	Banana	707
9.	Betel leaves	36
10.	Sugar cane	3
11.	Other tree crops	1174

(Source: Farm guide 2000, Government of Kerala)

From the table, we can conclude that out of a gross cropped area of 195829 ha only 6342 ha is irrigated. The maximum irrigated area comes

under paddy crop. In the case of vegetables only 588 hectares are irrigated. Only 659 hectares under coconut is being irrigated.

3.6 Description of selected panchayats

Five panchayats have been selected for this particular study. They are Kalliyoor, Venganoor, Kunnathukal, Pothencode and Kazhakuttom.

*Kalliyoor

Kalliyoor forms a part of one of the major agricultural tracts in Thiruvananthapuram district. It has a total area of 17.28 square kilometers. This panchayat was constituted in the year 1960 and has a population of 31,579, distributed in 12 wards. The panchayat accommodates the College of Agriculture, Vellayani, also boasts a high literacy of 91 per cent. One of the fresh water lakes, the Vellayani lake serves as a major water reservoir which supplies water for both irrigation and for domestic uses. Vegetables are being cultivated in an area of 100 hectares in the panchayat.

*Pothencode

The second panchayat under study is Pothencode. This panchayat with an area of 20.85 square kilometers is situated in Kazhakkuttom block in Thiruvananthapuram taluk.

Bordered on the north by Mundakkal, on the south by Vembayam, on the east by Kazhakkuttom and on the west by Mangalapuram panchayat, Pothencode is a long-established agricultural tract in

proximity of Vellayani Lake has a substantial area under vegetable cultivation.

Venganur is bordered on the north by Vellayani lake, on the south by Vizhinjam panchayat, on the west by Thiruvallam panchayat and on the east by Kottukal panchayat. The Vellayani lake acts as a major water reservoir which supplies water to the cultivated fields on the northern side. Almost all major crops are cultivated in this panchayat. Here also, coconut occupies the largest area under cultivation. Vegetables are cultivated in a significant area of 40 hectares.

***Kunnathukal**

Kunnathukal, which is one of the southernmost panchayats of the state, shares its boundary with Tamilnadu. This is a greenish area where most of the populace is engaged in agriculture. Chittar river, a tributary of Neyyar, streams through this panchayat.

This panchayat, situated in the Perumkadavila block of Neyyattinkara Taluk has a total area of 26.85 square kilometers and a population of 33648. Some parts of the panchayat have an undulating topography.

The Kanyakumari district of Tamilnadu borders the panchayat on the eastern side. On the southern border is the Kollayil panchayat, on the west Perumkadavila Panchayat and on the north there are two panchayats, Vellarada and Aryancode.

The major soil types are gravelly soil, red soil, alluvial soil, sandy loam and in some parts clayey soil. This panchayat has an extensive area under rubber cultivation. The area under vegetables is 35 hectares.

The general details regarding the panchayats under study are presented in Table 3.6.

Table 3.6 General details regarding the panchayats under study

Item	Kalliyur	Pothencode	Kazhakkuttom	Venganur	Kunnathukal
Area (sq.km)	17.28	20.80	19.47	12.60	26.85
Population	31579	24995	29469	44767	33648
Literacy rate(percent)	91.0	91.02	92.08	89.0	78.0
Area under vegetables (ha)	100	18	17	40	35

Methodology

schemes mentioned earlier, the Kerala Horticulture Development Project (KHDP) and Intensive Vegetable Development Programme (IVDP), of the Government of Kerala. The list of farmers doing vegetable cultivation with assistance from these two schemes were collected and from these two lists 15 farmers each (for IVDP and KHDP) were selected by random sampling method from a panchayat. The sample size thus worked out to 150 farmers distributed in five panchayats. The selected panchayats were Kalliyur, Venganur, Pothencode, Kunnathukal and Kazhakkuttom.

The important markets for the vegetables were Chalai, Palayam and Aralumoodu. In each of these markets, three market functionaries in each category namely, wholesalers, commission agents and retailers were randomly selected and contacted. Thus, twenty-seven market functionaries, nine in each of the selected markets at Chalai, Palayam and Aralumoodu were selected for the study, besides a sample of one hundred and fifty producers of vegetables.

Data

Preliminary surveys were conducted among vegetable growers as well as various agencies involved in promoting vegetable cultivation with a view to get an insight into the physical, economic and social environment of production and marketing of vegetables in the district. Based upon indications obtained from the pilot study, two different sets of interview schedules were prepared and pre-tested, the first one for gathering data from the farmers i.e. production data and the second for collecting data

from market functionaries. The primary data were collected from the level of ultimate sample units through personal interview method. The data were obtained from the farmer respondents of KHDP and IVDP, wholesale merchants, retail merchants and commission agents. Data pertain to the year 1999-2000.

Three vegetables viz., bittergourd, snakegourd and amaranthus were selected for the study as they occupy the greatest area under vegetable cultivation in the panchayats. The data pertain to the vegetables cultivated in the summer season. The collected data consisted of information on socio-economic status, land utilization pattern, general cropping pattern, specific cropping pattern for vegetables, comprehensive cost of cultivation, credit particulars, mode of marketing, costs involved in marketing, prices obtained for different crops as well as problems in production and marketing.

Secondary data on area and production of various vegetables were also collected from the publications of the Government of Kerala and by personal discussion with officials of KHDP, Farm Information Bureau and the Department of Agriculture.

The collected data were tabulated and analysed to arrive at results and to draw conclusions. Simple tabular and percentage analyses were used to work out costs and returns of vegetable cultivation. Stochastic frontier production function was used to estimate technical efficiency in production. The different variables studied and the measurement and valuation of variables are discussed below.

Calculation of costs

Cost of land preparation

The crops included in the study were all direct sown in the study area and hence, the cost of preparation of main field was taken as the cost of land preparation.

Cost of seeds

Farmers included in the study used both own seeds and seeds purchased from different agencies and fellow farmers. The cost of purchased seeds varied with the agency supplying them and as such the actual cost involved in procuring the seed was used. For own seeds, the value at the lowest market rate prevailing in the area was taken.

Cost of organic manure

Cowdung, poultry manure, ground nut cake, neem cake and green leaves were the common organic manures used by the farmers for vegetable cultivation. These were valued at the prevailing market rate for each in the locality.

Fertilizer costs

The cost of fertilizers used for the vegetables was calculated based on the actual prices paid by the sample farmers.

Cost of panthalling materials

The materials used for panthalling were GI wire and coir. These materials are used for more than one season. So the cost was arrived at by dividing the total cost for panthalling material with the number of times the materials were made use of. The number of times of usage of these materials varied between two to five times on an average.

Cost of staking materials

Different materials like bamboo poles and casuarina poles were used as staking material. These materials are also used more than once. So the cost was worked out by dividing the actual cost at the prevailing marketing rate with the number of times the materials were used.

Human labour

Human labour was measured in terms of man-day equivalents. Family labour and hired labour were treated alike and converted into a common physical unit in terms of man-day equivalent. Eight hours of labour was considered to be one man-day for this purpose. Both hired and family labour were valued at the prevailing wage rates in the area. The wage rate for male labourers varied from Rs. 105 to Rs. 140 and for female labourers it varied from Rs. 90 to Rs. 130.

Land

The cost of land was computed based on the actual rent paid by the tenant, if it was leased in land. In the case of owned land, the rental value prevailing in the area for similar type of land (rent equivalent) was considered. Land was leased out only in terms of rent paid in cash.

Depreciation

Depreciation was worked out by the straight-line method at the rate of 10 percent for farm building, farm equipment and implements.

Interest on working capital

Interest on working capital was worked out at the rate of 11.5 per cent per annum. Since the duration of the crop varied from 3-4 months and the working capital incurred was spread over this period only one-fourth of the 11.5 per cent interest rate was considered in computing the interest on working capital.

Gross Income

Gross income was computed by multiplying the quantity of output by the corresponding market price.

Net Income

Net income was arrived at by subtracting the total cost from Gross Income.

Factor shares

The ABC cost concept was followed and the different factor shares were arrived at. The total explicit costs included value of hired labour, value of other inputs like seeds, manures, fertilizers etc., transport costs and land revenue. Total implicit cost is composed of depreciation of fixed

capital and interest on development loan. The imputed value of family labour was calculated at the prevailing wage rates.

Benefit-cost ratio

The total market value of the vegetables was divided by the total cost of production for each vegetable separately to arrive at the benefit-cost relationship or the output per rupee of input invested in production of different vegetables. The benefit cost ratio at various costs (C1, C_2, C_3) were also worked out.

Income measures

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

(i) Gross income: It represents the total value of the produce including the quantity retained for home consumption valued at the prevailing market price.

(ii) Farm business income: Gross Income- Cost A_1

(iii) Own farm business income : Gross income- Cost A_2

(iv) Family labour income: Gross income - cost B_2 or Net income + imputed value of family labour.

(v) Net income: Gross income- Cost C_3

(vi) Farm investment income: Farm business income - imputed value of family labour.

Marketing Cost

The cost of marketing of different vegetables included the commission charges, transport cost, market fee and miscellaneous charges.

Marketing margin

The marketing margin at the level of various functionaries was worked out by deducting the costs incurred by them from the total price received by the particular intermediary. The cost items included building rent, transport, loading, unloading, losses during storage and the various prices paid by the trader.

Marketing channels

The marketing channels for the three crops under study were identified from the marketing survey conducted.

Marketing efficiency

Marketing efficiency for the three crops were calculated using the formula

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

Where, V=total value of goods marketed and

I=marketing cost

Technical efficiency

In this study, the frontier production function was used to analyze the technical efficiency of KHDP and IVDP vegetable growers. The frontier production function is defined as the function that denotes the maximum possible output from a given combination of inputs. When a firm fails to operate on the production frontiers we denote it as technical inefficiency. Farrel (1957) described the concept of Technical Efficiency. It denotes the farm's ability to obtain the maximum output from a given set of resources. The production frontier estimation had two general paths as outlined below.

1.Deterministic frontiers

This fixes all observations to be on or below the production frontiers so that all deviations from the frontier are attributed to inefficiency.

2. Stochastic frontiers

Here the disturbance term consists of two components, the first one represents technical inefficiency and the other the usual random noise. The advantage of the stochastic frontier over the deterministic frontiers is that farm-specific efficiency and random error effect can be separated. The key feature of the stochastic production frontier is that the disturbance term is composed of two parts, one symmetric and the other, one sided. The symmetric component captures the random effects outside the control of the decision maker including the statistical noise contained in every

empirical relationship. The one sided component captures deviations from the frontier due to inefficiency.

The Stochastic Production Frontier

Let us denote the stochastic production in the form

$$Q_i = Q(X_{ki}\ \beta)e^{\Sigma i}$$

$i = 1. . . . . n$, $k = 1 . . . . . k$, where, Q_i is the output of the i^{th} farm, X_{ki} is a vector of K inputs of the i^{th} farm, β is a vector of parameters and Σi is a farm specific error term. The Stochastic frontier is called a composed model because the error term is composed of two independent elements.

Thus $\Sigma i = v_i - u_i$

The term v_i is the symmetric component and permits random variation in out put due to factors like weather and plant disease. It is assumed to be identically and independently distributed as

$$v_i \approx N(0, \sigma^2 v)$$

A one sided component ($u_i \geq 0$) reflects technical efficiency relative to the stochastic frontier

$$Q_i = Q(X_{ki}, \beta)e^{vi}$$

Hence, expression $u_i = 0$ for any farm lying on the frontier while $u_i > 0$ for any farm lying below the frontier. Hence, expression (u_i) represents the amount by which the frontier exceeds realised out put.

Assume that u_i is identically and independently distributed and $u_i \approx N(0, \sigma^2 u)$, that is the distribution of u is half normal. Thus, u_i takes the value zero when the farm produces on its outer bound production function (realizing all the technical efficiency potential), and is less than zero when the farm produces below its outer bound production function (not realizing fully its technical efficiency potential). This might happen due to a number of factors such as risk aversion, self-satisfaction or information problems, which may prevent the farm from achieving its full potential.

The standard normal density function can be written as

$$f_u(u_i) = \frac{1}{\sigma_u \sqrt{\alpha^{\pi}}} \exp\left[\frac{-1}{2} \frac{u_i^2}{\sigma^2_u}\right] \text{ if } u_i \geq 0$$

$$= 0 \text{ other wise}$$

It follows that

$$\sigma^2 = v\ (\Sigma \times \sigma)^2 = \sigma^2 v + \sigma^2 u$$

The Cobb-Douglas functional form is generally preferred in most published papers on technical efficiency because of its well known advantages. Indeed, its purpose is to show what output of a given product can be achieved by different combinations of factors. In this study also the Cobb-Douglas functional form is used.

Here the estimation is carried out using the maximum likelihood method. The maximum likelihood estimates (MLE) of the parameters of the model can be obtained in terms of parameterization (Aigner *et. al.*)

$$\sigma^2 = \sigma^2_v + \sigma^2_u \text{ and}$$

$$\lambda = \frac{\sigma_u}{\sigma_v}$$

λ is an indicator of relative variability of u_i and v_i that differentiates the actual yield obtained from the frontier yield.

Mean Technical efficiency (MLE)

The mean technical inefficiency i.e., the mean of the distribution of the u_i could be calculated. In the half- normal case (u_i distributed in the absolute value of N (0, σ^2_u) variables), the mean technical inefficiency is

$$MTE = 1 - \sigma_u \sqrt{\frac{2}{\pi}}$$

The technical efficiency can be evaluated given one's estimate of σ_u, as in Aigner *et al.* (1977).

EMPIRICAL MODEL

The stochastic frontier, assuming a C-D specification can be written as

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + u_i$$

Where Y = Total output in kg/ha

X_1 = Total value of seed

X_2 = Total value of labour used

X_3 = Total value of chemical fertilizers

Assumptions for estimation of stochastic frontier

The following assumptions were made in the present study, to specify the stochastic frontier.

(I) The frontier is stochastic in nature, due to factors beyond human control and symmetrically distributed error term present in it is responsible to capture the effects of outside random shocks, observations and measurements error on the dependent variable and other statistical noises.

(II) Variations in the technical efficiency of individual farms are due to factors completely under the control of farmers.

The mean technical efficiency measurements of the IVDP and KHDP farmers were used for comparison.

Results

5.RESULTS

This chapter presents the results that were derived from the analysis of the collected data. The salient results are discussed under six major headings as given below.

5.1 General economic and social conditions of the sample

5.2 Cultivation practices of vegetables and employment generation

5.3 Costs and returns associated with vegetable cultivation

5.4 Marketing

5.5 Technical efficiency

5.6 Problems in vegetable cultivation

5.1 General economic and social conditions of the sample

Any study on production or marketing will be imperfect without a narrative of the general socio-economic conditions of the sample. An idea concerning the factors like family size, age and sex, number of children, educational status, size of holding, occupation and the average area under cultivation will help in understanding the results and interpreting it in a better way. In this part an attempt has been made to depict the above-mentioned factors. Here the data are presented separately for both IVDP and KHDP farmers.

5.1.1 Size of the family

5.1.1.1 Size of the family of IVDP farmers

Respondents who are members of IVDP in the five panchayats from where samples have been drawn viz., Kalliyoor, Kazhakuttam, Venganur, Kunnathukal and Pothencode were classified on the basis of their family size. Analyses showed that 57 per cent of the total IVDP farmers had an average family size of 4-6. In all the panchayats except Kalliyur included in the study, families of size 4-6 members dominated. Forty three per cent of the sample households belonged to the category of 1-3 members. In Kalliyoor panchayat the family size of 1-3 was dominant among the IVDP farmers. The average family size for the entire sample worked out to 3.6. The farmers in Venganur panchayat had the highest family size of 3.9 members. The distribution of farmers according to their family size is given in Table 5.1.1.

Table 5.1.1 Classification of the IVDP respondents according to the size of the family

Name of the panchayat	Family size and number of families			Average size of family
	1-3	4-6	Total	
Kalliyoor	11 (73.3)	4 (26.7)	15 (100.0)	3.0
Kazhakkuttom	7 (46.7)	8 (53.3)	15 (100.0)	3.6
Venganur	4 (26.7)	11 (73.3)	15 (100.0)	3.9
Kunnathukal	6 (40.0)	9 (60.0)	15 (100.0)	3.6
Pothencode	4 (26.7)	11 (73.3)	15 (100.0)	3.7
Total	**32 (43.0)**	**43 (57.0)**	**75 (100.0)**	**3.6**

(Figures in parentheses are percentages to total)

5.1.1.2 Size of the family of KHDP farmers

Majority of the KHDP farmers i.e., 76 per cent belonged to the family size of four to six. The pattern was similar in all the panchayats covered as can be discerned from Table 5.1.2 The average family size of the KHDP respondents for the whole district was 3.9. As in the case of IVDP farmers Venganur panchayat recorded the highest average family size of 4.3.

Table 5.1.2 Classification of KHDP farmers according to family size

Name of the panchayat	Family size and number of families			Average size of family
	1-3	4-6	Total	
Kalliyoor	6 (40.0)	9 (60.0)	15 (100.0)	3.5
Kazhakkuttom	6 (40.0)	9 (60.0)	15 (100.0)	3.6
Venganur	3 (20.0)	12 (80.0)	15 (100.0)	4.3
Kunnathukal	1 (6.7)	14 (93.3)	15 (100.0)	4.1
Pothencode	2 (13.3)	13 (86.7)	15 (100.0)	4.1
Total	18 (24.0)	57 (76.0)	75 (100.0)	3.9

(Figures in parentheses show percentages to total)

5.1.2 Agewise classification of farmers

5.1.2.1 IVDP farmers

The farmer respondents included in the study were catogorised into four groups as detailed in table 5.1.3 according to their age. Among the

IVDP farmers 46.6 per cent of farmers belonged to the age group of 31-50 years. The percentage of farmers belonging to the age group of 15-30 years was only 1.3. Sixty per cent of the farmers belonged to the age group of 31-50 in Pothencode and Kalliyoor panchayats. Thirty one farmers i.e., 41.3 per cent belonged to the age group of 51-70 years. It is interesting to note that eight farmers of the 75 IVDP farmers (10.7 per cent) were septuagenarians. In Kunnathukal panchayat about 33.3 per cent belonged to this category. The results of IVDP group of farmers are presented in Table 5.1.3. All the farmers were males in this group.

Table 5.1.3 Classification of IVDP farmers according to age

Name of the panchayat	Age group (years) & **Number of respondents**				
	15-30	31-50	51-70	> 70	Total
Kalliyoor	0 (0.0)	6 (40.0)	9 (60)	0 (0.0)	15 (100.0)
Kazhakkuttom	0 (0.0)	10 (66.7)	3 (20)	2 (13.3)	15 (100.0)
Venganur	1 (6.7)	9 (60.0)	5 (33.3)	0 (0.0)	15 (100.0)
Kunnathukal	0 (0.0)	5 (33.3)	5 (33.3)	5 (33.3)	15 (100.0)
Pothencode	0 (0.0)	5 (33.3)	9 (60.0)	1 (6.7)	15 (100.0)
Total	1 (1.3)	35 (46.7)	31 (41.3)	8 (10.7)	75 (100.0)

(Figures in parentheses show percentages to total)

5.1.2.2 KHDP farmers

All the farmers belonging to the KHDP group were above 30. On an average 56 per cent of the total belonged to the age group of 31-50.

and 21.3 per cent had schooling only up to the lower primary level. Seven farmers were illiterate.

Table 5.1.5 Classification of IVDP farmers according to literacy

Name of the panchayat	Educational status					Total
	Illiterate	Lower primary	Upper primary	High school	Pre-Degree	
Kalliyoor	2 (13.3)	4 (26.7)	9 (60.0)	0. (0.0)	0 (0.0)	15 (100.0)
Kazhakkuttom	0 (0.0)	4 (26.7)	7 (46.6)	4 (26.7)	0 (0.0)	15 (100.0)
Venganur	2 (13.3)	2 (13.3)	7 (46.7)	4 (26.7)	0 (0.0)	15 (100.0)
Kunnathukal	2 (13.3)	4 (26.7)	7 (46.7)	2 (13.3)	0 (0.0)	15 (100.0)
Pothencode	1 (6.7)	2 (13.3)	6(40.0)	6 (40.0)	0 (0.0)	15 (100.0)
Total	7 (9.4)	16 (21.3)	36 (48.0)	16 (21.3)	0 (0.0)	75 (100.0)

(Figures in parentheses show percentages to total)

5.1.3.2 Literacy and education level of KHDP farmers

Distribution of the KHDP respondents according to their educational and literacy status is presented in Table 5.1.6. The majority of the farmers in this category (56 per cent) had high school education. Twenty four per cent of the farmers had studied up to upper primary level and 5.3 percent upto primary level. It is noteworthy that 12 per cent of the KHDP farmers had been to college, up to pre-degree level of education. In Kalliyoor panchayat 26.7 per cent of farmers belonged to this category. Two farmers were illiterate and they were from Kazhakuttom and Kunnathukal panchayat.

Table 5.1.6 Literacy and education level of KHDP farmers

Name of the panchayat	Illiterate	Lower primary	Upper primary	High school	Pre-Degree	Total
Kalliyoor	0 (0.0)	0 (0.0)	3 (20.0)	8 (53.3)	4 (26.7)	15 (100.0)
Kazhakkuttom	1 (6.7)	1 (6.7)	5 (33.3)	6 (14.0)	2 (13.3)	15 (100.0)
Venganur	0 (0.0)	1 (6.7)	4 (26.6)	9 (60.0)	1 (6.7)	15 (100.0)
Kunnathukal	1 (6.7)	2 (13.3)	3 (20.0)	9 (60.0)	0 (0.0)	15 (100.0)
Pothencode	0 (0.0)	0 (0.0)	3(20.0)	10 (66.7)	2 (13.3)	15 (100.0)
Total	2 (2.7)	4 (5.3)	18 (24.0)	42 (56.0)	9 (12.0)	75 (100.0)

(Figures in parentheses show percentages to total)

5.1.4 Occupation

The respondents were classified into three categories according to their occupation in relation to agriculture and the results are presented in Tables 5.1.7 and 5.1.8 for IVDP and KHDP farmers respectively.

5.1.4.1 IVDP

Among the IVDP farmers, 66.7 per cent came under the first category with agriculture as the only occupation. Nineteen farmers had agriculture as their main occupation and for six respondents agriculture was the subsidiary occupation. The panchayat wise details are presented in Table 5.1.7.

Table 5.1.7 Classification of IVDP respondents according to their occupation

Name of the panchayat	Agriculture as the only occupation	Agriculture as main occupation	Agriculture as sub occupation	Total
Kalliyoor	9 (60.0)	4 (26.7)	2 (13.3)	15 (100.0)
Kazhakkuttom	7 (46.7)	7 (46.6)	1 (6.7)	15 (100.0)
Venganur	12 (80.0)	3 (20.0)	0 (0.0)	15 (100.0)
Kunnathukal	14 (93.3)	1 (6.7)	0 (0.0)	15 (100.0)
Pothencode	8 (53.3)	4 (26.7)	3 (20.0)	15 (100.0)
Total	50 (66.7)	19 (25.3)	6 (40.0)	75 (100.0)

(Figures in parentheses show percentages to total)

5.1.4.2 KHDP

Sixty per cent of the KHDP farmers (Table 5.1.8) had agriculture as the only occupation. Nineteen farmers (25.2 percent) had agriculture as their main occupation. The percentage of farmers with agriculture as subsidiary occupation was 14.7 per cent of the total. The trend was similar in all the panchayats under study.

Table 5.1.8 Classification of KHDP respondents according to their occupation

Name of the panchayat	Agriculture as the only occupation	Agriculture as main occupation	Agriculture as sub occupation	Total
Kalliyoor	10 (66.7)	4 (26.7)	1 (6.6)	15 (100.0)
Kazhakkuttom	8 (53.3)	4 (26.7)	3 (20.0)	15 (100.0)
Venganur	11 (73.4)	2 (13.3)	2 (13.3)	15 (100.0)
Kunnathukal	9 (60.0)	4 (26.7)	2 (13.3)	15 (100.0)
Pothencode	7 (46.7)	5 (33.3)	3 (20.0)	15 (100.0)
Total	45 (60.0)	19 (25.3)	11 (14.7)	75 (100.0)

(Figures in parentheses show percentages to total)

5.1.5 Land holding

Land holding pattern of IVDP and KHDP farmers are presented in Tables 5.1.9 and 5.1.10 respectively.

The average size of land holding for IVDP farmers was found to be 46.22 cents. The farmers of Venganoor had the highest average land holding of 61.1 cents and Kalliyoor had the minimum of 34.6 cents. The results are presented in Table 5.1.9.

Table 5.1.9 Average size of holding of respondent farmers (IVDP)

Name of panchayat	Average size of holding (cents)
Kalliyoor	34.6
Kazhakkuttom	37.4
Venganur	61.1
Kunnathukal	42.7
Pothencode	55.3
Average	46.2

The average size of holding for KHDP farmers was 55.5 cents. Pothencode had the highest average land holding of 81.7 cents and Kazhakkuttom had the lowest of 28.5 cents. Results are presented in Table 5.1.10.

Table 5.1.10 Average size of holding of respondent farmers (KHDP)

Name of panchayat	Average size of holding (cents)
Kalliyoor	41.1
Kazhakkuttom	28.5
Venganur	74.0
Kunnathukal	52.1
Pothencode	81.7
Average	55.5

***Distribution of farmers according to size of holding**

The distribution of farmer respondents according to holding size is presented in Table 5.1.11.

Table 5.1.11 Distribution of farmers according to size of holding (IVDP and KHDP)

Category of farmers	Holding size				Total
	0 – 40 cents	40 –100 cents	100 – 250 cents	Above 250 cents	
IVDP	38 (50.7)	19 (25.3)	16 (21.3)	2 (2.7)	75 (100.0)
KHDP	34 (45.3)	29 (38.7)	11 (14.7)	1 (1.3)	75 (100.0)
Total	72 (48.0)	48 (32.0)	27 (18.0)	3 (2.0)	150(100.0)

(Figures in parentheses show percentages to total)

As evident from the Table 5.1.11, 72 farmers of the total 150 possessed a land holding of less than 40 cents. This constituted 48 per cent of the total. Among the IVDP and KHDP farmers 50.7 per cent and 45.3 per cent respectively came under this group. Thirty two per cent of the farmers possessed a land holding of size between 40 to 100 cents. There were only three farmers who owned holdings of size more than one hectare.

5. 1.6 Family income

Table 5.1.12 Distribution of respondents based on family income

Annual family income (Rs.)	IVDP	Per cent	KHDP	Per cent
< 50,000	52	69.3	31	41.3
50,000-1,00,000	19	25.4	32	42.7
>1,00,000	4	5.3	12	16.0

As we can see from the above table the majority of IVDP farmers in the area come under the group of less than Rs.50,000 annual family income. There were only four farmers who earned an annual income more than Rs.1,00,000. But in the case of KHDP majority of farmers earned an annual income in the range of Rs.50,000 to Rs.1,00,000. Sixteen percent of the KHDP respondents earned more than Rs.1,00,000 per annum.

5.1.7 Source of finance

Table 5.1.13 Distribution of respondents based on source of finance

Category of farmers		Source of finance				
		No. of farmers	Institutional finance	Percentage to total	Self finance	Percentage to total
Snakegourd	IVDP	41	5	12.2	36	87.8
	KHDP	45	45	100.0	0	0
Bittergourd	IVDP	41	4	9.8	37	90.2
	KHDP	51	51	100.0	0	0
Amaranthus	IVDP	22	5	22.7	17	77.3
	KHDP	32	32	100.0	0	0

Based on the source from which the finance was availed, the respondents were classified into two groups viz., those who availed credit from institutional agencies and those who operated with self finance. Results are presented in table 5.1.13. It is worth noting that all the KHDP farmers, irrespective of the crop, which they grew, availed credit facility from institutional sources. This is because KHDP arrange institutional finance to their members. However, majority of the IVDP farmers operated with own finance. Only 14 IVDP farmers availed credit facilities.

5.2 Cultivation practices of vegetables

Specific cropping pattern of sample farms

The major vegetable crops cultivated in the study area included bitter gourd, snake gourd, amaranthus, cowpea and cucumber. Among these the most preferred were bitter gourd, snake gourd and amaranthus because of the higher consumer preference for these crops and the consequent high profits. Hence these three vegetables were selected for the study. The allocation of total cropped area among the three crops is given in Table 5.2.1. The remaining area is under a mixed cropping system of home garden where the base crop mostly is coconut.

Table 5.2.1 Cropping pattern of vegetables in the sample holdings

Crop	IVDP (cents)	Percentage to total operational area	KHDP (cents)	Percentage to total operational area
Amaranthus	514	7.4	764	6.2
Bitter gourd	1064	15.2	2491	20.3
Snake gourd	1230	17.6	1695	13.8
Total area under vegetables	2808	40.2	4950	40.4
Area under other crops	4182.5	59.8	7310.3	59.6
Total operational area of sample respondents	6990.5	100.0	12260.3	100.0

Bittergourd, snake gourd and amaranthus can be cultivated in any season of the year if assured irrigation is available. In the study area most of the vegetable cultivation is carried out in paddy fields. An account of the various cultural practices followed by the respondents in vegetable cultivation is presented in the ensuing sections.

Land preparation

The field is ploughed repeatedly, brought to a fine tilth and allowed to dry in the sun. The stubbles and roots of the previous crop as well as that of weeds are removed. Pits of 50cm diameter and depth are prepared at a spacing of 2x2 meter for bitter gourd and snake gourd. Approximately 10 kg farm yard manure are applied per pit and thoroughly incorporated

into the soil. For amaranthus, furrows of 30cm width and 10cm depth are taken at a spacing of 30cm.

Seeds and sowing

All the farmers in the study area, irrespective of the programme to which they were affiliated, used improved varieties of seeds released by the Kerala Agricultural University .For bittergourd the varieties used were Preethi and Priya, whereas for snakegourd the preferred variety was Kaumudi. The amaranthus variety commonly used was "Arun". Except for amaranthus the seed rate applied was much less compared to the recommended rate. The details are shown in Table 5.2.1

In the case of bittergourd and snakegourd, whereas the seed rate recommended by the Kerala Agricultural University is 5.0-6.0 kg/hectare the farmers were found to use only 2.7 to 3 kg seed per hectare. This may be due to the fact that they use pre soaked seeds and only 3 to 4 seeds are sown per pit, though only two healthy seedlings are retained after the initial stages of growth.

The recommended seed rate of amaranthus is 1.5-2.0 kg/hectare for a transplanted crop. However the farmers in the area adopt direct sowing method and hence they use nearly 3 to 4 times this quantity. The amaranthus seeds mixed with well powdered cowdung are broadcast in the prepared furrow.

Table.5.2.2(a) Varieties and seed rate of vegetables

Varieties and seed rate of vegetables				
Crop	Cultivars	Seed rate (kg/ha)		
		Recommended	Adopted	
			IVDP	KHDP
Bitter gourd	Preethi,Priya	5.0-6.0	2.7	3.0
Snake gourd	Kaumudi	3.0-4.0	2.2	2.3
Amaranthus	Arun	1.5-2.5	6.6	6.2

All the farmers who belonged to KHDP group obtained seeds from KHDP only. Among IVDP group, 46 farmers purchased seeds from Kerala Agricultural University farms or from the State Department of Agriculture. Twenty-nine farmers got the seeds either from private agencies or from their fellow farmers. Table 5.2.2 gives the details.

Table 5.2.2(b) Source of seed

Type of growers	Source of purchase			
	KHDP	University/department farms	Private agencies/ farmers	Total
IVDP	0	46	29	75
KHDP	75	0	0	75
Total	75	46	29	150

Staking and panthalling

In the case of bittergourd and snakegourd, two to three weeks after seeding, plants will be ready for climbing on a support. Necessary supports are then provided using casuarina or bamboo poles or other locally available materials and the vines are gently trained on to them. Then panthals are erected using GI wires and coir.

Manures and fertilizers

For bitter gourd and snake gourd the recommended rate of application of organic manure is 20-25 t/ha. Chemical fertilizer should be applied at the rate of 70:25:25kg NPK per hectare. In the case of amaranthus organic manure at the rate of 50 t/ha and chemical fertilizer at the rate of 50:50:50 kg NPK per hectare should be applied. The farmers' practice often deviated from this as can be seen from Table 5.2.3 and 5.2.4.

Table 5.2.3 Use of organic manure in vegetable cultivation

Crop	Recommended (t/ha)	Applied (t/ha)	
		IVDP	KHDP
Bittergourd	20-25	16.21	19.96
Snakegourd	20-25	19.20	18.40
Amaranthus	50	12.21	11.80

The quantity of organic manure applied was almost comparable to the recommended rates for bittergourd and snakegourd. However, in the case of amaranthus the rate of application was very low at 12.21 t/ha and 11.80 t/ha for IVDP and KHDP respectively, chiefly due to the high cost of organic manure.

Table 5.2.4 Nutrient use in vegetables ($kgha^{-1}$)

Bittergourd			
Nutrient	Recommended	Adopted	
		IVDP	KHDP
N	70:25:25 kg NPK/hectare	141.32	137.71
P_2O_5		122.65	102.56
K_2O		89.33	79.61
Snakegourd			
Nutrient	Recommended	Adopted	
		IVDP	KHDP
N	70:25:25 kg NPK/hectare	175.38	176.10
P_2O_5		95.21	85.31
K_2O		79.55	89.10
Amaranthus			
Nutrient	Recommended	Adopted	
		IVDP	KHDP
N	50:50:50 kg NPK/hectare	87.74	80.02
P_2O_5		88.52	51.61
K_2O		32.21	28.54

In the study area fertilizer use was much higher than the recommended dose. The common fertilizers applied were Urea, Muriate of potash, Mussoriphos and Factamphos. For bittergourd both the groups of growers applied about double the recommended dose of Nitrogen. More than four times the recommended dose was applied in the case of P_2O_5 Potash was applied at nearly thrice the recommended rates.

An almost similar pattern of high nutrient application could be noticed in the case of snake gourd also.

In the case of amaranthus, Nitrogen was applied at higher than the recommended rates by both the groups of farmers, P_2O_5 at recommended rates by the KHDP farmers, while K_2O was applied at lower rates. P_2O_5 application was also high in the case of IVDP farmers. The nutrient use pattern in the various crops are shown in Table 5.2.4.

5.3 Costs and returns associated with vegetable cultivation

An inquiry into the various costs and returns in vegetable cultivation will reveal the extent of profitability of the enterprise. In the following section the per hectare costs and returns associated with vegetable cultivation in Thiruvananthapuram district is presented.

5.3.1 Input wise cost of cultivation

The input wise break up of the total cost of cultivation of the three vegetable crops selected for study was worked out based on the ABC cost concept and is presented in this section.

5.3.1.1 Input wise cost of cultivation for bitter gourd

Input wise cost of cultivation per hectare of bittergourd is given in table 5.3.1.

Table 5.3.1 Input wise cost of cultivation for bittergourd (Rs. /ha)

Items of cost	IVDP	Percentage to Cost C_3	KHDP	Percentage to Cost C_3
Hired labour	9528.30	8.2	9841.30	7.3
seeds	1335.40	1.1	1436.00	1.1
manure	14450.00	12.4	20910.80	15.6
Staking material	5074.30	4.3	6967.80	5.2
Pantalling material	4667.80	4.0	5827.90	4.3
fertilizers	6987.40	6.0	7149.70	5.3
Plant protection	4692.30	4.0	4577.80	3.4
Land revenue	100.00	0.1	100.00	0.1
Interest on working capital	1317.20	1.1	1597.80	1.2
Interest on development loan	1903.20	1.6	5459.00	4.1
Depreciation on fixed capital	357.10	0.3	382.50	0.3
Cost A_1	*50413.00*	43.2	*64250.60*	47.9
Rental value of leased in land	6110.90	5.2	8746.80	6.5
Cost A_2	*56523.90*	49.2	*72997.40*	55.2
Interest on fixed capital	113.90	0.1	196.20	0.1
Cost B_1	*56637.80*	49.3	*73193.60*	55.3
Rental value of owned land	7810.90	6.7	10745.70	8.0
CostB_2	*64448.80*	55.2	*83939.30*	62.6
Imputed value of family labour	41661.30	35.7	38002.10	28.3
Cost C_1	*98299.10*	84.9	*111195.70*	83.6
Cost C_2	*106110.10*	90.9	*121941.50*	90.9
Imputed value of management	10611.10	9.1	12194.10	9.1
Cost C_3	***116721.10***	100.0	***134135.60***	100.0

Bittergourd was found to be the most remunerative crop among the three selected vegetables. The analysis showed that for IVDP growers Costs A_1, A_2, B_1, B_2, C_1, C_2 and C_3 were Rs. 50413.00, Rs 56523.90, Rs. 56637.80, Rs. 64448.80, Rs. 98299.10, Rs. 106110.0 and Rs. 116721.10 respectively. For KHDP growers the corresponding costs were Rs. 64250.60, Rs. 72997.40, Rs. 73193.60, Rs. 83939.30, Rs. 11195.70, Rs. 121941.40 and Rs 134135.60. Among the IVDP growers the highest share in total paid out costs was occupied by value of organic manure (12.3 per cent). This was followed by hired labour, fertilizers, staking material and panthalling material. The lowest was cost of seeds.

In the case of KHDP growers also the trend was same. But here the share of organic manure was 15.6 per cent to the total cost. The share of hired labour was also slightly higher than the IVDP group (7.3 per cent). The share of seed was 1.1 per cent of cost C_3. The amount spent on plant protection was 3.4 per cent of the total. The cost of staking and panthalling material came to 5.2 and 4.3 per cent respectively.

When we compare the two groups it can be seen that the proportion of expenditure on seeds, staking material, panthalling material, fertilizers and plant protection remained more or less same. But there were variations in the expenditure on hired labour and organic manure.

Table 5.3.2 Input wise cost of cultivation for snakegourd

Items of cost	IVDP	Percentage to Cost C_3	KHDP	Percentage to Cost C_3
Hired labor	9243.60	7.2	8030.10	6.7
Seeds	1125.00	0.9	1412.90	1.2
Manure	20979.50	16.4	18544.40	15.5
Staking material	6885.70	5.4	5276.70	4.4
Panthalling material	4322.10	3.4	3479.30	2.9
Fertilizers	7086.60	5.6	7873.40	6.6
Plant protection	5198.00	4.1	3996.20	3.3
Land revenue	100.00	0.1	100.00	0.1
Interest on working capital	1545.20	1.2	1370.10	1.1
Interest on development loan	826.90	0.6	4010.60	3.4
Depreciation of fixed capital	350.20	0.3	369.30	0.3
Cost A_1	*57662.80*	45.2	*54462.90*	45.5
Rental value of leased in land	5944.20	4.7	9350.80	7.8
Cost A_2	*63607.00*	50.6	*63813.70*	52.8
Interest on fixed capital	111.50	0.1	117.70	0.1
Cost B_1	*63718.50*	50.7	*63931.40*	52.9
Rental value of owned land	7944.20	6.2	8098.80	6.8
Cost B_2	*71662.70*	56.1	*72030.30*	60.2
Imputed value of family labour	44399.60	34.8	36686.60	30.7
Cost C_1	*108118.10*	85.5	*100618.00*	83.6
Cost C_2	*116062.30*	90.9	*108716.90*	90.9
Imputed value of management	11606.20	9.1	10871.70	9.1
Cost C_3	***127668.50***	100.0	***119588.60***	100.0

5.3.1.2 Input wise cost of cultivation of snakegourd

Costs A_1, A_2, B_1, B_2, C_1, C_2 and C_3 for IVDP growers were Rs. 57662.80, Rs. 63607.00, Rs. 63718.50, Rs.71662.70, Rs 108118.10, Rs. 116062.30 and Rs.127668.50 respectively. These costs were Rs. 54462.90, Rs. 63813.70, Rs. 63305.40, Rs. 72030.30, Rs. 100618.00, Rs. 108716.90 and Rs. 119588.60 for KHDP in the same order.

As in the case of bittergourd, here also the major share of expenditure on paid out costs was incurred on account of organic manure; 16.4 per cent in the case of IVDP and 15.5 per cent for KHDP growers. The next major item of expenditure was hired labour. Hired labour formed 7.2 and 6.7 per cent respectively of the total cost for IVDP and KHDP growers. The share of expenditure on fertilizers was slightly higher for KHDP growers and was 6.6 per cent compared to 5.6 per cent of the IVDP group. The costs of seed, staking material and panthalling material were comparable in both the groups. The cost of fertilizers was 5.6 per cent of the total cost for IVDP growers whereas it was 6.6 per cent for the KHDP group.

In short we can say that there was only very little variation among the two groups in the input wise break up of costs. The figures are shown in Table 5.3.2

Table 5.3.3 Input wise cost of cultivation for amaranthus (Rs./ha)

Item of cost	IVDP	Percentage to Cost C_3	KHDP	Percentage to Cost C_3
Hired labor	1788.30	2.7	2735.50	4.3
Seeds	5168.30	7.9	2552.40	4.0
Manure	8028.40	12.3	6582.40	10.2
Staking material	0.00	0.0	0.00	0.0
Panthalling material	0.00	0.0	0.00	0.0
Fertilizers	2359.80	3.6	2595.40	4.0
Plant protection	1295.40	2.0	1474.70	2.3
Land revenue	100.00	0.2	100.00	0.2
Interest on working capital	527.10	0.8	451.10	0.7
Interest on development loan	1106.10	1.7	4176.00	6.5
Depreciation on fixed capital	285.70	0.4	227.10	0.4
Cost A_1	*20659.10*	31.6	*20894.60*	32.5
Rental value of leased in land	8552.40	13.1	10313.30	16.0
Cost A_2	*29211.50*	41.8	*31281.10*	46.6
Interest on fixed capital	91.60	0.1	73.20	0.1
Cost B_1	*29303.10*	42.0	*31281.10*	46.7
Rental value of owned land	6671.40	10.2	9084.30	14.1
CostB_2	*34093.30*	52.2	*39136.40*	60.9
Imputed value of family labour	25323.20	38.7	19330.60	30.1
CostC_1	*54626.30*	80.7	*50611.70*	76.8
CostC_2	*59416.60*	90.9	*58467.00*	90.9
Imputed value of management	5941.60	9.1	5846.70	9.1
Cost C_3	***65358.20***	**100.0**	***64313.70***	**100.0**

5.3.1.3 Input wise cost of cultivation for Amaranthus

Compared to the two crops discussed so far amaranthus is a crop which gives good returns to the farmer in a short span of time.

The total cost of cultivation (Cost C_3) for the crop came to Rs. 65358.20 and Rs. 64313.70 for IVDP and KHDP respectively. Costs A1, A_2, B_1, B_2, C_1 and C_2 were Rs 20659.10, Rs. 29211.50, Rs. 29303.10, Rs. 34093.30, Rs. 54626.30 and Rs. 59416.60 respectively for IVDP growers. For KHDP growers these costs were Rs. 20894.60, Rs. 31207.90, Rs. 31281.10, Rs. 39136.40, Rs. 50611.70 and Rs 58467.00. The input wise cost of cultivation for amaranthus is given in Table 5.3.3.

Unlike in the case of the other two crops, here there is much variation among the groups in the respective share of the different cost components. The share of hired labour for IVDP growers was 2.7 per cent and for KHDP growers it was 4.3 per cent. In the case of expenditure on seed also we can see that the costs show much variation. For IVDP growers the expenditure on seed was 7.9 per cent of cost C_3 where as for KHDP growers it was 4.0 per cent. The shares of expenditure on manure, fertilizers and plant protection were 12.28, 3.6 and 2.0 per cent respectively for IVDP growers and for KHDP growers they were 10.2, 4.0 and 2.3 per cent.

5.3.2 Input-Output relationship

Input-output relationship for the three crops was analysed taking into account the explicit, implicit and total costs. The results are presented in table 5.3.4, 5.3.5 and 5.3.6.

5.3.2.1 Input-Output relationship for bittergourd

The total explicit costs (all paid out costs) came to Rs. 55699.60 in the case of IVDP growers and Rs. 72016.60 for KHDP growers. The total implicit costs came to Rs. 61021.50 and Rs. 62119.00 respectively for IVDP and KHDP growers. The total cost at cost C_3 was Rs. 116721.10 and Rs. 134135.60 respectively. The net returns at explicit cost came to Rs. 103795.10 and Rs. 134048.60 respectively for IVDP and KHDP growers. Net returns at total cost was Rs. 42773.60 and Rs. 71929.60 respectively for IVDP and KHDP growers. The benefit cost ratio at explicit cost and total cost for farmers of IVDP were 2.9 and 1.4 respectively and 2.9 and 1.5 respectively for KHDP. The results are presented in Table 5.3.4.

Table 5.3.4 Input-output relationship in bittergourd

Particulars	IVDP (Rs./ha)	KHDP (Rs./ha)
Total explicit cost	55699.60	72016.6
Total implicit cost	61021.50	62119.0
Total cost (cost C_3)	116721.10	134135.60
Total output (kg/ha)	13291.20	17213.80
Returns @ Rs.12 (Rs/ha)	159494.70	206065.20
Net returns at explicit cost	103795.10	134048.6
Net returns at total cost	42773.6	71929.6
Benefit-cost ratio at explicit cost	2.9	2.9
Benefit-cost ratio at total cost	1.4	1.5

5.3.2.2 Input-output relationship in snakegourd

The total explicit costs for IVDP and KHDP snakegourd growers were Rs. 62711.60 and Rs. 61448.40 respectively. Total implicit cost was worked out at Rs. 64956.90 and Rs. 58140.20 respectively for IVDP and KHDP growers. The total costs were Rs. 127668.50 and Rs. 119588.60 in that order.

The values of gross returns were Rs. 70810.70 and Rs. 86354.30 respectively for IVDP and KHDP growers. The net returns at total cost were Rs. -56857.8 and Rs. -33234.30 respectively for IVDP and KHDP.

The benefit cost ratios for IVDP and KHDP farmers at explicit cost was 1.1 and 1.4 respectively and at total cost these were 0.6 and 0.7 respectively. The results are presented in Table 5.3.5.

Table 5.3.5 Input-output relationship in snakegourd

Particulars	IVDP (Rs./ha)	KHDP (Rs./ha)
Total explicit cost	62711.60	61448.40
Total implicit cost	64956.90	58140.20
Total cost (cost C_3)	127668.50	119588.60
Total output (kg/ha)	14162.10	17270.90
Returns (Rs/ha)	70810.70	86354.30
Net returns at explicit cost	8099.10	24905.90
Net returns at total cost	-56857.8	-33234.30
Benefit/cost ratio at explicit cost	1.1	1.4
Benefit/cost ratio at total cost	0.6	0.7

5.3.2.3 Input output relationship in amaranthus

The total cost for amaranthus was worked out at Rs. 65358.20 and Rs. 64313.70 for IVDP and KHDP respondents respectively. Of this the total explicit cost came to Rs. 26517.70 and Rs. 29300.70 respectively for IVDP and KHDP respondents.

Total returns were Rs. 46134.90 and Rs. 54131.70 for IVDP and KHDP in that order.

The benefit cost ratio at total cost was 1.7 and 1.8 respectively for IVDP and KHDP. The results are shown in Table 5.3.6.

Table 5.3.6 Input-output relationship in amaranthus

Particulars	IVDP (Rs./ha)	KHDP (Rs./ha)
Total explicit cost	26517.70	29300.70
Total implicit cost	38840.50	35013.00
Total returns (kg/ha)	11533.7	13532.9
Total cost (cost C_3)	65385.20	64313.70
Returns (Rs/ha)	46134.90	54131.70
Net returns at explicit cost	19617.20	24831.00
Net returns at total cost	-19223.30	-13182.00
Benefit/cost ratio at explicit cost	1.7	1.8
Benefit/cost ratio at total cost	0.7	0.8

5.3.3 Production and value of output

Production and value of output for the three crops for the two groups are presented in Table 5.3.7.

Table 5.3.7 Production and value of output of different crops

Crop	IVDP		KHDP	
	Production (kg/ha)	Value of output/ha (Rs.)	Production (kg/ha)	Value of output/ha (Rs.)
Bittergourd	13291.2	159494.40	17213.8	206065.20
Snakegourd	14162.1	70810.70	17270.9	86354.30
Amaranthus	11533.7	46134.90	13532.9	54131.70

The production per hectare of bittergourd for IVDP was 13291.2 kg and the value of output at Rs. 12 per kg was Rs. 159494.40. For KHDP the corresponding figures were 17213.8 kg and Rs. 206065.20 respectively.

For snakegourd, production per hectare was 14162.1 kg and 17270.9 kg respectively for IVDP farmers and KHDP farmers. The corresponding market values at Rs. 5.00 per kg were Rs. 70810.70 and Rs. 86354.30.

The value of output per hectare for amaranthus was Rs. 46134.90 and Rs. 54131.70 respectively for IVDP and KHDP. The corresponding per hectare productions were 11533.7 kg and 13532.9 kg and the price was Rs. 4 per kg.

5.3.4 Measures of efficiency

The various measures of efficiency worked out were farm business income, own farm business income, family labour income, net income and farm investment income.

Table 5.3.8 Farm efficiency measures (Rs./hectare)

Efficiency measure	Bittergourd		Snakegourd		Amaranthus	
	IVDP	KHDP	IVDP	KHDP	IVDP	KHDP
Farm business income	109081.40	141814.60	13147.90	31891.40	25475.80	33237.10
Own farm business income	102120.50	132068.30	6203.70	23166.60	18804.50	24152.80
Family labour income	95045.60	134402.50	-852.00	14324.00	12041.60	14995.30
Net income	42773.30	71929.60	-56857.80	-33234.30	-19223.30	-10182.00
Farm investment income	14035.80	7412.10	13999.90	17567.40	13434.20	18241.80

*Farm business income

The farm business income was arrived at by subtracting cost A_1 from gross returns. For bittergourd this was Rs. 109081.40 and Rs. 141814.60 for IVDP and KHDP respectively. For snakegourd these were Rs. 13147.90 and Rs. 31891.40 for the two groups in the above order. In the case of amaranthus the farm business incomes were Rs. 25475.80 and Rs. 33237.10 for IVDP and KHDP respondents respectively.

*Own farm business income

The own farm business income was worked out by subtracting Cost A_2 from gross returns. It was Rs. 102120.50 and Rs. 132068.30 respectively for IVDP and KHDP farmers. In the case of snakegourd the corresponding figures were Rs. 6203.70 and Rs 23166.60. For amaranthus the own farm business income worked out to Rs. 18804.50 and Rs. 24152.80 for IVDP and KHDP farmers respectively.

*Family labour income

By deducting cost B_2 from gross income, the family labour income was arrived at. For IVDP group the values were Rs. 95045.60, Rs.–852.00 and Rs. 12041.60 for bittergourd, snakegourd and amaranthus respectively. The corresponding values for KHDP were Rs. 134402.50, Rs.14324.00 and Rs14995.30.

*Net income

Deducting cost C_3 from gross returns gave the net income. For bittergourd, the net income was Rs. 42773.30 and Rs. 71929.60 for IVDP and KHDP respectively. In the case of snakegourd these values were Rs. –56857.80 and Rs. –33234.30 respectively for the two groups. For amaranthus also the values were negative.

*Farm investment income

When we subtract imputed value of family labour from farm business income we get the farm investment income.

In the case of IVDP farmers, the farm investment incomes were Rs. 14035.80, Rs. 13999.90 and Rs. 13434.20 respectively for bittergourd, snakegourd and amaranthus. The corresponding values for KHDP farmers were Rs. 14035.80, Rs. 17567.40 and Rs. 18241.80. The results regarding the measures of efficiency are shown in table 5.3.8.

5.3.5 Benefit-cost ratio

Benefit cost ratio reveals the economic efficiency of production. The benefit-cost ratios for the three crops under study are presented in table 5.3.9.

Table 5.3.9 Benefit-cost ratio for various crops

Benefit-cost ratio at	Bittergourd		Snakegourd		Amaranthus	
	IVDP	KHDP	IVDP	KHDP	IVDP	KHDP
Cost A_1	3.16	3.20	1.22	1.58	2.23	2.59
Cost A_2	2.77	2.78	1.09	1.36	1.68	1.80
Cost B_1	2.77	2.78	1.09	1.36	1.68	1.80
Cost B_2	2.47	2.45	0.98	1.19	1.35	1.38
Cost C_1	1.60	1.83	0.64	1.86	0.87	1.09
Cost C_2	1.50	1.68	0.61	1.79	0.77	0.92
Cost C_3	1.36	1.53	0.55	0.72	0.70	0.84

The benefit-cost ratio on cost A_1 basis for bittergourd was above three for both the groups. However KHDP growers recorded a maximum benefit-cost ratio of 3.20. In the case of snakegourd and amaranthus also on cost A_1 basis KHDP growers recorded higher benefit-cost ratios of 1.58

and 2.59 respectively compared to IVDP farmers. At cost A_2 as well as at cost B_1 all the crops gave benefit-cost ratios above one. In the case of IVDP snake gourd growers the benefit-cost ratio fell to values less than one even at Cost B_2. In the case of amaranthus benefit-cost ratios below one were recorded at Cost C1 for IVDP and at cost C_2 for KHDP farmers. Bitter gourd was the only crop, which recorded a benefit-cost ratio higher than one at cost C_3.

5.3.6 Labour use and employment generation

Vegetable cultivation in general is labour intensive in nature. As there are many operations to be performed during a short time period of three or four months it is very difficult to carry out cultivation using only family labour. In this section it is proposed to examine the amount of labour involved in carrying out the various operations as well as the extent of employment generation in vegetable cultivation.

5.3.6.1 Bittergourd

In terms of profit we have seen that bittergourd is the most remunerative crop in the region. In terms of labour use it comes in the second position next to snakegourd. In the case of IVDP growers the total labour employed in the cultivation of bittergourd came to 462.1 man days of which 372.6 were family labour days. The maximum number of family labour days is employed for irrigation (124.1 man days). This amounts to 33.3 per cent of the total family labour employed. It should also be noted

Table 5.3.10 Operation wise labour use-Bittergourd man-days

Operation	IVDP (family)	Percentage to total family labour	IVDP (hired)	Percentage to total hired labour	KHDP (family)	Percentage to total family labour	KHDP (hired)	Percentage to total hired labour
Land preparation	28.3	7.6	34.4	38.5	24.0	7.8	30.4	33.9
Sowing	11.8	3.2	0.8	0.9	8.1	2.6	0.7	0.8
Manuring	25.2	6.8	7.0	7.8	20.2	6.6	8.8	9.8
Staking	27.7	7.4	16.0	17.9	17.9	5.8	15.3	17.1
Panthalling	25.0	6.7	14.4	16.1	18.8	6.2	14.5	16.2
Fertilizer	22.1	5.9	3.3	3.7	15.5	5.1	3.0	3.3
After cultivation	26.4	7.1	13.0	14.5	19.9	6.5	12.1	13.5
Plant protection	22.0	5.9	0.5	0.6	16.5	5.4	4.8	5.4
Irrigation	124.1	33.4	0.0	0.0	113.5	37.0	0.0	0.0
Harvesting	60.1	16.2	0.0	0.0	52.1	17.0	0.0	0.0
Total labour	**372.6**	**100.0**	**89.5**	**100.0**	**306.5**	**100.0**	**89.7**	**100.0**

that no hired labour is employed for this purpose. The next item where family labour is mainly used is harvesting. Here also no hired labour is employed, as both these operations are to be done regularly and demand less labour time per day. Other operations which need more family labour in the case of bitter gourd are land preparation, staking and after cultivation. Land preparation is the activity, which is most labour demanding and is generally done with hired labour. This activity demands 38.5 per cent of the total hired labour is engaged. Staking, panthalling and after cultivation are the other operations which require more hired labour. Thus IVDP farmers use 372.6 man days (80.8 per cent of the total labour) as family labour and 89.8 man days (19.2 per cent) as hired labour.

In the case of KHDP also we can see that the greatest amount of family labour employed was for irrigation followed by harvesting. This accounted for 37 and 17per cent respectively of the total family labour employed. These two operations together generate 163.6 man-days of employment. It is noteworthy that in the case of KHDP also only family labour is employed in these two operations. Hired labour employed was highest for land preparation in the case of KHDP also and was 30.4 man-days. This constituted 33.9 per cent of the total labour employed. The other operations for which hired labour was employed in higher amounts were staking and panthalling. Thus we can see that the KDHP group employed a total of 396.2 man days in vegetable cultivation per season. This included 306.5 man days (77.4 per cent) of family labour and 89.7

man days (22.6 per cent) of hired labour. The details regarding labour use in bittergourd cultivation are presented in Table 5.3.10.

5.3.6.2 Snakegourd

Among the three crops studied the most labour intensive crop was snakegourd. The total labour use in the case of IVDP for snakegourd cultivation was 468.3 man-days. Of these 377.7 were family labour and 90.6 were hired. These accounted for 80.7 per cent and 19.3 per cent respectively of the total labour employed.

The highest amount of family labour was employed for irrigation followed by harvesting. The values were 135.7 and 64.7 man days respectively for the two operations. As we have seen in the case of bittergourd, no hired labour was employed for irrigation and harvesting. Plant protection was another operation which was carried out using only family labour. About 44 man days of family labour were employed for plant protection.

Out of the total hired labour, 37.7 per cent was employed for land preparation. This was supplemented with family labour also, 7.7 per cent of the family labour being used for this purpose. As in the case of bittergourd, staking and panthalling accounted for 14.0 per cent and 18.8 per cent of the total hired labour.

KHDP farmers also employed the maximum number of hired labour for land preparation. Staking and panthalling accounted for 16.9 and

Table 5.3.11 Operation wise labour use-Snakegourd man-days

Operation	IVDP (family	Percentage to Total family labour	IVDP (hired)	Percentage to total hired labour	KHDP (family)	Percentage to total family labour	KHDP (hired)	Percentage to total hired labour
Land preparation	29.3	7.7	34.2	37.7	24.9	7.7	31.7	38.5
Sowing	10.3	2.7	4.0	4.5	10.5	3.2	0.5	0.6
Manuring	28.2	7.5	9.5	10.4	22.7	7.0	6.1	7.4
Staking	23.1	6.2	12.6	14.0	20.0	6.1	13.9	16.9
Panthalling	22.0	5.8	17.0	18.8	18.6	5.7	15.8	19.2
Fertilizer	24.3	6.4	3.0	3.3	20.7	6.4	4.3	5.2
After cultivation	21.1	5.6	10.2	11.3	19.6	6.0	9.5	11.5
Plant protection	19.1	5.1	0.0	0.0	43.2	13.3	0.5	0.6
Irrigation	135.7	35.9	0.0	0.0	88.5	27.2	0.0	0.0
Harvesting	64.7	17.1	0.0	0.0	56.7	17.4	0.0	0.0
Total labour	**377.7**	**100.0**	**90.6**	**100.0**	**325.6**	**100.0**	**82.2**	**100.0**

19.2 per cent of the total hired labour respectively. The total employment used was 407.8 man-days. Of these 325.6 and 82.2 man-days were family labour and hired labour respectively. These constituted 79.78 per cent and 20.2 per cent of the total employment use respectively. The details regarding labour use in snakegourd cultivation are presented in Table 5.3.11

5.3.6.3 Amaranthus

The details regarding labour use in amaranthus cultivation are presented in Table 5.3.12. Among the three crops studied amaranthus was the crop with the lowest labour demand as operations like staking and panthalling are absent here and also since it was raised as a direct sown crop in the area. In the case of both IVDP and KHDP growers family labour constituted the major share in the total labour used for cultivation. Land preparation, irrigation and harvesting were mostly done with family labour. This was supplemented with hired labour for operations such as land preparation and manuring which were highly labour intensive. The highest proportion of family labour was used in irrigation i.e., 63.7 per cent for IVDP and 69.5 per cent for KHDP. Fertilizer application contributed to 39.4 and 27.2 man-days respectively for KHDP and IVDP. Out of the total labour used of 262 mandays for KHDP farmers and 243 mandays in the case of IVDP growers only 27.3 and 12.6 man-days respectively were hired labour.

Table 5.3.12 Operation wise labour use-Amaranthus man-days

Operation	IVDP (family)	Percentage to total family labour	IVDP (hired)	Percentage to total hired labour	KHDP (family)	Percentage to total family labour	KHDP (hired)	Percentage to total hired labour
Land preparation	34.3	14.8	10.3	81.7	31.8	13.5	18.6	68.2
Sowing	14.9	6.4	0.0	0.0	17.4	7.4	0.7	2.6
Manuring	23.0	10.0	2.3	18.3	31.2	13.3	3.3	12.0
Fertilizer	27.2	11.8	0.0	0.0	39.4	16.8	1.4	5.2
After cultivation	13.5	5.8	0.0	0.0	4.8	2.0	3.3	12.0
Plant protection	18.8	8.2	0.0	0.0	17.1	7.3	0.0	0.0
Irrigation	63.7	27.6	0.0	0.0	69.5	29.5	0.0	0.0
Harvesting	35.6	15.4	0.0	0.0	24.0	10.2	0.0	0.0
Total labour	**231.0**	**100.0**	**12.6**	**100.0**	**235.3**	**100.0**	**27.3**	**100.0**

To sum up we can say that KHDP farmers are more efficient in their cultivation of vegetables as they cultivate the same area as an IVDP grower, using much less labour days. Another aspect worth mentioning is the gainful employment opportunity generated by this activity for family members. Considering that the labour would otherwise have remained idle, vegetable cultivation gains an added thrust in our society, where there is acute shortage of employment opportunities.

5.4 Marketing

In the present study an attempt has been made to recognize the important marketing channels and to analyse the marketing efficiency of the identified channels with respect to bittergourd, snakegourd and amaranthus, as indicated by marketing costs and margins. The values have been derived from the market survey conducted. The various marketing channels, costs and margins are explained below.

5.4.1 Market structure

The term market structure refers to those organisational characteristics of the market, which influence the nature of competition and pricing and influence the conduct of business firms (George and Singh, 1970). It also includes the mode of operation of the market.

Vegetable growers of the five panchayats under study by and large take their produce to Chalai or Palayam market. The number of village buyers or pre-harvest contractors is very negligible. The method of direct

selling of vegetables was also found to be meagre. Consumers buy vegetables either from the two major markets in Thiruvananthapuram city or local merchants (retailers) in the area.

5.4.2 Marketing channels

The major marketing channels identified for bittergourd, snakegourd and amaranthus were as follows.

1) Producer → consumer

2) Producer → retailer → consumer

3) Producer → wholesaler → consumer

4) Producer → wholesaler → retailer → consumer

5) Producer → commission agent → wholesaler → consumer

6) Producer → KHDP field centre → wholesaler → retailer

7) Producer → KHDP field centre → exporters

8) Producer → commission agent → retailer → consumer

9) Producer → commission agent → wholesaler → retailer → consumer

The most important marketing channel found was Producer → commission agent → wholesaler → retailer → consumer.

Distribution of farmer respondents according to the type of buyers is presented in Table 5.4.1.

Table 5.4.1 Distribution of farmer respondents according to the type of buyers

Type of buyer	Number of IVDP farmers	Number of KHDP farmers	Total number
Wholesaler through commission agent	64 (85.4)	22 (29.3)	86 (57.4)
Through KHDP	0 (0.0)	45 (60.0)	45 (30)
Wholesalers and retailers	5 (6.7)	4 (5.2)	9 (6.0)
Wholesalers and consumers	2 (2.7)	1 (1.3)	3 (2.0)
Retailers and consumers	1 (1.3)	1 (1.3)	2 (1.3)
Retailers	1 (1.3)	1 (1.3)	2 (1.3)
Wholesalers, commission agents and retailers	1 (1.3)	1 (1.3)	2 (1.3)
None	1 (1.3)	0(0.0)	1 (0.7)
Total	75 (100)	75 (100)	150 (100)

*Figures in parentheses represent the percentage of farmer respondents in each category

5.4.3 Marketing margins and costs

Marketing margins and costs were worked out for the most important marketing channel identified i.e., Producer → commission agent → wholesaler → retailer → consumer, for the three vegetable crops separately.

5.4.3.1 Marketing margins and costs for bittergourd

Marketing margins and costs incurred for bittergourd are presented in Table 5.4.2.

Table 5.4.2 Marketing margins and costs (Rs/tonne) for bittergourd in Thiruvananthapuram

Sl. No.	Shares	Values (Rs/tonne)	Percentage
1.	Producers' sale price or price paid by wholesaler	12000.00	70.7
2.	Transportation cost incurred by the producer	75.00	0.4
3.	Commission charges paid by the producers to the commission agents	600.00	3.6
4.	Net price received by producer	11325.00	66.7
5.	Fixed cost on investment for wholesaler	85.00	0.5
6.	Working cost of wholesaler	210.00	1.2
7.	Wholesalers' net margin	3205.00	18.9
8.	Price received by the wholesaler or price paid by retailer	15500.00	91.2
9.	Fixed cost on investment for retailer	158.00	0.9
10.	Transport cost incurred by retailer	200.00	1.2
11.	Other costs incurred by retailer	87.00	0.5
12.	Retailers' net margin	1055.00	6.2
13.	Retailers' sale price or consumers' price	17000.00	100.0

In the case of bittergourd, out of Rs. 17000.00 per tonne paid by the consumer, the producer received Rs. 11325.00. The wholesalers reaped a net margin of Rs. 3205.00 while the retailers' net margin was Rs. 1055.00. Thus the producers' share in consumers' rupee was 66.70 per cent.

5.4.3.2 Marketing margins and costs for snakegourd

Table 5.4.3 Marketing margins and costs (Rs/tonne) for snakegourd in Thiruvananthapuram

Sl. No.	Shares	Amount (Rs.)	Percentage
1.	Producers' sale price or price paid by wholesaler	5000.00	60.6
2.	Transportation cost incurred by the producer	75.00	0.9
3.	Commission charges paid by the producers to the commission agents	250.00	3.0
4.	Net price received by producer	4675.00	56.7
5.	Fixed cost on investment for wholesaler	85.00	1.0
6.	Working cost of wholesaler	210.00	2.5
7.	Wholesalers' net margin	1705.00	20.7
8.	Price received by the wholesaler or price paid by retailer	7600.00	84.8
9.	Fixed cost on investment for retailer	158.00	1.9
10.	Transport cost incurred by retailer	200.00	2.4
11.	Other costs incurred by retailer	87.00	1.1
12.	Retailers' net margin	805.00	9.8
13.	Retailers' sale price or consumers' price	8250.00	100

In the case of Snakegourd, out of Rs 8250 per tonne paid by the consumer, Rs 5000 (60.6 per cent) went to the producer seller. The wholesalers' net margin was found to be Rs 1705, i.e. 20.7 per cent of the net retail price. The retailers' net margin was Rs 805 per tonne (9.8 per cent). In snake gourd also wholesalers' margin was greater than the retailers' margins. The producers' share in consumers' rupee was 56.7 per cent. Marketing costs incurred by the wholesalers were low, accounting for a total of 3.5 per cent of the consumers' price. It is evident from this that the middlemen took away a substantial share from the consumers' rupee.The producers' net share in consumers' rupee was 56.7 per cent.

5.4.3.3 Marketing margins and costs for amaranthus

The marketing margins and costs for amaranthus are shown in Table 5.4.4.

The retailers' sale price for amaranthus was Rs. 8200 per tonne. Of this, only 48.8 per cent went to the producer seller. The net price received by the producer was 45.4 per cent of the retailers' sale price. The retailers' net margin was 15.3 per cent of the consumers' price. In the case of amaranthus also the net margin of the wholesaler was greater than the retailers' net margin. Marketing costs for the wholesalers was 3.7 per cent of the consumers' price. Here also it is seen that the middlemen absorbed a good portion of the consumers' rupee.

Table 5.4.4 Marketing margins and costs (Rs/tonne) for amaranthus

Sl. No.	Shares	Amount (Rs.)	Percentage
1.	Producers' sale price or price paid by wholesaler	4000.00	48.8
2.	Transportation cost incurred by the producer	75.00	0.9
3.	Commission charges paid by the producers to the commission agents	200.00	2.4
4.	Net price received by producer	3725.00	45.4
5.	Fixed cost on investment for wholesaler	85.00	1.0
6.	Working cost of wholesaler	210.00	2.6
7.	Wholesalers' net margin	2205.00	26.9
8.	Price received by the wholesaler or price paid by retailer	6500.00	79.3
9.	Fixed cost on investment for retailer	158.00	1.9
10.	Transport cost incurred by retailer	200.00	2.4
11.	Other costs incurred by retailer	87.00	1.1
12.	Retailers' net margin	1255.00	15.3
13.	Retailers' sale price or consumers' price	8200.00	100

5.4.4 Marketing efficiency

The economic efficiency of a marketing system can be measured as the ratio of the total value of goods marketed (V) to the marketing cost (I). The ratio is expressed as an index of marketing efficiency (ME), where

$$ME = \frac{V}{I} - 1$$

The index of marketing efficiency was highest at 1.99 for bitter gourd, 1.31 for snake gourd and for amaranthus it was the lowest (0.83).

5.5 Technical efficiency analysis using the production frontier

The stochastic production frontier was estimated using the maximum likelihood estimation method. The procedure was repeated for both KHDP and IVDP farmers.

5.5.1.1 Maximum likelihood estimates for KHDP respondents

The results of the maximum likelihood estimates are presented in Table 5.5.1. The explanatory variables selected were:

1) The value of total chemical fertilizers applied per hectare.

2) Total value of labour applied per hectare

3) Total value of seeds applied.

It can be seen from the table that the variance of one-sided error term (σ^2 u) and symmetric error term (σ^2 v) were 0.07005 and 0.0000122 respectively. This implies that the one-sided error term was dominant

which measured the shortfall of output from the maximum possible yield. The parameter values were 0.1649, -0.1307 and 0.0059 respectively for total fertilizers, total labour and total quantity of seeds. The constant term had a parameter value of 7.989. Total labour cost per ha and total fertilizers were found to be highly significant. The R^2 value was 0.40. This implies that 40 per cent of the variation in yield is explained by the explanatory variables. The mean technical efficiency of KHDP farmers was estimated to be 0.80. The results are presented in Table 5.5.1 and Table 5.5.2.

Table 5.5.1 Ordinary least square estimates for KHDP farms

Sl. No.	Explanatory variables	Parameter values
1.	Constant	3.776(0.4609)
2.	Chemical fertilizers	0.322(0.8441)
3.	Labour	-0.134(0.1027)
4.	Seed	-0.4930(0.9103)
5.	R^2	0.40

(Values in brackets denote corresponding t-values)

Table 5.5.2 Maximum Likelihood estimates for KHDP farms

Sl. No.	Explanatory variables	Parameter values
1.	Constant	7.989 (0.5313)
2.	Chemical fertilizers	0.1649 (0.7171)**
3.	Labour (both family and hired)	-0.1307 (0.3363)**
4.	Seed	0.0059 (0.1132)
5.	$\sigma^2 u$	0.07005
6.	$\sigma^2 v$	0.00000122
7.	$\lambda = \sigma u/\sigma v$	239.62
8.	$\sigma^2 u/\sigma^2 u + \sigma^2 v$	0.999
9.	MTE $=\sqrt{1-\sigma u(2/\pi)}$	0.80

**Significant at five per cent level
(Values in brackets denote corresponding t-values)

5.5.2 Maximum likelihood estimates for IVDP beneficiaries

Table5.5.3 Ordinary least square estimates for IVDP farms

Sl. No.	Explanatory variables	Parameter values
1.	Constant	3.557(0.5003)
2.	Chemical fertilizers	0.3711(0.7714)
3.	Labour	-0.4434(0.1823)
4.	Seed	-0.8796(0.7092)
5.	R^2	0.46

(Values in brackets denote corresponding t-values)

Table 5.5.4 Maximum Likelihood estimates for IVDP farms

Sl. No.	Explanatory variables	Parameter values
1.	Constant	4.4059 (0.3456)
2.	Chemical fertilizers	0.1806 (0.0871)**
3.	Labour (both family and hired)	0.660 (0.0676)
4.	Seed	-0.2025(0.0586)**
5.	$\sigma^2 u$	0.13216
6.	$\sigma^2 v$	0.00000465
7.	$\lambda = \sigma u/\sigma v$	168.59
8.	$\theta = \sigma^2 u/\sigma^2 u + \sigma^2 v$	0.99
9.	MTE $= \sqrt{1-\sigma u}\,(2/\pi)$	0.71

(**Significant at five per cent level)
(Values in brackets denote corresponding t-values)

Table 5.5.3 and 5.5.4 shows the coefficients of variables obtained for OLS and MLE estimates and the values of technical efficiency for IVDP farmers. The coefficient of constant term was 4.4059. The coefficient obtained for labour was 0.0660. The total chemical fertilizer applied and seeds used per hectare were found highly significant. The symmetric error term (σ^2 v) was 0.00000465 and the one-sided error term (σ^2 u) 0.13216. The mean technical efficiency was estimated to be 0.71 i.e., 71 per cent. The value of λ was 168.59.

5.6 Problems in Vegetable Cultivation

The various problems encountered in vegetable cultivation were listed and ranked according to their intensity in the field. In the case of IVDP growers the most important problem was lack of credit availability

followed by incidence of pests and diseases. The other problems in the decreasing order of intensity were unavailability of quality seeds at lower cost (65.3 per cent), lack of technical support (61.3 per cent), non - availability of irrigation water (45.3 per cent), unavailability of labour (44.0 per cent) and lack of marketing facilities. The major problems in vegetable cultivation are presented in table 5.6 .1.

Table 5.6.1 Problems in vegetable cultivation

Sl.No.	Problems	IVDP	Per cent	KHDP	Per cent
1.	Pest and diseases	68	90.7	28	37.3
2.	Unavailability of quality seed at low cost	49	65.3	2	0.02
3.	Unavailability of labour	33	44	38	50.7
4.	Lack of credit availability	69	92	0	0
5.	Non-availability of irrigation water	34	45.3	41	54.7
6.	Lack of technical support	46	61.3	9	12
7.	Lack of marketing facilities	28	37.3	17	22.7

Non-availability of irrigation water was the most serious problem encountered by KHDP growers. Unavailability of labour was the second most serious problem. The other problems were incidence of pests and diseases (37.3 per cent), lack of marketing facilities (22.7 per cent), lack of technical support (12 per cent) and unavailability of quality seed at reasonable cost (0.02 per cent).

Discussion

6. DISCUSSION

The results of the previous chapter necessitate some explanation about the real situation existing in the study area. In this chapter an attempt has been made to discuss the results as per the indications obtained from the previous chapter. This chapter has been divided into the following sections.

6.1 Cost of cultivation

6.1.1 Input wise cost of cultivation

6.1.2 Input-output relationship

6.1.3 Production and value of output

6.1.4 Farm efficiency measures

6.1.5 Benefit cost ratio

6.1.6 Labour use and employment generation.

6.2 Marketing

6.2.1 Market structure

6.2.2 Marketing channels

6.2.3 Marketing margins and costs

6.2.4 Marketing efficiency

6.3 Technical efficiency of bittergourd farmers

6.3.1 IVDP growers

6.3.2 KHDP growers

6.1 Cost of cultivation

6.1.1 Input costs

A perusal of the data pertaining to the input wise cost of production of the three vegetables included in the study show that the major item of cost was organic manure. The cost of organic manure ranged from 12.4 per cent in the case of IVDP bittergourd farmers to 16.4 per cent in the case of IVDP snakegourd cultivators. This translates approximately to 20 tonnes per hectare of organic manure, which is on par with the package of practices recommendations of the Kerala Agricultural University. This may be due to the increased awareness among the farmers about the benefits of using organic manure. Several farmers in the area reported that they used organic manure mainly due to the three reasons given below.

1) Sustainable production of vegetables can be brought about through increased application of organic manures.

2) The shelf life of vegetables can be increased.

3) Soil fertility can be maintained for a longer period.

Fig.1.Comparison of cost of cultivation of bitter gourd

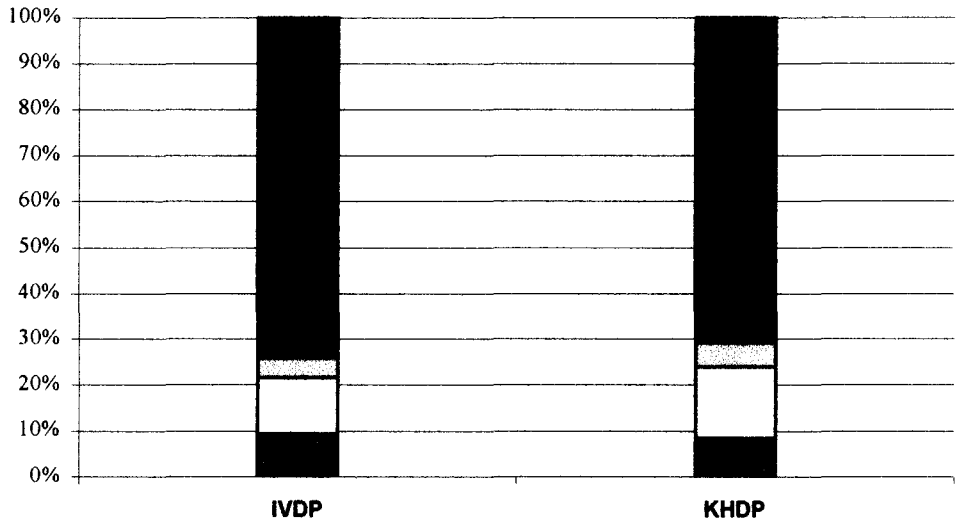
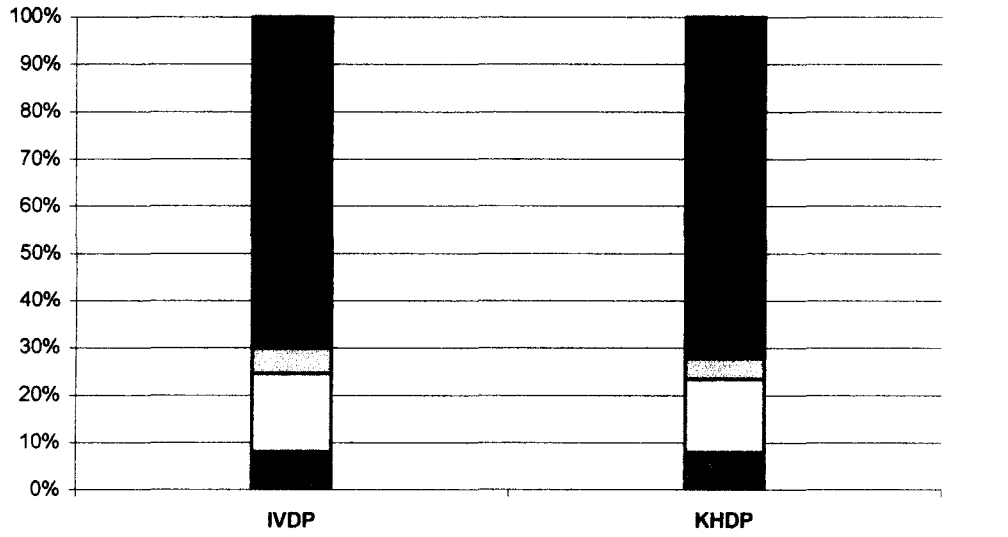


Fig.2. Comparison of cost of cultivation of snakegourd

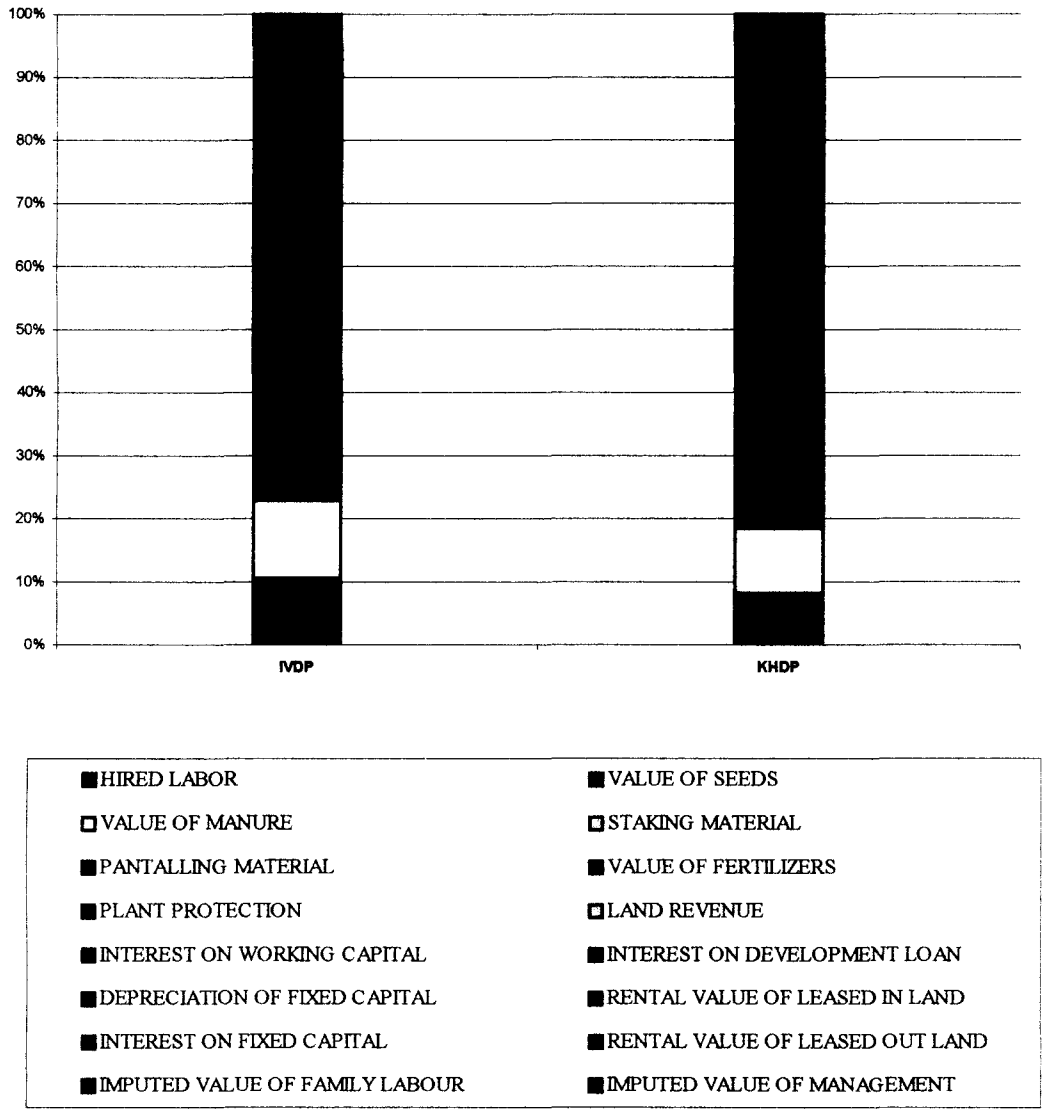


The Kerala Horticulture Development Programme has carried out efficient extension work in the vegetable growing panchayats except a few. The increased share of organic manure can be attributed partly to such extension activities carried out in the area. This is a good trend one witness in the field and such results were also reported by Subrahmaniyam and Doss (1981).

Hired labour is the second most important contributor to the total input cost in the case of bittergourd and snakegourd. The factor shares of hired labour for IVDP and KHDP were 8.2 and 7.3 per cent respectively in the case of bittergourd and 7.2 and 6.1 per cent respectively in the case of snakegourd. Vegetable being a highly labour intensive crop, this is quite expected. But in the case of amaranthus, for IVDP farmers it is only 2.7 per cent of the total cost due to a higher level of family labour used. The higher share of hired labour confirms the findings of Indersain *et al.* (1999), Thakur *et al.* (1994) and Mishra *et al.* (1999).

The third major input, cost wise is fertilizer. The share of fertilizer in the total cost ranged from 3.6 per cent in the case of amaranthus for IVDP growers to 4.1 per cent in the case of IVDP snakegourd growers. Sandhya (1992) has also reported fertilizers and manure as the second largest item of cost in the cultivation of vegetables. In general, there was a tendency for over use of chemical fertilizers in anticipation of a higher return. There were cases where the rate of fertilizer application was three times the recommended dose. This is a case of unscientific and inappropriate

Fig.3.Comparison of cost of cultivation of Amaranthus



fertilizer application. Further intervention by way of awareness creation on the merits of appropriate fertilizer application seems warranted. This can help in increasing the profitability of the farmer as well as in reducing environmental pollution.

Another major input, which requires some explanation about its relatively higher share in the cost of production of all the crops, is plant protection. Madan *et al., (1999)* reported that plant protection chemicals occupied 5.31 per cent of the total cost of cauliflower cultivation. Comparable results were obtained in this study also. Among all the crops, between the two different groups the cost for plant protection does not show much difference. Eventhough there are training programmes conducted by KHDP and Kerala Agricultural University to the vegetable farmers, regarding the use of organic and mechanical pest and disease control measures, only very few farmers in the study area seem to adopt them. In Kalliyoor and Venganur panchayats some farmers use even Methyl Parathion for amaranthus. In other vegetables also these farmers use pesticides with high residual toxicity. This will not only impair the health of the consumers but also degrade the environment. This is a particular area where both KHDP and IVDP should focus their attention.

In the case of bittergourd and snakegourd, cost of panthalling and staking occupied a significant share of the total input costs. This is still another area of intervention, where less costly and more durable materials for panthalling and staking can bring down the total cost of production.

Seed is the most crucial input necessary for success in vegetable cultivation, though its share in total cost is comparatively lesser. It ranges around one to two per cent in the case of bittergourd and snakegourd. Most of the farmers who are members of KHDP procure their seed from KHDP, but the IVDP farmers have no organised seed procuring mechanism. Often they have to get seeds from KHDP farmers or retain their own seeds from the previous crop. Since there is not much difference between the price of snakegourd and bittergourd seeds sold by government agencies and KHDP, the cost incurred on account of seed is almost same in the case of both the groups in the case of amaranthus. But it is not so in the case of amaranthus. The input share of seeds for amaranthus for IVDP farmers is 7.9 per cent of the total input cost whereas for the KHDP farmers it is only 4.0 per cent. This huge difference is due to the difference in the seed price. While the KHDP farmers get amaranthus seeds of the variety 'Arun' at a cost of Rs. 400 per kg, the seeds of the same variety distributed by government agencies cost Rs. 800 per kg. Seed production and processing is seldom done by individual farmers as it is a laborious task. Hence they have to buy seeds at a higher cost. Due to this difference the farmers try to cut the expenses on other inputs like hired labour. This is one reason why the percentage of hired labour is lesser in the case of IVDP than the KHDP farmers for amaranthus. The higher cost for vegetable seeds was earlier reported by Mishra *et. al.* (1999) for chilli crop. At this point it should be noted that

the seed processing and marketing system of KHDP is efficient, and highly beneficial to the farmers.

6.1.2 Input-output relationship

This part gives an idea about the different costs affecting the net return from vegetable cultivation. In the three different crops studied, the results obtained are quite dissimilar.

With regard to bittergourd, the explicit cost was more in the case of KHDP growers. The difference between the two groups was Rs. 16317.00. This is due to the higher amount paid by the KHDP farmer as interest on development loan, more rent on leased in land and also the higher amount spent for organic manure application. The total implicit costs were almost equal for KHDP and IVDP growers. In the case of IVDP vegetable growers, very few of them availed credit even though they were actually in need of credit. Most of them need credit, but the problems they confront in obtaining credit from the institutional agencies stand as a bottleneck for availing credit facilities. This has to be viewed seriously since credit can play a crucial role in increasing the production of crops by helping the farmers to adopt scientific cultivation practices.

Madan *et al.*, (1999) opined that easy availability of crop loans plays a key role in enhancing the production of vegetables. Vegetables being a seasonal crop, the produce of which is highly perishable in nature and also due to the increased amount of uncertainty associated with its

production and marketing, most of the financial institutions are reluctant to give credit to vegetable farmers. All KHDP farmers avail credit arranged by KHDP field officials from various banks. But the accessibility to credit for IVDP farmers is insufficient. They have to avail credit by their own effort. Usually they fail to get credit from banks due to technical difficulties and lack of awareness about the procedures. In this context it should be specially indicated that KHDP has performed outstandingly in this field. In all the panchayats except Kazhakkuttom, KHDP has operated well as a nodal agency, which satisfies the credit requirements of its member farmers.

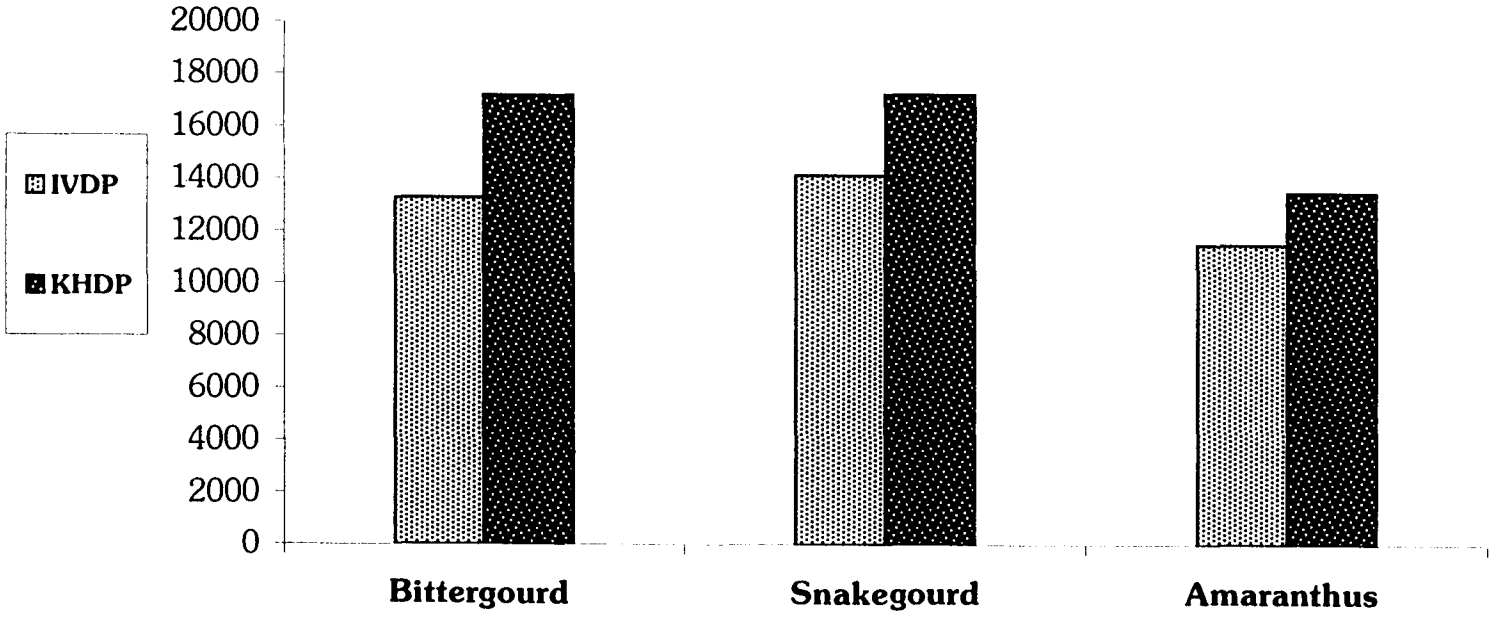
In the case of bittergourd, the net returns at total cost was found to be higher for KHDP growers than IVDP growers. This is due to higher output obtained for KHDP growers. But, for snakegourd and amaranthus the values were negative for both the groups. This is due to the relatively higher amount of family labour used in the cultivation of these crops.

The benefit-cost ratio at explicit cost was found to be more than one for all the crops. But for all the crops except bittergourd, the benefit-cost ratio at total cost was less than one.

6.1.3 Production and value of output of different crops

For all the three crops, production and consequently, the value of output was higher for KHDP growers. This was due to the higher level of production they could realise by adopting better management practices.

Fig.4. Production of vegetables(Kg/ha)



6.1.4 Farm efficiency measures

Farm efficiency measures provide an account of how the different cost components affect the total input-output relationship.

The farm business income obtained in the analysis was higher in the case of bittergourd than other crops. In the case of all the crops the KHDP growers recorded the highest farm business income. Besides higher yield, the difference may be attributed to the lower cost of cultivation on account of reduced share of hired labour, chemical fertilizers and plant protection chemicals.

Own farm business income was arrived at by deducting cost A_2 from gross returns. Here too values were higher in the case of KHDP growers for all the crops. The rental value of leased in land is much higher for KHDP growers in the case of all the crops. The land rent is fixed depending upon the fertility of soil and availability of irrigation water. The persons who lease out land for KHDP cultivators demand more rent. Also due to the availability of credit facilities the KHDP growers lease in land of higher fertility status and better irrigation facilities which naturally commands more rental value. At the same time a good number of IVDP growers cultivate either on their own land or even if they lease in land, due to shortage of capital they go in for land which has a lower rent.

Family labour income gives an idea regarding how much family labour is involved in cultivation and how it contributes to the income of

Fig.5. Farm efficiency measures-Bittergourd

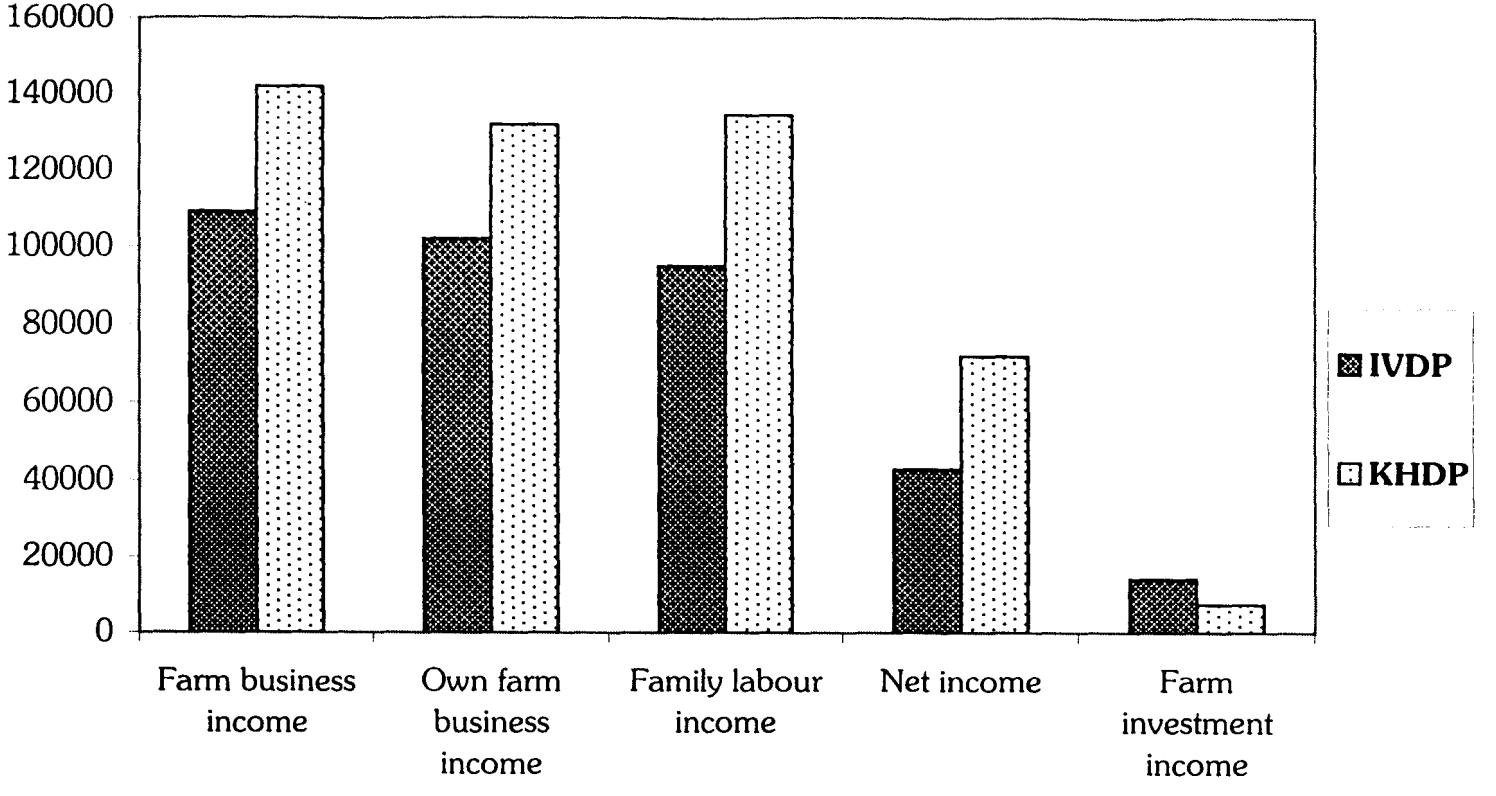


Fig.6.Farm efficiency measures-Snakegourd

Fig.7.Farm efficiency measures-Amaranthus

the farmers. In the case of bittergourd, if we examine the entire cost structure we can see that among the two groups, hired labour utilized by KHDP farmers was less (16.7 per cent of the total input) whereas IVDP groups employed more. This is one of the reasons why the KHDP growers realised more family labour income for all the crops. Considering the case of snakegourd IVDP growers showed a negative value for family labour income. This is due to the comparatively lower gross returns and higher cost incurred.

Net income shows positive values only for bittergourd. This is because of the comparatively higher gross returns the crop fetches due to higher consumer demand and consequent better price. Amaranthus though in demand, came to the market in large quantities and hence commanded a lower price. Snakegourd however, fetched a low price as it was considered to be a vegetable of inferior quality by the average Keralite. The farmers hence preferred bittergourd to all other vegetables.

The farm investment income was calculated by deducting the imputed value of family labour from farm business income. The values obtained were positive due to higher farm business income for all the crops.

6.1.5 Benefit-cost ratio

Benefit-cost ratio indicates the value of output per rupee of input. This ratio serves as a measure of whether the returns obtained are commensurate with the cost incurred. On cost C_3 basis returns generated

per rupee invested was found to be greater than one for bittergourd only. In general the benefit-cost ratio on cost C_3 basis was lower for IVDP growers than KHDP growers. On cost A_1 basis the benefit cost ratios were all positive. Thus in general it can be stated that bittergourd was the most profitable crop followed by amaranthus.

6.1.6 Labour use and employment generation

Both hired and family labour were employed in vegetable cultivation by both the groups. In terms of operation wise labour use some general trends can be observed. For operations like irrigation and harvesting which are to be done regularly and frequently and which require only part of a labour day, family labour was used mainly by both the groups. But for amaranthus family labour was predominant in all the operations. This is in confirmation with the findings of Thakur *et. al.* (1994) This is because it is a comparatively labour intensive crop compared to bittergourd and snakegourd.

Another trend we can observe is that for specialized operations like staking, panthalling and land preparation hired labour was used in higher intensity. The above discussion thus reveals the importance of family labour in the cultivation of vegetables in Kerala. Hired labour being very costly, vegetables can be profitably cultivated only through engaging family labour. In addition, it also provides gainful employment opportunities to the farm family members which otherwise would have remained idle and unproductive.

Fig.8. Operation wise labour use in bittergourd

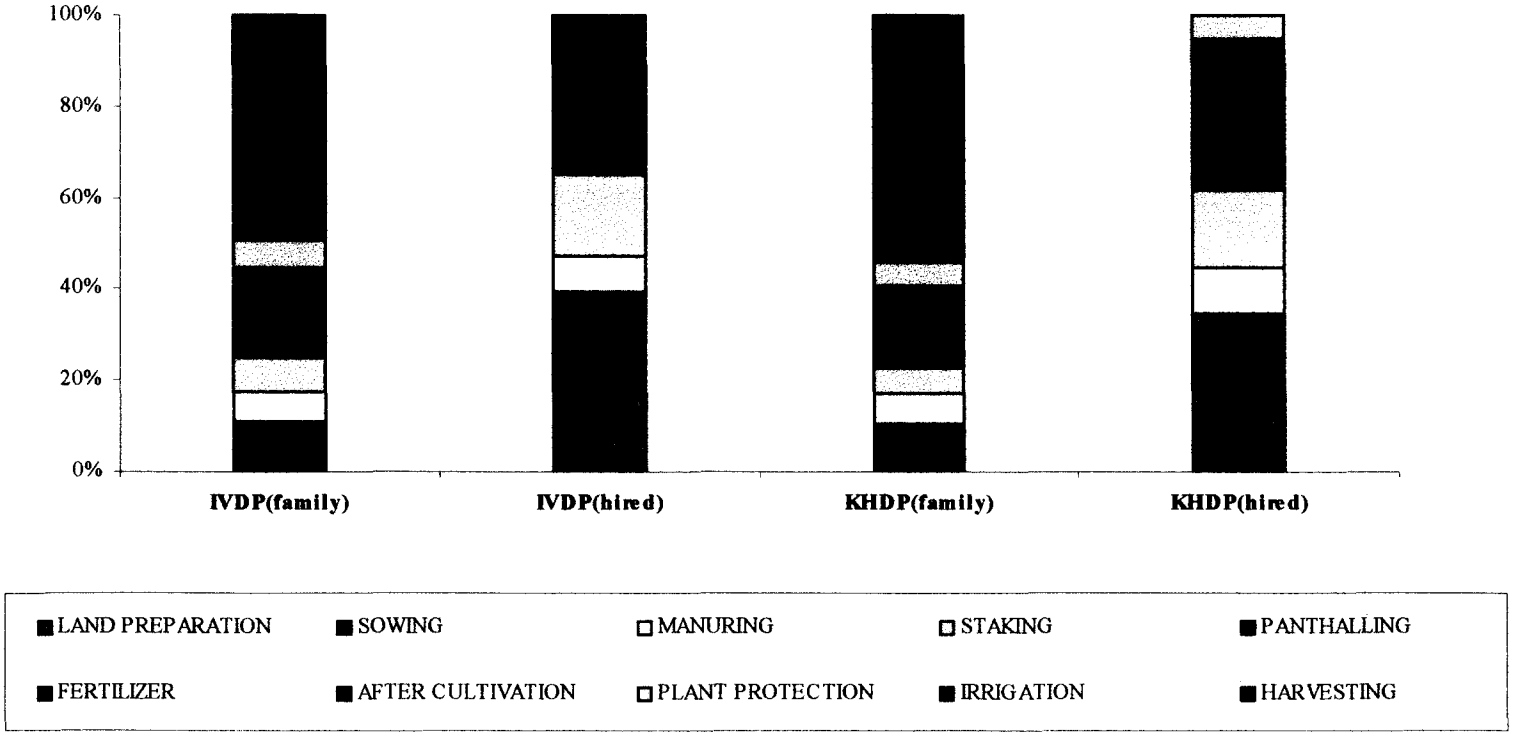


Fig.9.Operation wise labour use in snakegourd

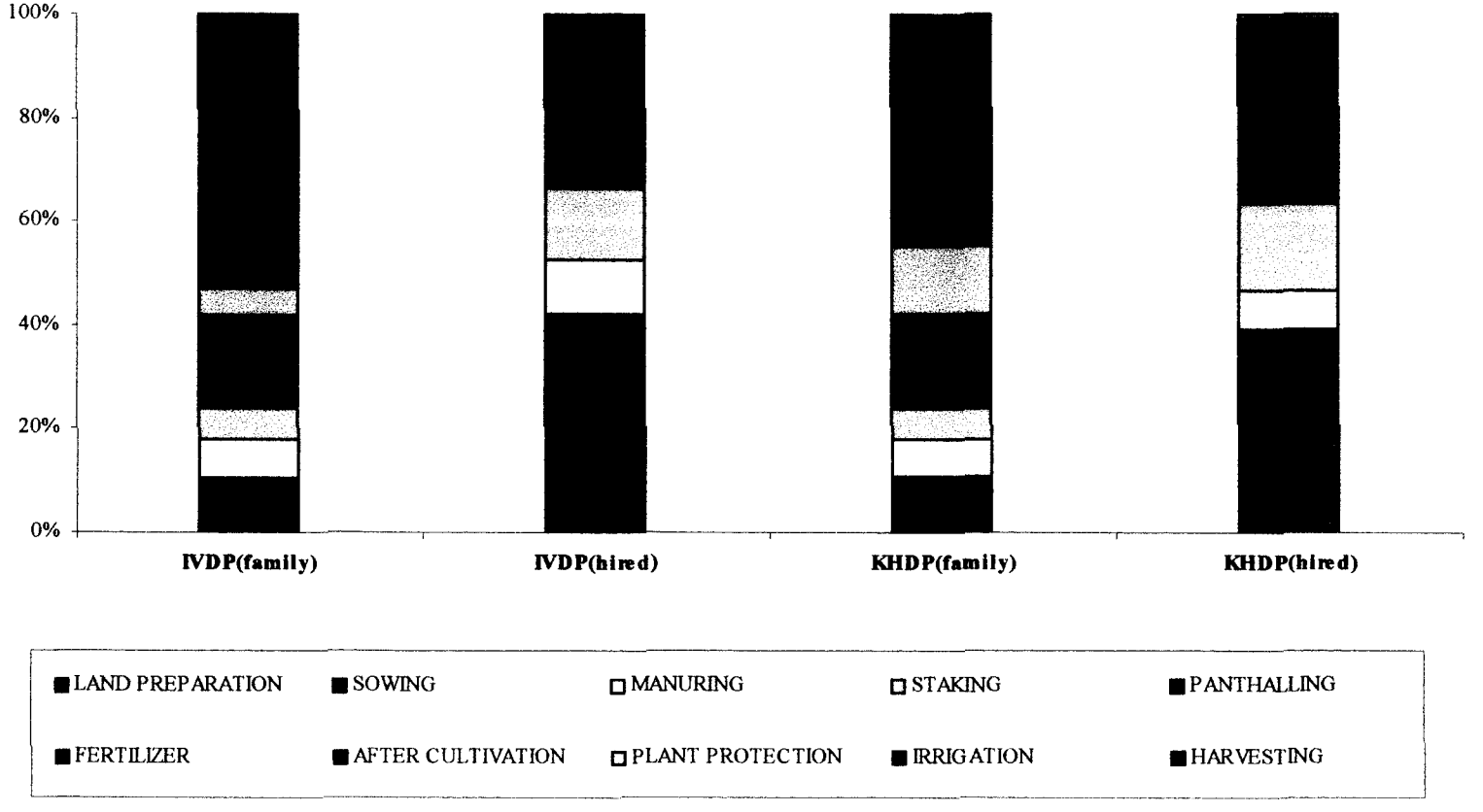
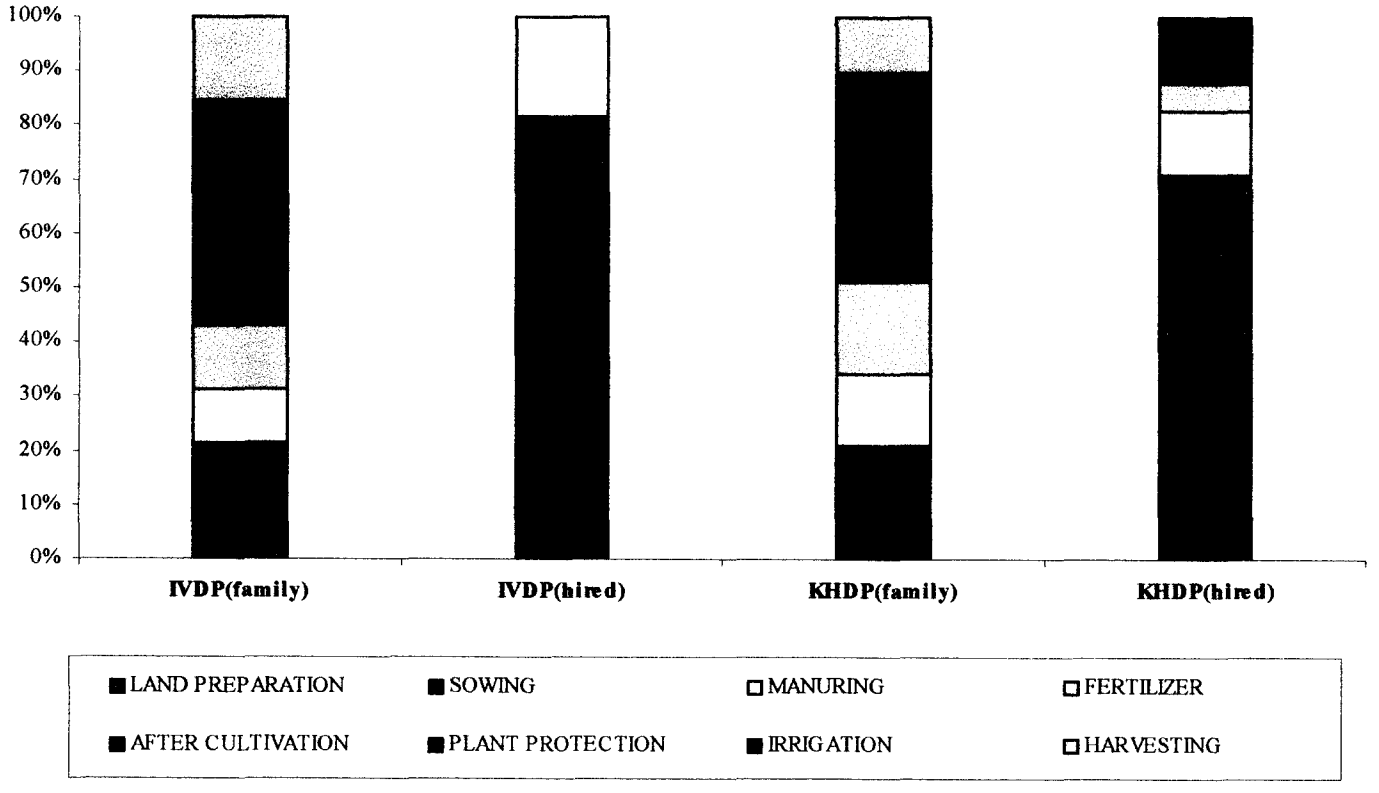


Fig.10. Operation wise labour use in amaranthus



6.2 Marketing

In this part a critical analysis of the various results that have been presented in the previous chapter regarding the marketing aspects of vegetables under study is carried out.

6.2.1 Market structure

In the study area most of the vegetable producers take their produce to the markets in Thiruvananthapuram city. The number of village buyers was found to be very negligible. This negates the findings of Prasad(1993). Even when there are village buyers, the farmers are reluctant to sell their produce to them due to the lower price they offer. However, in the study area KHDP has set up some field centres for selling the produce of their member farmers and 60 per cent of the farmers sold their produce through these field centres. The KHDP follows a method of marketing known as group marketing. Here by mutual co-operation, the farmers collect their produce in a pre-determined venue. They bring the wholesale merchants to this place and sell their produce. This market place is known as 'Swashraya Karshaka Vipani'. In this method about 10 to 12 Self Help Groups join together and they decide to conduct group marketing. An elected committee will take decisions upon details regarding bylaws, accounts and gathering of capital and finding suitable buyers. These markets take a five per cent commission from the farmers. From the amount thus collected, according to their participation a certain amount will be given to the members as bonus. There will be a secretary

of the retailers' sale price. Similar results were obtained for amaranthus also. Here also it can be observed that middlemen incurred a substantial amount of consumer's rupee.

6.2.4 Marketing efficiency

Among the three vegetables studied, marketing efficiency was found to be the higher for bittergourd. This is due to the better demand and consequent higher price obtained for bittergourd.

6.3 Technical efficiency

In this study, an attempt to measure the technical efficiency of bittergourd farmers was made. Among the three vegetables bittergourd was selected because, it is the predominant crop cultivated in the area and occupies the largest area among the vegetables under study. From the cost analysis done earlier we could find that it is also the most remunerative crop among the three. The technical efficiency values were arrived at using the maximum likelihood estimators. In this portion we make a comparison of the two schemes, IVDP and KHDP based on technical efficiency.

6.3.1 IVDP growers

Of the three variables considered, cost of chemical fertilizers and cost of seeds were found highly significant. The sum of the coefficients was less than one indicating decreasing returns to scale in bittergourd for IVDP growers. The coefficient for seed was found to be negative. This reiterates the fact that the seed rate is high and such high seed rate

reduces the yield due to scientific reasons such as crowding. The estimated value of θ was 0.99 indicating that about 99 per cent of the difference in potential and actual output could be explained due to technical inefficiency of farmers. The value of R^2 was 0.46 indicating that 46 per cent of the variation in the dependent variable is explained by the explanatory variables. From the estimates in the results we can say that the intercept term in MLE is higher than the ordinary least square estimates, while the slopes are almost comparable in both OLS and MLE results. Thus there will be a parallel shift upwards from the average production curve. The estimated mean technical efficiency is 71 per cent indicating that on an average the sample farms in the study area tend to realise only 71 per cent of their technical abilities. It means that 29 per cent of technical potentials are not realised by the farms. The poor performance can be attributed to the following reasons.

1. Lack of technical support
2. Lack of irrigation facilities in some panchayats
3. Difficulty in credit availability
4. Attitude of farmers towards vegetable cultivation
5. Pests and diseases
6. Unfavourable practices like higher seed rate, higher dose of fertilizer etc.
7. Inadequate marketing facilities.

6.3.2 KHDP growers

The results of the maximum likelihood estimators indicate that the KHDP farmers experienced decreasing returns to scale as can be seen from the sum of the coefficients. The R^2 value was 0.40 which implies that 40 per cent of the variation in the yield is explained by the explanatory variables. The value of fertilizers and value of labour were found highly significant. Contrary to the case of IVDP farmers we can see the adoption of improved techniques by the KHDP growers. They use good quality seeds in correct quantity, and adopt scientific cultivation practices so that it brings about higher production. Here also 99 per cent of the difference between actual and potential output can be explained on the basis of technical inefficiency of farms. The estimated mean technical efficiency is 0.80, which indicate that on an average the bittergourd farmers under KHDP scheme tend to realise about 80 per cent of the technical abilities. As these farmers are properly trained and the fields monitored by KHDP staffs, they can manage the farms in a more efficient manner. As stated by Dawson *et al.*, (1991) technical efficiency or inefficiency rests mainly with the management.

Eventhough the technical efficiency of KHDP growers is nine per cent higher than IVDP growers, we must realise that 20 per cent of the technical abilities still remains unutilized. It follows that there is scope for further increase in production by improving the level of efficiency without increasing the resource use. Lack of irrigation, incidence of pest and

diseases and lack of availability of labour are some of the constraints, which the KHDP growers also face. Helping them to overcome these difficulties can go a long way in improving their efficiency.

In short we can say that vegetable cultivation in the district is remunerative to the farmers if the right technical support, credit support and marketing support are provided. Technical efficiency analysis also show that the farmers are operating far away from the maximum possible technical efficiency. Though KHDP has done an excellent job in promoting vegetable cultivation in the area, it has still a long way to go in making both production as well as marketing more effective and efficient. The vegetable growers who are members of IVDP are worse off, with very limited access to credit facilities and practically no technical support. Providing them with technical know-how and timely and adequate credit availability is a responsibility which the government should undertake with top most priority, if it is to attain the target of self-sufficiency in vegetable production.

Summary

7. SUMMARY

The present study on the economic analysis of production and marketing of vegetables was conducted in five panchayats in Thiruvananthapuram district, with a view to examine the costs and returns of vegetable cultivation, employment generation, marketing efficiency and problems encountered in production and marketing of vegetables.

The study included the two main schemes which operate in the vegetable sector of Kerala namely the Intensive Vegetable Development Programme (IVDP) and the Kerala Horticulture Development Programme (KHDP). Three major vegetables cultivated in the area viz., bittergourd, snakegourd and amaranthus were selected for the study. The required information was collected from the sample population of 150 vegetable growers (75 for IVDP and 75 for KHDP) by personal interview method with the help of a well-structured and pre-tested interview schedule. Twenty-seven market functionaries, nine in each of the selected markets were randomly selected and contacted to gather data regarding the marketing of vegetables. Percentage analyses were carried out for analysing the data on production and marketing aspects. Technical efficiency of bittergourd farmers was also estimated using frontier production function. All the costs, returns and other parameters have been discussed on per hectare basis.

7.1 Production

7.1.1 Bittergourd

Bittergourd was found to be the most remunerative crop among the three vegetables. Cost C_3 for bittergourd for IVDP and KHDP growers were Rs. 116721.10 and Rs. 134135.60 respectively. In the case of both the groups of farmers, the highest share of the total cost was occupied by organic manure (Rs. 14450.00).

The share of hired labour occupied 8.2 and 7.3 per cent of the total cost in the case of IVDP and KHDP respectively. The amount spent on account of fertilizers were Rs. 6987.4 and Rs. 7149.7 in the above order. The value of seeds were comparable for both the groups each occupying 1.1 per cent of the total cost of cultivation.

The interest on development loan and the rental value of leased in land were higher in the case of KHDP growers than IVDP growers.

Family labour was another major input, occupying 35.7 per cent and 28.3 per cent of the total cost of cultivation for IVDP and KHDP respectively.

The total production per hectare of bittergourd was 13291.2 kg and 17213.8 kg, valued at Rs. 159494.40 and Rs. 206065.20 for IVDP and KHDP farmers respectively.

The farm business income, own-farm business income, family labour income, net income and farm investment income were Rs. 109081.40, Rs. 102120.50, Rs 95045.60, Rs. 42773.30 and Rs. 14035.80 respectively for IVDP growers. For KHDP growers they were Rs 141814.60, Rs. 137068.30, Rs. 134402.50, Rs. 71929.60 and Rs. 7412.10 in the above order.

The benefit cost ratios on cost C_3 basis was positive for bittergourd.

7.1.2 Snakegourd

The cost C_3 values were Rs. 127668.50 and Rs. 119588.60 for IVDP and KHDP growers. The major item of expenditure was organic manure for both the groups.

The costs of seeds as well as staking and panthalling materials were comparable for both the groups. The share of family labour was on the higher side for both IVDP (34.8 per cent) and KHDP (30.7 per cent) farmers.

The total explicit costs for IVDP and KHDP were Rs. 62711.60 and Rs. 61448.40 respectively. The total implicit cost was worked out at Rs 64956.90 and Rs. 58140.20 in the above order.

The production per hectare of snakegourd was 14162.1kg and 17270.9 kg for IVDP and KHDP growers.

The benefit cost ratios on cost C_3 basis were less than one for both the groups.

7.1.3 Amaranthus

The total cost of cultivation for amaranthus came to Rs.65358.20 and Rs.64313.70 respectively for IVDP and KHDP. Among the purchased inputs, organic manure occupied the highest share with 12.3 and 10.2 per cent of the total cost for IVDP and KHDP respectively.

The value of seeds showed significant variation between the groups with KHDP occupying a share of 4.0 per cent of the total cost and IVDP 7.9 per cent.

The total production in kilograms per hectare for amaranthus was 11533.7 and 13532.9 for IVDP and KHDP correspondingly.

The KHDP growers employed more family labour (235.3 man days) compared to IVDP growers (231.0 man days). The amount of hired labour employed was lower compared to other type.

The benefit cost ratios on cost C_3 basis were less than one at 0.70 and 0.84 respectively for IVDP and KHDP.

7.2 Marketing

Vegetable growers of the five panchayats under study by and large take their produce to Chalai or Palayam market. Consumers buy

vegetables either from the two major markets in Thiruvananthapuram city or local merchants (retailers) in the area.

Nine marketing channels were identified for bittergourd, snakegourd and amaranthus. The most important marketing channel was producer → commission agent → wholesaler → retailer → consumer.

Regarding marketing costs and margins, in the case of bittergourd, out of Rs. 17000.00 per tonne paid by the consumer, the producer received only Rs. 11325.00. The producers' share in consumers' rupee thus was 66.70. For snakegourd this was 56.70. In amaranthus, marketing costs of the wholesalers was 3.7 per cent of the consumers' price. Thus the middlemen absorbed a good portion from the consumers' rupee.

The index of marketing efficiency was highest for bittergourd (1.99), 1.31 for snakegourd and for amaranthus it was 0.83.

7.3 Technical efficiency

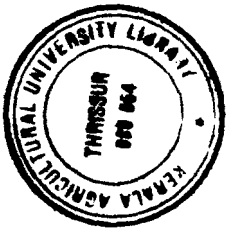
Technical efficiency of KHDP farms and IVDP farms were estimated using stochastic production frontier.

Three explanatory variables viz., the value of total chemical fertilizers applied, total value of labour applied and total value of seeds were used for analysis. The one-sided error term (σ^2u) was dominant over symmetric error term (σ^2v) which measured the short fall of output from

the maximum possible yield for KHDP growers. The mean technical efficiency was estimated to be 0.80 for KHDP farms. In the case of IVDP the mean technical efficiency was 0.71 i.e. 71 per cent. Here also the one sided error term was found to be dominant over symmetric error term.

7.4 Constraints in vegetable production

The major problems faced by the vegetable cultivators include high incidence of pests and diseases, unavailability of quality seeds, lack of credit availability, lack of marketing facilities and shortage of irrigation water.



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ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF VEGETABLES IN THIRUVANANTHAPURAM DISTRICT

BY

NAGESH. S.S.

ABSTRACT OF THE THESIS

SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF

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ABSTRACT

The present study on "Economic analysis of production and marketing of vegetables in Thiruvananthapuram district" was conducted with a view to examine the costs and returns of vegetable cultivation, employment generation, marketing efficiency, technical efficiency and problems encountered in production and marketing of vegetables. A comparative study of vegetable growers of KHDP and IVDP was also carried out. The data pertains to the year 1999-2000.

The total explicit costs for IVDP and KHDP snakegourd growers were Rs. 62711.60 and Rs. 61448.40 respectively. Total implicit cost was worked out at Rs. 64956.90 and Rs. 58140.20 respectively for IVDP and KHDP growers.

Bitter gourd was the only crop, which recorded a benefit-cost ratio higher than one at cost C_3.

The total cost of cultivation (Cost C_3) ranged from the lowest of Rs. 64313.70 for amaranthus to as high as Rs. 134135.60 for bittergourd. Bittergourd was the most remunerative crop in the area with a gross return of Rs. 206065.20 for KHDP and a benefit cost ratio of 1.53 at cost C_3. Cost of organic manure occupied the highest share of the total cost of cultivation of all the three crops.

The KHDP bittergourd growers showed an estimated mean technical efficiency of 80 per cent and for IVDP growers it was 71 per cent.

In the study area most of the vegetable producers marketed their produce in the markets in Thiruvananthapuram city. The marketing efficiency was highest for bittergourd (1.99) followed by snake gourd (1.31) and amaranthus (0.83).

The major constraints experienced in cultivation were incidence of pests and diseases, unavailability of quality seeds at reasonable cost, lack of credit availability and lack of marketing facilities.