PRODUCTION AND MARKETING OF VEGETABLES IN PALAKKAD DISTRICT

By
SREELA, P.

THESIS

Submitted in partial fulfilment of the requirement for the degree of

Master of Science in Agriculture

Faculty of Agriculture
Kerala Agricultural University

Department of Agricultural Economics
COLLEGE OF HORTICULTURE
VELLANIKKARA, THRISSUR - 680 656
KERALA, INDIA

2005

DECLARATION

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

Vellanikkara

Sreela. P

CERTIFICATE

Certified that the thesis entitled **"Production and marketing of vegetables in Palakkad district"** is a record of research work done independently by **Ms. Sreela. P,** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, associateship or fellowship to her.

Vellanikkara
28-9-05

Dr. E. K. Thomas

(Chairman, Advisory Committee)
Associate Professor and Head
Department of Agricultural Economics,
College of Horticulture,
Vellanikkara.
Thrissur-680 656.

CERTIFICATE

We, the undersigned members of the advisory committee of **Ms.Sreela. P,** a candidate for the degree of **Master of Science in Agriculture**, with major field in Agricultural Economics, agree that the thesis entitled **"Production and marketing of vegetables in Palakkad district"** may be submitted by **Ms.Sreela. P**, in partial fulfilment of the requirement for the degree.

Dr. E.K. THOMAS 28/09/05
(Member, Advisory Committee)
Associate Professor and Head
Department of Agricultural Economics
College of Horticulture,
Vellanikkara

28/9/05
Dr.K.JESY THOMAS
(Member, Advisory Committee)
Associate Professor,
Department of Agricultural Economics
College of Horticulture,
Vellanikkara

28.9.05
Dr.P.G.SADHAN KUMAR
(Member, Advisory Committee)
Associate Professor,
Department of Olericulture
College of Horticulture,
Vellanikkara

S. Krishnan 28/09/05
Sri.S.KRISHNAN
(Member, Advisory Committee)
Assistant Professor (sel.grade)
Department of Agricultural Statistics
College of Horticulture,
Vellanikkara

28/09/05
Dr. LALITH ACHOTH
Associate Professor and Head
Department of Animal sciences
and Business Management
UAS, Hebbal
Bangalore
(EXTERNAL EXAMINER)

Dedicated to

My Loving Amma, Acha and chuthi

ACKNOWLEDGEMENT

I bow my head before the Almighty God for his blessings, which gave me a chance to do post graduation and enabled me to successfully complete the thesis work in time. I am also gifted with the rarest of the rare blessings of working under a wonderful guide.

I would like to extend my profound gratitude and indebtedness to Dr E.K.Thomas, Chairman of my advisory Committee, Associate Professor and Head, Department of Agricultural Economics, College of Horticulture, for his valuable guidance, constant support and encouragement throughout the course of my study period and in the preparation of this thesis. I am very fortunate to be his student and without his cooperation and advice, I would not have been able to complete this work.

I consider it as my privilege to express my deep-felt gratitude to Dr.K.Jesy Thomas, Associate Professor, Department of Agricultural Economics, College of Horticulture for her sustained interest and constructive criticisms throughout the the course of my work. My heartfelt thanks are due to Dr P.G.Sadhan Kumar, Associate Professor, Department of Olericulture, College of Horticulture, for his candid suggestions and help. My sincere thanks are also due to Sri.S.Krishnan, Assistant Professor, Department of Agricultural Statistics, College of Horticulture for his valuable help during the preparation of this thesis.

I am especially thankful to my teachers of the Department of Agricultural Economics Dr.P.Indira Devi, Dr.Sathees.K.Babu and Dr.A.Prema for their timely help and support, which enabled me to carry out this investigation effectively. I respectfully thank Smt. Laly John, Assistant Professor, Department of Agricultural Statistics and Dr.NirmalaDevi.S,

Associate Professor, Department of Olericulture for extending their helping hands whenever I needed so.

I am highly indebted to the farmers of Nemmara who took a genuine interest in my case and offered me all the required assistance. Their friendly attitude and cooperation helped me a lot for the smooth conduct of the survey. I am also thankful to VFPCK officials, especially to Smt. Uma and to the Krishi Bhavan officials of Nemmara for their kind cooperation during the course of my survey.

I have no words to express my sense of gratitude to my friends Deepa, Jyothi, Jaisal and Sapheera. I would like to acknowledge the sincere help rendered to me by Sujatha, Habeeba, Smitha, Prathibha, Roopa, Asha, Simi and Ambili, Reena. My heartfelt thanks are extended to my seniors Aswathy, Kousalya, Divya, Pratheesh and Geevar. I am also thankful to my fellow juniors Shibi, Chitra and Lina. Help rendered by Santhoshettan of computer club is also duly acknowledged.

I greatfully acknowledge the Kerala Agricultural University for awarding me the Junior Fellowship for the postgraduate programme.

Above all, I express my heartfelt gratitude to my parents and my sister whose continuous inspiration and prayers gave me the strength to successfully complete the thesis work.

Sreela. P

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction

1. INTRODUCTION

India, with diverse soil and climatic conditions comprising of several agro- ecological regions, provides ample opportunity to grow a variety of horticultural crops. These crops form a significant part of total agricultural produce in the country comprising of fruits, vegetables, root and tuber crops, flowers, ornamental plants, medicinal and aromatic plants, spices, condiments, plantation crops and mushrooms. It is estimated that all the horticulture crops put together covers 7 million hectares of area with an annual production of 91 million tonnes.

India is the second largest producer of vegetables in the world (surpassed only by China). Though, India has 16 per cent share in the world population it contributes only to the extent of 12.22 per cent of the total vegetable production in the world (Ramamurthy *et al*, 2003). In 2002, India produced 78.2 million tonnes of vegetables from 5.73 million hectares of land. But it is not catering much to the needs of increasing population. Population growth characterized with rapid urbanization will induce higher demand for fruits and vegetables.

Though the share of vegetable production in Indian horticulture is 60.5 per cent, hardly one per cent of the produce is exported (Sirohi and Behera, 2003). Indian farmers today cannot meet the high domestic demand for vegetables, as India imports approximately $ 678 million vegetables annually (Shanmugasundaram, 2004). In future, availability of more area under vegetables crops will be very much restricted because the irrigated area under fruits and vegetables is stagnant at 4.5 per cent of the total irrigated area, which is shared, mainly by cereals and commercial crops. Hence for increased production in the next century, steps will have to be taken to raise productivity considerably rather than expanding the area.

Vegetables are rich source of vitamins, minerals, proteins, and carbohydrates, which are essential in human nutrition. Hence, these are referred to as protective foods and assume great importance in the nutritional security of the nation.Per capita consumption of vegetables in India is only around 130g against a minimum of 300g recommended by Indian Council of Medical Research. This is mainly because of the low availability and high price of the vegetables. The dietary requirement of vegetables will grow in proportionate to the population growth. There is a need to achieve the target of 125.5 million tonnes of vegetables for meeting the dietary requirements (Talati, 2003). Nutrional security can be obtained by diversifying the diets of the poor households through increased intake of fruits and vegetables, which are rich in micronutrients.

Vegetables play a unique role in India's economy by improving the financial position of the rural people. Cultivation of these crops is labour intensive and as such they generate lot of employment opportunities for the rural population. They are short duraton crops giving good yields and favourable prices in markets. They are suited for production on small land parcels. Thus, cultivation of vegetable crops plays a vital role in the prosperity of a nation and is directly linked with the health and happiness of the people.

Kerala offers a great scope for cultivating different types of vegetables with its diverse climatic conditions. Inspite of all the congenial conditions, it depends on neighbouring states for meeting a major share of its vegetable requirements. Neighbouring states like Tamil Nadu and Karnataka, taking the advantage of low cost of production, dump their low priced produce in the Kerala market. Because of labour intensive nature of cultivation, shortage of labour, high wage rate, scarcity of land etc, Kerala faces stiff competition from these states. Moreover, confining the cultivation of vegetables to homesteads and the heavy incidence of pests and diseases are causing serious threats for the large-scale cultivation of vegetables in the state.

The interference of middlemen during marketing increases the price of the vegetables. They offer low price to the growers by falsely rejecting the produce as substandard and indulge in other malpractices. At the same time, due to the high perishability of the vegetables, farmers are forced to sell off their produce at the price fixed by the traders. A major share of the consumer's rupee thus goes to the middlemen. Thus a disorganized system of marketing service is a threat to vegetable production in the state. With the active participation of Vegetable and Fruit Promotion Council Keralam (VFPCK) in the marketing of vegetables, the exploitation of middlemen is averted to a large extent. VFPCK could bring an additional area of 13500 hectares under vegetable cultivation and production of two lakh tonnes of vegetables have been achieved. (Mathew, 2001). Currently, VFPCK gives the needed help and assistance to the growers in exporting the vegetables. For that farmers are being induced to practice organic farming. In many parts of Chittur taluk, vegetables like tomato and bittergourd and fruits like banana, pineapple and mango are getting exported in this manner. Hence there is a need for making entrepreneurs aware of the new opportunities existing in the field of vegetable cultivation.

Nemmara block of Chittur taluk in Palakkad district was selected as the area of study as it had one of the major vegetable growing tracts in the district. It also had one of the best functioning VFPCKs in the district. Among the vegetables grown in the study area, bittergourd, snakegourd and ivy gourd were cultivated extensively and hence the study was centered on these three vegetables. Record production of bittergourd and snakegourd were reported by VFPCK in this area. Though many studies have been conducted in the production and marketing of bittergourd and snakegourd economics of production and marketing aspects of ivy gourd has not yet received the attention that it deserves, particularly so in Kerala.

A study on production and marketing of vegetables would appear relevant in this context. Hence, it is necessary to know the present cost of production and profitability so that proper planning can be done to make

production more remunerative and attractive. The specific objectives of the study were

1) To examine the cost and returns of vegetable cultivation
2) To measure the technical efficiency of vegetable farms
3) To find out the marketing efficiency
4) To identify the major constraints of vegetable production and marketing

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.

Limitations of the Study

The results of the study were based on farm level data, which were collected from farmers and traders through interview method. Since the farmers do not maintain records for the cultivation practices, responses were drawn from their memory, which may be subject to recall bias. However every effort was made to minimize the error by cross-questioning and cross – checking.

Plan of the thesis

The thesis consists of five chapters, including the present one. A review of the relevant literature is given in chapter two. A brief description of the area of study and methodology are given in chapter three. The results and discussion were presented in chapter four. The summary of the major findings of the study is given in the final chapter.

Review of Literature

2. REVIEW OF LITERATURE

A comprehensive review of the past studies is useful to formulate concepts, methodologies and tools of analysis to be used for any research. In this chapter an attempt has been made to review important past studies relevant to the present study.

The chapter has been divided into three section viz; studies related to production economics, technical efficiency and marketing. First section (Section 2.1) deals with production economics studies. In section 2.2 and 2.3,studies related to technical efficiency and marketing respectively are covered.

2.1. PRODUCTION ECONOMICS

Madalia and Kukadia (1978) conducted an investigation regarding cost and returns in the cultivation of four vegetables viz., pointed gourd, lady's finger, bittergourd and chilli in Olapad taluk of Surat district of Gujarat. The data were collected from eighty farmers using personal interview method. The study revealed that per hectare cost of cultivation of pointed gourd, lady's finger and chilly during 1974-75 was higher when compared to that in 1973-74 and in the case of bittergourd the cost was lower. Human labour was found to be the most important item of expenditure followed by the plant protection chemicals. The average cost of production of pointed gourd was worked out to beRs.5974.96 per hectare, which was the highest, while that for bhindi worked was out to be Rs.3230.50 per hectare, which was the lowest among the four vegetables under study.

Ramaswamy (1981) in his study on production aspects of major vegetables in Coimbatore district found that the realized 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 brinjal varied from

1.80 tonnes per hectare to 14.56 tonnes per hectare, the average being 9.60 tonnes. The coefficient of variation in yield was estimated to be 19.26 per cent for the same crop.

In a study on farm profitability and resource productivity in cultivation of chillies in Chindwara district of Madhya Pradesh, Nahatkar and Pant (1984) found that the average cost of cultivation of chillies was Rs.4, 260.27 per hectare. Out of the total operational costs, cost of fertilizers and manures was the highest on small farms, whereas the cost of hired labour was higher on medium and large farms as compared to small farms.

Bhalerao and Maurya (1985) in a study based on data collected by survey method, from randomly selected 150 vegetable growers in Sevapuri block of Varnasi district of Uttar Pradesh reported that there was a negative relationship between cost C and the size of the farm. Among the vegetables studied the output-input ratio was the highest in the case of bittergourd (2.11) followed by cauliflower (1.78), onion (1.77) and tomato (1.45).

Gupta (1987) reported that vegetables accounted for more than 70 percentage of the total income of the farmers in Solan in Himachal Pradesh. It was found that income on large farms was 3.5 and 1.7 times higher than that of small and medium size farms respectively. As much as 48 per cent of the total expenditure went to hired labour alone. Cost of production per unit area was lower on large sized farms, making them economically more efficient.

According to Kiresur and Kumar (1988) vegetables had low cost of production, but received high prices on Dharwad district of Karnataka. Cost of production was higher for potato compared to onion and brinjal. Profits were higher in case of onion followed by brinjal and potato. It was found that tomato was the most profitable crop with a net profit of Rs.3195 per acre followed by brinjal and onion.

Singh and Bhatia (1988) had examined the role of vegetables in augmenting farm income and employment in Himachal Pradesh. Examining the area under vegetables, average yield and yield gap between experimental field and farmers field, the authors had arrived at the conclusion that for some of the vegetables like pea, cabbage, cauliflower, tomato and potato there was vast scope to increase productivity through proper use of technology.

Mankar *et al.* (1990) investigated input requirements and productivity of ratoon cabbage and the economic feasibility of such a crop under Akola condition. The ratoon crops yielded 27,780 compared to 32,241 kg per hectare for the main crop. The total cost of ratoon crop cultivation was Rs.8167.29 per hectare as compared to Rs.26169.62 per ha for main crop. The net returns were Rs.19612.80 per ha for the ratoon crop and Rs.6071.38 per ha for the main crop.

Lamberts (1992) studied the production trends for Asian vegetables in Dade country, Florida. It was found that in addition to the traditional vegetables grown in Dade country in the autumn and winter months, production of Asian vegetables had been on the increase during the 1980s and 1990s as a result of demographic changes and increased demand from the cities. The major cucurbitaceous vegetables grown were bottlegourd, pointed gourd, ivy gourd, luffa, Chinese okra, winter melon, chayote and bittergourd.

Sandhya (1992) compared the cost of production of bittergourd and ashgound in her study on economics of production and marketing of vegetables in Ollukkara block of Trichur district and found that cost incurred in producing one quintal of bittergourd was higher than the cost incurred in that of ashgourd. For ashgourd, a rupee invested returned Rs.2.24 on cost C_2 basis while a rupee invested returned only Rs.1.88 in the case of bittergourd. Net income derived from bittergourd cultivation was 44 per cent more than that from ashgourd. Both in the case of bittergourd and ashgourd, the contribution of two inputs, namely

manures and fertilizers and land, towards net income were found to be significant and positive explaining thereby the possibility of further increase in total income by the use of these inputs.

Sharma *et al.* (1992) in a study on economics of vegetable farming in mid hills of Himachal Pradesh found that lady's finger and chillies in kharif and cauliflower, cabbage, potato in zaid-rabi were the most paying vegetable crops. However, cauliflower, cabbage and peas in rabi and bottlegourd, brinjal and bittergourd in zaid-kharif were the most remunerative vegetable crops. The input-output analysis suggested that farmers can increase total income by enhancing the use of labour. The study also brought out that there was increasing returns to scale in cauliflower, potato and brinjal thereby suggesting that more returns could be obtained if the use of the inputs like human labour, bullock labour and working capital were enhanced.

Aggarwal (1993) studied the cultivation of hybrid tomatoes in West Bengal. The cultivation of hybrid tomatoes and capsicum in Kulpi block produced amazing results. In the very first year, farmers got yield as high as 65 tonnes for tomato and 13 tonnes for capsicum per acre. Due to such high yields and incomes, the farmers bought seeds at aboutRs.15000 per kg and made total investment of about Rs. 30000 per acre. Some enterprising farmers even grew tomatoes in the most unfavorable periods of heavy monsoon. Their argument was that their loss of production was more than off set by the very high prices which their off season produce fetched in Calcutta market.

Brahmaiah and Naidu (1993) in their studies on chillies reported that labour was one of the major constituents of total cost incurred and therefore had a direct impact on farm earnings. It showed that there was a direct relation between size of the farm and total labour cost. Cost components for large and small farms indicated that manures and fertilizers took the largest share in total expenditure followed by other inputs like rent on land, plant protection, human

labour and bullock labour. Their findings indicated that chillies in general were a responsive and labour intensive crop. Productivity was highest on large farms and it decreased with decrease in farm size.

Srivastava (1993) in his study on 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) followed by spongegourd (Rs.19, 263). The capital output ratio was estimated to be highest at 1:2.68 for spongegourd followed by cowpea.

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 the five vegetables viz., tomato, capsicum, cauliflower, cabbage and peas, human labour (hired and family labour combined) occupied the lion's share.

Jain and Gauraha (1996) conducted a study in Bilaspur district of Madhya Pradesh. The data were recorded for the year 1994-95. The study revealed that the average cropping intensity was 22.7 per cent. Benefit cost ratio was maximum for chilli (1.35) followed by cauliflower (1.21).

Prasad and Bonney (1996) conducted a study in the Pananchery and Puthur Panchayats of Trichur district in Kerala to delineate the constraints in the adoption of improved agricultural practices by commercial vegetable growers. Increased cost of plant protection chemicals was reported by 98per cent of the respondents as the most important constraint followed by inadequate market facilities (88 per cent) and poor storage and other post harvest facilites (74 per cent). The other constraints in the order of importance reported were inadequacy of capital, high labour charges and water scarcity.

Gupta and Verma (1997) undertook a study in Durg district of Madhya Pradesh to analyze the production and marketing of ivy gourd. It showed that the material used to prepare the panthal and land rent were the most expensive cost items. Manuring and fertilizer application, plant protection and harvesting were found to be very important variable cost component. Marketing cost formed about 33-40per cent of the total per hectare cost of production. Thus marketing cost played a key role in deciding the scale of ivy gourd production.

Koshta and Chandrakar (1997) conducted a study in profitability of vegetable crops in Chattisgarh region of Durg district of Madhya Pradesh. It was found that cost of production per quintal was minimum for ivy gourd when compared to that of other vegetables grown there. Marketing cost was the maximum in ivy gourd. The returns from ivy gourd, cabbage and bittergourd were comparatively higher than that from other crops on per hectare basis.

Ramachandran (1997) studied economics of production and marketing of okra and tomato in Chittur taluk of Palakkad district. It was observed that the net income from tomato was higher (Rs.22686/hect) than from okra (Rs.15434/ha). Manure formed the third largest input constituting 15.92 per cent of the total cost in okra cultivation. The study showed that the major constraint in vegetable cultivation in Chittur taluk was the ever-increasing cost of production without a corresponding increase in the returns accruing to the cultivators.

Chauhan (1998) in a study on economic analysis of production and marketing of vegetables in Azamgarh district of Uttar Pradesh observed that there was not much variation in the farm size and area under irrigation between vegetable and non-vegetable crops. Tomato and brinjal emerged as most profitable crops among the crops studied. Results revealed greater scope for the increase in farm income through readjustment of resources.

Sailaja *et al.* (1998) conducted a study in Guntur district of Andhra Pradesh using multistage sampling technique from ninety vegetable farmers. Cobb-Douglas production function was employed to estimate the production elasticities of resource use on vegetable farms and observed that there were diminishing returns to scale for tomato and brinjal constant returns to scale for cauliflower and increasing returns to scale for coccinia. Regarding production elasticities, human labour was found to have positive and significant effect on the output for all the crops concerned. In the case of tomato, seed material had significant but negative effect on the output.

Bavrah and Salikutty (1999) made an economic analysis of a crop combination system involving vegetables. They found that gross return, net return, BC ratio and per day return were significantly influenced by both planting system and intercropping. An investigation was undertaken at the vegetable research plots in College of Horticulture, Kerala Agricultural University to evaluate the productivity of ashgourd as influenced by crop combinations. For intercrops cucumber, pole cowpea, bush cowpea and amaranthus were tried in different combinations with ashgourd. In the case of intercrops, ashgourd + cucumber + amaranthus gave the highest gross and net returns. Significantly, lowest gross return was obtained by the sole crop of ashground which was on par with ashgourd + pole cowpea combination.

Kumar and Arora (1999) concluded that vegetable cultivation gave better net profit to the growers over different costs. But when marketing cost was included the net profit was considerably reduced, which explained the need to economize on marketing cost, maximize the sale price and the production level in the region. The study was conducted in Kumaon and Garhaal division of Uttar Pradesh using cluster-sampling approach with 150 farmers. The vegetables studied were greenpea, potato, tomato, capsicum, cabbage, cauliflower, carrot, radish, onion and ginger.

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 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, and compared to small and medium farmers they had less family labour in relation to land. Farmyard manure constituted 30.53 per cent of the total cost. He opined that efforts must be made for easy availability of crop loans.

Karthikeyan (2001) studied the input wise cost of cultivation of potato, garlic, carrot and cabbage in Devikulam block of Idukki district. It showed that human labour cost was the single largest item of input occupying around one half of the total cost while operation wise cost of cultivation of the above crops showed that seeds and sowing was the single largest item which occupied the major share of the total cost.

Nagesh (2001) in his study on producton and marketing of vegetables in Trivandrum district in Kerala found that cost of panthalling and staking occupied a significant share of total input costs in the case of bittergourd and snakegourd. Among the three crops, snakegourd, bittergourd and amaranthes, snakegourd was the most labour intensive crop. In terms of profit, bittergourd was the most remunerative in the study area. He opined that less costly and more durable materials for panthalling and staking could bring down the total cost of production.

The study conducted by Agro-Economic Research Centre, University of Delhi (2004) revealed that the economics of vegetable cultivation was favourable or more attractive than of any other crop whether looked from the point of per acre income or from the point of returns per rupee of investment. Per rupee investment made in vegetable cultivation in Delhi gave average income

from all vegetables up to Rs.0.74. Vegetable cultivation absorbed substantial amount of labour and almost one third of the total cost was incurred on labour charges.

2.2. TECHNICAL EFFICIENCY

Efficiency in economics could be mainly defined in terms of optimality conditions associated with the perfectly competitive firm. Put at the briefest the optimality condition was 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) elaborated the concept of technical efficiency. It involved the farmer's ability to obtain the maximum output from a given set of resources. Clearly, a farm, which used the best practice methods, achieved a similar bundle of inputs and technology. Then it was likely to be superior to another farm or section that did 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 contributed to economic efficiency.

Pasour and Bullock (1975) considered a situation to be efficient when the decision maker had no preferred alternative, given the circumstances. Further, they added, "Efficiency is a relative concept. Hence, judgement 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 input in optimum proportions when the input price is given.

The measurement of efficiency appeared to be a difficult task, both conceptually and operationally, than had 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 their study to compare the result 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 was called deterministic if all observations lie on or below the frontier and stochastic if observations lie above the frontier due to random everts.

The allocative efficiency and supply response of farmers growing a modern variety of rice (IR 20) and local varieties in the irrigated areas of Coimbatore district of Tamil Nadu, were examined by Kalirajan and Flinn (1981) by fitting a profit function and the associated factor demand schedules to the data. The analysis suggested that both groups of producers showed similar levels of technical efficiency. The growers of local varieties appeared to be allocatively efficient given the variable factors of production included in the analysis. The producers of the modern variety were not efficient with respect to pest management, but were so with regard to other variable inputs of labour, fertilizer and animal power.

As described by Ureta and Rieger (1990) the stochastic production frontier possesses a distinct feature. The disturbance term was composed of two parts, a symmetric and a one-sided component. The symmetric component described the random effect outside the control of the decision-maker including the statistical noise contained in empirical relationship. The one-sided component captured deviations from the frontier due to inefficiency. The main advantage of

the stochastic frontier production model was 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 were expected to be efficient than those from deterministic models.

Chennarayadu *et al.* (1990) studied the land use efficiency of banana applying the frontier production function. Although banana was an important crop in Andhra Pradesh, with acreage of 23,200 hectares and production of 23.39 lakh tonnes, its cultivation was 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 efficiency 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 residual 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 was relevant in developing agricultural economies, where resources were meagre and opportunities for developing better technologies were 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 of 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 Northwestern 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 analyzing 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

$TE_{it} = \exp(-U_{it})$ 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 of 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 they had decreased over time. This analysis also indicated the potential usefulness of the modeling of technical inefficiency effects on 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.

Technical efficiency of potato production in Badulla district of Sri Lanka was assessed by Amarasinghe and Weerahewa (2001). A stochastic frontier production function and model to explain technical efficiency was estimated to achieve the purpose of study. Technical efficiency was regressed as a function of age of the farmer, education level of the farmer and farm assets. According to the

econometric results, labour and seed rate significantly affect the potato production. Production technology exhibits decreasing returns to scale. The average level of technical efficiency of farmers was found to be 72 per cent indicating that the production would increase by 28 per cent, if all the farmers achieved the technical efficiency level of the best farmer. However, the average yield of the best farmer too was far below the potential yield. The results of the model for the inefficiency effects indicated that educated farmers tend to be more efficient than the others.

Karthikeyan (2001) undertook a study in production and marketing of cool season vegetables viz; potato, garlic, carrot and cabbage in Devikulam block of Idukki district. Stochastic frontier production function estimates revealed that 71 per cent of the deviation in the yield of potato was due to the differences in the technical efficiency among farms. Mean technical efficiency was 0.78,0.80,0.71 and 0.63 respectively for potato, garlic, carrot and cabbage. The frequency distribution of farm specific technical efficiencies showed that 22 per cent of farms were operating at a technical efficiency of more than 90 percent in the case of potato.

Nagesh (2001) in his study on economic analysis of production and marketing of vegetables in Trivandrum district used the frontier production function to analyze the technical efficiency of VFPCK and IVDP vegetable growers. The bittergourd growers under VFPCK showed an estimated mean technical efficiency of 80 per cent and for IVDP growers it was 71 per cent.

Elsamma and George (2002) estimated the technical efficiency in rice production in Kuttanad area of Alappuzha district using the stochastic frontier production function of the Cobb-Douglas type and parameters using Maximum Likelihood Estimate. The empirical analysis showed that even in an advanced agricultural region there was need to improve technical efficiencies of majority of farmers. The technical efficiency varied widely between 58per cent and 99per

cent various socioeconomic, biophysical and technological factors are responsible for the differences in efficiencies. The study showed that with proper allocation of the existing technology, a potential exists for improving the productivity of rice. Efforts were to be made to strengthen the extension machinery to improve farmer's practices through extension service and training programmes.

According to Jha *et al.* (2004) efficiency was the measure of performance, depicting how the available resources were being utilized for producing some pre-determined research output. It was a relative measure that evaluates the performance of an individual or organization by comparing the observed values of output(s) and input(s) with their corresponding optimal values in a particular production process. Technically efficient production assumed maximum attainable output at a given level of input. In other words, technical efficiency was achieved by producing at the production frontier.

The technical, allocative and cost efficiency of individual farms had been estimated in arecanut production by Rajashekharappa *et al.* (2004) in three distinctive regions of Karnataka using Data Envelopment Analysis - a non parametric linear programming approach. The results indicated that on an average the output could be raised by 10-31 per cent without additional resources in the arecanut growing areas.

2.3 MARKETING

Bhalerao and Charan (1967) enquired about the marketing of vegetables in Varanasi, which covered 50 randomly selected farms, using personal interview method. They reported that the producer's share in the consumer's rupee varied from 64.44 per cent to 81.53 per cent. They also found that increased irrigation facilities and institutional finance increased the area under vegetables in most of the villages. The vegetables considered for the study were cabbage,

cauliflower, bottergourd, sponge gourd, pumpkin, pawal, okra, radish, green pea, brinjal, chillies, spinach, tomato, desi potato and onion.

Vigneshwar (1986) conducted a study on dynamics of fruits and vegetable marketing in India. Out of the total production of about 20 million tonnes of fruits and 35 million tonnes of vegetables, nearly 30-40 per cent was accounted for post-harvest losses. It was also estimated that about 10-25 per cent of the perishables and semi perishables were lost due to spoilage in the absence of adequate cold storage facilities.

Sidhu (1988) in a study of new thrusts in agricultural marketing in Punjab found that there should be right type of marketing structure, correct government policies and sound network of input supply system for marketing of agricultural commodities. It was found that about 30 per cent of the fruits and vegetables production was lost due to lack of processing and cold storage facilities.

Subrahmanyam (1988) made an interstate comparison of practices and associated costs of marketing of vegetables in Karnataka, Andra Pradesh and Tamil Nadu and reported that Producer-Commission agent was the most popular marketing channel, followed by direct sale by cultivators. Commission charges were found to be high in Karnataka and Andhra Pradesh, at around 10per cent as compared to 7 per cent in Tamil Nadu. Most of the cultivators in Tamil Nadu used carts for transporting vegetables due to short distances transported and ready availability of carts in villages.

Chahal and Gill (1989) attempted to consolidate various methods of measurement of marketing efficiency. The study showed that price spread was the main parameter in judging the marketing efficiency in various channels or in assessing the comparative efficiency of various markets. The market integration was also a useful parameter in measuring marketing efficiency both for spatial and

temporal analysis. The assessment of the type of competition must also be included in the measurement of marketing efficiency.

Raj *et al.* (1991) made a case study of fresh fruits and vegetables in India from the export perspective. The study was based on secondary data collected from various issues of FAO production and trade yearbooks. India's export of vegetables and fruits as a percentage of total production showed erratic trend during the period under study. India's share as a percentage of total world export of potato, orange, lemon and banana during the period under review was negligible and onion was an exception.

Sahoo (1991) made a similar study on export marketing of fresh fruits and vegetables. The study concluded that India had vast potential in enhancing the export of fresh fruits and vegetables. So far these constituted only 5 per cent of the total value of exports of agricultural and allied products, which could readily be enhanced to a growth rate of 10 per cent per annum if concerted effort was made.

Sandhya (1992) studied the economics of production and marketing of vegetables in Ollukkara block in Trissur district. It was observed that the wholesaler's margin accounted for 16.45 per cent of the consumer's price of bittergourd and 23.76 per cent of that of ashgourd whereas marketing costs incurred by wholesalers accounted for 4.02 per cent and 7.26 per cent of the consumer's price respectively for bittergourd and ashgourd. Marketing efficiency of bittergourd was 1.45, which was more than that of ashgourd (0.62). In the case of bittergourd, out of Rs.5.47/kg paid by the consumer Rs.3.58 went to the producer seller.

Gupta and Verma (1994) studied the marketing of ivy gourd in Durg district of Madhya Pradesh. Data were collected from 37 farmers comprising eight small, eighteen medium and eleven large growers based on farm acreage of

ivy gourd. Per hectare production was found to decrease with size of holding. Producers received the highest prices in June and July and lowest prices in October-January.

Kasar *et al.* (1994) studied the marketing of bittergourd in Ahmednagar. Average cost of bittergourd was worked out to Rs.1.48 per kg in the Bombay market. The producer's share in consumer's rupee was only 41.49 per cent. The wholesaler and retailer could secure a share of 14.09 per cent and 16.25 per cent respectively.

Agarwal and Saini (1995) found that there were two marketing channels for vegetables, which were 1. Producer-Commission agent-Retailer-Consumer, 2. Producer-Commission agent-Mashakories-Retailer-Consumer. Channel two was an important channel in sale of vegetables for the farmers of the area in spite of more number of middlemen involved in this channel.

Raha and Baten (1995) studied the marketing of vegetables viz. aubergines, okra, pumpkin and bittergourd in Bangladesh. Data were collected from growers and retailers operating in a market in Gaforgaon in Mymensingh during 1993. It showed that consumers were paying a high price, yet the growers were not receiving a reasonable price. It concluded that an improvement in the marketing system would reduce consumer's price and increase the grower's share, thereby facilitating the sustainable development of vegetable production in Bangladesh.

Talathi and Thakare (1995) studied the temporal changes in arrivals and prices of vegetables in Bombay APMC. The study concluded that in 1992-93,the annual arrival of vegetables in Bombay APMC was 18,0318 tonnes in which tomato, cabbage, cauliflower and brinjal together shared about 80 per cent of total arrivals. The monthly average prices for capsicum, lady's finger, cluster beans, bittergourd and green chillies were high whereas that for tomato,

cauliflower, cabbage and cucumber were at moderate levels. The real prices of most of the vegetables (except cluster bean) in the year 1992-93 decreased over the base period. The substantial decrease in wholesale prices was for tomato, green chillies, lady's finger, brinjal, cucumber and cabbage.

Devi (1996) in her study on Marketing of fruits and vegetables in Kerala reported that the producer's share in consumer's rupee for vegetable and fruits varied between 51 and 57 per cent and 49 and 53 per cent respectively. In case of vegetables the marketing margin was higher than the costs incurred by the farmers. However the situation was vice versa in the case of fruits. The marketing cost was high for intermediaries with respect to fruits.

Bilonikar *et al.* (1998) studied the marketing efficiency and operational problems of vegetable marketing societies in Maharashtra state. The results indicated that the 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 cooperative marketing societies. Cooperative marketing societies operated more efficiently than the other agencies in marketing the vegetables of the growers.

Shiyani *et al.* (1998) 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 total vegetable production in all the different sizes of holding in the selected villages. The study revealed that percentage of spoilage was also high (5.17per cent). The values of marketing efficiency for all the 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. 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.

According to Suresh and Devaraja (1999) one of the major items of marketing cost of the horticultural produce in Karnataka state was the commission charge. Among the different horticultural produce, commission charges were the highest in the case of flowers followed by vegetables with 43-45 per cent. Vegetables were sold both by auction and by bargaining. It was also observed in Bangalore market that the produce was sold by other than weight basis also viz., by baskets, numbers etc. No grading was done at either field level or all the market place before the produce is sold.

Karthikeyan (2001) studied the input wise cost of cultivation of potato, garlic, carrot and cabbage in Devikulam block of Idukki district. The study identified seven channels through which the produce was marketed. Out of these channels, producer - village merchant - commission agent - wholesaler - retailer - consumer was observed to be the most important channel. About 87 per cent of total respondents marketed their produce to village merchants

Nagesh (2001) estimated the producer's share in consumer's rupee as 56.7 per cent in the case of snakegourd and 66.70 per cent in the case of bittergourd in a study on production and marketing of vegetables in Trivandrum district. Thus it was evident that middlemen took away a substantial share from consumer's rupee.

The marketing efficiency was highest for bittergourd(1.99) followed by snakegourd(1.31) and amaranthus(0.83).

Anilkumar and Arora (2003) analysed the market surplus and marketing cost of vegetables in Uttaranchal. It showed that marketed surplus of vegetables on overall basis varied from 89.33per cent in potato to 97.51per cent in cabbage. Important determinants of marketing cost of vegetables appeared to be packing cost, transportation and commission charges. The major problems in marketing were high cost of packing material, deduction by traders in the form of commission and problems of transportation.

Materials and Methods

3. MATERIALS AND METHODS

This section is subdivided into two. A brief description of the study area is given in the first section and the second section (section 3.2) covers the methodology used for the study.

3.1.AREA OF STUDY

3.1.1.Palakkad district

Palakkad district is situated in the Southwest coast of India. The district is bounded on the north by Malappuram district, in the east by Coimbatore district of Tamilnadu, in the south by Trichur district and in the west by Trichur and Malappuram districts. The district lies between 10' 21 and 11' 14 North latitude and 76' 02 and 76' 54 East longitude. The total geographical area of the district is 4480 sq.kms, representing 11.53 per cent of the state's geographical area.

Topographically the district can be divided into two regions, the low land comprising the midland and the high land formed by the hilly portion. The soil is laterite in the hill and mid regions. Midland is thick with Coconut, Arecanut, Cashew, Pepper, rubber and paddy cultivation. The forestland of the district covers an area of 136257 hectares.

The district has got two types of climates. Ottappalam, Alathur and Mannarkkad taluks are having a humid climate with a very hot season extending from March to June, similar to that of other districts of Kerala, whereas Palakkad and Chittur are having rather a dry climate similar to Tamilnadu Average annual rainfall of the district is 1831.3 mm. About 75per cent of the annual rain is received during the southwest monsoon period. During the period December to May, practically no rain is received. The temperature of the district ranges from 20' C to 45' C. The maximum temperature recorded at Palakkad was 43'C.

There are three types of soil (1) laterite soil seen in Ottappalam, Alathur, Chittur and Palakkad taluks (2) virgin forest soil of Mannarkkad taluk and (3) black soil in Chittur and Attappady valley which is used for the cultivation of cotton.

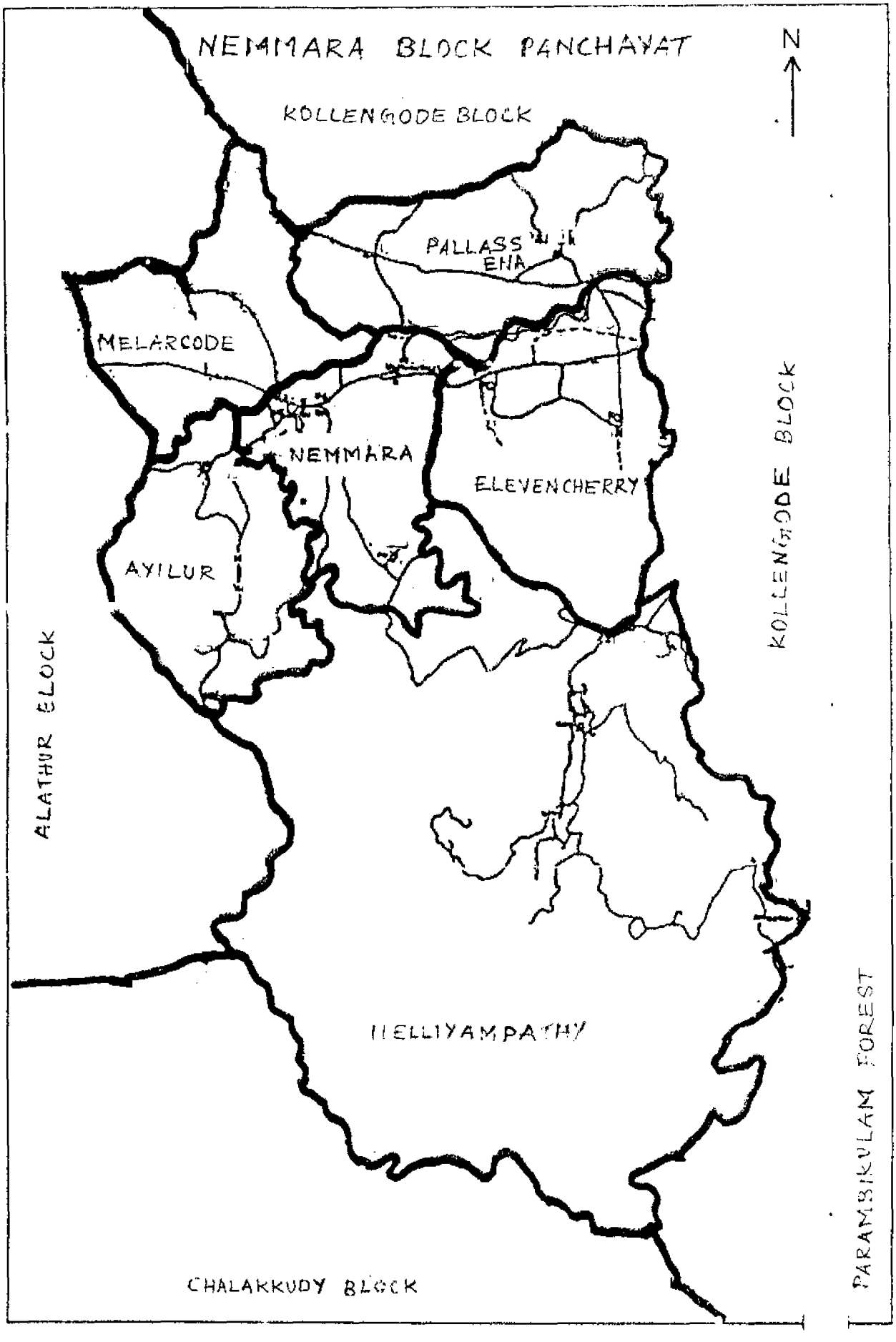
The district has a population of 2382243 persons according to the 2001 census, which constitute 8.21 per cent of the population of the state. The density of the population is 532 per sq.k.m. The sex ratio of the district is 1061 females for 1000 males. This is in consonance with the unique pattern of the state, which is contrary to the all India figure of 929 females per 1000 males. The literacy rate of the district, 81.27per cent, is lower than the state average (89.81per cent)

For the purpose of administration the district is divided into two Revenue Divisions – Ottappalam and Palakkad and 5 Taluks viz. Alathur, Chittur, Palakkad, Ottappalam and Mannarkkard. The district has thirteen blocks and ninety panchayaths. There are 163 villages in the district. Nemmara block panchayat comes under Chittur taluk. The map of the block is shown in Fig.1.

3.1.2.NEMMARA BLOCK PANCHAYAT

3.1.2.1.History

Nemmara development block came into existence in the year 1952.During that period,it had only three panchayats namely Ayalur,Nemmara and Nelliyampathy.Later on in 1990-91,the three panchayats viz.Pallassana,Elevenchery and Melarkode which belonged to the erstwhile Malabar state were merged with the block. Thus the block was constituted with the six panchayats, Ayalur, Nemmara, Nelliyampathy, Pallassena, Elevencherry and Melarcode.


NEMMARA BLOCK PANCHAYAT
N
KOLLENGODE BLOCK
PALLASSENA
MELARCODE
NEMMARA
ELEVENCHERRY
AYILUR
KOLLENGODE BLOCK
ALATHUR BLOCK
HELLIYAMPATHY
PARAMBIKULAM FOREST
CHALAKKUDY BLOCK

3.1.2.2.*Location*

Nemmara block is bounded by the Kollengode block (north and east),Alathur block (west)and Chalakkudy block (south).All the panchayats except Nelliyampathy comes under the category of valleys and plains while, Nelliyampathy lies in the high land area. Plantation crops like coffee, tea, cardamom and pepper are extensively grown here.

3.1.2.3.*Area*

The total area of the block scales to 741.35 square kilometers. This block constitutes seventeen per cent of the total area of the district. Nelliyampathy having 576.54 sq.km. occupies the highest area among the panchayats followed by Ayalur (40.94 per cent), Nemmara (36.84 per cent), Elevencherry (32.18) per cent, Pallassena (29.83 per cent) and Melarcode (25.52 per cent).Geographical area of each panchayat is given in Table 3.1.1.

Table 3.1.1.Geographical area of Nemmara block.

Name of the panchayat	Area (sq.km)
Ayalur	40.94
Elevencherry	32.18
Melarcode	25.52
Nelliyampathy	576.54
Nemmara	36.84
Pallassena	29.33
Total	**741.35**

(Source: Department of Economics and Statistics)

3.1.2.4.*Climatic conditions*

The block has a humid climate with a very hot season extending from March to May. It receives rainfall mainly from the southwest monsoon (June

to September). It also experience showers during northeast monsoon (October to December) and summer. The temperature of the block varied from 15^0 C to 40^0 C. As Nelliyampathy is situated in high land the climatic conditions differ from other parts of the block Distinctly, it has three seasons winter (December to January), summer (February to May) and rainy season (June to July). The average annual rainfall is 230 cm and average temperature hovers around 16^0 C.

3.1.2.5.*Rivers*

The main rivers flowing through this block are Gayathri, Pothundi and Kallchadi. All these rivers are tributaries of Bharatapuzha. Thiruvazhiyadu river originates from this block and joins the Gayathri river as Mangalam river. Chalakkudy river gets rejuvenated by the waters of Kuriarkutty Karappara river which also originates from this block.

3.1.2.6.*Population*

Nemmara block supports a population of 130450 persons in which 63476 are males and 66974 are females. It accounts for 5.5 per cent of the total population of the district. Density of population per square kilometer is 176.It has 1059 females against 1000 males. Regarding literacy rate there is 84.45 per cent literacy among males and 68.60 per cent among females. Details containing panchayat wise population and literacy rate is given in Table 3.1.2.

Table.3.1.2.Population, population density and literacy rate in Nemmara block.

Name of the panchayat	Total population			Population density (sq.km.)	Sex ratio (Per1000 males)	Literacy rate (per cent)
	Male	Female	Total			
Ayalur	12259	12911	25170	615	1053	77.12
Elevencherry	8126	8814	17000	528	1077	73.14
Melarcode	11497	12209	23706	929	1062	76.80
Nelliyampathy	4901	4884	9785	17	997	68.79
Nemmara	15785	16671	32456	881	1056	78.99
Pallassena	10848	11485	22333	761	1059	76.23
Total	63476	66974	130450	176	1059	76.25

(Source: Department of Economics and Statistics)

3.1.2.7.*Employment situation*

Agriculture is the main source of income in the block. About 80 per cent of the rural population of this block are agriculturists or agricultural labourers. Paddy, coconut, banana, arecanut, tuber crops, fruits, vegetables, ginger, turmeric and groundnut are cultivated in plains whereas cashew, rubber and pepper are grown in valleys. Plantation crops like cardamom, coffee, tea, orange and citrus fruits are taken in high land. More than ninety per cent of the industries established here are small-scale industries and nearly 25 per cent of them are agro based. These industries are involved in the processing of paddy, oilseeds, fruits, bamboo and various products of plantation crops. Quarrying, handicraft and tourism are other industries flourishing in the area.

3.1.2.8.*Land distribution.*

Out of 15462 ha of land available in the block, 6995 ha is wetland and 8467 ha is dry land.. The panchayat wise land distribution is given in Table 3.1.3.

Table 3.1.3. The panchayat wise land distribution in Nemmara block(hectares)

Name of the panchayat	Wet land	Dry land	Forest area	Area under plantation crops	Total area
Ayalur	1355	2064	630	-	4049
Elevencherry	1500	1661	-	-	3161
Melarcode	1196	1342	123	-	2661
Nelliyampathy	-	483	1237	953	2673
Nemmara	1375	1988	276	-	3639
Pallassena	1569	929	-	-	2498
Total	6995	8467	2266	953	18681

(Records of the Assistant Director of agriculture,2000)

In Nelliyampathy an area of 953 ha is brought under plantation crops. Forests occupied an area of 630 ha, 276 ha, 123 ha and 1237 ha respectively in Ayalur, Nemmara, Melarcode and Nelliyampathy panchayats

3.1.2.9.*Cropping pattern*

A variety of crops are cultivated in the area. In addition to the tropical crops, temperate crops are also cultivated in the high ranges of the block. Details showing the information regarding the area of various crops are given in Table 3.1.4.

Table 3.1.4 Area under different crops in Nemmara block

Crops	Ayalur	Nemmara	Melarcode	Pallassena	Elevencherry	Nelliyampathy	Total area
Paddy-1st crop	1200	1312	1060	1759	1084	-	6415
Paddy 2nd crop	1200	1290	1060	1414	980	-	5944
Fruits	20	4	65	14	42	-	145
Coconut	824	690	476	50	64	-	2105
Banana	650	45	1059	24	50	-	1827
Pepper	25	60	42	-	-	-	128
Cashew	-	10	42	-	-	-	52
Tapioca	50	62	24	10	20	-	166
Rubber	285	155	162	-	15	300	917
Vegetables	65	102	32	16	60	30	305
Ginger	-	65	70	35	40	10	220
Turmeric	410	-	25	-	20	-	455
Arecanut	-	115	-	18	18	-	151
Groundnut	-	-	-	40	105	-	145
Mango	-	25	-	-	37	-	62
Tea	-	-	-	-	-	650	650
Coffee	-	-	-	-	-	2464	2464
Cardamom	-	-	-	-	-	1908	1908

(Records of the Assistant Director of agriculture,2000)

Paddy is having the largest area under cultivation (6415 ha in the first crop and 5944 ha in the second crop) followed by coffee (2464 ha), coconut (2104 ha), cardamom (1908 ha) and banana (1829 ha). Vegetables were cultivated in an area of 305 hectares. Paddy was cultivated in all the panchayats except Nelliyampathy. Ayalur holds the major share in the area under turmeric and coconut in the block, while Nemmara had a major share in the area under

vegetables and tapioca. Groundnut cultivation is limited to Pallassena and Elevencherry.

3.1.2.10. *Vegetable farming*

Nemmara is one of the major vegetable growing belts in Palakkad district. The area under vegetables has almost doubled in the last decade. High price of vegetables and the ready access to the wholesale markets like Trichur and Ernakulam are the main reasond for the entry of more and more farmers into vegetable cultivation. Mainly, cultivation of vegetables is practiced in two seasons, May-August and September-December. Because of the lack of irrigation facilities generally, no crop is taken during summer. Details regarding the area under vegetables in the block are given in Table 3.1.5.

Table.3.1.5. Area, production and productivity of vegetables in Nemmara block

Panchayat	Area (ha)	Production (tonnes)	Productivity (t/ha)
Ayalur	65	1181	18.17
Elevencherry	60	843	14.00
Melarcode	32	3218	10.00
Nelliyampathy	30	367	12.22
Nemmara	102	1579	15.48
Pallassena	16	208	13.33

(Records of the Assistant Director of agriculture, 2000)

Nemmara (102 ha) has the largest area under vegetable cultivation when compared to other panchayats followed by Ayalur (65 ha) and Elevencherry (60 ha). But Ayalur (18.17 t/ha) ranks first in terms of productivity leaving behind Nemmara (15.48 t/ha) and Elevencherry (14 t/ha). Cool season vegetables like cauliflower, cabbage, sweet potato, carrot, radish, peas, potato, onion, beans etc are grown in high ranges of Nelliyampathy, where a production of 367 tonnes is achieved from an area of 30 hectares.

3.2. METHODOLOGY

The study was conducted in Nemmara block panchayat of Palakkad district. The block was purposively selected, as it is one of the major vegetable growing tracts in the district. Major vegetable crops grown in the area were bittergourd, snakegourd, Ivy gourd. ashgourd, pumpkin, pulses, amaranthus and cucumber. Of these, data regarding cultivation and marketing of three vegetables namely bittergourd, snakegourd and ivy gourd were collected for the present study. These three vegetables were selected because they occupied a major portion of area under vegetables.

3.2.1. Sampling procedure

Two stage random sampling procedure was adopted for the study, with panchayat as the primary unit and farmer as the second and the ultimate unit. There are six panchayats under Nemmara block, viz., Ayilur, Elavanchery, Melarkode, Nelliyampathy, Nemmara and Pallassena. Out of these, two panchayats viz. Nemmara and Ayilur were selected at random. List of commercial growers (having a minimum of 5 cents) cultivating the concerned vegetables bittergourd, snakegourd and ivy gourd was collected from the krishibhavans of the respective panchayats.

From the list of growers, a sample of 180 farmers (60 farmers for each crop) was selected randomly from the two panchayats. The sample growers of each vegetable were further classified into three classes, namely class I, class II and class III based on area under selected vegetables cultivated by them as shown in Table 3.2.1

Table 3.2.1. Classification of sample farmers

Class	Area (in cents)
I	0 -50
II	51 - 100
III	Above 100

3.2.2.Collection of data

The data were collected through personal interview method using well-structured and pre-tested schedule. A separate schedule for market intermediaries in the study area was prepared and data on marketing aspects were collected. Reference period of the study was the year 2004-2005 and survey was carried out during March to June 2005. Since the farmers and traders did not maintain proper records, they gave the information from their memory. Therefore information gathered is likely to be subject to recall bias. However every effort was made to get the data as accurate as possible.

3.2.4.Analytical framework

3.2.4.1.*Estimation of costs*

The profitability of a crop enterprise can be estimated by finding the relationship between the costs incurred and the returns from the crop production. Various cost concepts studied are

1. Cost A_1

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

a) Hired human labour

The actual paid wage labour engaged in crop production was considered as value of hired labour. Hired labour charge included that incurred in land preparation, sowing, application of manures and fertilizers and crop protection chemicals after cultivation, panthal making, irrigation and harvesting. Hired human labour was valued at the prevailing wage rates in the area, which were Rs.125 for male labourers and Rs.60 for female labourers.

b) Seed

As the bittergourd and snakegourd farmers purchased seeds from VFPCK at concessional rate, the cost of seed was evaluated on the basis of the purchase price, which was Rs.540 per kg of seeds. In the case of ivy gourd, farmers obtained the stem cuttings free of cost from neighbour's and relative's field.

c) Manures and fertilizers (farm produced and purchased)

Expenditure on purchased quantities of manures and fertilizers has been evaluated by multiplying the physical quantities of different manures and fertilizers used with their respective prices. Farm produced items were also evaluated at their market prices.

d) Panthalling material

The materials used for panthal making were GI wire, coir and bamboo poles. These materials were used for more than one season. So the cost was carried out by dividing the total cost for panthalling material with the number of times the materials were made use of coir was used for two seasons whereas GI wire and bamboo poles were used for four seasons.

e) Plant protection chemicals

Expenditure on fungicides and insecticides has been calculated by multiplying the physical quantities of different fungicides and insecticides used by their respective market prices.

f) Depreciation of farm implements

Depreciation was worked out by straight-line method. Cost of sprayer and spade were included as depreciation, the life spans of which were 5 years and 2 years respectively.

g) Interest on farm loan

Interest on farm loan was calculated at 8.5 per cent rate of interest which was the interest rate charged by Canara Bank for short term agricultural loans.

h) Interest on working capital

Interest on working capital was charged at the rate of 3.5 per cent per annum. This was the rate of interest charged by Canara Bank for savings deposit.

i) Land revenue

This was taken as the actual rate paid to the revenue department, which was Rs.40 per acre in the area.

j) Miscellaneous expenses

These include items such as cost of sacks and bamboo baskets, which were used for transporting the harvested produce from farm to market.

2. Cost A_2

Cost A_2 is equal to cost A_1 plus rent paid for leased in land. Land was leased for a period of one year. Based on the prevailing rent in the area, an amount of Rs.25, 000 per hectare per annum was accounted as rent for leased in land.

3. Cost B_1

It is equal to cost A_1 plus interest on own fixed capital. The item fixed capital included iron and wooden implements and equipments such as sprayer.

4. Cost B_2

It is equal to cost B_1 plus rent paid for leased in land plus rental value of owned land. Rent was imputed, in the case of owned land based on the prevailing rent of Rs.25, 000 per hectare per annum.

5. Cost C_1

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

6. Cost C_2

It is equal to cost B_2 plus imputed value of family labour.

7. Cost C_3

Cost C_3 is equal to cost C_2 plus 10 per cent of cost C_2 which is accounted as allowance given for management of farm. Input wise and operation wise cost of cultivation and their percentages to total were worked ou'.

3.2.4.2.*Cost of cultivation and cost of production*

Cost of cultivation refers to the total expenses incurred in cultivating one hectare of the vegetable. Cost of production is the cost of producing one quintal of the vegetable.

3.2.4.3.*Production and value of output*

The output of vegetables produced by each farmer was noted down from VFPCK records in the case of bittergourd and snakegourd. Value of output was also obtained from the same. Ivy gourd farmers had maintained a record of transactions with themselves from which the details on production and value of output were collected.

3.2.4.4.*Efficiency measures*

Income measures are used as one of the measures of efficiency in the present study. Different income measures are associated with different cost concepts. They are as follows:

1. Farm business income: It is Gross income minus cost A_1
2. Own farm business income: Gross income minus cost A_2
3. Family labour income: Gross income minus cost B_2
4. Net income: Gross income minus cost C_3
5. Farm investment income: Farm business income minus inputed value of family labour
6. Benefit cost ratio: It is the ratio of benefits to the costs.

The ratio will serve as a measure, which would indicate whether the costs are commensurate with the returns obtained. This has been worked out at Cost A_1, Cost A_2, Cost B_1, Cost B_2, Cost C_1, Cost C_2 and Cost C_3 basis.

3.2.4.5.*Bulk line cost*

Bulk line cost was worked out for the vegetables, under study. Bulk line cost is that cost which covers the cost of production of the majority of the farmer's production or area. Conventionally, bulk line cost is calculated so as to cover 85 per cent of farmer's production or area on cost C_2 basis (Kahlon and Tyagi, 1983).

According to Panse (1958), possibility of use of cost figures in connection with the formulation of price and other agricultural policies were related to the frequency distribution of cost and the major portion of distribution of holdings accounted for 85 per cent of the frequency, which was usually defined as the bulk line cost.

In the present study for calculating bulk line cost, average total cost per quintal on cost C_3 basis was arranged in ascending order and the cost at 85 per cent of total output supplied was selected as the bulk line cost.

3.2.5.Measurement of technical efficiency

The frontier production function was used to analyze the technical efficiency of vegetable growers. The frontier production function is defined as the function that denotes the maximum possible output from a given combination of inputs. When the production is estimated using the ordinary least squares method (OLS) and evaluated at the mean level, it would give only the average production and not maximum production. To overcome this difficulty the concept of frontier was applied.

The measurement of efficiency has been the main motivation for the study of the frontier. The distance by which the actual production level lies below the production frontier (implied by maximum production) is considered as a measure of production inefficiency. When a firm fails to operate on the production frontiers it was denoted 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.

3.2.5.1. *The Stochastic Production Frontier*

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.Consider the Cobb-Douglas function

$$Q_i = Q(X_{ki})^{\beta} e^{\Sigma I} \qquad i = 1 \ldots . n, k = 1 \ldots . k,$$

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. On natural log transformation it becomes·

$$Q_i = \beta_0 + \Sigma \beta_i (X_{ki}) + \Sigma I \qquad i = 1 \ldots . n,$$

where the italicized letters represent the log values of the corresponding variables in the Cobb-Douglas function. The disturbance term ΣI is divided into two components a stochastic disturbance vi and one sided efficiency disturbance ui.

Thus, $\Sigma I = v_i - u_i$

The term v_i is the symmetric component and permits random variation in output due to factors like weather and plant disease. It is assumed to be identically and independently distributed as $v_i = N(0, \sigma^2 v)$

A one-sided component u_i reflects technical efficiency relative to the stochastic frontier. This condition, $u_i > 0$, ensures that all the observations lie beneath the stochastic production frontier.

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 realized out put. Direct estimates of the stochastic production frontier are obtained by maximum likelihood estimation procedure. It is assumed that u_i is identically and independently distributed $u_i = N(0, \sigma^2 u)$ and that 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 greater 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.

A model with this error specification is called as stochastic frontier since the non-positive component of the disturbance represents the shortfall of the actual output from the frontier while the frontier contains the normal component of disturbance and is therefore stochastic.

The standard normal density function can be written as

$$f_u(u_i) = \frac{1}{\sigma_u (1/2\Pi)^{0.5}} \exp\left(\frac{-1}{2}\frac{u_i^2}{\sigma^2_u}\right) \text{ if } u_i \leq 0$$

$$f_u(v_i) = \frac{1}{\sigma_v (2\Pi)^{0.5}} \exp\left(\frac{-1}{2}\frac{v_i^2}{\sigma^2_v}\right) \text{ if } -\infty < v_i > \infty$$

The likelihood function of y is the product of the density function of each y_i, which is equal to the density function of (ui + vi). The maximum likelihood estimates (MLE) of the parameters of the model can be obtained in terms of parameterization (Aigner *et al.*, 1977). It follows that

1) $\sigma^2 = \sigma^2_v + \sigma^2_u$

2) $\lambda = \frac{\sigma_u}{\sigma_v}$ and

3) $\gamma = \frac{\sigma^2_u}{\sigma^2_v + \sigma^2_u}$

γ is an indicator of relative variability of u_i and v_i that differentiates the actual yield obtained from the frontier yield. There are two interpretations for γ. When σ^2_v is tending to zero which implied that ui is the predominant error then γ = 1.This means that the farm's yield differed from the maximum feasible yield mainly because it did not use the best practice technique. When σ^2_u is tending to zero, which implied that symmetric error term vi is the predominant error then γ is tending to zero. This means that the farmer's yield differed from maximum feasible yield mainly because of either statistical errors or external factors not under its control.

3.2.5.2. *Mean Technical Efficiency (MLE)*

Farm specific technical efficiencies were worked out as the ratio of production of the i^{th} farm to the frontier production of the same farm (Aigner *et al*, 1977). Mean technical efficiency was calculated by taking the average of the farm specific technical efficiencies.

3.2.5.3. *Specification of the model*

For the present study, a Cobb-Douglas production function of the following form was specified.

$$\ln Y_j = \ln B_0 + B_1 \ln X_1 + B_2 \ln X_2 + B_3 \ln X_3 + B_4 \ln X_4 + B_5 \ln X_5 + E_j$$ where,

Y_j = Yield (Quintals)

X_1 = Land (cents) / Number of mounds

X_2 = Labour (man days)

X_3 = Fertilizers (kg)

X_4 = Manures (tonnes)

X_5 = Plant protection chemicals (ml)

$E_j = V_j - U_j$

$j = 1, 2, \ldots, n$ farms

3.2.5.4. *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.

3.2.6.Marketing

Marketing consists of a series of activities involved in moving the goods from the point of production to the point of consumption (Acharya and Agarwal, 2004).

3.2.6.1.*Marketing channels*

Marketing channels are routes through which agricultural products move from producers to consumers. In the present study important marketing channels in the marketing of vegetables under study were identified.

3.2.6.2.*Marketing costs and margins*

The cost of marketing of different vegetables included the commission charges, transport cost and miscellaneous charges. 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 costs items included building rent, transport, loading, unloading, losses during storage and the various prices paid by the trader.

3.2.6.3.*Marketing efficiency*

Marketing efficiency for the three crops was calculated using the Sheperd's formula (Acharya and Agarwal, 2004). Marketing efficiency is given as,

ME = (V / I) – 1,where

ME is the marketing efficiency

V is the total value of goods marketed in rupees and

I is the marketing cost including the marketing margin in rupees

3.2.7.Constraints faced by the farmers in the cultivation of vegetables

The list of constraints, which was given to the farmers as follows,

1. Incidence of pests and diseases
2. Low price of the produce
3. Lack of irrigation facilities
4. Inadequacy of capital
5. High wage rate
6. Lack of marketing facilities
7. Non-availability of labour
8. Climatic factors
9. Poor germination of seeds.
10. Others

The farmers were asked to rank the constraints from one to ten according to the order of importance as perceived by each of them. Weights from ten tc one were assigned to these ranks respectively and a weight of zero was assigned to the constraints, which were not recognized as problems. The number of farmers who indicated a specific rank for a specific constraint was multiplied by the corresponding weight for that rank to obtain a score. Total score for each constraint is the sum of the scores for that constraint. The constraint with the highest score was considered as the most important constraint for the farmers.

Results and Discussion

4. RESULTS AND DISCUSSION

The data for the present study on economic analysis of production and marketing of vegetables in Palakkad district was collected during the period April to June 2005. The results obtained from the study are presented and discussed under the following headings.

4.1 General economic and social conditions of the sample farmers

This section of the chapter attempts to describe the general economic and social conditions of the sample farmers. It contains information about factors such as landholding, family size, age, sex, educational status and occupation of the respondent farmers.

4.1.1. LAND HOLDING

Distribution of sample farmers according to the size of land holding is given in Table 4.1.1. A sample of 180 farmers, 60 farmers each for bittergourd, snakegourd and ivy gourd were selected for the present study,. The respondents were classified based on their size of land holding. Out of the total respondents 41.7 per cent had less than 50 cents under cultivation, 51.7 per cent

had an area between 50 cents and 100 cents under cultivation and 6.6 per cent had more than 100 cents under cultivation. They were classified as Class I, Class II and Class III respectively.

Table 4.1.1 Distribution of sample farmers according to the size of land holding

Respondents	Holding size			
	Class I	Class II	Class III	Total
Bittergourd	24 (40)	31 (51.7)	5 (8.3)	60 (100)
Snakegourd	18 (30)	39 (65)	3 (5)	60 (100)
Ivy gourd	33 (55)	23 (38.3)	4 (6.7)	60 (100)
Total	75 (41.7)	93 (51.7)	12 (6.6)	180 (100)

(Figures in parenthesis show percentages to total)

Among bittergourd growers, 40 per cent had less than 50 cents, 51.7 per cent had an area between 50 cents and 100 cents and 8.3 per cent had more than 100 cents under cultivation. In the case of snakegourd, 30 per cent of the growers had less than 50 cents, 65 per cent had an area between 50 cents and 100 cents, while 5 per cent had more than 100 cents under cultivation. For ivy gourd, they were 55 per cent, 38.3 per cent and 6.7 per cent respectively which showed that most of the farmers operated in an area of less than 50 cents. In bittergourd and snakegourd, most of the farmers operated in an area between 50 cents and 100 cents.

4.1.1.1 Area under bittergourd, snakegourd and ivy gourd

It was found that leasing in of land for vegetable cultivation for duration of one year was a common practice in the study area. Farmers raised vegetables both in leased in land and owned land. Area owned and area leased in by the bittergourd, snakegourd and ivy gourd growers were given in Tables 4.1.2, 4.1.3 and 4.1.4 respectively. For making comparison effective, area was given in acres instead of hectares.

Out of the total area under bittergourd cultivation, 54.8 per cent of area was leased in by the respondents. They owned the rest of the area. For class I and class III 68.5 per cent and 56.5 per cent of the total area were leased in by them respectively. But for class II, 51.6 per cent of the total area was owned and 48.4 per cent was leased in by them. Numbers of mounds taken vary from one class to another. Class II farmers (558) had the practice of taking more number of mounds when compared to class I (553) and class III (536).

Table 4.1.2 Area under bittergourd cultivation (acre)

Respondents	Area owned	Area leased in	Total area	Number of mounds per acre
Class I	3.50 (31.5)	7.60 (68.5)	11.10 (100)	553
Class II	13.35 (51.6)	12.50 (48.4)	25.85 (100)	558
Class III	4.15 (43.5)	5.40 (56.5)	9.55 (100)	536
Total	21.00 (45.2)	25.50 (54.8)	46.50 (100)	551

(Figures in parenthesis show percentages to total)

Out of the total area under snakegourd cultivation, sample farmers leased in 59.7 per cent. For class I, class II and class III, areas leased in by them were 52.1 per cent, 61.3 per cent and 61.2 per cent of the total area respectively. As in bittergourd, here also Class II farmers (501) prepared more mounds per acre followed by Class I (487) and Class III (455).

Table 4.1.3 Area under snakegourd cultivation (acre)

Respondents	Area owned	Area leased in	Total area	Number of mounds per acre
Class I	4.00 (47.9)	4.35 (52.1)	8.35 (100)	487
Class II	13.95 (38.7)	22.10 (61.3)	36.05 (100)	501
Class III	1.90 (38.9)	3.00 (61.2)	4.90 (100)	455
Total	19.85 (40.3)	29.45 (59.7)	49.30 (100)	486

(Figures in parenthesis show percentages to total)

Out of the total area under ivy gourd cultivation, the respondents owned 72.96 per cent of area. As the lease will expire in one year and ivy gourd is more profitable in the second year, farmers find ivy gourd cultivation unsuitable in a leased in land. Thus unlike, snakegourd and bittergourd, ivy gourd was

mainly cultivated in owned land in the study area. Number of mounds per acre was higher for Class II (818) when compared to Class I (805) and Class III (781)

Table 4.1.4 Area under ivy gourd cultivation (acre)

Respondents	Area owned	Area leased in	Total area	Number of mounds per acre
Class I	11.10 (93.3)	0.80 (6.7)	11.90 (100)	805
Class II	9.95 (56.1)	7.80 (43.9)	17.75 (100)	818
Class III	6.20 (80.5)	1.50 (19.5)	7.70 (100)	781
Total	27.25 (72.96)	10.10 (27.04)	37.35 (100)	803

(Figures in parenthesis show percentages to total)

4.1.2 Family size

Classification of sample farmers based on their family size, as presented in the Table 4.1.5, revealed that 51 per cent of the total sample farmers came under the family size group having five to six members.

Table 4.1.5 Distribution of respondents according to their family size

Respondents	Family size (number)				
	Upto 4	5-6	Above 6	Total	Average size of the family
Bittergourd	22 (37)	34 (57)	4 (6)	60 (100)	5.03
Snakegourd	26 (43)	32 (54)	2 (3)	60 (100)	5.00
Ivy gourd	21 (35)	29 (48)	10 (17)	60 (100)	5.15
Total	72 (40)	92 (51)	16 (9)	180 (100)	5.06

(Figures in parenthesis show percentages to total)

In the case of bittergourd, snakegourd and ivy gourd growers, the size group having five to six members had the highest concentration of sample farmers (57 per cent of bittergourd growers,. 54 per cent of snakegourd growers and 48 per cent of ivy gourd growers). Average size of the family of respondent farmers was 5.06.

4.1.3. Age and sex

The classification of respondents family according to age and sex as given in Table 4.1.6 showed that as much as 38 per cent of the total members came under the age group of 31 to 60 years, 37 per cent in the age group of 15-30 years and 16 per cent in the age group of 7-14 years. Only a small percentage belonged to the age group of 0-6 years (4 per cent) and above 60 years (5 per cent). Out of the total 911 members, 456 members (50.1 per cent) were male and 455 members (49.9 per cent) were female. Thus the sex ratio was almost 1:1.

Table 4.1.6 Classification of respondent's family (including the respondents) based on age and sex (number)

Age group (years)	Respondents											
	Bittergourd			Snakegourd			Ivy gourd			Total members		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
0-6 years	5	6	11	5	4	9	7	13	20	17	23	40 (4)
7-14 years	24	31	55	26	30	56	17	16	33	67	77	144 (16)
15-30 years	48	56	104	46	56	102	61	70	131	155	182	337 (37)
31-60 years	62	54	116	63	56	119	63	44	107	188	154	342 (38)
Above 60 years	8	8	16	7	7	14	14	4	18	29	19	48 (5)
Total	147 (49)	155 (51)	302 (100)	147 (49)	153 (51)	300 (100)	162 (52)	147 (48)	309 (100)	456 (50.1)	455 (49.9)	911 (100)

(Figures in parenthesis show percentages to total)

4.1.4. Educational status

Classification of the respondents according to their educational status was given in Table 4.1.7. It was found that 36 per cent of the total respondents were educated upto the middle school level, 22 per cent upto the high

school level and 2 per cent upto the pre-degree level. 17 per cent of the total sample farmers had passed the secondary level.

Table 4.1.7. Classification of the respondents according to their educational status

Respondents	Primary school level	Middle school level	High school level	SSLC	Higher secondary level	Total
Bittergourd	16 (27)	23 (38)	9 (15)	11 (18)	1 (2)	60 (100)
Snakegourd	18 (30)	28 (47)	8 (13)	4 (7)	2 (3)	60 (100)
Ivy gourd	8 (13)	13 (22)	23 (38)	15 (25)	1 (2)	60 (100)
Total	42 (23)	64 (36)	40 (22)	30 (17)	4 (2)	180 (100)

(Figures in parenthesis show percentages to total)

Classification of the respondent's family according to their educational status, which was given in Table 4.1.8, revealed that about 26.4 per cent of the total members were educated upto the secondary level, 25.6 per cent up to the high school level, 11.08 per cent upto the primary school level and 15.46 per cent upto the middle school level. Almost four per cent of the total members had graduated and 7.39 per cent were educated upto the pre-degree level, while 9.99 per cent of total members were illiterate.

Table 4.1.8. Classification of respondent's family (excluding the respondents) according to educational status

Education level	Respondents			
	Bittergourd	Snakegourd	Ivy gourd	Total
Illiterate	25 (10)	27 (11)	21 (8)	73 (9.99)
Primary school level	30 (13)	28 (12)	23 (9)	81 (11.08)
Middle school level	42 (170	39 (16)	32 (13)	113 (15.46)
High school level	62 (26)	60 (25)	65 (26)	187 (25.6)
SSLC	59 (24)	60 (25)	73 (30)	192 (26.4)
Higher secondary	15 (6)	16 (7)	23 (9)	54 (7.39)
Graduation	9 (4)	10 (4)	12 (5)	31 (4.24)
Total	242 (100)	240 (100)	249 (100)	731 (100)

(Figures in parenthesis show percentages to total)

4.1.5 Occupation

Respondents were classified according to their occupation as given in Table 4.1.9. It was observed that agriculture was the only occupation of 83.4 per cent of bittergourd farmers, 66.7 per cent of snakegourd farmers and 30 per cent of ivy gourd farmers. This was because bittergourd and snakegourd are annual crops of four month duration and need more care when compared to ivy gourd which is a perennial crop grown as an annual one. Ivy gourd farmers got enough spare time to take up subsidiary occupation.

Table 4.1.9 Classification of respondents according to their occupation

Respondents	Agriculture as the only occupation	Agriculture as the main occupation	Agriculture as sub occupation	Total
Bittergourd	50 (83.4)	8 (13.3)	2 (3.3)	60 (100)
Snakegourd	40 (66.7)	19 (31.7)	1 (1.6)	60 (100)
Ivy gourd	42 (30)	15 (25)	3 (5)	60 (100)
Total	132 (73.4)	42 (23.3)	6 (3.3)	180 (100)

(Figures in parenthesis show percentages to total)

Agriculture served as the main occupation for 13.3 per cent of bittergourd farmers, 31.7 per cent of snakegourd farmers and 25 per cent of ivy gourd farmers. Agriculture turned out to be a sub occupation for 3.3 per cent of the sample farmers who took up jobs in public sector and private sector.

4.1.6. Family income

As given in Table 4.1.10, respondents were classified based on their family income. Out of the total respondents (180), 82.3 per cent had family income ranging between Rs.50,000 and Rs.1,00,000. This was followed by the income category of less than Rs.50,000 which included 9.4 per cent of the total respondents. Only 8.3 per cent of the respondents had family income of more than one lakh rupees.

Table 4.1.10 Classification of respondents based on family income (number)

Respondents	Family income per annum			
	< 50,000	50,000-100,000	> 100,000	Total
Bittergourd	7 (12)	51 (85)	2 (3)	60 (100)
Snakegourd	6 (10)	51 (85)	3 (5)	60 (100)
Ivy gourd	4 (7)	46 (77)	10 (16)	60 (100)
Total	17 (9.4)	148 (82.3)	15 (8.3)	180 (100)

(Figures in parenthesis show percentages to total)

4.1.7. Cropping pattern

The major crops grown in the area were paddy, vegetables, ginger, coconut and rubber. Gross cropped area of the total respondent farmers were 114.69 hectares. Cropping pattern of the sample farmers in the study area was shown in the Table 4.1.11.

Table 4.1.11. Cropping pattern of the sample farmers (area in hectares)

Crop	Respondents			
	Bittergourd	Snakegourd	Ivy gourd	Total
Paddy	3.68 (21.8)	9.44 (55.9)	3.76 (22.3)	16.88 (100)
Ginger	4.06 (32.1)	4.00 (31.6)	4.60 (36.3)	12.66 (100)
Vegetables	24.28 (30.6)	25.16 (31.7)	29.98 (37.7)	79.42 (100)
Coconut	0.45 (22.6)	0.40 (20.0)	1.14 (57.3)	1.99 (100)
Rubber	0 (0)	0 (0)	2.40 (100)	2.40 (100)
Other perennial crops	0.30 (22.4)	0 20 (14.9)	0.84 (62.7)	1.34 (100)
Total	32.77 (28.6)	39.20 (34.2)	42.72 (37.3)	114.69 (100)

(Figures in parenthesis show percentages to total)

Ivy gourd occupied the largest share in gross cropped area, which was 37.3 percent followed, by snakegourd (34.2 per cent) and bittergourd (28.6 per cent). Moreover, ivy gourd growers gave more importance to perennial crops when compared to bittergourd and snakegourd growers, as it was evident from the table. Vegetables were cultivated in an area of 79.42 hectares. It included cowpea,

bhindi, chilly, amaranthus, coleus and cucurbits like bittergourd, snakegourd, ivy gourd, smooth gourd, pumpkins, cucumber and ashgourd.

4.2. GENERAL PRACTICES OF CULTIVATION

In this section, it is attempted to briefly describe the cultural practices adopted by the farmers in the study area for the crops namely bittergourd, snakegourd and ivy gourd.

4.2.1 Season

In the study area, bittergourd was observed to be cultivated mainly during May-August. Duration of the crop was 120 days. Snakegourd was cultivated in two seasons namely May-August and September-December and the duration of the crop was also 120 days. The cropping season generally followed by farmers in the study area was presented in Table 4.2.1.

Table 4.2.1. Cropping season practiced by the farmers

Crop	Season	Duration
Bittergourd	May-August	120 days
Snakegourd	May-August and September-December	120 days
Ivy gourd (Main crop)	Throughout the year	1 year
Ivy gourd (Ratoon crop)	Throughout the year	1 year

There was no specific season for ivy gourd as it was cultivated throughout the year. After one year of planting of the main crop, plants are pruned for ratoon cropping. Generally, 1-3 ratoons were taken by the sample farmers depending upon the yield, incidence of pests and diseases, climatic factors etc.

4.2.2. Land preparation

Generally, tractor was used in the study area for the preparation of land. Mounds of 2 feet diameter and 1-1.5 feet height were taken. Initially, lime was incorporated in the soil followed by farmyard manure at the rate of 10 kg per mound after 10 days.

4.2.3. Seeds and sowing

VFPCK (Vegetable and Fruit Promotion Council Keralam) was the main supplier of seeds for both the bittergourd and snakegourd farmers. Stem cuttings with three to four nodes and 30-40 cm length were used as planting material for ivy gourd. Farmer's sourced their planting material from their neighbours, friends and relatives. Ivy gourd farmers used only local varieties like Pachakettan, Thavalakannan and Super. In the case of bittergourd high yielding varieties like Priya, Priyanka and Preeti were cultivated. Snakegourd farmers also used high yielding varieties like Baby and Kaumudi.

In the case of bittergourd, eight seeds were sown per mound and after germination five healthy plants were retained. For snakegourd, four seeds were sown per mound and three healthy plants were retained after germination. Seed rate adopted by the bittergourd and snakegourd farmers were 2.5 kg/hectare. Three stem cuttings were planted per mound in the case of ivy gourd. Spacing practiced by the vegetable farmers in the study area for the vegetables under study and their deviations from the recommended spacing are given in Table 4.2.2.

Table 4.2.2. Spacing adopted by the sample farmers

Crop	Recommended spacing	Actual spacing adopted by sample farmers
Bittergourd	2.0 m x 2.0 m	2.50-2.75 m x 2.50-2.75 m
Snakegourd	2.0 m x 2.0 m	2.75-3.0 m x 2.75-3.0 m
Ivy gourd	4.0 m x 3.0 m	2.2-2.5 m x 2.2-2.5 m

From the table, it is evident that the bittergourd and snakegourd farmers practiced more spacing than the recommended one for vegetable cultivation. They opined that better quality fruits were obtained if they adopt wider spacing. In the case of ivy gourd, the farmers adopted less spacing than that was recommended.

4.2.4. Manures and fertilizers

First dose of farmyard manure was given while preparing the land and a second dose was given fifteen days after sowing. Manures were given in split doses, as the intense heat generated out of the manure decomposition would inhibit the germination of seed. Farmyard manures were applied at the rate of 25 t/ha. Weekly application of cow dung slurry was also practiced. Other manures, which were found to be used by the sample farmers, were poultry manure, neem cake, castor cake, groundnut cake and bone meal.

Chemical fertilizers like Factomphos, 18:18:18, 17:17:17, Murate of potash and Urea were quite common in the study area. Fertilizers were given in several split doses at fortnightly intervals. Weeding was done before applying the fertilizers.

4.2.5. Irrigation

Irrigation was given once in two days. Crop was irrigated manually using water from wells during February-May. Water is available from Pothundi canal during the rest of the months.

4.2.6. Plant protection

Generally, farmers were using insecticides like Furadan, Ekalux, Confidor, Hostathion and Metacid and fungicides like Mancozeb, Radar and Saff.

Fruit fly traps were found to be used by most of the sample farmers. In bittergourd and snakegourd, insect pests like fruit flies, epilachna beetle, red pumpkin beetle and jassids were predominant in the study area. Fungal disease like yellowing and leaf spot was quite common in the area. Viral diseases were also found. In the case of ivy gourd, no serious infestation of pests and diseases were reported from the study area. However incidence of viral disease was found to recur over the years against which a proper method of control was not available with the sample farmers. Pesticide use pattern of the sample farmers is given in Table 5.2.3

Table 4.2.3 Pesticide use pattern of the sample farmers

Pests	Chemicals recommended	Rs/l or Rs/kg	Chemicals used by the sample farmers	Rs/l or Rs/kg
Fruit fly	Carbaryl (DP)	67	Furadan	65
Epilachna beetle	Carbaryl (spray)	490	Ekalux	500
Red pumpkin beetle	Carbaryl (DP)	67	Ekalux	500
Jassids	-	-	Confidor	1800
Diseases				
Downy mildew	Mancozeb	260	Mancozeb	260
Yellowing	-	-	Saff Radar	900 240
Leaf spots	-	-	Mancozeb	260

It is evident from the table that, while applying the plant protection chemicals farmers did not follow the recommendation, except in the case of downy mildew attack where they went for Mancozeb. For controlling fruit flies Furadan was used instead of Carbaryl. Though furadan was cheaper, it would not break down easily in the soil and could create environmental problems. Farmers were found to depend upon the traders who prescribed them the needed chemicals. Hence traders were exploiting the ignorant farmers by selling them costlier chemicals. This could be because of the lack of extension activities in the study area.

Moreover, certain pests like jassids and diseases like yellowing and leaf spots were found to be severe in the study area against which a control

measure had not been recommended. Again farmers were put under the mercy of the traders This could be averted if scientists can come up with a cheaper and eco-friendly pesticide which can be used against the concerned pest and disease.

4.2.7. Harvesting

First harvest was taken after 45 days of sowing in the case of bittergourd and snakegourd. Harvesting was done once in four days. Hence, for these two crops a total of 18 harvests were made. In the case of ivy gourd, the crop will start yielding after 70 days of sowing. As it could not be irrigated during February to May, very less yield or relatively no yield was reported from the crop during those months. Thus, farmers could take up only 26 harvests in a year in ivy gourd.

4.3. COST OF CULTIVATION OF BITTERGOURD

This section includes input wise cost of cultivation, operation wise cost of cultivation, labour use pattern and fertilizer use pattern of bittergourd. They are shown in the respective tables, Tables 4.3.1, 4.3.2, 4.3.3 and 4.3.4

4.3.1. Input wise cost of cultivation

The results showed that Cost A_1, Cost A_2, Cost B_1, Cost B_2, Cost C_1, Cost C_2 and Cost C_3 were Rs.51326, Rs.57032, Rs.51340, Rs.59673, Rs.93355, Rs.101688 and Rs.111857 respectively for class I farmers and they were Rs.52771, Rs.56962, Rs.52787, Rs.61120, Rs.85666, Rs.93999 and Rs.103399 respectively at class II level. The costs were found to be Rs.62382, Rs.66657, Rs.62393, Rs.70726, Rs.82677, Rs.91010 and Rs.100111 respectively for class III farmers. At aggregate level, the costs were 53583, Rs.58590, Rs.53598, Rs.61931, Rs.87773, Rs.96106 and Rs.105717 in the respective order.

Table 4.3.1. Input wise cost of cultivation of bittergourd (Rs/ha)

Particulars	class I	per cent	class II	per cent	class III	per cent	Aggregate	per cent
Hired labour	9032	8.07	11519	11.14	16836	16.82	11801	11.16
Machine labour	1500	1.34	1500	1.45	1500	1.50	1500	1.42
Seed	1350	1.21	1350	1.31	1350	1.35	1350	1.28
Manures	16201	14.48	15324	14.82	18841	18.82	15898	15.04
Fertilisers	7486	6.69	6236	6.03	7444	7.44	6848	6.48
Panthalling material	9425	8.43	9255	8.95	9955	9.94	9403	8.89
Plant protection	2901	2.59	4065	3.93	3314	3.31	3344	3.16
Transport charge	616	0.55	414	0.40	319	0.32	444	0.42
Land revenue	32	0.03	50	0.05	49	0.05	40	0.04
Depreciation	743	0.66	824	0.80	602	0.60	774	0.73
Interest on farm loan	713	0.64	733	0.71	866	0.87	744	0.70
Interest on working capital	294	0.26	302	0.29	357	0.36	306	0.29
Miscellaneous cost	1033	0.92	1199	1.16	949	0.95	1130	1.07
Cost A1	51326	45.89	52771	51.04	62382	62.31	53583	50.69
Rent paid for leased in land	5706	5.10	4191	4.05	4276	4.27	5007	4.74
Cost A2	57032	50.99	56962	55.09	66657	66.58	58590	55.42
Interest on fixed capital	14	0.01	16	0.02	12	0.01	15	0.01
Cost B1	51340	45.90	52787	51.05	62393	62.32	53598	50.70
Rental value of own land	2628	2.35	4142	4.01	4058	4.05	3326	3.15
Cost B2	59673	53.35	61120	59.11	70726	70.65	61931	58.58
Inputed value of family labour	42015	37.56	32879	31.80	20284	20.26	34175	32.33
Cost C1	93355	83.46	85666	82.85	82677	82.59	87773	83.03
Cost C2	101688	90.91	93999	90.91	91010	90.91	96106	90.91
Allowance given for management of farm	10169	9.09	9400	9.09	9101	9.09	9611	9.09
Total cost	111857	100	103399	100	100111	100	105717	100

For the entire sample, human labour constituted the highest share of 43.49 per cent, in which family labour contributed a higher percentage (32.33 per cent) when compared to hired labour (11.16 per cent). Non-availability of agricultural labourers forced the farmers to depend on family labour itself. Moreover, they found vegetable cultivation more remunerative when compared to other crops and the idle time of the female members of the family could be effectively utilized for the same. This reason out the increased usage of family labour as confirmed by Sandhya (1992)

Manure (15.04 per cent) was the second important item. The third largest item was allowance given for management of farm occupying 9.09 per cent of the total cost. Cost of panthalling material was also an important item which accounted 8.89 per cent to the total cost, followed by rental value of land (both owned and leased in land) which took up a share of 7.89 per cent, fertilizer (6.48 per cent), plant protection chemicals (3.16 per cent), machine labour (1.42 per cent) and seed (1.28 per cent).

Analysis of class wise cost of inputs showed that human labour was the largest item of expenditure adding 45.63 per cent to the total cost (Rs.111857) for class I farmers, followed by manure (14.48 per cent), allowance given for management of farm (9.09 per cent), panthal making (8.43 per cent), fertilizers (6.69 per cent), rent paid for leased in land (7.45 per cent) and plant protection chemicals (2.59 per cent).

In the case of class II farmers also human labour was the largest item of input cost accounting for 42.94 per cent of the total cost. With 14.82 per cent share in the total cost, manures occupied the second position followed by allowance given for management of farm (9.09 per cent). Panthalling material contributed 8.95 per cent to the cost. This was followed by fertilizers (6.03 per cent), rental value of land (8.06 per cent) and plant protection chemicals (3.93 per cent).

For class III farmers human labour contributed the highest share in the total cost by imparting 37.08 per cent to the total cost. As observed in class I and class II, here also manure was the second largest item occupying 18.82 per cent of the total cost. Panthalling material (9.94 per cent) took the third place unlike the other classes. Allowance given for management of farm came next. Fertilizers (7.44 per cent), rental value of land (8.32 per cent) and plant protection chemicals (3.31 per cent) were other important items holding a major share in total cost.

In all the classes, human labour was the single largest item of expenditure followed by manures, allowance given for management of farm, panthalling material, fertilizers, rental value of land and plant protection chemicals except in class III where the third position was occupied by the panthalling material. Percentage share of hired labour, manures, panthalling material, interest on farm loan and interest on working capital were found to have an increasing trend from class I to class III. However, the percentage share of fertilizers and plant protection chemicals were observed to be highest for class III and class II farmers respectively.

Thus it was observed that Cost A_1, Cost B_1 and Cos B_2 were increasing from class I to class III, while the Costs A_2, C_1, C_2 and C_3 were found to be declining from class I to class III. This was in conformity with the study of Bhalerao and Maurya (1985) who reported that a negative relationship existed between Cost C and the size of the farm. For the entire sample, human labour constituted the highest share as reported by Madalia and Kukadia (1978).

4.3.2. Operation wise cost of cultivation

Manuring, fertilizer application and weeding contributed the greatest share in the total cost in all the classes. Costs incurred at class I, II, III and at aggregate levels for that operation were Rs.36324, Rs.31766, Rs.34962 and

Table 4.3.2.Operation wise cost of cultivation of bittergourd (Rs/ha)

Particulars	class I	per cent	class II	per cent	class III	per cent	Aggregate	per cent
Land preparation								
Hired labour	3069	2.74	3693	3.57	3894	3.89	3454	3.27
Family labour	3238	2.89	2357	2.28	1898	1.90	2628	2.49
Machine labour	1500	1.34	1500	1.45	1500	1.50	1500	1.42
Total	7807	6.98	7550	7.30	7292	7.28	7582	7.17
Sowing								
Input cost	1350	1.21	1350	1.31	1350	1.35	1350	1.28
Hired labour	16	0.01	68	0.07	85	0.08	58	0.05
Family labour	578	0.52	525	0.51	389	0.39	532	0.50
Transport charge	43	0.04	24	0.02	11	0.01	26	0.02
Total	1987	1.78	1967	1.90	1835	1.83	1966	1.86
Manuring and fertiliser application								
Input cost	23687	21.18	21560	20.85	26285	26.26	22746	21.52
Hired labour	2150	1.92	1645	1.59	4289	4.28	2229	2.11
Family labour	10217	9.13	8339	8.06	4179	4.17	8649	8.18
Transport charge	270	0.24	222	0.21	209	0.21	228	0.22
Total	36324	32.47	31766	30.72	34962	34.92	33852	32.02
Pandal making								
Input cost	9425	8.43	9255	8.95	9955	9.94	9403	8.89
Hired labour	2717	2.43	2997	2.90	3241	3.24	2985	2.82
Family labour	2991	2.67	2436	2.36	2054	2.05	2494	2.36
Transport charge	270	0.24	150	0.15	92	0.09	171	0.16
Total	15403	13.77	14838	14.35	15342	15.32	15053	14.23
Plant protection								
Input cost	2901	2.59	4065	3.93	3314	3.31	3344	3.16
Hired labour	0	0.00	0	0.00	0	0.00	0	0.00
Family labour	2602	2.33	2315	2.24	1748	1.75	2222	2.10
Transport charge	32	0.03	18	0.02	8	0.01	19	0.02
Total	5535	4.95	6398	6.19	5070	5.06	5585	5.28
Irrigation								
Hired labour	1081	0.97	1979	1.91	1063	1.06	1374	1.30
Family labour	12658	11.32	8589	8.31	4564	4.56	8604	8.14
Total	13739	12.28	10568	10.22	5627	5.62	9978	9.44
Harvesting								
Hired labour	0	0.00	1137	1.10	4266	4.26	1801	1.70
Family labour	9730	8.70	8318	8.04	5452	5.45	7833	7.41
Total	9730	8.70	9455	9.14	9718	9.71	9634	9.11
Miscellaneous cost	1033	0.92	1199	1.16	949	0.95	1130	1.07
Depreciation	743	0.66	825	0.80	602	0.60	774	0.73
Land revenue	32	0.03	50	0.05	49	0.05	40	0.04
Interest on farm loan	713	0.64	733	0.71	866	0.87	744	0.70
Interest on working capital	294	0.26	302	0.29	357	0.36	306	0.29
Interest on fixed capital	14	0.01	16	0.02	12	0.01	15	0.01
Rent on own land	2628	2.35	4143	4.01	4058	4.05	3326	3.15
Rent on leased in land	5706	5.10	4191	4.05	4276	4.27	5007	4.74
Allowance given for management of farm	10169	9.09	9400	9.09	9101	9.09	9611	9.09
Total cost	111857	100	103399	100	100111	100	105717	100

Rs.33852 respectively. At aggregate level 32.02 per cent of total cost was confined to this operation out of which 21.52 per cent was contributed by the input cost. Family labour was utilized by the farmers of all the classes in a greater proportion when compared to hired labour for this operation.

Panthal making was the next important item. It accounted for 14.23 per cent of the total cost in which, 8.89 per cent, 2.82 per cent and 2.36 per cent were taken up by input cost, hired labour and family labour respectively at aggregate level. Total amount spend towards this operation by class I, class II, class III and aggregate level farmers were respectively ordered as Rs.15403, Rs.14838, Rs.15342 and Rs.15053.08

Cost of irrigation followed panthal making expense and it added Rs.9978 (9.44 per cent) to the total cost at aggregate level. A major share of the cost was contributed by family labour, which took up Rs.8604 (8.14 per cent). Cost incurred for this operation by class I, II and III farmers were Rs.13739, Rs.10568 and Rs.5627 respectively.

Next important item contributing to the total cost was harvesting. At aggregate level, 9.11 per cent (Rs.9634) of the total cost was incurred on it. It included family labour's share of 7.41 per cent (Rs.7833) and hired labour's share of 1.70 per cent (Rs.1801). Here also, family labour was observed to have prominence over hired labour in all the classes. Expense incurred on harvesting operation was Rs.9730, Rs.9455 and Rs.9718 for class II, III farmers and I respectively. It was also noted that harvesting operation of class I farmers was exclusively accomplished by family labour.

Land preparation operation took its position after harvesting. A total amount of Rs.7582 was utilized for this operation at aggregate level. Thus it contributed to 7.17 per cent of total cost, which included hired labour (3.27 per cent), family labour (2.49 per cent) and machine labour (1.42 per cent). Class wise

expense on land preparation was Rs.7807 for class I, Rs.7550 for class II and Rs.7292 for class III. Share of hired labour (Rs.3454) in land preparation was found to be more than that of family labour (Rs.2628) at aggregate level. Unlike class I farmers, class II and class III farmers occupied hired labour in greater proportion for land preparation. At class I level, family labour (Rs.3238) got dominated over hired labour (Rs.3069).

Plant protection received a major share in the total cost to the extent of Rs.5585 (5.28 per cent) at aggregate level, in which input cost occupied a share of 3.16 per cent (Rs.3324). This operation was carried out entirely by family labour and its contribution was 2.10 per cent (Rs.2222). Class II farmers spent more amount as input cost (Rs.4065) when compared to class III (Rs.3314) and class I (Rs.2901). Expense meted out towards plant protection by class I, class II and class III were Rs.5535, Rs.6398 and Rs.5070 respectively.

At aggregate level, only 1.86 per cent of the total cost was attributed to sowing operation which came to Rs.1966. Cost of seeds occupied the single largest item of expenditure in sowing operation. It was Rs.1350 (1.28 per cent) at aggregate level. It was also noted that hired labour (0.05 per cent) was dominated by family labour (0.50 per cent) in this operation.

The findings that manuring, fertilizer application and weeding contributed the greatest share in the total cost was supported by the results of the study conducted by Madan *et al* (1999) who reported that farmyard manure constituted 30.53 per cent of the total cost of cauliflower cultivation. The study also confirmed that plant protection chemicals occupied 5.31 per cent of the total cost. Comparable results were obtained in this study also. Sowing operation received the lowest share in the present study, which negated the findings of Karthikeyan (2001) who opined that seeds and sowing was the single largest item that occupied a major share of the total cost in the case of cool season vegetables.

4.3.3. Labour use pattern

Except land preparation, all the operations were carried out using human labour. However, for practices like ploughing farmers in the study area used machine labour in the form of tractor hours. For one acre of land, machine labour was hired for 2 hours for which they paid Rs.300. The man days were worked out on the basis of two female labour a day as equalent to one male labour day, as this was approximately the wage rate ratio.

Total labour use at the aggregate level was 343 man days and the same were 408, 355 and 297 man days for class I, class II and class III levels respectively. At aggregate level, manuring, fertilizer application and weeding required the highest amount of human labour (87 man days) and it was closely followed by irrigation (80 man days). Plant protection was entirely carried out by family labour (18 man days). Harvesting operation demanded 77 man days while panthal making required 44 man days.

Labour use for fertiliser application and weeding was highest for class I (99 man days) followed by class II (80 man days) and class III (67 man days). Similar trend was observed in land preparation, panthal making, plant protection and irrigation. For harvesting, class I farmers depended entirely on family labour.

Total labour use at the aggregate level was greater than that reported by Sandhya (1992).

4.3.4. Fertiliser use pattern

For bittergourd, the recommended rate of application of organic manure is 20-25 t/ha. Chemical fertilisers should be applied at the rate of 70:25:25 kg NPK per hectare. The farmer's practice often deviated from this, as can be seen

Table.4.3.3.Labour use pattern in bittergourd (man days)

Operations	class I			class II			class III			Aggregate		
	Hired labour	Family labour	Total	Hired labour	Family labour	Total	Hired labour	Family labour	Total	Hired labour	Family labour	Total
Land preparation	25	26	51	30	19	48	31	15	46	28	21	49
Sowing	0	5	5	1	4	5	1	3	4	1	4	5
Manuring,fertiliser application& weeding	17	82	99	13	67	80	34	33	67	18	69	87
Panthal making	22	24	46	24	19	43	26	16	42	24	20	44
Plant protection	0	21	21	0	19	19	0	14	14	0	18	18
Irrigation	9	101	110	16	69	85	9	37	46	11	69	80
Harvesting	0	78	78	9	67	76	34	44	78	14	63	77
Total	72	336	408	92	263	355	135	162	297	86	256	343

Table.4.4.3.Labour use pattern in snakegourd (man days)

Operations	class I			class II			class III			Aggregate		
	Hired labour	Family labour	Total	Hired labour	Family labour	Total	Hired labour	Family labour	Total	Hired labour	Family labour	Total
Land preparation	22	20	42	23	18	41	23	16	39	23	18	41
Sowing	0.2	4	4	0.1	4	4	0.0	4	4	0.1	4	4
Manuring,fertiliser application& weeding	21	81	102	8	76	84	14	58	72	11	75	86
Panthal making	24	22	46	23	22	45	16	29	45	23	23	46
Plant protection	0	12	12	0	11	11	0	7	7	0	11	11
Irrigation	9	90	99	22	60	82	24	50	74	20	64	84
Harvesting	8	66	74	12	55	67	18	48	66	12	56	68
Total	84	295	379	89	246	335	95	212	307	89	250	339

from Table 4.3.4. The quantity of farmyard manure applied by the sample farmers was less when compared to the recommended dose. However, the fertilizer use was much higher. Class III and I applied about double the recommended dose of nitrogen. More than three times the recommended dose was applied in the case of P_2O_5. Potash was applied nearly seven times more than that was recommended. This result is comparable with that obtained by Nagesh (2001) who reported that fertilizer use among vegetable growers were 2-4 times higher than the recommended dosage though the rate of application of organic manure was found to be same as the dosage recommended.

Table 4.3.4. Nutrient use pattern in bittergourd (per hectare)

Nutrient	Farmer's practice			
	Recommended dose	Class I	Class II	Class III
FYM (tonnes)	20-25	16.8	14.15	16.92
N (kg)	70	148	90	130
P_2O_5 (kg)	25	128	92	124
K_2O (kg)	25	182	180	188

Common manures and fertilizers used by the sample farmers are given in Table 4.3.5. Poultry manure, Factomphos, MOP and Neem cake were used in higher quantities when compared to other fertilisers by the sample farmers.

Table 4.3.5. Manure and fertiliser use pattern in bittergourd (kg/ha)

Manures and fertilizers	Farmer's practice		
	Class I	Class II	Class III
Poultry manure	251	237	249
Neem cake	143	156	141
Castor cake	84	72	50
Groundnut cake	74	94	131
Bone meal	69	39	73
Factomphos	254	204	314
18:18:18	151	52	105
17:17:17	11	10	0
MOP	244	271	271
Rajphos	112	91	82
Mussorie phos	34	26	26
Urea	101	34	52

4.4. COST OF CULTIVATION OF SNAKEGOURD

The results on input wise cost of cultivation, operation wise cost of cultivation, labour use pattern and fertilizer use pattern of snakegourd are presented and discussed in this section with the help of the respective tables Tables 4.4.1, 4.4.2, 4.4.3 and 4.4.5 respectively.

4.4.1. Input wise cost of cultivation

The analysis of input wise cost per hectare of snakegourd showed that cost A_1, A_2, B_1, B_2, C_1, C_2 and C_3 were Rs.54227, Rs.59329, Rs.54241, Rs.62609, Rs.86157, Rs.93888 and Rs.103277 respectively for the sample as a whole. These costs were Rs.55334, Rs.60266, Rs.55351, Rs.63684, Rs.92240, Rs.100573 and Rs.110630 respectively at class I level. For class II farmers, they were Rs.54212, Rs.59349, Rs.54226, Rs.62606, Rs.85011, Rs.93391 and Rs.102730 in their respective order. The costs were found to be Rs.52673, Rs.57775, Rs.52686, Rs.61019, Rs.85415, Rs.87503 and Rs.96253 respectively at class III level.

As in bittergourd, for the sample as whole, human labour was the most important item of input, which accounted for 41.00 per cent of the total expense. This cost was comprised of family labour cost (Rs.31279) and hired human labour cost (Rs.11065). Manures occupied the next important position with 16.21 per cent share in the total cost followed by, allowance given for management of farm (9.09 per cent) fertilisers (8.77 per cent), panthalling material (8.75 per cent) rental value of land (8.10 per cent) and plant protection chemicals (2.01 per cent).

In the case of class I farmers, human labour was the largest item of expenditure. It accounted for 42.82 per cent of the total cost. Expense meted out towards cost of manures and fertilizers were Rs.15886 (14.36 per cent) and

Table 4.4.1. Input wise cost of cultivation of snakegourd (Rs/ha)

Particulars	class I	per cent	class II	per cent	class III	per cent	Aggregate	per cent
Hired labour	10486	9.48	11068	10.77	11916	12.38	11065	10.71
Machine labour	1500	1.36	1500	1.46	1500	1.56	1500	1.45
Seed	1350	1.22	1350	1.31	1350	1.40	1350	1.31
Manures	15886	14.36	17197	16.74	14666	15.24	16739	16.21
Fertilisers	11300	10.21	8632	8.40	8812	9.15	9058	8.77
Panthalling material	9119	8.24	8989	8.75	9247	9.61	9036	8.75
Plant protection	1871	1.69	2134	2.08	1968	2.04	2077	2.01
Transport charge	630	0.57	404	0.39	328	0.34	431	0.42
Land revenue	41	0.04	39	0.04	39	0.04	39	0.04
Depreciation	842	0.76	748	0.73	704	0.73	758	0.73
Interest on farm loan	769	0.69	753	0.73	732	0.76	753	0.73
Interest on working capital	316	0.29	310	0.30	301	0.31	310	0.30
Miscellaneous cost	1224	1.11	1088	1.06	1110	1.15	1111	1.08
Cost A1	55334	50.02	54212	52.77	52673	54.72	54227	52.51
Rent paid for leased in land	4932	4.46	5137	5.00	5102	5.30	5102	4.94
Cost A2	60266	54.48	59349	57.77	57775	60.02	59329	57.45
Interest on fixed capital	16	0.01	14	0.01	13	0.01	15	0.01
Cost B1	55351	50.03	54226	52.79	52686	54.74	54241	52.52
Rental value of own land	3401	3.07	3243	3.16	3231	3.36	3266	3.16
Cost B2	63684	57.56	62606	60.94	61019	63.39	62609	60.62
Inputed value of family labour	36889	33.34	30784	29.97	26484	27.51	31279	30.29
Cost C1	92240	83.38	85011	82.75	85415	88.74	86157	83.42
Cost C2	100573	90.91	93391	90.91	87503	90.91	93888	90.91
Allowance given for management of farm	10057	9.09	9339	9.09	8750	9.09	9389	9.09
Total cost	110630	100	102730	100	96253	100	103277	100

Fig.2. Input wise cost of cultivation of bittergourd

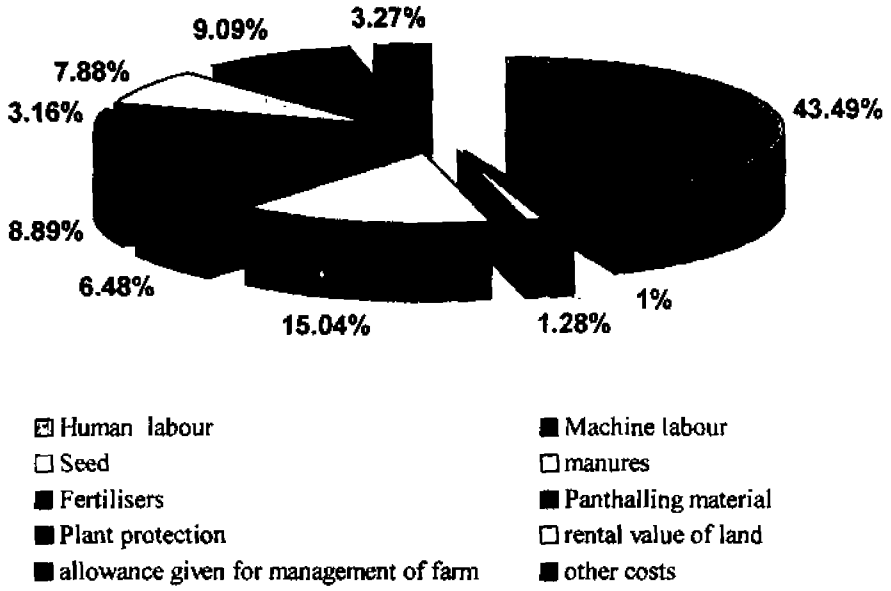
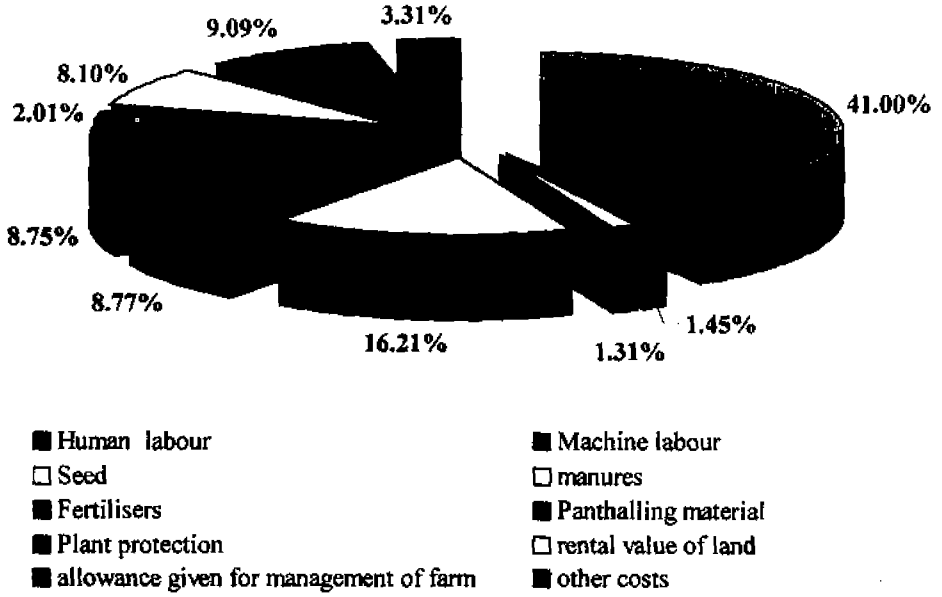


Fig.3.Input wise cost of cultivation of snakegourd



Rs.11300 (10.21 per cent) respectively. Rental value of land, which included the rent on own land (3.07 per cent) and rent on leased in land (4.46 per cent), occupied the fifth slot after allowance given for management of farm (9.09 per cent). They were followed by panthalling material (8.24 per cent) and plant protection chemicals (1.69 per cent).

In class II also human labour held a substantial share of 40.74 per cent in which hired human labour (Rs.11068) and family labour (Rs.30784) were included. Manuring came second with 16.74 per cent share in total cost followed by allowance given for management of farm (9.09 per cent), panthalling material (8.75 per cent), fertilisers (8.40 per cent), rental value of land (8.16 per cent) and plant protection chemicals (2.08 per cent).

As in class I and class II, human labour accounted for 39.59 per cent of total cost with hired labour occupying 12.38 per cent and family labour with 27.51 per cent in class III. It was followed by manures (15.24 per cent), panthalling material (9.15 per cent), allowance given for management of farm (9.09 per cent), rental value of land (8.66 per cent) and plant protection chemicals (2.04 per cent). Class II farmers incurred the lowest expense on panthal making and fertilisers when compared to others. On manuring and plant protection they incurred the highest expense.

ABC cost analysis showed that all the cost items except cost C_1 were decreasing from class I to class III. The findings of Karthikeyan (2001) who had stated that almost one half of the total cost was attributed to human labour supported the result of the present study that human labour occupied the highest share in total cost. Hired human labour and family labour were found to have an increasing and decreasing trend respectively from class I to class III. According to Madan *et al* (1999) small farmers had the advantage of more family labour when compared to large farmers.

4.4.2. Operation wise cost of cultivation

As in bittergourd, fertilizer application and weeding incurred the greatest share in cost of cultivation, which accomplished 35.59 per cent of the total cost at aggregate level. It came to Rs.36759. Cost incurred in this operation by class I, II and III were Rs.40262, Rs.36597 and Rs.32693 respectively. Major portion of the cost for this operation went to the input cost (24.98 per cent). Family labour cost (Rs.9368) overtook the cost of hired labour (Rs.1359).

An amount of Rs.14955 was assigned for the expense of panthal making at aggregate level, which took up a share of 14.38 per cent in total cost. It included input cost of Rs.9035.52 (8.75 per cent), hired labour charge of Rs.2832.02 (2.74 per cent), family labour cost of Rs.2832.15 (2.74 per cent) and transportation cost of Rs.152 (0.15 per cent). Cost incurred by class I, II and III were Rs.15132, Rs.14781 and Rs.14952 respectively. Except class III farmers hired labour was used in greater proportion when compared to family labour by other classes. But at aggregate level both were almost equal. Class III farmers depended less on family labour (Rs.2036) than on hired labour (Rs.3567).

Irrigation was the next important operation. It consumed a total amount of Rs.10455 (10.12 per cent) at aggregate level. Family labour (Rs7944) and hired labour (Rs.2511) contributed 7.69 per cent and 2 43 per cent respectively towards total cost for this operation. Here also, family labour was found to have a dominant role among all classes. Amount spent for irrigation by different classes were Rs.12380, Rs.10218 and Rs.9306 by class I, class II and class III farmers respectively.

Harvesting was yet another important item. For harvesting family labour was found to be used in greater proportion than hired labour. Hence out of the total cost of harvesting (Rs.8524.16) at aggregate level, family labour occupied a share of 6.79 per cent (Rs.7944) of total cost, while hired labour

Fig.2. Input wise cost of cultivation of bittergourd

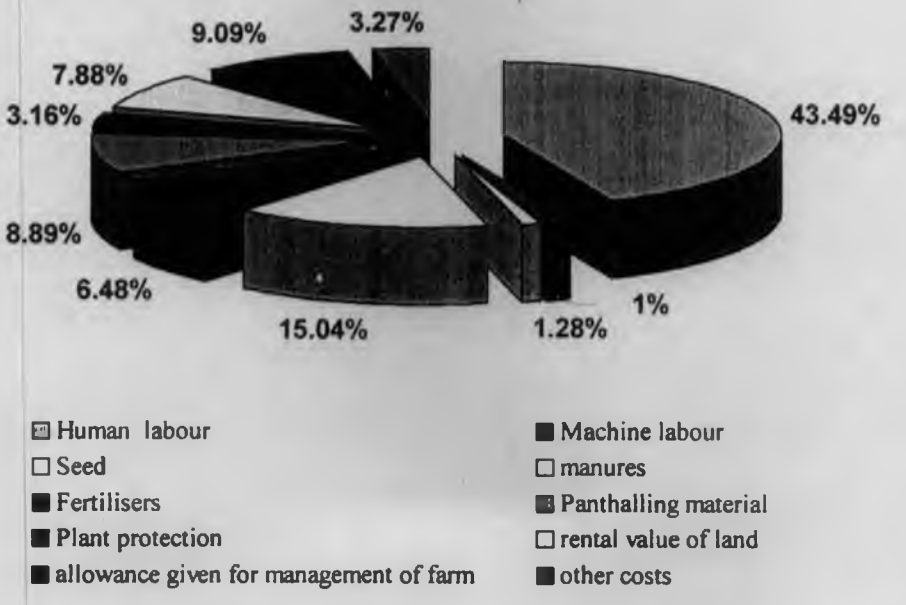


Fig.3.Input wise cost of cultivation of snakegourd

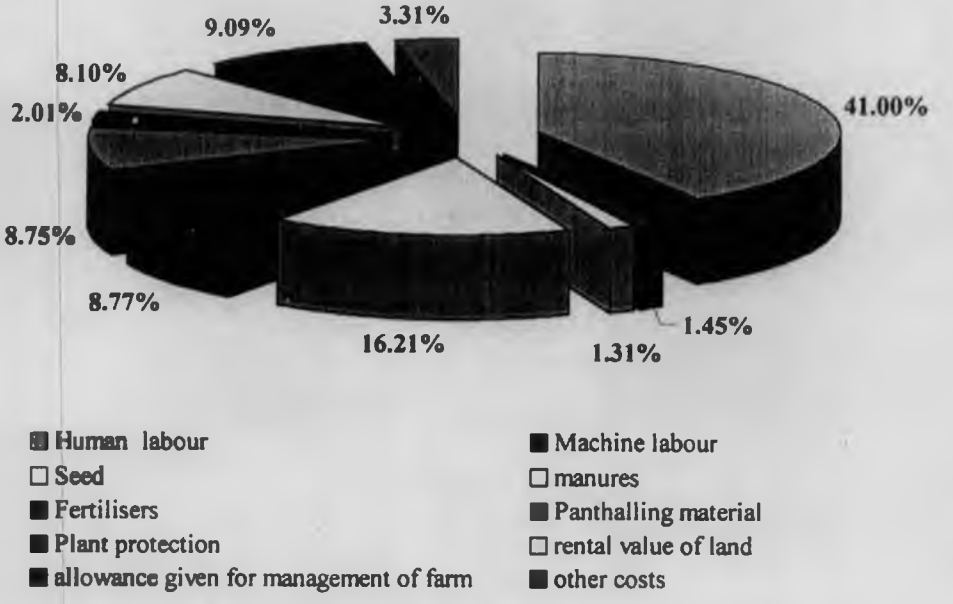


Table 4.4.2.Operation wise cost of cultivation of snakegourd (Rs/ha)

Particulars	class I	per cent	class II	per cent	class III	per cent	Aggre gate	per cent
Land preparation								
Hired labour	2785.00	2.52	2837.00	2.76	2902.00	3.01	2835.89	2.75
Family labour	2487.00	2.25	2275.00	2.21	2041.00	2.12	2284.00	2.21
Machine labour	1500.00	1.36	1500.00	1.46	1500.00	1.56	1500.00	1.45
Total	6772.00	6.12	6612.00	6.44	6443.00	6.69	6619.89	6.41
Sowing								
Input cost	1350.00	1.22	1350.00	1.31	1350.00	1.40	1350.00	1.31
Hired labour	31.00	0.03	14.00	0.01	0.00	0.00	15.00	0.01
Family labour	547.00	0.49	432.00	0.45	444.00	0.46	473.00	0.46
Transport charge	49.00	0.04	22.00	0.02	12.00	0.01	25.00	0.02
Total	1977.00	1.79	1848.00	1.80	1806.00	1.88	1863.00	1.80
Manuring and fertiliser application								
Input cost	27186.00	24.57	25829.00	25.14	23478.00	24.39	25796.68	24.98
Hired labour	2621.00	2.37	1052.00	1.02	1714.00	1.78	1359.37	1.32
Family labour	10174.00	9.20	9486.00	9.23	7297.00	7.58	9367.95	9.07
Transport charge	281.00	0.25	230.00	0.22	204.00	0.21	235.00	0.23
Total	40262.00	36.39	36597.00	35.62	32693.00	33.97	36759.01	35.59
Trellis making								
Input cost	9119.00	8.24	8989.00	8.75	9247.00	9.61	9035.52	8.75
Hired labour	2971.00	2.69	2913.00	2.84	2036.00	2.12	2832.02	2.74
Family labour	2778.00	2.51	2743.00	2.67	3567.00	3.71	2832.15	2.74
Transport charge	264.00	0.24	136.00	0.13	102.00	0.11	152.00	0.15
Total	15132.00	13.68	14781.00	14.39	14952.00	15.53	14851.69	14.38
Plant protection								
Input cost	1871.00	1.69	2134.00	2.08	1968.00	2.04	2077.00	2.01
Hired labour	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Family labour	1439.00	1.30	1424.00	1.39	830.00	0.86	1365.89	1.32
Transport charge	37.00	0.03	16.00	0.02	9.00	0.01	19.00	0.02
Total	3347.00	3.03	3574.00	3.48	2807.00	2.92	3461.89	3.35
Irrigation								
Hired labour	1127.00	1.02	2720.00	2.65	3061.00	3.18	2511.02	2.43
Family labour	11253.00	10.17	7498.00	7.30	6245.00	6.49	7944.00	7.69
Total	12380.00	11.19	10218.00	9.95	9306.00	9.67	10455.02	10.12
Harvesting								
Hired labour	951.00	0.86	1533.00	1.49	2204.00	2.29	1512.16	1.46
Family labour	8211.00	7.42	6897.00	6.71	6061.00	6.30	7012.00	6.79
Total	9162.00	8.28	8430.00	8.21	8265.00	8.59	8524.16	8.25
Miscellaneous cost	1225.00	1.11	1088.00	1.06	1110.00	1.15	1111.00	1.08
Depreciation	842.00	0.76	748.00	0.73	704.00	0.73	758.00	0.73
Land revenue	41.00	0.04	39.00	0.04	39.00	0.04	39.00	0.04
Interest on farm loan	769.00	0.70	753.00	0.73	732.00	0.76	753.00	0.73
Interest on working capital	317.00	0.29	310.00	0.30	301.00	0.31	310.00	0.30
Interest on fixed capital	16.00	0.01	14.00	0.01	13.00	0.01	15.00	0.01
Rent on own land	3401.00	3.07	3243.00	3.16	3231.00	3.36	3266.00	3.16
Rent on leased in land	4932.00	4.46	5137.00	5.00	5102.00	5.30	5102.00	4.94
Allowance given for management of farm	10057.00	9.09	9339.00	9.09	8750.00	9.09	9389.00	9.09
Total cost	110630	100	102730	100	96253	100	103277	100

incurred a share of 1.46 per cent (Rs.1563) class wire analysis revealed that class I, class II and class III farmers contributed Rs.9162, Rs.8430 and Rs.8265 towards harvesting cost respectively.

For land preparation expenses were meted out at the rate of Rs.6772 by class I, Rs.6612 by class II and Rs.6443 per hectare by class III farmers. Hired labour showed its prominence over family labour for this operation in all the classes. At aggregate level, out of the total cost of Rs.6619.89 (6.41 per cent), Rs.2835.89 (2.75 per cent) and Rs.2284 (2.21 per cent) were spent on hired labour and family labour respectively. Rest of the expense that came to Rs.1500 (1.45 per cent) was incurred on machine labour.

Contribution from plant protection measures to the total cost was Rs.3461.89 (3.35per cent) at aggregate level. It included the cost of plant protection chemicals (Rs.2077), which came to 2.01 per cent of total cost and family labour charge of Rs.1365.89 (1.32 per cent). Obviously, plant protection operations were entirely carried out by family labour, which was applicable to all classes as well. Class wise expenses incurred on this operation were Rs.3347, Rs.3574 and Rs.2807 by class I, class II and class III farmers respectively.

Seeds and sowing operation followed plant protection measures, with 1.80 per cent share in total cost at aggregate level. Majority of the cost involved in seeds and sowing operation was incurred on cost of seed (1.31 per cent). Hired labour and family labour occupied respective shares of 0.01 per cent and 0.46 per cent at aggregate level. It was also noted that, this operation depended on family labour alone for class III farmers unlike class I and class II farmers who depended on both, though the share of family labour was greater than that of hired labour. Amount spent by class I, class II and class III farmers for this operation were Rs.1977, Rs.1848 and Rs.1806 respectively.

. Fertilizer application and weeding incurred the greatest share in the cost of cultivation. This result was not in conformity with that obtained by Nagesh (2001) who opined that cost of panthalling and staking occupied the most significant share in the total input costs in the case of bittergourd and snakegourd.

4.4.3. Labour use pattern

At aggregate level, total labour use was 339 man days, which was less than that for bittergourd. Farmers were of the opinion that snakegourd requires less care when compared to bittergourd. Incidence of pests and diseases were also found to be less. This contradicted the observations of Nagesh (2001) who reported that snakegourd was the most labour intensive crop.

Fertiliser application and weeding operation demanded the most number (86 man days) followed by irrigation (84 man days) and harvesting (68 man days). Panthal making and land preparation required 46 and 41 man days respectively. Plant protection and sowing were entirely carried out by family labour (11 man days and 4 man days respectively).

Total labour use at class I, class II and class III levels were 379, 335 and 307 man days respectively. Analysis revealed a decreasing trend of labour use from class I to class III for the operations like land preparation, fertiliser application cum weeding, panthal making, plant protection, irrigation and harvesting. Labour use for sowing remained the same for all the three classes.

4.4.4. Fertiliser use pattern

The recommended rate of application of organic manure for snakegourd is 20-25 t/ha. Chemical fertilisers need to be applied at the rate of 75-25-25 kg/ha.

Table 4.4.4. Nutrient use pattern in snakegourd (per hectare)

Nutrient	Recommended dose	Farmer's practice		
		Class I	Class II	Class III
FYM (tonnes)	20-25	11.61	15.61	10.71
N (kg)	70	262	175	240
P_2O_5 (kg)	25	188	146	161
K_2O (kg)	25	375	307	258

It was observed that, in snakegourd, FYM applied was almost half the recommended dose, whereas usage of chemical fertilisers was found to be higher than the recommended dose. Quantity of nitrogen was applied was more than double the recommended one. Phosphorus and Potash applied was more than six times and twelve times the recommended rates respectively. Similar results were obtained by Nagesh (2001).

The common manures and fertilisers used by the sample farmers were given in Table 4.4.5. Poultry manure, MOP, factomphos and urea were used by the farmers in greater quantities when compared to other fertilisers. Farmers held the practise of mixing caster cake or groundnut cake with the chemical fertilisers, factomphos and MOP before application. Thus it can be observed that there was a tendency among farmers for over use of fertilisers in anticipation of a higher return.

Table 4.4.5. Manure and fertilisers use pattern of snakegourd (kg/ha)

Manures and fertilisers	Farmer's practice		
	Class I	Class II	Class III
Poultry manure	482	382	418
Neem cake	209	153	120
Castor cake	103	89	69
Groundnut cake	95	113	153
Bone meal	153	115	133
Factomphos	390	309	342
10:18:18	255	167	138
17:17:17	25	28	0
MOP	526	439	375
Rajphos	61	61	163
Mussorie phos	26	21	0
Urea	219	109	255

4.5. COST OF CULTIVATION OF IVY GOURD

This section examines the input wise cost of cultivation operation wise cost of cultivation, labour use pattern and fertilizer use pattern of ivy gourd (main crop) and ivy gourd (ratoon crop). Those are given in Tables 4.5.1.1, 4.5.1.2, 4.5.1.3 and 4.5.1.4 respectively in the case of main crop and in Tables 4.5.2.1, 4.5.2.2, 4.5.2.3 and 4.5.2.4 respectively in the case of ratoon crop.

4.5.1. Cost of cultivation of ivy gourd (main crop)

4.5.1.1.Input wise cost per hectare of ivy gourd (main crop)

The analysis of input wise cost per hectare of ivy gourd showed that cost A_1, A_2, B_1, B_2, C_1, C_2 and C_3 were Rs.66604, Rs.72533, Rs.66639, Rs.91639, Rs.99998, Rs.124998 and Rs.137498 respectively at aggregate level. For class I they were Rs.62120, Rs.63695, Rs.62173, Rs.87173, Rs.102973, Rs.127973 and Rs.140770 respectively and for class II they were Rs.57451, Rs.66563, Rs.57485, Rs.82485, Rs.96906, Rs.121906 and Rs.134097 in the same order. The same costs were Rs.83674, Rs.88544, Rs.83698, Rs.108698, Rs.102064, Rs.127064 and Rs.139770 for class III in the respective order.

In the case of ivy gourd, human labour continued to be the largest item of expenditure contributing 37.39 per cent to the total cost for the sample as a whole. Manures with a share of 14.37 per cent occupied the third place next to rental value of land (18.18 per cent), which included rental value of own land (13.87 per cent) and rent on leased in land (4.31 per cent). This was followed by allowance given for management of farm (9.09 per cent), panthalling material (7.43 per cent), fertilisers (7.05 per cent), interest on farm loan (1.94 per cent) and plant protection chemicals (1.48 per cent).

In class I, human labour input was the single largest item with 34.66 per cent of which family labour accounted to 28.98 per cent. Next largest

Table 4.5.1.1. Input wise cost of cultivation of ivy gourd-main crop (Rs/ha)

Particulars	class I	per cent	class II	per cent	class III	per cent	Aggregate	per cent
Hired labour	7996	5.68	9866	7.36	38310	27.41	18054	13.13
Machine labour	1500	1.11	1500	1.12	1500	1.07	1500	1.09
Manures	25387	18.03	19288	14.38	15822	11.32	19764	14.37
Fertilisers	10069	7.15	9605	7.16	9494	6.79	9688	7.05
Panthalling material	10215	7.26	10256	7.65	10139	7.25	10210	7.43
Plant protection	1808	1.28	1969	1.47	2305	1.65	2031	1.48
Transport charge	646	0.46	454	0.34	349	0.25	470	0.34
Land revenue	94	0.07	64	0.05	81	0.06	76	0.06
Depreciation	920	0.65	576	0.43	419	0.30	614	0.45
Interest on farm loan	2491	1.77	2305	1.72	3355	2.40	2670	1.94
Interest on working capital	1026	0.73	949	0.71	1381	0.99	1100	0.80
Miscellaneous cost	535	0.38	622	0.46	519	0.37	569	0.41
Cost A1	62120	44.13	57451	42.84	83674	59.87	66604	48.44
Rent paid for leased in land	1575	1.12	9111	6.79	4870	3.48	5929	4.31
Cost A2	63695	45.25	66563	49.64	88544	63.35	72533	52.75
Interest on fixed capital	53	0.04	33	0.02	24	0.02	35	0.03
Cost B1	62173	44.17	57485	42.87	83698	59.88	66639	48.47
rental value of own land	23425	16.64	15889	11.85	20130	14.40	19071	13.87
Cost B2	87173	61.93	82485	61.51	108698	77.77	91639	66.65
Inputed value of family labour	40800	28.98	39421	29.40	18365	13.14	33359	24.26
Cost C1	102973	73.15	96906	72.27	102064	73.02	99998	72.73
Cost C2	127973	90.91	121906	90.91	127064	90.91	124998	90.91
Allowance given for management of farm	12797	9.09	12191	9.09	12706	9.09	12500	9.09
Cost C3	140770	100	134097	100	139770	100	137498	100

contribution was from manures, which occupied 18.03 per cent of the total cost. The share of rental value of land was 17.76 per cent which included rent on leased in land (1.12 per cent) and rental value of own land (16.64 per cent). This was followed by allowance given for management of farm (9.09 per cent), panthalling material (7.26 per cent), fertilisers (7.15 per cent), interest on farm loan (1.77 per cent) and plant protection chemicals (1.28 per cent).

In class II also, human labour input covered 36.76 per cent of the total cost, which included hired labour (7.36 per cent) and family labour (29.40 per cent). Rental value of land (18.64 per cent) manures (14.38 per cent), allowance given for management of farm (9.09 per cent), panthalling material (7.65 per cent), fertilisers (7.16 per cent), interest on farm loan (1.72 per cent) and plant protection chemicals (1.47 per cent) followed human labour input.

In class III, women labour continued to be the largest item of expenditure with a share of 40.55 per cent of total cost, which amounted to Rs.56675. Of the total labour cost Rs.38310 (27.41 per cent) was for hired labour and Rs.18365 (13.14 per cent) was for family labour. Rental value of land was the second largest item and as much as Rs.25000 (17.88 per cent) was attributed to this input. Manures occupied 11.32 per cent of the total cost followed by allowance given for management with 9.09 per cent. Panthalling material and fertilisers shared Rs.10139 (7.25 per cent) and Rs.9494 (6.79 per cent) with the total cost. Inputs like interest on farm loan and plant protection chemicals constituted 2.40 and 1.65 per cent.

It was observed that costs A_1, A_2, B_1 and B_2 were the highest in class III, while costs C_1, C_2 and C_3 were highest in class I. Increasing and decreasing trend from class I to class III was noted in hired human labour and family labour respectively. Manures, fertilisers and plant protection also followed a declining trend from class I to class III. Rent paid for leased in land was the highest for class II farmers followed by class III and class I. Class I farmers

incurred the highest rent for own land and highest expense for panthalling material when compared to others.

Human labour constituted the largest item of expenditure for the sample as a whole The study conducted by Agro-Economic Research Centre (2004) revealed that almost one third of the total cost was incurred on labour charges. As observed by Ramachandran (1997) in Okra cultivation, manures took up the third largest share in the total cost after human labour and rental value of land. It was noted that the cost of manures and fertilizers followed a decreasing trend from from class I to class III. This was supported by the study of Nahatkar and Pant (1984) in chillies where the cost of ferrtilisers and manures was the highest on small farms.

4.5.1.2. Operation wise cost per hectare of ivy gourd (main crop)

The analysis revealed that the cost per hectare was the highest for manuring, fertilizer application cum weeding operation (28.90 per cent) at aggregate level, while for class I, II and III farmers, cost for this operation was Rs.45397, Rs.39530 and Rs.34928 respectively. The total cost for this operation was comprised of the cost of manures and fertilisers (Rs.29451.78), hired labour (Rs.1684), family labour (Rs.8368) and transportation (Rs.228). As it is seen from the table, family labour had more share than hired labour in total cost for all the classes for this operation.

Panthal making got the next biggest share of 11.87 per cent in total cost (Rs.16321.43). It included the cost of panthalling materials (Rs.10210), hired labour (Rs.2587), family labour (Rs.3303.23) and transportation cost (Rs.221). For this operation also family labour (2.40 per cent) occupied more share than hired labour (1.88 per cent) in total cost at aggregate level. But for class III farmers it was observed that hired labour (Rs.3937) was more in use for panthal

Table 4.5.1.2.Operation wise cost of cultivation of ivy gourd (Rs/ha)

Particulars	class I	per cent	class II	per cent	class III	per cent	Aggre gate	per cent
Land preparation								
Hired labour	3617.13	2.57	4111.00	3.07	6981.00	4.99	4860.00	3.53
Family labour	5037.40	3.58	4625.00	3.45	1583.00	1.13	3803.00	2.77
Machine labour	1500.00	1.07	1500.00	1.12	1500.00	1.07	1500.00	1.09
Total	10154.53	7.21	10236.00	7.63	10064.00	7.20	10163.00	7.39
Sowing								
Hired labour	119.00	0.08	226.00	0.17	1029.00	0.74	444.00	0.32
Family labour	1926.00	1.37	1581.00	1.18	542.00	0.39	1352.00	0.98
Total	2045.00	1.45	1807.00	1.35	1571.00	1.12	1796.00	1.31
Manuring and fertiliser application								
Input cost	35456.77	25.19	28892.84	21.55	25316.23	18.11	29451.78	21.42
Hired labour	1048.22	0.74	507.13	0.38	3496.59	2.50	1684.00	1.22
Family labour	8588.69	6 10	9912.19	7.39	5932.84	4.24	8368.90	6.09
Transport charge	303.00	0.22	218.00	0.16	182.00	0.13	228.00	0.17
Total	45396.68	32.25	39530.16	29.48	34927.67	24.99	39732.68	28.90
Panthal making								
Input cost	10214.76	7.26	10256.00	7.65	10139.00	7.25	10210.00	7.43
Hired labour	2088.58	1.48	1945.00	1.45	3936.69	2.82	2587.20	1.88
Family labour	3667.26	2.61	4004.74	2.99	1978.08	1.42	3303.23	2.40
Transport charge	303.00	0.22	218.00	0.16	159.00	0.11	221.00	0.16
Total	16273.61	11.56	16423.74	12.25	16212.77	11.60	16321.43	11.87
Plant protection								
Input cost	1808.00	1.28	1969.00	1.47	2305.00	1.65	2031.00	1.48
Hired labour	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Family labour	1302.17	0.93	1228.00	0.92	1256.00	0.90	1255.29	0.91
Transport charge	40.00	0.03	19.00	0.01	8.00	0.01	21.00	0.02
Total	3150.17	2.24	3216.00	2.40	3569.00	2.55	3307.29	2.41
Irrigation								
Hired labour	201.00	0.14	275.00	0.21	3649.00	2.61	1283.24	0.93
Family labour	7888.00	5.60	7046.00	5.25	2895.00	2.07	5994.00	4.36
Total	8089.00	5.75	7321.00	5.46	6544.00	4.68	7277.24	5.29
Harvesting								
Hired labour	921.00	0.65	2802.00	2.09	8885.00	6.36	4181.32	3.04
Family labour	12390.00	8.80	11024.00	8.22	4179.00	2.99	9284.00	6.75
Total	13311.00	9.46	13826.00	10.31	13064.00	9.35	13465.32	9.79
Miscellaneous cost	535.43	0.38	622.22	0.46	519.48	0.37	569.00	0.41
Depreciation	920.28	0.65	575.56	0.43	418.83	0.30	614.00	0.45
Land revenue	93.70	0.07	63.56	0.05	80.52	0.06	76.00	0.06
Interest on farm loan	2490.67	1.77	2305.00	1.72	3354.87	2.40	2670.00	1.94
Interest on working capital	1025.57	0.73	949.00	0.71	1381.42	0.99	1100.00	0.80
Interest on fixed capital	52.92	0.04	33.09	0.02	24.08	0.02	35.00	0.03
Rent on own land	23425.20	16.64	15888.89	11.85	20129.87	14.40	19071.00	13.87
Rent on leased in land	1574.80	1.12	9111.11	6.79	4870.13	3.48	5929.00	4.31
Allowance given for management of farm	12797.28	9.09	12190.60	9.09	12706.38	9.09	12500.00	9.09
Total cost	140770	100	134097	100	139770	100	137498	100

making than family labour (Rs.1978). Class wise expense on this operation were Rs.16274, Rs.16424 and Rs.16213 respectively for class I, II and III respectively.

Harvesting operation (9.79 per cent) came next to panthal making, in terms of its share in total cost. This operation contained expenses on hired labour amounting to Rs.4181.32 and family labour Rs.9284. For this operation also family labour had incurred a major share than hired labour, in all the classes except class III. For class III, hired labour's share (Rs.8885) was more than that of family labour's. (Rs.4179). Class I, class II and class III farmers incurred Rs.13311, Rs.13826 and Rs.13064 respectively as total cost for harvesting.

Land preparation occupied the next position. At aggregate level, total cost was Rs.10163, which took up 7.39 per cent share in total cost. It included cost of hired labour (Rs.4860), cost of family labour (Rs.3803) and cost of machine labour (Rs.1500), which contributed 3.53 per cent, 2.77 per cent and 1.09 per cent respectively. Thus at aggregate level, percentage share of hired labour was more than that of family labour which was found to be true only in the case of class III farmers. In class I and class II levels, family labour (Rs.5037 and Rs.4625 respectively) assumed prominence to hired labour (Rs.3617 and Rs.4111 respectively). Total expenses for class I, class II and class III farmers were Rs.10155, Rs.10236 and Rs.10064 respectively.

The share of irrigation in total cost was Rs.7277.24 (5.29 per cent), which comprised of that cost of hired labour that amounted to Rs.1283.24 (0.93 per cent) and cost of family labour to Rs.5994 (4.36 per cent) at aggregate level. Irrigation expenses for class I, class II and class III farmers were Rs.8099, Rs.7321 and Rs.6544 respectively. Here also, the share of family labour was found to be more than that of hired labour in all the class levels.

Expenses amounted to Rs.3307.29 (2.40 per cent) was incurred in plant protection measures at aggregate level. It comprised of the cost of chemicals

(Rs.2031), family labour cost (Rs.1255.29) and transportation cost (Rs.21). Thus it was evident that no hired labour was utilized for this operation in all the classes. Total costs were Rs.3150, Rs.3216 and Rs.3569 respectively for class I, class II and class III farmers.

Sowing required spending of Rs.1796 (1.31 per cent) which included hired labour charge (Rs.444) and family labour charge (Rs.1352) whose respective percentages to total cost were 0.32 per cent and 0.98 per cent. As farmers sourced their planting material from neighbour's or relative's field, they obtained the seed free of cost. Hence input cost was included as the labour charge incurred by the farmer for acquiring the planting material. Class wise expenses on sowing were Rs.2045, Rs.1807 and Rs.1571 for class I, class II and class III farmers in the respective order. Family labour was utilized more for sowing in the case of class I and class II farmers whereas in the case of class III farmers, hired labour (Rs.1029) dominated over the family labour (Rs.542).

Gupta and Verma (1997) reported that manuring and fertilizer application, plant protection and harvesting were very important variable cost component in ivy gourd. Similar results were obtained in this study also.

4.5.1.3. Labour use pattern

Total labour use was 387 man days at aggregate level, in which harvesting required the largest number of man days (107 man days) followed by fertiliser application cum weeding (80 man days), land preparation (69 man days), irrigation (58 man days), panthal making (47 man days), sowing (15 man days) and plant protection (10 man days).

Man days utilization was the highest for class I farmers for the operations sowing and irrigation followed by class II and class III. Largest share in total labour use for the operations, fertilizer application cum weeding, land

Table 4.5.1.3.Labour use pattern in ivy gourd main crop (man days)

Operations	class I			class II			class III			Aggregate		
	Hired labour	Family labour	Total	Hired labour	Family labour	Total	Hired labour	Family labour	Total	Hired labour	Family labour	Total
Land preparation	29	40	69	33	37	70	56	13	69	39	30	69
Sowing	1	15	16	2	13	15	8	4	12	4	11	15
Manuring,fertiliser application& weeding	8	69	77	4	79	83	28	47	75	13	67	80
Panthal making	17	29	46	16	32	48	31	16	47	21	26	47
Plant protection	0	10	10	0	10	10	0	10	10	0	10	10
Irrigation	2	63	65	2	56	58	29	23	52	10	48	58
Harvesting	7	99	106	22	88	110	71	33	104	33	74	107
Total	64	326	390	79	315	394	224	147	371	120	267	387

Table4.5.2.3.Labour use pattern in ivy gourd ratoon crop (man days)

Operations	class I			class II			class III			Aggregate		
	Hired labour	Family labour	Total	Hired labour	Family labour	Total	Hired labour	Family labour	Total	Hired labour	Family labour	Total
Pruning	1	12	13	0	11	11	1	13	14	1	12	13
Manuring,fertiliser application & weeding	4	63	67	2	57	59	33	33	66	13	51	64
Panthal making	17	29	46	16	32	48	31	16	47	21	26	47
Plant protection	0	8	8	0	7	7	0	8	8	0	8	8
Irrigation	2	63	65	2	56	58	29	23	52	11	47	58
Harvesting	5	74	79	15	72	87	44	27	71	21	58	79
Total	28	250	278	35	236	271	139	120	259	67	202	269

preparation and harvesting was contributed by class II farmers when compared to the other two.

4.5.1.4. Fertiliser use pattern

For ivy gourd, farmyard manure is recommended to be applied at the rate of 25 kg per pit. No recommendation is given for chemical fertilisers. But the sample farmers applied fertilisers like factomphos, urea MOP, 18 18 18 and 17 17 17 in addition to farm yard manure.

Table 4.5.1.4 Nutrient use in ivy gourd- main crop (per hectare)

Nutrient	Recommended dose	Farmer's practice		
		Class I	Class II	Class III
FYM (kg/pit)	25	19	16	16
N (kg)	-	214	207	217
P_2O_5 (kg)	-	119	115	124
K_2O (kg)	-	231	186	160

Farmers applied farmyard manure well below the recommended dose. Instead, they relied on chemical fertilizers, which have not been recommended for ivy gourd. Common manures and fertilizers used by the sample farmers is given in Table 4.5.1.5. From the table it is evident that, farmers applied more quantities of factomphos, 18 18 18 and MOP when compared to others. Class II and class III farmers increasingly depended on factomphos, which was found to be readily available in the study area.

Table 4.5.1.5. Manures and fertilizers use pattern of ivy gourd-main crop (kg/ha)

Manures and fertilisers	Farmer's practice		
	Class I	Class II	Class III
Neem cake	30	0	0
Castor cake	211	129	166
Groundnut cake	90	44	0
Factom phos	270	436	471
18 18 18	289	138	146
17 17 17	39	0	0
MOP	280	264	219
Urea	181	189	195

4.5.2. Cost of cultivation of ivy gourd (ratoon crop)

4.5.2.1.Input wise cost per hectare of ivy gourd (ratoon crop)

At the aggregate level, costs A_1, A_2, B_1, B_2, C_1, C_2 and C_3 were Rs.39148, Rs.45077, Rs.39184, Rs.64184, Rs.64738, Rs.89738 and Rs.98711 in the respective order. Same costs were Rs.36802, Rs.38376, Rs.36855, Rs.61855, Rs.69510, Rs.94510 and Rs.103961 respectively for class I farmers. These costs were Rs.34910, Rs.44021, Rs.34943, Rs.59943, Rs.64406, Rs.89406 and Rs.98347 for class II farmers in the same order. Class III farmers had these costs at Rs.47276, Rs.52146, Rs.47300, Rs.72300, Rs.61286, Rs.86286 and Rs.94915 respectively.

In the case of class I farmers, human labour was the largest item of expenditure occupying 34.68 per cent share in total cost. It was followed by rental value of land (24.04 per cent) consisting of rent on leased in land (1.51 per cent) and rental value of own land (22.53 per cent). The other items, which followed rental value, were manures (9.24 per cent), cost for management (9.09 per cent), panthalling material (9.83 per cent), fertilizers (7.21 per cent) and plant protection (1.74 per cent).

Highest expenditure was incurred for human labour (34.47 per cent) at class II level with hired labour occupying 4.46 per cent and family labour had a share of 29.96 per cent. Panthalling material took the third position with a share of 10.43 per cent after rental value of land (25.42 per cent) which included rental value of own land (16.16 per cent) and rent paid for leased in land (9.26 per cent). Allowance gives for management came next. It was followed by fertilizers (6.13 per cent) and plant protection chemicals (2.00 per cent).

In the case of class III farmers human labour accounted for the largest amount of expenditure which came to Rs.31331 (33.01 per cent) which included family labour (14.74 per cent) and hired labour (18.27 per cent). Rental

Table 4.5.2.1 Input wise cost of cultivation of ivy gourd-ratoon crop (Rs/ha)

Particulars	class I	per cent	class II	per cent	class III	per cent	Aggregate	per cent
Hired labour	3401	3.27	4388	4.46	17344	18.27	8084	8.19
Machine labour	0	0.00	0	0.00	0	0.00	0	0.00
Manures	9603	9.24	8573	8.72	8187	8.63	8714	8.83
Fertilisers	7496	7.21	6033	6.13	5256	5.54	6164	6.24
Panthalling material	10215	9.83	10256	10.43	10139	10.68	10210	10.34
Plant protection	1808	1.74	1969	2.00	2305	2.43	2031	2.06
Transport charge	646	0.62	454	0.46	349	0.37	470	0.48
Land revenue	94	0.09	64	0.06	81	0.08	76	0.08
Depreciation	920	0.89	576	0.59	419	0.44	614	0.62
Interest on farm loan	1476	1.42	1400	1.42	1895	2.00	1570	1.59
Interest on working capital	608	0.58	576	0.59	780	0.82	646	0.65
Miscellaneous cost	535	0.52	622	0.63	519	0.55	569	0.58
Cost A1	36802	35.40	34910	35.50	47276	49.81	39148	39.66
Rent paid for leased in land	1575	1.51	9111	9.26	4870	5.13	5929	6.01
Cost A2	38376	36.91	44021	44.76	52146	54.94	45077	45.67
Interest on fixed capital	53	0.05	33	0.03	24	0.03	35	0.04
Cost B1	36855	35.45	34943	35.53	47300	49.83	39184	39.70
Rental value of own land	23425	22.53	15889	16.16	20130	21.21	19071	19.32
Cost B2	61855	59.50	59943	60.95	72300	76.17	64184	65.02
Inputed value of family labour	32655	31.41	29463	29.96	13987	14.74	25554	25.89
Cost C1	69510	66.86	64406	65.49	61286	64.57	64738	65.58
Cost C2	94510	90.91	89406	90.91	86286	90.91	89738	90.91
Allowance given for management of farm	9451	9.09	8941	9.09	8629	9.09	8974	9.09
Cost C3	103961	100	98347	100	94915	100	98711	100

Fig.4.Input wise cost of cultivation of ivy gourd-main crop

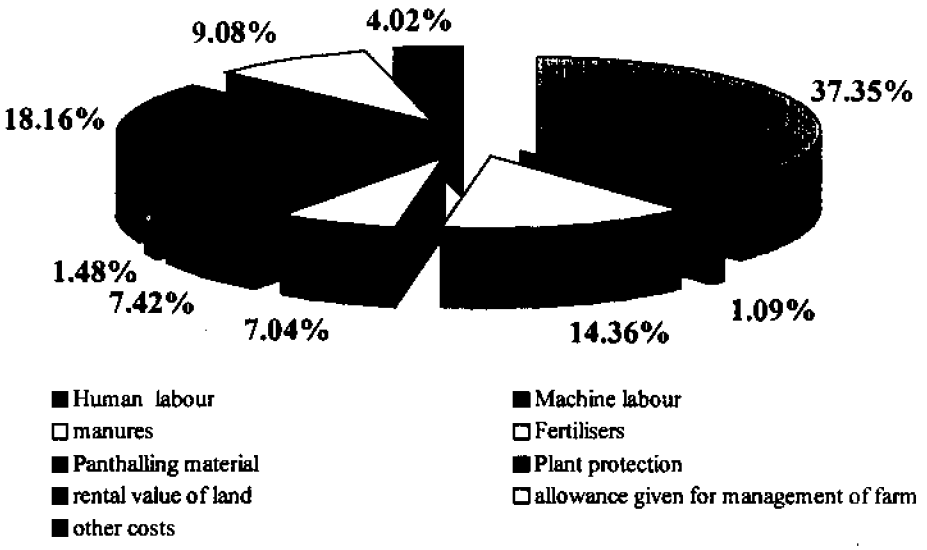
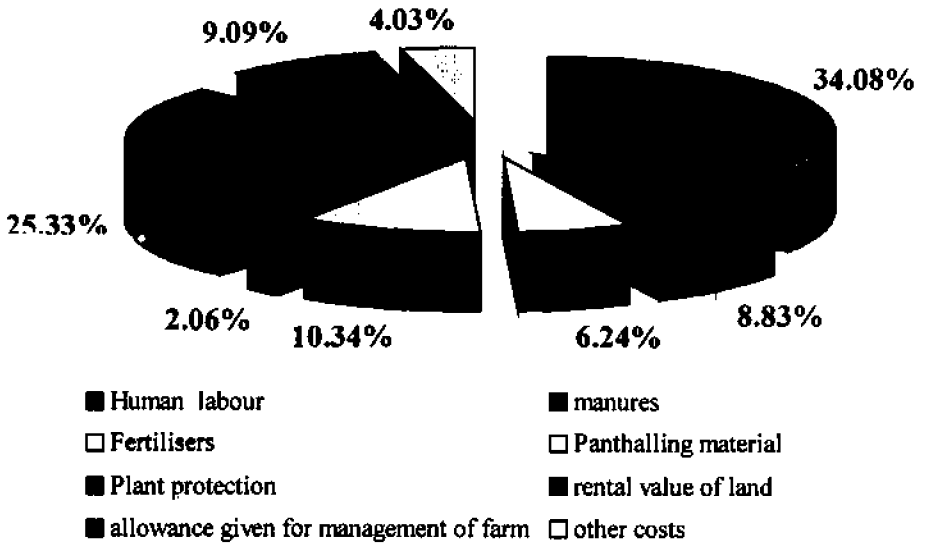


Fig.5.Input wise cost of cultivation of ivy gourd-ratoon crop



value of land (26.34 per cent) occupied the second position, followed by panthalling material (10.68 per cent), Allowance given for management of farm (9.09 per cent), manures (8.63 per cent), fertilizers (5.54 per cent) and plant protection (2.43 per cent).

At the aggregate level also, human labour (Rs.33638) was the largest item of expenditure. Rental value of land (25.33 per cent) came next with rent on leased in land (6.01 per cent) and rental value of own land (19.32 per cent). Cost of panthalling material came to Rs.10210, which occupied 10.34 per cent share of total cost. It was followed by cost of farm management (9.09 per cent), manures (8.83 per cent), fertilizers (6.24 per cent) and plant protection chemicals (2.06 per cent).

It was observed that costs A_1, A_2, B_1 and B_2 were the highest for class III, while costs C_1, C_2 and C_3 were found to have a declining trend from class I to class III. The share of hired labour increased from 3.27 per cent to 18.27 per cent and that of family labour decreased from 31.41 per cent to 14.74 per cent from class I to class III. Manures and fertilizers had an decreasing trend, while plant protection had a increasing trend from class I to class III. Class II farmers incurred the highest expenditure on panthalling materials.

When main and ratoon crops of ivy gourd were compared, all types of input costs except plant protection were less in ratoon crop when compared to main crop at aggregate level. Same trend was noticed in the case of ABC cost components.

Human labour was the largest item of expenditure in all the classes. In vegetables, Thakur *et al* (1994) found that 25.40 per cent of the variable cost was occupied by human labour alone which supported the findings of the present study. Cost of hired labour was increasing from class I to class III. This was

confirmed by the study of Nahatkar and Pant (1984) who reported that the cost of hired labour was higher on medium and large farms as compared to small ones.

4.5.2.2.Operation wise cost per hectare of ivy gourd (ratoon crop)

As seen in other cases, manuring fertilizer application cum weeding operation was the single largest item of expenditure in ratoon crop. At aggregate level, it contributed 23.32 per cent (Rs.23022) towards total cost. Amount spent by class I, II and III farmers were Rs.25822, Rs.22232 and Rs.21870 respectively. This operation included the following costs; cost of manures and fertilizers which was Rs.14877.88 (15.07 per cent), cost of hired labour amounting to Rs.1501.90 (1.52 per cent), cost of family labour which was Rs.6414.32 (6.50 per cent) and transportation cost amounting to Rs.228 (0.24 per cent) at aggregate level. It was evident that percentage share was more for family labour than for hired labour in all the classes.

Panthal making cost was estimated to be Rs.16321 (16.53 per cent of total cost), out of which input cost contributed 10.34 per cent of total cost. It came to Rs.10209.88 at aggregate level. Hired labour (Rs.2587) and family labour (Rs.3303) constituted 2.62 per cent and 3.35 per cent respectively. Class I and class II farmers were depended on family labour in greater proportion when compared to hired labour for this operation, while class III farmers had to resort to more hired labour (Rs.3937) than family labour (Rs.1978). Class wise expenses for this operation were Rs.16274, Rs.16424 and Rs.16213 respectively for class I, class II and class III levels.

Harvesting showed up as the next important item constituting nearly 10.26 per cent (Rs.10132.23) of the total cost at aggregate level. Hired labour amounted to Rs.2647 (2.68 per cent) and family labour to Rs.7485 (7.58 per cent). Class I, class II and class III farmers had the total cost of harvesting pegged at Rs.9862, Rs.10856 and Rs.8968 in the respective order. Thus it was

Table 4.5.2.2.Operation wise cost of cultivation of ivy gourd (Rs/ha)

Particulars	class I	per cent	class II	per cent	class III	per cent	Aggre gate	per cent
Pruning								
Hired labour	119.00	0.11	54.00	0.05	115.00	0.12	63.96	0.06
Family labour	1534.00	1.48	1343.00	1.37	1603.00	1.69	1417.00	1.44
Total	1653.00	1.59	1397.00	1.42	1718.00	1.81	1480.96	1.50
Manuring and fertiliser application								
Input cost	17098.70	16.45	14606.09	14.85	13443.51	14.16	14877.88	15.07
Hired labour	526.00	0.51	278.63	0.28	4094.41	4.31	1501.90	1.52
Family labour	7894.59	7.59	7128.82	7.25	4149.65	4.37	6414.32	6.50
Transport charge	303.00	0.29	218.00	0.22	182.00	0.19	228.00	0.23
Total	25822.29	24.84	22231.54	22.61	21869.57	23.04	23022.10	23.32
Panthal making								
Input cost	10215.00	9.83	10256.00	10.43	10139.00	10.68	10209.88	10.34
Hired labour	2088.58	2.01	1945.00	1.98	3936.69	4.15	2587.20	2.62
Family labour	3667.26	3.53	4004.74	4.07	1978.08	2.08	3303.23	3.35
Transport charge	303.00	0.29	218.00	0.22	159.00	0.17	221.00	0.22
Total	16273.85	15.65	16423.74	16.70	16212.77	17.08	16321.31	16.53
Plant protection								
Input cost	1500.00	1.44	2169.00	2.21	2413.00	2.54	2030.93	2.06
Hired labour	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Family labour	977.00	0.94	921.00	0.94	942.00	0.99	941.46	0.95
Transport charge	40.00	0.04	19.00	0.02	8.00	0.01	21.00	0.02
Total	2517.00	2.42	3109.00	3.16	3363.00	3.54	2993.39	3.03
Irrigation								
Hired labour	201.00	0.19	275.00	0.28	3649.00	3.84	1283.24	1.30
Family labour	7888.00	7.59	7046.00	7.16	2875.00	3.03	5994.00	6.07
Total	8089.00	7.78	7321.00	7.44	6524.00	6.87	7277.24	7.37
Harvesting								
Hired labour	567.00	0.55	1836.00	1.87	5549.00	5.85	2647.23	2.68
Family labour	9295.00	8.94	9020.00	9.17	3419.00	3.60	7485.00	7.58
Total	9862.00	9.49	10856.00	11.04	8968.00	9.45	10132.23	10.26
Miscellaneous cost	535.43	0.52	622.22	0.63	519.48	0.55	569.17	0.58
Depreciation	920.28	0.89	575.56	0.59	418.83	0.44	614.00	0.62
Land revenue	93.70	0.09	63.56	0.06	80.52	0.08	76.00	0.08
Interest on farm loan	1475.54	1.42	1399.70	1.42	1895.49	2.00	1570.00	1.59
Interest on working capital	607.57	0.58	576.35	0.59	780.49	0.82	646.00	0.65
Interest on fixed capital	52.92	0.05	33.09	0.03	24.08	0.03	35.00	0.04
Rent on own land	23425.20	22.53	15888.89	16.16	20129.87	21.21	19071.00	19.32
Rent on leased in land	1574.80	1.51	9111.11	9.26	4870.13	5.13	5929.00	6.01
Allowance given for management of farm	9450.98	9.09	8940.62	9.09	8628.63	9.09	8974.00	9.09
Total cost	103961	100	98347	100	94915	100	98711	100

observed that family labour held a remarkable share in total cost in harvesting operation when compared to hired labour in the case of class I and class II farmers. Class III farmers was inclined towards using more hired labour (Rs.5549) than family labour (Rs.3419) for the same purpose.

Irrigation incurred an expense of Rs.7277.24 (7.37 per cent) at aggregate level. It included the cost of hired labour (1.30 per cent) and family labour (6.07per cent) which were respectively given as Rs.1283.24 and Rs.5994. Total amount spent for irrigation by class I, class II and class III farmers were Rs.8089, Rs.7321 and Rs.6524 respectively. Family labour were utilized for irrigation purposes in greater proportion when compared to hired labour by class I and class II farmers. For class III farmers dependency on hired labour (Rs.3649) was found to be more than that on family labour (Rs.2875).

Plant protection measures contributed in 3.03 per cent (Rs.2993.39) to the total cost at aggregate level, in which majority of the cost was covered by the input cost of Rs.2030.93 (2.06 per cent) followed by family labour charge of Rs.941.46 (0.95 per cent) and transportation cost of Rs.21 (0.02 per cent). Here also, the entire operation was carried out by family labour alone in all the classes. Rs.2517, Rs.3109 and Rs.3363 were the costs incurred by class I, class II and class III farmers respectively

At aggregate level, Rs.1480.96 were spent on pruning the crop, which took up 1.50 per cent of total cost. It was composed of hired labour charge of Rs.63.96 (0.06 per cent) and family labour charge of Rs.1417 (1.44 per cent). Expenses meted out by class I, class II and class III farmers towards pruning were observed to be Rs.1653, Rs.1397 and Rs.1718 in the respective order. Family labour held a substantial share in pruning in all the classes when compared to hired labour.

4.5.2.3.Labour use pattern

At aggregate, level, total labour use was 269 man days. Here also harvesting utilized the maximum number of labour days (79 man days) followed by fertilizer application cum weeding operation (64 man days), irrigation (58 man days), panthal making (47 man days), pruning (13 man days) and plant protection (8 man days).

Total labour use for class I, II and III farmers were 278, 271 and 259 man days respectively. Class I farmers utilized most number of man days, for operations like fertilizer application cum weeding and irrigation, while labour use was the highest in panthal making and harvesting for class II farmers. When compared to other classes, class III farmers demanded most number of man days for pruning operation.

4.5.2.4 Fertiliser use pattern

As observed in main crop, here also, farmyard manure applied was far below the recommended dose. The sample farmers of the ratoon crop applied less than half the recommended dose of FYM. However, they added chemical fertilizers, which have not been recommended.

Table 4.5.2.4. Nutrient use in ivy gourd- ratoon crop (per hectare)

Nutrient	Recommended dose	Farmer's practice		
		Class I	Class II	Class III
FYM (kg/pit)	25	9.2	9.5	10
N (kg)	-	178	153	118
P_2O_5 (kg)	-	94	66	58
K_2O (kg)	-	220	188	175

The common fertilizers used by the sample farmers for the ratoon crop is given in Table 4.5.2.5. Factomphos, MOP and urea were used by the

sample farmers in greater quantities. Fertilizer use was less in ratoon crop when compared to the main crop.

Table 4.5.2.5. Fertilisers use pattern of ivy gourd-ratoon crop (kg/ha)

Fertiliser	Farmer's practice		
	Class I	Class II	Class III
Factom phos	270	162	146
18 18 18	146	167	97
17 17 17	79	22	65
MOP	301	257	244
Urea	181	186	130

4.6. PRODUCTION AND VALUE OF OUTPUT

4.6.1 Output per hectare in bittergourd, snakegourd and ivy gourd

The output of vegetables viz. bittergourd, snakegourd and ivy gourd on per hectare basis is given in 4.6.1.The analysis of output per hectare of bittergourd revealed that, output obtained by class I farmers (23907 kg/ha) was higher than that of class II farmers (22680 kg/ha) and was less than that of class III farmers (24085 kg/ha).

Table 4.6.1. Output per hectare in bittergourd, snakegourd and ivy gourd.

Crop	Output (kg/ha)			
	Class I	Class II	Class III	Aggregate
Bittergourd	23907	22680	24085	23721
Snakegourd	24959	24097	21843	23999
Ivy gourd (main crop)	19554	19894	18019	19364
Ivy gourd (ratoon crop)	16954	17294	15419	16764

In the case of snakegourd, class I farmers had the highest output per hectare which was 24959 kg/ha followed by class II (24097 kg/ha) and class III (21843 kg/ha).For class III farmers productivity of bittergourd was highest

which was in conformity with the study of Brahmaiah and Naidu (1993).But that was lowest in the case of snakegourd.

For ivy gourd, output per hectare obtained by class II farmers was the highest. It was 19894 kg/ha for the main crop and 17294 kg/ha for the ratoon crop. Class I farmers occupied the second position with 19554 kg/ha for main crop and 16954 kg/ha for the ratoon crop. Class III farmers had the lowest per hectare output (18019 for main crops and 15419 for ratoon crop). Compared to the main crop, yield was lesser in ratoon crop. Similar trend was noticed in cabbage by Mankar *et al* (1990)

At the aggregate level, the outputs were 23721 kg/ha, 23999 kg/ha, 19364 kg/ha and 16764 kg/ha respectively in the case of bittergourd, snakegourd, ivy gourd (main crop) and ivy gourd (ratoon crop).

4.6.2 Value of output per hectare in bittergourd, snakegourd and ivy gourd

The value of output of vegetables under study is shown in Table 5.6.2. The total value of output per hectare of these vegetables was Rs.186195, Rs.116565, Rs.135547 and Rs.117347in the respective order at the aggregate level.

Table 4.6.2. Returns per hectare in bittergourd, snakegourd and ivy gourd

Crop	Value (Rs./ha)			
	Class I	Class II	Class III	Aggregate
Bittergourd	191256	181444	192677	186195
Snakegourd	124794	120483	109215	116565
Ivy gourd (main crop)	136876	139257	126136	135547
Ivy gourd (ratoon crop)	118676	121057	107936	117347

The total value of bittergourd was highest for class III (Rs.192677) followed by class I (Rs.191256) and class II (Rs.181444). In the case of snakegourd, the total value per hectare was found to be decreasing from class I to class III. For ivy gourd (main crop) and ivy gourd (ratoon crop), total value was the highest for class II farmers (Rs.139257 and Rs.121057 respectively) followed by class I (Rs.136876 and Rs.118676 respectively) and class III (Rs.126136 and Rs.107936 respectively).

4.6.3.Cost of production per quintal of vegetables

4.6.3.1. Cost of production of bittergourd

Cost of production per quintal of the bittergourd was given in Table 4.6.3.1.Class wise analysis showed that an increasing trend was observed in the case of cost of production at A_1, A_2, B_1, B_2 and B_3 from class I to class III while the reverse was observed in the case of costs at C_1, C_2 and C_3. Cost of production per quintal at cost C_3 basis for class I, class II and class III and at aggregate levels were Rs.468, Rs.456, Rs.416 and Rs.446 respectively. As observed by Gupta (1987) cost of production per unit area was lower on large sizes farms, making them economically more efficient. Cost of production for the sample as a whole were Rs.226, Rs.247, Rs.226, Rs.261, Rs.370 and Rs.405 per quintal in the respective order for cost A_1, cost A_2, cost B_1, cost B_2, cost C_1 and cost C_2.

4.6.3.2.Cost of production of snakegourd

From the Table 4.6.3.1, it was evident that the cost of production at A_1, A_2, B_1, B_2 and B_3 were the highest for class III that followed a decreasing trend to class I, in the case of snakegourd. Costs of production on C3 basis were Rs.443, Rs.426 and Rs.441 for class II, III farmers and I respectively. At the aggregate level, costs at A_1, A_2, B_1, B_2, C_1, C_2 and C_3 were observed in the respective order as Rs.226, Rs.247, Rs.226, Rs.261, Rs.359, Rs.391 and

Table 4.6.3.1Cost of production of bittergourd, and snakegourd (Rs/quintal)

Particulars	Bittergourd				Snakegourd			
	class I	class II	class III	Aggregate	class I	class II	class III	Aggregate
Hired labour	38	51	70	50	42	46	55	46
Machine labour	6	7	6	6	6	6	7	6
Seed	6	6	6	6	5	6	6	6
Manures	68	68	78	67	64	71	67	70
Fertilisers	31	27	31	29	45	36	40	38
Panthalling material	39	41	41	40	37	37	42	38
Plant protection	12	18	14	14	7	9	9	9
Transport charge	3	2	1	2	3	2	1	2
Land revenue	0.13	0.22	0.20	0.17	0.16	0.16	0.18	0.16
Depreciation	3	4	2	3	3	3	3	3
Interest on farm loan	3	3	4	3	3	3	3	3
Interest on working capital	1	1	1	1	1	1	1	1
Miscellaneous cost	4	5	4	5	5	5	5	5
Cost A1	215	233	259	226	222	225	241	226
Rent paid for leased in land	24	18	18	21	20	21	23	21
Cost A2	239	251	277	247	241	246	264	247
Interest or fixed capital	0.06	0.07	0.05	0.06	0.06	0.06	0.06	0.06
Cost B1	215	233	259	226	222	225	241	226
rental value of own land	11	18	17	14	14	13	15	14
Cost B2	250	269	294	261	255	260	279	261
Inputed value of family labour	176	145	84	144	148	128	121	130
Cost C1	390	378	343	370	370	353	391	359
Cost C2	425	414	378	405	403	388	401	391
Allowance given for management of farm	43	41	38	41	40	39	40	39
Cost C3	468	456	416	446	443	426	441	430

Rs.430.Cost incurred in producing one quintal of bittergourd (Rs.446) was higher than the cost in that of snakegourd (Rs.430). Similar results were reported by Sandhya (1992)

4.6.3.3.Cost of production of ivy gourd (main crop)

Cost of production of ivy gourd was given in the Table 4.6.3.2. The analysis of cost of production per quintal at various cost concepts revealed that at all the cost concepts; cost of production was the highest for class III farmers. On cost C_3 basis, when cost of production was calculated it was found that highest cost per quintal was attributed to class III farmers (Rs.776) followed by class I (Rs.720) and class II (Rs.674). An amount of Rs.344, Rs.375, Rs.344, Rs.473, Rs.516, Rs.646 and Rs.710 respectively were spent to produce one quintal of ivy gourd at aggregate level on costs A_1, A_2, B_1, B_2, C_1, C_2 and C_3.

4.6.3.4.*Cost of production of ivy gourd (ratoon crop)*

Cost of production in relation with various cost concepts, as revealed by the Table 4.6.3.2, indicated that cost of production per quintal were highest for class III farmers at all the cost concepts. Cost of production on cost C_3 basis for class I, class II, class III and for sample as a whole were Rs.613, Rs.569, Rs.677 and Rs.589 respectively. At the aggregate level, costs A_1, A_2, B_1, B_2, C_1 and C_2 were obtained in the respective order as Rs.234, Rs.269, Rs.234, Rs.383, Rs.386 and Rs.535.

Cost of production per quintal was maximum for ivy gourd in the study area when compared to other vegetables. The study conducted by Koshta and Chandrakar (1997) showed a different picture. The results indicated that cost of production was minimum for ivy gourd.

Table 4.6.3.2.Cost of production of ivy gourd (Rs/quintal)

Particulars	Ivygourd(main crop)				Ivygourd (ratoon crop)			
	class I	class II	class III	Aggregate	class I	class II	class III	Aggregate
Hired labour	41	50	213	93	20	25	124	48
Machine labour	5	8	8	7	0	0	0	0
Seed	-	-	-	-	-	-	-	-
Manures	130	97	88	102	57	50	58	52
Fertilisers	51	48	53	50	44	35	37	37
Panthalling material	52	52	56	53	60	59	72	61
Plant protection	9	10	13	10	11	11	16	12
Transport charge	3	2	2	2	4	3	2	3
Land revenue	0.48	0.33	0.41	0.39	0.55	0.37	0.57	0.46
Depreciation	5	3	2	3	5	3	3	4
Interest on farm loan	13	12	19	14	9	8	14	9
Interest on working capital	5	5	8	6	4	3	6	4
Miscellaneous cost	3	3	3	3	3	4	4	3
Cost A1	318	289	464	344	217	202	337	234
Rent paid for leased in land	8	46	27	31	9	53	35	35
Cost A2	326	335	491	375	226	255	372	269
Interest or fixed capital	0.27	0.17	0.12	0.18	0.31	0.19	0.17	0.21
Cost B1	318	289	465	344	217	202	337	234
rental value of own land	120	80	112	98	138	92	144	114
Cost B2	446	415	603	473	365	347	516	383
Inputed value of family labour	209	198	102	172	193	170	100	152
Cost C1	527	487	566	516	410	372	437	386
Cost C2	654	613	705	646	557	517	615	535
Allowance given for management of farm	65	61	71	65	56	52	62	54
Cost C3	720	674	776	710	613	569	677	589

4.6.4. Bulkline cost of production

According to Dhondyal and Krishna (1959) there are two extremities of producers-the least efficient ones or the high cost producers and the efficient producers having the lowest cost of production. The costs of either of these categories of producers cannot be accepted as the basis of price-fixing, because in the former case the poor consumers would be hard hit, whereas in the latter case a majority of cultivators would go broke. The only alternative left is to accept the average total cost per unit of bulkline producers as the basis for price fixation.

Bulkline cost for bittergourd, snakegourd, ivy gourd (main crop) and ivy gourd (ratoon crop) were worked out and they are shown in Table 4.6.4. In the case of bittergourd, bulkline cost was estimated at Rs.508 per quintal. The bulkline output was supplied by 77 per cent of the sample farmers. Bulkline cost of snakegourd was Rs.484 and the bulkline output was supplied by 78 per cent of the cultivators. For ivy gourd (main crop) bulkline cost came to Rs.852 the output of which was supplied by 77 per cent of farmers. Bulkline cost of ivy gourd (ratoon crop) was Rs.768 and 74 per cent at the cultivators contributed to the bulkline output.

Table 4.6.4. Bulkline cost of production (Rs./quintal)

Crop	Bulkline cost (1)	Per cent to the total supply (2)	Percentage of cultivators coming under categories (1) and (2)
Bittergourd	508	84.58	77
Snakegourd	484	84.31	78
Ivy gourd (main crop)	852	85.00	77
Ivy gourd (ratoon crop)	768	86.60	74

4.6.5. Farm efficiency measures

Income measures in relation to various cost concepts were worked out for the vegetables and presented in Tables 4.6.5.1, 4.6.5.2 and 4.6.5.3 respectively. The profitability of the crop production can be judged better from the income measures, namely, farm business income, own farm business income, family labour income, net income and farm investment income.

4.6.5.1. Farm efficiency measures of bittergourd

The farm business income, own farm business income, family labour income, net income and farm investment income at the aggregate level for bittergourd were Rs.132612, Rs.127605, Rs.124264, Rs.80478 and Rs.98437 respectively. Class wise analysis showed that farm business income, own farm business income and family labour income were the greatest for class I farmers followed by class III farmers and class II farmers. But, in the case of net income and farm investment income, class III farmers occupied the first position, class I came next and class II had the lowest. Net income at class I, class II and class III levels were Rs.79399, Rs.78044 and Rs.92566 in the respective order.

Table 4.6.5.1. Farm efficiency measures of bittergourd (Rs./ha)

Farm efficiency measures	Income			
	Class I	Class II	Class III	Aggregate
Farm business income	139930	128673	130295	132612
Own farm business income	134225	124482	126020	127605
Family labour income	131583	120324	121951	124264
Net income	79399	78044	92566	80478
Farm investment income	97916	95793	110012	98437

4.6.5.2 *Farm efficiency measures of snakegourd*

Farm business incomes at cost A1 were Rs.69459, Rs.66271 and Rs.56542 for class I, class II and class III respectively. The same at aggregate level was Rs.62338. Own farm business income at cost A_2 were Rs.64527,

Rs.61134, Rs.51440 and Rs.57236 at class I, class II, class III and at aggregate levels respectively. Family labour income at cost B_1 was estimated to be Rs.53956 at aggregate level, while that for class I, class II and class III were Rs.61110, Rs.57877 and Rs.48195 in the respective order. Net income at cost C_3 for various class levels were Rs.14164 for class I, Rs.17754 for class II and Rs.12961 for class III farmers. At aggregate level, the same was Rs.13288. Farm investment income obtained by deducting the value of family labour from farm business income was found to be Rs.32570, Rs.35487, Rs.30058 and Rs.31059 at class I, class II, class III and at aggregate levels.

Table 4.6.5.2. Farm efficiency measures of snakegourd (Rs./ha)

Farm efficiency measures	Income			
	Class I	Class II	Class III	Aggregate
Farm business income	69459	66271	56542	62338
Own farm business income	64527	61134	51440	57236
Family labour income	61110	57877	48195	53956
Net income	14164	17754	12962	13288
Farm investment income	32570	35487	30058	31059

4.6.5.3. *Farm efficiency measures of ivy gourd*

In ivy gourd cultivation most of the farmers in the study area obtained profits only during the second year i.e., during the ratoon crop. During the main crop most of them suffered losses or enjoyed only nominal profits. So it is highly beneficial to extend the ivy gourd cultivation to two or more years. Hence, farm efficiency measures were calculated by adding the main crop income measures and ratoon crop income measures on per hectare basis.

Table 4.6.5.3. Farm efficiency measures of ivy gourd (Rs./ha)

Farm efficiency measures	Income			
	Class I	Class II	Class III	Aggregate
Farm business income	156630	167953	103123	147142
Own farm business income	153480	149731	93383	135284
Family labour income	106524	117887	53075	97071
Net income	10821	27870	-612	16684
Farm investment income	83175	99069	70771	88229

Fig.6 Farm efficiency measures of bittergourd

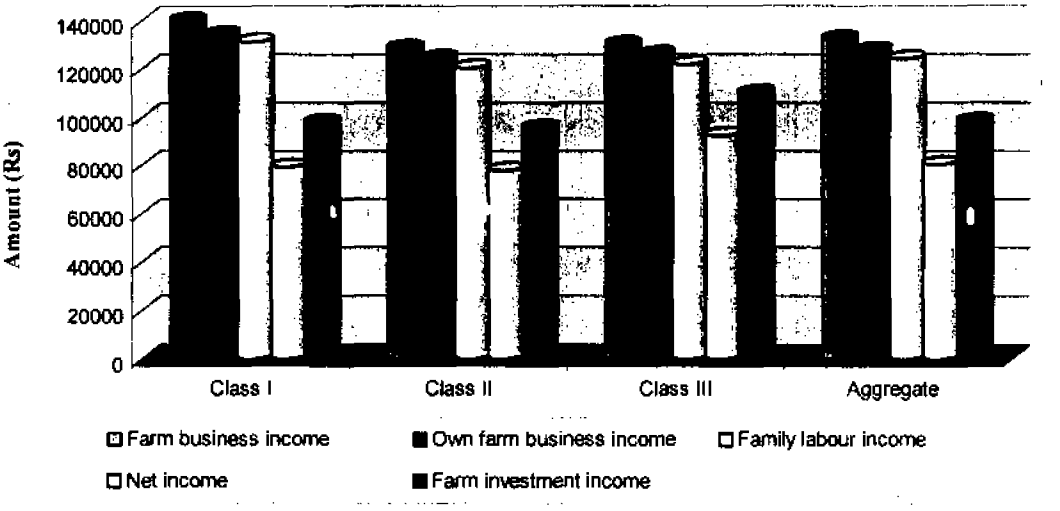
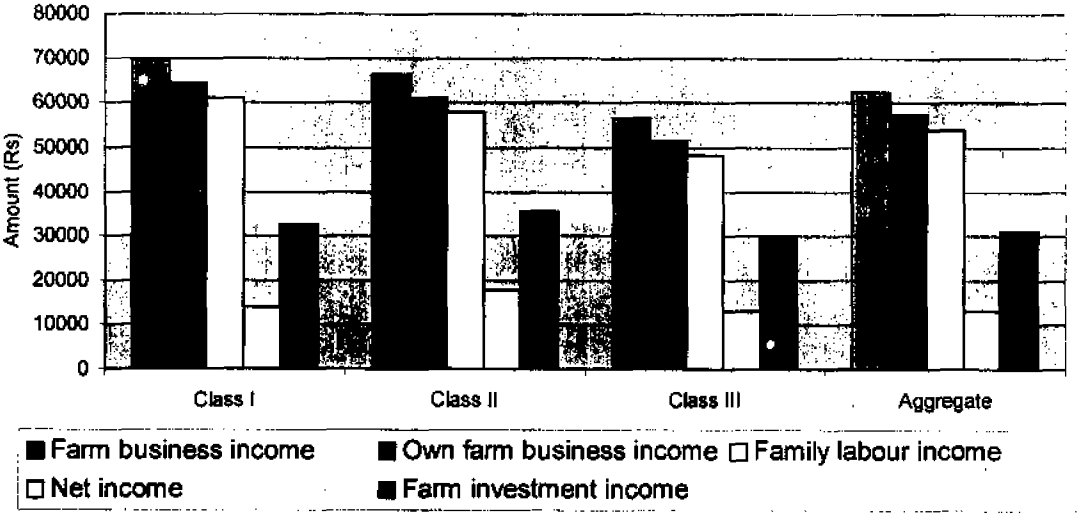


Fig.7.Farm efficiency measures of snakegourd



Thus, at the aggregate level, the farm business income, own farm business income, family labour income, net income and farm investment income were Rs.147142, Rs.135284, Rs.97071, Rs.16684 and Rs.88229 in the respective order. Class wise analysis showed that all the income measures except own farm business income, were the highest for class II farmers followed by class I and class III. In the case of own farm business income, class I farmers had the largest figure and that showed a decreasing trend from class I to class III. Profits on cost C_3 basis for the three classes were Rs.10821, Rs.27870 and Rs.-612 respectively. Class III farmers incurred a loss to the tune of Rs.612 at cost C_3.

When the three vegetables were compared, net income estimated was the highest for bittergourd (Rs.80478) followed by ivy gourd (Rs.16684) and snakegourd (Rs.13288) at the aggregate level, as per hectare basis. Sandhya (1992) and Nagesh (2001) came up with a similar result indicating that bittergourd was the most remunerative crop.Net income of bittergourd was five and two times greater than that of snakegourd and ivy gourd respectively.

4.6.6. Benefit cost ratio

The benefit cost ratio indicates value of output per rupee of input cost. This ratio will serve as a measure, which would indicate whether the cost incurred is commensurate with the returns obtained. Benefit cost ratio of bittergourd, snakegourd and ivy gourd were estimated separately for various cost concepts and the results are presented in Tables 4.6.6.1, 4.6.6.2. and 4.6.6.3 respectively.

4.6.6.1 Benefit cost ratio of bittergourd

The analysis of benefit cost ratio of bittergourd revealed that investment of one rupee yielded more than one rupee for all the classes. BC ratio at cost A_1, A_2, B_1 and B_2 were highest for class I followed by class II and class III.

On cost C_3 basis, BC ratio of class I, class II and class III farmers were 1.71, 1.75 and 1.89 respectively. On an average bittergourd sustained a benefit cost ratio of 1.76 at cost C_3 level.

Table 4.6.6.1. Benefit cost ratio of bittergourd at different cost concepts

Cost	Benefit cost ratio			
	Class I	Class II	Class III	Aggregate
Cost A_1	3.73	3.44	3.09	3.47
Cost A_2	3.35	3.19	2.89	3.18
Cost B_1	3.73	3.44	3.09	3.47
Cost B_2	3.21	2.97	2.72	3.01
Cost C_1	2.05	2.12	2.33	2.12
Cost C_2	1.88	1.93	2.12	1.94
Cost C_3	1.71	1.75	1.89	1.76

4.6.6.2. *Benefit cost ratio of snakegourd*

The analysis of benefit cost ratio revealed that returns generated from a rupee were greater than one for all the classes. BC ratios for class I, class II and class III at cost C3 were 1.11, 1.17 and 1.12 respectively.

Table 4.6.6.2. Benefit cost ratio of snakegourd at different cost concepts

Cost	Benefit cost ratio			
	Class I	Class II	Class III	Aggregate
Cost A_1	2.26	2.22	2.07	2.15
Cost A_2	2.07	2.03	1.89	1.96
Cost B_1	2.25	2.22	2.07	2.15
Cost B_2	1.96	1.92	1.79	1.86
Cost C_1	1.35	1.42	1.28	1.35
Cost C_2	1.24	1.29	1.25	1.24
Cost C_3	1.11	1.17	1.12	1.13

From BC ratio at cost A_1 to that at cost B_2, the ratio were found to have a declining trend from class I to class III. On an average, snakegourd can bring about Rs.1.13 as returns on every rupee invested. Class II farmers had the highest BC ratio at cost concepts C_1, C_2 and C_3.

4.6.6.3. *Benefit cost ratio of ivy gourd*

It was observed that for class I and class, II BC ratio at all cost concepts were more than one. But it was so less for class III that BC ratio at cost C_3 came as low as 0.99 and the average was also centered around one (1.05). At aggregate level, the ratios based on cost A_1, A_2, B_1, B_2, C_1, C_2 and C_3 were 2.39, 2.15, 2.39, 1.62, 1.54, 1.18 and 1.07 respectively.

Table 4.6.6.3. Benefit cost ratio of ivy gourd at different cost concepts

Cost	Benefit cost ratio			
	Class I	Class II	Class III	Aggregate
Cost A_1	2.58	2.82	1.79	2.39
Cost A_2	2.50	2.35	1.66	2.15
Cost B_1	2.58	2.82	1.79	2.39
Cost B_2	1.71	1.83	1.29	1.62
Cost C_1	1.48	1.61	1.43	1.54
Cost C_2	1.15	1.23	1.10	1.18
Cost C_3	1.04	1.12	0.99	1.07

Ivy gourd crop was found to be severely affected by a viral disease, which was found to occur every year as the farmers used the same planting material for their next planting as well. Moreover, they are ignorant of a proper control measure to check the disease. The disease was extensively found among class III farmers, which caused the BC ratio to go below one.

BC ratio obtained was highest for bittergourd (1.78) followed by snakegourd (1.13) and ivy gourd (1.05) Sandhya (1992) reported that a rupee invested returned Rs.1.88 for bittergourd. Bhalerao and Maurya (1985) obtained a BC ratio of 2.11 for bittergourd, which was the highest among the vegetables studied.

4.6.7. **Input-output relationship**

The explicit and implicit costs per hectare were worked out for the crops under study and are given in Table 4.6.7. The explicit costs, which

Fig.8.Farm efficiency measures of ivy gourd

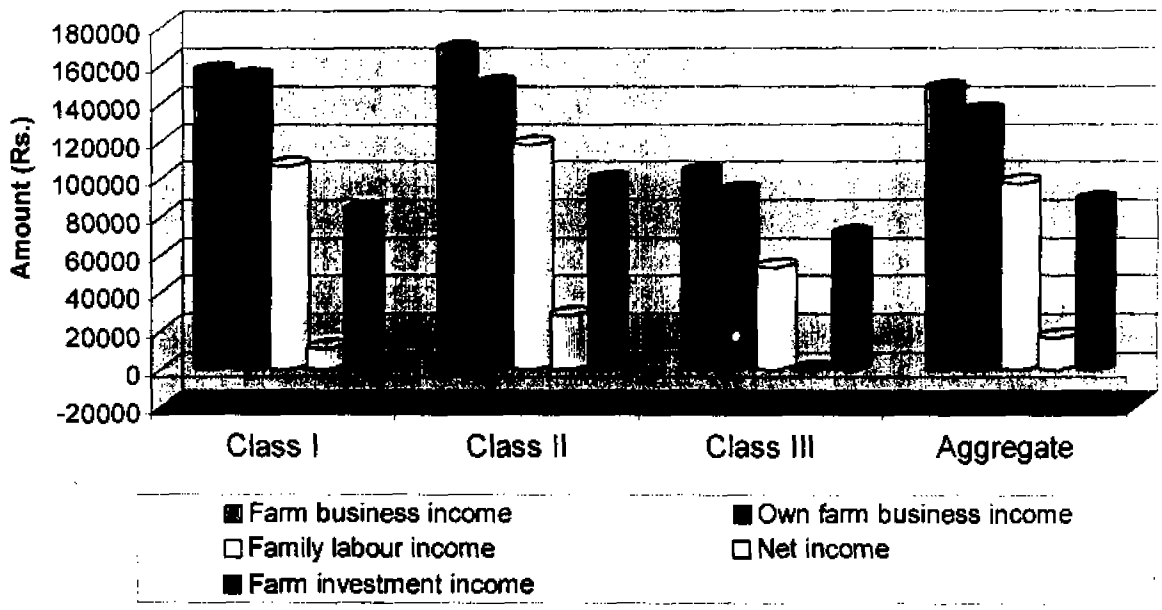
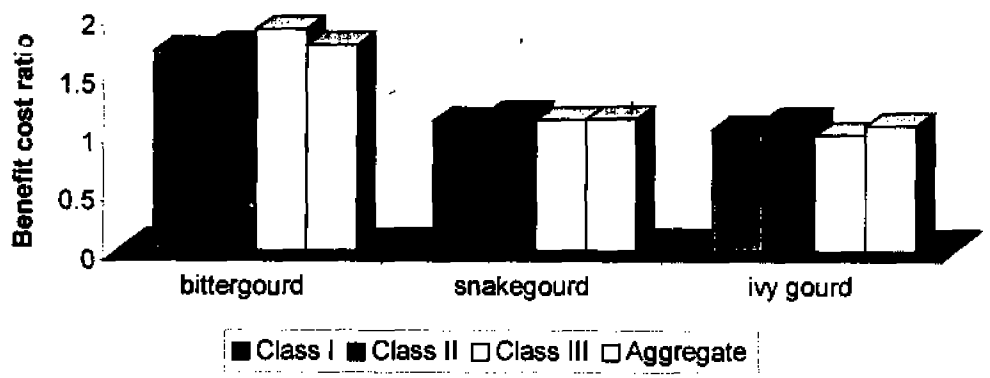


Fig.9.Benefit cost ratio of vegetables



included all the paid out costs, were Rs.55027, Rs.54293, Rs.72934 and Rs.38217 respectively for bittergourd, snakegourd ivygourd (main crop) and ivygourd (ratoon crop) Net returns at explicit costs per hectare were the highest for bittergourd (Rs.131168) followed by ivygourd (ratoon crop) with Rs.79130, ivygourd (main crop) with Rs.62613 and snakegourd (Rs.62272).

Table 4.6.7 Input-output relationship in bittergourd, snakegourd and ivygourd

Particulars	Bittergourd	Snakegourd	Ivygourd (main crop)	Ivygourd (ratoon crop)
Cost per hectare (Rs.)				
Explicit cost	55027	54293	72934	38217
Implicit cost	50690	48984	64564	60494
Total cost	105717	103277	137498	98711
Returns per hectare (Rs.)	186195	116565	135547	117347
Net returns Per hectare (Rs.)				
At explicit cost level	131168	62272	62613	79130
At total cost level	80478	13288	-1951	18636
BC ratio				
At explicit cost level	3.38	2.15	1.86	3.07
At total cost level	1.76	1.13	0.99	1.16

Implicit cost was less than the explicit cost in the case of bittergourd (Rs.50690), snakegourd (Rs.48984) and ivy gourd- main crop (Rs.64564), while in ivygourd-ratoon crop (Rs.60494); it was greater than the explicit cost. This is because of the fact that no expense was incurred on land preparation during the ratoon crop of ivygourd. More over cost on manures and fertilizers and labour got reduced to half in ratoon crop, when compared to that in main crop. As the paid out cost in the main crop of ivygourd was higher than at ratoon crop, BC ratio at explicit cost level (1.86) was less than that in ratoon crop (3.07). It can be inferred that when explicit cost alone was considered, ivy gourd cultivation was profitable in the main crop itself. It was the inclusion of implicit cost in the total cost which made the net returns negative (Rs.-1951) at total cost

level. Bittergourd had the highest BC ratio (3.38) at paid out cost followed by ivygourd-ratoon crop, snakegourd (2.15) and ivy gourd-main crop.

4.7. MEASUREMENT OF TECHNICAL EFFICIENCY

Efficiency is a very important concept in production economics where resources are meager and opportunities for developing and adopting better technologies are competitive Efficiency of a farm refers to its performance in the utilization of resources at its disposal. It is also important to know-how well the resources are being utilized and what possibilities exist for improving the operational efficiency in the phase of overall resource scarcity.

Efficiency studies would show whether it is still possible to raise productivity by improving the level of efficiency without actually increasing the resource base. Estimates on the extent of inefficiency could also help to decide whether to improve efficiency (or) to develop technologies to raise agricultural productivity.

In the present study to understand the technical efficiency among the vegetable farmers, the stochastic frontier function of Cobb-Douglas form was estimated using Maximum Likelihood Estimator (MLE) method. The stochastic frontier function analysis attempted in this study had the vegetable output in quintals, as the dependent variable and independent variables included were land in cents or mounds in number, labor in man days, manures in tonnes, fertilizers in kg and plant protection chemicals in ml. The model was fitted separately for each crop under study. Both average production function (OLS) and stochastic production function were estimated for bittergourd, snakegourd and ivy gourd.

4.7.1. OLS estimates

The OLS estimates of bittergourd, snakegourd and ivy gourd were shown in Tables 4.7.1,4.7.2 and 4.7.3

4.7.1.1. *OLS estimates of bittergourd*

When land was included as one of the variables, the parameters of the model namely land, labour, fertilizer, manure and plant protection were significant at 38.89,0.07,8.86,0.58 and 0.01 percent probability level respectively. Thus plant protection was found to be most significantly influencing the yield followed by labour, manure, fertilizer and land.

Table 4.7.1 OLS estimates of bittergourd

Explanatory variables	Coefficient	P value	Explanatory variables	Coefficient	P value
Constant	-0.8821	0.0520	Constant	-2.2138	0.0000
Land	0.1577	0.3889	Mounds	0.8661	0.0000
Labor	0.6250	0.0007	Labor	0.1382	0.1382
Fertilizer	0.0945	0.0886	Fertilizer	0.0310	0.4935
Manure	0.2004	0.0058	Manure	0.0936	0.498
Plant protection	0.2438	0.0001	Plant protection	0.1279	0.0261
R^2	0.91		R^2	0.96	

When mounds were added as a variable instead of land the parameters labour, fertilizer, manure and plant protection were found to be significant at the probability levels 13.82,49.35,49.8 and 2.61 percent respectively, whereas mound was significant at 0.001 percent probability level. Mounds had the highest effect on yield followed by plant protection, labour, fertilizer and manure.

4.7.1.2. *OLS estimates of snakegourd*

The parameters of the model namely labour, fertilizer, manure and plant protection were significant at 88.78,12.27,0.02 and 1.01 percent probability level respectively when land was included as a variable. Land was significant at 0.001 percent probability level, which indicated that, land exerted the greatest influence on yield. Others which followed land were manures, plant protection, fertilizer and labour in the respective order.

Table 4.7.2 OLS estimates of snakegourd

Explanatory variables	Coefficient	P value	Explanatory variables	Coefficient	P value
Constant	2.0411	0.0000	Constant	1.5319	0.0036
Land	0.4396	0.0000	Mounds	0.2623	0.045
Labor	0.0102	0.8878	Labor	0.0806	0.2128
Fertilizer	0.0794	0.1227	Fertilizer	0.1356	0.0101
Manure	0.1973	0.0002	Manure	0.2810	0.0000
Plant protection	0.1309	0.0101	Plant protection	0.1504	0.0094
R^2	0.90		R^2	0.89	

Adding mounds as a variable instead of land it was noticed that the parameters constant, mounds, labour, fertilizer, manure and plant protection were found to be significant at the probability levels 0.36,0.45,21.28,1.01,0.001 and 0.94 percent respectively. Analysis revealed that the effect of manures on yield was the highest, which was followed by mounds, plant protection fertilizers and labour.

4.7.1.3. *OLS estimates of ivygourd*

The parameters of the model namely constant, land, labour, fertilizer, manure and plant protection were significant at 1.63,0.001,8.45,12.86,0.84 and 65.89 percent probability level respectively in which land was found to affect the yield most.

When mounds were added as a variable instead of land the parameters constant, mounds, labour, fertilizer, manure and plant protection were found to be significant at the probability levels 42.59,6.39,0.18,0.001,0.68 and 67.11 percent respectively. Fertilizer had the greatest influence on yield followed by labour, manure, mounds and plant protection. Plant protection had the least effect on yield in both the cases

Table 4.7.3 OLS estimates of ivygourd

Explanatory variables	Coefficient	P value	Explanatory variables	Coefficient	P value
Constant	1.0288	0.0163	Constant	0.3841	0.4259
Land	0.5691	0.0000	Mounds	0.2053	0.0639
Labor	0.0469	0.0845	Labor	0.2900	0.0018
Fertilizer	0.3714	0.1286	Fertilizer	0.3603	0.0000
Manure	0.0769	0.0084	Manure	0.2499	0.0068
Plant protection	0.0258	0.6589	Plant protection	0.0199	0.6711
R^2	0.98		R^2	0.98	

4.7.2. Maximum likelihood estimates (MLE) of stochastic production frontier

Estimates of stochastic production frontier function of bittergourd, snakegourd and ivy gourd were given in tables 4.7.4, 4.7.5 and 4.7.6 respectively.

4.7.2.1 *MLE estimates of bittergourd*

In the first case were land was included as variable the values of γ indicated that 83.88 per cent of the variation between the actual output and the maximum possible output was due to the technical inefficiency at the farmers level.

Table 4.7.4 MLE estimates of bittergourd

Explanatory variables	Coefficient	P value	Explanatory variables	Coefficient	P value
Constant	-0.3963	0.5124	Constant	-2.0128	0.0000
Land	0.1376	0.5291	Mounds	0.8725	0.0000
Labor	0.6042	0.0053	Labor	0.1221	0.1618
Fertilizer	0.0634	0.3825	Fertilizer	0.0244	0.6478
Manure	0.2272	0.0003	Manure	0.0746	0.1127
Plant protection	0.2529	0.0000	Plant protection	0.1441	0.0110
σ^2_u	0.04579	-	σ^2_u	0.02749	-
σ^2_v	0.00880	-	σ^2_v	0.0014	-
γ	0.8388	-	γ	0.95286	-
MTE	0.85	-	MTE	0.88	-

As σ^2_v is tending to zero, farmers yield differed from the maximum feasible yield mainly because it did not use the best practice technique. It can be observed that σ^2_u is tending to zero which implied that various factors other than technical inefficiency of the farmers have come to act to reduce the farmers yield from the frontier yield. Mean technical efficiency (MTE) was found to be 0.85. Thus the farmers were 15 per cent less efficient in utilizing the inputs and hence they had the potential to increase the yield.

When mounds were added as a variable γ was estimated to be 0.95 which indicated that 95 per cent of the variation between the actual output and the maximum possible output was due to technical inefficiency. As in the other case both σ^2_v and σ^2_u are tending to zero and thus they are found to have a cumulative effect. It revealed that the farmers were not using best practice technique and various factors other than technical inefficiency had a significant effect on yield. Mean technical efficiency was 0.88. This was in conformity with that obtained by Nagesh (2001) among bittergourd growers.

From the frontier equation it can be observed that when land was taken as a decisive factor the parameters, namely labour, manure and plant protection were found to be highly significant in which labour played the most important part. Here the parameter land did not play significant role. When mounds were taken into consideration, the most important parameters that were found to be significant were number of mounds and plant protection. A comparison of these two frontiers will bring out the fact that it was the proper development and utilization of land that was quite essential as could be seen from the significance of the mounds. Inorder to increase the technical efficiency of the input appropriate manuring and timely plant protection are also important for the crop.

4.7.2.2. *MLE estimates of snakegourd*

The value of γ estimated for the frontier production functions were 0.64 and 0.55 respectively when land and mounds were added as variable. It

revealed that 64 per cent and 55 per cent of the yield differences from the frontier yield were due to technical inefficiency at the farmer's level in the respective order. But the combined effect of σ^2_v and σ^2_u which were tending to zero gave an indication that in addition to technical inefficiency other factors which were beyond the control of the farmer had influenced the yield. Mean technical efficiency estimated was 0.91 and 0.92 in the two cases respectively. The stochastic frontier estimates of cool season vegetables obtained by Karthikeyan (2001) supported the findings of this study.

Table 4.7.5 MLE estimates of snakegourd

Explanatory variables	Coefficient	P value	Explanatory variables	Coefficient	P value
Constant	2.0882	0.0000	Constant	1.5644	0.0002
Land	0.4367	0.0002	Mounds	0.2640	0.0000
Labor	0.02162	0.7911	Labor	0.0929	0.2421
Fertilizer	0.0790	0.2190	Fertilizer	0.1343	0.0181
Manure	0.2088	0.0012	Manure	0.2866	0.0000
Plant protection	0.1260	0.0141	Plant protection	0.1451	0.0204
σ^2_u	0.01678	-	σ^2_u	0.01548	-
σ^2_v	0.00960	-	σ^2_v	0.01284	-
γ	0.6355	-	γ	0.5466	-
MTE	0.91	-	MTE	0.92	-

Manure and plant protection had a highly significant effect on the output when compared to other parameters in both the cases. Thus their adequate application has to be given importance. Number of mounds had the greatest effect when it was included as a variable and the comparison of the two frontier estimates indicate that mounds had a greater role than land. Hence farmers should take care to prepare the appropriate number of mounds.

4.7.2.3. *MLE estimates of ivy gourd*

When land and mounds were included as variables the stochastic frontier estimates of γ (0.93 and 0.92 respectively), σ^2_v (0.00076 and 0.00104

respectively) and σ^2_u (0.01027 and 0.01152 respectively) revealed that technical inefficiency and various other factors beyond the control of the farmer had together contributed to the decrease the yield from the maximum possible yield. More than 90 per cent of the differences in yield were attributed to the inefficiency in the use of the inputs.

Table 4.7.6 MLE estimates of ivy gourd

Explanatory variables	Coefficient	P value	Explanatory variables	Coefficient	P value
Constant	0.9711	0.3499	Constant	0.6633	0.1593
Land	0.7365	0.0001	Mounds	0.2065	0.1257
Labor	0.0216	0.3386	Labor	0.2451	0.0159
Fertilizer	0.1409	0.2094	Fertilizer	0.2561	0.0027
Manure	0.0766	0.5789	Manure	0.3626	0.0154
Plant protection	0.0342	0.6566	Plant protection	0.0333	0.4943
σ^2_u	0.01027	-	σ^2_u	0.01152	-
σ^2_v	0.00076	-	σ^2_v	0.00104	-
γ	0.9310	-	γ	0.9172	-
MTE	0.58	-	MTE	0.92	-

When mounds were added as a variable instead of land, labour, manure and fertilizer were found to be the major decisive factors of the yield. This necessitated the appropriate and timely usage of these inputs in the cultivation of ivy gourd. Mean technical efficiency was 0.92. But when land was included mean technical efficiency got reduced to 0.58 and all the inputs except land assumed less significance and land projected itself as the dominant variable. This showed that land was not utilized properly and farmers should take care to prepare adequate number of mounds in a given area of land.

A mean technical efficiency of 0.92 in the case of mound as a decisive factor signified that the output could be raised by 8 per cent without any additional resources in the ivy gourd growing area, which was found to follow the results of the study conducted by Rajashekharappa *et al* (2004)

4.7.3.Farm specific technical efficiencies

Technical efficiency of the individual farms were worked out in the two cases: land as a variable and mound as a variable for bittergourd, snakegourd and ivy gourd, the frequency distribution of which were given in Tables 4.7.7. and 4.7.8 respectively.

When land was taken as a variable, the farm specific technical efficiencies revealed that for bittergourd, 30 per cent of the sample farmers operated in a technical efficiency of 80-90 per cent while 28 per cent operated above 90 per cent efficiency. Fourty eight per cent of the snakegourd farmers were found to operate in a technical efficiency of more than 90 per cent, while none of the ivy gourd farmers had an efficiency of greater than 70 per cent and 55 per cent of them operated in an efficiency range of 50-60 per cent.

Tables 4.7.7.Frequency distribution of farm specific technical efficiencies when land was included as one of the variable.

Efficiency level (per cent)	Bittergourd	Snakegourd	Ivy gourd
30-40	-	-	1
40-50	-	-	4
50-60	4	1	33
60-70	10	3	22
70-80	11	4	-
80-90	18	23	-
90-100	17	29	-

Inclusion of mound as a variable increased the percentage of bittergourd (38 per cent) and snakegourd farmers (58 per cent) operating in a technical efficiency of more than 90 per cent. In the case of ivy gourd, all the sample farmers confined themselves to an efficiency range of 50 -100 per cent, in which, 62 percent had more then 90 per cent efficiency.

Tables 4.7.8.Frequency distribution of farm specific technical efficiencies when mound was included as one of the variable

Efficiency level (per cent)	Bittergourd	Snakegourd	Ivy gourd
50-60	5	1	2
60-70	3	3	2
70-80	14	6	4
80-90	15	15	15
90-100	23	35	37

Thus it could be observed that technical efficiency varied widely between 30 and 100 per cent. Similar results were reported earlier by Karthikeyan (2001) and Elsamma and George (2002)

4.8. MARKETING

Marketing is as critical to better performance in agriculture as farming itself. (Acharya and Agarwal, 2004). It is not enough to produce a crop or an animal product; it must be satisfactorily marketed. An efficient marketing system always pays dividend to the producers and safeguard interests of the consumers and is by all means, a pre-requisite for the well being of the community in general and farmers in particular.

In the present study an attempt has been made to identify the important marketing channels and to analyse the marketing efficiency of the identified channel, with respect to bittergourd, snakegourd and ivy gourd, as indicated by marketing costs and margins.

4.8.1. Market Structure.

The term market structure refers to those organizational characteristics of the market, which influence the nature of completion and pricing

and influence the conduct of business firms. (George and Singh, 1970). It also includes the manner of operation of the market (Acharya and Agarwal, 2004).

Often, bittergourd and snakegourd growers took their produce to VFPCK market. The entire harvest was sold to VFPCK. Out of the whole lot, the farmers sold a few kilograms, which were of low quality, directly to the consumers. VFPCK used to direct the traders to the farmers plot where they could get the required quantity of vegetables. Hence the farmers could save the cost of transporting the produce from farm to market. However, VFPCK retained five per cent of the entire value of the produce of grower as commission and the remaining amount were handed over to them. Growers need not pay any market entry, fee loading and unloading charges and weighing charges. Thus a major rate was played by VFPCK in the marketing of vegetables in Nemmara block panchayat.

Among the VFPCK functioning in Nemmara, the one at Vithanassery, was considered to the best. During July 2004, they could bring into effect a sale of 422 tonnes of vegetables, in which bittergourd and snakegourd contributed more than 80 per cent. They were planning to export vegetables for which farmers were being induced to practice organic farming. This significant role of VFPCK was earlier acknowledged by Nagesh (2001).

In the case of ivy gourd, farmers organized in groups and carried their produce to Trichur wholesale market using Temp van, Lorry or Jeep. In the absence of a VFPCK nearby, farmers have problems in marketing like high marketing cost and low price of the produce. The frequent motor vehicles strikes in Kerala also impede the efficient marketing of ivy gourd.

4.8.2. Marketing channels.

Marketing channels are the routes through which producers move from producers to consumers. The different marketing channels identified in the marketing of bittergourd and snakegourd are given below:

1. Producer – Consumer
2. Producer – VFPCK market – Wholesaler – Retailer – Consumer

The second channel, Producer – VFPCK market – wholesaler – Retailer– consumer, was the most important marketing channel in the case of bittergourd and snake gourd. Almost all the farmers depended on it. At times, they used the first channel to dispose off the damaged, diseased or low quality produce.

Ivy gourd farmers marketed their produce through the following channels.

1. Producer – Commission agent – Wholesaler – Retailer – Consumer
2. Producer – Wholesaler – Retailer – Consumer
3. Producer – Retailer – Consumer
4. Producer – Consumer

More than 90 per cent of the farmers depended on the first channel, producer – commission agent – wholesaler – retailer – consumer, to market their produce. Farmers took their produce to Trichur wholesale market, where it was sold at a price fixed by the traders.

4.8.3. Marketing efficiency

There are two aspects of marketing efficiency, namely technical and economic efficiency. The latter can be assessed by different methods such as marketing margins, degree of market integration and temporal and spatial price differences. In the present study marketing efficiency is assessed on the basis of marketing costs and margins. In the marketing of agricultural commodities, the difference between the price paid by the consumer and the price received by the

producer for an equivalent quantity of farm produce is often known as price spread. (Acharya and Agarwal, 2004).

There are two concepts of marketing margins such as concurrent margin and lagged margin. The concept of concurrent margin is used in the present study in which the price prevailing at different stages of marketing are compared with reference to a given point of time. In the study, the average prices received by the vegetable growers were compared with the prices that prevailed in the Trichur wholesale market.

The marketing costs and margins for bitter gourd, snake gourds and ivy gourds are given in Table 4.8.1.

Table 4.8.1. Marketing costs and margins (in Rs., per kg.)

Particulars	Crops		
	Bittergourd	Snakegourd	Ivy gourd
Price received by the farmer	8.0	5.0	7.0
Marketing cost of the farmer	---	---	1.0
Commission paid by the farmer	0.4	0.25	0.56
Net price received by the farmer	7.6	4.75	5.44
Price received by VFPCK	8.0	5.0	---
Marketing cost of wholesaler	0.90	0.90	0.50
Net margin of wholesaler	3.0	2.00	4.00
Price received by the wholesaler	11.90	7.90	11.50
Marketing cost of retailer	1.15	1.15	0.30
Net margin of retailer	1.95	0.95	3.20
Price paid by the consumer	15.00	10.00	15.00

In the case of bitter gourd, out of Rs. 15 per kilogram paid by the consumer, Rs. 7.6 (50.70 per cent) went to the producer seller and in the case of snakegourd producer's share was Rs. 4.75 (47.50 per cent) out of Rs. 10.00 per kilogram paid by the consumer. The wholesalers reaped a net margin of Rs. 3.00 (20 per cent) per kg for bittergourd and Rs. 23.00 (13.33 per cent) and Rs. 2.00 per kg for snake gourd. The retailer's net margin was 1.95 (12 per cent) per kg

for bittergourd and Rs. 0.95 (6.3 per cent) per kg for snake gourd. Devi (1996) reported that in the case of vegetables, marketing margin was higher than the cost incurred by the farmer.

Both for bittergourd and snake gourd, wholesaler's margins were higher than that of retailer's. The producer's share in consumer's rupee was 50.70 per cent and 47.50 per cent in the case of bittergourd and snakegourd respectively. Thus middlemen took away a substantial share of consumer's rupee in the case of snakegourd while for bittergourd almost 50 per cent of the share of consumer's rupee went to the producer seller. This is because of the greater demand of bittergourd when compared to that of snake gourd.

The marketing efficiency of bittergourd and snakegourd were worked out to be 1.03 and 0.91 respectively. The higher the ratio the higher is the efficiency of marketing system. Hence bittergourd was marketed more efficiently than snake gourd. This was in conformity with the findings of Nagesh (2001) who could find that marketing efficiency was the highest for bittergourd (1.99) followed by snakegourd (1.31)

Analysis of marketing costs and margins of ivy gourd revealed that out of Rs. 15.00 per kg. paid by consumer only Rs. 5.44 per kg. (36.3 per cent) went to the producer seller. Thus producer is share in consumer's rupee, in the case of ivy gourd, was only 36.3 per cent. Here also, wholesaler's margin (26.7 per cent) was more than that of retailer's (21.33 per cent). It could be noted that farmer's incurred a high marketing cost to the tune of Rs. 1.56 per kg (10.4 per cent) of the produce. This was supported by the study of Gupta and Verma (1997) and Koshta and Chandrakar (1997) who stated that marketing cost was maximum in ivy gourd when compared to other vegetables.

Marketing efficiency was 0.57 for ivy gourd, which was the lowest among the vegetables under study. This gave a proof of the inefficient system of

marketing existing in the study area for ivy gourd and highlighted the role of VFPCK in the efficient marketing of bittergourd and snake gourd, when compared to ivy gourd.

4.9.CONSTRAINTS IN VEGETABLE CULTIVATION

The constraints in vegetable cultivation as perceived by the sample farmers were identified through the pilot study and ten major constraints faced by them were included in the final interview schedule. The constraints were ranked in the order of their importance. These ranks were given weights as mentioned in the methodology to find out the order of importance of constraints according to the responses of the farmers. The results are given in tables 4.9.1. and 4.9.2.

Incidence of pests and diseases was the most important constraint identified by 30 per cent of the respondents, while it was the second important problem for 28 per cent of them. After giving weights the total score of this constraint was estimated to be 1495,which was the highest one. The second most important problem was the input cost. High cost of panthalling material and plant protection chemicals was a major constraint in vegetable cultivation. As much as, 22 per cent of the farmers ranked it first.

Inadequacy of capital was considered as the third important problem. Most of the farmers could not repay the loans timely because of which they were not given further loans by the banks. So they had to depend upon non-institutional sources like moneylenders who charged high rate of interest. Moreover, banks provided loans only to those farmers who owned an area of at least one acre of land. Farmers who raised vegetables in leased in land were not owners of land and thus they could not avail loan from any commercial bank. The problem of inadequate capital was felt as the most important one for 12 per cent of the respondents. Non-availability of labour was the next serious constraint. The problem of low price of the produce was ranked fifth.

Table.5.9.1.Constraints in vegetable cultivation as ranked by respondents

Ranks	Incidence of pests and diseases	Low price of the produce	Lack of irrigation facilities	Inadequacy of capital	Poor germination of seeds	Lack of marketing facilities	Non availability of labour	Climatic factors	High input cost	Others
1	54	10	0	21	0	22	16	8	39	10
2	50	20	0	32	0	2	10	10	45	11
3	23	22	0	33	0	5	9	31	49	8
4	20	30	1	30	0	18	42	8	26	5
5	23	22	1	13	2	11	38	10	10	50
6	5	31	0	5	0	46	31	14	8	40
7	3	15	56	17	28	5	12	21	3	20
8	2	19	41	11	49	3	15	34	0	6
9	0	2	49	8	49	51	6	11	0	4
10	0	9	30	10	50	17	1	33	0	26
NA	0	0	2	0	2	0	0	0	0	0
Total	180	180	180	180	180	180	180	180	180	180

Table.5.9.2.Scores of constraints after giving weights

Ranks	Incidence of pests and diseases	Low price of the produce	Lack of irrigation facilities	Inadequacy of capital	Poor germination of seeds	Lack of marketing facilities	Non availability of labour	Climatic factors	High input cost	Others
1	540	100	0	210	0	220	160	80	390	100
2	450	180	0	288	0	18	90	90	405	99
3	184	176	0	264	0	40	72	248	392	64
4	140	210	7	210	0	126	294	56	182	35
5	138	132	6	78	12	66	228	60	60	300
6	25	155	0	25	0	230	155	70	40	200
7	12	60	224	68	112	20	48	84	12	80
8	6	57	123	33	147	9	45	102	0	18
9	0	4	98	16	98	102	12	22	0	8
10	0	9	30	10	50	17	1	33	0	26
NA	0	0	0	0	0	0	0	0	0	0
Total	1495	1083	488	1202	419	848	1105	845	1481	930
Order of importance	1	5	9	3	10	7	4	8	2	6

In the event of strikes and bandhs, which were highly frequent in Kerala, farmers suffered difficulty in selling off their produce. Ten per cent of the sample farmers voted it as the most important problem. This was included under the category of others, which assumed the sixth rank. This was followed by constraints like lack of marketing facilities, climatic factors, lack of irrigation facilities and poor germination of seeds with scores of 848,845,488 and 419 respectively.

Increased cost of plant protection chemicals was reported as the most important constraint in a study conducted by Prasad and Bonney (1996). But in the present study incidence of pests and diseases turned out to be the most important one. The same was identified by Karthikeyan (2001) as the second important constraint next to low price of the produce.

Summary and conclusion

5. SUMMARY AND CONCLUSIONS

The present study on production and marketing of vegetables viz. bittergourd, snakegourd and ivy gourd in Palakkad district was undertaken during the year 2004 – 2005. The main objective of the study was to examine the profitability, market structure and technical efficiency in vegetable production and marketing. The concerned vegetables are predominantly grown in Nemmara block panchayat of Palakkad district and hence it was selected as the study area.

The study was based on primary data collected from 180 vegetable farmers (60 each for bittergourd, snakegourd and ivy gourd) through personal interview method. Percentage analysis was done for analysis the date on production and marketing aspects. Stochastic frontier production function was fitted for estimating technical efficiencies of farms. The sixty growers of each crop were classified into three classes based on the size of the land holding. All the costs, returns and other parameters have been discussed on per hectare basis.

5.1 BITTERGOURD

The total cost of cultivation at aggregate level was Rs. 105717. This was sound to be declining from class I (Rs. 111857) to class III (Rs. 100111). Human labour constituted the highest share of 43.49 per cent followed by manures (15.04 per cent), cost incurred for management of farm (9.09 per cent) and panthalling material (8.89 per cent). Total labour use at the aggregate level was 343 man days in which manuring, fertilizer application cum weeding required the highest number (87 man days) followed by irrigation (80 man days).

Manuring, fertilizer application and weeding operation incurred the highest expense in all the classes. All aggregate level, if amounted to Rs. 33852 (32.02 per cent). It was followed by panthal making (14.23 per cent) irrigation (9.44 per cent) and harvesting (9.11 per cent). Fertilizers were used two to seven

times in excess of the recommended usage by the sample farmers. But, farmyard manure applied was less than the recommended rate. Among the fertilizers, factomphos and M O P were found to be applied in higher quantities.

Farmers had not followed the package of practices recommendation for the major pest and disease attack vegetable crops. Instead, they used more costly insecticides and fungicides, which had harmful effect on the environment. Attack by jassids and incidence of diseases like leaf spot and yellowing were found to be severe in the study area, against which a control measure has not been recommended.

Out put per hectare was highest for class III (24085 kg/ha) followed by Class I (23907 Kg/ha) and Class II (22680 Kg. 1 ha.). At aggregate level, it was 23721 kg/ha. The total value of out put was Rs. 186195, at aggregate level. Class III (Rs. 192677) had the highest value followed by Class I (Rs. 191256) and Class II (Rs. 181444). Cost of production per quintal, at aggregate level, was Rs. 446. A decreasing trend was observed in the case of cost per quintal from class I (Rs. 468) to Class III (Rs. 416). Bulk line cost was estimated at Rs. 508 per quintal and the bulk line out put was supplied by 77 per cent of the sample farmers.

The farm business income, own farm business income, family labour income, net income and farm investment income at the aggregate level were Rs. 13612, Rs. 1237605, Rs. 124264, Rs. 80478 and Rs. 98437 respectively. Net income was highest for Class III (Rs. 92566) followed by Class I (Rs. 79399) and class II (Rs.780440). Benefit cost ratio at aggregate level was 1.76 each rupee invested, yielded 1.71, 1.75 and 1.89 for class I, II and III respectively. The explicit and implicit costs per hectare were Rs. 55027 and Rs.50690 respectively. At explicit cost level, net returns was Rs. 131178 and benefit cost ratio was 3.38.

OLS estimates indicated that plant protection and number of mounds had the highest effect on yield when land and mounds were included as variables respectively. The mean technical efficiency was 0.85 and 0.88 in the two cases in the respective order.

Marketing channels identified for bittergourd were

(1) Producer – Consumer and

(2) Producer – VFPCK market – Wholesaler – Retailer – Consumer.

The second channel was the most important marketing channel. Almost all the farmers marketed through this route. Out of Rs. 15 per kg. paid by this consumer Rs. 7.6 (50.70 per cent) went to the producer. The wholesaler's margin (Rs. 3.00 kg.) was more than the retailer's margin (Rs. 12.95 per kg.) Marketing efficiency was worked out to be 1.03.

5.2 SNAKEGOURD

Analysis of input wise cost per hectare showed that, human labour (41 per cent) incurred the highest expenditure at the aggregate level followed by manures (16.21 per cent), allowance given for management of farm (9.09 per cent), fertilizers (8.77 per cent) and panthalling material (8.75 per cent). Total cost of cultivation was found to decrease from Class I (Rs. 110630) to Class III (Rs. 96253), while that at aggregate level was Rs. 103277. At aggregate level, total labour use was 339 man days, in which fertilizer application cum weeding demanded the most number (86 man days) followed by irrigation (84 man days) and harvesting (68 man days).

Manuring, fertilizer application and weeding (35.59 per cent) accomplished the highest share in the total cost which was followed by the operations, panthal making (14.38 per cent), irrigation, (10.12 per cent) and harvesting (825 per cent).Fertilizers were applied two to twelve times higher than the recommended doses. The sample farmers applied only half the recommended

dose of farmyard manure. MOP, factomphos and urea were used in greater quantities when compared to other fertilizers.

Pesticide use pattern indicated that farmers applied more costly chemicals than that was recommended, as observed in the case of bittergourd. Attack by jassids and incidence of diseases like leaf spot and yellowing were found to be severe in the study area, against which a control measure has not been recommended.

Out put obtained by Class I (24959 kg/ha) was more when compared to Class II (24097 kg. 1 ha.) and Class III (21843 kg/ha.) At aggregate level, it was 23999 kg/ha. Total return was Rs. 116565 at aggregate level. It was highest for Class I (Rs. 124794) followed by Class II (Rs. 120483) and Class III (Rs. 109215). Cost of production at aggregate level was Rs. 430. Cost per quintal was highest for class I (Rs. 443) followed by class III (Rs. 441) and Class II (Rs. 426). Bulk line cost of snakegourd was Rs. 484 the output of which was supplied by 78 per cent of the sample farmers.

Farm business income, own farm business income, family labour income, net income and farm investment income were Rs. 62338, Rs. 57236, Rs. 53956, Rs. 13288 and Rs. 31059 respectively at aggregate level. Net income was observed to be highest for class II (Rs. 17754) followed by class I (Rs.14163) and class III (Rs. 12961). The analysis of benefit cost ratio revealed that returns generated from a rupee was the highest for Class II (1.17) followed by class III (1.12) and class I (1.11). At aggregate level, it was 1.13. Explicit cost and implicit cost, at aggregate level, were Rs. 54293 and Rs. 48984 respectively. Net returns at explicit cost level and its corresponding benefit cost ratio were Rs. 62272 and 2.15 in the respective order.

OLS estimates indicated that, when land was included as a variable, land exerted the greatest influence on yield. The mean technical

efficiency was 0.91.When number of mounds was added as a variable, it was observed that the effect of manures on yield was the highest. The mean technical efficiency in this case was 0.92

The marketing channels identified for the marketing of snakegourd by the sample farmers were

(1) Producer – Consumer and

(2) Producer – VFPCK market – Wholesaler – Retailer – Consumer,

The second channel was the most important one. Almost the entire sample of farmers depended on it. Producers' share in consumer's rupee was Rs. 4.75 (47.60 per cent). The wholesaler's reaped a net margin of Rs. 2.00 (13.33 per cent) while that for retailers was Rs. 0.95 (6.3 per cent). Marketing efficiency was 0.91.

5.3 IVY GOURD

5.3.1 Ivy gourd (main crop)

The total cost of cultivation at aggregate level was Rs. 137498. It was higher for Class I (Rs. 140770) when compared to class III (Rs.139770) and Class II (Rs. 134097). Human labour accounted for 37.39 per cent of total cost at aggregate level. Total labour use for the sample as a whole was 387 man days, in which harvesting required the highest number (107 man days) followed by manuring, fertilizer application cum weeding (80 man days) and land preparation (69 man days).

Manures with a share of 14.37 per cent occupied the third place after rental value of land (18.18 per cent). Manuring, fertilizer application and weeding operation (28.90 per cent) incurred the highest expense, at aggregate level, followed by panthal making (11.87 per cent) and harvesting (9.79 percent). Besides farmyard manure, farmers were found to apply chemical fertilizers like factomphos, urea, MOP, 18-18-18 and 17-17-18 which was not recommended.

Farmyard manure applied was lesser than the recommended dose. Factomphos and MOP were used by the farmers in higher quantities when compared to others.

Though no serious pests and fungal diseases were reported in ivy gourd in the study area, the incidence of viral attack was very severe and was found to recur year after year. As no recommendation was given in package of practice for any of the pest or disease attack, farmers obtained necessary guidance from the traders who sold the chemicals to them.

The total output per hectare was estimated to be 19364 kg/ha at aggregate level. It was highest for class II (19894 kg/ha.) followed by class I (19554kg/ha.) and class III (18019 kg/ha.). The value of out put was Rs. 135547 for the sample as a whole. It was highest for class II (Rs. 139257) followed by class I (Rs. 136876) and class III (Rs.126136). Cost of production oat aggregate level was Rs. 710. Highest cost per quintal was attributed to class III (Rs. 776) followed by class I (Rs. 720) and class II (Rs. 674). Bulk line cost was estimated at Rs. 852 and the bulk line out put was supplied by 77 per cent of the sample farmers.

Implicit and explicit costs per hectare were Rs. 64564 and Rs. 72934 respectively. Net returns at explicit cost level and its corresponding benefit cost ratio were Rs. 62613 ands 1.86 in the respective order. Negative returns were obtained at total cost level to the tune of Rs. 1951. Benefit cost ratio was 0.99 at total cost.

5.3.2 Ivy gourd (ratoon crop)

Total cost of cultivation for the sample as a whole was Rs. 98711. Class I farmers (Rs. 102961) incurred the highest cost followed by Class II (Rs. 98347) and class III (Rs. 94915). Human labour constituted the highest share of 34.08 per cent in total cost followed by rental value of land (25.33 per cent)

panthalling material (10.34 per cent), allowance given for management of farm (9.09) per cent) and manures (8.83 per cent). Total labour use at aggregate level was 269 man days in which harvesting required the highest number (79 man days) followed by manuring, fertilizer application cum weeding (64 man days) and irrigation (58 man days).

Manuring, fertilizer application cum weeding operation incurred the highest expenses of 23.32 per cent of total cost, at aggregate level. It was followed by panthal making (16.53 per cent), harvesting (10.26 per cent) and irrigation (7.37 per cent). Farmyard manure used was lesser the recommended dose. Chemicals fertilizers like factomphos, urea, MOP, 18 18 18 and 17 17 17 which had not been recommended, were also added as a supplement to farm yard manure.

The total out put per hectare was estimated to be 16764 kg/ha. Out put was higher for class II (17294 kg/ha) when compared to class I (16954 kg/ha) and class III (154019 kg/ha.). Value of out put per hectare at aggregate level was Rs. 117347. Class II (Rs. 121057) had the highest value followed by class I (Rs. 118676) and class III (Rs. 107936). Cost of production was Rs. 589 for the sample as a whole while that for class I, II and III were Rs. 613, Rs. 569 and Rs,. 677 respectively. Bulk line cost was Rs. 768 and 74 per cent of the sample farmers contributed to the bulk line out put.

Implicit and explicit costs for the ratoon crop were Rs. 60494 and Rs. 38217 respectively. Net returns and benefit cost ratio level were Rs. 79130 and 3.07 in the respective order. At total cost level, net returns per hectare was Rs. 18636 and benefit cost ratio was 1.16.

For ivy gourd (both man and ratoon crop), farm business income, own farm business income, family labour income net income and farm investment income were respectively obtained as Rs. 147142, Rs. 135284 Rs, 97071, Rs,

16685 and Rs. 88229 at aggregate level. Net income was highest for class II (Rs. 27871) followed by class I (Rs. 19821). Net income was negative for class III (Rs. 612). Every rupee invested yielded 1.07 by the sample as a whole. For class I, II and III, benefit cost ratio was 1.04, 1.12 and 0.99 respectively.

When land was included as a variable, OLS estimate indicated that land had greatest effect on yield followed by manures, labour, fertilizer and plant protection. The technical efficiency estimated was 0.58. Fertilizer was found to affect the yield most, when mounds were added as a variable. The technical efficiency obtained was 0.92.

Ivy gourd farmers marketed their produce through the following channels

(1) Producer – commission agent – wholesaler – retailer – consumer.

(2) Producer – wholesaler – retailer – consumer

(3) Producer – retailer – consumer

(4) Producer – consumer.

More than 90 per cent of the farmers depended on first channel. Out of Rs. 15.00 per kg. paid by the consumer, only 5.44 per kg (36.3percent) went to the producer seller. Farmers incurred a high marketing cost of 10.4 per cent of the value of the produce. Marketing efficiency was 0.57.

The most important problem faced by the vegetable growers in the study area was the incidence of pests and diseases. It was followed by the problems of high input cost, inadequacy of capital, non-availability of labor and low price of the produce.

Conclusions

1) The total cost of cultivation per hectare at aggregate level was highest for ivy gourd–main crop (Rs.137498) followed by bittergourd (Rs.105717), snakegourd (Rs.103277) and ivy gourd-ratoon crop (Rs.98711).

2) Total labour use at aggregate level were 387,343,339 and 269 man days for ivy gourd-main crop, bittergourd, snakegourd and ivy gourd-ratoon crop respectively.

3) Fertilisers were applied two to twelve times highe· than the recommended rate by the bittergourd and snakegourd growers. Ivy gourd farmers used chemicals fertilizers that had not been recommended. But farm yard manure applied was less than that was recommended.

4) Farmers had not followed the package of practices recommendation for the major pest and disease attack in vegetable crops. Instead, they used more costly insecticides and fungicides prescribed by the traders, which had harmful effect on the environment. Attack by jassids and incidence of diseases like leaf spot and yellowing were found to be severe in the study area, against which a control measure has not been recommended.

5) Output per hectare for bittergourd was 23721 kg/ha while that for snakegourd, ivy gourd-main crop and ivy gourd-ratoon crop were 23999 kg/ha,19364 kg/ha and 16764 kg/ha respectively.

6) Bulkline cost per quintal was the highest for ivy gourd-main crop (Rs.852) followed by ivy gourd-ratoon crop (Rs.768), bittergourd (Rs.508) and snakegourd (Rs.484).

7) Benefit cost ratio estimated was higher for bittergourd (1.76) when compared to ivy gourd-ratoon crop (1.16), snakegourd (1.13) and ivy gourd-main crop (0.99).

8) When land was included as a variable mean technical efficiencies were 0.85,0.91 and 0.58 respectively for bittergourd, snakegourd and ivy gourd.

The same were 0.88 for bittergourd and 0.92 for both snakegourd and ivy gourd when mounds were added as a variable.

9) Marketing efficiency was the highest for bittergourd (1.03) followed by snakegourd (0.91) and ivy gourd (0.57)

10) The most important constraint faced by the vegetable growers in the study area was the incidence of pests and diseases. It was followed by the problems of high input cost, inadequacy of capital, non-availability of labor and low price of the produce

5.4. SUGGESTIONS FOR IMPROVEMENT

1) Emphasis should be given for reducing the cost of cultivation and increasing productivity to reap maximum profit.

2) Productivity of ivy gourd can be effectively increased by the use of high yielding and disease resistant varieties instead of the traditional varieties widely cultivated by the sample farmers.

3) As farmers were increasingly getting exploited by the traders who marketed chemicals, awareness should be created among the farmers regarding the use of appropriate chemicals.

4) Incidence of pests like jasside and diseases like yellowing and leaf spots were found to be severe in the study area against which no proper control measure has been recommended. Scientists could direct their attention on this aspect. Extension activities should be undertaken to give proper guidance to the farmers.

5) Ivy gourd farmers need to organize themselves and join hands with VFPCK for reducing the marketing cost and increasing producer's share in consumer's rupee. VFPCK can help the farmers by opening a unit in a convenient place in the study area so that farmers can market their produce more efficiently.

6) Financial institutions should take necessary steps for the regular repayment of loans by the farmers.

References

REFERENCES

Acharya, S.S. and Agarwal, N.L. 2004. *Agricultural Marketing in India*, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 452p.

Agro Economic Research Centre (AERC). 2004. Fruits and vegetable mandies located in urban and semi-urban areas of Delhi. *agric. Situ. India*. 61(3): 159-161

Agarwal, N.L. and Saini, T.C. 1995. Vegetable marketing, A case study of Jaipur market (Rajasthan). *Indian J. agric. Mktg*. 9(1): 37-43

Aggarwal, V.S. 1993. Cultivation of hybrid tomatoes in West Bengal. *Indian Fd Packer*. 6: 13-15

Aigner, D.J., Lovell, C.A.K. and Schmidt, P. 1977. Formation and Estimation of Stochastic Frontier Production Function Models. *J. Econometrics*. 6: 21-37

Ali, M. and Chaudhary, M.A. 1990. Inter-regional farm efficiency in Pakistan's Punjab: A frontier production study. *J. agric. Econ*. 41(1): 62-74

Amarasinghe, S.T.C. and Weerahewa, J. 2001. An assessment of technical efficiency of potato production. *Trop. agric. Res*. 13: 292-300

Anilkumar, S. and Arora, V.P.S. 2003. An analysis of marketed surplus and marketing cost of vegetables in Uttaranchal. *Indian J. agric. Mktg*. 17(1): 63-74

Banick, A. 1994. Technical efficiency of irrigated farms in a village of Bangladesh. *Indian J. agric. Econ*. 49(1): 70-78

Battesse, G.E. and Coelli, T.J. 1995. A model for technical inefficiency effects in a stochastic frontier production function for panel data. *Empirical Econ*. 20: 325-332

Bavrah, B. and Salikutty, J. 1999. Economic analysis of a crop combination system involving vegetables. *agric. Situ. India.* 56(9): 541-544

Bhalerao, M.M. and Charan, K. 1967. Marketing of vegetables in Varanasi. *agric. Situ. India.* 20(4): 19-22

Bhalerao, M.M. and Maurya, R.P. 1985. Economics of vegetable cultivation in sewapuri. *agric. Banker.* 8(4): 20-21

Bilonikar, K.V., Tilekar, S.N., Nawadkar, D.S. and Kamble, S.S. 1998. Marketing efficiency and operational problems of vegetables co-operative marketing societies in Maharashtra state. *Bihar J. Mktg.* 6(2): 220-226

Brahmaiah, P. and Naidu, M.R. 1993. Economics of chillies production in Guntur district of Andhra Pradesh. *Indian Cocoa Arecanut Spices J.* 17(1&2): 22-28

Broek, J.V.D., Forsund, F.R., Hjalmarsson, L. and Meeuren, W. 1980. On the estimation of determination and stochastic frontier production function - a comparison. *J. Econometrics.* 13: 117-138

Chahal, S.S., Gill, K.S. and Singh, B. 1989. Price spread in vegetables in Punjab. *J. Res.* 26(1): 125-134

Chauhan, R.S. 1998. Economic analysis of vegetable production and marketing in Azamgarh district of U.P. *Indian J. agric. Res.* 53(4): 131-133

Chennarayudu, K.C., Prasad, Y.E., Satyanarayana, G. and Rao, L.S. 1990. Land use efficiency of banana - an application of frontier production function. *agric. Situ. India.* 45 (1): 15-17

Dawson, P.J., Lingard, J. and Woodford, C.H. 1991. A generalized measure of farm-specific technical efficiency. *American J. agric. Econ.* 73(4): 1098-1104

Devi, P.I. 1996. Marketing of fruits and vegetables in Kerala: a participatory management approach. *Rediscovering Cooperation* (ed. Rajagopalan, R.). Vol.3. Institute of Rural Management, Anand. pp.321-337

Dhondyal, S.P. and Krishna, J. 1959. Price programmes for agricultural produce in India. *Indian J. agric. Econ.* 14(3): 23-30

Elsamma, J. and George, M.V. 2002. Technical efficiency in rice production - A frontier production function approach. *agric. Econ. Res. Rev.* 15(1): 50-55

Farrel, M.J. 1957. The Measurement of Production Efficiency. *J. Royal Stat. Society.* 120(3): 253-281

George, M.V. and Singh, A.J. 1970. Structure, conduct and performance of wholesale vegetable markets in Punjab. *agric. Mktg.* 13(1): 1-8

Gupta, S. 1987. Investment pattern of increased income of vegetable growers in North Indian hills. *World. agric. Econ. rur. Social abstr.* 30(5): 264

Gupta, S.P. and Verma, J.S. 1994. Marketing of ivygourd in Drug district of Madhya Pradesh. *Bihar J. agric. Mktg.* 2(3): 241-247

Gupta, S.P. and Verma, J.S. 1997. Ivygourd production in Durg district of Madhya Pradesh: An economic analysis. *Indian J. agric. Econ.* 52(3): 647-648

Hayek, F.A. 1945. The use of knowledge in society. *American Econ Rev.* 35: 519-530

Indersain, T., Toor, M.S. and Aggarwal, M. 1999. An economic analysis of winter tomato crop around Ludhiana city. *Bihar J. Mktg.* 7(1): 83-86

Jain, B.C. and Gauraha, K. 1996. Economics of vegetable farming: Micro level study, *agric. Banker.* 20(2): 16-21

Jha, A.K., Suresh, P. and Joshi, P.K. 2004. Efficiency of public funded crop sciences research in India. *agric. Econ. Res. Rev.*, 17(1): 17-27

Kahlon, A.S. and Tyagi, D.S. 1983. Agricultural Price Policy in India. Allied publishers, New Delhi, 510p.

Kalirajan, K. and Flinn, J.C. 1981. Allocative efficiency and supply response in irrigated rice production. *Indian J. agric. Econ.* 36(2): 16-24

Karthikeyan, N. 2001. Economic analysis of cool season vegetables in Devikulam block of Idukki district. M.Sc. (Ag.) thesis, Kerala Agricultural University, Thrissur.124p.

Kasar, D.V., Amre, B.S., Raut, R.C. and Rasane, V.S. 1994. Marketing of bitter gourd in Ahmednagar, Maharashtra. *Indian J. agric. Mktg.* 8(2): 246-249

Kiresur, V.R. and Kumar, M.N. 1988. Impact of regulation on vegetable marketing in India. A case study of Dharwad district of Karnataka state. *Indian J. agric. Mktg.* 2(1): 23-30

Koshta, A.K. and Chandrakar, M.R. 1997. Profitability of vegetable crops in Chattisgarh region of Durg district. *Indian J. agric. Econ.* 52(3): 633-634

Kumar, A. and Arora, V.P.S. 1999. Ecoomic issues in vegetable production in UP hills. *agric. Situ. India.* 52(9): 535-540

Lamberts, M. 1992. Production trends for speciality Asian vegetables in Dade country, Florida. *Acta Hort.* 318: 79-85

Madalia, V.K. and Kukadia, M.V. 1978. Cost and returns in vegetable cultivation. *Fin. agric.* 10(1): 15

Madan, M.S., Singh, R.V. and Singh, M.L. 1999. Economics of production and marketing of cauliflower in Ranchi district of Bihar. *Bihar J. Mktg.* 7(1): 28-35

Mankar, N.K., Kulwal, L.V. and Bhole, B.D. 1990. Economics of ratooning in cabbage under Akola condition. *PKV Res. J.* 14(2): 201-202

Mathew, D. 2001. 'Pachakari Ulpadanathil Keralam Iniyum Munneranam'. (Malayalam) *Krishnankanam* 6(3): 2-3

Nagesh, S.S. 2001. Economic analysis of production and marketing of vegetables in Thiruvananthapuram district. M.Sc. (Ag.) thesis, Kerala Agricultural University, Thrissur. 123p.

Nahatkar, B.S. and Pant, S.P. 1984. Farm profitability, resource productivity in cultivation of chillies in Chhindwara district of Madhya Pradesh. *agric. Situ India* 39(6): 421-424

Panse, Y.G. 1958. Problems and techniques in the study of the cost of production in agriculture. *Indian J. agric. Econ.* 13(3): 9-10

Parikh, A. and Shah, K. 1994. Measurement of technical efficiency in the North-West Frontier Province of Pakistan. *J. agric. Econ.* 45(1): 132-138

Pasour, E.C. and Bullock, J.B. 1975. Implication of uncertainty for the measurement of efficiency. *American J. agric. Econ.* 57(2): 335-339

Prasad, K.M. and Bonny, B.P. 1996. Constraints in commercial production of vegetables. *J. trop. agric.* 34(2): 159-160

Raha, S.K. and Baten, M.A. 1995. Vegetables marketing in Bangladesh: do consumer's pay a high price? *Econ. Affairs.* 40(1): 41-45

Raj, K.N., Singh, S.N. and Niwas, S. 1991. India's agricultural export - A case study of fresh fruits and vegetables. *Indian agric. Mktg.* 5(1): 18-24

Rajashekharappa, M.T., Umesh, K.B. and Sivaramane, N. 2004. Technical efficiency in arecanut production - An application of non-parametric linear programming. *agric. Econ. Res. Rev.* 17(1); 121-129

Ramachandran, P. 1997. Economics of production and marketing of vegetables in Chittur Taluk (Palghat District) with special reference to Tomato (*Lycopersicon esculentum* L.) and Okra (*Abelmoschus esculentus* L.). M.Sc. (Ag.) thesis, Kerala Agricultural University, Thrissur.106p.

Ramamurthy, V.B., Kumaracharyulu, D., Prasad, T.K. and Eswaraprasad, Y. 2003. Factors influencing decision making of vegetable growers and brand loyalty in vegetable seed market in Andra Pradesh. *Indian J. agric. Mktg.* 17(3): 235-242

Ramasamy, C. 1981. Problems in production and marketing of major vegetables in Coimbatore district (1) Brinjal and (2) Bhindi. *Research Report No. 19*, Department of Agricultural Economics, Centre for Agricultural and Rural Development Studies, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu.pp.22-23

Sahoo, S.C. 1991. Export marketing of fresh fruits and vegetables. *Indian J. agric. Mktg.* 5(1): 25-29

Sailaja, D., Choudhary, N.A. and Rao, D.V.S. 1998. Resource productivity and resource use efficiency on vegetable farms. *Andhra agric. J.* 45(3&4): 164-166

Sandhya, V. 1992. Economics of production and marketing of vegetables in Ollukara block in Thrissur district. M.Sc. (Ag.) thesis, Kerala Agricultural University, Thrissur, 133p.

Schmidt, P. and Lovell, C.A.K. 1979. Estimating technical and allocative inefficiency relative to stochastic production and cost frontiers. *J. Econometrics.* 9: 343-366

Sen, C. and Maurya, R.P. 1999. Producer's share in consumer's rupee - a study of vegetables. *Econ. Affairs.* 44(3): 177-178

Shanmugasundaram, S. 2004. Surmountable challenges. The Hindu survey of Indian Agriculture. 2004. pp.126-127

Sharma, A.K., Moorthi, T.V. and Oberoi, R.C. 1992. Economics of vegetable farming in mid hills of Himachal Pradesh. *agric. Situ. India.* 47(1): 11-14

Shiyani, R.L., Kuchhadiya, D.B. and Patat, M.V. 1998. Marketing of vegetables in South Saurastra zone of Gujarat. *Indian J. agric. Mktg.* 12(1): 158

Sidhu, D.S. 1988. New thrusts in agricultural marketing in Punjab. *agric. Situ India* 43(7): 575-578

Singh, R. and Bhatia, J.P. 1988. Role of vegetables in increasing employment and income in hill agriculture - case of Himachal Pradesh. *Indian J. agric. Econ.* 43(3): 516

Sirohi, P.S. and Behera, T.K. 2003. Indian vegetable export: present status and future strategies. *Indian Hort.* 48(1): 27-29

Srivastava, G.C. 1993. An Empirical Investigation into Production, Marketing and Export Potential of Vegetables in Bihar. *Bihar J. Mktg.* 1(3): 339-349

Subrahmanyam, K.V. 1988. Marketing of vegetables: An Inter-state comparison of practices and associated costs. *Indian J. Hort.* 45(1/2): 153-159

Suresh, H.B. and Devaraja, T.S. 1999. Marketing of Horticultural produce in Karnataka state - present status and required changes. *agric. Situ. India.* 56(8): 467-470

Talathi, J.M. and Thakare, R.P. 1995. Temporal changes in arrivals and prices of vegetables in Bombay APMC. *Bihar J. agric. Mktg.* 3(3): 255-263

Talati, J. 2003. Demand for fruits and vegetables in the early 21st century. *agric. Situ. India* 60(7): 467-473

Thakur, D.S., Thakur, D.R., Sharma and Sanjay. 1994. Vegetable Revolution and Economics in Himachal Pradesh. *Bihar J. Mktg.* 2(2): 145-151

Ureta, B.E. and Rieger, L. 1990. Alternative production frontier methodologies and dairy farm efficiency. *J. agric. Econ.* 41(2): 218-219

Vigneshwar, V. 1986. Dynamics of fruit and vegetable marketing in India, *Indian J. Mktg.* 17(4): 29-32

PRODUCTION AND MARKETING OF VEGETABLES IN PALAKKAD DISTRICT

By
SREELA. P.

ABSTRACT OF THE THESIS

Submitted in partial fulfilment of the
requirement for the degree of

Master of Science in Agriculture

Faculty of Agriculture
Kerala Agricultural University

Department of Agricultural Economics
COLLEGE OF HORTICULTURE
VELLANIKKARA, THRISSUR - 680 656
KERALA, INDIA

2005

ABSTRACT

The present study on the economic analysis of production and marketing of vegetables in Palakkad district was aimed at analyzing the economics of vegetables viz; bittergourd, snakegourd and ivy gourd and to assess the technical efficiency, marketing efficiency and constraints faced by the vegetable growers.

The study was conducted in Nemmara block of Palakkad district, which was one of the major vegetable growing belts in the district having a larger proportion of area under bittergourd, snakegourd and ivy gourd when compared to other vegetables. A sample of 60 growers for each vegetable was selected. Two stage random sampling procedure was adopted for the study and percentage analysis was used to analyse the data. The profitability was estimated using ABC cost concepts and technical efficiency was estimated using stochastic frontier production function of Cobb Douglas form. Bulkline costs were calculated for the three vegetables. Marketing efficiency was worked out using Shepherd's formula.

Total expenditure at Cost C_3 at aggregate level was Rs.105717, Rs.103277, Rs.137498 and Rs.98711 for bittergourd, snakegourd, ivy gourd-main crop and ivy gourd-ratoon crop respectively. The explicit costs, which included all the paid out costs, were Rs.55027, Rs.54293, Rs.72934 and Rs.38217 respectively for the three vegetables.

The outputs per hectare were 23721 kg/ha, 23999 kg/ha, 19364 kg/ha and 16764 kg/ha respectively in the case of bittergourd, snakegourd, ivy gourd (main crop) and ivy gourd (ratoon crop). The total value of output per hectare of these vegetables were 1.86 lakh, 1.17 lakh,1.36 lakh and1.17 lakh rupees in the respective order.

Cost of production per quintal of bittergourd were Rs.226, Rs.247, Rs.226, Rs.261, Rs.370 Rs.405 and Rs.446 per quintal in the respective order for

cost A_1, cost A_2, cost B_1, cost B_2, cost C_1 cost C_2 and C_3. These costs were observed in the respective order as Rs.226, Rs.247, Rs.226, Rs.261, Rs.359, Rs.391 and Rs.430 in the case of snakegourd. An amount of Rs.344, Rs.375, Rs.344, Rs.473, Rs.516, Rs.646 and Rs.710 respectively were spent to produce one quintal of ivy gourd-main crop on the above costs. The corresponding figures for ivy gourd-ratoon crop were Rs.234, Rs.269, Rs.234, Rs.383, Rs.386 Rs.535 and Rs.589.

Bulkline cost per quintal for bittergourd, snakegourd, ivy gourd (main crop) and ivy gourd (ratoon crop) were Rs.508, Rs.484, Rs.852 and Rs.768 respectively.

The net income for bittergourd, snakegourd and ivy gourd (main crop) and ivy gourd (ratoon crop) were Rs.80478, Rs. 13288, Rs. -1951 and Rs.18636 respectively. At cost C_3 level, benefit cost ratio of bittergourd and snakegourd were 1.76 and 1.13 in the respective order. The corresponding figures for ivy gourd-main crop and ivy gourd-ratoon crop were 0.99 and 1.16 respectively. Bittergourd had the highest BC ratio (3.38) at paid out cost level followed by ivygourd-ratoon crop (3.07), snakegourd (2.15) and ivy gourd-main crop (1.86)

For bittergourd, snakegourd and ivy gourd, mean technical efficiencies were 0.85,0.91 and 0.58 respectively when land was included as one of the variables. In the case where mounds were added as a variable instead of land, mean technical efficiencies were worked out to be 0.88 for bittergourd and 0.92 for both snakegourd and ivy gourd. Technical efficiency of the individual farms varied widely between 30 and 100 per cent.

The channel, Producer – VFPCK market – wholesaler – Retailer–consumer, was the most important marketing channel in the case of bittergourd and snake gourd, while the channel, Producer – Commission agent – Wholesaler –

Retailer – Consumer was identified as the most important one for ivy gourd. In the case of bitter gourd, producer's share in consumer's rupee was Rs. 7.6 (50.70 per cent) whereas in the case of snakegourd it was Rs. 4.75 (47.50 per cent). For ivy gourd, the same was Rs. 5.44 per kg. (36.3 per cent). The index of marketing efficiency was highest for bittergourd (1.03) followed by snakegourd (0.91) and ivy gourd (0.57).

The most important constraint faced by the vegetable growers in the study area was the incidence of pests and diseases. It was followed by the problems of high input cost, inadequacy of capital, non-availability of labor and low price of the produce