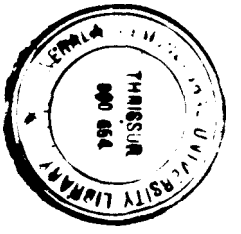
ECONOMIC ANALYSIS OF COOL SEASON VEGETABLES IN DEVIKULAM BLOCK OF IDUKKI DISTRICT

By

N. KARTHIKEYAN



THESIS

Submitted in partial fulfilment of the requirement for the degree of

Master of Science in Agriculture

(AGRICULTURAL ECONOMICS)

Faculty of Agriculture

Kerala Agricultural University

Department of Agricultural Economics

COLLEGE OF HORTICULTURE

VELLANIKKARA, THRISSUR - 680 654

KERALA

2001

DECLARATION

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

Vellanikkara

12.11.2001

N. KARTHIKEYAN

CERTIFICATE

Certified that the thesis, entitled **"Economic analysis of cool season vegetables in Devikulam block of Idukki district"** is a record of research work done independently by **Mr. N. Karthikeyan,** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, fellowship or associateship to him.

Dr.E.K. Thomas
Chairman, Advisory Committee
Associate Professor and Head
Department of Agricultural Economics
College of Horticulture
Vellanikkara
Thrissur-680 656

Vellanikkara
12-11-01

CERTIFICATE

We, the undersigned members of the Advisory Committee of **Mr.N. Karthikeyan,** a candidate for the degree of **Master of Science in Agriculture** with major in **Agricultural Economics,** agree that the thesis entitled **"Economic analysis of cool season vegetables in Devikulam block of Idukki district"** may be submitted by Mr.N. Karthikeyan, in partial fulfilment of the requirement for the degree.

Dr. E.K. THOMAS 12/11/2001
(Chairman, Advisory Committee)
Associate Professor and Head
Department of Agricultural Economics
College of Horticulture
Vellanikkara

12/11/01
Dr.K. JESY THOMAS
Associate Professor
Department of Agricultural Economic
College of Horticulture
Vellanikkara
(Member)

T. Paul Lazarus
Mr.T. PAUL LAZARUS 12-11-2001
Assistant Professor
Department of Agricultural Economics
College of Horticulture
Vellanikkara
(Member)

12/11/01
Smt.T.K. INDIRA BAI
Assistant Professor (S.S.)
Department of Agricultural Statistics
College of Horticulture
Vellanikkara
(Member)

12/11/2001
Dr.R. SUNDARESAN
Professor and Head
Department of Agricultural Economics
CARDS, TNAU
Coimbatore
(External Examiner)

ACKNOWLEDGEMENT

I would like to exploit this opportunity to extend my profound sense of gratitude and heartfelt appreciation to **Dr.E.K.Thomas**, Associate Professor and Head, Department of Agricultural Economics, College of Horticulture, Chairman of my advisory committee for his avuncular guidance, constant support, bolstering encouragement and constructive professional comments throughout the course of my study period and in the preparation of this thesis. His vision and dedication were the guiding light of this toil. I am proud of having worked under the guidance and without his enthusiasm the work would not have been completed this much soon.

I consider it as my privilege to express my deepful gratitude and indebtedness to **Dr.K.Jesy Thomas**, Associate Professor, Department of Agricultural Economics for her sustained interest and constant encouragement during the course of this investigation. My sincere thanks are due to **Mr.T. Paul Lazarus**, Assistant Professor, Department of Agricultural Economics for his candid suggestions and valuable criticisms. My heartfelt thanks are also due to Smt.**T.K.Indira Bai**, Assistant Professor (SS), Department of Agricultural Statistics for her valuable help during the preparation of this thesis.

I am especially indebted to my teachers of the Department of Agricultural Economics, Dr.P.Indira Devi and Dr.Sathees. K Babu for their unrivalled teaching, kind concern, sincere advices, timely help and support rendered during the investigation and throughout my study period.

I am very grateful to the Assistant Director of Agriculture, Munnar and farmers of Devikulam block for their kind co-operation during the course of my survey.

I am also deeply thankful to Dr.R. Sundaresan, Professor and

Assistant Professor, Department of Agricultural Economics, Tamil Nadu Agricultural University, Coimbatore for their timely help.

The help and assistance rendered by Alemayehu, Arunachalam, Reshmi and Sherin throughout the investigation are gratefully remembered. I am also thankful to my TNAU friends Meenakshi Sudaram, Anil Kuruvilla and Binu for their useful help.

True words of thanks are to all of my friends. More personally I would like to thank to Ganapathi, Suresh, Yusuf, Kali, Ravi, Makesh, Mishra, Smitha Baby,Santhosh Narayanan, Karthick, Rajiv, Kingsely, Vezha and Shankar for their love, concern and extending their helping hands whenever I was in need. I appreciate all my friends who helped me in one way or the other.

I have no words to express my indebtedness to my fellow students Shibu, Deepan and Joby and my junior friends Pratheesh and Rani for their immense co-operation I enjoyed during the critical stages of my investigation.

Neat typing work done by Mr.Jomon, J.M.J. Computer Centre, Thottappady is very much acknowledged.

I also gratefully acknowledge the ICAR for awarding me Junior Research Fellowship.

I express my heartfelt gratitude and indebtedness to my parents and family members for their moral support and inspiring encouragement, which helped me to undertake the strenuous toil successfully.

Above all, I bow my head before the **ALMIGHTY GOD** for his blessings, which enabled me to complete this work.

N. Karthikeyan

Dedicated to

My Loving Parents

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Introduction

1. INTRODUCTION

India is the second largest producer of vegetables next to China. During 1997-98, 72.83 million tonnes of vegetables were produced from an area of 5.63 million hectares (National Horticultural Board, 1999). India produces around 12 per cent of the world's vegetables (Gowda, 1999). Even though, Indian vegetable exports have achieved a growth rate of 23 per cent in the last decade, it's share in world export is only one per cent. It is worth mentioning that the country is not able to exploit the 'Market vacuum' existing in international trade (Bose and Rajan, 1999).

According to Diet Advisory committee of the Indian Council of Medical Research, an adult requires 284 grams of vegetables per day. But the present national production of 87.5 million tonnes (1999-2000) of vegetables does not meet the requirement (Singh, 2001). There is a need to achieve the target of 100 million tonnes for the supply of 250 g of vegetables per adult per day. But these projections are very high considering annual growth rate in production being only 2.6 per cent (Attavar, 2000).

Vegetables are rich source of vitamins and minerals. Vegetables like carrot, cabbage, peas, beet root, tomato, greens, onion, sweet potato, etc. are important sources of vitamin A. Vitamin C is present in appreciable quantities in chilli, *palak*, cabbage, cauliflower, tomato etc. Green leafy vegetables are good source of vitamin D, E and K. Vegetables like carrot, cabbage, cauliflower, tomato, potato etc. are good sources of minerals like calcium, phosphorus and iron. Vegetables like potato, sweet potato, cassava, yams, sweet potato etc. are good sources of carbohydrates. Spicy vegetables like onion, garlic, coriander etc. add taste and flavour to the food (Veeraraghavathatham *et al.*, 1998).

Besides their importance in human nutrition vegetable crop support many industries like processing industry, seed industry, fertilizers and plant protection chemicals industries, weedicide industries, farm machinery and implements and packaging and marketing industries.

The cultivation of vegetables gives a much higher income per acre than field crop. Vegetable crops can be fitted into many viable crop rotations and cropping pattern like inter cropping, multiple cropping and companion cropping. Their cultivation is labour intensive and hence help in generating employment throughout the year.

Kerala is endowed with diverse climatic conditions. The mild humid tropical climate in plains, hot dry climate in the Chittoor tract adjoining Tamil Nadu and relatively cool, sub-tropical to temperate climate in Idukki, Wayanad and parts of Palakkad district offer great scope for cultivation of a variety of cool season vegetable crops in this small state (Devadas, 1999 and Gopalakrishnan, 1999).

Total area and production of vegetables in the state during 1997-98 were 0.24 million hectares and 2.79 million tonnes respectively (National Horticultural Board, 1999). In spite of congenial climatic condition, the present situation regarding vegetable production in the state is not satisfactory. While comparing with other states like Bihar, West Bengal, Uttar Pradesh, Andhra Pradesh, Karnataka etc. the contribution from Kerala is meagre both in area and production.

Kerala being the thickly populated depends on neighbouring states for meeting a major share of its vegetable requirements. It is estimated that 60 per cent of the vegetable requirement of the state is met from outside sources and an amount of Rs.850 crores is spent annually for the import of vegetables (Gopalakrishnan, 1999).

Vegetable cultivation is mostly confined to homestead levels in the state. Large scale cultivation is limited due to high cost of production imparted by the labour intensive nature of cultivation, shortage of labour, scarcity of land etc. In addition to these factors, competition from neighbouring states, heavy incidence of pests and diseases are causing serious threats for the commercial cultivation of vegetables in the state (Gopalakrishnan, 1999).

Marketing of vegetables is still unorganised in the state except a few Self Help Groups (SHG) of KHDP. In the market, the produce from Kerala has to compete with the produce from neighbouring states. Vegetables from other states arrive in huge amounts in Kerala market and prices are fixed based on the quantity of arrival of vegetables from these states. But, high marketing costs incurred on other state vegetables, which include long distance transportation costs, tolls, etc. are ultimately supplemented to the consumer's rupee (Mathew, 2001).

Now, the scenario is changing towards positive side, as government and some other organisations have taken initiatives. Kerala Horticultural Development Board (KHDP), presently known, as Vegetable and Fruit Production Council, and Intensive Vegetable Development Programme are some examples. Thanks to the efforts taken by KHDP, an additional area of 13,500 hectare and produce of two lakh tonnes of vegetables have been achieved (Mathew, 2001).

Economics of production and marketing of cool season vegetables has not yet received the attention that it deserves particularly so in Kerala. 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. A study on economics of production and marketing of cool season vegetables would appear very relevant in this context.

In Kerala, most of the cool season vegetables are cultivated largely in hilly areas of Idukki and Wayanad districts. Devikulam block in Idukki district which has the largest area under cool season vegetable cultivation in the state was purposively selected for the study.

The specific objectives of the study were

1. to estimate the costs and returns
2. to examine the employment generation
3. to identify the marketing channels
4. to estimate the marketing costs and marketing margins
5. to study the problems encountered by farmers in the production and marketing of cool season vegetable crops

There have been no studies conducted on economics of production and marketing of cool season vegetables in the state. In this context, basic information regarding production, marketing and problems faced by farmers of cool season vegetables in the state would be of vital importance to planners and policy makers

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 subjected to recall bias. However every effort was made to minimise the error by cross-questioning and cross checking.

This thesis consists of seven chapters including the present one. A review of the relevant literature was given in chapter two. A brief description of the area of study is given in chapter three. Chapter four deals with the materials and methods used in this study. The results of the study were presented in chapter

five while chapter six deals with discussion. The summary of major findings of the study was given in the final chapter.

Review of Literature

2. REVIEW OF LITERATURE

A comprehensive review of 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 four sections. In section I production economics studies are included. Second section deals with production economics studies and third and fourth sections consist of studies related to technical efficiency and marketing respectively.

2.1 Production economics studies

Gaarg and Prasad (1974) worked out the comparative profitability of various vegetable crops in the vicinity of Kanpur city in Uttar Pradesh. Data were collected from a random sample of farmers in the vicinity of the city. It was found that the vegetable farming yielded higher return per ha in comparison to food grains. The highest net return per ha was obtained from tomato (Rs.3,948.28) followed by cauliflower (Rs.3,640.26), onion (Rs.2,658.04) and brinjal (Rs.2, 394.00). Non-availability of storage facilities, processing and preservation units and wide price fluctuation were found to be the problems faced by farmers in vegetable cultivation.

Rathore *et al.* (1974) in their study on economic analysis of temperate vegetables like potato, ginger, tomato, French bean and chillies of Solan district of Himachal Pradesh and observed that the per hectare total cost of cultivation of potato, ginger, tomato, French bean and chillies were Rs.6, 615, Rs.7, 667, Rs.7, 736, Rs.3, 864 and Rs.5, 959 respectively. Tomato growers received the highest returns per unit of out cost (5.83) closely followed by chillies (5.71) and then

French bean (3.18), ginger (2.76) and potato (2.57) in that order. The data were collected from 150 randomly selected farmers using personal interview method.

Tewari *et al.* (1974) observed that vegetable farmers were cultivating more intensively than the cereal farmers. The expenditure on variable inputs was on the higher side for vegetable farmers as compared to cereal farmers. Fertilizers contributed more than 40 per cent towards the total variable capital for the vegetable farmers while hired labour accounted for more than 47 per cent of the total variable capital for the cereal farmers. The gross income of cereal farms was less than half of that of the vegetable farms.

Madalia and Kukadia (1978) conducted an investigation regarding costs and returns in vegetable cultivation in Olpad taluk of Surat district of Gujarat. The data were collected from 80 farmers using personal interview method. The study revealed that per ha cost of cultivation for pointed gourd, *bhindi* and chilly during 1974-75 as compared to 1973-74 was higher and in case of little gourd the cost was lower. Human labour was found to be the most important item of expenditure followed by the plant protection chemicals. The average input output ratio for pointed gourd and *bhindi* was calculated to be 1:1.98 and 1:2.30 respectively while that for little gourd and chilly was calculated to be 1:2.0 and 1:2.3.

Kumar *et al.* (1979) studied the economic and financial aspects of potato production in Karnataka. Data were collected from 60 farmers using personal interview method. Bangalore, where potato is grown under irrigated condition and Hasan district having rain fed potato cultivation were selected for the study. The total operational cost of production of potato per ha under irrigated condition was nearly three times more as compared to the total operational cost under rainfed conditions. The labour cost formed quite an important item of operating expenditure. The benefit cost ratios were 1:1.2 and 1:1.3 for irrigated and rainfed fields respectively.

Puttusamy (1979) in his study on potato found that the average labour productivity was Rs.21.80 and 20.80 on medium and large farms respectively.

Srivastava and Prasad (1979) in their study of vegetable economy of small farms around Bhagalpur found that the profit obtained from vegetable crops was almost four times higher than that from food crops, i.e., net profit for food crops was Rs.1058.80 per acre while the same for vegetables was Rs.3, 784.93 per acre. A total of 60 randomly selected farmers were interviewed using personal interview method. The input output ratio was 1:3.34 for vegetables and the same for food crops was 1:2.01.

Bhalerao and Maurya (1985) in a study based on data collected by survey method, from randomly selected 150 vegetable growers in Sevapuri block of Varanasi district of Uttar Pradesh found 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) respectively.

Saraf and Mishra (1987) worked out cost of cultivation of tomato, potato, cauliflower and brinjal based on the 70 randomly selected samples using personal interview method in the vicinity of Jabalpur city. The cultivation of tomato seemed to be quite remunerative as compared to other three vegetable crops. The cropping intensity was worked out and it was found that it declined with an increase in the size of holding. The net return from tomato was Rs.2037 per acre followed by brinjal with Rs.1952 per acre, cauliflower with Rs.1467 per acre and potato with Rs.1408 per acre.

Lohar (1987) studied the economics and marketing of hybrid tomato in Satara district of Maharashtra. The analysis showed that about 33 per cent of the total cost was covered by input items like fertilizer, human labour and plant

protection chemicals. The study was conducted in Satara district of Maharashtra, getting information from 29 cultivators using personal interview method. Around 52 per cent of the total cost was occupied by marketing item alone, which consumed almost 25 per cent of the gross income.

Sharma and Thakur (1988) conducted a study in Lahaul subdivision of Lahaul district of Himachal Pradesh. The data were collected from 100 randomly selected farmers, through personal interview method. Commercial crops like potato, *kuth*, *hops* and *manoo* and off-season vegetables like capsicum, tomato, cauliflower and peas were selected. The study came out with results that tomato had the highest cost of cultivation and net return at cost C (Rs.64, 655.27 and Rs.81, 289.49 per ha) followed by cauliflower (Rs.53, 390.56 and Rs.63, 066.44 per ha), hill capsicum (Rs.13, 604.36 and Rs.15, 072.93 per ha) and potato (Rs.19, 867.65 and Rs.10, 911.66 per ha).

Singh and Bhatia (1988) examined the role of vegetables in augmenting farm income and employment in Himachal Pradesh. The data were collected from 90 randomly selected farmers using personal interview method. Examining the area under vegetables, average yield and yield gap between experimental field and farmers field, the authors arrived at the conclusion that for vegetables like pea, cabbage, cauliflower, tomato and potato, there is a vast scope for increasing productivity through proper use of technology.

Mehta *et al.* (1989) worked out the economics of radish seed production both at farmers level and at recommended technology in Gurdaspur (Punjab) and Poanta Valley (Himachal Pradesh) by calculating the variable cost of all the inputs at current market prices. The total variable cost incurred by the farmer and the net returns were estimated to be Rs.4778 and Rs.12, 322 per hectare respectively.

Mankar *et al.* (1990) investigated input requirements and productivity of ratoon cabbage and the economics feasibility of such a crop. The ratoon crops

yielded 27,780 compared to 32,241 kg per ha for the main crop. The total cost of ratoon crop cultivation was Rs.8167.29 per ha 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.

Boers (1991) studied the profitability and income from financing of cultivation and capital investment in field vegetables grown in the Netherlands and reported that the farms suffered an average loss of Dfl 37500 or 10 per cent of costs. Total family income came to Dfl 82900 per farmer. After deducting personal taxation and levy payments, Dfl 70100 remained as disposal income for family and farm.

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

The report by Boers (1992) provided information on the profitability, income, financing and capital assets of field vegetables growing enterprises in the Netherlands. The farm suffered an average loss of Dfl 9200 or two per cent of the costs. Total family income was Dfl 113900 per grower as compared to Dfl 82900 in 1989. After deducting personal levies and taxation Dfl 10800 remained as disposable income for family and farm.

Kuchhadiya *et al.* (1992) studied the cost benefit analysis of garlic crop in Jamnagar district of Gujarat state. The data were collected by survey method. The net income per hectare was to the tune of Rs.38, 369 showing higher profitability of crop. The cost benefit ratio was 1:1.99.

Sandhya (1992) in her study on the economics of production and marketing of vegetables in Ollukkara block in Thrissur district reported that cost

C_2 for bitter gourd was Rs 20563.37 per ha and the same for ash gourd was Rs 11037.67 per ha. Labour was the largest item of input for both the crops (bitter gourd and ash gourd) under study.

A study conducted by Sharma *et al.* (1992) in two major vegetable growing regions of Kangra district of Himachal Pradesh, showed that cauliflower, cabbage and peas were the most remunerative in one region while bottle gourd, aubergine and bitter gourd were more profitable in the other.

Grewal and Sharma (1993) concluded that potato based cropping system could be profitable. Studies conducted in All India Co-ordinated Potato Improvement Project have shown that potato-tomato-okra (at Hisar, Hariyana), potato-*mung* bean - groundnut and potato - *mung* bean - rice (at Jorhat), potato-pearl millet -groundnut (at Dersa-Gujarat and Kanpur of Uttar Pradesh) and potato-okra-soya bean (at Chinamare of Madhya Pradesh) were the most remunerative cropping systems for these regions.

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). The overall labour utilization was about 49.5 per cent ratio of female to male labour on vegetable farms.

Singh *et al.* (1995) in their study of economics of cauliflower in the vicinity of Faizabad district reported that average total cost was maximum for marginal farms, followed by small farms and medium farms in that order. Gross income per hectare was more on marginal and small farms as compared to medium and large farms. The benefit cost ratio was estimated to be 1:2.6

Chauhan (1998) 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.

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 economise on marketing cost, maximise the sale price and the production level in the region. The study was conducted in Kumaon and Garhual 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.

Saha and Mukhopadhyay (1999) conducted study in four police circles of Burduon district of West Bengal using personal interview method, with simple random sampling without replacement. Cost A and Cost C estimates per hectare were ranging over different police circles from Rs.9262.87 to Rs.11577.26 and Rs.10580.42 to Rs.11829.37 respectively. The results revealed that there was existence of spatial variation in cost of cultivation of potato per hectare. There was notable variation over different categories of size of operational holdings.

2.2 Resource use efficiency studies

Sankhayan and Sirohi (1970) observed that there was constant returns to scale existing for seed potato cultivation. The study was conducted in Theog teshsil of Mahasu district of Himachal Pradesh from a random sample of 30 farmers using personal interview method. The marginal value products of land and human labour were higher in the case of seed potato as compared to the maize crop

explaining the reason as to why seed potato was more popular in the area under study.

Puttusamy (1979) in his study on potato found that all variables considered viz. rental value of land, human labour, seeds, manures, fertilizers and plant protection chemicals were highly significant and explained 76 per cent variation in output.

Srivastava and Prasad (1979) in their study on vegetable economy of small farms around Bhagalpur found that production efficiency analysis showed that there was diminishing return to scale prevalent as regression co-efficient of each of the inputs were less than one. Inputs like manure and fertilizers, human labour and plant protection had positive and significant effects on output but bullock labour had negative significant effect.

A study conducted by Sharma *et al.* (1992) in two major vegetable growing regions of Kangra district of Himachal Pradesh, showed that farmers could increase total returns by enhancing use of labour. Further, given increasing returns to scale of okra, potato and aubergine, more intensive use of human labour, bullock labour and working capital would lead to higher returns.

Singh *et al.* (1995) studied of economics of cauliflower in the vicinity of Faizabad district. The Cobb-Douglas production function estimates revealed that manures and fertilizer and irrigation had played significant and positive role in the production of cauliflower in all size groups of farms. The effect of area under crops was observed to be negative but not statistically significant in all size groups of farms at 5 per cent level of significance.

Sailaja *et al.* (1998) conducted a study in Guntur district of Andhra Pradesh using multistage sampling technique from 90 vegetable farmers. Cobb-Douglas production function was employed to estimate the production elasticities

of resource use on vegetable farms and observed that there was diminishing returns to scale for tomato and brinjal, constant returns to scale for cauliflower and increasing return to scale for coccinia. Regarding production elasticities, human labour input was found to have positive and significant effect on the output for all the crops concerned. In the case of tomato, seed material input had significant but negative effect on the output.

Kumar and Arora (1999) conducted a study on economics of vegetable production in Kumaon and Garhwal division of Uttar Pradesh using cluster sampling approach with 150 farmers. The vegetables studied were green peas, potato, tomato, capsicum, cabbage, cauliflower, carrot, radish, onion and ginger. Cobb-Douglas production function was fitted to estimate the resource use efficiency in vegetable production.

2.3 Technical efficiency studies

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

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

Pasour and Bullock (1975) considered a situation to be efficient when the decision maker has no preferred alternative, given the circumstances. Further, they added, "Efficiency is a relative concept. Hence, 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 appears to be a difficult task, both conceptually and operationally, than has generally been recognized. The difficulties arise because of the inability of researchers to define the 'optimal' situation in a world of uncertainty. Broek *et al.* (1980) in 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 is called deterministic if all observations lie on or below the frontier and stochastic if observations lie above the frontier due to random events.

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

representing the statistical noise comprising of measurement error and exogenous shocks beyond the control of the production unit in addition to the efficiency component. In this way technical efficiency measures obtained from stochastic frontier are expected to be efficient than those from deterministic models.

Chennarayadu *et al.* (1990) studied the land use efficiency of banana applying the frontier production function. Although banana is an important crop in Andhra Pradesh, with an 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 inefficiency was more in large farms compared to marginal farms. They also suggested that introduction of crop insurance might encourage investments on modern inputs.

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

Dawson *et al.* (1991) calculated single measures of farm specific technical efficiency for rice farms in Central Luzor, the Philippines from the 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 is relevant in developing agricultural economies, where resources are meager and opportunities for developing better technologies are not widespread. Banick (1994) studied the technical efficiency of irrigated farms in a village of Bangladesh using the stochastic production frontier. The results exhibited a wide variation in the levels of technical efficiencies across farms. Out of 99 farms, 88 had technical efficiency of 71 per cent or more. Thirteen farms showed technical efficiency in the range of 91 per cent to 100 per cent. The average technical efficiency for the entire sample of farms was 78 per cent indicating that there was considerable scope for increasing the technical efficiency of the sample farms as a group. A very interesting finding was that 10 out of 13 most efficient farms belonged to the category of small farms. It was also observed that the average technical efficiency of owner-tenant or tenant farms is higher than that of owner farms. The median values of technical efficiencies were 82 per cent for small farms, 80 per cent 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 North-Western province of Pakistan. Education had a positive and significant impact on technical efficiency. Credit improved farmer's liquidity and facilitated the purchase of inputs. For determining efficiency it was found that farm assets, wealth, contact with extension workers and the size of the holdings were important factors. On inefficient farms, farm size was low, fragmentation was high and there were no extension visits. All these farms were located far away from village and

Tehsil markets. They also found that land fragmentation was a consequence of technical inefficiency rather than a cause of it. The study also revealed that younger farmers with easier access to credit, more education and larger assets were most likely to operate efficiently.

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

$TE_{it} = \exp(-U_{it})$ 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 that 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.

2.4 Marketing studies

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

Bhalerao and Charan (1967) enquired about the marketing of vegetables in Varanasi, which covered 50 randomly selected farmers, 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, bottle gourd, sponge gourd, pumpkin, *pawal*, okra, radish, green pea, brinjal, chillies, spinach, tomato, *desi* potato and onion.

Singh (1975) estimated the price spread and marketing cost of potato in Secunderabad. It was found that producers received only Rs.88.90 whereas consumer paid Rs.138.50 per quintal. The marketing cost of wholesalers and retailers accounted for 5.65 and 1.88 per cent out of total marketing cost respectively and it was less than that for producers.

Raghubansi and Kansal (1979) conducted an investigation in Sapran valley of Solan district of Himachal Pradesh. The studies showed that private traders mainly controlled marketing of tomato in Himachal Pradesh. The tomato growers could generally get about 56-63 per cent of the consumers rupee.

Gupta and Ram (1979) in their investigation of behaviour of marketing margins and costs of vegetables in Delhi reported that the producer received only a very low (38 per cent) share in the consumer's rupee. The retailers margin and marketing costs were quite substantial, each appropriating one fourth of the consumer's rupee. Location played an important role in influencing retail margin.

Transport, packing and labour expenses were the major components of marketing cost.

Nandal and Karwarsa (1979) studied the price spread of onion in Kurukshetra and Karnal districts of Hariyana and found that 81.43 per cent of the farmers disposed of 78.85 per cent of the marketed surplus in the village through itinerant merchant (56.84 per cent), village merchant (17.59 per cent) petty village retailer (1.92 per cent) and direct to the consumer (0.50 per cent). The farmer received 51.12 and direct to the consumer (0.50 per cent). The farmer received 51.12 per cent, 80.84 per cent and 52.30 per cent of the consumer's rupee during the peak period in Panipat, Shekabad, Markand and Radan markets respectively.

Prasad (1979) analysed price spread in the marketing of selected vegetables in Bangalore city. Price spread at producers level amounted to Rs.0.55, Rs.0.51 and Rs.0.44 for every kilogram of beans, cabbage and brinjal respectively.

The parallelogram analysis done for potato by Chatta and Kaul (1979) showed a divergent pattern of prices never reaching equilibrium in Punjab. The price spread was also worked out and it was found that there was a wide margin between retail and wholesale prices to the extent of 45.13 per cent. Marketing costs and margins were also examined for their feasibility.

Chatta and Sidhu (1980) studied the production and marketing of potato in Punjab state and examined the problems of potato marketing. It was based on information collected from 80 potato growers, 10 commission agents, five primary wholesalers and 10 peddlers, randomly selected from Jalandhar city in Punjab in 1978-79. The trends in area cultivated, production, marketable surplus, price behavior, marketing channels, price spread, role of cold storage industries, scope for processing, procurement and price support policy for potato were examined.

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

Korak and Isikil (1985) conducted a study in Amritsar, Jalandhar and Faridkot districts using multistage sampling technique. The study revealed that the marketable surplus in Amritsar was 881.53 q per farm in Jalandhar it was 1074.07 q per farm and in Faridkot it was 763.85 q per farm. Regarding the pattern of disposal the results showed that farmers preferred local market to *Apnimandis*. The percentage of disposal was 98.27 per cent for local market in Amritsar, and the same was 93.14 per cent in Jalandhar and 91.82 per cent in Faridkot district.

Kalayankar and Rajmane (1987) in their study on marketing of potato in Jaina district of Maharashtra showed that March was the peak month for arrival while minimum arrivals were recorded in November. Seasonal price indices showed that the increase in the off-season price compared with the immediate post harvest price was around 30 per cent. The producer's share in the consumer's rupee was 65.71 per cent.

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

Sidhu (1988) in a study of new thrusts in agricultural marketing in Punjab found that there should be right type of marketing structure, correct government policies and found net work 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.

Singh and Agarwal (1989) in an economic analysis of market functionaries of cauliflower in rural markets of Kanka block of Ranchi district, found that farmers of Kanka and Mesra sold most of their produce directly to consumers while those in Pithoria sold more output through retailers and wholesalers. Marketing costs were found to vary according to farm size with small farmers incurring the least cost. The most important determinant of market efficiency was said to be the number of middlemen involved in the marketing network.

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.

Rana (1991) concluded that seed potato production was a promising agribusiness in Himachal Pradesh. The per ha average cost of cultivation and profit (over cost C) for seed potato were Rs.36363.99 and Rs.7662.78 respectively. Commission agents and village merchants dominated the marketing scene. The major bottlenecks identified were high cost and non-availability of good and healthy seed and lack of efficient transportation for marketing.

Saini and Thakur (1992) in their study on dynamics of production of seed potato marketing in Himachal Pradesh reported that production of seed potato increased at a compound growth rate of 2.59 per cent per annum. The increase in

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

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

Parmer *et al.* (1994) studied the marketing of vegetables in South Gujarat. Five major vegetable crops namely brinjal, tomato, cabbage, cauliflower and potato were undertaken. The results showed that marketing cost of these vegetables was nearly double at Sonat market than that of Navasri market. The major cost components were transportation and commission charges.

Sen (1994) in his case study on the problems of potato marketing in West Bengal found that the Government or local bodies had very little control over the business adopted by the private traders at the cost of the growers. Trader's return from a quintal of the crop was also higher than the producer's returns.

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 middle men involved in this channel.

Sharma *et al.* (1995) reported that the highest percentage of loss occurred during market operation and assembling caused major loss for beans and peas. Increased production with minimum losses was the important factor for increasing marketed surplus. Costly wooden boxes, time consuming, manual

grading, distant markets, high transportation charges. Malpractices in market and lack of market information were the major problems faced by the growers.

Ramachandran (1997) in her study on economics of production and marketing of vegetables in Chittur Taluk (Palghat district) reported that net income from tomato was higher (Rs. 15434 per hectare) than that from okra (Rs. 15434 per hectare).

Chauhan (1998) in a study on economic analysis of vegetable production in Azamgarh district of Uttar Pradesh observed that out of three major marketing channels, sales through commission agent - retailer was the most important one.

Investigation carried out by Mendez (1998) revealed that private dealers occupy a larger share of the seed market in the Nilgris district of Tamil Nadu. For instance, in the case of hybrid cabbage and carrot seeds Sandoz had the largest market share of 95.86 per cent and 95.60 per cent respectively.

Nagesh (2001) in his study on economic analysis of production and marketing of vegetables in Thiruvananthapuram district found that the KHDP (Kerala Horticultural Development Programme) bitter gourd growers showed an estimated mean technical efficiency of 80 per cent and for IVDP (Intensive Vegetable Development Programme) growers it was 71 per cent.

Area of Study

3. AREA OF STUDY

3.1 Idukki district

Idukki district is widely known across the country for its scenic beauty with numerous mountains and valleys. Places like Thekkady wild life sanctuary and lake, abode of hydroelectric projects especially the Idukki dam, the Periyar river, dense forests etc. of the district have found place in the tourist map of the country. The district is also famous for plantation and spice crops like tea, coffee, cardamom, pepper, ginger etc. in the high ranges and rubber in the middle land.

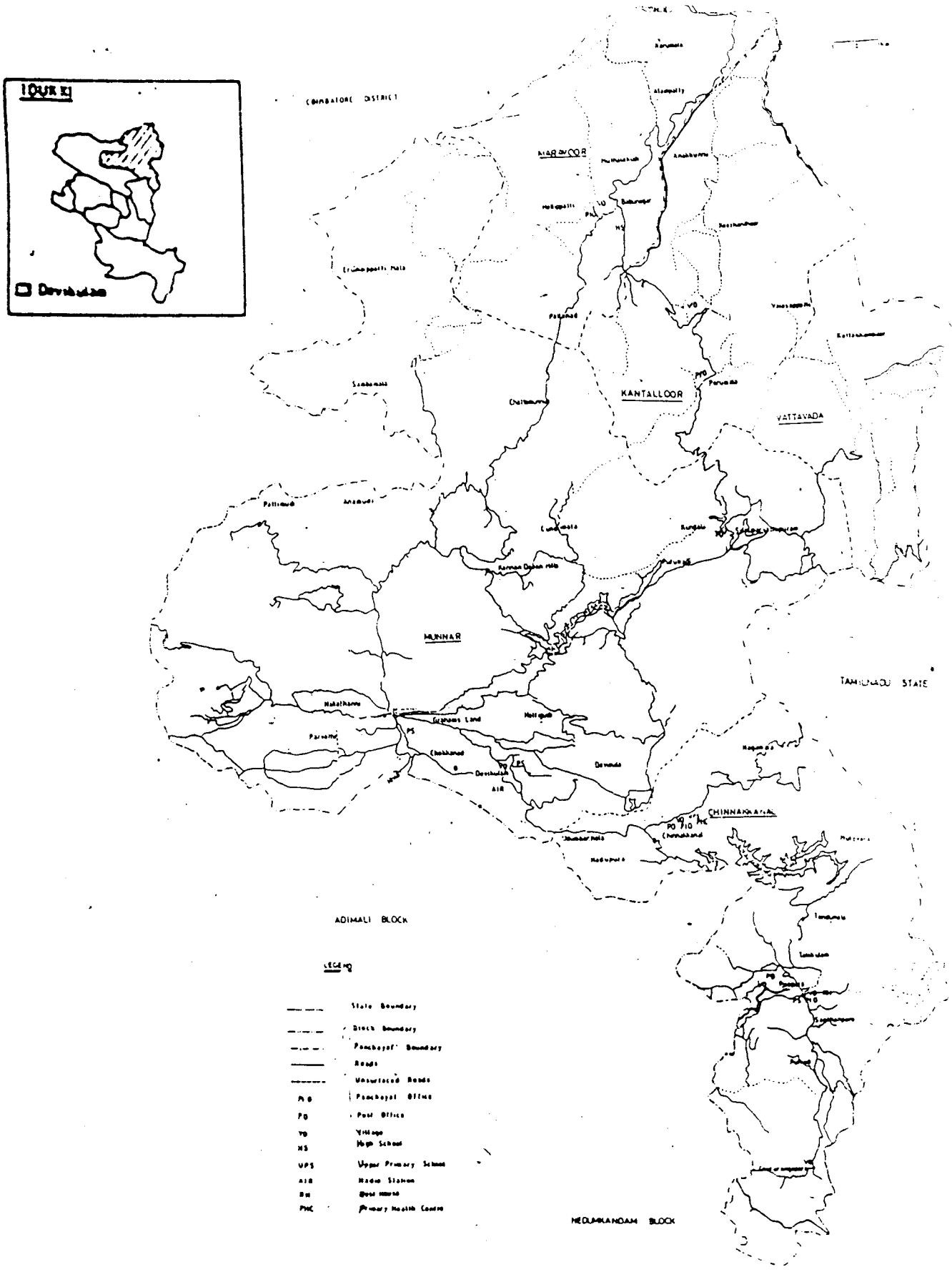
Periyar, Thodupuzha, Thalayar etc. are some of the important river systems in the district. The famous Pamba river originates here and after that runs through a while through the district. Devikulam, Eravikulam and Elaveehaponchira are the three fresh water lakes in the district.

The national high way system and railway lines do not figure in the district map. The main road systems are Kottayam-Kumily, Kochi-Munnar, Kumily-Munnar, Thodupuzha-Idukki, Kothamangalam-Idukki and Idukki-Kumily/Nedumkandam.

Idukki district is bound on the north by Trichur district (Kerala) and Coimbatore district (Tamil Nadu), on the east by Dindigul, Theni, Ramanathapuram and Thirunelveli districts (Tamil Nadu), on the south by Pathanamthitta district (Kerala) and on the west by Kottayam and Ernakulam districts (Kerala). The district lies between 9°-15° and 10°-21° of north latitude and 76°-37° and 77°-25° of each latitude.

The headquarters of the district is Idukki. There are four blocks in the district viz. Devikulam, Udumbanchola, Peermedu and Thodupuzha. The former

Fig. 1. Map of Devikulam block



three blocks lie in the high land, which is 250 ft above MSL, while Thodupuzha block lies partly in the high land and partly in the midland which is between 25 ft and 250 ft above MSL. The majority of geographical area of the district lies in the high land characterised by high rainfall and cool climate and the district does not have coastal belt in the low land which is below 25 ft above MSL. The total geographical area of the district sprawls over an area of 5150 sq.km, which is 13 per cent of the total area of the state.

3.2 Devikulam block

3.2.1 History

Several notes are found in history and epics about this area. It is believed that, Lord Sriram and Sitadevi visited this place during '*Vanavasam*'. The name 'Devikulam' came after Sitadevi as she took bath in a pond here. In another great epic Mahabharata also this area has been cited. It is said that, '*Pandavas*' had stayed in the area during their '*Vanavasam*' and so the place was named as '*Maranjirunna oor*'. Now the place is called as '*Marayur*'(Source : Records of the Assistant Director of Agriculture, Munnar, 1996).

People migrated from Tamil Nadu to this area as Madurai King Thirumalainaicker was defeated by Tippu Sultan. Migrated people created villages like Kanthalloor, Keezhanthur, Karayur, Marayur and Kottakudi. These villages were called as 'Anju nadu'.

During British period this block was under Periyakulam taluk. British administration introduced plantation crops like rubber, coffee, tea, cardamom etc. Now plantation crops are grown predominantly in Devikulam block. Labourers from Tamil Nadu were brought here to work in these plantations. As a result migration of hundreds of Tamil families took place.

A mixture of culture of Tamil and Malayalam is prevailing here. Apart from Malayalees and Tamils, Tribes are also living in some area of the block.

3.2.2 Location

Devikulam block lies in western ghats, at an altitude range of 3500 to 8500 feet. Geographically, the block is divided into four parts. they are

1. Tall mountains
2. Steepy slopes
3. Medium type mountains
4. Valleys and plains

Tall mountains comprise of nearly 25 per cent of the total geographical area of the block. Major geographical area is covered by medium type mountains. Plantation crops like tea, coffee, cardamom etc. are cultivated extensively in these areas. These types of mountains mainly lie in panchayats like Munnar, Chinnakkanal and Santhanpara.

Marayur and Kanthallur panchayats fall under valleys and plains category. Crops like paddy, sugarcane, Vegetables etc. are cultivated here.

3.2.3 Area

Theni district of Tamil Nadu (east), Adimali block (west), Coimbatore district of Tamil Nadu (north) and Nedunkandam and Adimali panchayats (south) are boundaries for the block. There are six panchayats viz. Marayur, Munnar, Kanthallur, Vattavada, Chinnakkanal and Santhapara under the block.

The total area of the block scales to 994.49 sq.km. Munnar panchayat having 556.87 sq.km occupies the highest area among the blocks followed by Kanthallur (116.29 sq.km) and Marayur (108.07 sq.km). Geographical area of each panchayat is given in Table 3.2.1.

Table 3.2.1. Geographical area of Devikulam block

Name of the panchayat	Area (sq.km)
Marayur	108.07
Munnar	556.87
Kanthallur	116.29
Vattavada	67.81
Chinnakkanal	66.74
Santhanpara	78.71
Total	994.49

Source : Records of the Assistant Director of Agriculture, Munnar, 1996

3.2.4 Climatic conditions

The climatic conditions prevailing in the area can be divided into three seasons. They are, winter (December-January), summer (February-May) and rainy season (June-July).

The average annual rainfall in Devikulam block was 29.2 cm. The block receives rainfall mainly from south west monsoon (June-September). It also experiences showers during north east monsoon period (October-December) and summer. Kallar and Nallathanni areas of the block which recorded a maximum rainfall of 630 cm (1990) are called as 'Chirrapunji of South India'. The average annual rainfall of the block is given in Table 3.2.2.

Table 3.2.2. Annual average rainfall of Devikulam block (in cm)

Place	Annual average	June-September	October-December	January-May
Devikulam	292	192	49	41
Munnar	382	289	41	44
Santhanpara	187	84	64	39
Chinnakkanal	66	17	34	14
Marayur	137	61	54	24

Source : Records of Assistant Director of Agriculture, Munnar, 1996

3.2.5 Rivers

Pambar river which originates from Ernakulam district, flows towards east through Munnar, Marayur and Kanthallur and finally reaches Tamil Nadu.

Nallar, Palar and Kanniyar rivers which originate from different parts of Munnar panchayat, combine at Munnar and flows towards west by name 'Muthirappuzha'. It is a sub-river of Periyar.

3.2.6 Population

Devikulam block supports a population of 1,27,830 of which 65,453 were males and 62,377 were females. Regarding literacy rate, there is 70 per cent literacy among males, and 61 per cent among females. Details containing panchayat wise population and literacy rate is given in Table 3.2.3.

Table 3.2.3. Population, population density and literacy rate in Devikulam block

Panchayat	Population (number)			Population density (per sq.km)	Literacy rate (%)	
	Male	Female	Total		Male	Female
Marayur	4792	4798	9590	89	70	60
Munnar	40208	38135	78343	141	85	74
Kanthallur	5272	4993	10265	88	81	70
Vattavada	2362	2266	4588	68	48	28
Santhanpara	7113	6776	13889	176	77	59
Chinnakkanal	5706	5449	11155	167	74	58
Total	65453	62377	127830	129	70	61

Source : Records of Assistant Director of Agriculture, Munnar, 1996

3.2.7 Employment situation

Agriculture is the major source of income in the block. Plantation crops like tea, coffee, cardamom and rubber, fruits, vegetables, spices and many other agricultural crops are cultivated in the area. Unlike other parts of the state, there is no labour shortage in the block. Labourers from Tamil Nadu who have migrated here are working in various farms and estates. The wage rate prevalent in the block

is almost similar to that of the wage rate prevailing in Tamil Nadu. Employment situation in the block is shown in Table 3.2.4

Table 3.2.4. Employment situation in Devikulam block

Panchayat	Permanent labourers (number)	Temporary labourers (number)	Unemployed (number)
Marayur	42246	229	5115
Munnar	37241	1020	40082
Kanthallur	5603	137	4525
Vattavada	6935	492	2021
Santhanpara	2485	72	6474
Chinnakkanal	5777	358	5018
Total	62287	2308	63235

Source : Records of the Assistant Director of Agriculture, Munnar, 1996

3.2.8 Land distribution

Out of 5,07,012 ha land available in the block, 505608 ha is garden land and the remaining 1404 ha is wetland. Of the total area, 57372 ha is used for agricultural purposes. But a major portion of land area (445198 ha) is left fallow. A sum of 2104 ha land area, lies under non-agricultural use. Munnar panchayat has a major share of garden land. But most of the portions of land (about 94 per cent) are left fallow in the panchayat. In Munnar and Santhanpara panchayats there are no wetlands, but occupied fully by garden lands. In Kanthallur and Marayur panchayats there is a considerable share of wetlands (580 ha and 578 ha respectively). Land used for non-agricultural purpose was more in Munnar and Santhanpara (599 ha and 559 ha). Tables 3.2.5 and 3.2.6. show the land distribution in the block.

Table 3.2.5. Panchayat wise land distribution based on use in Devikulam block (in ha)

Panchayat	Garden land	Wet land	Total
Marayur	6205	578	6783
Munnar	467052	-	467052
Kanthallur	11054	680	11634
Vattavada	6562	221	6783
Santhanpara	8008	-	8008
Chinnakkanal	6727	25	6737
Total	505608	1404	507012

Source : Records of Assistant Director of Agriculture, Munnar, 1996

Table 3.2.6. Panchayat wise land distribution based on use in Devikulam block (in ha)

Panchayat	Total land area	Agricultural land	Fallow land	Non-agricultural purpose land
Marayur	6783	4643	1966	174
Munnar	467052	28105	438348	599
Kanthallur	11634	6688	4532	414
Vattavada	6783	4442	2323	18
Santhanpara	8008	7363	86	559
Chinnakkanal	6737	6131	266	340
Total	507012	57372	445198	2104

Source : Records of the Assistant Director of Agriculture, Munnar, 1996

3.2.9 Company estates

Out of the plantation crops cultivated in the block, tea holds a major share in area, which comes about 14000 ha. Three major companies namely Tata Tea Ltd., Harrisons Malayalam Ltd. and Thalayar Estates dominate the tea cultivation in the area. Tata Tea Ltd. itself has an area of 9578.89 ha under tea cultivation in the block. The company has 18 tea factories in various estate sites.

Most of the labourers working in these estates are those who have migrated from Tamil Nadu. Various facilities have been provided to them by the companies under the Plantation Act. Tata tea company has provided quarters, hospitals and schools to the labourers. More over, to each family of labourers has been rented about 0.4 acre of land, from which the family can earn some income by way of farming.

The lands given to the labourers were owned by the factory and the labourers need not pay the land revenue. Once the labourers retire from the company, they should leave all the facilities provided to them.

3.2.10 Cropping pattern

A variety of crops were cultivated in the area. Agricultural crops like paddy, *ragi* and sugarcane, fruit crops like orange, guava, mango etc. were cultivated. But plantation crops like tea, coffee, cardamom, rubber, cashew, coconut etc cover major area. Other crops like ginger, pepper, lemongrass etc. are also cultivated in an area of 1767 ha in the block. Details showing the information regarding area of various crops was given in Table 3.2.7.

Table 3.2.7. Cropping pattern in Devikulam block

Crop	Area (ha)
Tea	14000
Paddy	482
Rubber	250
Sugarcane	500
Coconut	400
Cardamom	822
Coffee	320
Black pepper	1120
Lemon grass	100
Tapioca	106
Ragi	30
Ginger	45
Arecanut	15
Cashew	8
Nendran banana	6
Other fruits	-
Vegetables	1767

Source : Records of the Assistant Director of Agriculture, Munnar, 1996.

Paddy was cultivated in an area of 482 ha. It is mainly cultivated in Marayur, Kanthallur and Chinnakkanal panchayats. Sugarcane cultivation extends to Marayur and Kanthallur panchayats. Marayur jaggery is well known in many parts of the country.

Coffee and cardamom are extensively cultivated in Santhanpara and Chinnakkanal panchayats. Mulberry cultivation is undertaken in small pockets in Kanthallur and Marayur panchayats, to support silk thread production. Arecanut is

cultivated in 150 ha of Marayur, Santhanpara and Chinnakkanal panchayats and Mankulam area of Munnar panchayat. Mangala and Kasargod local are the predominant varieties of arecanut grown in these areas.

Pepper varieties like Panniyur-1, Karimunda, Vellamunda etc. are grown in Santhanpara and Muttukad and Mankulam areas of Munnar panchayat. Lemongrass cultivation is confined to Kanthallur and Marayur panchayats, in 100 ha of area. Rubber is cultivated in an area of 250 ha and is concentrated in Mankulam area. Coconut is cultivated in very few pockets of Marayur, Santhanpara, Kanthallur and Munnar panchayats.

A variety of fruit crops like banana, orange, mango, jack, pineapple, guava, papaya, grapes, strawberry, peach, plum, pear etc. are cultivated in the block. Orange cultivation is directly undertaken by Tata Tea Ltd. Details related to the area of fruit crops in the block is shown in Table3.2.8.

Table 3.2.8. Area under fruit crops in Devikulam block

Fruit crop	Area (ha)
Mango	5
Grapes	1
Orange	50
Guava	40
Pear	5
Strawberry	75

Source : Records of the Assistant Director of Agriculture, Munnar, 1996.

In addition to the above ginger, Nendran banana, cashew, *ragi* and some medicinal plants are also cultivated in the block.

3.2.11 Vegetable farming

In Devikulam block, vegetables are cultivated in 'Puncha' lands of Kanthallur and Marayur panchayats and in the estate plots of Munnar and Vattavada panchayats. Cool season vegetables like cabbage, cauliflower, knol khol, carrot, radish, beet root, turnip, onion, beans, bush beans, peas, potato, garlic,

tomato, sweet potato etc. were cultivated. Potato was cultivated in largest area (542 ha) among the vegetables grown, closely followed by garlic (472 ha). These two crops are widely cultivated in Kanthallur and Vattavada panchayats. Other vegetables like carrot, cabbage, beans etc. also occupy a considerable land area under vegetable cultivation. Details regarding the area under vegetables in the block were given in Table 3.2.9.

Vegetables like cabbage, cauliflower, knol-khol, radish, carrot, beet root, turnip, celery, beans, amaranthus, coriander etc. were cultivated throughout the year. In October-December season onion, peas, etc. were cultivated, potato and garlic were cultivated in April-July and October-December months.

Table 3.2.9. Area under cool season vegetable crops in Devikulam Block

Sl. No.	Name of crop	Area (ha)	Season	Total yield (M.T)
1.	Potato	542.00	Apr. - Jul./Oct. - Dec.	21680.00
2.	Garlic	472.00	Apr. - Jul./Oct. - Dec.	5664.00
3.	Cabbage	92.00	All season	4140.00
4.	Cauliflower	73.00	Jan.-April	1460.00
5.	Knolkhol	31.56	All season	1136.16
6.	Radish	18.00	All season	756.00
7.	Carrot	123.00	All season	1369.00
8.	Beet root	77.00	All season	3003.00
9.	Turnip	23.00	All season	690.00
10.	Celery	7.00	All season	126.00
11.	Green Peas	95.00	Oct.-Dec.	570.00
12.	Beans	140.00	All season	2100.00
13.	Amaranthus	35.00	All season	840.00
14.	Coriander	30.00	All season	225.00
15.	Onion	8.00	April-July	28.00

Source : Records of the Assistant Director of Agriculture, Munnar, 1996

Methodology

4. METHODOLOGY

The study was conducted in Devikulam block of Idukki district. The block was purposively selected as it has a major area under cool season vegetables in the state. The data were collected from farmers who were cultivating potato, garlic, carrot and cabbage in the block.

4.1 Sampling procedure

Two stage random sampling procedure was adopted for the study with panchayat as the primary unit and farmer as the second and ultimate unit. There are six panchayats under Devikulam block, viz. Marayur, Munnar, Kanthallur, Vattavada, Chinnakkanal and Santhanpara. From the list, two panchayats viz. Munnar and Vattavada were selected at random. List of commercial growers (having a minimum of 5 cents) cultivating cool season vegetables was collected from the office of the Assistant Director of Agriculture of Devikulam block and Krishi Bhavans of the respective panchayats.

Total area under cool season vegetables in these two selected panchayats was collected from the concerned Krishi Bhavans (1110 ha in Vattavada and 395 ha in Munnar). Out of the vegetable grown in the area only four cool season vegetables viz., potato, garlic, carrot and cabbage were selected for the study. These vegetables were selected as they occupy the major portion of the area under vegetable cultivation.

From the list of growers a sample of 200 farmers (50 farmers for each crop) was selected randomly from the two panchayats. The sample growers of each vegetable were further classified into two classes, namely class I and class II based on the size of operational holding and was given in Table 4.1.1.

Table 4.1.1. Distribution of sample farmers according to size of operational holding

Crop	Number of farmers		Total
	Class I (≤ 0.2 hectare)	Class II (>0.2 hectare)	
Potato	28	22	50
Garlic	32	18	50
Carrot	31	19	50
Cabbage	27	23	50
Total	118	82	200

4.2 Collection of data

The data were collected through personal interview method using well structured and pre-tested schedule.

For each vegetable, data on marketing aspects were collected from a sample of five village traders. A separate schedule was developed for collecting data on marketing aspects such as marketing costs, marketing margins etc. The data were collected from April to June 2000 and the reference period for the study was the year 1999-2000.

4.3 Main items of observations made:

a) Major vegetables grown by each farmer

b) Area under each vegetable

c) Labour use - family as well as hired

d) Cropping pattern - season, total area and irrigated area

e) Irrigation - mode of irrigation and number of irrigations

f) Manures and fertilizers

g) Pests and diseases - plant protection measures followed

h) Cost of cultivation of selected cool season vegetables

i) Mode of marketing, marketing costs and margins

j) Constraints in production and marketing

k) Employment generation

4.4 Analytical framework

4.4.1 Costs and returns

The profitability of crop enterprises can be estimated by finding the relationship between the costs incurred and the returns realized from the crop production.

4.4.2 Cost concepts

Various cost concepts used in farm management studies viz. Cost A_1, Cost A_2, Cost B_1, Cost B_2, Cost C_1, Cost C_2 and Cost C_3 were employed.

1. Cost A_1

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

a) Value of hired human labour

Human labour employed for various cultural practices like land preparation, interculture, manuring, plant protection, irrigation and harvesting were included in determining the value of hired human labour. The actual wages paid for labour was considered as the value of hired labour.

b) Value of seeds

The purchased seeds were evaluated on the basis of their purchase price. Farm produced items were valued at their market price.

c) Value of manures and fertilizers

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 valued at their market price.

d) Value of plant protection chemicals

Expenditure on fungicides, insecticides and weedicides have been calculated by multiplying the physical quantities of different fungicides, insecticides and weedicides used by their respective market price.

e) Depreciation on farm implements

Depreciation of farm implements and machinery was estimated for the duration of the crops at a rate of 11.5 per cent per annum (Farm buildings were not found in the study area).

f) Interest on working capital

Interest on working capital was charged at the rate of 11.25 per cent per annum. This was the rate of interest charged by Canara Bank for short term agricultural loans. Interest was charged for only half the duration of the crop, as all the costs are not incurred at the beginning itself.

g) Land revenue

As the lands were not owned by the sample farmers (they were cultivating in company's plots) land revenue was not included.

2. Cost A_2

As rent is not paid for the leased in land by the cultivators in the study area, Cost A_1 = Cost A_2

3. Cost B_1

Cost B_1 = Cost A_1 + interest on own fixed capital. The fixed capital items included iron and wooden implements, machinery such as diesel and electric motors etc.

4. Cost B_2

As lands were not owned by the farmers (they are cultivating in company's lands) the rental value of owned land is zero. So Cost B_1 = Cost B_2

5. Cost C_1

Cost C_1 = Cost B_1 + imputed value of family labour. The actual work done by the members of the family on crop production was taken as family labour. This was evaluated in the basis of wage rate prevailing in the locality.

6. Cost C_2

Cost C_2 = Cost B_2 + imputed value of family labour. The cost of family labour was imputed on the basis of prevailing wage rates paid to hired human labour in the study area. So Cost C_1 = Cost C_2.

7. Cost C_3

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

8. Cost of cultivation

Cost of cultivation refers to the total expenses incurred in cultivating one hectare of vegetables. Input-wise and operation-wise cost of cultivation and their percentages to total were worked out.

9. Cost of production

Cost of production is the cost of producing one quintal of the concerned vegetable.

4.4.3 Efficiency measures

The following income measures associated with different cost concepts were used to study the efficiency of cool season vegetables cultivation in the area.

1. Farm business income: It is gross income minus Cost A_1
2. Family labour income: It is gross income minus Cost B_1
3. Net income: It is gross income minus Cost C_1
4. Farm investment income: It is farm business income minus imputed value of family labour
5. 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 incurred are commensurate with the returns obtained. This has been worked out at Cost A_1, Cost B_1, Cost C_1 and Cost C_3.

4.4.4 Bulk line cost

Bulk line cost was worked out for vegetables namely potato, garlic, carrot and cabbage. Bulk line cost of production is that cost which covers cost of production of the majority of farmers production or area. Conventionally, the bulk line cost is calculated so as to cover 85 per cent of farmers or production or area on cost C basis (Kahlon and Tyagi, 1983).

In the present study for calculating bulk line cost, average total cost per quintal on Cost C_3 basis was analysed in ascending order and the cost at 85 per cent of total output supplied was selected as the bulk line cost. Data obtained from the analysis of bulk line cost were used to draw bulk line cost curves. Bulk line cost curve as given by Marshall represents the array of actual average costs of the different producers, in an industry when the total output of an industry is given, the

industrial costs being arranged in increasing order of size from left to right (Dhondyal and Krishna, 1958).

4.4.5 Measurement of technical efficiency

The frontier production function was employed to measure the technical efficiency of farmers. The concept of production frontier is the same as that of production function. The production frontier is defined as the function that describes the greatest possible output from a given combination of inputs, that is, it is a production "frontier". Therefore, failure to operate on the production frontier is technical inefficiency.

The measurement of inefficiency is the main motivation for the study of frontiers. Farrel elaborated the concept of technical efficiency. It involves the firm's ability to obtain the maximum output from a given set of inputs or resource. If a firm uses the best practice or method and could achieve the maximum output with a given set of inputs and technology, then it is likely to be superior to another firm which do not get the same output with a given bundle of similar inputs and technology.

The estimation of production frontier proceeded along two general paths.

1. Deterministic frontier - which forces all observations to be on or below the production frontier so that all deviations from the frontier are attributed to inefficiency.

2. Stochastic frontier - where the disturbance term consists of two components; one component representing technical inefficiency and the other representing the usual random noise. The advantage of the stochastic frontier over the deterministic frontier is that farm-specific efficiency and random error effect can be separated.

Thus, in the stochastic production frontier, 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 (such as poor input performance, bad weather, input supply breakdown etc.). The one-sided component captures deviations from the frontier due to inefficiency.

4.4.5.1 The stochastic frontier

The following equation denotes the production frontier in the matrix form.

$$Qi = Q(X_{ki}, ß)e^{Ei}$$

$$i = 1, \ldots\ldots, n; \; k = 1, \ldots\ldots, k$$

where, Qi is the output of the i^{th} farm, Xi is a vector of k inputs of the i^{th} farm, ß is the vector of parameters to be estimated and Ei is a farm-specific error term. The stochastic frontier is called a 'composed' model because the error term is composed of two independent elements,

i.e.,

$$E_i = V_i - U_i, \; i = 1, \ldots, n$$

The term V_i is the symmetric component and permits random variation in output due to factors like weather, plant disease, etc. It is assumed to be identically and independently distributed as $Vi = N(0, \sigma^2 v)$. A one-sided component ($Ui > 0$) reflects efficiency relative to the stochastic frontier $Q_i = Q(X_{ki}, ß)e^{Ei}$. Thus $Ui = 0$ for any farm lying on the frontier, while $Ui > 0$) for any farm lying below the frontier. Hence, expression (Ui) represents the amount by which the frontier exceeds realised output. Assuming that U_i is identically and independently distributed as $U_i = N(0, \sigma^2 u)$, that is, the distribution of Ui is half normal. Thus, U_i takes the value zero when the farm produces on its outer-bound

production function (realising all the technical efficiency potential) and is less than zero when the farm produces below its outer-bound production function (not realising fully its technical efficiency potential). This might happen due to a number of factors, such as risk aversion, self satisfaction, lack of information, which may prevent the farm from achieving its full potential.

The Cobb-Douglas functional form was generally preferred in most published papers on technical efficiency because of its well known advantages. In principle, confining the analysis to this functional form can be somewhat restrictive. However, it is possible to estimate the stochastic frontier production function using the MLE (Maximum Likelihood Estimation) method. Aigner suggested that the maximum likelihood estimates (MLE) of the parameters of the model could be obtained in terms of parameterisation.

The Density function can be written as:

$$fu(Ui) = \frac{1}{\sigma U\sqrt{\pi/2}} \exp\left[-1/2\frac{U^2}{\sigma^2 U}\right] \quad \text{if} Ui > 0$$

It follows that:

$\sigma^2 = V$, $(\Sigma\sigma)^2 = \sigma^2 V + \sigma^2 U$

Further defining

$\lambda = \sigma u/\sigma v$ (i.e.) ratio of one sided error term to symmetric error term.

$$\text{i.e.}\ \sigma^2 = \sigma^2 U + \sigma^2 V; \text{and} \gamma = \frac{\sigma^2 U}{\sigma^2 V}$$

One advantage of estimating the frontier is that it is possible to find out whether the farmer's deviation of yield from the frontier yield is mainly because he/she did not use the best practice or technique or is due to external random factors. Thus, one can say whether the difference between the actual yield obtained and the frontier yield, if any, occurred accidentally or not.

$$\text{i.e.}\ \sigma^2 = \sigma^2 U + \sigma^2 V; \text{and}\ \gamma = \frac{\sigma^2 U}{\sigma^2 V}$$

Where, 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 interesting points about γ.

i) When σ^2V is tending to zero, which implies that U_i is the predominant error, then the $\gamma = 1$. This means that the farmer's yield difference from the maximum feasible yield is because he/she did not use the best practice or technique.

ii) When σ^2U is tending to zero, which implies that the symmetric error term V_i is the predominant error, then γ is tending to zero. This means that the farmer's yield difference from the frontier yield is mainly because of either statistical error or external factors not under his/her control. In this study, the MLE (Maximum Likelihood Estimation) method was used for estimation.

4.4.5.2 Specification of the model

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

$$\ln Y_j = \ln \beta_o + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \varepsilon_j$$

where,

Y_j = yield (kg/ha)

X_1 = Human labour (man days/ha)

X_2 = Seed (kg/ha)

X_3 = Fertilisers – NPK combined (kg/ha)

X_4 = Farm yard manure (tonnes/ha)

$\varepsilon_j = V_j - U_j$

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

4.4.5.3 Technical efficiency of individual farms

The farm specific technical efficiency (TE_j) of the j^{th} farmer was estimated by using the expectation of U_j conditional on the random variable ε_j.

$$TE_j = \exp(-U_j)$$

so that

$$0 \leq TE_j \leq 1$$

4.4.5.4 Assumptions in estimating the stochastic frontier model

In the present study, the following assumptions were made which underline the specification of a 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 measurement error on the dependent variable and the other statistical noise.

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

4.5 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, 1997). In the present study important marketing channels in the marketing of cool season vegetables were identified.

4.5.1 Marketing channels

Marketing channels are the routes through which agricultural products move from producers to consumers. The length of the channel varies from commodity to commodity, depending on the quantity to be moved, the form of consumer demand and degree of regional specialization in production (Acharya and Agarwal, 1997).

4.5.2 Marketing costs and margins

Marketing efficiency was measured in terms of marketing costs and margins. Marketing margin is the difference between the price paid by the consumer and the price received by the producer for an equivalent quantity of farm produce. The concept of 'concurrent margin' refers to the difference between the prices prevailing at successive stages of marketing at a given point of time.

Marketing efficiency is measured as follows:

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

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

4.6 Constraints faced by the farmers in the cultivation of cool season vegetables

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

1. Incidence of pests and diseases
2. Lack of capital
3. Lack of irrigation facilities
4. High wage rate
5. Lack of marketing facilities
6. Low price of the produce
7. Lack of access to market
8. Climatic factors
9. Transportation
10. Problem of forest animals

The farmers were asked to rank the constraints from one to 10 according to the order of importance as perceived by each of them. Weights from 10 to one

were assigned to these ranks respectively and a weight of zero was assigned to the constraints, which were not recognised 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

5. RESULTS

The data for the present study on economic analysis of production and marketing of cool season vegetables in Devikulam block of Idukki district during the period from April-May of 2001. The results obtained from the study are presented and an attempt has been made to interpret the results.

Results have been discussed under following headings

5.1. General socio-economic conditions of the sample farmers
5.2. General practices of cultivation
5.3. Input wise cost of cultivation
5.4. Operation wise cost of cultivation
5.5. Production and value of output
5.6. Cost of production
5.7. Bulk line cost of production
5.8. Labour use pattern
5.9. Farm efficiency measures
5.10. Benefit cost ratio
5.11. Measurement of technical efficiency
5.12. Marketing
5.13. Constraints in cool season vegetable cultivation

5.1 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 land holding, family size, age, sex, educational status and occupation of the respondents.

5.1.1 Land holding

Distribution of sample farmers according to the size of operational holding is given in Table 5.1.1.

Table 5.1.1. Distribution of respondents according to size of operational holding (number)

Growers	Holding size		
	≤ 0.2 ha	> 0.2 ha	Total
Potato	28 (56)	22 (44)	50 (100)
Garlic	32 (64)	18 (36)	50 (100)
Carrot	31 (62)	19 (38)	50 (100)
Cabbage	27 (54)	23 (46)	50 (100)
Total	118 (59)	82 (41)	200 (100)

(Figures in parentheses are percentage to the total)

A sample of 200 farmers has been selected for the present study, 50 farmers each for potato, garlic, carrot and cabbage. Of the total respondents 59 per cent had less than 0.2 ha under cultivation and the remaining 41 per cent had land area of above 0.2 ha under cultivation.

Among potato growers, 56 per cent had less than 0.2 ha. and the same was 64 per cent, 62 per cent and 54 per cent in the case of garlic, carrot and cabbage growers respectively.

5.1.2 Family size

Distribution of respondents according to their family size is given in Table 5.2.2.

Table 5.1.2. Distribution of respondents based on family size

Growers	Family size (number)			
	Up to 4	5 to 6	Above 6	Total
Potato	19 (38)	24 (48)	7 (14)	50 (100)
Garlic	21 (42)	19 (38)	10 (20)	50 (100)
Carrot	23 (46)	19 (38)	8 (16)	50 (100)
Cabbage	25 (50)	18 (36)	7 (14)	50 (100)
Total	88 (44)	80 (40)	32 (16)	200 (100)

(Figures in parentheses denote percentage to the total)

Results of analysis on classification of sample farmers based on their family size revealed that 44 per cent had family size of less than four members.

About 40 per cent of the respondents' family size was five to six members and 32 per cent respondents' family size was more than six members.

5.1.3 Age and sex

Classification of respondents according to age and sex is given in Table 5.1.3.

Table 5.1.3. Distribution of respondents based on age and sex (number)

Growers	0-6 years			7-14 years			15-30 years			31-60 years			>60 years		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
Potato	16	14	30	32	38	69	33	21	54	40	33	73	8	13	21
Garlic	14	12	26	37	29	66	31	34	65	38	33	71	4	8	12
Carrot	14	10	24	30	31	61	29	34	63	33	24	57	7	7	14
Cabbage	12	10	22	33	24	57	29	33	62	36	25	61	9	6	15
Total	56	46	102 (11.05)	132	121	253 (27.41)	122	122	244 (26.44)	147	115	262 (28.39)	28	34	62 (6.22)

(Figures in parentheses denote percentage to the total)

About 28.39 per cent of the total members were under the age group of 31-60 years, and 7-14 years age group and 15-30 years age group having 27.41 and 26.44 per cent of the total members respectively closely followed it. Only a small percentage belonged to the age group of 0-6 years (11.05 per cent) and more than 60 years (6.72 per cent). Of the total members 52.55 per cent were males and 47.45 per cent were females.

5.1.4 Educational status

Analysis regarding educational status of the respondents revealed that 43.5 per cent were educated up to middle school level, 35.5 per cent were educated up to primary school level and 10.5 per cent up to high school level. The study also showed that two per cent of the respondents had completed technical education viz.. electrician, plumber, welder etc. The results showed that 91.5 per cent of the respondents were literate. Table 5.1.4 shows the classification of respondents according to the educational status.

Table 5.1.4. Classification of respondents according to educational status (number)

Growers	Education status					
	Illiterate	Primary School level	Middle School level	High School level	Technical Education level (ITI)	Total
Potato	4 (14)	12 (46)	23 (46)	6 (12)	2 (4)	50 (100)
Garlic	4 (8)	16 (32)	20 (40)	8 (16)	2 (4)	50 (100)
Carrot	3 (6)	23 (46)	19 (38)	5 (10)	0 (0)	50(100)
Cabbage	3(6)	20 (40)	25 (50)	2 (40)	0 (0)	50(100)
Total	17 (8.5)	71 (35.5)	87 (43.5)	21 (10.5)	4 (2)	200 (100)

(Figures in parentheses denote percentage to the total)

5.1.5 Family income

Classification of respondents based on family income is given Table 5.1.5.

Table 5.1.5. Classification of respondents based on family income (number)

Growers	Family income (Rs. per household/annum)			
	Up to 25,000	25,000 to 50,000	Above 50,000	Total
Potato	12 (24)	32 (64)	6 (12)	50 (100)
Garlic	9 (18)	34 (68)	7 (14)	50 (100)
Carrot	8 (16)	37 (74)	5 (10)	50 (100)
Cabbage	11 (22)	35 (70)	4 (8)	50 (100)
Total	40 (25)	138 (69)	22 (11)	200 (100)

(Figures in parentheses denote percentage total)

Of the total respondents, a maximum of 69 per cent had family income of Rs.25,000 to 50,000. This was followed by the income category of up to Rs.25,000 (25 per cent of the total respondents). About 11 per cent of the total respondents had an annual income of more than Rs. 50,000.

5.1.6 Distribution of family income

Distribution of family income of the sample farmers was worked out and it is shown in Table 5.1.6.

Table 5.1.6. Distribution of family income of respondents (Rs./household /annum)

Source of income	Growers			
	Potato	Garlic	Carrot	Cabbage
I. Farm income				
1. Agriculture				
i) First season	1399.20	1189.20	1128.29	1152.96
	(3.98)	(3.36)	(2.90)	(2.85)
ii) Second season	1331.16	977.64	1392.24	1014.99
	(3.79)	(2.76)	(3.57)	(2.50
iii) Third season	1337.84	1280.52	1340.04	1045.56
	(3.81)	(3.61)	(3.44)	(2.59)
2. Livestock and poultry	1190.40	1240.68	1013.28	1074.72
	(3.39)	(3.50)	(2.66)	(2.66)
Sub total	5258.60	4688.04	4873.85	4288.23
	(14.97)	(13.23)	(12.51)	(10.66)
II. Non farm income				
1. Factory wages				
i) Respondents	18192.00	17862.36	17706.72	18495.60
	(51.80	(50.41)	(45.46)	(45.73)
ii) Family members	10706.52	12096.80	14640.00	15965.16
	(30.49)	(34.14)	(37.58)	(39.47)
2. Business	960.84	785.88	1733.28	1695.60
	(2.74)	(2.22)	(4.45)	(4.10)
Sub total	29859.36	30745.04	34080.00	36156.36
	(85.03)	(86.77)	(87.49)	(89.40)
Grand total	35117.96	35433.08	38953.85	40444.59
	(100.00)	(100.00)	(100.00)	(100.00)

The results of the analysis showed that non farm income was the predominant part of the total family income and it was 85.03 per cent, 86.77 per cent, 87.49 per cent and 89.40 per cent respectively, for the respondents of potato, garlic, carrot and cabbage. Of the total non farm income, wages from services in tea estates took up a major share, which were, 82.29 per cent, 84.55 per cent, 83.04 per cent and 85.21 per cent respectively for potato, garlic, carrot and cabbage farmers.

Farm income for potato sample farmers was 14.97 per cent of the total income and the same was 13.23 per cent, 12.51 per cent and 10.66 per cent respectively for garlic, carrot and cabbage respondents. Farm income comprised of agricultural income for three seasons and income from livestock and poultry. Of the total farm income 3.39 per cent, 3.50 per cent, 2.66 per cent and 2.66 per cent respectively of potato, garlic, carrot and cabbage were occupied by income from livestock and poultry.

5.2 Cultural practices

In this section, it is attempted to briefly describe the cultural practices adopted by the farmers in the study area for the crops namely potato, garlic, carrot and cabbage.

5.2.1 Season

In the study area, potato was observed to be cultivated in two seasons viz. April-July and October-December. Duration of the crop was 90-100 days. Garlic was also cultivated in two seasons namely April-September and October-February, and the duration was 130-140 days. However, there was no specific season for carrot and cabbage; cultivated throughout the year. The cropping season generally followed by farmers in the study area is presented in Table 5.2.1.

Table 5.2.1. Cropping season practiced by the farmers

Crop	Season	Duration (days)
Potato	April-July and October-December	90-100
Garlic	April-September and October-February	130-140
Carrot	Throughout the year	110-120
Cabbage	Throughout the year	110-120

5.2.2 Land preparation

Use of machine labour or bullock labour was not observed in the study area for land preparation. It was carried out manually with mammutties. While

preparing the land farmyard manure was also incorporated in the soil. In the case of potato, beds were prepared for planting seed tubers. For garlic, beds or ridges and furrows were prepared for planting. Ridges and furrows were prepared for carrot and cabbage.

5.2.3 Seeds and sowing

In the case of potato, seed tubers were mostly bought from private farms of Mettupalayam and local farmers were also source of seed tuber. For garlic, the seed cloves were purchased from village merchants. Some farmers used their own seed cloves for sowing. Seeds of carrot and cabbage were purchased from private traders of Munnar, Theni and Mettupalayam. Only local varieties were used in the case of potato and garlic. Seeds of varieties like Suttons New Coroda, Mahyco etc. of carrot and Krishna, Priyanka, Maharani etc. of cabbage purchased from private companies were generally used for sowing.

Spacing practised for potato was 15 x 15 cm in general. The same spacing was adopted for garlic also. In the case of carrot it was 30 x 30 cm or 45 x 30 cm. A spacing of 45 x 45 cm for followed for cabbage. The seed rate for potato was 1200-1300 kg/ha and the same for garlic was 300-350 kg/ha. Carrot and cabbage farmers adopted a seed rate of 3.5-4 kg/ha and 400-450 g/ha respectively.

5.2.4 Manures and fertilisers

Farmyard manure was purchased from private traders in the surroundings of Munnar. Generally 20-25 t/ha of farmyard manure in corporated in the field while preparing the land.

Chemical fertlisers like 17:17:17 complex, urea and mixtures like 17:17:17 and 10:26:26 were quite common in the study area. Some farmers used muriate of potash and triple super phosphate also. Most part of the fertilizers were applied as basal and after that one or two top dressing were done.

Table 5.2.2. Class wise nutrient use in potato (kg/ha)

Nutrient	Recommended dose	Actual quantities used by sample farmers		
		Class I	Class II	Aggregate
N	120	61.79	54.56	57.55
P	240	58.99	52.21	54.99
K	120	55.45	48.88	51.60

Actual use of chemical fertilizers by the farmers in the study area was compared with the dosage recommended by Tamil Nadu Agricultural University (TNAU) (As scientific recommendation for chemical fertilisers application was not available from KAU, TNAU recommendations have been used here).

The comparison revealed that there was wide gap between recommended dose and actual usage of chemical fertilisers. While the recommended doses of N, P and K were 120, 240 and 120 kg/ha, the actual usage were 57.55, 54.99, 51.60 kg/ha in respective order at the aggregate level. At the same time the usage of N, P, K fertiliser were declining from class I to class II.

Table 5.2.3. Classwise nutrient use in garlic (kg/ha)

Nutrient	Recommended dose	Actual quantities used by sample farmers		
		Class I	Class II	Aggregate
N	75	64.59	54.59	56.76
P	70	61.20	40.20	50.89
K	75	56.69	33.69	46.07

In the case of garlic, the use of N, P and K were higher for class I than class II. Among nutrients, nitrogen (56.76 kg/ha) was used in higher doses, followed by phosphorus (50.89 kg/ha) and potassium (46.07 kg/ha) at the aggregate level. While comparing actual use of fertilisers by the farmers, with the recommend dose, it was observed that, farmers were using lesser amount of fertilizers than the recommended one. The recommended dose of this crop is 75:70:75 kg/ha of N:P:K.

Table 5.2.4. Classwise nutrient use in carrot (kg/ha)

Nutrient	Recommended dose	Actual quantities used by sample farmers		
		Class I	Class II	Aggregate
N	135	73.12	55.23	66.32
P	135	34.34	29.07	32.34
K	135	33.49	27.51	31.22

Class wise nutrient use analysis of carrot showed that, class I farmers were using more of nutrients than class II farmers. Among the three nutrients nitrogen was used in higher dose (66.32). However, this was less than half the amount of the recommended dose (135 kg/ha). For phosphorus and potassium also. actual usage of fertiliser were very much lesser than the recommended one. An amount of 32.34 kg/ha of phosphorus and 31.22 kg/ha of potassium were used at the aggregate level.

Table 5.2.5. Classwise nutrient use in cabbage (kg/ha)

Nutrient	Recommended dose	Actual quantities used by sample farmers		
		Class I	Class II	Aggregate
N	135	63.13	39.61	51.44
P	135	42.76	14.65	28.93
K	135	48.67	21.53	34.88

There was a huge gap between recommended dose of nutrients and actual use by the respondents. At the aggregate level, hardly 38.10 per cent, 21.43 per cent and 25.58 per cent, respectively of the recommended dose of N, P and K were used by the farmers. While comparing nutrient use in Class I and Class II it was observed that, the quantum of nutrients used by the Class II farmers were far behind that of Class I farmers.

5.2.5 Weeding, hoeing and earthing up

Weeding was done manually. Only female labourers were engaged in this operation. For potato and carrot three or four weedings were done. For

Table 5.3.1. Input wise cost of cultivation of potato (Rs./hectare)

Particulars	Class I	Per cent	Class II	Per cent	Aggregate	Per cent
Hired labour	6316.81	16.32	6765.24	20.50	6579.46	18.60
Seed	9227.91	23.85	9176.83	27.81	9197.99	26.00
Farm yard manure	3588.36	9.27	2038.87	6.18	2680.80	7.58
Fertilizers	3294.83	8.51	2506.17	7.59	2832.89	8.01
Plant protection chemicals	2220.09	5.74	2357.26	7.14	2300.43	6.50
Transportation cost	1757.54	4.54	1334.60	4.04	1509.82	4.27
Hiring charges for sprayer	214.44	0.55	128.05	0.39	163.84	0.46
Depriciation	210.27	0.54	172.46	0.52	188.14	0.53
Interest on working capital	510.22	1.32	488.89	1.48	497.72	1.41
Cost A1	27340.47	70.66	24968.38	75.66	25951.10	73.37
Interest on fixed capital	517.23	1.34	448.51	1.36	486.99	1.38
Cost B1	27857.70	71.99	25416.89	77.02	26438.09	74.75
Imputed value of family labour	7320.04	18.92	4583.08	13.89	5716.96	16.16
Cost C1	35177.74	90.91	29999.97	90.91	32155.06	90.91
Allowance given for farm management	3517.77	9.09	3000.00	9.09	3215.51	9.09
Cost C3	38695.52	100.00	32999.97	100.00	35370.56	100.00

cabbage, apart from the same number of weedings one or two hoeings and earthing up were also carried out. The frequency of weeding for garlic was 4 -5.

5.2.6 Plant protection

Generally farmers were using insecticides like Rogar, Ekalux and Ethion and fungicides like Endosulphan and blue copper.

In potato, insect pests like cutworms and leaf eating caterpillar and diseases like late blight and early blight were commonly occurring in the study area. In garlic, aphids and leaf blight respectively were the important pest and diseases. In carrot, infestation of carrot fly and aphids and infection of leaf spot, and soft rot were commonly observed. Diamond back moth was the major pest in cabbage and black rot disease was also noticed.

5.2.7 Harvesting

Both family as well as hired human labour were used to carry out this operation. Pre harvest contract was also in practice to carry out harvesting operation.

5.3 Input wise cost of cultivation

5.3.1 Input wise cost per hectare of potato

Input wise cost per hectare of potato was worked out and it is presented in Table 5.3.1.

The results showed that cost A_1, Cost B_1, Cost C_1 and Cost C_3 were Rs.27340.47, Rs.27857.70, Rs.35177.74 and Rs.38695.52 respectively at class I level and the same costs were Rs.24968.38, Rs.25416.89, Rs.29999.97 and Rs.32999.97 respectively for class II. At the aggregate level the costs were Rs.25951.10, Rs.26438.09, Rs.32155.06 and Rs.35370.56 in respective order.

For the entire sample, human labour constituted the highest share of 34.76 per cent and in monetary terms it worked to Rs.12296.42, which included the share of Rs.6579.46 of hired labour. This was followed by seed material input (Rs.9197.99), which occupied 26 per cent of the total cost. The third largest item was allowance given for farm management occupying 9.09 per cent of the total cost. Cost of chemical fertilisers was also an important item, which supplied 8.01 per cent (Rs.2832.89) to the total cost. This was followed by farmyard manure (7.58 per cent), plant protection chemicals (6.50 per cent) and transportation charges (4.27 per cent).

Class wise costs of inputs were also worked out. In class I human labour was the largest item of input adding Rs.13636.85 (35.24 per cent), to the total cost. Seed material input was the second largest item of input and an amount of Rs.9227.91 (23.85 per cent) was incurred on this expense. Farmyard manure took a share of 9.27 per cent (Rs.3528.36) from the total cost. Allowances given for farm management gained 9.09 per cent from the total cost. This was followed by plant protection chemicals (Rs.2220.09) and transportation charges (Rs.1757.44).

In class II, also human labour was the largest item of input, accounting for 34.39 per cent (Rs.11348.32) of the total cost. As observed in class I, here also seed material input was the second largest item occupying 27.81 per cent (Rs.9176.83) of the total cost. Allowance given for farm management came next, followed by chemical fertilizers input sharing Rs.2506.17 (7.59 per cent) with the total cost. Plant protection chemicals, farmyard manure and transportation charges were also the important items, which constituted 7.14 per cent (Rs.2357.26), 6.18 per cent (Rs.2038.87) and 4.04 per cent (Rs.1334.60) respectively of the total cost.

It was observed that cost A_1, B_1, C_1 and C_3 were less in Class II when compared with Class I. Costs of hired human labour, seed material and plant protection chemicals were approximately equal in both the classes. However a

Table 5.3.2. Input wise cost of cultivation of garlic (Rs./hectare)

Particulars	Class I	Per cent	Class II	Per cent	Aggregate	Per cent
Hired labour	7635.74	20.51	8676.03	27.07	8129.39	23.47
Seed	5987.23	16.08	5885.77	18.36	5937.15	17.14
Farm yard manure	3001.64	8.06	1942.88	6.06	2479.11	7.16
Fertilizers	2498.72	6.71	1991.62	6.21	2248.45	6.49
Plant protection chemicals	1503.38	4.04	1026.63	3.20	1268.09	3.66
Transportation cost	1203.47	3.23	1105.34	3.45	1155.04	3.33
Hiring charges for sprayer	389.33	1.05	147.33	0.46	263.86	0.76
Depriciation	422.39	1.13	393.31	1.23	408.04	1.18
Interest on working capital	142.51	0.38	122.68	0.38	132.37	0.38
Cost A1	22784.41	61.21	21291.59	66.43	22021.50	63.57
Interest on fixed capital	326.65	0.88	287.14	0.90	312.43	0.90
Cost B1	23111.06	62.09	21578.73	67.32	22333.93	64.47
Imputed value of family labour	10728.22	28.82	7560.39	23.59	9156.99	26.43
Cost C1	33839.28	90.91	29139.13	90.91	31490.92	90.91
Allowance given for farm management	3383.93	9.09	2913.91	9.09	3149.09	9.09
Cost C3	37223.20	100.00	32053.04	100.00	34640.01	100.00

declining trend was observed from Class I to Class II in the case of family labour, farmyard manure and fertilisers.

5.3.2 Input wise cost per hectare of garlic

Input wise cost per hectare of garlic is presented in Table 5.3.2.

Figures obtained from the analysis of input wise cost per hectare of garlic showed that Cost A_1, B_1, C_1 and C_3 were Rs.22021.50, Rs.22333.93, Rs.31490.92 and Rs.34640.01 respectively for sample as a whole. These costs at Class I level were Rs.22784.41, Rs.23111.06, Rs.33839.28 and Rs.37223.20 respectively. The same costs were Rs.21291.59, Rs.21578.73, Rs.29139.13 and Rs.32053.04 respectively for Class II sample farmers.

For sample as a whole, human labour was the most important item of input. Almost 50 per cent of the total expenses were incurred on this input. This cost comprised of family labour cost (Rs.9156.99) and hired human labour cost (Rs.8129.39). Seed material input was the next important input attributing an amount of Rs.5937.15 (17.14 per cent) to the total cost.

Farmyard manure input followed seed material cost and it received 7.16 per cent (Rs.2476.11) share of total cost. Fertilizer cost added Rs.2248.45 (6.49 per cent) followed by plant protection chemicals (Rs.1268.09) having share of 3.66 per cent of the total cost. Transportation cost accounted to Rs.1155.04. Remaining items like hiring charges for sprayers, interest on working capital, interest on fixed capital and depreciation contributed very less to the total and when the costs of these items were added together it tallied only to Rs.1116.70.

Class wise analysis showed that, human labour input was the single largest item in both Class I and Class II. It accounted for 49.33 per cent and 50.66 per cent respectively in Class I and Class II. Second largest item in Class I was seed material input and Rs.5987.23 (16.08 per cent) was incurred on it. An amount

Table 5.3.3. Input wise cost of cultivation of carrot (Rs./hectare)

Particulars	Class I	Per cent	Class II	Per cent	Aggregate	Per cent
Hired labour	7658.84	23.22	7647.69	27.01	7648.94	25.02
Seed	3678.60	11.15	3594.70	12.69	3633.30	11.89
Farm yard manure	2794.84	8.48	2098.59	7.41	2433.99	7.96
Fertilizers	2466.07	7.48	1612.25	5.69	2024.07	6.62
Plant protection chemicals	1364.47	4.14	1046.29	3.69	1199.51	3.92
Transportation cost	1002.22	3.04	761.37	2.69	877.37	2.87
Hiring charges for sprayer	310.28	0.94	132.25	0.47	218.23	0.71
Depriciation	182.00	0.55	150.18	0.53	169.84	0.56
Interest on working capital	369.44	1.12	323.79	1.14	345.68	1.13
Cost A1	19826.75	60.12	17367.11	61.33	18550.94	60.69
Interest on fixed capital	367.63	1.11	326.77	1.15	352.10	1.15
Cost B1	20194.38	61.24	17693.88	62.48	18903.04	61.84
Imputed value of family labour	9784.88	29.67	8049.50	28.43	8883.95	29.07
Cost C1	29979.25	90.91	25743.38	90.91	27786.99	90.91
Allowance given for farm management	2997.93	9.09	2574.34	9.09	2778.70	9.09
Cost C3	32977.18	100.00	28317.72	100.00	30565.69	100.00

of Rs.3001.64 (8.06 per cent) was spent on farmyard manure input. This was followed by cost of fertilizers, plant protection chemicals by transportation, which shared Rs.2498.72, Rs.1503.38 (4.04 per cent) and Rs.1203.47 (3.23 per cent) respectively with the total cost.

In Class II also human labour (Rs.16236.42) held a substantial share of 50.66 per cent of which hired human labour and family labour worked out to Rs.7560.39 and Rs.8676.03 respectively. Cost of seed material input was the second most important item, which came to Rs.5885.77 (18.36 per cent). Cost for fertilizer input was estimated to be Rs.1991.62 (6.21 per cent). Cost incurred on farmyard manure input was Rs.1942.88, which was 6.06 per cent of the total cost. Plant protection chemicals and transportation required as much as Rs.1026.63 and Rs.1105.34 respectively.

In comparative analysis, when Class I was weighted against Class II, it was evident that costs like A_1, B_1, C_1 and C_3 were higher in Class I than Class II. There was no noticeable variation between two classes for inputs like labour, seed, transport, etc. But a marked difference between two classes was observed in the case of farmyard manure, fertilizers and hiring charge for machinery labour. These costs were decreasing from Class I to Class II.

5.3.3 Input wise cost of cultivation of carrot

The analysis of input wise cost of cultivation per hectare of carrot showed that cost A1, cost B1, cost C1 and cost C3 were Rs.19826.75, Rs.20194.38, Rs.29979.25 and Rs.32977.18 respectively for Class I farmers. The same costs were Rs.17367.11, Rs.17693.88, Rs.25743.38 and Rs.28317.72 respectively in the case of Class II, in the same order. For sample farmers as a whole these costs were Rs.18550.94, Rs.18903.04, Rs.27786.99 and Rs.30565.69 respectively in the same order.

At aggregate level human labour occupied more than half of the total cost i.e. 54.09 per cent which included 25.02 per cent of hired human labour and 29.07 per cent of family labour. This was followed by seed material input. allowance given for farm management, expenditure incurred on farmyard manure. fertilisers and plant protection chemicals having 11.89 per cent (Rs.3633.30). 9.09 per cent (Rs.27786.99), 7.96 per cent (Rs.2433.99), 6.62 per cent (Rs.2024.07) and 3.92 per cent (Rs.1199.51) respectively.

In Class I also, human labour input was the single largest item with 52.89 per cent of which family labour accounted to 29.67 per cent. In monetary terms, human labour shared Rs.17443.72 with the total cost. Next largest contribution was from seed material input, which occupied 11.5 per cent of the total cost. Allowance given for farm management worked out to Rs.2997.93 with a share of 9.09 per cent to the total cost. This was followed by farmyard manure. fertilizers and plant protection chemical inputs which accounted to 8.48 per cent (Rs.2794.84), 7.48 per cent (Rs.2466.07) and 4.14 per cent (Rs.1364.47) respectively, to the total cost.

In Class II also, human labour input covered more than half of the total cost. The cost of this input was estimated to Rs.15697.19 (55.44 per cent). out of which Rs.7647.69 was for hired human labour (27.01 per cent). Seed material input, allowance given for farm management and fertilizer inputs followed human labour input with Rs.3594.70 (12.69 per cent), Rs.2574.34 (9.09 per cent). Rs.2098.59 (7.41 per cent) and Rs.1612.25 (5.69 per cent), respectively.

In both the classes, the contribution of inputs like transportation charges. hiring charges for machinery labour, depreciation, interest on working capital and interest on fixed capital were very meager.

While comparing Class II, and I it was observed that there was a considerable decline in A_1, B_1, C_1 cost and Cost C_3 from Class I to Class II. This kind

Table 5.3.4. Input wise cost of cultivation of cabbage (Rs./hectare)

Particulars	Class I	Per cent	Class Ii	Per cent	Aggregate	Per cent
Hired labour	5721.49	18.39	5331.88	21.66	5486.911	19.76
Seed	4490.13	14.43	4043.48	16.42	4221.204	15.20
Farm yard manure	2615.13	8.40	1952.90	7.93	2216.405	7.98
Fertilizers	2563.71	8.24	1585.87	6.44	1974.956	7.11
Plant protection chemicals	885.61	2.85	1001.30	4.07	955.271	3.44
Transportation cost	864.04	2.78	703.62	2.86	767.452	2.76
Hiring charges for sprayer	265.35	0.85	81.88	0.33	154.887	0.56
Depriciation	180.04	0.58	135.33	0.55	160.370	0.58
Interest on working capital	333.60	1.07	281.77	1.14	302.394	1.09
Cost A1	17919.11	57.58	15118.04	61.41	16239.85	58.48
Interest on fixed capital	371.52	1.19	299.67	1.22	339.910	1.22
Cost B1	18290.63	58.78	15417.71	62.62	16579.760	59.71
Imputed value of family labour	10000.00	32.13	6963.91	28.29	8664.12	31.20
Cost C1	28290.63	90.91	22381.62	90.91	25243.881	90.91
Allowance given for farm management	2829.06	9.09	2238.16	9.09	2524.388	9.09
Cost C3	31119.69	100.00	24619.79	100.00	27768.27	100.00

of variation existed for inputs like family labour, fertiliser, farmyard manure, plant protection chemicals, transportation charges and hiring charges for sprayers. But there was no highlighted deviation between two classes for hired human labour and seed material input used.

Input wise cost per hectare of carrot is presented in Table 5.3.3.

5.3.4 Input wise cost per hectare of cabbage

Input wise cost per hectare of cabbage was worked out and it is given in Table 5.3.4.

The results showed that Cost A_1, Cost B_1, Cost C_1 and Cost C_3 were Rs.17919.11, Rs.18290.63, Rs.28290.63 and Rs.31119.69 respectively for Class I and the same costs were Rs.15118.04, Rs.15417.71, Rs.21381.62 and Rs.24619.79 respectively for Class II. At aggregate level the costs were Rs.16239.85, Rs.16579.76, Rs.24149.66 and Rs.27768.27 in the same order.

At aggregate level, human labour shared almost half of the total cost i.e. 50.96 per cent and in monetary terms it was Rs.14151.03. Out of this cost, Rs.8664.12 was for family labour and the remaining Rs.5486.91 was for hired labour. This was followed by seed material input, which occupied 15.20 per cent of the C_3 cost. Third largest item was allowance given for farm management with 9.09 per cent (Rs.2524.39). Cost for farmyard manure and fertilizer inputs were Rs.2616.41 (7.98 per cent) and Rs.1974.96 (7.11 per cent) respectively. Plant protection chemical inputs, transportation cost and hiring charges for machinery contributed Rs.955.27 (3.44 per cent), Rs.767.45 (2.76 per cent) and Rs.154.89 (0.56 per cent) to the total cost.

Class wise costs of inputs also were worked out and in Class I human labour was the single largest item of input. It added Rs.1572.49 to the total cost. Of the total labour cost Rs.5721.49 (18.39 per cent) was for hired human labour, and

Table 5.4.1. Operation wise cost of cultivation of potato (Rs./ hectare)

Operations	Class I	Per cent	Class II	Per cent	Aggregate	Per cent
Land preparation						
Family labour	711.21	1.84	365.85	1.11	508.93	1.44
Hired labour	1939.66	5.01	1905.49	5.77	1919.64	5.43
Total	2650.86	6.85	2271.34	6.88	2428.57	6.87
Seed and sowing						
Input cost	9227.91	23.85	9176.83	27.81	9197.99	26.00
Family labour	495.69	1.28	297.26	0.90	379.46	1.07
Hired labour	318.97	0.82	772.87	2.34	584.82	1.65
Transportation cost	493.53	1.28	487.80	1.48	490.18	1.39
Total	10536.10	27.23	10734.76	32.53	10652.46	30.12
Farm yard manure and application						
Input cost	3588.36	9.27	2038.87	6.18	2680.80	7.58
Family labour	683.19	1.77	320.12	0.97	470.54	1.33
Hired labour	1131.47	2.92	894.82	2.71	992.86	2.81
Transportation cost	1099.14	2.84	701.22	2.12	866.07	2.45
Total	6502.16	16.80	3955.03	11.98	5010.27	14.17
Fertilizers and application						
Input cost	3294.83	8.51	2506.17	7.59	2832.89	8.01
Family labour	540.59	1.40	437.50	1.33	479.46	1.36
Hired labour	64.66	0.17	97.56	0.30	83.93	0.24
Transportation cost	164.87	0.43	145.58	0.44	153.57	0.43
Total	4064.94	10.50	4386.81	13.29	4252.72	12.02
Weeding						
Family labour	245.69	0.63	172.26	0.52	202.68	0.57
Hired labour	1933.19	5.00	1707.32	5.17	1800.89	5.09
Total	2178.88	5.63	1879.57	5.70	2003.57	5.66
Plant protection measures						
Input cost	2220.09	5.74	2357.26	7.14	2300.43	6.50
Family labour	1632.54	4.22	817.07	2.48	1154.91	3.27
Hired labour	0.00	0.00	0.00	0.00	0.00	0.00
Hiring charges for sprayer	214.44	0.55	128.05	0.39	163.84	0.46
Total	4067.07	10.51	3302.38	10.01	3619.18	10.23
Irrigation						
Family labour	2728.45	7.05	1872.71	5.67	2227.23	6.30
Hired labour	0.00	0.00	0.00	0.00	0.00	0.00
Total	2728.45	7.05	1872.71	5.67	2227.23	6.30
Harvesting						
Family labour	282.69	0.73	300.30	0.91	293.75	0.83
Hired labour	928.88	2.40	1387.20	4.20	1197.32	3.39
Total cost	1211.57	3.13	1687.50	5.11	1491.07	4.22
Depriciation	210.27	0.54	172.46	0.52	188.14	0.53
Interest on working capital	510.22	1.32	488.89	1.48	497.72	1.41
Interest on fixed capital	517.23	1.34	448.51	1.36	486.99	1.38
Allowance given for farm management	3517.77	9.09	3000.00	9.09	3215.51	9.09
Total cost	38695.52	100.00	32999.97	100.00	35370.56	100.00

Rs.10000.00 was for family labour cost. Seed material input was the second largest item and as much as Rs.4490.13 (14.43 per cent) was attributed to this input. Allowance given for farm management gained 9.09 per cent of the total cost. Farmyard manure and fertilizer inputs shared Rs.2615.13 (8.40 per cent), Rs.2563.17 (8.24 per cent) respectively with the total cost. Inputs like plant protection chemicals and transport costs constituted 2.85 and 2.78 per cent.

In Class II also the same trend as found in aggregate level and Class I. Hired human labour (Rs.5331.88) and family labour (Rs.6963.91) accounted for nearly half of the total cost i.e., 49.95 per cent. The second largest constituent was seed material input as like Class I and it was Rs.4043.48 (16.42 per cent). Allowance given for farm management occupied 9.09 per cent of the total cost. This was followed by farmyard manure and fertilizer input with 7.93 per cent and 6.44 per cent respectively. Costs for plant protection chemicals, transportation cost and hiring charges for sprayers were Rs.1001.30 (4.07 per cent), Rs.703.62 (2.86 per cent) and Rs.81.88 (0.33 per cent).

It was observed that Cost A_1, Cost B_1, Cost C_1 and Cost C_3 were less in Class II when compared with Class I. Costs for hired labour, seed and plant protection chemicals were almost equal in both the classes. But declining trend was noticed for family labour while moving from Class I to class II. The same kind of variation was there in the case of farmyard manure, fertilizers and transportation costs.

5.4 Operation wise cost of cultivation

5.4.1 Operation wise cost per hectare of potato

The analysis of the operation wise cost of cultivation of potato proved that, seed and sowing operation was the most important item. It took up a share of Rs.10652.46 (30.06 per cent), Rs.10536.10 (27.23 per cent) and Rs.10734.76 (32.53 per cent) respectively at aggregate level, Class I and Class II levels.

Analysis at aggregate level showed that farmyard manure and its application held a share of Rs.5010.27 (14.17 per cent) to the total cost. Apart from the cost of farmyard manure input (Rs.2680.80), hired human labour cost, transportation cost and family labour cost added Rs.992.86, Rs.866.07 and Rs.470.54 to the total cost.

Fertilisers and their application possessed next important position, having a deal of Rs.4252.72 (12.02 per cent) with the total cost. It was found that family labour was commonly employed for the application of fertilizer which amounted for Rs.479.46. Transportation cost was estimated to be Rs.153.57. Fertiliser and their application was followed by plant protection measures which supplemented Rs.3619.18 (10.23 per cent) to the total cost. Contribution of hired human labour for the application of plant protection chemicals was found to be nil and the operation was wholly carried out by family labour which supplemented Rs.1154.91. Hiring charges for sprayers annexed a sum of Rs.163.84.

As much of Rs.2428.57 was conceded on land preparation. Irrigation operation occupied 6.30 per cent (Rs.2227.23), which was fully accomplished by family labour. Cost of weeding was estimated to Rs.2003.57 (5.66 per cent), of which Rs.1800.89 was spent on hired human labour. Harvesting cost came to Rs.1491.07.

Class wise analysis showed that in Class I farmyard manure and its application was the important item, coming next to seeds and sowing operation. It accounted for Rs.6502.16 (16.80 per cent), of which, cost of farmyard manure was Rs.3588.36. Transportation, hired human labour and family labour supplemented Rs.1099.14, Rs.1134.47 and Rs.683.19 respectively. Plant protection measures and fertilizers and their application occupied equal proportion of share i.e. Rs.4067.07 and Rs.4064.94 respectively of the total cost.

Cost of hired human labour had a major share of Rs.1933.19 in weeding operation, which worked out to Rs.2178.88 (5.63 per cent). An amount of

Table 5.4.2. Operation wise cost of cultivation of garlic (Rs./ hectare)

Operations	Class I	Per cent	Class II	Per cent	Aggregate	Per cent
Land preparation						
Family labour	821.17	2.21	355.81	1.11	591.50	1.71
Hired labour	1697.08	4.56	2059.93	6.43	1876.16	5.42
Total	2518.25	6.77	2415.73	7.54	2467.65	7.12
Seed and sowing						
Input cost	5987.23	16.08	5885.77	18.36	5937.15	17.14
Family labour	470.80	1.26	234.08	0.73	353.97	1.02
Hired labour	343.07	0.92	378.28	1.18	360.44	1.04
Transportation cost	131.39	0.35	254.68	0.79	192.24	0.55
Total	6932.48	18.62	6752.81	21.07	6843.81	19.76
Farm yard manure and application						
Input cost	3001.64	8.06	1942.88	6.06	2479.11	7.16
Family labour	600.55	1.61	280.90	0.88	442.79	1.28
Hired labour	677.01	1.82	496.25	1.55	587.80	1.70
Transportation cost	939.78	2.52	702.25	2.19	822.55	2.37
Total	5218.98	14.02	3422.28	10.68	4332.26	12.51
Fertilizers and application						
Input cost	2498.72	6.71	1991.62	6.21	2248.45	6.49
Family labour	460.79	1.24	299.63	0.93	381.25	1.10
Hired labour	0.00	0.00	18.73	0.06	9.24	0.03
Transportation cost	132.30	0.36	148.41	0.46	140.25	0.40
Total	3091.81	8.31	2458.38	7.67	2779.19	8.02
Weeding						
Family labour	500.00	1.34	245.32	0.77	374.31	1.08
Hired labour	3669.71	9.86	4441.95	13.86	4050.83	11.69
Total	4169.71	11.20	4687.27	14.62	4425.14	12.77
Plant protection measures						
Input cost	1503.38	4.04	1026.63	3.20	1268.09	3.66
Family labour	2399.64	6.45	884.83	2.76	1652.03	4.77
Hired labour	0.00	0.00	0.00	0.00	0.00	0.00
Hiring charges for sprayer	389.33	1.05	147.33	0.46	263.86	0.76
Total	4292.34	11.53	2058.79	6.42	3183.98	9.19
Irrigation						
Family labour	4981.75	13.38	5059.46	15.78	5020.10	14.49
Hired labour	0.00	0.00	0.00	0.00	0.00	0.00
Total	4981.75	13.38	5059.46	15.78	5020.10	14.49
Harvesting						
Family labour	493.52	1.33	200.37	0.63	341.04	0.98
Hired labour	1248.88	3.36	1280.90	4.00	1244.92	3.59
Total cost	1742.41	4.68	1481.27	4.62	1585.95	4.58
Depriciation	422.39	1.13	393.31	1.23	408.04	1.18
Interest on working capital	142.51	0.38	122.68	0.38	132.37	0.38
Interest on fixed capital	326.65	0.88	287.14	0.90	312.43	0.90
Allowance given for farm management	3383.93	9.09	2913.91	9.09	3149.09	9.09
Total cost	37223.20	100.00	32053.04	100.00	34640.01	100.00

Rs.2650.86 was spent on land preparation operation. Harvesting operation was estimated to be Rs.1211.57, which was 3.13 per cent to the total cost.

In Class II, next to seeds and sowing operation, fertilisers and their application was the most determining item, which added Rs.4386.81 (13.29 per cent) to the total cost. This was closely followed by farmyard manure and its application, which had a share of 11.98 per cent (Rs.3955.03) to the total cost. Fertilisers application was accomplished by hired human labour and family labour to an extent of Rs.894.82 and Rs.320.12 respectively. Transportation cost of farmyard manure added Rs.701.22 to the total cost.

Plant protection measures were another important operation, covering 10.01 per cent (Rs.3302.38) of the total cost. Apart from the cost of plant protection chemicals, remaining amount was shared by family labour cost and hiring charges for machinery labour to an extent of Rs.817.07 and Rs.128.05. Operations like land preparation, weeding, irrigation and harvesting annexed a sum of Rs.2271.34, Rs.1879.57, Rs.1872.71 and Rs.1687.50 to the total cost respectively.

For operations like land preparation, seed material and sowing, fertilizers and their application, weeding and harvesting, no distinct variation in costs was observed between two classes. But a note worthy difference was found in the case of farmyard manure and their application, plant protection and irrigation. The costs for these operations were lesser in the case of Class II than Class I.

Operation wise cost per hectare of potato is presented in Table 5.4.1.

5.4.2 Operation wise cost per hectare of garlic

Table 5.4.2 exhibits operation wise cost per hectare of garlic.

Seed and sowing operation was the single major item in both the classes and at aggregate level. It amounted Rs.6932.48 (18.62 per cent), Rs.6752.81 (21.07 per cent) and Rs.6843.81 (19.76 per cent) respectively for Class I, Class II and sample as a whole. At aggregate level, sowing operation conceded Rs.353.97 and Rs.360.44 for family labour and hired human labour. Transportation cost for seeds added Rs.192.24 to the total cost. Irrigation was the next important item, which approximated an amount of Rs.5020.10 to the total cost. This operation was exclusively accomplished by family labour.

Weeding operation followed irrigation and a sum of Rs.4425.14 (12.77 per cent) was spent on it. Majority of cost for weeding went to hired human labour. which took up Rs.4050.83. Next best contribution came from farmyard manure and its application. This whole operation amounted for Rs.4332.26, which was 12.51 per cent of the cost. Besides the cost of farmyard manure input, transportation cost accounted for Rs.822.55 and costs for family labour and hired human labour were Rs.442.79 and Rs.587.80.

Fertilizer and their application followed farmyard manure and their application with a cost of Rs.2779.19 (8.02 per cent) for the entire operation. Apart from cost of fertilizer input, cost of family labour and transportation added up Rs.381.25 and Rs.140.25 to the total. Cost for plant protection measures was estimated to Rs.3183.98. In the operation, only family labour was used and cost for that was Rs.1652.03. Cost for hiring charges for machinery labour supplemented Rs.263.86. Land preparation and harvesting operations took a share of 7.12 per cent (Rs.2467.65) and 4.58 per cent (Rs.1585.95) from total cost.

In Class I, farmyard manure and its application was the second important item of operation. A sum of Rs.5218.98 was incurred for this operation. In addition to the cost of farmyard manure Rs.939.78, Rs.677.01 and Rs.600.55 were spent respectively on transportation, hired human labour and family labour. Irrigation operation received the next position, with a cost of Rs.4981.75 (13.38

per cent) and the operation was entirely carried out by family labour. Plant protection measures took a share of 11.53 per cent (Rs.4292.34) from the total cost. Cost for family labour was the major item which amounted to Rs.2399.64 followed by cost of plant protection chemical (Rs.1503.38).

Cost of hired human labour was dominant in weeding operation, which mounted up to Rs.3669.71 when total weeding cost was Rs.4169.71, which was 11.20 per cent to the total cost.

An amount of Rs.3091.81 was spent on fertilizers and their application. For this operation only family labour was used and its share was Rs.460.79. Transportation cost of fertilizers came to Rs.132.30. Land preparation and harvesting operations were the other important items, which supplemented Rs.2518.25 (6.77 per cent) and Rs.1742.41 (4.68 per cent) respectively to the total cost.

In Class II, cost for irrigation followed seeds and sowing operation and it was Rs.5059.46 (15.78 per cent), which was fully taken up by family labour. Weeding operation took a share of Rs.4687.27 (14.62 per cent) from total cost and out of this amount a sum of Rs.4441.95 was taken up by hired human labour. Cost incurred on farmyard manure and its application was Rs.3422.28 (10.68 per cent). In addition to the input cost of Rs.1943.38, as much as Rs.702.25, Rs.496.25 and Rs.288.90 were incurred respectively on transportation of farmyard manure, hired human labour and family labour.

An amount of Rs.2458.38 (7.67 per cent) was incurred on fertilizer and their application. The cost of land preparation accounted to Rs.2415.73 and out of this cost the expenditure incurred on hired human labour was Rs.2059.93. Plant protection measures, which supplemented Rs.2058.78 to the total cost. No hired human labour was used for this operation. The family labour was used to an extent

Table 5.4.3. Operation wise cost of cultivation of carrot (Rs./ hectare)

Operations	Class I	Per cent	Class II	Per cent	Aggregate	Per cent
Land preparation						
Family labour	392.16	1.19	238.97	0.84	313.09	1.02
Hired labour	2196.65	6.66	2424.63	8.56	2313.12	7.57
Total	2588.80	7.85	2663.60	9.41	2626.21	8.59
Seed and sowing						
Input cost	3678.60	11.15	3594.70	12.69	3633.30	11.89
Family labour	313.73	0.95	183.82	0.65	246.68	0.81
Hired labour	392.26	1.19	385.74	1.36	388.68	1.27
Total	4384.58	13.30	4164.26	14.71	4268.66	13.97
Farm yard manure and application						
Input cost	2794.84	8.48	2098.59	7.41	2433.99	7.96
Family labour	802.31	2.43	257.35	0.91	520.87	1.70
Hired labour	656.86	1.99	818.01	2.89	740.04	2.42
Transportation cost	877.85	2.66	689.34	2.43	780.36	2.55
Total	5131.86	15.56	3863.30	13.64	4475.26	14.64
Fertilizers and application						
Input cost	2466.07	7.48	1612.25	5.69	2024.07	6.62
Family labour	626.89	1.90	335.39	1.18	468.75	1.53
Hired labour	196.16	0.59	36.77	0.13	113.85	0.37
Transportation cost	124.51	0.38	72.61	0.26	97.72	0.32
Total	3413.62	10.35	2057.02	7.26	2704.40	8.85
Weeding						
Family labour	156.86	0.48	141.54	0.50	148.96	0.49
Hired labour	2990.97	9.07	2606.48	9.20	2736.24	8.95
Total	3147.83	9.55	2748.02	9.70	2885.20	9.44
Plant protection measures						
Input cost	1364.47	4.14	1046.29	3.69	1199.51	3.92
Family labour	1872.52	5.68	947.53	3.35	1450.66	4.75
Hired labour	0.00	0.00	32.17	0.11	12.60	0.04
Hiring charges for sprayer	310.28	0.94	132.35	0.47	218.41	0.71
Total	3547.26	10.76	2158.34	7.62	2881.19	9.43
Irrigation						
Family labour	5208.97	15.80	5691.70	20.10	5461.74	17.87
Hired labour	0.00	0.00	0.00	0.00	0.00	0.00
Total	5208.97	15.80	5691.70	20.10	5461.74	17.87
Harvesting						
Family labour	294.12	0.89	251.84	0.89	272.30	0.89
Hired labour	1343.14	4.07	1344.57	4.75	1344.40	4.40
Total cost	1637.25	4.96	1596.41	5.64	1616.70	5.29
Depriciation	182.00	0.55	150.18	0.53	169.84	0.56
Interest on working capital	369.44	1.12	323.79	1.14	345.68	1.13
Interest on fixed capital	367.63	1.11	326.77	1.15	352.10	1.15
Allowance given for farm management	2997.93	9.09	2574.34	9.09	2778.70	9.09
Total cost	32977.18	100.00	28317.72	100.00	30565.69	100.00

of Rs.884.83. Cost of hiring charge for sprayer was Rs.147.33. Contribution of harvesting operation to the total cost was total an extent of Rs.1481.27.

While comparing operation wise costs of Class II, and I it was observed that costs incurred on farmyard manure and its application, fertilizers and their application and plant protection measures were decreasing from Class I to Class II. But there was no noticeable variation found in the case of land preparation, seeds and sowing, weeding and irrigation operations between two classes.

5.4.3 Operation wise cost per hectare of carrot

Operation wise cost per hectare of carrot is shown in Table 5.4.3.

For sample as a whole, irrigation was the largest item, which contributed 17.87 per cent to the total cost. The analysis also showed that, this operation was fully carried out by family labour. This was followed by farmyard manure and its application, which was estimated to be Rs.4475.26 (14.64 per cent) to the total cost. Of this cost, Rs.2433.99 (7.96 per cent) was attributed to cost of farmyard manure. Transportation cost of farmyard manure was Rs.780.36. Family labour and hired human labour contributed Rs.520.87 and Rs.740.04 for the application of farmyard manure.

Farmyard manure and its application was followed by seeds and sowing which amounted Rs.4268.66 (13.67 per cent) to the total cost. Sowing operation consumed a cost of Rs.246.68 (0.81 per cent) and Rs.388.68 (1.27 per cent) respectively for family labour and hired human labour. As much as 9.44 per cent (Rs.2885.20) was occupied by weeding operation. Major part of the weeding operation was done by hired female labour that came 8.95 per cent to the total.

An amount of Rs.2881.19 of the total cost was attributed to plant protection measures. This operation was most of carried out by family labour, which amounted toRs.1450.66. The share of hiring charges for machinery was

Rs.218.41. Fertilizers and their application shared Rs.2704.40 (8.85 per cent) with total cost and it was followed by land preparation, which worked out to land preparation Rs.2626.21 (8.59 per cent).

Class wise analysis revealed that irrigation was the single largest item, which contributed 15.80 per cent and 20.10 per cent respectively to total cost, in Class I and Class II. Next to irrigation, the cost on farmyard manure was the largest item attributing 15.56 per cent (Rs.5131.86) to the total cost in Class I. Next to cost of farmyard manure, transportation cost was the largest item. Seeds and sowing shared 13.30 per cent (Rs.4884.58) of the total cost. Farmers generally purchased seeds from private trades of Munnar, Theni and Mettupalayam. For sowing, family labour and hired human labour were used in equal proportion.

Plant protection measures were another important items followed, seeds and sowing with 10.76 per cent. Out of total cost for plant protection measures (Rs.3547.26), Rs.1872.52 was occupied by family labour and cost of plant protection chemicals was Rs.1364.47. The cost for fertilizers and their application amounted to Rs.3413.62, which was 10.35 per cent of the total cost in Class I. For application as much of Rs.628.89 and Rs.194.16 respectively were spent on family labour and hired human labour. Transportation charges for fertilizers were Rs.124.51. Contribution from weeding, land preparation and harvesting were Rs.3147.83 (9.55 per cent), Rs.2588.80 (7.85 per cent) and Rs.1637.25 (4.96 per cent) respectively to the total cost.

In Class II, seeds and sowing operation followed irrigation costs, occupying 14.71 per cent, which was Rs.4164.26 in monetary terms. Out of this amount, seed material added Rs.3594.70. Family labour and hired human labour costs were Rs.183.82 and the cost for hired human labour was Rs.385.74 respectively. This was followed by costs for farmyard manure and its application, which tallied to Rs.3863.30 (13.64 per cent). Here the cost of hired human labour was Rs.818.01 and transportation cost was Rs.689.34.

Table 5.4.4. Operation wise wise cost of cultivation of cabbage (Rs./ hectare)

Operations	Class I	Per cent	Class II	Per cent	Aggregate	Per cent
Land preparation						
Family labour	877.19	2.82	318.84	1.36	541.01	2.04
Hired labour	1469.30	4.72	2043.48	8.69	1815.01	6.83
Total	2346.49	7.54	2362.32	10.04	2356.02	8.87
Seed and nursery						
Family labour	4490.13	14.43	4043.48	17.19	4221.20	15.89
Hired labour	612.35	1.97	326.57	1.39	440.52	1.66
Total	5102.48	16.40	4370.05	18.58	4661.72	17.55
Transplanting						
Family labour	675.44	2.17	294.20	1.25	445.90	1.68
Hired labour	778.51	2.50	576.81	2.45	657.07	2.47
Total	1453.95	4.67	871.01	3.70	1102.97	4.15
Farm yard manure and application						
Input cost	2615.13	8.40	1952.90	8.30	2216.40	8.34
Family labour	578.95	1.86	246.38	1.05	378.71	1.43
Hired labour	657.89	2.11	411.59	1.75	509.60	1.92
Transportation cost	734.65	2.36	623.19	2.65	667.54	2.51
Total	4586.62	14.74	3234.06	13.75	3772.25	14.20
Fertilizers and application						
Input cost	2563.71	8.24	1585.87	6.74	1974.96	7.43
Family labour	537.28	1.73	282.61	1.20	383.94	1.45
Hired labour	65.79	0.21	17.39	0.07	36.65	0.14
Transportation cost	129.39	0.42	80.43	0.34	99.91	0.38
Total	3296.16	10.59	1966.30	8.36	2495.46	9.39
Weeding						
Family labour	850.88	2.73	310.14	1.32	525.31	1.98
Hired labour	1938.60	6.23	1894.20	8.05	1911.87	7.20
Total	2789.47	8.96	2204.35	9.37	2437.17	9.17
Plant protection measures						
Input cost	885.61	2.85	1001.30	4.26	955.27	3.60
Family labour	1458.33	4.69	702.17	2.99	904.01	3.40
Hired labour	0.00	0.00	0.00	0.00	0.00	0.00
Hiring charges for sprayer	265.35	0.85	81.88	0.35	154.89	0.58
Total	2609.30	8.38	1785.36	7.59	2014.17	7.58
Irrigation						
Family labour	4256.07	13.68	3364.98	14.31	3819.60	14.38
Hired labour	0.00	0.00	0.00	0.00	0.00	0.00
Total	4256.07	13.68	3364.98	14.31	3819.60	14.38
Harvesting						
Family labour	153.51	0.49	118.01	0.50	130.89	0.49
Hired labour	811.40	2.61	388.41	1.65	556.72	2.10
Total cost	964.91	3.10	506.42	2.15	687.61	2.59
Depriciation	180.04	0.58	135.33	0.58	160.37	0.60
Interest on working capital	333.60	1.07	281.77	1.20	302.39	1.14
Interest on fixed capital	371.52	1.19	299.67	1.27	339.91	1.28
Allowance given for farm management	2829.06	9.09	2138.16	9.09	2414.97	9.09
Total cost	31119.69	100.0	23519.78	100.00	26564.62	100.00

The total cost for weeding was Rs.2748.02, which amounted 9.70 per cent to the total cost. This operation consumed more of hired human labour, which constituted Rs.2606.48.

Farmyard manure shared 13.64 per cent of the total cost which was Rs.3863.30 in monetary terms. The application cost of hired human labour was more (Rs.818.01) than of family labour. Transportation cost added Rs.72.61 to the total cost for farmyard manure and its application. Land preparation occupied 9.41 per cent of the total cost (Rs.2663.60) followed by cost incurred on harvesting operation. which was Rs.1596.41 (5.64 per cent).

Comparative analysis of cost of operation between Class I and Class II levels proved that, the absolute amounts of costs of land preparation, seeds and sowing. irrigation, weeding and harvesting were relatively equal, but it was less in Class I for operations like farmyard manure and its application fertilizer and their application and plant protection measures, and considerable difference was noticed in the case of fertilizer and their application.

5.4.4 Operation wise cost per hectare of cabbage

Operation wise cost per hectare of cabbage is shown in Table 5.4.4.

The analysis showed that, seed and nursery management was the largest item that was 17.55 per cent of the total cost at aggregate level. Besides the cost of seed material (Rs.4221.20), Rs.440.52 went to family labour for the maintenance of the nursery. No respondent in the study area was found to use chemical fertiliser or plant protection chemicals for nursery. They used only farmyard manure and that also was not purchased for this purpose, but some amount of farmyard manure. which had been brought for main field incorporation, was applied to nursery.

Farmyard manure and its application followed seed and nursery management, which accounted Rs.3772.25 (14.20 per cent) to the total cost. For application of farmyard manure Rs.378.71 and Rs.509.60 were conceded respectively as family labour cost and hired human labour cost. Cost for irrigation was third important item accounted to Rs.3819.60 (14.38 per cent), which was cent percent occupied by family labour.

In cabbage, besides weeding, hoeing and earthing up was also practiced. This operation was mostly carried by hired human labour that had 7.20 per cent share of the total cost (Rs.1911.87). The total weeding cost was Rs.2437.17. There was no expense on weedicides and machinery labour found for weeding and earthing up operation. Land preparation and plant protection were the next important items, with 8.87 per cent (Rs.2356.02) and 7.58 per cent (Rs.2014.17) respectively contribution to the total cost.

Class wise analysis showed that seed and nursery management was the largest item in Class I. This operation worked out to Rs.5102.48 (16.40 per cent). Second most important item was farmyard manure and its application (Rs.4586.62). Besides the cost of farmyard manure (Rs.2615.13), Rs.734.65, Rs.657.89 and Rs.578.95 respectively were the expenses incurred on transportation, hired human labour and family labour for this operation. The total operation had 14.74 per cent share of the total cost. Unlike aggregate level, cost for irrigation occupied third position only with Rs.4256.07 (13.68 per cent), and the operation was fully carried out by family labour.

Fertilizer and their application added Rs.3296.16 to the total cost which was 10.59 per cent. Cost of fertilizer input was Rs.2563.17. For applying fertilizers family labour was mostly used to an extent of Rs.537.28. Transportation cost contributed Rs.129.39. Weeding and earthing up accounted for Rs.2789.47. The cost of family labour or carrying out this operation was Rs.1938.60 and the same was Rs.850.88 for hired human labour.

The share of plant protection measures was Rs.2609.30 (8.38 per cent) and only family labour was engaged for this operation. Land preparation and transplanting operations occupied Rs.2346.49 (7.54 per cent) and Rs.1453.95 (4.67 per cent) respectively of the total cost.

In Class II also seed and nursery management was the most cost requiring operation with 18.58 per cent (Rs.4370.05). Irrigation claimed Rs.3364.98, which was 14.31 per cent of the total cost. This was followed by farmyard manure and its application with 13.75 per cent (Rs.3234.06) and in that operation transportation of farmyard manure from traders yard to farmers field was the second largest item, coming next to cost of the manure input.

Weeding and hoeing got the next biggest share of 9.37 per cent (Rs.2204.35). Fertilizers and their application accounted to Rs.1966.30, which came to 8.36 per cent of the total cost. Plant protection accounted for 7.59 per cent of the total cost.

While comparing Class I and II, the variation was much less in the case of land preparation and weeding and hoeing. But considerable difference was observed between two classes for farmyard manure and its application, fertilizer and their application, plant protection, seeds and nursery management and irrigation. There was a declining trend from Class I to Class II.

5.5 Production and value of output

Table 5.5.1. Output per hectare in different classes

Crop	Output (kg/ha)		
	Class I	Class II	Aggregate
Potato	9090.73	8190.10	8563.22
Garlic	3257.30	2757.49	3016.63
Carrot	6568.36	5233.46	5878.56
Cabbage	18196.70	14022.63	16360.11

Table 5.5.2. Value of output per hectare in different classes

Crop	Value (Rs/ha)		
	Class I	Class II	Aggregate
Potato	51661.21	46403.24	48698.68
Garlic	40211.22	33942.41	37117.38
Carrot	37953.91	32347.71	35039.98
Cabbage	35218.86	24804.42	28948.39

The output of vegetables viz., potato, garlic, carrot and cabbage on per hectare basis is given in Table 5.5.1.

The analysis of output per hectare of potato revealed that, output obtained by Class I farmers (9090.73 kg/ha) was higher than that of Class II farmers (8190.10).

The same trend was found in other crops also. The outputs obtained by Class I and Class II farmers were 3257.30 kg/ha and 2757.49 kg/ha respectively for garlic. The same was 6568.36 kg/ha and 5233.46 kg/ha respectively for carrot and 18196.70 kg/ha and 14022.63 kg/ha respectively for cabbage. At the aggregate level the outputs were 8563.22 kg/ha, 3016.63 kg/ha, 5878.56 kg/ha and 16306.11 kg/ha respectively in the case of potato, garlic, carrot and cabbage.

The total value of output of potato, garlic, carrot and cabbage at the aggregate level were Rs. 48698.68, Rs. 37117.38, Rs.35039.98 and Rs. 28948.39 respectively. For all the four crops the value of output obtained by Class I level farmers were higher than that of Class II level farmers.

The value of output of vegetables viz., potato, garlic, carrot and cabbage on per hectare basis is given in Table 5.5.2.

5.6 Cost of production per quintal of vegetables

Cost of production of production per quintal of potato, garlic, carrot and cabbage are given in the Tables 5.6.1, 5.6.2, 5.6.3 and 5.6.4 respectively.

Table 5.6.1. Cost of production of potato (Rs./q)

Particulars	Class I	Class II	Aggregate
Hired labour	69.49	82.60	76.83
Seed	101.51	112.05	107.41
Farm yard manure	39.47	24.89	31.31
Fertilizers	36.24	30.60	33.08
Plant protection chemicals	24.42	28.78	26.86
Transportation cost	19.33	16.30	17.63
Hiring charges for sprayer	2.36	1.56	1.91
Depriciation	2.31	2.11	2.20
Interest on working capital	5.61	5.97	5.81
Cost A1	300.75	304.86	303.05
Interest on fixed capital	5.69	5.48	5.69
Cost B1	306.44	310.34	308.74
Imputed value of family labour	80.52	55.96	66.76
Cost C1	386.96	366.30	375.50
Allowance given for farm management	38.70	36.63	37.55
Cost C3	425.66	402.93	413.05

Table 5.6.2. Cost of production of garlic (Rs./q)

Particulars	Class I	Class II	Aggregate
Hired labour	234.42	314.63	270.02
Seed	183.81	213.45	197.21
Farm yard manure	92.15	70.46	82.35
Fertilizers	76.71	72.23	74.68
Plant protection chemicals	46.15	37.23	42.12
Transportation cost	36.95	40.08	38.37
Hiring charges for sprayer	11.95	5.34	8.76
Depriciation	12.97	14.26	13.55
Interest on working capital	4.38	4.45	4.40
Cost A1	699.49	772.14	731.46
Interest on fixed capital	10.03	10.41	10.38
Cost B1	709.52	782.55	741.84
Imputed value of family labour	329.36	274.18	304.16
Cost C1	1038.88	1056.73	1045.99
Allowance given for farm management	103.89	105.67	104.60
Cost C3	1142.76	1162.40	1150.59

Table 5.6.3. Cost of production of carrot (Rs./q)

Particulars	Class I	Class II	Aggregate
Hired labour	116.60	146.13	130.12
Seed	56.00	68.69	61.81
Farm yard manure	42.55	40.10	41.40
Fertilizers	37.54	30.81	34.43
Plant protection chemicals	20.77	19.99	20.40
Transportation cost	15.26	14.55	14.92
Hiring charges for sprayer	4.72	2.53	3.71
Depriciation	2.77	2.87	2.89
Interest on working capital	5.62	6.19	5.88
Cost A1	301.85	331.85	315.57
Interest on fixed capital	5.60	6.24	5.99
Cost B1	307.45	338.09	321.56
Imputed value of family labour	148.97	153.81	151.12
Cost C1	456.42	491.90	472.68
Allowance given for farm management	45.64	49.19	47.27
Cost C3	502.06	541.09	519.95

Table 5.6.4. Cost of production of cabbage (Rs./q)

Particulars	Class I	Class II	Aggregate
Hired labour	31.44	38.02	33.54
Seed	24.68	28.84	25.80
Farm yard manure	14.37	13.93	13.55
Fertilizers	14.09	11.31	12.07
Plant protection chemicals	4.87	7.14	5.84
Transportation cost	4.75	5.02	4.69
Hiring charges for sprayer	1.46	0.58	0.95
Depriciation	0.99	0.97	0.98
Interest on working capital	1.83	2.01	1.85
Cost A1	98.48	107.81	99.26
Interest on fixed capital	2.04	2.14	2.08
Cost B1	100.52	109.95	101.34
Imputed value of family labour	54.96	49.66	52.96
Cost C1	155.48	159.61	154.30
Allowance given for farm management	15.55	15.96	15.43
Cost C3	171.02	175.57	169.73

5.6.1 Potato

Cost of production in relation with various cost concepts showed that cost of production per quintal at Cost A_1 and Cost B_1 was higher in Class I than Class II and the reverse was observed at Cost C_1 and Cost C_3. Cost of production per quintal at Cost 3 for Class I, Class II and at aggregate levels were Rs.425.66. Rs.402.93 and Rs.413.05 respectively. Cost of production per quintal for the sample as a whole were Rs.303.05, Rs.308.74 and Rs.375.50 and Rs.413.05 respectively for Cost A_1, Cost B_1, Cost C_1 and Cost C_3.

5.6.2 Garlic

The analysis on cost of production per quintal at various cost concepts revealed that all the costs were higher in the case of Class II when compared to Class I. Cost of production per quintal at Cost C_3 for Class I, Class II and for sample as a whole were Rs.1142.76, Rs.1162.40 and Rs.1150.59 respectively. The A_1. B_1, C_1 and C_3 cost were Rs.731.46, Rs.741.84, Rs.104.99 and Rs.1150.59 respectively for the sample as a whole.

5.6.3 Carrot

From the analysis it was evident that, all the cost concepts were higher for Class II than Class I. The cost of production per quintal at C_3 cost level for Class I, Class II and for the whole sample were Rs.502.06, Rs. 541.09 and Rs. 519.95 respectively. A sum of Rs. 315.57, Rs.315.57, Rs. 312.56, Rs. 472.68 and Rs. 519.95 respectively were spent to produce one quintal of carrot at Cost A_1, Cost B_1, Cost C_1 and Cost C_3 concepts.

5.6.4 Cabbage

The analysis of cost of production per quintal at various cost concepts showed that Cost A_1, B_1, C_1 and C_3 were greater in the case of Class II than those in Class I. The cost of production per quintal at Cost C_3 level was Rs.171.02.

Rs.171.57 and Rs.169.73 respectively for Class I, Class II and for the whole sample. At aggregate level, cost of production per quintal were Rs.99.26, Rs.101.34, Rs.154.30 and Rs.169.73 respectively at Cost A_1, Cost B_1, Cost C_1 and Cost C_2.

5.7 Bulk line cost of production

Bulk line cost for potato, garlic, carrot and cabbage were worked out and they are shown in Table 5.7.1.

Table 5.7.1. Bulk line cost of cool season vegetables (Rs /q)

Crops	Bulk line cost (1)	Per cent to the total supply (2)	Percentage of cultivators coming under categories (1) and (2)
Potato	514.48	84.95	72
Garlic	1518.99	85.38	78
Carrot	709.99	84.37	76
Cabbage	199.57	85.79	70

In the case of potato bulk line cost was estimated at Rs.514.48 per quintal. The bulk line output was supplied by 72 per cent of the cultivators. Bulk line cost of garlic was Rs.1518.99 and the bulk line output was supplied by 78 per cent of the cultivators.

In the case of carrot, the bulk line output was supplied by 76 per cent of cultivators and the bulk line cost was Rs.709.99. For cabbage the bulk line cost was Rs.199.42 and 70 per cent of the total sample farmers supplied the bulk line output.

5.8 Labour use pattern

Vegetables are highly labour intensive. However there was no practice of using bullock labour and machine labour for cultivation of the selected cool season vegetables in the study area. Only human labour was used for all the

operations. The operation wise labour use in man days for potato, garlic, carrot and cabbage are given in Tables 5.8.1. The man days were worked out on the basis of three female labour day as equivalent to two male labour days; as this was approximately the wage rate ratio.

In case of potato, the total human labour use at the aggregate level was 119.06 man days and the same was 135.29 and 108.78 man days respectively at class I and class II levels. At the aggregate level land preparation required the highest amount of human labour (22.59 man days) and it was closely followed by irrigation operation demanding 22.10 man days and weeding operation requiring 21.59 man days. Irrigation was entirely carried out by family labour. Plant protection measures also were done fully by family labour (13.39 man days).

In the case of garlic, total man days used for the sample as a whole was 188.51. At Class I and Class II levels it was 236.3 and 172.84 respectively. Among the operations, irrigation required the highest amount of man days (49.97) at the aggregate level and this was higher for Class I (51.35 man days) farmers when compared with Class II (50.59 man days). Weeding operation required 46.89 man days for the whole sample and it was 45.21 man days and 50.06 man days for Class I and Class II respondents respectively. Harvesting operation, land preparation and plant protection measures required 28.45, 24.49 and 16.94 man days respectively at the aggregate level.

The analysis revealed that in the case of carrot, irrigation demanded the highest quantum of human labour to an extent of 56.82 man days per hectare at the aggregate level. The same was 55.31 and 60.04 man days respectively for class I and class II. Only family labour was used for carrying out the operation.

The next important item was weeding operation; most of this operation was carried out by hired human labour. At the aggregate level, it accounted for

Table 5.9.1 Farm efficiency measures of cool season vegetables (Rs./hectare)

Crops	Farm business income			Family labour income			Net income			Farm investment income		
	Class I	Class II	Aggregate	Class I	Class II	Aggregate	Class I	Class II	Aggregate	Class I	Class II	Aggregate
Potato	24320.70	21634.86	22747.58	23785.51	21186.35	22260.59	12965.69	13603.27	13328.12	17000.66	17051.78	17030.62
Garlic	17426.81	12650.82	15095.88	17100.16	12363.68	147.83.45	2988.02	1889.37	2477.37	10106.77	8067.74	9378.92
Carrot	18127.16	14980.60	16489.04	17759.53	14653.83	16136.94	4976.73	4029.99	4474.29	8342.28	6931.10	7605.09
Cabbage	17299.75	9686.38	12708.54	16928.23	9386.71	12368.63	4099.17	1284.64	2383.77	7299.75	3722.47	5138.64

30.04 man days and it was declining from Class I (32.65 man days) to Class II (28.35 man days).

At the aggregate level, land preparation (26.29 man days), harvesting (18.15 man days) and plant protection measures (13.94 man days) followed weeding operation.

Total man days used for carrot was 171.34 for the entire sample and this was declining from Class I (182.68 man days) to Class II (165.15).

The analysis of human labour use in cabbage cultivation revealed that, irrigation operation demanded the highest amount of labour to an extent of 32.59 man days at the aggregate level, and the same was declining from Class I (48.88 man days) to Class II (22.26 man days). This was followed by weeding operation (27.84 man days), land preparation (24.52 man days), plant protection measures (9.53 man days) and harvesting (4.92 man days) at the aggregate level.

In all the crops, operations like irrigation and plant protection measures were carried out only by family labour. Weeding operation was done mostly by hired human labour.

5.9 Farm efficiency measures

Income measures in relation to various cost concepts were worked out for the four crops studied and presented in Table 5.9.1. The profitability of crop production can be judged better from the income measures, namely, farm business income, family labour income, net income and net investment income.

5.9.1 Potato

The farm business income, family labour income, net income and net investment income at the aggregate level for potato were Rs.22747.58, Rs.22260.59, Rs.13328.12 and Rs.17030.62 respectively.

Class wise analysis showed that farm income and family labour income were greater for Class I than for Class II. But the reverse was observed in the case of net income and net investment income. The net income for Class I and Class II were estimated at Rs.12965.69 and Rs.13603.27 respectively.

5.9.2 Garlic

Farm business income or profit at cost A_1 of garlic for Class I and Class II were Rs.17426.81 and Rs.12650.82 respectively. The same, at aggregate level was Rs.15095.88. Family labour income or profits at cost B1 were Rs.17100.16, Rs.12363.68 and Rs.14783.45 respectively for Class I and Class II levels and for sample as a whole. Net income or profit at cost C_3 were estimated to be Rs.2988.02 for Class I level, Rs.1889.37 for Class II level and Rs.2477.37 for the sample as a whole. Farm investment income, which was calculated by deducting the wages of the family labour from the farm business income, were worked out to Rs.10106.77 and Rs.8067.74 for Class I and Class II and the same for the whole sample was Rs.9378.92.

5.9.3 Carrot

Income measures in relation to various cost concept for carrot showed that farm business income, family labour income, net income and net investment income at aggregate level were Rs.16489.04, Rs.16136.94, Rs.4474.29 and Rs.7605.09 respectively. The class wise analysis revealed that there was an inverse relation between size group and various income efficiency measures. The net income for Class I and Class II was worked out to be Rs.4976.73 and Rs.4029.99 respectively.

5.9.4 Cabbage

The farm business income, family labour income, net income and farm investment income at the aggregate level in the case of cabbage were Rs.12708.54,

Rs.12368.63, Rs.2383.77 and Rs.5138.64, respectively. Class wise analysis showed that these measures were higher in the case of Class I than in Class II. The net income for Class I and Class II were estimated to be Rs.4099.17 and Rs.1284.64 respectively.

5.10 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 returns obtained. The benefit cost ratios of potato garlic, carrot and cabbage were estimated separately for various cost concepts and the results presented in Tables 5.10.1, 5.10.2, 5.10.3 and 5.10.4 respectively.

Table 5.10.1. Benefit cost ratio of potato based on different cost concepts

Cost	Benefit cost ratio		
	Class I	Class II	Average
Cost A_1	1.89	1.87	1.88
Cost B_1	1.85	1.83	1.84
Cost C_1	1.47	1.55	1.51
Cost C_3	1.34	1.41	1.38

The analysis of benefit cost ratio of potato showed that investment of one rupee, yielded more than one rupee for both the classes. Cost A_1 and Cost B_1 were greater in the case of Class I than Class II. But the reverse was observed in the case of cost C_1 and Cost C_2. The cost C_3 at Class I level and Class II level and at aggregate level were 1.34, 1.41 and 1.38 respectively.

Table 5.10.2. Benefit cost ratio of garlic based on different cost concepts

Cost	Benefit cost ratio		
	Class I	Class II	Average
Cost A_1	1.76	1.59	1.69
Cost B_1	1.74	1.57	1.66
Cost C_1	1.19	1.16	1.18
Cost C_3	1.08	1.06	1.07

The analysis of benefit cost ratio of garlic revealed that returns generated from a rupee were greater than one for both the classes. But benefit cost ratio at Cost C_3 were very low, hanging around one. The ratio at all cost concepts were found to be highest for Class I. At aggregate level they were 1.69, 1.66, 1.18 and 1.07 respectively on Cost A_1, Cost B_1, Cost C_1 and Cost C_3.

Table 5.10.3. Benefit cost ratio of carrot based on different cost concepts

Cost	Benefit cost ratio		
	Class I	Class II	Average
Cost A_1	1.91	1.86	1.89
Cost B_1	1.88	1.83	1.85
Cost C_1	1.27	1.26	1.26
Cost C_3	1.15	1.14	1.15

For carrot, the ratios were greater than one. The analysis proved that the ratio were greater in the case of Class I than Class II. At aggregate level the ratios based on Cost A_1, Cost B_1, Cost C_1 and Cost C_3 were 1.89, 1.85, 1.26 and 1.15 respectively.

Table 5.10.4. Benefit cost ratio of cabbage based on different cost concepts

Cost	Benefit cost ratio		
	Class I	Class II	Average
Cost A_1	1.97	1.64	1.78
Cost B_1	1.93	1.61	1.75
Cost C_1	1.24	1.16	1.20
Cost C_3	1.13	1.05	1.09

The ratios based on Cost A_1, Cost B_1, Cost C_1 and Cost C_3 for the sample as a whole in cabbage were 1.78, 1.75, 1.20 and 1.09 respectively. The ratios were found to be greater than one in all the three classes.

5.11 Measurement of technical efficiency

Table 5.11.1. Ordinary Least Squares and stochastic frontier estimates of potato

Variables	Co-efficients	
	Ordinary Least Squares	Stochastic frontier
Constant	3.6686*** (1.2747)	3.8799*** (1.5379)
Labour	0.2046 (0.1388)	0.2271 (0.1935)
Seed	0.5769*** (0.1496)	0.5598*** (0.1863)
Fertiliser	0.01853* (0.0098)	0.0205* (0.0166)
Farmyard manure	0.0313* (0.0161)	0.03123* (0.0163)
R^2	0.46	-
λ	-	1.5664** (0.6737)
γ	-	0.7104
N	50	50

Table 5.11.2. Ordinary Least Squares and stochastic frontier estimates of garlic

Variables	Co-efficients	
	Ordinary Least Squares	Stochastic frontier
Constant	4.3992*** (1.0709)	4.4179*** (1.1390)
Labour	0.1032 (0.0745)	0.0865 (0.1108)
Seed	0.497*** (0.16621)	0.5417*** (0.1522)
Fertiliser	0.0232** (0.01001)	0.0254** (0.0118)
Farmyard manure	0.0265** (0.0118)	0.0272** (0.01315)
R^2	0.34	-
λ	-	1.2730* (0.6574)
γ	-	0.618
N	50	50

*** - significant at one per cent level
** - significant at five per cent level
* - significant at 10 per cent level
(Figures in parentheses indicate standard error)

Table 5.11.3. Ordinary Least Squares and stochastic frontier estimates of carrot

Variables	Co-efficients	
	Ordinary Least Squares	Stochastic frontier
Constant	5.7380***	6.2234***
	(1.0569)	(1.3492)
Labour	0.4760**	0.4434**
	(0.2114)	(0.2276)
Seed	0.3841**	0.4074**
	(0.1802)	(0.2031)
Fertiliser	0.0444**	0.0529**
	(0.0208)	(0.02414)
Farmyard manure	0.0147	0.0213
	(0.0146)	(0.0162)
R^2	0.40	-
λ	-	3.3557*
		(1.7209)
γ	-	0.92
N	50	50

Table 5.11.4. Ordinary Least Squares and stochastic frontier estimates of cabbage

Variables	Co-efficients	
	Ordinary Least Squares	Stochastic frontier
Constant	5.9237***	8.57***
	(1.8984)	(1.9114)
Labour	0.8923**	0.8650**
	(0.3519)	(0.3564)
Seed	0.5861**	0.5878**
	(0.2841)	(0.2916)
Fertiliser	0.0437	0.0419
	(0.0522)	(0.0175)
Farmyard manure	0.0242	0.0428
	(0.0631)	(0.0815)
R^2	0.33	-
λ	-	7.514**
		(3.3607)
γ	-	0.98
N	50	50

*** - significant at one per cent level
** - significant at five per cent level
* - significant at 10 per cent level
(Figures in parentheses indicate standard error)

Table 5.11.5. Frequency distribution of technical efficiencies of vegetable farms

Technical efficiencies (per cent)	Potato	Garlic	Carrot	Cabbage
0-10	0	0	0	4
10-20	0	0	1	0
20-30	1	0	1	0
30-40	3	1	1	0
40-50	0	2	3	5
50-60	0	3	6	7
60-70	7	10	9	15
70-80	15	5	15	10
80-90	12	14	7	7
90-100	12	15	7	2

In the present study, stochastic production, function has been employed to estimate the technical efficiencies of vegetables like potato, garlic, carrot and cabbage. The model was fitted separately for the four crops for the sample as a whole. Both average production function estimates (OLS) and stochastic frontier production function estimates were analysed. The results are shown in Tables 5.11.1, 5.11.2, 5.11.3 and 5.11.4.

The co-efficient of multiple determination (R^2) explain the proportion of variation in the dependent variable as explained by the independent variable included in the model. The explanatory variables in the functions explained 46 per cent of variation in the output in the case of potato, 34 per cent in the case of garlic, 40 per cent in the case of carrot and 33 per cent in the case of cabbage.

Ordinary least squares estimates of potato showed that, all the regression co-efficients (bi), were positive. Regression co-efficients of seed, fertilizer and farmyard manure were statistically significant but that of labour was insignificant. The stochastic frontier production function estimates showed that λ (1.5664) and σ (0.3191) were statistically significant which indicated a good fit and the correctness of the specified distributional assumption. The estimate of γ

which is the ratio of the variance of farm specific technical efficiency to the total variance of output was 0.71. This would mean that 71 per cent of the variation in output among the farms was due to differences in technical efficiency.

The technical efficiency was 0.78 (78 per cent). The frequency distribution of the farm specific technical efficiencies as given in Table 5.11.5 showed that 22 per cent of the farms were operating at a technical efficiency of more than 90 per cent. As much of 30 per cent of the farm were operating at a technical efficiency of in between 70 and 80 per cent.

In the case of garlic all the regression co-efficients of both OLS and stochastic frontier estimates were positive. Except labour, co-efficients of other inputs like seed, fertilizers and farmyard manure were statistically significant. The stochastic frontier production function estimates like λ (1.2730) and σ (0.3370) were statistically significant. The estimate of γ was 0.62 which meant that 62 per cent of the variation in output among the farm was due to differences in technical efficiency. The average technical efficiency was 0.80 (80 per cent), and the frequency distribution of the farm specific technical efficiencies showed that 30 per cent of the farms were operating at a technical efficiency of more than 90 per cent and 28 per cent of farm were in between 80 to 90 per cent technical efficiency.

Regression co-efficients of carrot for both OLS and stochastic frontier production function estimates were positive and they were statistically significant except for farmyard manure. The stochastic frontier production function estimates such as λ (3.3557) and σ (0.5199) were statistically significant. The γ value was 0.92 (92 per cent) which indicated that more than 90 per cent of the variation in output among the farm was due to differences in technical efficiency. The technical efficiency was 0.71 (71 per cent). As much as 14 per cent of the farms were operating at technical efficiency of more than 90 per cent and same percentage of farms were operating in between 80-90 per cent of technical efficiency. Around 30 per cent of the farms were operating at a technical efficiency of 70 to 80 per cent.

Ordinary least square and stochastic frontier estimates production function of cabbage showed that all the regression co-efficients were positive. While comparing the regression co-efficients of OLS and stochastic frontier production functions an upward shift in the constant term was observed in the stochastic frontiers production functions and all other coefficients were more or less same, for both the functions. Labour and seed co-efficients were statistically significant. The stochastic frontier production function estimates like λ (7.514) and σ (0.9229) were statistically significant and the γ value was 0.98 (98 per cent) implying as much of 98 per cent of the variation in output among the farm was attributed to differences in technical efficiency. The average technical efficiency was 0.63 (63 per cent). The frequency distribution of the farm specific technical efficiencies showed that 30 per cent of the farms were operating at a technical efficiency range of 70 to 80 per cent.

5.12 Marketing

Marketing activity includes the functioning of various agencies mainly classified as producer, middlemen and consumer who have an individualistic view towards marketing and are concerned with profit alone. Besides unnecessary attachment of large number of intermediaries results in producer's smaller share in consumer's rupee (Lepcha *et al.*, 1993).

In the present study an attempt has been made to identify the important marketing channels and also to analyse the marketing efficiency of cool season vegetables viz. potato, garlic, carrot and cabbage as indicated by marketing costs and margins.

In the study area, harvesting of vegetables was done by farmers or through pre harvest contracts.

In the case of potato, garlic and carrot, harvesting was done with the help of spades. Cabbage was harvested by cutting it with sharp knife. Mostly, single harvesting was followed and some farmers went for two harvests also. In the case of carrot and potato, produce was cleaned in running stream of water, immediately after the harvest. Garlic bulbs were tied along with the leaves for storage. These bulbs were sold either immediately after harvest or after drying them in shade for 7-10 days. The dried bulbs fetched more prices, but weight of the bulbs would be reduced to half. If the bulbs were sold to the village merchants, immediately after harvest, it was their responsibility to dry them. Before selling the produce to the wholesale market, dried leaves were separated from the bulbs.

Produce was usually packed in gunny bags. In the case of potato and garlic 50-60 kg of produce were packed in a bag and 90-100 kg of carrot and cabbage were packed in a single gunny bag. Jeep and tempo van were the means of transport for vegetables to take them to the wholesale market. Transportation cost per sack or gunny bag varied from product to product as the charge was based on weight.

5.12.1 Market structure

Market structure refers to the size and design of the market. It also includes the manner of the operation of the market (Acharya and Agarwal, 1992). It refers to the formal organisation of the functional activity of a marketing institution (Amarchand and Varadarajan, 1980).

Vegetable growers of Munnar and Vattavada panchayats of Devikulam block generally sold their produce to the village merchants. Village merchants sold the produce usually in Ernakulam wholesale market or Madurai wholesale market or Mettupalayam wholesale market. Selection of market was dependent on the prevailing prices of the product. In general, these produces were sold in Ernakulam wholesale vegetable market.

5.12.2 Marketing channels

Marketing channels are routes through which agricultural products move from producers to consumers. The length of the channel varies from commodity to commodity, depending on the quantity to be moved, the form of consumer demand and degree of regional specialization in production (Acharya and Agarwal, 1997).

The different marketing channels identified in the marketing of cool season vegetables in the study are given below.

1. Producer-consumer
2. Producer-retailer-consumer
3. Producer-village merchant-wholesaler-consumer
4. Producer-village merchant-wholesaler-retailer-consumer
5. Producer-village merchant-commission agent-wholesaler-consumer
6. Producer-village merchant-commission agent-wholesaler-retailer-consumer
7. Producer-wholesaler-retailer

Among these channels, the most widely adopted channel was producer - village merchant-commission agent-wholesaler-retailer-consumer. Distribution of respondents according to the type of buyers is shown in Table 5.12.1.

Table 5.12.1. Distribution of respondents based on type of buyers

Product sold to	Number of farmers				
	Potato	Garlic	Carrot	Cabbage	Total
1. Village merchant	43 (86)	45 (90)	43 (84)	43 (86)	173 (86.5)
2. Wholesalers and commission agents	2 (4)	0 (0)	1 (2)	2 (4)	2 (2-5)
3. Retailers	4 (8)	2 (4)	5 (10)	3 (6)	14 (7)
4. Consumers and village merchants	1 (2)	3 (6)	2 (4)	2 (4)	8 (4)
Total	50 (100)	50 (100)	50 (100)	50 (100)	50 (100)

(Figures in parentheses indicate percentage to the total)

In case of potato 43 respondents (86 per cent) sold their produce to village merchants, two (4 per cent) to wholesalers, four (8 per cent) to retailers and one (2 per cent) to consumers and village merchants.

Out of 50 respondents of garlic, as much as 45 farmers (90 per cent) sold their produce to village merchants. A number of two (4 per cent) and three (6 per cent) farmers respectively sold their produce to retailers and consumers and village merchants.

Among 50 carrot growers, 84 per cent sample farmers sold their produce to village merchant and 10 per cent farmers to retailers and four per cent farmers to consumers and village merchants.

In case of cabbage, 43 respondents sold their produce to village merchants, and two (4 per cent), three (6 per cent) and two (4 per cent) farmers respectively sold to wholesalers, retailers, consumers, and village merchants.

Considering sample as a whole, 86.5 per cent (83 farmers) sold their produce to village merchants. About 24 percent (5 farmers), 7 per cent (914 farmers) and 4 per cent (98 farmers) respectively sold to wholesalers, retailers and consumers, and village merchants.

5.12.3 Marketing costs and margins

For the most widely adopted channel, the price received by the potato growers was Rs.5.89 per kg while the price paid by the consumer was Rs.9.84 per kg. Producers share was 59.86 per cent and the price spread was Rs.3.95 per kg. In the case of garlic price received by the farmer, price paid by the consumer, farmers share in consumers rupee and price spread were Rs.12.50 per kg, Rs.28.76, 43.46 per cent and Rs.16.26 per kg, respectively.

Table 5.12.2 Marketing cost and margins in Ernakulam vegetable market (Rs /kg)

Particulars	Potato	Garlic	Carrot	Cabbage
Price received by producer	5.89 (49.86)	12.50 (43.46)	6.12 (60.12)	2.17 (42.14)
Cost incurred by village merchant	1.02 (10.37)	11.75 (40.85)	1.02 (10.09)	1.02 (19.81)
Commission charges paid by village merchant	0.49 (4.98)	1.60 (5.56)	0.51 (5.04)	0.23 (4.47)
Cost incurred by commission agent	0.20 (2.03)	0.20 (0.70)	0.20 (1.98)	0.20 (3.88)
Price received by village merchant from Wholesaler	8.13 (82.62)	26.69 (92.80)	8.41 (83.18)	3.89 (75.53)
Net margin for village merchant	0.73 (7.42)	0.84 (2.92)	0.76 (7.52)	0.47 (9.13)
Cost incurred by wholesaler	0.22 (2.24)	0.22 (0.76)	0.22 (2.18)	0.22 (4.27)
Price paid by retailer	9.19 (93.39)	27.92 (97.08)	9.44 (93.37)	4.66 (90.49)
Net margin for wholesaler	0.84 (8.54)	1.01 (3.51)	0.81 (8.01)	0.66 (10.68)
Cost incurred by retailer	0.18 (1.83)	0.18 (0.62)	0.18 (1.78)	0.18 (3.50)
Net margin for retailer	0.47 (4.78)	0.66 (2.29)	0.49 (4.85)	0.31 (6.02)
Price paid by consumer	9.84 (100)	28.76 (100)	10.11 (100)	5.15 (100)

(Figures in parentheses indicate percentage to the total)

The price received by carrot growers was Rs.6.12 per kg while the price paid by the consumer was Rs.10.11 per kg. An amount of 60.12 per cent was the farmer's share in consumer's rupee and price spread was observed to be Rs.3.99. In the case of cabbage price received by the grower, price paid by the consumer, producer's share in consumer's rupee and price spread were Rs.2.17 per kg, Rs.5.15 per kg, 42.14 per cent and Rs.2.98 per kg respectively.

Producer's share in consumer's rupee was the highest for carrot followed by potato, garlic and cabbage while price spread was the highest for garlic, followed by carrot, potato and cabbage. The marketing costs and margins of cool season vegetables are shown in Table 5.12.2.

5.12.4 Marketing efficiency

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

Table 5.12.3 Marketing efficiency of cool season vegetables

Cool season vegetables	Marketing efficiency
Potato	1.49
Garlic	0.77
Carrot	1.53
Cabbage	0.73

There are two aspects of marketing efficiency, namely technical efficiency and economic efficiency. The latter can be assessed by different methods such as marketing costs and marketing margins, degree of market integration and temporal and spatial price differences. In the present study marketing efficiency is assessed on the basis of marketing costs and margin. 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, 1992).

There are two concepts of marketing margins, namely 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 this study the average prices received by the cool season vegetable growers were compared with the prices, which prevailed in the Ernakulam wholesale market.

Table 5.13.1. Constraints in cool season vegetable cultivation as ranked by respondents

Rank	pest and diseases	lack of capital	lack of irrigation facilities	high wage rate	lack of marketing facilities	low price for produce	high input cost	climatic factors	lack of transport facilties	problem of wild animals
1	34	1	23	3	17	32	18	2	37	33
2	28	0	1	5	47	40	18	5	27	29
3	37	1	4	6	29	56	11	1	19	36
4	45	2	13	1	29	26	34	8	8	34
5	40	12	16	5	27	26	31	3	25	15
6	8	20	34	9	15	8	32	14	39	21
7	4	52	35	33	9	2	10	23	16	0
8	0	40	17	33	8	8	17	32	11	4
9	4	8	25	24	14	0	13	40	4	11
10	0	4	8	34	5	2	1	30	11	4
NA	0	60	24	47	0	0	15	42	3	13
Total	200	200	200	200	200	200	200	200	200	200

Table 5.13.2. Scores of constraints after giving weights

Ranks	pest and diseases	lack of capital	lack of irrigation facilities	high wage rate	lack of marketing facilities	low price for produce	high input cost	climatic factors	lack of transport facilties	problem of wild animals
1	340	10	230	30	170	320	180	20	370	330
2	252	0	9	45	423	360	162	45	243	261
3	296	8	32	48	232	448	88	8	152	288
4	315	14	91	7	203	182	238	56	56	238
5	240	72	96	30	162	156	186	18	150	90
6	40	100	170	45	75	40	160	70	195	105
7	16	208	140	132	36	8	40	92	64	0
8	0	120	51	99	24	24	51	96	33	12
9	8	16	50	48	28	0	26	80	8	22
10	0	4	8	34	5	2	1	30	11	4
NA	0	0	0	0	0	0	0	0	0	0
Total	1507	552	877	518	1358	1540	1132	515	1282	1350
Order of importance	**2**	**8**	**7**	**9**	**3**	**1**	**6**	**10**	**5**	**4**

From the table it is clear that net margin received by the wholesaler was higher than other intermediaries for all the vegetables except garlic, where, net margin of commission agent was higher.

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

Marketing efficiency of potato, garlic, carrot and cabbage were 1.49, 0.77, 1.53 and 0.73 respectively. The higher the ratio, higher is the efficiency of marketing system. From the results obtained, it was evident that marketing efficiency of carrot was the highest. Marketing efficiency of cool season vegetables is given in Table 5.12.3.

5.13 Constraints in vegetable cultivation

The constraints in vegetable cultivation were identified after consulting with concerned agricultural officers and the farmers in the study area. Finally, 10 different constraints were identified and 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 farmer responses. The results are given in Tables 5.13.1 and 5.13.2.

Low price for the produce was the most important constraint faced by 32 per cent of the respondents while it was the second most important problem for 40 per cent of them. After giving weights, total score for this constraint was estimated to be 1540, which was the highest of all other scores. The second most important problem was pest and disease, which accounted for a score of 1507. As much of 34 per cent of the sample farmers ranked first for this constraint and 28 percent ranked second. Lack of marketing facilities was also a serious constraint for 17 per cent of the respondents and this was the third most important constraint in the study area. Problem of wild animals was the next serious problem faced by

the sample farmers. This was followed by constraints like lack of transportation facilities, higher input cost, lack of irrigation facilities, lack of capital high wage rate and climatic factors with scores of 1282, 1132, 877, 552, 518 and 515 respectively.

Discussion

6. DISCUSSION

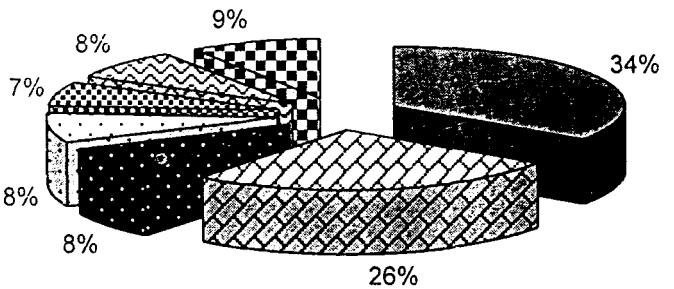
Cool season vegetables were cultivated on commercial basis by majority of the respondents in the study area. Among the four vegetables selected, potato was cultivated in largest area followed by garlic, carrot and cabbage. The results based on the present study have already been mentioned in the previous chapter and are being discussed in this chapter under the following heads.

6.1 Input wise cost of cultivation
6.2 Operation wise cost of cultivation
6.3 Production and value of output
6.4 Farm efficiency measures
6.5 Benefit cost ratio
6.6 Technical efficiency
6.7 Marketing
6.8 Constraints in vegetable cultivation

6.1 Input wise cost of cultivation

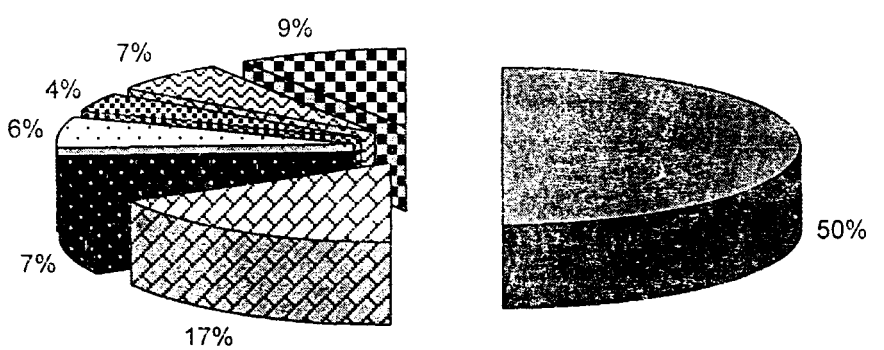
Input wise cost of cultivation of potato showed that human labour was the most important input expenditure occupying 34.76 per cent of total cost at aggregate level. This could be explained by the fact that in general vegetable cultivation is highly labour intensive. Tewari *et al.* (1974) and Rathore *et al.* (1974) reported that human labour accounted for almost 27 per cent of the total cost of potato cultivation, which is lesser than that in the present study. Tewari *et al.* (1974) reported that almost 27 per cent of the cost accounted for human labour for potato cultivation, which is lesser than that in the present study. Rathore *et al.* (1974) estimated that the cost of human labour was 26.68 per cent of the total cost which also is lesser than that in the present study. But in both of these studies, the use of bullock labour was observed. In the present study, bullock labour was not at all used and this could explain the higher use of human labour.

Fig. 2. Input wise cost of cultivatin of potato



Hired labour
seed
Farm yard manure
Fertilizers
Plant protection chemicals
Other costs*
Allowance given for farm management

Fig. 3. Input wise cost of cultivation of garlic



Hired labour
seed
Farm yard manure
Fertilizers
Plant protection chemicals
Other costs*
Allowance given for farm management

Cost of seed material was the second most important item of input accounting for 26 per cent of the total cost, at the aggregate level. This was supported by the findings of Kumar *et al.* (1980) and Saha and Mukhopadhay (1999) who estimated it to be 27.8 per cent and 27.57 per cent respectively.

Fertilizer cost was the next important item of input, which shared 8.01 per cent of the total cost at the aggregate level. Farmyard manure input cost closely followed the cost of fertilizers with a share of 7.58 per cent. The result is in conformity with the findings of Saha and Mukhopadhay (1999) who estimated the cost of farmyard manure to be 6.38 per cent of the total cost. For both fertilizers and farmyard manure the cost was declining from Class I to Class II.

The hiring charges of sprayers were declining from Class I to Class II. Even though the cost of plant protection chemicals input was apparently equal in both classes, a declining trend was observed in the case of hiring charges of sprayers. This is because, there was no much change the frequency of spraying plant protection chemicals even though the quantity of chemicals purchased were almost same and while converting the hiring charge from actual land holding to hectare, the difference was found.

The transportation cost also was declining from Class I to Class II. As these costs were incurred for the transportation of farmyard manure and fertiliser mostly, the same declining trend also reflected in transportation cost also.

Cost A_1, Cost B_1, Cost C_1 and Cost C_3 were declining from Class I to Class II. This declining trend in Cost A_1, could be understood from the contribution of farmyard manure, fertilizers and transportation costs in both the classes. As there was a huge decline in family labour cost from Class I to Class II. Cost C_1 also was declining from Class I to Class II.

Input wise cost of cultivation analysis of garlic showed that cost on human labour was the single largest item of input occupying 49.90 per cost of the

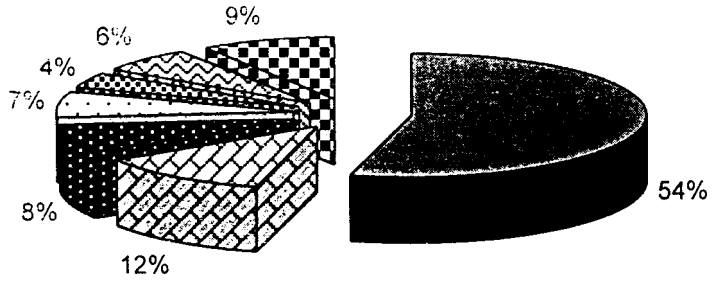
total cost at the aggregate level. This result is not in conformity with the observation of Haq *et al.* (1999) who estimated the share of human labour to 29.3 per cent to the total cost. Cost on seed material input was the next important item, which shared 17.14 per cent with the total cost. In both the classes the cost incurred on the input was approximately similar in monetary terms.

Fertilizers and farmyard manure input costs were the next important item of input, which occupied 6.49 per cent and 7.16 per cent at the aggregate level. The above result on fertilizer cost was in conformity with the finding of Haq *et al.* (1999), who estimated the cost to be 5.8 per cent of the total cost, in a study conducted in Natore village of Bangladesh. For both farmyard manures and fertilizers, the costs were declining from Class I to Class II. In both the classes, farmers were using these two inputs at levels lesser than the recommended level. Plant .protection chemicals were one of the important input items whose cost occupied 3.66 per cent of the total cost.

Cost A_1, B_1, C_1 and C_3 were declining from Class I to Class II. The observed declining trend in cost A_1, among the two classes could be explained from the contribution of farmyard manure cost and fertilizer cost in these two classes. As there was a considerable reduction in the cost of imputed value of family labour, in Class II when compared with Class I, the declining trend was observed in Cost C_1 among the classes.

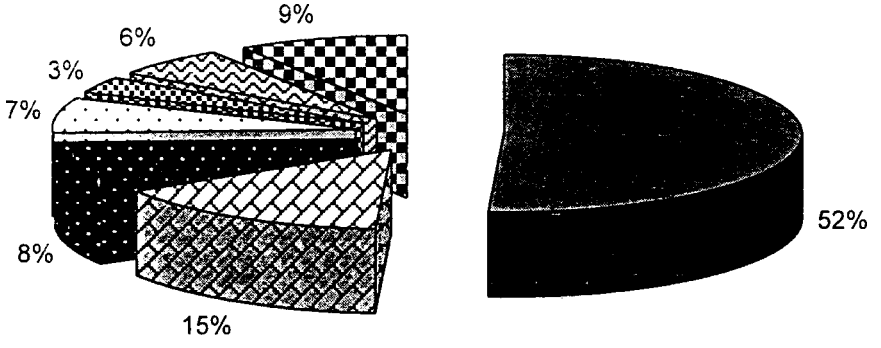
Input wise cost of cultivation analysis of carrot showed that, human labour was the single largest item in both the classes. At aggregate level, it's share was 54.09 per cent to the total cost. Even though the use of hired labour was almost equal in both the classes, in monetary terms, there was a declining trend from Class I to Class II in the case of family labour. This proved that, there was an inverse relationship between size of holding and the use of family labour.

Fig. 4. Input wise cost of cultivation of carrot



- Human labour
- seed
- Farm yard manure
- Fertilizers
- Plant protection chemicals
- Other costs*
- Allowance given for farm management

Fig. 5. Input wise cost of cultivation of cabbage



- Hired labour
- seed
- Farm yard manure
- Fertilizers
- Plant protection chemicals
- Other costs*
- Allowance given for farm management

Cost of seed material was the second largest item of input and cost incurred on this expense was apparently equal in both the classes. But there was a considerable reduction in the cost of chemical fertilizers for Class II when compared to Class I. Farmyard manure and plant protection chemicals were also the important inputs.

Cost A_1 was less in the case of Class II when compared with Class I. This could be attributed to the declining trend of cost of chemical fertilizers from Class I to Class II. Cost B_1, Cost C_1 and Cost C_3 were also declining in the case of Class II. The difference in Cost C_1 could be explained through the contribution of family labour cost in both the classes.

In the case of cabbage, labour cost was the most important item of input, which occupied 49.15 per cent of the total cost at the aggregate level. As much as 20.65 per cent was attributed to hired human labour. Balrayan (1981) reported that the contribution of hired human labour was 20.66 per cent, which is in conformity with the present study. Seed material input was the next important item of input. In monetary terms, it's cost was more or less equal in both the classes. However, considerable variation was observed in the cost of fertilizers and farmyard manure, between both the classes. There was a declining trend from Class I to Class II was observed. Plant protection chemicals were also an important input and there was no considerable variation in its cost between the two classes. But a considerable decline for the hiring charges of sprayers was observed. This could be because the frequency of spraying was almost same for both the classes irrespective of the size of land holding.

Cost C_3 was declining from Class I to Class II, which could be mainly attributed to the contribution of costs of farmyard manure, chemical fertilizers and imputed value of family labour in both the classes.

6.2 Operation wise cost of cultivation

Operation wise cost of cultivation of potato showed that seeds and sowing was the single largest item which accounted for 30.12 per cent of the total cost at the aggregate level. In monetary terms there was no much variation between Class I and Class II. It was followed by the application of farmyard manure and fertilisers. For both these operations, the costs incurred by Class I respondents were higher than that of Class II. As quantity of farmyard manure and fertilizers used was less in Class II, the corresponding application costs and transportation costs were also lesser.

Plant protection measures were also an important operation taking a share of 10.23 per cent of the total cost. Even though the cost of plant protection chemical inputs was almost similar in both the classes, the cost of the operation was declining from Class I to Class II. This could be because of the reason that, the frequency of spraying of chemicals was similar in both the classes irrespective of the size of land holding and that is why the application costs and hiring charges of sprayer were declining from Class I to Class II.

Weeding operation was carried out by female labourers only and there was no marked variation in the cost between two classes. The harvesting work was mainly carried out by hired human labour and special skill is required to accomplish this operation, to avoid damage to product.

Transportation cost was incurred for transporting seeds, farmyard manure and fertilizers. Compared with other two operations, this cost on farmyard manure was more and it was one third of the farmyard manure input cost. In general Rs.50 per tonne was incurred for the transportation of this input. Irrigation was carried out only by family labour.

In garlic also, seeds and sowing was the most important operation. There was no considerable variation in the cost of this operation between two

classes. Irrigation was the next important operation, which occupied 14.49 per cent of the total cost. As observed in the case of potato, here also weeding operation was mostly carried out by hired labour. The cost incurred on irrigation and weeding was almost equal in monetary terms. However, a notable difference was found in the case of cost of operations like farmyard manure and fertilizer application. As input costs were less in Class II for these two operations, the same trend reflected in corresponding application costs and transportation cost also.

Operation wise cost of cultivation of carrot showed that irrigation was the most important item sharing 17.87 per cent with the total cost at the aggregate level. This operation was totally accomplished by family labour and the cost of it remained almost same for both the classes. Farmyard manure and its application was the next important item. A decreasing trend was noticed from Class I to Class II. For fertilizers and their application was also had similar trend. This could be because of the quantity of these inputs used in the two classes.

Seeds and sowing was another important operation supplementing 13.97 per cent to the total cost at the aggregate level. In monetary terms, the cost was more or less same in both the classes. The cost on plant protection measures was declining from Class I to Class II. This could be because, there was no much variation in the frequency of spraying in accordance with the size of holding and this attributed to the reduced spraying charges and hiring charges for sprayer in Class II. Land preparation was also an important operation occupying 8.59 per cent of the total cost at the aggregate level. There was no considerable variation in the cost of this operation between two classes.

Operation wise cost of cultivation of cabbage showed that nursery management was the most important item, which shared 17.55 per cent of the total cost, at the aggregate level. This was followed by farmyard manure and its application and irrigation. Fertilizers and their application was also an important item accounting for 9.39 per cent of the total cost at the aggregate level. As

Fig. 6. Farm efficiency measures of potato

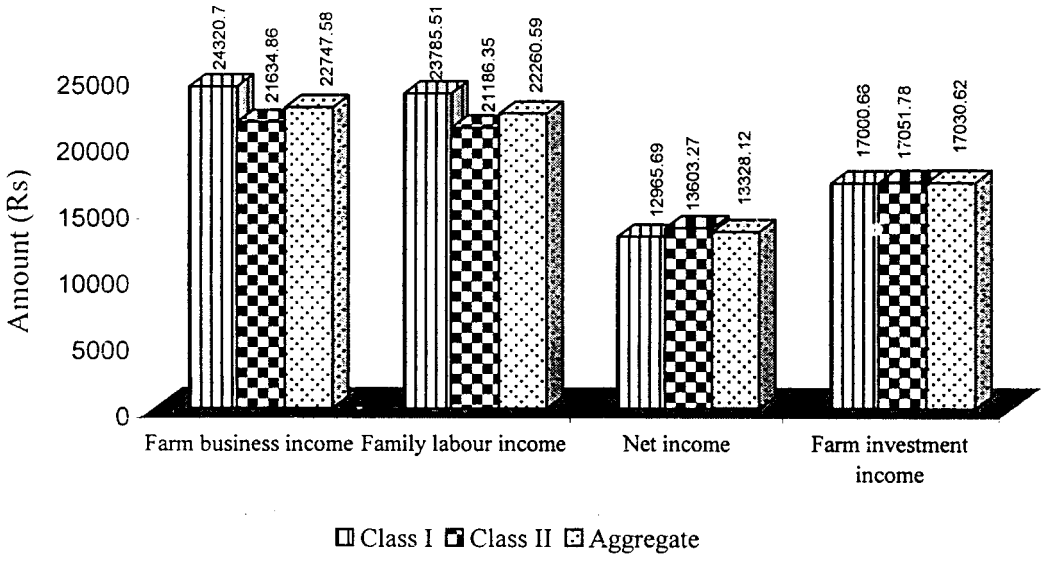
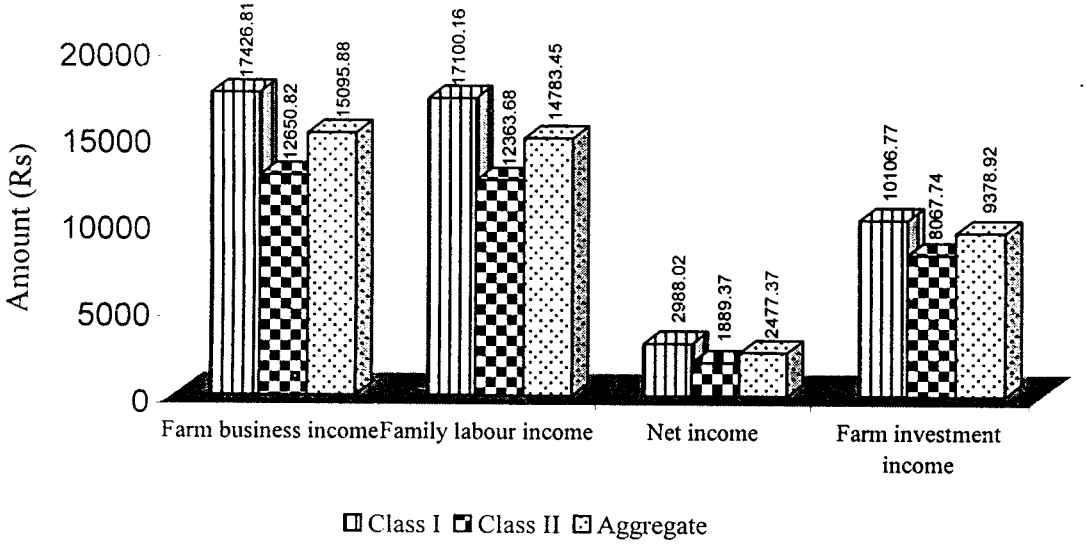


Fig. 7. Farm efficiency measures of garlic



observed in other vegetables, here also a similar declining trend from Class I to Class II was observed in the case of farmyard manure and fertiliser application and plant protection measures.

6.3 Production and value of output

Production of potato tubers in the present study was 8563.25 kg per hectare at the aggregate level. This was declining from Class I to Class II. Kumar *et al.* (1980) reported that the production was 7629 kg per hectare, which is slightly lesser than the present study. Kumar *et al.* (1999) estimated this to be 13,246 kg per hectare, which is higher than the present study. In the case of garlic, the production was 3016.63 kg at the aggregate level. This is supported by the finding of Haq et *al.* (1999) who estimated it to 3115 kg per hectare. In garlic also declining trend in production from Class I to Class II was noticed.

In carrot, production was observed to be 5878.56 kg per hectare for the sample as a whole and in the case of cabbage it was 16,360.11 kg per hectare. Kumar and Arora (1999) observed that the production of cabbage was 18,263 kg, which is higher than the result of present study at the aggregate level, and it was in conformity with the result at Class I level. In both carrot and cabbage yields were decreasing from Class I to Class II.

In all the four vegetables, the value of output was lesser in the case of Class II than in Class I farmers. This could be understood from the fact that the same trend was found in yield also. This proved that there was an inverse relationship existing between output and the size of holding.

6.4 Farm efficiency measures

Various farm efficiency measures like farm business income, family labour income, net income and farm investment income were worked out for all the four vegetables. Net income, which denotes the profit obtained by the grower,

Fig. 8. Farm efficiency measures of carrot

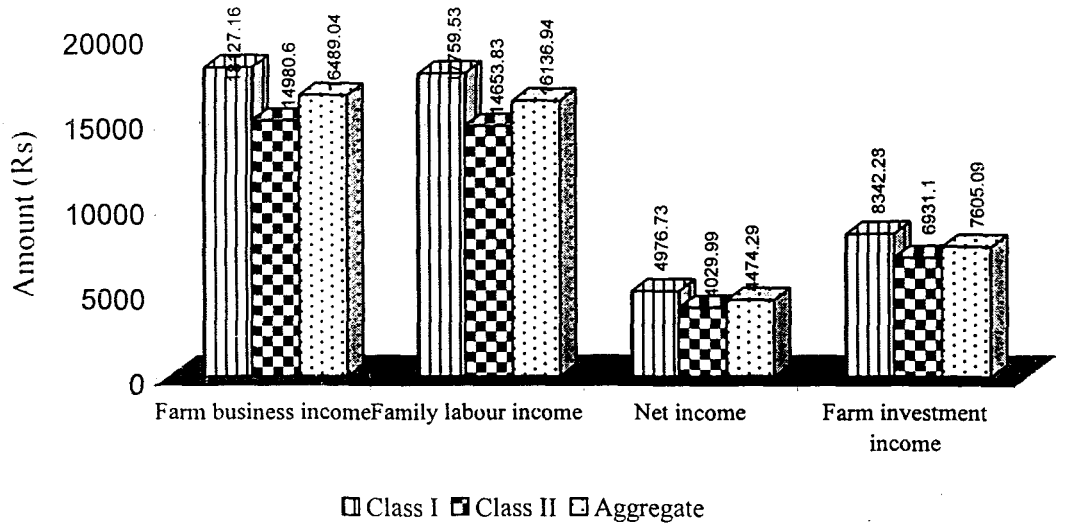
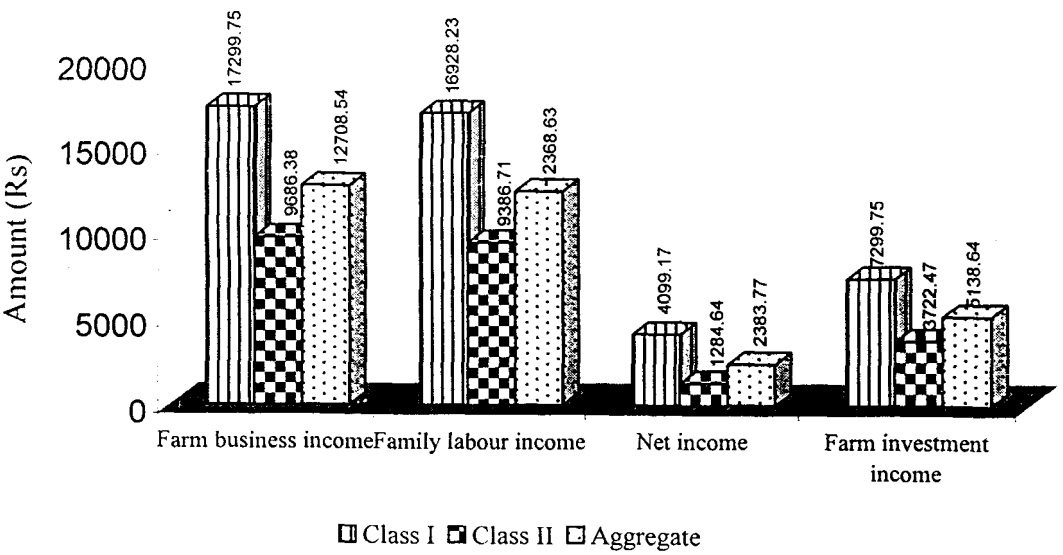


Fig. 9. Farm efficiency measures of cabbage



was slightly higher in Class II when compared with Class I in potato. At the aggregate level it was estimated to Rs.13,328.12 per hectare. Rana (1991), Srivastava and Prasad (1979) and Bhalerao and Maurya (1985) estimated net return to Rs.7,662.78,Rs.7,014.58 and Rs.1,330.50 which were lesser than the present study. Sharma and Thakur (1988) reported that the net return was Rs.10,911.66 per hectare which was Rs.2,416.46 lesser than the present study. Other income measures such as farm business income, family labour income and farm investment income were more for Class I when compared with Class II.

Net return obtained from garlic was Rs.2477.37 and it was declining from Class I to Class II. Same kind of variation was observed for farm business income, family labour income and farm investment income also.

In the case of carrot, the net income at the aggregate level was Rs.4474.29. All the income measures were declining from Class I to Class II. Kumar and Arora (1999) estimated the net income to Rs.9052.76, which is not on par with the present study. In the present study

Mankar *et al.* (1990) reported that the net income was Rs.6,071.38, which also is higher than the present study. The difference between the results of these studies could be due to the higher wage of family labour and lesser yield in the present study when compared with the reference.

6.5 Benefit cost ratio

Benefit cost ratio was calculated at cost concepts like Cost A_1, B_1, C_1 and C_3.

In the case of potato, benefit cost ratio was 1.38 at Cost C_3, for the sample as a whole. Rathore *et al.* (1974) observed that the benefit cost ratio was 2.57, which is not in conformity with the present study. Kumar *et al.* (1980), Bhalerao and Maurya (1985), Sharma and Thakur (1988) reported that the ratio

Fig. 10. Bulk line cost of potato

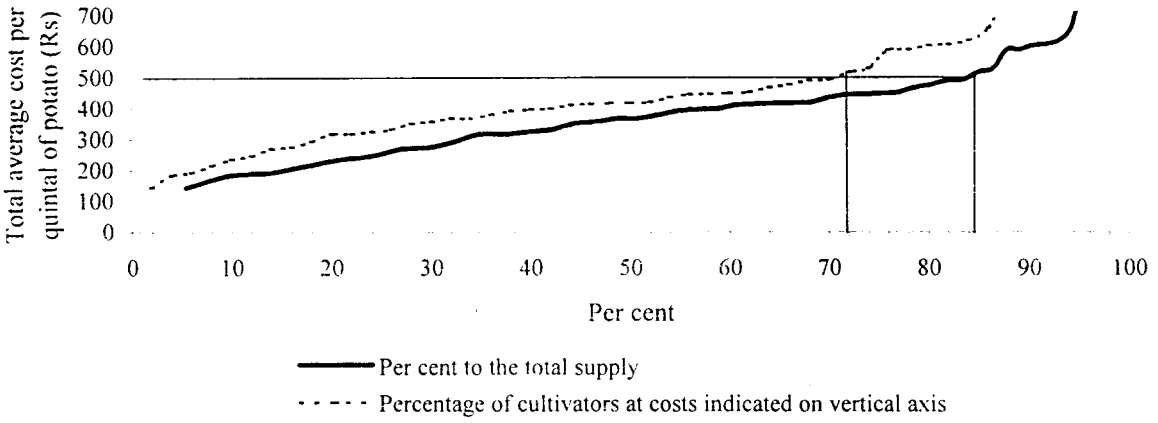
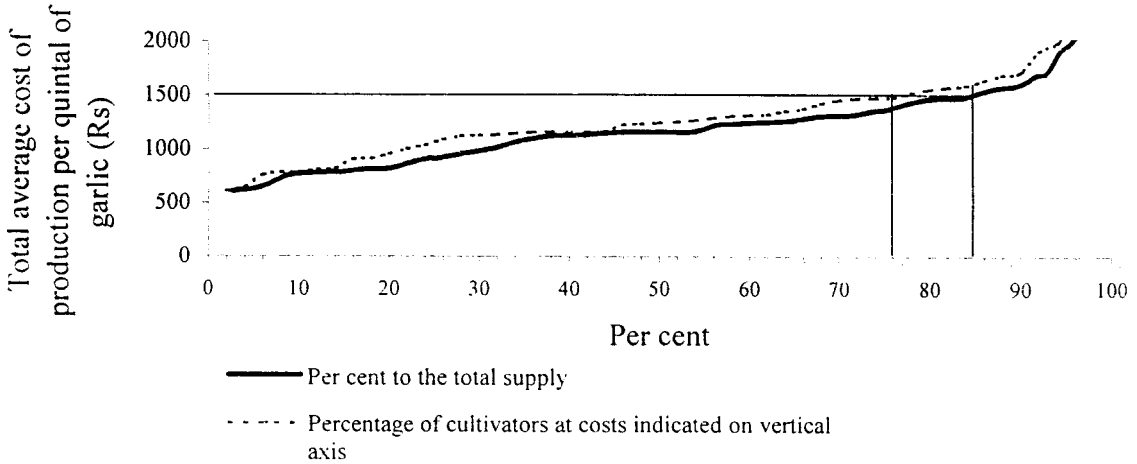


Fig. 11. Bulk line cost of garlic



was 1.32, 1.28 and 1.55 respectively which was comparable with the present study. Jain and Gauraha (1996) estimated the ratio to 0.82, which is lesser than the present study.

Benefit cost ratio for garlic at the aggregate level on cost C_3 basis was 1.07. Kuchadiya *et al.* (1992) observed that the ratio was 1.99, which is higher than the present study. The result of the present study was comparable with findings of

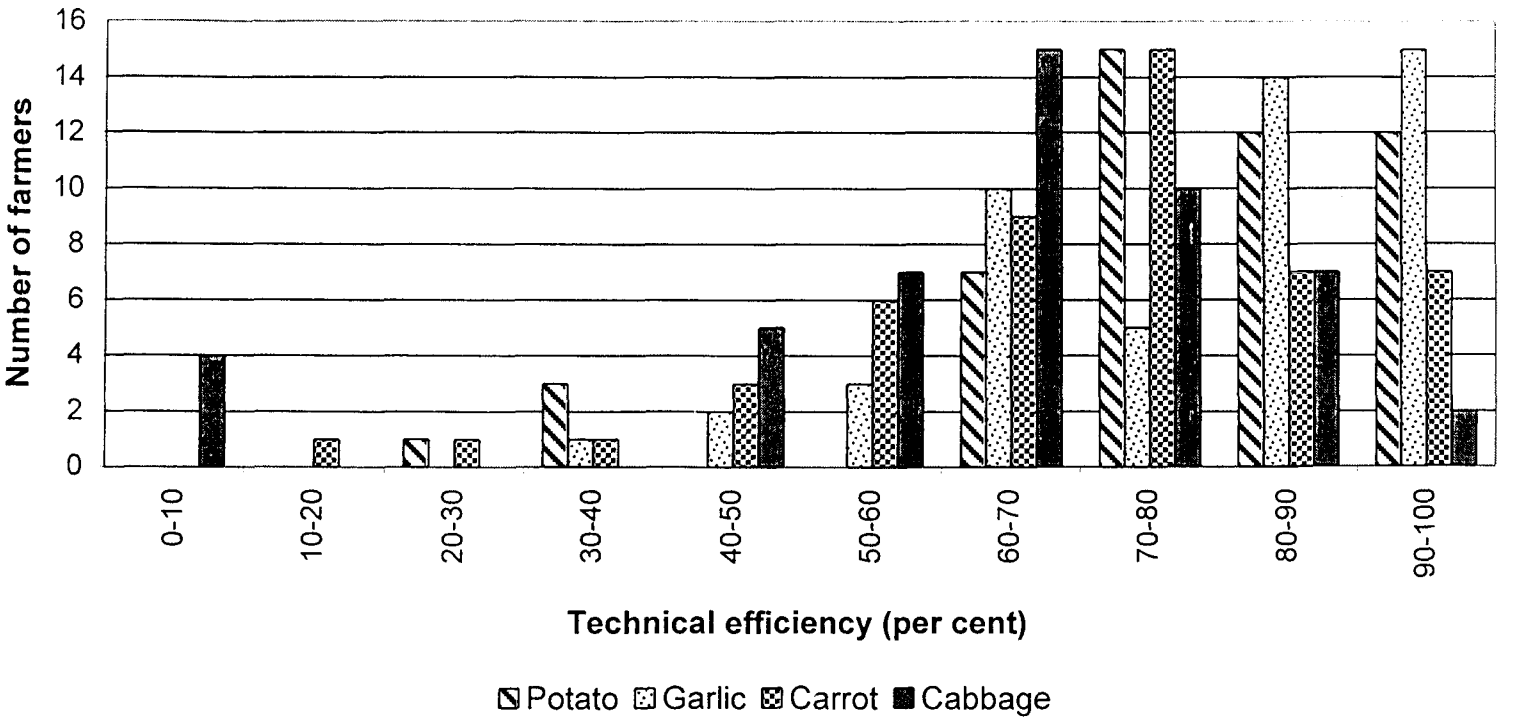
In the case of carrot the benefit cost ratio was 1.15 at Cost C_3 for the sample as a whole. The ratios at all cost concepts were declining from Class I to Class II. The benefit cost ratio of cabbage was 1.09 at Cost C_3 for the sample as a whole. Balrayan (1983) reported that the ratio was 1.73, which is higher than the present study. Jain and Gauraha (1996) in their study estimated it to be 0.76, which is lesser than the present study.

6.6 Technical efficiency

The results of functional analysis using OLS estimates of Cobb Douglas model of production function revealed that 46 per cent, 34 per cent, 40 per cent and 33 per cent of the variation in output was explained by the regression model in case of potato, garlic, carrot and cabbage respectively. Kumar and Arora (1999) reported that 40 per cent of the variation in total yield of potato and 41 per cent in carrot were explained by the regression model, which are comparable with the results of present study. The results of the present study showed that the use of seed, fertilizer and farmyard manure in the case of potato and garlic, land, seed and fertilizers in the case of carrot and labour and seed in the case of cabbage could be increased to increase the yield.

Regression co-efficients of all the vegetables for both OLS average production function and stochastic frontier production function were close to each other except for cabbage. There was a parallel upward shift in the constant term, in

Fig. 14. Frequency histogram of technical efficiency



the case of stochastic frontier for cabbage. Taderse and Krishnamoorthy (1997) also reported the same kind of shift in constant term.

The average technical efficiency in potato was 0.78. Banick (1994) estimated the technical efficiency in irrigated farms to be 0.78. which is on par with the reported present study. In garlic, the technical efficiency was found to be 0.80. This result is comparable with the findings of Battesse and Coelli (1995) who estimated it to be 0.79 for wheat farmers of Faisalabad region. The average technical efficiency of carrot was 0.71. In the case of cabbage it was 0.63. This was higher than the findings of Battesse and Coelli (1995), which were 0.58 and 0.57 respectively for wheat farmers of Badin and Dic regions and these were slightly lesser than those in the present study. The average technical efficiencies of potato, garlic, carrot and cabbage were 0.78, 0.80, 0.71 and 0.63 respectively, implied that there is a scope for increasing the production of potato, garlic, carrot and cabbage by 22 per cent, 20 per cent, 29 per cent and 37 per cent respectively with the present technique itself.

6.7 Marketing

There were seven channels identified in the present study through which the produce was marketed. Out of those channels, producer-village merchant-commission agent-wholesaler-retailer-consumer was observed to be the most important channel. Around 87 per cent of the total respondents marketed their produce to the village merchants. From these figures it could be understood that, village merchants were dominating in the marketing of cool season vegetables in the study area.

Study on marketing costs and margins showed that the price received by the producer accounted for the largest share in carrot (60.12 per cent) followed by potato (59.66 per cent), garlic (43.56 per cent) and cabbage (42.14 per cent). Gupta and Ram (1979) reported that the producer's share in consumer's price was 38 per

cent which is comparable with the results of garlic and cabbage in the present study. In their study on economics of marketing of potato, Kalayankar and Rajmane (1987) and Sikka and Vaidya (1992) observed the producer's share in consumer's rupee to be 65.71 per cent and 54.05 per cent respectively, which are slightly varying from the present study.

In the case of garlic, cost incurred by village merchant was very high (40.85 per cent) when compared with other vegetables. This is because, generally they buy raw garlic bulbs from the farmers and dry them in shade for seven to 10 days to enable marketing of the produce. During this operation, around 40-50 per cent weight loss in the bulbs occurs and moreover they incur handling cost of the produce. Marketing costs incurred by village merchant for potato, carrot and cabbage were 10.37 per cent, 10.09 per cent and 19.81 per cent respectively of the total cost.

Marketing costs incurred by commission agent were 2.03 per cent, 0.70 per cent, 1.98 per cent and 3.88 per cent respectively for potato, garlic, carrot and cabbage. The same costs incurred by wholesalers were 2.24 per cent, 0.76 per cent, 2.18 per cent and 4.27 per cent in the same respective order. Marketing cost of cabbage for retailer was the highest (3.50 per cent of the total cost) and the same for potato was 1.83 per cent, which is comparable with findings of Singh (1975) who estimated it to be 1.88 per cent.

Net margin was the highest for wholesaler in the case of potato, carrot and cabbage, and in garlic, commission agent's net margin was the highest.

Marketing efficiency index of carrot was found to be the highest among the four vegetables followed by potato, garlic and cabbage.

6.8 Constraints in vegetable cultivation

Respondents' opinion on some important constraints related to the cool season vegetable cultivation in the study area revealed that low price for produce was the most important problem. Village merchants, dominate the marketing of vegetables in the study area. The farmers were found to sell their produce, for the price fixed by these traders. Many of the occasions this price was very low and farmers suffered a lot from this. Reddy *et al.* (1995) reported that violent price fluctuations were the prime most marketing problem. Haq *et al.* (1999) observed low price for the produce to be an important constraint.

Next to low price for the produce, incidence of pests and diseases was the important problem. This problem was severe in winter season. Steps should be taken to advice the farmers to adopt technologies like Integrated Pest Management (IPM).

Lack of marketing facilities was the next important problem. The main markets for the selected vegetables were Ernakulam, Mettupalayam and Madurai, which are far away from the production area. So, this naturally increases the transportation cost of marketing. Even though a project called 'HORTICORP' is being implemented in the block through which facilities like cold storage marketing of fruits and vegetables are arranged, most of the farmers were not aware of it and none of the respondents were observed to market their produce through this channel. Good publicity should be given for this programme among the farmers. For input purchase also, farmers were dependent on Theni, Mettupalayam and Ernakulam markets. Even though inputs like seeds, pesticides and implements are available in Munnar, they were costlier than in other markets.

Problem of wild animals was another important problem in the study area, as forest is nearby, wild animals like elephants, oxen, pigs etc. invade in to the fields and destroy the crops. According to some respondents' opinion, many times, nothing will be left out in the field after these animals' invasion. Lack of transportation facilities was also a serious problem as previewed by the

respondents. Jeeps and tempo vans are the only means of transport from Munnar to the study area particularly for places like Chenduvarai, Vattavada etc. and that was also not available for places like top division, P.R. division etc. Conditions of roads reaching these places were also so poor. Reddy *et al.* (1995) also reported that high transportation cost was another problem.

Summary

7. SUMMARY AND CONCLUSIONS

Vegetables are a rich source of vitamins and minerals. Even though conducive conditions are available vegetable cultivation in Kerala, the state depends on neighbouring states to meet the demand. Even though there are some studies on economics of production and marketing of tropical vegetables, there were no studies conducted on cool season vegetables in Kerala. The study covers economics of production, marketing and constraints faced by farmers of cool season vegetables of the study area. Technical efficiency of farms was also estimated.

The study was based on primary data collected from 200 vegetable farmers, 50 each for potato, garlic, carrot and cabbage, selected from Devikulam block of Idukki district. Percentage analysis was done for analysing the data on production and marketing aspects. Stochastic frontier production function was fitted for estimating technical efficiencies of farms. The 50 growers of each crop were classified into two classes based on the size of land holding. All the costs, returns, and other parameters have been discussed on per hectare basis.

7.1 Production

The total cost of cultivation of potato was estimated to Rs.35370.5 per hectare at the aggregate level. This was found to be decreasing from Class I to Class II, being Rs.38695.5 for Class I and Rs.33000.0 for Class II.

Human labour took the major share (34.98 per cent) of the total cost followed by seed material (26.00 per cent) and fertilizers (8.01 per cent) at the aggregate level.

The total receipt at the aggregate level was worked out to Rs.48698.68. This was decreasing from Class I (Rs.51551.2) to Class II (Rs.46603.2).

The per quintal cost of production of potato on cost C_3 was Rs.413.05 for sample as a whole, and this was Rs.425.66 and Rs.402.93 for Class I and Class II respectively.

The benefit cost ratio at cost C_3 was 1.88 at the aggregate level and the same was 1.74 and 1.41 respectively for Class I and Class II. The benefit cost ratio at cost A_1, cost B_1 and cost C_3 were 1.88, 1.84 and 1.51 respectively at the aggregate level.

The net income for the sample as a whole was Rs.13328.12 and this was Rs.12965.69 for Class I and Rs.13603.27 for Class II.

The farm business income, family labour income and farm investment income at the aggregate level were, Rs.22747.58, Rs.22260.59 and Rs.17030.62 respectively.

The regression analysis revealed that 46 per cent of variation in output of potato was explained by explanatory variables and that the contribution of seed and farmyard manure inputs were positive and significant, explaining there by possibility of further increase in total yield by additional use of these variable inputs. Stochastic frontier production function estimates showed that 71 per cent of the deviation in the yield was due to the differences in the technical efficiency among the farms.

The total cost of cultivation of garlic was estimated to Rs.34,640.01 at the aggregate level and at Class I and Class II it was Rs.37223.20 and Rs.32053.04 respectively.

Here also human labour constituted a major share (49.90 per cent) of the total cost, followed by seed material (17.14 per cent) and farmyard manure (7.16 per cent).

The total receipts from garlic worked to Rs.37117.4 at the aggregate level and it was higher for Class I (Rs.40211.22) than Class II (Rs.33942.41).

The per quintal cost of production at cost C_3 was Rs.1150.59 for the sample as a whole and it was Rs.1142.76 and Rs.1162.40 for Class I and Class II respectively.

The benefit cost ratio at cost C_3 was 1.07 at the aggregate level and was declining from Class I (1.08) to Class II (1.06). The same at cost A_1, cost B1 and cost C_1 were 1.69, 1.66 and 1.18 respectively for the entire sample.

The net income at the aggregate level was Rs.2477.37 and it was higher for Class I (Rs.2988.02) than Class II (Rs.1889.37).

The farm business income family labour income and farm investment income for the whole sample was Rs.15095.88, Rs.14783.45 and Rs.9378.92 respectively.

Functional analysis showed that 34 per cent of the variation in output was explained by independent variables and the contribution of variable inputs like seed material, fertiliser and farmyard manure were positive and significant. The Stochastic frontier production function analysis revealed that 62 per cent of the deviation in the yield was because of difference in technical efficiency among the sample farmers.

The cost of cultivation of carrot accounted for Rs.32977.18, Rs.28317.72 and Rs.30565.69 at Class I, Class II and at the aggregate level respectively.

Here again human labour constituted the major share (54.09 per cent) of the total cost followed by seed material input (11.89 per cent) and farmyard manure (7.96 per cent).

The Total receipts from carrot cultivation worked to Rs.35039.98. for the entire sample and it was declining from Class I (Rs.37953.91) to Class II (Rs.32347.71).

The per quintal cost of production of carrot at cost C_3 was Rs.519.95 and the same was Rs.502.06 and Rs.541.09 for Class I and Class II respectively.

The benefit cost ratio at cost C_3 was 1.15 at the aggregate level and at Class I and Class II levels, it was 1.15 and 1.14 respectively. The same at cost A_1, cost B_1 and cost C_1 for the whole sample were 1.89, 1.85 and 1.26 respectively.

The net income for the sample as a whole was Rs.4474.29 and it was higher in the case of Class I (Rs.4976.73) than Class II (Rs.4029.99). As the aggregate level efficiency measure like farm business income, family labour income and farm investment income were Rs.16489.04, Rs.16136.94 and Rs.7605.09 respectively.

Functional analysis revealed that 40 per cent of the variation in output was explained by independent variables. Variable inputs like labour, fertilizer and seed were positive and significant. The Stochastic frontier production function showed that 92 per cent of the deviation in the output was due to the difference in technical efficiency among farmers.

The total cost of cultivation of cabbage accounted for Rs.26564.62 at the aggregate level. This was higher for Class I (Rs.31119.69) than Class II (Rs.23519.78).

Human labour constituted a major share (49.15 per cent) of the total cost followed by seed (15.89 per cent) farmyard manure inputs (8.43 per cent).

The total return from cabbage cultivation worked to Rs.28948.39 at the aggregate level, and the same was Rs.35218.86 for Class I and Rs.24804.42 for Class II.

The per quintal cost of production at cost C_3 was Rs.168.97 at the aggregate level and this was Rs.171.02 and Rs.167.73 respectively for Class I and Class II levels. The cost of production at cost A_1, B_1 and C_1 for the entire sample were Rs.101, Rs.104 and Rs.158 respectively.

The benefit cost ratio at cost C_2 was 1.09 and it was declining from Class I (1.13) to Class II (1.05). The same ratio at cost A_1, cost B_1 and cost C_1 at the aggregate level were 1.78, 1.75 and 1.20 respectively.

The net income at the aggregate level was Rs.2383.77 and this was higher in the case of Class I (Rs.4099.17) when compared with Class II (Rs.1284.64).

The farm business income, family labour income and farm investment income at the aggregate level were Rs.12708.54, Rs.12368.63 and Rs.5138.64 respectively.

Functional analysis revealed that 32 per cent of the variation in the output was explained by the independent variables and variable inputs namely human labour and seed material were positive and significant. The Stochastic frontier production function analysis showed that 98 per cent of the deviation from the yield was due to difference in the technical efficiencies among the farms.

7.2 Marketing

Out of seven marketing channels identified in the study area, the most important channel producer-village merchant-commission agent-wholesaler-retailer-consumer, adopted by 86.5 per cent of the respondents. As much of 86 per

cent, 90 per cent, 84 per cent and 86 per cent respectively of potato, garlic, carrot and cabbage sample farmers marketed their produce through the most important channel.

Producers net share in consumers rupee was 59.86 per cent, 43.46 per cent, 60.12 per cent and 42.14 per cent for potato, garlic, carrot and cabbage respectively.

The index of marketing efficiency was the highest for carrot (1.53) followed by potato (1.49), garlic (0.77) and cabbage (0.73).

The most important problem faced by the cool season vegetable growers was low price for produce. Pest and disease incidence was the next important constraint. This was followed by constraints like lack of marketing facilities, problem of wild animals, lack of transportation facilities etc.

Suggestions for improvement

Emphasis should be given for reducing the cost of cultivation and increasing productivity to reap maximum profit. Cost of cultivation can be effectively controlled by farmer's ability in managing inputs. Productivity can be improved by use of improved varieties, modern inputs and adoption of scientific methods of cultivation. Scientists could direct their attention in developing high yielding, pest and disease resistant varieties of cool season vegetables suitable for Kerala conditions and they could put their interest in evolving modern technologies. Efforts should be taken by the extension department to give proper advice to the farmers on these aspects.

The pests and diseases could be kept under control by persuading the farmers to adopt Integrated Pest Management rather than going for indiscriminant use of pesticides.

Better price realisation could be achieved through an efficient marketing system characterised by shorter marketing channels of fewer intermediaries and better infrastructure facilities. Encouraging farmer manned markets (e.g. Self Help Groups) can go a long way in reducing the problems of middle men exploitation and assuring a reasonable price to the producer. Existing government organised marketing facilities like 'HORTICORP' could be popularised among the farmers. Providing enough marketing centers in the block can reduce the problem of transportation.

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Appendices

APPENDIX I

Personal Interview Schedule for the thesis work on "Economic analysis of production and marketing of cool season vegetables in Devikulam block of Idukki district"

Date of interview

1. Identification

1.1 Name of the village

1.2 Name of the panchayat

1.3 Name of the farmer

1.4 Address of the farmer

2. Code No.

3. **Family size and consumption**

Name	Sex	Relation to the household	Age	Literacy	Occupation	
					Main	Sub.

House hold income
Non farm income

Services	– Respondents
	- Family members
Wages	- Respondents
	- Family members
Business	- Respondents
	- Family members
Other non farm units	- Respondents
	- Family members

Farm income

Crops (other than crops under study)

Season I
Season II
Season III

Crops under study

Season I
Season II
Season III

Livestock (Annual)

Cow
Bull
Goat
Poultry
Others

Rent on leased out land

4. Fixed assets

4.1 **Particulars of land holding**

Sl.No.	Particulars	Wet land	Garden land	Dry land	Total area
1	i. Area owned ii. Area leased in iii. Area leased out iv. Operational area (1+2)-3 v. Whether land is irrigated or not if yes - source				
2	i. Value of own land ii. Route of leased out land iii. Rent of leased in land				
3	i. Land Revenue ii. Others				

4.2 **Implements and machineries**

Sl.No.	Particulars	No.	Purchase price	Year of purchase	Expected life
1	Implements				
2	Plough - wooden - iron				
3	Sprayers				
4	Dusters				
5	Mammatties				
6	Crow ban				
7	Sickles				
8	Spades				
9	Pick axe				
10	Carts				
11	Machineries				
	Others (specify)				

4.3 **Building and other structures**

Sl.No.	Particulars	Construction cost	Expected life
1	Farm house		
2	Implemented shed		
3	Storage godown		
4	Irrigation structure - open well - tube well		
5	Cattle shed		
6	Drying yard		
7	Others		

5. **Live stock details**

Sl. No.	Lives tock	Number	Present value
1	Cow		
2	Buffalo		
3	Goat		
4	Poultry		
5	Others		

5.1 **Cropping pattern**

Name of crop	Season	Area	
		Total area	Irrigated area

5.2 **Cropping pattern (vegetables)**

Name of crop	Season	Duration	Total area	Leased in area	Irrigated area

6. **Cost of cultivation**

Name of crop :

Variety :

Area under Crop :

Source of seed :

Season :

Duration :

Wage rate - Male

Spacing :

Female

A. **Nursery**

Duration

Sl. No.	Particulars	Inputs used			Labourers used				ML
		Qty.	Rate	Cost	M	F	M	F	
1	Land preparation								
2	Seed and sowing								
a	Seeds								
b	Seed treatment								
c	Sowing								
3	Manuring and Fertilizers								
a	FYM								
	Own								
	Purchased								
b	Ash								
	Own								
	Purchased								
c	Others								
	1.								
	2.								
	3.								
d	Application charges								

e	Transportation charges								
5.a	Fert. (No. of times applied)								
	1.								
	2.								
	3.								
b	Transportation								
c	Application charge								
6	Plant protection								
	Chemicals used								
	1.								
	2.								
	3.								
7	Application charges								
8	Weeding								
9	Irrigation charge								
B	Main field								
1	Land preparation								
2	Seeds and sowing/ Transplanting								
	a. Seeds								
	b. Sowing								
	c. Transplanting								
3	Manuring								
a	FYM								
	Own								
	Purchased								
b	Ash								
	Own								
	Purchased								
c	Others								
	1.								
	2.								
	3.								
d	Transportation charges								
c	Application charges								
4	Fertilizers								
a	Fertilizers used								
	Basal/Topdressing								
	1.								
	2.								
	3.								
	4.								
	5.								
b	Transportation cost								
c	Application charges (Specify the method of application)								
5	After cultivation								
a	Weeding and earthing up								
b	No. of weedings								
c	Hoeing operation								

d	Weedicides used 1. 2. 3.								
e	Application charges (specify time and mode)								
6	Plant protection								
A	Insecticides 1. 2. 3. 4.								
a	Application charges (specify time and mode)								
b	Transportation cost								
B	Fungicides used. 1. 2. 3.								
a	Application charges (specify time and mode)								
b	Transportation cost								
7	Irrigation								
a	Source								
b	Method of irrigation								
c	No. of irrigation								
d	Time required for irrigation								
e	Irrigation charges								
f	Labour								
9	Marketing								
a	Mode of marketing								
b	Transportation charges								

Sl. No.	Harvesting	Labour	Yield				
			1st	2nd	3rd	4th	5th
A	No. of harvests i. First harvest ii. Second harvest iii. Third harvest iv. Fourth harvest v. Fifth harvest						
b	Post harvest treatment (cleaning, washing, bunching etc.)						

Marketing aspects at the producers level

1. Total quantity produced
2. Quantity retained for home consumption
3. Quantity spoilt

a. During physical handling
b. Due to perishability

Source of capital

Private
Commercial banks
Co-operative

4. Method of sale

Sl.No.	Method of sale	Quantity	Price
1	Pre harvest contract		
2	Village merchant		
3	Direct sale to consumer		
4	Sales in wholesale market		
5	Others (specify)		

5. Cost of marketing (per quintal)

A. Cost incurred by the fauna from farm to market
a. Preparation for market
b. Loading and unloading
c. Transport
i. Mode of transport
ii. Distance from the market
iii. Transport/unit/trip
iv. Total charges

d. Cleaning and grading charges
B. Cost incurred by the farmer at the market
a. Gate fee :
b. Stall fee :
c. Commission :
d. Brokerage :
e. Taxes :

Intermediaries

1. Type of intermediary :

2. Name and address :

3. Type of vegetable handled :

4. Fixed costs :

Sl. No.	Particulars	Amount per month	Present values	Depreciation
1	Rent paid			
2	Furniture used			
3	Permanent staff			
4	Licence fee			
5	Other items (specify)			

5. Working costs

Sl. No.	Particulars	Expenditure
1	Casual labour charge i. Wage paid ii. Pre requisites if any	
2	Electricity charge per month	
3	Water charge per month	
4	Taxes 1. Sales tax 2. Income tax 3. Local tax 4. Professional tax	

6. Volume of business per year

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

7. Sources of funds for business

a. Total amount (Rs.)
b. Own capital (Rs.)
c. Borrowing (Rs.)
d. From other sources if any
e. Terms on which money is borrowed

Problems of vegetable production

Sl.No.	Problems of vegetable production	1	2	3	4	5	6	7	8	9	10
1	Incidence of pest and disease										
2	Lack of capital										
3	Lack of irrigation facilities										
4	High wage rate										
5	Lack of marketing facilities										
6	Low price of the produce										
7	Lack of accessibility to market										
8	Climatic factor										
9	Transportation										
10	Problem of wild animals										
11	Others (specify)										

APPENDIX - II

Operation wise lbour use in potato (mandays)

Operations	Mandays used											
	Class I				Class II				Aggregate			
	Family labour	Per cent	Hired labour	Per cent	Family labour	Per cent	Hired labour	Per cent	Family labour	Per cent	Hired labour	Per cent
Land preparation	6.88	8.88	18.10	31.32	3.66	7.89	17.81	28.52	5.16	8.51	17.43	29.86
Sowing	4.95	6.39	3.18	5.50	3.35	7.24	6.24	9.99	4.07	6.71	4.57	7.83
Farmyard manure application	7.56	9.76	6.52	11.28	3.92	8.47	5.77	9.24	5.63	9.28	5.96	10.22
Fertilizer application	5.79	7.48	0.68	1.17	3.32	7.17	0.91	1.45	4.47	7.36	0.77	1.32
Weeding	5.03	6.49	19.59	33.89	1.72	3.72	17.91	28.68	3.31	5.45	18.20	31.19
Plant protection measures	17.26	22.27	0.00	0.00	10.06	21.72	0.00	0.00	13.39	22.07	0.00	0.00
Irrigation	26.31	33.96	0.00	0.00	18.77	40.51	0.00	0.00	22.10	36.41	0.00	0.00
Harvesting	3.70	4.78	9.74	16.84	1.52	3.29	13.82	22.13	2.56	4.22	11.43	19.59
Total	77.49	100.00	57.80	100.00	46.33	100.00	62.45	100.00	60.69	100.00	58.37	100.00

Operation wise lbour use in garlic (mandays)

Operations	Mandays used											
	Class I				Class II				Aggregate			
	Family labour	Per cent	Hired labour	Per cent	Family labour	Per cent	Hired labour	Per cent	Family labour	Per cent	Hired labour	Per cent
Land preparation	8.39	7.42	16.42	13.33	3.56	4.64	20.60	21.41	6.01	6.49	18.48	19.26
Sowing	4.46	3.94	3.39	2.75	2.37	3.10	3.56	3.70	3.36	3.63	3.42	3.56
Farmyard manure application	5.87	5.19	6.66	5.40	2.81	3.67	4.99	5.19	4.25	4.60	5.73	5.97
Fertilizer application	6.64	5.87	0.00	0.00	3.07	4.01	0.19	0.19	4.78	5.16	0 09	0.10
Weeding	5.65	5.00	39.56	32.10	2.37	3.10	47.69	49.56	3.94	4.26	42.95	44.74
Plant protection measures	23.86	21.10	0.00	0.00	8.85	11.55	0.00	0.00	16.94	18.31	0 00	0.00
Irrigation	51.35	45.41	0.00	0.00	50.59	66.03	0.00	0.00	49.97	54.02	0.00	0.00
Harvesting	6.86	6.07	57.19	46.41	3.00	3.91	19.19	19.95	3.27	3.53	25.32	26.38
Total	113.08	100.00	123.22	100.00	76.62	100.00	96.22	100.00	92.51	100.00	96.00	100.00

Operation wise lbour use in carrot (mandays)

Operations	Mandays used											
	Class I				Class II				Aggregate			
	Family labour	Per cent	Hired labour	Per cent	Family labour	Per cent	Hired labour	Per cent	Family labour	Per cent	Hired labour	Per cent
Land preparation	3.46	3.46	22.79	27.66	1.64	1.96	25.46	31.25	2.52	2.78	23.77	29.44
Sowing	3.04	3.03	3.89	4.72	1.64	1.96	3.81	4.68	2.31	2.54	3.79	4.70
Farmyard manure application	8.19	8.16	6.38	7.74	2.27	2.71	8.71	10.69	5.15	5.68	7.43	9.21
Fertilizer application	6.02	6.00	2.01	2.44	2.62	3.13	0.52	0.64	4.25	4.70	1.25	1.54
Weeding	2.03	2.02	32.65	39.61	1.86	2.22	28.35	34.79	1.91	2.11	30.04	37.22
Plant protection measures	18.24	18.19	0.00	0.00	10.06	12.02	0.00	0.00	13.94	15.38	0.00	0.00
Irrigation	55.31	55.16	0.00	0.00	60.04	71.75	0.00	0.00	56.82	62.71	0.00	0.00
Harvesting	3.99	3.98	14.69	17.82	3.55	4.24	14.63	17.96	3.71	4.10	14.44	17.89
Total	100.27	100.00	82.41	100.00	83.67	100.00	81.48	100.00	90.61	100.00	80.73	100.00

Operation wise lbour use in cabbage (mandays)

Operations	Mandays used											
	Class I				Class II				Aggregate			
	Family labour	Per cent	Hired labour	Per cent	Family labour	Per cent	Hired labour	Per cent	Family labour	Per cent	Hired labour	Per cent
Land preparation	8.72	8.67	14.86	24.96	3.35	7.52	20.25	38.05	5.39	8.08	19.13	33.24
Nursery management	3.35	3.33	0.00	0.00	1.94	4.35	0.00	0.00	2.64	3.96	0.00	0.00
Sowing	4.16	4.14	7.86	13.20	1.24	2.79	5.63	10.59	2.70	4.05	6.65	11.55
Farmyard manure application	5.73	5.70	6.53	10.97	2.39	5.37	4.30	8.09	3.67	5.50	5.26	9.15
Fertilizer application	4.24	4.21	0.74	1.24	2.81	6.30	0.32	0.60	3.42	5.13	0.48	0.83
Weeding	9.07	9.01	22.00	36.95	3.72	8.35	20.83	39.15	5.77	8.64	22.07	38.34
Plant protection measures	14.68	14.59	0.00	0.00	6.31	14.17	0.06	0.12	9.53	14.29	0.04	0.08
Irrigation	48.88	48.59	0.00	0.00	22.26	49.96	0.00	0.00	32.59	48.85	0.00	0.00
Harvesting	1.78	1.77	7.55	12.68	0.53	1.19	1.81	3.40	1.00	1.49	3.92	6.81
Total	100.60	100.00	59.54	100.00	44.54	100.00	53.20	100.00	66.72	100.00	57.56	100.00

APPENDIX III

Bulkn line costof potato

Avererage total cost per quintal of cabbage (1)	Per cent to the total supply (2)	Percentage of cultivators coming under categories (1) and (2)
142.61	5.472	2
182.69	9.74	4
192.18	13.80	6
213.87	17.45	8
234.46	20.78	10
245.35	23.96	12
268.99	26.86	14
274.02	29.71	16
293.07	32.38	18
316.83	34.84	20
316.83	37.30	22
323.90	39.71	24
331.15	42.07	26
349.93	44.30	28
355.85	46.49	30
366.34	48.62	32
366.34	50.75	34
377.96	52.82	36
390.76	54.81	38
396.04	56.78	40
397.99	58.74	42
410.73	60.64	44
413.20	62.53	46
415.23	64.41	48
416.81	66.29	50
418.67	68.15	52
434.18	69.95	54
444.05	71.70	56
445.28	73.46	58
447.44	75.20	60
450.88	76.93	62
465.71	78.61	64
475.43	80.25	66
488.45	81.85	68
490.55	83.44	70
514.48*	84.95	72
527.34	86.43	74
585.94	87.77	76
586.14	89.10	78
600.46	90.40	80
602.68	91.69	82
616.05	92.96	84
656.72	94.15	86
781.25	95.15	88
871.64	96.04	90
878.90	96.93	92
878.90	97.82	94
976.90	98.62	96
1087.31	99.33	98
1172.28	100.00	100

* indicates bulk line cost

Bulkn line costof garlic

Avererage total cost per quintal of cabbage (1)	Per cent to the total supply (2)	Percentage of cultivators coming under categories (1) and (2)
607.79	2.69	2
645.73	5.83	4
759.38	8.96	6
781.15	12.37	8
788.41	14.80	10
812.68	17.38	12
821.94	20.04	14
907.74	23.98	16
915.22	25.41	18
953.30	27.87	20
1000.95	31.36	22
1033.31	32.89	24
1084.81	35.17	26
1117.50	37.63	28
1123.91	39.06	30
1130.22	41.53	32
1144.02	43.17	34
1155.13	45.26	36
1156.97	47.12	38
1158.48	49.20	40
1158.48	51.29	42
1160.94	53.95	44
1223.91	56.42	46
1228.94	57.80	48
1241.75	60.26	50
1250.56	62.35	52
1261.84	64.82	54
1288.56	66.40	56
1306.59	67.92	58
1310.64	69.68	60
1318.48	71.74	62
1347.57	73.45	64
1372.57	75.54	66
1418.68	77.44	68
1452.71	79.14	70
1466.34	80.57	72
1470.23	81.77	74
1475.76	83.67	76
1518.99*	85.38	78
1547.92	86.69	80
1570.30	87.85	82
1586.26	89.50	84
1632.88	90.82	86
1684.74	91.77	88
1707.55	92.91	90
1902.48	94.33	92
1978.77	95.45	94
2167.99	97.34	96
2257.71	98.48	98
2286.42	100.00	100

* indicates bulk line cost

Bulkn line costof carrot

Avererage total cost per quintal of cabbage (1)	Per cent to the total supply (2)	Percentage of cultivators coming under categories (1) and (2)
239.37	3.65	2
276.86	6.96	4
295.64	10.03	6
340.48	13.14	8
412.47	16.75	10
414.04	20.16	12
415.52	22.47	14
417.75	24.83	16
422.15	26.79	18
425.10	29.80	20
445.32	31.42	22
445.44	33.14	24
447.53	35.15	26
449.76	38.03	28
466.32	39.19	30
469.63	41.49	32
493.77	43.84	34
499.29	46.49	36
507.86	49.00	38
517.24	51.88	40
533.35	54.05	42
536.33	55.71	44
546.36	57.44	46
568.89	58.84	48
579.17	61.14	50
585.87	64.26	52
586.15	65.86	54
586.73	67.67	56
599.22	69.77	58
619.98	71.58	60
632.68	73.04	62
633.04	74.75	64
637.20	75.90	66
653.18	77.71	68
666.11	78.80	70
680.79	80.31	72
694.18	81.46	74
709.99*	84.37	76
718.37	85.50	78
729.62	87.30	80
749.47	88.67	82
759.68	89.53	84
786.15	91.26	86
812.64	93.22	88
828.69	94.65	90
830.54	95.63	92
851.29	97.43	94
893.35	99.14	96
2442.76	99.60	98
3529.10	100.00	100

* indicates bulk line cost

Bulkn line costof cabbage

Avererage total cost per quintal of cabbage (1)	Per cent to the total supply (2)	Percentage of cultivators coming under categories (1) and (2)
74.93	2.48	2
80.31	5.35	4
84.51	7.26	6
87.49	11.67	8
89.60	14.80	10
100.21	17.74	12
100.24	20.22	14
100.31	22.98	16
100.31	25.74	18
102.57	28.03	20
103.97	31.09	22
113.56	33.38	24
113.90	35.10	26
113.91	37.86	28
114.83	39.58	30
115.36	42.89	32
118.66	45.56	34
123.37	48.21	36
129.89	50.60	38
132.01	54.80	40
138.55	55.80	42
139.17	58.38	44
139.84	59.00	46
140.80	61.73	48
140.80	63.64	50
144.17	65.85	52
151.94	68.42	54
154.07	71.18	56
159.98	72.52	58
165.10	75.46	60
169.19	78.41	62
175.27	80.24	64
185.37	82.08	66
196.42	83.50	68
199.57*	85.79	70
205.08	87.79	72
219.44	89.10	74
233.35	89.86	76
235.87	91.33	78
245.00	92.77	80
245.07	94.06	82
272.11	95.16	84
287.56	96.26	86
299.46	97.37	88
377.90	98.23	90
377.90	99.09	92
530.67	99.47	94
786.57	99.77	96
1790.97	99.93	98
3904.74	100.00	100

* indicates bulk line cost

ECONOMIC ANALYSIS OF COOL SEASON VEGETABLES IN DEVIKULAM BLOCK OF IDUKKI DISTRICT

By

N. KARTHIKEYAN

ABSTRACT OF THE THESIS

Submitted in partial fulfilment of the requirement for the degree of

Master of Science in Agriculture

(AGRICULTURAL ECONOMICS)

Faculty of Agriculture

Kerala Agricultural University

Department of Agricultural Economics

COLLEGE OF HORTICULTURE

VELLANIKKARA, THRISSUR - 680 654

KERALA

2001

ABSTRACT

The present study on the economic analysis of production and marketing of cool season vegetables in Devikulam block of Idukki district was aimed at analysing the economics of cool season vegetables like potato, garlic, carrot and cabbage, and to assess the marketing efficiency and constraints faced by the vegetable growers. The study was conducted with a sample of 50 growers per vegetable. Percentage analysis was used to analyse the data and stochastic frontier production function was fitted for analysing technical efficiency.

Cost A_1, Cost B_1, Cost C_1 and Cost C_3 per hectare were Rs.25951.10, Rs.26438.09, Rs.32155.06 and Rs.35370.56 respectively for potato. The figures in the same order were Rs.22021.50, Rs.22333.93, Rs.31490.92 and Rs.34640.01 for garlic. The corresponding figures were Rs.18550.94, Rs.18903.04, Rs.27786.99 and Rs.30565.69 respectively for carrot. The figures were Rs.16239.85, Rs.16579.76, Rs.25243.88 and Rs.27768.27 respectively for cabbage in same order.

The outputs per hectare were 8563.22 kg in the case of potato and for garlic, carrot and cabbage the same was 3016.63 kg, 5878.56 kg and 16360.11 kg respectively. The gross values of output per hectare at the prevailing price were Rs.48698.68, Rs.37117.38, Rs.35039.98 and Rs.28948.39 for potato, garlic, carrot and cabbage in respective order.

Costs of production per quintal of potato based on Cost A_1, Cost B_1, Cost C_1 and Cost C_3 were Rs.303.05, Rs.308.74, Rs.375.50 and Rs.413.05 respectively. For garlic, the figures were Rs.731.46, Rs.741.84, Rs.1045.99 and Rs.1150.59 in same order. The corresponding figures were Rs.315.57, Rs.321.56, Rs.472.68 and Rs.519.95 for carrot. The figures in same order for cabbage were Rs.99.26, Rs.101.34, Rs.154.30 and Rs.169.73.

Farm business income in Rs per hectare for potato was 22747.58 and the same was 15095.88, 16489.04 and 12708.54 respectively for garlic, carrot and cabbage. Family labour incomes Rs per hectare for potato, garlic, carrot and cabbage were 22260.59, 14783.45, 16136.94 and 12368.63 respectively for potato, garlic, carrot and cabbage. Farm investment incomes Rs per hectare for potato, garlic, carrot and cabbage were 17030.62, 9378.92, 7605.09 and 5138.64 respectively. The net income Rs per hectare was 13328.12 for potato, 2477.37 for garlic, 4474.29 for carrot and 2383.77 for cabbage.

Benefit cost ratios based on Cost A_1, Cost B_1, Cost C_1 and Cost C_3 were 1.88, 1.84, 1.51 and 1.38 respectively for potato. The figures in same order were 1.69, 1.66, 1.18 and 1.07 respectively for garlic. The corresponding figures were 1.89, 1.85, 1.26 and 1.15 respectively for carrot and the same figures were 1.78, 1.75, 1.20 and 1.09 respectively for cabbage.

Bulk line cost in Rs per q was 514.48, 1518.99, 709.99 and 199.57 respectively for potato garlic, carrot and cabbage.

The average technical efficiencies of potato, garlic, carrot and cabbage were 0.78, 0.80, 0.71 and 0.63 respectively.

The major marketing channel identified was Producer-Village merchant-Commission agent-Wholesaler-Retailer-Consumer. The producer's share in consumer's rupee was Rs.5.89 (49.86 per cent) for potato and the same was Rs.12.50 (43.46 per cent) for garlic, Rs.6.12 (60.12 per cent) for carrot and Rs.2.17 (42.14 per cent) for cabbage. The index of marketing efficiency was the highest for carrot (1.53) followed by potato (1.49), garlic (0.77) and cabbage (0.73).

Low price for the produce was the most important problem faced by the farmers of cool season vegetables in the study area.