

I. INTRODUCTION

The project “Assessment of Hill Top Agriculture at Vattavada Panchayat of the Highranges” was sponsored by The Kerala Research Programme on Local Level Development, Centre for Development Studies, Thiruvananthapuram and was operated from The Department of Plantation Crops and Spices, College of Horticulture, Kerala Agricultural University, Vellanikkara. The period of study was 2000-2003.

This project was note worthy for the difficult terrain in which it was conducted, the extreme climate and the scarcity of motorable roads and innumerable such factors that would have deterred any, but the most determined of people.

The term “Vattavada” means a place encircled by mountains, an apt name if one looks at the place from a height. Koviloor, Pazhathottam, Chilanthiyar, Kottakombur and Kadavari are the main centres in the panchayat. Koviloor (area with many ‘Kovils’ or temples), is the headquarters. Chilanthiyar got its name after a plant, ‘Chilanthi’ whose beads are made into garlands. Kottakombur is the place where ‘Kottan’ (Jagerry dealer) lived. The term “Pazhathottam” means “fruit garden” the place once being used as a Government orchard. People of Vattavada are mostly Tamil emigrants and are characteristically simple minded. The Pazhathottam-Chilanthiyar area is virtually cut off from the rest of the world except for a Jeep which leaves Pazhathottam at 7 am and returns at 5 pm ferrying people and products of every description between Pazhathottam and Munnar town. This jeep called “Ullasaparavai” (Happy bird) belongs to a rich land lord “Doraipandi” who owes more than 50 acres of land at Pazhathottam. This jeep “Ullasaparavai” came in handy for our research work.

The entire Vattavada area is blessed with natural beauty - cloud laden mountains, grassy hill sides, trickling streams, numerous glades and glens. Myriads of flowers bloom here and are more deeply coloured than their low land counterparts. In spite of rampant deforestation Vattavada still has a rich bird life and animal life. Recently, a man was killed at Pazhathottam by a wild elephant.

During our visits to Vattavada for research work, we used to stay with the family of Sri.Balakrishnan, a teacher in the local school at Pazhathottam. The life of this family always used to remind us of some Malayalam film which depicted the romantic life of mountain people, a life whose charm can never be described by words. The chilling nights, the weird cloud patterns in the sky, the moon playing hide and seek among them, myriads of fire flies and the coolness of the night breeze - have to be experienced to be understood. We can never forget the delicious food we ate at Pazhathottam, especially the “butter beans kolambu” and the “tree tomato sambar”, some of their specialities. Life here is pretty slow, people taking to bed early and waking up late, there being no electricity at Pazhathottam.

Life at Kovilour area is considerably different from Pazhathottam area. Unlike at Pazhathottam density of population is so high, that Koviloor can be described as overcrowded and outright unhygeinic. With the onset of rains, the whole place becomes a muddy mess, indescribably filthy.

Like Pazhathottam, Koviloor too is unforgettable to us, *albiet* for a different reason. It was here, during the dissemination ceremony of this project, that we saw the “Kuruthy” (sacrificial ceremony) at the Mariamman temple. Goats and Chickens were sacrificed to appease the deity. The sheer number of animals sacrificed was staggering and the whole area was reddened with blood.

Vattavada is not such a heaven as these descriptions might lead one to believe. The nearest police out post is at Devikulam, 3 hrs. by jeep from here. Hence, crimes generally go unregistered. While we were camping at Pazhathottam Ganja traders gang raped three women and left them tied to poles in broad day light, just an indication of what to expect my way of law and order. Here, on the mountains, it is every man for himself. Coup contractors abducted a girl and left her after three days, only to be rejected by her family members. Most of these crimes are perpetuated by outsiders who come in as coup labourers/contractors/traders etc.

This project, conducted over three years gives but a glimpse of a vast topic - hill top agriculture. The project is over, but we the researchers have fallen in love with that remote place and the simple folk who live there cut off from the rest of the world, the world of hypocrisy and artificiality we are all familiar with.

II. BACKGROUND

About 60 percent of the world's cultivated land is still farmed by traditional or subsistence methods. These systems however, have been regarded as primitive by western agriculturists. This concept has led to the attitude that the existing food production problems in under developed countries are due to the fact that local farmers are incapable of coping with crop production process and that modern technologies must be imported to promote suitable solutions.

Today, it is becoming very apparent that most of the rural development programmes are highly contradictory. Studies conducted in farmer's fields suggest that the only way to formulate technology appropriate and adaptable to farmers criteria and resource base is by analyzing the socio-economic and biophysical constraints of crop production (Harwood, 1979). This requires both an ecological and economic approach which formalises the body of complex relationships implicit in traditional farming systems. It also requires a change in attitude so that traditional subsistence agro-ecosystems are no longer regarded as primitive and as the product of ignorance, but rather as the product of ecological rationale and when considered within the frame work of their origins, these are virtually optimal agricultural systems (Egger, 1981). This renewed view of the agrarian question reveal that hunger and malnutrition problems that plague the developing world are not due to the incapacity of traditional farming systems, but to problems of institutional support, credit, marketing and definitely to inequalities in the distribution of income and food.

2.1 Traditional subsistence farming systems

A common goal of small farmers through out the world, whether in tropical or temperate regions is to maximize returns from their limited resource base with low levels of technology. While maintaining stability within their farm systems, small farmers do so in a way that prevents the long term degradation of the productive capacity of their land (Harwood, 1979; Gliessmen *et al.*, 1981). In most cases these farmers are faced with significant biophysical and socio-economic constraints on their productive capabilities (de Janvry, 1981). Limitations to production may include land marginality, steep slopes, infertile soils, unpredictable water availability, low access to credit and technical assistance, seasonal unavailability of labour and power,

distance to supplies and marketing centres, lack of economic incentives to government policies etc. (Altieri, 1983). Given the various limiting conditions, and as a result of the experience of many generations, small farmers have evolved or inherited complex cropping systems and management technologies adapted to a specific local soil-climate complex and circumventing socio-economic frame work (Egger, 1981; Ruthenberg, 1976).

The farming systems of the campesinos of Mediterranean Chile are diversified systems (Altieri and Farelli, 1984). By maintaining a high diversity of enterprises in their farms, campesinos are able to promote diversity of diet and income source, ensure relative stability of production, minimise risks, make some what efficient use of labour and intensify use of land with limited resources. Today, perhaps more than ever, Chilean campesinos have low capital, little or no available markets and few purchasable production inputs.

The consequences of commercialization in the subsistence farming systems in Indonesia and Java are given by Soemarwoto and Conway (1991). The traditional home garden systems have changed from a system characterized by low yields, low inputs and low risks to one of high yields, high inputs and high risks. Frequently this results in villagers becoming indebted to unscrupulous middlemen and money lenders. In the traditional home gardens, although the gross yields per hectare are relatively low, they have tended to function largely outside the market economy to cheaply satisfy a variety of domestic needs. The produce is widely shared in the community, is an important supplement to diet and income. They are a valuable genetic resource, and they protect against soil erosion. But these desirable features are now being threatened.

Fleuret and Fleuret (1980) analysed the declining nutritional status during agrarian transitions and found that worst nutritional declines experienced in rural areas happen when households are changing from subsistence to commercial production.

The rural inhabitants of the low land tropical region of southeastern Mexico have managed their traditional agro-ecosystems for centuries with a focus on sustaining yields on a long term basis rather than maximizing them in the short run

(Gliessmen *et al.*, 1981). Recently introduced agricultural technology in the region has been rapidly displacing and even eliminating local practices in favour of large scale commercial farming and cattle raising, yet without achieving the production levels originally proposed. This is accompanied by a loss of diversity in local cropping systems, leading to an ever increasing dependence on imported food products, poorer nutrition and degradation of natural resources.

Understanding traditional cropping schemes, which are the result of a long selection process, may reveal important ecological clues for the development of alternative production and management systems (Atiere, 1983). In the design of such systems, it should always be kept in mind that the goal is not short-term maximization of yield, but rather stabilization of yield with the most efficient utilization of energy and of non-renewable resources and a minimal degree of ecosystem degradation. The present strategy is to husband renewable resources in such a way as to provide a long term sustainable base for production (Conway and Barber, 1990).

The large scale resource use in modern farming lead to resource crunch. Where ever the modernization of traditional subsistence occurred, or where ever traditional subsistence was forced to share its territories with modern ones, conflict arises (Shiva and K rir, 1997). The modern ones with more resource mobility over space and time succeed in marginalizing traditional communities.

2.2 Indigenous hill farming systems

The North eastern hill region comprising the states of Manipur, Meghalaya, Nagaland, Sikkim, Tripura, Arunachal Pradesh and Mizoram has a variety of indigenous farming systems which are prevalent since centuries. In the NEH region, agriculture is mainly primitive, labour intensive, which need collective community efforts. The Zabo farming system and Bench terracing system in Nagaland, Bamboo drip irrigation system in the khasi hills of Meghalaya, alder based farming system in Nagaland and the rice based farming system of Apatani plateau of Arunachal Pradesh are excellent examples (Singh, 2001). But here again, the shifting cultivation (jhuming) which is a predatory system of agriculture involving indiscriminate cutting and burning of forests and improper land use leading to resource degradation and ecological imbalance has precipitated serious problems in

agricultural production and also to the conservation of the future production potential of soils and forests (Satapathy, 2001).

2.3 Hill farming systems at Vattavada

The rural inhabitants of Vattavada, a high land humid tropical region have managed their traditional agro-ecosystems for centuries with a focus on sustaining yields on a long term basis rather than maximizing them in the short run. Recently introduced agricultural technology in the region has been rapidly displacing and even eliminating local resources and practices in favour of large scale commercial farming, yet without achieving the production levels originally proposed.

Current outside interventions of varied nature have created new circumstances of costly farm inputs, low capital and lack of credit, forcing the inhabitants to attune their agronomic systems and to make adjustments in the marketing strategies and social organization.

In the name of development, farmers have been convinced to turn their small plots over to agri-business for providing market crops. Formerly, self provisioning small subsistence farmers have been drawn into a system controlled by agri-business agencies and plunged into a cycle of perpetual indebtedness and exploitation with irrecoverable change in the fragile ecosystem.

The present study assessment of hill top agriculture at Vattavada panchayat of the highranges was taken up in this background.

III. PRODUCTION ECONOMICS STUDIES

Main crops cultivated at Vattavada are temperate vegetables and a brief review on the production economics and marketing studies on these vegetables is presented below.

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 output (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.

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 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.

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 (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.

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.

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.

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 - ground nut (at Dersa Gujarat and Kanpur of Uttar Pradesh) and potato -okra-soyabean (at chinamare of Madhya Pradesh) were the most remunerative cropping systems for these regions.

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, maximize the sale price and the production level in the region. The study was conducted in Kumaon and Garhwal division of Uttar Pradesh using cluster sampling approach with 150 farmers. The vegetables studied were green pea, potato, tomato, capsicum, cabbage, cauliflower, carrot, radish, onion and ginger.

The study by Karthikeyan (2001) on the economic analysis of production and marketing of cool season vegetables in Devikulam block of Idukky district worked out the costs of production per quintal of potato, carrot, cabbage and garlic based on Cost A₁, Cost B₁, Cost C₁ and Cost C₃. They were Rs.303.05, Rs.308.74, Rs.375.50 and Rs.413.05 for potato; Rs.731.46, Rs.741.84, Rs.1045.99 and Rs.1150.59 for garlic in the same order. The corresponding figures were Rs.315.57, Rs.321.56, Rs.472.68 and Rs.519.95 for carrot. The figures in the same order for cabbage were Rs.99.26, Rs.101.34, Rs.154.30 and Rs.169.73. Benefit cost ratio at cost C₃ was 1.38, 1.07, 1.15 and 1.09 respectively for potato, garlic, carrot and cabbage.

3.1 Marketing studies

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 whole salers 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 cost 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.

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.

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 the 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.

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 were 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. Traders return from a quintal of the crop was also higher than the producer's returns.

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.

Investigation carried out by Mendez (1998) revealed that private dealers occupy a larger share of the seed market in the Nilgiris 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.

In his study Karthikeyan (2001) identified the major marketing channel in the vegetable trade in Devikulam block of Idukky district as Producer-village merchant-commission agent-wholesaler-retailer-consumer. The producers share in

consumers rupee was 5.89 (49.86%) for potato, and the same was Rs.12.50 (43.46%) for garlic, Rs.6.12 (60.12%) for carrot and Rs.2.17 (42.14%) 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).

IV. OBJECTIVES OF THE STUDY

The objectives of the study were

1. Documentation of the system of hill top agriculture as it existed in the past, its present and the future scope.
2. Analysis of the socio economic situation of the panchayat.
3. Assessment of the present production and marketing systems
4. Formulation of a viable package for agricultural production for the panchayat

V. AREA OF STUDY

5.1 Idukki district

Vattavada is situated in the Idukki district of Kerala. The majority of geographical area of Idukki district lies in the high land characterized 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.

5.2 Devikulam block

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 Mahabharatha, 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 five

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. A map of Devikulam block is given as Fig. 1.

5.3 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).

5.4 Employment situation

Agriculture is the major source of income 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 area is almost similar to that of the wage rate prevailing in Tamil Nadu. Employment situation in the block is shown in Table 1.

Table 1. Employment situation in Devikulam block

Panchayat	Permanent labourers (number)	Temporary labourers (number)	Unemployed (number)
Marayur	42246	229	5115
Munnar	37241	1020	40082
Kanthalloor	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

5.5 Vattavada

Vattavada is situated in the high ranges of the Western Ghats which borders Kerala on the eastern side. The area lies between 9° 15' and 10° 21' N latitude and 76° 37' and 77° 25' E longitude at an altitude of 7200 feet above MSL. Total land area is approximately 68 km², 25 percent of which is still under forest cover. The climate is characterized by mild wet winters and hot dry summers. Average temperature during winter months range between 10-15° C. During summer, average monthly temperature may go above 27° C. A considerable quantum of sunshine is also

'Kalpottakavai'

This is a living monument of the Vattavadites who boldly resisted the British entering their village. The British were expanding their tea estates towards Pazhathottam area, pushing the people inwards. At Chittivarrai villagers resisted and they put huge stones making a boundary to their village and planted trees all along the boundary. The tree belt now stand as a live fence with the name 'Kalpottakavai'.

characteristic to this region even during rainy winter. Due to combination of clear skies and high levels of radiation, diurnal fluctuation of temperature tend to be fairly wide. Mean annual rainfall is 60 cm which tend to be unreliable from year to year in both quantity and distribution. Natural vegetation include tropical evergreen forests and grasslands. Soil type is forest loam with high organic matter content.

The inhabitants are mainly migrants from plains who have sought refuge in the mountains in times of extreme insecurity or instability. The population include Muthuva tribes who live far away up the hills. Agriculture is the main source of livelihood for the people. A major portion of the land area is occupied by two transecting mountain ranges and between these lies a long central valley. Cultivation is being done on the stable terraced fields made all along the hills. Major crops include cereals viz. rice, wheat and finger millet; vegetables viz. cabbage, carrot, peas, beans, garlic and potato. The terrace cultivation at different localities is presented in Plate 1.

Vattavada is geographically isolated from the rest of the state. Transport, communication, education and health facilities are practically nil or inadequate. In this rugged terrain, especially in the tribal areas, people have to walk scores of kilometers for their day to day requirements. Mules are used for transporting essential commodities.

5.6 Basic information regarding Vattavada panchayat

Name of the block	: Devikulam
Total land area	: 67.81 km ²
Total No. of families	: 1087

Population

Men	: 2362
Women	: 2226
Total	: 4588*
No. of people belonging to Schedule Castes	: 952
No. of people belonging to Schedule Tribes	: 1478
No. of houses	: 6562
No. of families below the poverty line	: 1204
No. of wards	: 10
No. of ST colonies	: 4
Name of the tribe	: Muthuva

ST colonies

- 1) Kudalar kudi
- 2) Swamiyarala
- 3) Melvalasapetty
- 4) Keezhvalasapetty

No. of primary schools	: 1
High schools	: 1
Primary Health Centre	: 1
Telephone	: Nil
Post office	: 1
Krishi Bhavan	: 1

Roads

Pakka road	: 15 km
Kutchu road	: 15 km
Nearest towns	: Munnar towards Kerala Kodaikkanal towards Tamil Nadu
Nearest bus point	: Koviloor

(Source: Records at the Krishi Bhavan, Vattavada)

* The present population is around 8000

Census details of the panchayat are given as Appendix I, II and III.

VI. METHODOLOGY

6.1 Period of study

Period of the study was 2000-2003. Project period was from 01-04-2000 to 30-06-2003.

6.2 Secondary data

Secondary data on basic details of the panchayat, resources, population structure etc. were collected from various departments and local administrative bodies. Informal discussions were held with the peoples representatives of the panchayat and other prominent leaders, social organisations etc. regarding the study.

6.3 Survey

In the preparatory phase, a reconnaissance survey was conducted to understand the topography, housing pattern, social structure, soil structure, vegetation and farming and cropping systems. A field camp was established at Pazhathottam in one of the farmers homes.

6.4 Sampling

Random sampling procedure was adopted for the study. There are ten wards and from each ward 50 farmers with a minimum of 50 cents land were selected at random. For the socio-economic survey, the total sample size was 500. For working out the cost of cultivation of individual crops 10 farmers having 1 acre holding under the target crop were selected from each ward and information gathered. Sample size in this case was 100 for each crop.

6.5 Collection of data

Data/information were collected through personal interview method using well structured and pre-tested schedule as well as through direct observation of the farming and cropping systems. There were three separate schedules, one each for the socio-economic survey, crop production systems and the marketing aspects.

6.6 PRA tools

Ward level meetings were arranged to interact with the elderly people, village chiefs etc. to gather information on the historic and cultural aspects and also about the traditional knowledge systems prevalent in the society. PRA tools like daily routine analysis, time line and constraint identification and prioritisation were carried out to gather qualitative information on various aspects. In the tribal areas several visits were made to get rapport with the people, especially tribal women. In the 4 tribal colonies the 'one teacher school' teachers were contacted with the help of whom the inhabitants were approached for gathering information.

Meetings of the "Mathrusangams" (Womens groups) were convened at many places to have a clear understanding of the gender status and gender issues among the society.

6.7 Verification of data/information

The local Agricultural Officer and Krishi Bhavan staff were also contacted and several meetings with the farmers were arranged at the Krishi Bhavan for collecting useful information. Officials of the tea estates, Health department and Agriculture department, Kerala Forest Development Corporation, Forest Department and HORTICORP were contacted to verify the data/information and to supplement information. Service of a medical doctor was sought to analyse the problems of health and hygiene. The marketing aspects in one crop i.e., garlic was studied in depth by observing and analysing the events from seed to sale. The intermediary results were presented in the study circle meetings and review workshops organised by KRPLLD and the suggestions were incorporated to the extent possible.

6.8 Soil analysis

Soil analysis was done by taking random samples. Soil samples were analysed for pH, organic matter content, content of available nutrients etc. using standard methods.

6.9 Agro-biodiversity

Agro-biodiversity of the area with respect to the cultivated species, wild species and related species were documented. Voucher specimens were collected and

herbarium prepared. Herbaria were later identified at the Kerala Forest Research Institute, Peechi.

6.10 Main observations

Information were collected regarding general economic and social condition of sample farmers, resources available and their status, area under each crop, cropping pattern - season, total area, irrigated area etc., cultural practices, plant protection measures etc., cost of cultivation of select crops, labour use - family as well as hired, credit linkage, mode of marketing, marketing costs, marketing channels etc. and constraints in production and marketing.

6.11 Analysis of data

The data/information gathered were tabulated and statistically analysed. The information gathered through PRA tools were put together for graphic/tabular presentations. Cost of production of crops was worked out using accepted procedures as given below.

6.12 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.

6.13 Cost concepts

Various cost concepts used in farm management studies viz. Cost A₁, Cost A₂, Cost B₁, Cost B₂, Cost C₁, Cost C₂ and Cost C₃ were employed.

1. Cost A₁

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 are 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 of 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.

2. Cost A₂

As rent is not paid for the leased in land by the cultivators in the study area, Cost A₁ = Cost A₂.

3. Cost B₁

Cost B₁ = Cost A₁ + interest on own fixed capital. The fixed capital items included iron and wooden implements such as diesel and electric motors etc.

4. Cost C₁

Cost C₁ = Cost B₁ + 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.

5. Cost C₃

It is equal to Cost C₂ plus 10 per cent of Cost C₂ to account for the value of management of the farmers.

6. 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.

6.14 Benefit-cost ratio

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

6.15 Market information

The main two loading centres in the area viz. Pazhathottam and Koviloor were closely monitored to gather market information. The daily outflow of produce to various markets in and outside the state were recorded. Information regarding marketing channel, average price realised, credit linkages etc. were collected through the marketing survey.

6.16 Constraints faced by the farmers

The list of constraints, which was given to the farmers were 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 recognized as problems. The number of farmers who indicated a specific rank for a specific constraint was multiplied by the corresponding weight for that rank to obtain a score. Total score for each constraint is the sum of the scores for that constraint. The constraint with the highest score was considered as the most important constraint for the farmers.

6.17 Dissemination of findings

Panchayat level dissemination seminars were conducted to discuss the interim findings and for getting feed back. After completion of the project, a district level agricultural seminar was organised at Kovaloor which was attended by officials from KRPLLD, Kerala Agricultural University, State Department of Agriculture, NGO's, panchayat and district administration, peoples representatives and farmers. Findings and suggestions of the study were presented before them.

VII. RESULTS AND DISCUSSION

Results of the study are presented and discussed under different sub heads.

A. Socio-economic set up

A general profile of the study area is given in Plate 2.

1. Social organization

In general the socio-economic situation of the panchayat is poor. The natural and social environments are bound closely together. People live mostly in hamlets and some areas have isolated houses also. At Kovaloor, Vattavada and Kottakombur people live in colonies whereas at Pazhathottam, Mammal and

Chilanthiyar houses are separated. Houses are small, made in the traditional ways using locally available clay and other materials with tiled or tin sheet roofs.

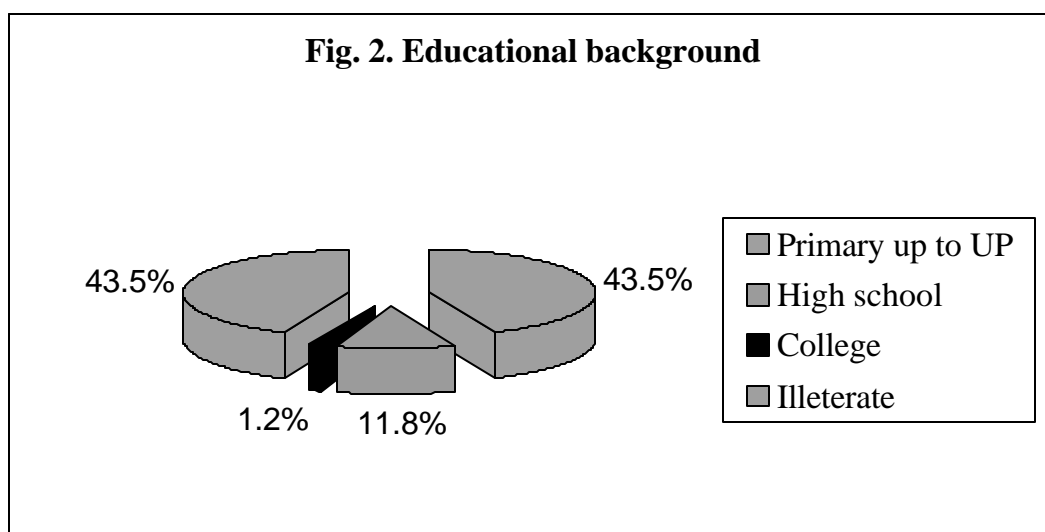
2. Educational status

The population is educationally backward. Educational status of the sample population is presented in Table 2 and Fig. 2.

Table 2. Educational background of the sample respondents

Educational background	Number	Percentage (%)
Primary upto UP	1033	43.5
High school	280	11.8
College	29	1.2
Illiterate	1031	43.5
Babies (1-4yrs)	273	-
Total sample size	2646	100

43.5 per cent of the population is illiterate and an equal percentage has only primary education. 11.8 per cent have gone up to upper primary and very few have reached up to college (1.2 %). Lack of facilities in the main reason for the illiteracy. There is only one UP school in Tamil medium at Koviloor. The recent trend in this area is to sent children in schools outside the panchayat and district. Many children from Vattavada are now staying in residential school at Kanthalloor, Kottayam, Angamaly, Ernakulam and Thrissur. Many of the students are sponsored by religious agencies.



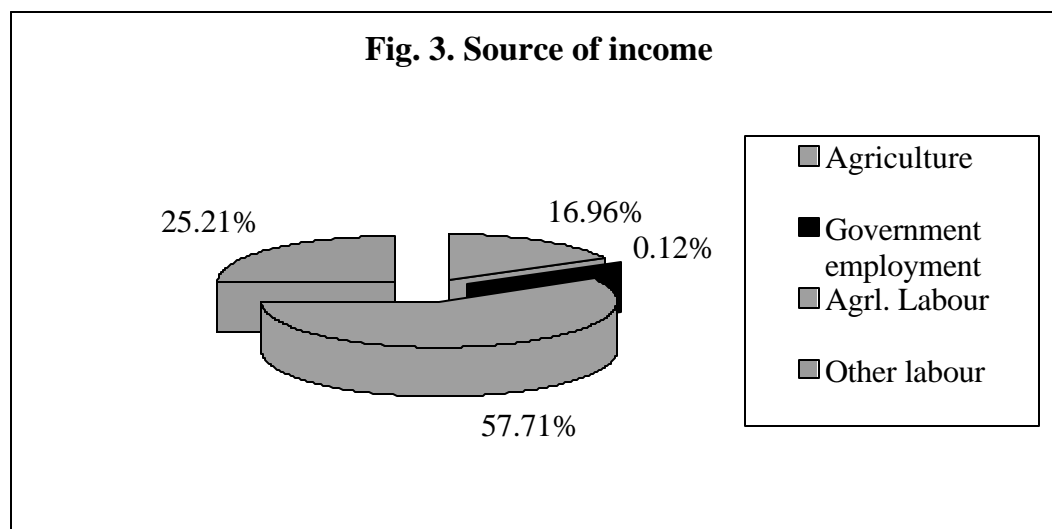
3. Source of income

People in this area still depend mainly on farming and farm labour for employment income (Table 3, Fig. 3). And for most people such income is overwhelmingly the main source of food entitlements.

Table 3. Source of income of the sample respondents

Source	Number	Percentage
Agriculture	449	16.96
Agriculture labour	1527	57.71
Other labour	667	25.21
Government employment	3	0.12
Total sample size	2646	100

Table 3 clearly indicates that about 58 per cent of the population depend on agricultural labour for their income. 25 per cent derived their income from labour other than agriculture and 17 per cent from farming. Only 0.12 per cent had government employment and it was mainly in the education sector.



4. Cattle and other animals

Each household rears two or three cattle, few goats and chicken. At Koviloor, Vattavada and Kottakombur each village has got 10-15 mules, which are used for transporting agricultural produce and other commodities. Animal population of the sample respondents is given below.

Cow/bull - 403

Goat - 283

Mule	- 46
Total	- 732

5. Tribal scenario

The tribes live in colonies with their own distinct culture and survival strategies. They were gradually ousted from the more fertile low lands and pushed up the agriculturally least suitable areas as the plains people migrated into the hills. There are four colonies with a total population of 1478. Colonies are at Swamiyarala, Kudarlarkudy in settlement

Greens at Vattavada

The traditional diet of Vattavada people included a great many number of green leafy vegetables ('Keerai'). 'Parippukeerai', 'Arikeerai', 'Englishkeerai', 'Thandankeerai' and 'Moolairani' are to mention a few. Ragi ('Keppa') and greens ('Keerai') was the most popular combination. Now this diet is confined to tribal people only.

Muthuva tribal total population of are at Kudalarkudi, Melvalasapetty, Keezhvalasapetty. the biggest which is more accessible from Kanthallur. Roads to these colonies are not motorable. For the daily needs and medical emergencies the tribes take head loads, shoulder loads or depend on mules.

Agriculture is the main source of livelihood. Influence of plains people who indulge in illicit cultivation of Ganga have affected the tribal culture in some colonies.

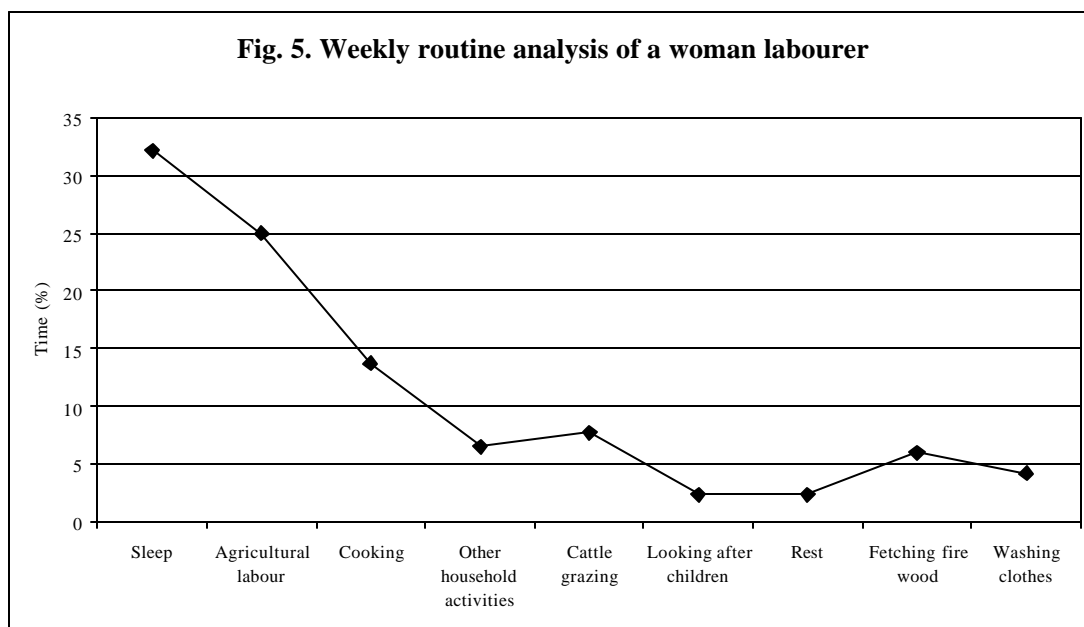
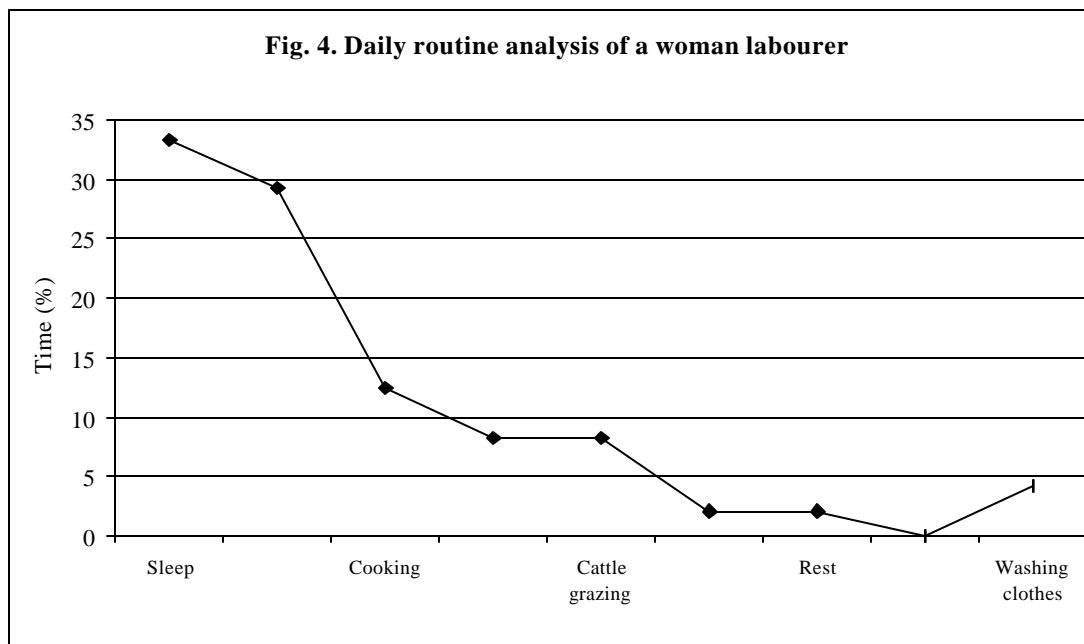
Houses are mostly made of grasses and clay. There is a common 'Sathram' (public place) in each colony. Muthuva women are shy and do not come out of their houses usually. They rear cattle and poultry.

There are Anganwadi, DPEP and ITDP schools in all the colonies where the children acquire only primary education. In the tribal areas also many agencies have sponsored children who stay in residential school outside the districts.

6. Status of women

Women at Vattavada do not enjoy economic independence. They contribute a significant portion to the labour force and are increasingly joining the

labour market. The dual burden of bringing up the family and outside work often leaves her no rest or leisure time (Fig. 4, 5).



Commercial agricultural production has placed increased demand on the labour time of women. Food, fuel and water were plenty in the earlier sustenance farming where she enjoyed a better status. At present she has to strive hard for gathering these necessities. In areas like Mammal and Chilanthiyar where water is scarce women struggle hard for fetching water. Similarly in the earlier days when forest were nearby, firewood collection was easy. Now they have to walk scores of

kilometers for gathering firewood. Economic circumstances and upcoming of tree plantations are forcing men to leave farming resulting in more participation of women. Less productive agriculture has also forced her to look for work in settler farms especially in eucalyptus and wattle plantations where she is exploited in all ways. These outside interventions have alienated her from land and other productive resources. The time she spends for nutritionally related activities has also come down which manifests as deleterious nutritional consequences especially in children.

7. Problems of health and hygiene

The entire health care system of Vattavada panchayat revolves around the solitary primary health centre (PHC) at Koviloor. Maternal and child healthcare (RCH) services are rendered from here under pitiable conditions. Facilities are few and inadequacies plenty. The geographical and agricultural scenario at Vattavada is such that one might expect to find international athletes there - The pollution free air, the rugged terrain, necessitating more than adequate physical exercise, the abundance of nutritionally important crops. But one look at some of the local inhabitants is enough to reveal the true picture. Reasons for this perplexing contradiction are manifold. A short study of the area, revealed some of the more important causes for this potentially hazardous health situation which could easily precipitate disastrous epidemics.

a) Water Pollution

Water sources are few and far between. Of necessity, those who live lower down, use water polluted by those who live higher up, facilitating oro-faecal transmission of pathogenic bacteria, viruses, protozoa and helminths resulting in malnutrition, anemia and sporadic outbreaks of diarrhoeal diseases, infective hepatitis or typhoid.

b) Environmental pollution due to improper disposal of wastes and night soil

Wastes, both degradable as well as non-degradable are recklessly disposed off, along with night soil and domestic wastes facilitating transmission of pathogens and parasites through flies.

c) Neglect of personal hygiene

Wearing dirty clothes and with hair matted with dust, most Vattavadites run the risk of acquiring or transmitting skin disease such as scabies, taenia and pyoderma.

d) Malnutrition

Due to improper dietary habits and intestinal parasitic infestation, the people of Vattavada are literally starving the midst of plenty. Various degrees of PCM (Protein - Calorie Malnutrition) can be seen especially among children below 5 years, although frank marasmus or kwashiorkor are rare.

e) Lack of transport facilities

This makes Vattavada a veritable death-trap as far as medical emergencies are concerned. The nearest causality service is at Munnar, at least one hour's jeep ride from Vattavada, if at all a jeep is obtained.

f) Inadequacies of the health care delivery system

The entire Vattavada panchayat is dependent on the Vattavada PHC (Primary Health Centre) for its health needs. The meagre Govt. supply of medicines, mostly RCH (reproductive and child health) is distributed by the available staff. As with most High Range Hospitals, there is no residential quarters for the doctor who therefore has to travel several hours to reach the PHC, a factor which, by itself, is more than sufficient to ensure the failure of the entire health care system.

The disease profile of Vattavada shows a preponderance of preventable and treatable diseases - nutritional diseases, vector-borne, and water-borne diseases. But chronically neglected and isolated, it is unlikely that Vattavada, like many other far flung areas of the High Ranges, will ever receive the medical attention due to it.

B. Agricultural Scenario

In the first part, assessment of the general agricultural situation is presented in comparison with the traditional farming. In the second half individual crops are dealt with.

1. General agricultural situation

a) History of agriculture

Agriculture existed at Vattavada even before the colonial period. The native tribes (Muthuva) and the migrants fashioned the agricultural landscape. The culture and agriculture have undergone drastic changes over years; the sequence of major turning points as identified in the study are presented in Table 4.

Table 4. Time line – agricultural history of Vattavada

Year	Major events
1700-1800	Migration from plains, cultivation of rice, finger millet, cattle rearing in the extensive pasture
1870-1900	Tea estates by the British
1908-1930	Monorail and ropeway facility connecting tea estates to marketing centres
1950-1980	Cultivation of wheat, garlic, potato and beans
1974-1977	Sugarcane cultivation started and abandoned
1985-1990	Monoculture plantations of eucalyptus and wattle for industrial purpose, reduction in pasturage and cattle population
1987-1995	Co-operative milk society
1990-1992	Cabbage, cauliflower, peas were introduced
1992-1995	High yielding varieties and F1 hybrids were introduced. Loss of indigenous diversity and traditional farming practices. Chemical agriculture
1995-2002	Geranium, digitalis and cannabis cultivation. Drastic change in land use pattern. Reduction in forest cover, depletion of natural resources. Change in dietary habits. Highly market oriented agriculture.

A close scrutiny of the information would reveal that over a period of 300 years, this remote panchayat has been subjected to a great variety of outside interventions. The traditional sustenance farming concentrating on staples like rice and finger millet along with pasture provided the population the essentials of life. Colonial establishment in hills resulted in the spread of tea estates which attracted lot

of people in terms of employment. Crops of the British viz. wheat, potato, garlic and beans were introduced which acclimatised well to the ecosystem. Sugarcane, chicory and digitalis were introduced through agri-business agencies which failed to establish.

Drastic changes in agriculture

10-15 years when to chemical systems were production and impoverishment of more sensitive hill to mono culture profit, both by the and by settlers fragmented leading

Ropeway

There existed a rope way facility at Top station which connected Tamil Nadu and Munnar, inter linking the tea estates in between. This was established by the British mainly for the transport of tea chests and other commodities. Main route was Kurangani (TN) - Top station - Chittivarrai - Gundumalai - Madupetty - Munnar. Rope way was abandoned when the area became accessible by road.

the land use pattern and occurred during the last organic farming gave way agriculture. The farming simplified to maximize there was increased social capital. More and areas have been changed tree plantations for quick Governmental machinery from cities. Forests were to drastic changes in the

agro-eco system. Reports of man-animal conflicts are common in the cropping season. At present farming at Vattavada is mostly commercial.

b. Agro-biodiversity

The whole population depended on the natural biological resources for food, nutrition, health care, energy, fibre and housing. A wide array of crops viz. cereals, vegetables, fruits and tubers were grown here. It is interesting to find the existence of variety of cultivars and land races in many of the crops which resulted through the process of evolution and natural selection (Table 5, Plate 2).

Table 5. Indigenous agro-biodiversity at Vattavada

Crop	Land races/cultivars	Peculiarities
Rice	Anakkomban, hill rice, Mulaisamba, Valnellu	Awned, 9-10 month duration, Red rice
Wheat	Dwarf wheat Soochi wheat Beaked wheat Large wheat	Dwarf stature grains Slender grains Beaked panicle Bold grains
Finger millet	Local	Brown grained Black grained
Garlic	Hill garlic	Highly pungent. Considered best quality garlic in India.

Contd.

Crop	Land races/cultivars	Peculiarities
Beans	Double beans Bush beans Butter beans Arakodi Muringa beans	Grain type, trailing Vegetable type, bushy Grain type, trailing Red poded, red seeded Vegetable type, extra long beans
Peas	Local	Trailing
Grain amaranth	Local	Red and green types for leaf and grain purpose
Greens	Many species of <i>Amaranthus</i> and <i>Portulaca</i>	Used as green leafy vegetables
Plantain	Vellavazhai Karivazhai Poovazhai	Table varieties
Passion fruit	Local	Yellow long fruited Yellow round Violet round

Apart from these cultivars/land races, local varieties of pomegranate, citrus, pear, plum, wild and related species of *Lycopersicon*, *Solanum*, *Capsicum*, *Piper*, beautiful flowers viz. rhododendron, thunbergia, tree dahlias, medicinal herbs

'Aarumaathakilangu'

This was a potato cultivar traditionally grown by Vattavadites. The term means "Six month potato". As the term indicates, duration of this cultivar was six months. Tubers were larger in size. Crop was propagated by divisions of the sprouts which were allowed to elongate during storage period. Each family used to have few beds of this six month potato which served as a reserve food for the lean months. This potato has now vanished into memory.

viz. geranium, hypericum, acorus etc. grow here naturally (Plate 3). Farmers have, through centuries developed crop varieties that are suitable to the agro-eco-system.

The onslaught of chemical agriculture has caused the erosion of agricultural biodiversity by limiting the choice of farmers. The farmer's right to choose a variety is replaced by those

varieties which are developed by multi national companies. Table 6 presents the list of cultivated varieties in commercial as well as traditional crops. First generation hybrids of carrot, cabbage, beet root, cauliflower etc. produced by multi national companies are made available to the farmers by the private dealers who control largely the farming at Vattavada. These highly costly seeds by their nature can be used only for one season and the farmer is not able to produce his own seed. Ultimately, the self reliance of the farmers in owning and sowing the seed of his choice is replaced by

reliance on seeds of private companies. Genetic heterogeneity which was inherent in the traditional farming is lost. Numerous varieties that the farmer cultivated, like the 'six month potato' have been abandoned. As stated by FAO (2000), reliance on narrow genetic base has also threatened the food security of the population. Nutritionally complimentary dietary associations are upset by the new cultigens, to the detriment of nutritional status among the population. Even more deleterious is the replacement of traditional staples of tribes mainly finger millet with rice and wheat. This can further make the population vulnerable to the out break of epidemics. There are many instances wherein the farmer wants to revert back to traditional varieties, but they are no longer available in the region.

Table 6. Cultivated varieties and their source

Crop	Varieties	Source	Supplying agency
Potato	Kufri Jyothi Kufri Muthu	Central Potato Research Institute	Private dealers in Tamil Nadu
Carrot	Early Nantes New Kuroda Suttons seed	Private seed companies in India and abroad	-do-
Cabbage	F ₁ hybrids Sandoz, Hari Rani, Krishna, Priyanka	-do-	-do-
Beet root turnip, cauliflower	F ₁ hybrids	-do-	-do-
Garlic, beans, peas, rice, wheat and finger millet	Local	Farmer	Farmer

c) Land use pattern

Distribution of the land of the sample households under various crops is given in Table 7 and Fig. 6.

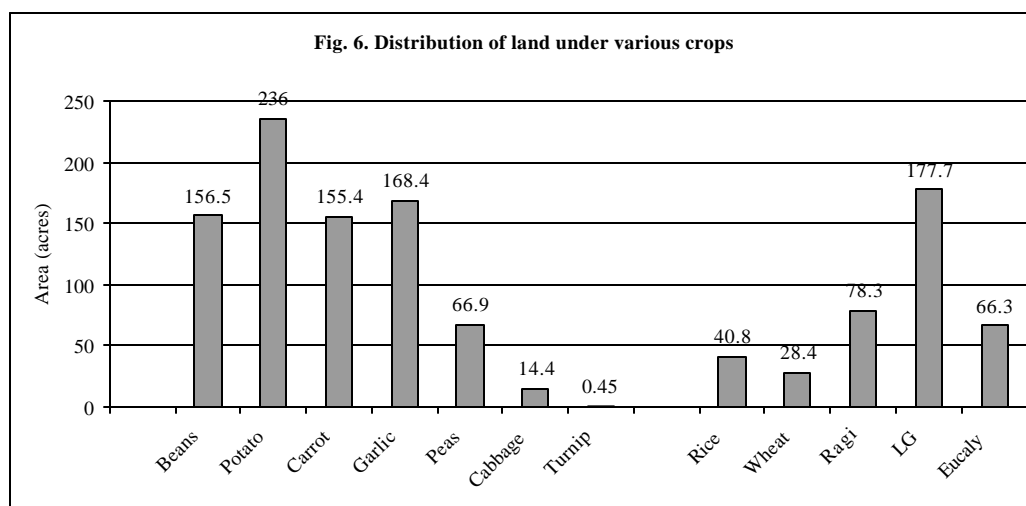
Table 7. Cropping pattern of the sample respondents

Crops	Gross area (Acre)
Vegetables	
Beans	156.5
Potato	236.0
Carrot	155.4
Garlic	168.4
Garden pees	66.9
Cabbage	144
Turnip	0.45
Total	798.05

Contd.

Crops	Gross area (Acre)
Grains	
Wheat	28.4
Rice	40.8
Fingermillet	78.3
Total	147.5
Other crops	
Eucalyptus	66.3
Lemongrass	177.7
Total	244.0
Grand total	1189.55

Area put under staples is low (147.5 acres) when compared with market vegetables (818.05 acres). Among vegetables and among all crops potato ranks first in area followed by lemon grass which is mostly used for distilling the essential oil by tribes. Area under garlic, beans and carrot is almost the same. Next major crop is garden peas (66.9 acres) followed by cabbage. Among grains, finger millet occupies maximum area most of which is in the tribal land. The latest step in this area has been the large scale public investment in tree plantation schemes. Eucalyptus plantations occupy an area of 66.3 acres.



This cropping pattern reflects the land use pattern of the entire panchayat. Plate 4 gives the crop diversity at Vattavada.

d) Fertility status of soils

In general, the soils were of acidic nature, soil pH ranged from 4.5 to 5.2 and electrical conductivity was 1. Available nutrient status was as follows.

Organic carbon - 0.36 to 0.52 %

Available P₂O₅ - 30 to 34.4 kg/ha

Available K₂O - 118 to 190 kg/ha

Soils were found to be low in the content of nitrogen, high in phosphorus and medium in potassium, three major nutrients needed for plant growth.

At many places, due to indiscriminate application of chemical fertilizers, soils have become more acidic, affecting plant growth. In few farms at Pazhathottam, lime application was recommended which gave good results.

e) Crop management

i) General

Transition from sustenance farming to commercial agriculture has changed the crop management practices to a great extent.

In the traditional farming system a considerable body of empirical knowledge existed concerning the structure and management. Land was disturbed only to the minimum, using small agricultural implements or by bullock labour. Another important feature was the inter/mixed cropping and crop sequencing followed by traditional farmers. The practice of mixed cropping is a traditional strategy to promote diversity of diet and income source, stability of production, minimization of risk, reduced insect and disease incidence, efficient use of labour, intensification of production with limited resources and maximization of returns under low levels of technology (Harwood, 1979). Common intercropping systems included corn-amaranth-finger millet, wheat-mustard, coriander-beans, garlic -beans-onion etc. A legume is always included in the cropping which added to the natural fertility of the soil. The rate of accumulation of biomass within the system was high in relation to the harvest output. The traditional systems were managed without inorganic fertilizers and plant protection chemicals. At present only rice, wheat and finger millet are grown in the traditional ways.

Recent introductions to the traditional system, mainly F₁ hybrids of vegetables, have totally changed the crop management practices. These high yielding varieties which are also high input responsive varieties demand more fertilizers, water and plant protection chemicals. With the only objective of maximizing production,

fertilizers, pesticides and fungicides are indiscriminately pumped into this fragile ecosystem with severe pollutive effects on the biota. Fertilizer and pesticide consumption of major crops are given in Table 8.

Table 8. Fertilizer and pesticide consumption of major crops

Crop	Fertilizer consumption (kg/ha)			Fungicides (kg/ha)	Pesticides (l/ha)
	N	P	K		
Potato	58.2	60.3	51.7	20	0.83
Cabbage	58.6	35.3	36.1	1.0	4.00
Carrot	56.0	30.4	32.3	-	-
Garlic	56.2	50.4	45.1	5	-

A hectare of potato crop consumed 58.2 kg N, 60.3 kg P₂O₅ and 51.7 kg K₂O. Likewise a hectare of garlic consumes 56.2 kg N, 50.4 kg P₂O₅ and 45.1 kg K₂O. Carrot and cabbage also consumed higher quantities of nitrogen.

With respect to plant protection chemicals potato consumed greater quantities of fungicides (20 kg/ha) and pesticides (0.83 kg/ha). In cabbage pesticide consumption was high (4 l/ha) compared to fungicides (1 kg/ha). These agricultural chemicals have deleterious effects which extend beyond the ecosystem. They not only undermine the natural agricultural resource base but also will destroy the natural resources over a wide area down in the plains. Continued and unjudicious use of agrochemicals have increased the pest disease complex, degraded the soil and land has become increasingly unproductive.

ii) Individual crops

GARLIC

Garlic is one of the important bulb crops grown in India. Use of garlic in food preparations as a spice and its nutrition and medicinal properties are well known. Madhya Pradesh is the largest garlic producing state in India followed by Gujarat, Rajasthan, Uttarpradesh, Maharashtra, Tamil Nadu and Kerala. While in the northern states garlic is cultivated in the plains, it is raised in the southern states in the hilly tracts, especially in Nilgiris and Kodaikanal in Tamil Nadu and Kanthallur and Vattavada in Kerala.

Garlic is a frost hardy crop requiring cool and moist period during the vegetative phase and dry spell during the maturity stage. It requires well drained loamy soils rich in humus for better growth and yield.

In Vattavada garlic is the second largest crops cultivated. Koviloor, Kottakombur and Vattavada are the major garlic growing localities in the panchayat. The area cultivated by each farmer ranges from a few cents to a few acres.

Seasons

There are mainly two garlic growing seasons. The first crop season starts from May-June and the harvesting is done in September-October. The second crop is sown during November - December and ends by March - April. Main season is May - October.

Varieties

Two varieties viz. 'Singapore' and 'Mettuppalayam' are grown by the farmers, the former having pink coloured cloves and the latter with white coloured cloves. Use of Mettuppalayam variety dates back to 1980's whereas Singapore variety is of recent introduction. Pungency is more in Mettuppalayam variety compared to the Singapore. Eventhough the yield is more in Singapore variety, Mettuppalayam variety gives more driage. Cloves of both those varieties are small in size compared to the improved varie ties released by various agencies.

Seeds and Sowing

Farmers often use their own seed materials or collect it from markets located in Mettuppalayam or Kodaikanal. The cost of seed varied from Rs.100 to Rs.150/kg. Usually fresh seeds of Mettuppalayam variety is used for sowing. While seeds stored under smoke condition for about 46 months are preferred in case of Singapore variety. This is said to help in better germination. Smoke drying after longer duration helps in better germination, establishment and growth of plants. Seed rate was 250-300 kg/ha.

Management Practices

The land is prepared by digging and leveling. They are divided into small plots to facilitate irrigation. FYM @ 20 t/ha is incorporated as basal dose. Split cloves (bulbils) are used for sowing. They are dibbled at a depth of 5-10 cm at a distance of about 5 to 10 cm, between plants and between rows. Chemical fertilizers mostly 17:17:17 mixture or 10:26:26 mixture are applied. Fertilizers are applied as two top dressings. Average Nutrient use in garlic was as follows:

<u>Nutrient</u>	<u>Consumption kg/ha</u>
N	56.76
P	50.89
K	46.07

Weeding is carried out by female labourers and three to four rounds are required to eliminate weeds. Weeding is done with a small fork. In areas where irrigation facilities are available crop is irrigated once in ten days.

Inter/mixed cropping

Garlic is often inter cropped with small onion. The onion is used for household purpose only. Sometimes a border row of bush beans is given which again is used for own consumption.

Plant protection

In garlic, aphids and leaf blight respectively were the important pest and disease noticed. Farmers spray Indofil M-45 and Rogor once in 10 days.

Harvesting

Singapore variety has five to six months duration, whereas Mettupalayam variety comes to harvest in 4-5 months time. Harvesting is done when withering or drying of leaves takes place. The plants are pulled out with the bulbs and heaped for 3-4 days to reduce the moisture content. Later on, soil particles adhering to the bulb are removed and the plants with bulb and aerial parts are hanged from the kitchen roof for smoke drying and storage. This period will last for 4-6 months. This is practiced mainly because sun drying of the produce is not possible due to cool moist misty weather prevailing during the harvest season. The farmers also believe that this

technique improves the keeping quality as well as gives a yellow colour of the bulbs and they can sell the produce in the market as and when higher prices are realizable in the market. This method of sowing also keeps the bulbs dormant for some time and they can be used as seed material for the subsequent season.

Some farmers sell a part of the harvested produce as fresh garlic and invariably this is more a distress sale. The price varies from Rs.19-40 per kilogram depending upon the size of the bulb. Single cloves ("Ottappoodu") without side bulbils fetch upto Rs.60/kilogram. The average yield realised is 3-3.5 t/ha.

The main market of garlic is located at Vadukapetty in Theni district of Tamil Nadu. Almost the entire production of garlic is sold here.

Cost of cultivation

Input wise cultivation cost per acre of garlic is presented in Table 9. Cost A, B and C were Rs.25796.5, 25833.5 and 32133.5 respectively. Cost of seed was the most important item of input (32.9%) closely followed by human labour (30.8%) where again family labour was more important. Transportation cost accounted to 11.9 per cent, fertilizer 5.3 per cent and PP chemicals 1.6 per cent.

Table 9. Cost of cultivation of garlic (Rs./acre)

Sl. No.	Item	Cost of cultivation (Rs.)	% to total cost
1	Seed	11620.0	32.9
2	Fertilizers	1881.0	5.3
3	PP chemicals	561.0	1.6
4	Transportation cost	4203.0	11.9
5	Hired labour	4580.0	13.0
6	Depreciation	37.0	0.1
7	Interest on working capital	2914.5	8.2
8	Cost A ₁	25796.5	73.0
9	Interest on fixed capital	37	0.1
10	Coat B ₁	25833.5	73.1
11	Imputed value of family labour	6300.0	17.8
12	Cost C ₁	32133.5	90.0
13	Allowance given for farm management	3213.4	9.1
14	Cost C ₃	35346.9	-
15	Benefit	37680.0	-

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.

<u>Cost</u>	<u>Benefit cost ratio</u>
A ₁	1.34
B ₁	1.23
C ₃	1.07

Analysis of benefit cost ratio of garlic revealed that returns generated from a rupee were greater than one at cost A₁, B₁ and C₃. At Cost C₃ it hang around one.

POTATO

Potato was introduced in the Nilgiri hills in 1822. Though it is a crop of the temperate region, it is adapted to a wide range of climatic conditions. It thrives best in the cold regions of the plateaus and the hills where the temperature is low. Plenty of bright sunshine is required for the development of tubers.

Potato is the major crop of Vattavada hills both in terms of area and production. It is grown in an area of 236 ha. It is cultivated in all parts of the panchayat, right from valleys upto hill tops. Cultivation in leased lands is common in the Pazhathottam area.

Season

There are two seasons for potato viz. April-July and October-December. Duration of the crop is 90-100 days. Few farmers who have irrigation facilities raise three crops in an year.

Seeds and sowing

Seed tubers are mostly bought from private seed dealers at Mettupalayam. None of the farmers produce and use seed potato tubers in their own farms. There is a deep rooted belief among the farmers that locally produced seed tubers will not give good yield. Improved varieties like Kufri Jyothi and Kufri Muthu

are popular here. Seeds are procured well in advance of the season and they are stored to break the dormancy after which the tubers sprout and these just sprouted tubers are used for sowing. Small seed tubers weighing 50-70 g are used for sowing. Seed rate is 1200-1500 kg/ha.

Crop Management

Potato was earlier cultivated in the stable terraces only where tillage and other cultural operations were minimum. But recently potato cultivation has extended to non traditional areas especially in the abandoned and young eucalyptus plantations up the hills. Long stretches of steep slopes are cultivated with potato without resorting to soil conservation measures like contour bunding or terracing which leads to soil erosion and loss of fertility.

The land is dug three to four times and levelled. Furrows are taken at a spacing of 30-45 cm. Basal dose of fertilizers are put inside the furrows. Seed tubers are placed at a spacing of 15 cm and covered with soil from two sides, making the furrow into a ridge.

No farmer applies FYM or any other organic manure in potato, because they believe that will cause tuber rot. Complex fertilizers or fertilizer mixtures are applied as basal dose and two top dressings are given with urea. Weeding and earthing up are done along with fertilizer application.

Protection from wild animals

In potato tuber initiation starts one month after planting. From this period upto harvest, the crop is attacked by wild boars. Day and night security is provided by erecting 'kaavalmaadam' in the farm. Most often family labour is utilized for this. When potatoes are raised in virgin lands near forests animal proof fences are erected all around the farm.

Plant protection

Late blight caused by *Phytophthora infestans* is the serious disease found in potato. Farmers give on an average 9-10 rounds of fungicide spray for a crop with Indofil M-45 or Blue copper. Cut worms and leaf eating caterpillars are seen to a lesser extent. Ekalux and Rogor are the common pesticides used.

Harvesting

The time of harvest is very important in potato. Potatoes are harvested when the tubers attain sufficient size, indicated by yellowing of the plant. The loss in yield due to early harvest is normally compensated by higher prices. Tubers are dug out using small spade and fork, without damaging them. Tubers are left in the field for one day, cleaned and graded in the field itself and packed in gunny bags. The average yield obtained is only 810 tonnes/ha which is far less from the potential yield of the varieties used. Some progressive farmers get a seed to tuber ratio of 1:20 under good management. Potatoes can't be stored for long time under open conditions and hence have to be sold immediately.

Cost of cultivation

Input wise cost of cultivation for an acre of potato was worked out and it is presented in Table 10. Cost A_1 , B_1 and C_3 were Rs.18969.2, 19006.2 and 23282.3 respectively. Human labour constituted the highest share of 30 per cent which included the share of 20.9 per cent hired labour. This was followed by seed material input (16.5%) and fertilizers (15.9%). Cost of transportation accounted for 9 per cent and PP chemicals 8.3 per cent.

Table 10. Cost of cultivation of potato (Rs./acre)

Sl. No.	Item	Cost of cultivation (Rs.)	% to total cost
1	Seed	3848.8	16.5
2	Fertilizers	3697.9	15.9
3	PP chemicals	1941.9	8.3
4	Transportation cost	2101.3	9.0
5	Hired labour	4855.4	20.9
6	Depreciation	37.00	0.20
7	Interest on working capital	2487.6	10.7
8	Cost A_1	18969.2	81.5
9	Interest on fixed capital	37	0.20
10	Coat B_1	19006.2	81.60
11	Imputed value of family labour	2159.2	9.30
12	Cost C_1	21165.7	90.90
13	Allowance given for farm management	2116.6	9.10
14	Cost C_3	23282.3	-
15	Benefit	31370.8	-

Benefit cost ratio

<u>Cost</u>	<u>Benefit cost ratio</u>
A ₁	1.65
B ₁	1.65
C ₃	1.35

The investment of one rupee yielded more than one rupee at Cost A₁, B₁ and C₃. At cost C₃ it was 1.35.

CARROT

Carrot has been grown in India for a very long time. There are tropical as well as temperate types in carrot. Tropical types perform well under Kerala conditions. Carrots grown at higher temperatures are shorter and thicker, whereas those grown under low temperatures are comparatively longer and slender.

Season

There is no specific season for carrot. It is grown throughout the year. Duration ranges from 100-120 days. Carrot is a major vegetable of Vattavada and it is grown in all localities of the panchayat.

Varieties

Only F₁ hybrids are used in carrot. Early Nantes, New Kuroda and Suttons seed are the popular varieties. These seeds are costly (Rs.100/100 g). New Kuroda is an imported variety marketed by Unicorn seeds Secunderabad and supplied by private seed dealers in Mettupalayam. Seed rate followed is 3-4 kg/ha.

Crop management

Carrot is mostly grown as a pure crop and sometimes mixed with beetroot, radish or knol khol and bush beans.

Land is bullock ploughed or dug well and leveled. FYM is incorporated at last ploughing. Small fine raised beds are taken and seeds are broadcasted after mixing with fine sand and covered lightly with soil. After 2-3 weeks the beds are thinned to get a uniform stand of seedlings at a spacing of about 10 cm. Chemical fertilizers are applied mostly as a single top dressing and some times as basal and top dressing. Forking and earthing up is given 45 days after sowing. Weeding is an

important operation in carrot and it consumes lot of labour. Four to five rounds of weeding becomes necessary to get a good crop. The crop also requires protection from wild animals viz., wild boars and rabbits.

Plant protection

No serious pests and diseases are observed in carrot.

Harvesting

Carrots are harvested 100-120 days after sowing by digging out the tubers with hand spades without damaging them. The green tops are removed, roots are cleaned in running water, sacked and marketed. The average yield is 67 t/ha. The realizable yield of the F₁ hybrids is 26-30 t/ha. This low yield is obviously the result of low input farming for a high input responsive variety.

Cost of cultivation

Analysis of cost of cultivation per acre of carrot (Table 11) showed that cost A₁, B₁ and C₃ were Rs.11542, Rs.11579 and Rs.18729 respectively. Human labour occupied about 40 per cent of the total cost which included 28 per cent family labour and 11 per cent hired labour. Transportation cost accounted for 18 per cent, followed by fertilizer (15%) and seed (9%).

Table 11. Cost of cultivation of carrot (Rs./acre)

Sl. No.	Item	Cost of cultivation (Rs.)	% to total cost
1	Seed	1727.778	9.22
2	Fertilizers	2775	14.82
3	PP chemicals	0	0
4	Transportation cost	3425	18.287
5	Hired labour	2035.556	10.87
6	Depreciation	37	0.198
7	Interest on working capital	1541.667	8.23
8	Cost A ₁	11542	61.62
9	Interest on fixed capital	37	0.198
10	Cost B ₁	11579	61.822
11	Imputed value of family labour	5447.778	29.087
12	Cost C ₁	17026.78	90.90
13	Allowance given for farm management	1702.678	9.09
14	Cost C ₃	18729.46	
15	Benefit	15309	

Benefit cost ratio

<u>Cost</u>	<u>Benefit cost ratio</u>
A ₁	1.33
B ₁	1.32
C ₃	0.82

At cost A₁ and cost B₁ the benefit cost ratio was more than one, but at cost C₃ it was less than one indicating that in the real sense carrot farmers are at loss.

CABBAGE

Cabbage is a comparatively recent introduction in the area. The crop was introduced in the most advanced form i.e., as F₁ hybrids and farmers now struggle to get good crop and good returns from cabbage. Climate and soil at Vattavada are ideal for cabbage cultivation.

Season

Cabbage is grown throughout the year. As rainfed crop two crops are taken and where irrigation is possible, three crops are taken. Cabbage is extensively cultivated in all parts of the panchayat except the tribal settlements. Like potato, long stretches of cabbage farms are a common sight in the Pazhathottam area.

Varieties

Only high yielding F₁ hybrids are used for cultivation. Seeds are purchased from outside the area. Krishna, Hari Rani, Priyanka and Sandoz are the common varieties. Seed rate is 400-500 g/ha. Cost per 100 g of seed is Rs.1000/-. Crop duration ranges from 110-120 days.

Crop management

In cabbage nursery is raised first near a water source and 40 days old seedlings are transplanted in the main field. Main field is prepared by digging/bullock ploughing. FYM is incorporated at the final stage. Ridges are made at a spacing of 45 cm and seedlings are transplanted at a distance of 45 cm. NPK mixtures are added to

the crop as basal and one or two top dressings, one and two months after transplanting. Two weedings and one earthing up are also given.

Plant protection

Cabbage is the crop where pest problem is severe and cause serious damage. Diamond black moth (*Plutella* sp.) is the most serious pest. Aphids and leaf caterpillars and leaf webbers also make considerable damage in the crop. The crop is free from any serious diseases. Plant protection chemicals are indiscriminately applied in this crop. The list include Ekalux, Rogor, Indofil M-45, Blue copper etc. 7-10 rounds of sprays are given in a single crop. The chemicals are directly applied on the heads until harvest, the residues of which are bound to stay on the produce.

Attack by wild animals

Wild elephants, deers, wild boars and rabbits destroy the crop by feeding on them. Hence, arrangements for warding off animals are done by way of drum beating, fireworks etc.

Harvesting and yield

The hybrids take three to four months for attaining maturity. The heads are cut by the farmers or by the preharvest contractors as the case may be, sacked in the field itself and marketed. Average yield obtained is only 16.1 t/ha whereas the potential yield of the varieties is around 50 t/ha. Low input and poor management practices coupled with the pest complex are the major reasons for this low yield. The price realized is highly variable (Average Rs.2.11/kg). Some times prices crash down to even Rs. 0.50/kg and the farmers opt for feeding the cabbage fields to cattle instead of loosing the harvesting charges.

Cost of cultivation

The table shows that cost A₁, cost B₁ and cost C₃ were Rs.5382.9, Rs.5419.9 and Rs.6570.7/acre respectively. Almost 47 per cent of the cost was contributed by labour which included 31 per cent hired labour and 16 per cent family labour. Share of seeds was 10.7 per cent, fertilizers 10.1 per cent, transportation cost 7.6 per cent and PP chemicals 6.2 per cent.

Table 12. Cost of cultivation of cabbage (Rs./acre)

Sl. No.	Item	Cost of cultivation (Rs.)	% to total cost
1	Seed	778.3	10.7
2	Fertilizers	731.7	10.1
3	PP chemicals	450.2	6.2
4	Transportation cost	548.9	7.6
5	Hired labour	2246.1	31.1
6	Depreciation	37.0	0.5
7	Interest on working capital	590.6	8.2
8	Cost A ₁	5382.9	74.5
9	Interest on fixed capital	37.0	0.5
10	Coat B ₁	5419.9	75.0
11	Imputed value of family labour	1150.8	15.9
12	Cost C ₁	6570.7	90.9
13	Allowance given for farm management	657.0	9.1
14	Cost C ₃	7227.8	-
15	Benefit	6523.1	-

Benefit cost ratio

Cost	Benefit cost ratio
A ₁	1.21
B ₁	1.20
C ₃	0.91

Even though at cost A₁ and cost B₁ the benefit cost ratio was more than one, at cost C₃ it was less than one.

FRENCH BEANS

French bean is a widely cultivated vegetable in India. It is a crop where lot of morphological variability exists with respect to plant habit, pod color, pod size etc. Broadly there are two categories in French bean. The bush types and the pole types. In terms of area covered, french bean is the third largest crop of Vattavada. It is grown both as a pure crop and also mixed with other vegetables. Every household has a few beds of the bush variety and this is a crop which is solely managed by the women folk. The crop is common in the tribal areas too.

Season

Crop is grown through out the year. There are no definite seasons. The duration varies with the cultivar. In general the bush types commonly called as

selection beans are of two months duration and the trailing types are of 34 months duration.

Types/varieties

Great variability exist in this crop. Based on plant habit, nature of pods and pod color four distinct types are grown here (Table 13).

Table 13. Variability in cultivated *Phaseolus* sp.

Type	Characters	Duration
1. Bush beans	Bushy nature, with small pods, used at tender stages	60 days
2. Muringa beans	Trailing type with extra long pods used at tender stage	90 days
3. Arakkodi	Trailing type with small pods used at tender stage	90 days
4. Butter beans	Trailing type with large and bold pods used at the full mature stage. Seeds are rich in protein and delicious.	90 days
5. Double beans	Trailing type with double pods used as grain at mature stage.	Perennial

Apart from these types many cultivars which differ in their pod characteristics are locally found here.

Seeds and sowing

Farmers use their own seeds. Land is prepared well by digging / bullock ploughing and leveled. Well decomposed farm yard manure is applied at the time of final digging and incorporated into the soil. Seeds are dibbled on ridges. Spacing for bush bean is 30 x 15 cm and for trailing beans is 45 x 15 cm. Fertilizers are applied as basal well as top dressing. One or two weedings and raking are also needed. For the trailing types poles are erected for trailing. The bush types are harvested after 45 days from sowing and it extends up to 60 days. In trailing types extended harvests are obtained. In butter beans the pods are harvested only when the vines start yellowing and pods become ripe.

Plant protection

There are no serious pests and diseases. Against sporadic appearance of Anthracnose and powdery mildew diseases and aphids and pod borers, fungicide / pesticide sprays are given as and when they are noticed.

Cost of cultivation

In bush beans cost of cultivation per acre of crop was Rs.4487.5 at cost C₃. Contribution of labour component was maximum (39.8%) followed by fertilizers (18.7%), seeds (13.9%). In butter beans cost C₃ was Rs.13894.01, major share of which was by seed (29.6%) and labour (31%).

Table 14. Cost of cultivation of French Beans (Bush type) (Rs./acre)

Sl. No.	Item	Cost of cultivation (Rs.)	% to total cost
1	Seed	622.97	13.88
2	Fertilizers	837.50	18.66
3	PP chemicals	162.40	3.61
4	Transportation cost	231.50	5.158
5	Hired labour	1020.00	22.73
6	Depreciation	37.00	0.824
7	Interest on working capital	364.137	8.11
8	Cost A ₁	3275.507	72.99
9	Interest on fixed capital	37.00	0.824
10	Coat B ₁	3312.507	73.81
11	Imputed value of family labour	767.00	17.09
12	Cost C ₁	4079.507	90.90
13	Allowance given for farm management	407.9507	9.09
14	Cost C ₃	4487.458	
15	Benefit	4627.125	

Table 15. Cost of cultivation of Butter Beans (Rs./acre)

Sl. No.	Item	Cost of cultivation (Rs.)	% to total cost
1	Seed	4116.111	29.62
2	Fertilizers	1164.444	8.38
3	PP chemicals	899.4444	6.47
4	Transportation cost	918.1111	6.61
5	Hired labour	2403.333	17.298
6	Depreciation	37	0.260
7	Interest on working capital	1146.589	8.25
8	Cost A ₁	10685.03	76.90
9	Interest on fixed capital	37	0.266
10	Coat B ₁	10722.03	77.17
11	Imputed value of family labour	1908.889	13.74
12	Cost C ₁	12630.92	90.90
13	Allowance given for farm management	1263.092	9.09
14	Cost C ₃	13894.01	
15	Benefit	13057.22	

Benefit cost ratio

<u>Cost</u>	<u>Bush bean</u>	<u>Butter bean</u>
A ₁	1.41	1.22
B ₁	1.35	1.22
C ₃	1.03	0.94

In the case of bush beans benefit cost ratio was greater than one at cost A₁, B₁ and C₃ where as in butter beans it was less than one at cost C₃.

GARDEN PEAS

Garden pea is one of the most important vegetable crops grown in India. The crop is usually grown for its green pods which contain unmaturing seeds which are cooked as vegetable. Peas yield best when the crop matures under fairly cool climatic conditions.

Season

Main season is from April-October. It is cultivated in all parts of the study area.

Varieties

Only local varieties are used. Farmers use their own seeds. Two distinct types are available.

1. Sweet peas with small pods which do not require staking.
2. Samba peas with long pods and more seeds which require staking.

The latter variety is more preferred by farmers.

Crop management

Garden pea is generally raised as a pure crop. Cultivation practices are similar to that of French beans. About 75 kg seed is required per hectare of land. Spacing followed is 45 x 15 cm. Both organic and inorganic fertilizers are applied. Trailing types are staked properly. Unlike other beans types, individual plants are trailed on straight twigs. Birds damage the crop at the flowering and milky stage of pods. Bird scaring is hence done by women labourers at this stage. No serious pests

and diseases are found in this crop except the occasional incidence of powdery mildew and pod borers. Two sprays of Ekalux / Roger and Indofil M45 are given against this disease and pest. Crop is harvested when pods are well-filled with young, tender peas changing in colour from dark to light green. Hand picking is done carefully without injuring the plant. Three to four pickings are done in one crop. Garden pea is one crop where a stable price is obtained. Average price realised is Rs.22/kg.

Cost of cultivation

Cost of cultivation worked out for one acre of garden pea is Rs.26083/- at cost C₃ (Table 16). Major contribution is by the labour component (37%) followed by transportation cost (17.4%) seed (12.9%) and fertilizers (9.9%).

Table 16. Cost of cultivation of Garden Peas (Rs./acre)

Sl. No.	Item	Cost of cultivation (Rs.)	% to total cost
1	Seed	3369.769	12.91
2	Fertilizers	2591.846	9.94
3	PP chemicals	1146.538	4.395
4	Transportation cost	4549.269	17.44
5	Hired labour	4919.615	18.86
6	Depreciation	37.00	0.142
7	Interest on working capital	2148.896	8.23
8	Cost A ₁	18762.93	71.94
9	Interest on fixed capital	37.00	0.142
10	Coat B ₁	18799.93	72.07
11	Imputed value of family labour	4911.923	18.83
12	Cost C ₁	23711.86	90.90
13	Allowance given for farm management	2371.186	9.09
14	Cost C ₃	26083.04	
15	Benefit	25822.08	

<u>Cost</u>	<u>Benefit cost ratio</u>
A ₁	1.38
B ₁	1.37
C ₃	0.99

Analysis of the benefit cost ratio indicates that garden pea is almost a no loss no profit crop.

OTHER MINOR VEGETABLES

Temperate vegetables viz., cauliflower, beetroot, radish, knolkhol, celery, mustard, coriander, capsicum, turnip and horsepea, are also grown here to a limited extent. Except capsicum and cauliflower all others are grown in mixed/inter cropping systems. Tropical vegetable like chilli, tomato are also grown on a small scale, only for household consumption. One or two plants of perennial vegetables like tree tomato (*Cyphomandra bataceae*) and chow-chow (*Sechium edule*) are maintained by each family.

In the tribal areas grain amaranth (both the green and red variety) is a common crop. It is always grown mixed with ragi and or maize. The protein rich grains are consumed by the tribes after parching and mixing with honey.

RICE

Vattavada is the only area in Kerala where traditional hill rice cultivation is still practiced. Lower valleys and lower terraces known as "pallamvayal" are often utilised for growing paddy. Vattavada farmers grow rice only for their own consumption. Area under hill paddy is decreasing year after year and people depend on market for rice. Rice cultivation is confined to lower elevation of Vattavada, Koviloor and Kottakombur villages.

Varieties

Many local hill rice types viz., 'Vaalnellu', 'Mulaisamba', 'Aanakkomben', 'Kuruvai' etc. are grown here. All are red rice and awned. Unlike lower elevation paddy the duration is long i.e., 7-9 months.

Season

Hill rice is sown during October-December and harvested during August-September. Seeds are soaked in water for 3-4 days, they are rubbed with hand to remove the awn. The field is ploughed well puddled and sprouted seeds are broadcasted. Farm yard manure dissolved in irrigation water is pumped into the field at frequent intervals. Weeding is done up to three months after planting. Flooding and draining of the field are done at intervals. There are no pests and diseases in hill

paddy. No chemicals are applied either by way of fertilizers or pesticides. One month before harvest water is drained completely, field is allowed to dry and then harvesting is done. Threshing, winnowing and cleaning are done in the field itself and the produce is taken for home. Rice is not sold but it is bartered.

Table 17. Cost of cultivation of rice/acre

Item	Cost of cultivation (Rs.)	% to total cost
Seed	259.53	6.85
Fertilizers	0	0
PPC	0	0
Transportation cost	232.86	6.14
Hired labour	1869.76	49.34
Depreciation	37.00	0.98
Interest on working capital	306.45	8.01
Cost A ₁	2705.60	71.39
Interest on fixed capital	37.00	0.98
Cost B ₁	2742.60	72.30
Imputed value of family labour	702.38	18.50
Cost C ₁	3444.98	90.91
Allowance given to farm management	344.50	9.09
Cost C ₃	3789.47	-
Benefit		

Benefit cost ratio

Cost	Benefit cost ratio
A ₁	1.13
B ₁	1.12
C ₃	0.81

Analysis of cost of cultivation reveals that cost C₃ was Rs.3789.47/acre. Major share is by the labour component (67.8%) which includes hired labour (49.34%) and family labour (18.5%). Share of fertilizers and PP chemicals was nil. At cost C₃ the benefit cost ratio was less than one.

WHEAT

Wheat is probably an accidental introduction in this area. It was one of the earlier food crops grown only in this part of the state. Wheat cultivation is confined to Koviloor, Kottakombur, Vattavada and to some extent in the tribal areas.

Varieties

Four distinct types of wheat are grown here.

1. Dwarf wheat ("Kuttathorai") - Short statured
2. Soochi wheat ("Doosi thorai") - Slender grained variety
3. Large wheat ("Nattu thorai") - with large grains
4. Beaked wheat ("Kokkuthorai") - with beaked panicles

Season

Main season of wheat is from October to February-March. Farmers use own seeds for cultivation. Wheat is grown mostly as a pure crop and sometimes mixed with mustard. Only organic farming is practiced. No pests and diseases are found. Only the earheads are harvested when they mature fully. Earheads are beaten with sticks to separate the grains, cleaned and taken home. Wheat is never sold to outsiders. It is either used at home or bartered.

Cost of cultivation

Analysis of cost of cultivation for an acre of wheat shows that Rs.4368.9 was the cost at C_3 . 65 per cent of the cost was attributed by labour component (31.5% hired and 33.7% family labour). Other input costs were negligible.

Table 18. Cost of cultivation of wheat (Rs./acre)

Sl. No.	Item	Cost of cultivation (Rs.)	% to total cost
1	Seed	465.7111	10.65
2	Fertilizers	0	0
3	PP chemicals	0	0
4	Transportation cost	228.3333	5.2
5	Hired labour	1377.778	31.5
6	Depreciation	37.00	0.85
7	Interest on working capital	353.1267	8.08
8	Cost A_1	2461.949	56.35
9	Interest on fixed capital	37.00	0.85
10	Coat B_1	2498.949	57.19
11	Imputed value of family labour	1472.778	33.71
12	Cost C_1	3971.727	90.90
13	Allowance given for farm management	397.1727	9.09
14	Cost C_3	4368.899	-
15	Benefit	809.7778	-

Cost	Benefit cost ratio
A ₁	0.33
B ₁	0.32
C ₃	0.22

Benefit cost ratio shows that the farmer was at great loss in cultivating wheat. Area under wheat is decreasing year after year.

FRUIT CROPS

Various tropical and subtropical fruit crops are grown at Vattavada to a limited extent. Banana is the most prominent fruit crop. Local varieties viz., 'Vellavazhai', 'Karivazhai', 'Poovazhi' etc. are popular in all the villages and tribal areas. From Koviloor area banana bunches are marketed also.

Other fruits crops include oranges, lime, lemon, pummello, pomegranate, guava, pear, peaches and plums. There are locally marketed during peak season. Three distinct varieties of passion fruit are grown here

- 1) Yellow passion fruit ("English Kattuputtan") with elongated yellow ripe fruits
- 2) Round passion fruit ("Manjakattuputtan") - round yellow ripe fruits
- 3) Violet passion fruit ("Karuppu Kattuputtan") with round violet fruits and vine.

AROMATIC PLANTS

Geranium

Geranium (*Pelargonium* sp.) is a profitable crop in the hills. The herbage is distilled to get the essential oil. The crop was introduced by a progressive farmer Sri.Doraipandi at Pazhathottam. He owns 3 acres of geranium. Initial investment on distillation equipment was high he says. Crop is cut every two months and distilled. Firewood consumption is high in the country still which may not be affordable at Vattavada in future. If fuel efficient distillation machinery is introduced the crop can be successfully cultivated here. A kg of geranium oil fetches Rs.4000-5000/-.

Aromatic plants like geranium, lemongrass and eucalyptus are grown on a commercial scale for extracting the essential oil. Lemongrass and eucalyptus oils are extracted in country stills in the tribal areas and in some non tribal pockets. Fire wood requirement for these stills is high and extraction efficiency low. Geranium cultivation is found only in the Pazhathottam area.

iii) Tribal agriculture

There was not much difference in the tribal agricultural practices from that followed in other parts of the villages with respect to commercial crops. But with respect to food crops, the tribal priorities were different. They grew fingermillet, maize, wheat and grain amaranth for their food needs. Mixed cropping was common in tribal agriculture. Major cash crops were beans, peas, garlic and potato. Cash needs were met by extracting and selling eucalyptus and lemongrass oils. The tribal agriculture at Vattavada is presented in Plate 5.

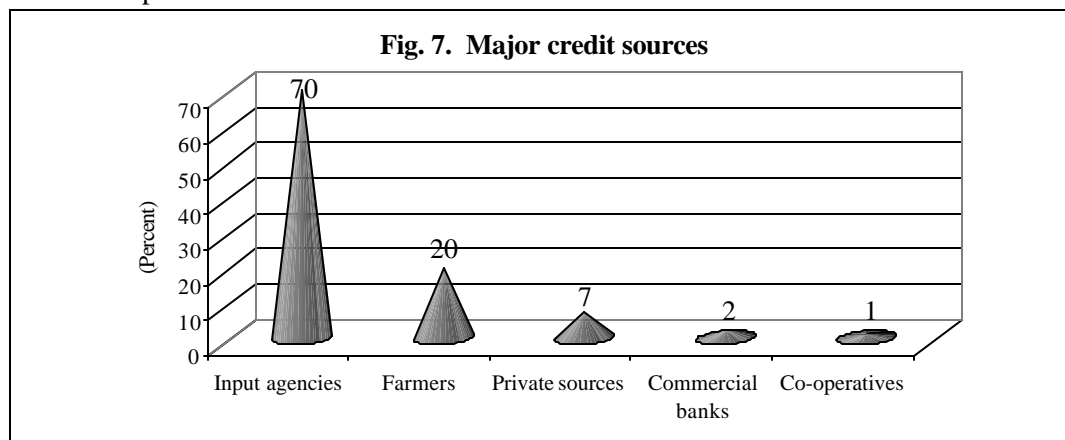
iv) Major credit sources

Commercial agriculture made its entry into the area through the input agencies mainly fertilizer and pesticide dealers. Their percentage share in extending credit is evident from Table 19 and Fig. 7.

Table 19. Major credit sources

Source	Share (%)
Input agencies	70
Farmers	20
Private sources	7
Commercial banks	2
Co-operatives	1

These agencies supply in advance all the inputs (seeds, fertilizers and pesticides) and also the technical information. In turn the farmer would surrender all his produce back to them. Money value is assessed only for the inputs and definitely not for the output. It is very difficult to assess the incidence of indebtedness among the farmers. The small farmer's debt is like a chain that binds him securely to his financial partner.



v) Main markets

After harvesting and cleaning the produce is either loaded from the field itself or taken to the common loading centres and then transported. There are mainly two loading centres in the panchayat, Koviloor and Pazhathottam.

Table 20. Markets of the agricultural produce from Vattavada

Produce/ Market	Kerala						Tamil Nadu		
	Mnr.	Ekm.	Alw.	Pbvr.	Adly	Mdu	Cmbm	Body	Vpty
Cabbage	✓	✓	✓	✓		✓		✓	
Carrot	✓	✓	✓	✓	✓	✓		✓	
Potato	✓	✓	✓	✓		✓	✓	✓	
Beans	✓	✓	✓	✓		✓		✓	
Butter beans	✓					✓		✓	
Garlic						✓		✓	✓
Beet root	✓	✓	✓	✓		✓		✓	
Turnip	✓	✓	✓	✓		✓		✓	
Cauli flower	✓	✓	✓	✓		✓		✓	
Sweet peas	✓					✓			

Table 20 gives an idea of the leading markets of various produce, both inside and outside the state. Nearest market is Munnar in Kerala and Bodynaikkannur in Tamil Nadu. Carrot, Potato, Cabbage, Cauliflower, Turnip, Beans etc. are sent to almost all markets. Garlic is sold at Vadukapetty in Tamil Nadu. Cumbam market prefers only potato. Butter beans and garden peas are preferred items in Tamil Areas and maximum quantity goes to Munnar and Madurai markets.

Monthly outflow of various agricultural produce during January - December 2000 to different markets is presented in Table 21.

Table 21. Monthly outflow of produce to various markets inside & outside Kerala during Jan. - Dec. 2000 (t/yr).

Month/Market	Kerala					Tamil Nadu				
	Mnr.	Ekm.	Alw.	Pbr.	Adly.	Mdu.	Cbm.	Bod.	Vpty.	Total
Jan.	70.2	40.4	50.6	11.8	-	65.2	-	-	-	238.4
Feb.	51.6	22.7	27.7	2.2	-	20.4	-	7.7	-	132.4
March	52.7	12.3	20.4	2.2	-	17.9	-	-	-	105.6
April	45.9	27.1	19.3	13.1	-	-	-	-	-	105.5
May	49.1	13.7	16.3	4.3	6.0	18.1	-	2.0	-	109.5
June	15.9	19.5	4.5	-	-	25.4	-	-	-	65.2
July	29.3	12.1	10.2	19.2	-	120.5	15.3	2.3	-	208.9
Aug.	91.9	16.3	76.3	41.5	-	405.4	179.5	2.1	25.2	838.2
Sep.	155.2	83.5	118.7	26.6	0.8	134.1	86.5	7.2	74.0	686.6
Oct.	43.6	69.9	84.3	-	-	112.8	28.9	25.7	90.6	455.8
Nov.	21.4	40.1	26.3	4.5	-	55.00	-	7.4	12.4	167.2
Dec.	33.4	13.2	16.1	4.0	-	64.5	4.7	4.5	-	140.3
Total	660.2	370.9	470.7	129.4	6.8	1039.3	314.9	58.9	202.2	3253
	1638.0					1615.3				
GT	3253.29									

It was found that almost equal quantities of vegetables were sold at Kerala and Tamil Nadu markets. During the year 2000, procurement of HORTICORP was maximum and that is not included in the Table.

In general the distance between the production and consumption centres was a great factor which decided the price that the produce gets.

Table 22. Average price realised in different crops (Rs.)

Crop	Average price (Rs./kg)
Potato	4.32
Cabbage	2.11
Carrot	5.96
Garlic	19.60
Beans	6.60
Peas	22.60
Butter beans	14.80

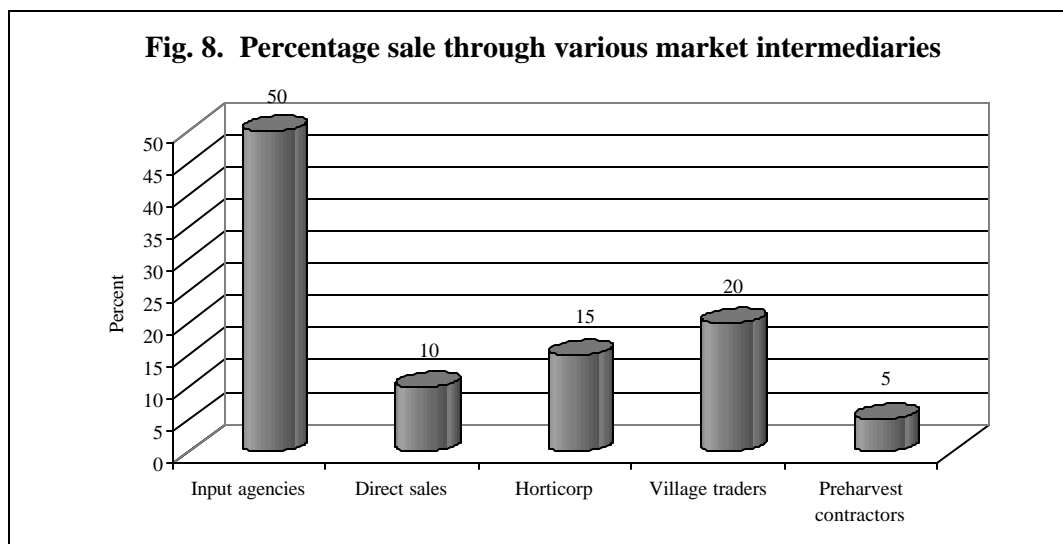
Prices of all vegetables fluctuate with seasons. Only garlic and butter beans get a stable price. But compared to the efforts put in the production, these prices are also not reasonable.

Market intermediaries and their share in marketing is given in Table 23 and Fig. 8.

Table 23. Market intermediaries

Intermediary	Share (%)
Input agencies	50
Village traders	20
Horticorp	15
Direct sales	10
Pre-harvest contractors	5

Only large farmers sell their produce directly in markets outside the district and state. In the marketing scenario again, input agencies dominate (Fig. 7). Often the farmer has no way to get the information regarding the prevailing market prices and is forced to dispose his produce (mostly perishable) without much bargaining. Here again the middle men mint money.



VIII. CONSTRAINTS IN AGRICULTURAL PRODUCTION

a) As perceived by the farmer

Constraints in agricultural production from the perception of the farmers is discussed below in their order of importance.

1. Low price for produce

The price realized is very low in most of the crops. Only garlic and butter beans get a stable price. In the case of potato, if rains come early and subsequently if an early crop is possible, better price is assured for the produce. For the late crop, farmers do not get good returns. Another problem is that the farmers are not able to get the latest market information due to lack of communication facilities and hence are not able to bargain with their produce. They are forced to believe what traders say and ultimately are forced to compromise. Being highly perishable in nature they can't store the produce also. It is the cabbage farmers who some times, not willing to accept the meagre prices offered by the traders allow their cattle to graze the cabbage fields.

2. Lack of marketing facilities

The farmer folk who earlier had not depended on market for their food needs are not aware of the market structure and its complexities even now. There is no proper planning on crops to be grown, seasons to be selected, markets to be sold etc.

When they grow crops full devotion is given to that and when the produce is ready only they think of disposal. By that time middlemen might have intervened and finally the produce is marketed as per their contract and conditions.

The HORTICORP came forward to procure the produce mainly potato and garlic during Onam season and during first procurement farmer were benefited by receiving ready cash from them. But during next year the procurement was not properly done and now the farmers have lost faith in them.

3. Lack of transport facilities

Transportation facilities are pitiable in this panchayat. This vast panchayath has tar roads only to the length of 8 km (Topstation - Koviloor). Vegetable cultivation is done in almost all the wards which are not connected by pakka roads. To the pazhathottam side up to OC division of Chittivurrai estate, road is tarred by Tata Tea. From here, Pazhathottam, Mammal, Chilanthiyar roads are not motorable during rainy season. People residing in these areas depend on the trip jeeps plying between Munnar and Chilanthiyar. The road which connects Vattavada and Pazhathottam is also not in good condition. The tribal settlements at Smamiyarala, Koodalarkudi, Melvalasapetty and Keezhvalasapetty are at present not accessible by vehicles. People here transport their inputs, and produce on pony loads. One pony load costs then Rs.100/- up to Koviloor. For transportation of goods to remote fields the villages also depend on ponys. Share of transportation charges is great in the cost of production of all most all vegetables especially in the Mammal-Chilanthiyar area and in the tribal hamlets.

4. High input cost

Inputs like seeds, fertilizers and PP chemicals are procured from far away places where again transportation cost is an added burden.

5. Pests and diseases

Modern seeds and technology have invited an array of pests and diseases in crops like potato and cabbage which farmers find difficult to manage due to a variety of reasons.

6. Problem of wild animals

Most of the crops grown here are favoured foods of elephants, wild boars, deer and rabbits. Security way of protective fencing or overnight stay in the farm land are essential to ward off the animals. Potato and cabbage farmers construct tree houses/sheds in the farm. One can't account for this overnight staying awake in the chilling temperatures.

7. Lack of irrigation facilities

Traditional farming was all rainfed. Now with modern crops and varieties which are more water demanding irrigation has become essential. National springs dried up in summer and crops suffer from drought situation is acute in the Chilanthiyar-Mammal area compared to other areas Kottekombur village and the tribal areas have assured water supply.

8. Climatic factors

The global changes in climate is manifested in this part of the state also. Unseasonal and frequent rainfall affects crop production to a great extent.

b) Constraints in agricultural production as identified in this study

The study has brought about the major constraints in agricultural production at Vattavada as discussed below. Constraints are discussed in their order of intensity (Plate 6).

1. Change in land use pattern

Large scale deforestation in the Vattavada area is a matter of great anxiety to all those who are concerned with human welfare. The pace of deforestation is alarming. A major factor responsible for deforestation is the large scale investment on monoculture tree plantations of eucalyptus and wattle. The biological productivity of this vulnerable hill ecosystem is undermined by these plantations.

It was after 1980's that modern farming technology and crops were introduced to this area on a mass scale. There was a sudden shift from sustenance farming to commercial agriculture which attracted outsiders to the area. By that time the Government agencies had already introduced eucalyptus and wattle plantations in this area mainly for the pulp industry. This resulted in conversion of a large extent of grasslands and

“Ottamaram”

This is a place name in Vattavada. In the earlier days a view from the Vattavada valley at Koviloor could sight a solitary tree high up the grass lands and thus the location got the name. Old records say that this huge eucalyptus tree was there from the 17th century onwards. Now, if one looks from the valley, the tree is not identifiable, because of the crowded eucalyptus plantations all around. The tree which stands on the trek path from Vattavada to Pazhathottam is now protected by the panchayat.

fragmentation of the existing forests. Interactions with outsiders induced undesirable cultural transformations in the society which diluted the cultural competence of the community to manage their land and resources. There was mass scale land transfer to outsiders, mostly from Ernakulam and Kottayam for subsequent conversion to eucalyptus plantations. Seeing the monetary benefits, the native people also started planting eucalyptus in their farm lands. Younger generation soon turned out to be the farm managers of these absentee landlords, earning money effortlessly. Now almost all the large farmers have converted part of their agricultural land to tree plantations. Upper areas like Chilanthyar, Mammal and Pazhathottam have vast stretches of private sector tree plantations. Rate of conversion was accelerated in the last decade.

In the tribal areas situation is different. Like in other places the tribal colonies have shifted their settlements many times for their own reasons and at present their farm lands are surrounded by tree plantations in the public sector. In the Valasapetty settlement the tribes complain about the loss of grasslands for their cattle to graze.

The net effect of these plantations, whether private or public was large scale deforestation and destruction of grass lands, and farm lands resulting in ecodegradation and desertification.

2. Lack of soil conservation measures

With the growth in population and expansion of cultivation, non traditional areas were brought under cultivation. Stable terraces which are ideal in hill slopes were replaced by unstable field cultivation without resorting to soil conservation measures. This resulted in wide spread soil erosion removing the entire top soil from high slopes.

3. Decrease in soil fertility

Maintenance of the fertility of the soil is the first condition of any permanent system of agriculture. In the ordinary process of crop production, fertility is steadily lost; its continuous restoration by means of manuring and soil management is therefore imperative. In the traditional farming practices soil fertility was maintained through the practice of mixed cropping, addition of crop residues and farm yard manure. Now the organic matter application has come down substantially largely because of decrease in cattle population. A major portion of the vegetables are raised on artificial manures and most often these are applied indiscriminately. The pressure on soil fertility has become intense. Either the existing fertility of the soil is cashed or a temporary substitute of soil fertility in the form of chemical fertilizers is done. The net result has been that agriculture has become unbalanced and therefore unstable. Even with the application of chemical fertilizers the crops failed to give their potential yield.

4. Decrease in water availability

Loss of vegetation cover coupled with drastic changes in climate affected the hydrological cycle of the area. With the degeneration of the vegetation (forests and grasslands) which safe guarded the water sources, the perennial streams dried up. With the expansion of water demanding eucalyptus plantations, water table still lowered. The steeply sloping hills devoid of the protective cover of vegetation or top soil could not absorb the rains and let off in a regular manner causing over flow of streams in rainy period. Once the rains ceased, the soil less hill slopes immediately drain up exposing themselves to further damage by desiccating dry winds. Unpredictability of the rainfall makes the gamble of agriculture riskier in Vattavada. Worst water scarce areas are Chilanthiyar and Mammal. Even potable water is scarce

here during summer. Various Govt. schemes have constructed overhead tanks for storing and diverting water, but most of these are not functional.

In the tribal areas water availability is satisfactory when compared to other villages.

5. Over use of pesticides and fungicides

With the introduction of new crops and the spread of artificial manures and exhaustion of the inherent fertility of the soil, there has been a corresponding increase in the pests and diseases which resulted in indiscriminate use of pesticides and fungicides. Cabbage and potato are the worst affected crops. Visual residues of these chemicals could be noticed on cabbages ready to market. Pollutive effects of these toxic chemicals may extend well beyond the agricultural production system.

6. Over dependence on F₁ hybrids

Hill agricultural system prevailing in this part of the region can accommodate only low input responsive varieties sustainably. Instead, the shift to high water, fertilizer and energy demanding crops has upset the balance of the system. The crops not only disrupted the natural resource base but failed to attain their targeted yield, because of the mismatching technologies.

7. Erosion of indigenous agro-biodiversity and farming practices

The hill ecosystem provided a variety of livelihood options to the rural population. These were made possible due to the diverse biological diversity. Commercialisation of this zone of late has drawn limits to these capabilities and degraded the biodiversity. Although many traditional stakeholders who directly derive their livelihood from the system value their biodiversity, the society at large, especially has chosen modern development programmes, under estimated its total economic value causing heavy damage to the environment.

This traditional agricultural area had practically entire spectrum of crops excepting a few tropical vegetables. This area used to have exceptional biodiversity of both the wild as well as the cultivated crops. The cultural competence to utilise and manage this diversity was rapidly diluted. Land management and crop husbandry expertise also degenerated.

8. Over dependence on input agencies for credit marketing and for technology information

The study indicated that input agencies are the real decision makers in the farming at Vattavada. When, what, where and how to grow a crop is actually decided by them. The farmer is often trapped without any options of his own. The efforts made by Govt. agencies in technology dissemination are usually neglected. The sincere efforts of local krishibhavan in organizing “harithasangams” gave good results in the beginning, but failed later. Free supply of organic manure for potato cultivation was almost totally ignored by the farmers. The blind faith of the innocent and ignorant farmer is exploited by the private money making agencies.

9. Inadequacies in the procuring system

In this remote less accessible trait, taking produce to the market is a huge task. Govt. interventions are inadequate. HORTCORP made some efforts to procure vegetables during Onam season by giving ready cash to growers from Koviloor and Vattavada area. But far away places like Pazhattottam and Chilanthyar were neglected. The subsequent procurements were ineffective and finally growers lost faith in them.

10. Inadequacies in agricultural technology dissemination system

Government machinery to disseminate timely agricultural technology information to the farmers is very weak. Extreme climate and the lack of transport, accommodation and communication facilities do not attract many people to work here. Continuity is lost in implementation and follow up action in many programmes which is so essential in this area to win the confidence of the people.

c) Suggestions for a viable agricultural production system for the panchayat

The transition from subsistence to commercial farming was comparatively recent (within the past 10-15 years). In the process of increasing out put, the area has lost forests, grass lands, and other natural habitats; soils have been depleted and water polluted.

Transition towards a viable and sustainable agriculture requires a shift in both practices and values. Agriculture has be the central part of community's

economic and social activity, with sustainability becoming an emerging property of whole community, catchment and landscape.

A successful blend of traditional as well as recent innovations is required which can be achieved only step wise.

1. Regenerative and resource conserving technologies

Regenerative and resource conserving technologies have to be brought back as a first step. They include

1. checking the spread of monoculture tree plantations
2. adopting soil and water conservation measures
3. incorporation of crops and trees that fix nitrogen (legumes, green manures, cover crops etc.)
4. organic manuring
5. compost making
6. Gobar biogas plants to meet the fuel and power requirements of the population in addition to the supply of nutrient enriched slurry as manure, and
7. use of alternative biological pesticides.

Apart from adopting these technologies certain priority areas discussed below are felt beneficial in improving the agricultural situation in the area.

2. Seed production technology for vegetables

Self reliance on seed requirement can be achieved with the introduction of available technology for individual crops. Seed farms can be started in the public sector or in the co-

Demonstration trial in potato

A demonstration trial was conducted in potato using the seed tubers produced in the farmers field. Seed tubers of uniform size (50 g) were used for sowing. There were three trials, two at Pazhathottam and one at Koviloor. Two treatments (Farmers seed and Mettuppalayam seed) were laid out, side by side. General performance of the crop was same in both the treatments. Even though one trial was vitiating due to wild boar attack, result of the remaining two trials indicated that potato seed tuber produced by the farmer himself at Vattavada were equally good in growth and yield to that purchased from outside. The seed to tuber ratio was 1:15 in local seed whereas it was 1:17 in Mettuppalayam seed. This is a clear indication of the possibility of potato seed tuber production at Vattavada.

operative sector. Quality seeds of potato, carrot, cabbage, cauliflower, beetroot, turnip, radish, peas and leaves can be produced here. Once the technology is introduced and accepted by the farmers seed production can be taken up at individual level also. Agencies who have expertise in seed production technology may be contacted and the programme may be implemented through the Department of Agriculture.

3. Cultivation of high value medicinal/aromatic plants

For meeting the cash needs of the society, medicinal and aromatic plants cultivation offers great scope here. Crops like geranium, rosemary, celery, marjara, isabgol, patchouli, aswagandhi, *Coleus forskholli*, celery, spring onion, lettuce can be introduced here for cultivation, accompanied by buy-back guarantee schemes.

4. Cultivation of subtropical fruit crops

Subtropical fruit crops like apple, pomegranate, peas, peach, plum, lime, lemon, oranges, passion fruit, avocado, litchi and mangosteen are suitable for this hill region. They can will be fitted into mixed cropping systems involving medicinal/aromatic plants.

5. Increasing area under food crops

Efforts are required to retain the present production of food grains viz., rice, wheat and ragi and even to increase the area under food grains to make the population self sufficient with respect to food.

6. Conservation of indigenous agro-biodiversity

The local wealth of agro-biodiversity have to be conserved and utilized by bringing them into the farming and food habits of the people. This will also help to attain household food security.

7. Formation of co-operatives

A concerted effort to start co-operative for giving credit and to arrange procurement and marketing facilities is highly essential in this panchayat. This could greatly stabilize and stream line the agricultural population system in the panchayat.

IX. CONCLUSION

It is farming that has given almost every landscape, community and environment throughout the world its distinctiveness. It is also modern farming that has taken it away. Today the peasants at Vattavada symbolize for all similarly situated peasants in the third world. There is increasingly good evidence to show that regenerative and resource conserving technologies and practices can bring forth both environmental and economic benefits to farmers, communities and nations. The best evidence comes from centres of Africa, Asia and Latin America. In these lands where farming has been largely untouched by modern packages of externally supplied technologies, farming communities adopting regenerative technologies have substantially improved agricultural yields often only using a few or no external inputs.

The structural integrity of the tribals as well as non tribal indigenous societies have been disrupted. Their knowledge systems, skills and machinery for collective responses have been devalued and undermined through this process of modern farming.

Mismatching technologies become disastrous when it is applied on a large scale in the belief that natural resources they are intended to manage are uniform. Over dependence on external resources is not only frequently costly but has lead to make the production systems more vulnerable to external stress and shocks. Such dependence has also lead to fundamental changes in the farming system that makes it more vulnerable to vagaries of local environment.

Biological resources are the basis of prosperity. Yet, the biologically rich Vattavada is the economically poorest in Kerala. Currently about 8000 people living in this hill area are dependant on land husbandry. Their very survival rests on agriculture. Initial awareness creation at the root cause of their own plight, de-schooling and re-schooling them on real farming and land husbandry are required which would increase productivity, create employment, ensure food security, generate income and elevate their standard of living. Crisis of the subsistence farmer is not restricted to Vattavada alone. All similar distant, inaccessible lands every where in the world have been and would continue to be sought after by seekers of wealth in the name of progress and prosperity.

X. DISSEMINATION SEMINAR

A district level agricultural seminar was organized jointly by the Kerala Agricultural University and the KRPLLD on 28-05-2003 at Government UP School, Koviloor (Plate 7). Main objective was dissemination of the findings of the study. The seminar was attended by the following persons.

1. Dr.A.Sukumara Varma, Dean, College of Horticulture, Kerala Agricultural University
2. Dr.S.Rajan, Officer on special duty, KAU seed authority
3. Dr.K.C.Aipe, Associate Director of Research (High range zone), KAU
4. Dr.E.V.Nybe, Professor and Head, Department of Plantation Crops and Spices, College of Horticulture, KAU
5. Dr.K.Vasanthakumar, Head, Cardamom Research Station, Pampadumpara, Idukky
6. Dr.T.R.Gopalakrishnan, Head, Department of Olericulture, KAU
7. Dr.Jim Thomas, Head, Department of Agricultural Entomology, KAU
8. Dr.Alice Kurien, Associate Professor, Department of Plantation Crops and Spices, College of Horticulture, KAU
9. Dr.P.C.Rajendran, Associate Professor, Department of Plantation Crops and Spices, College of Horticulture
10. Dr.Meagle Joseph, Assistant Professor, Onfarm Research Centre, KAU, Vadakkancherry
11. Shri. M. Murughan, Assistant Professor, Cardamom Research Station, Pampadumpara.
12. Dr.P.Haridas, Deputy General Manager (R & D), Tata Tea Ltd., Munnar
13. Sri.K.K.Chandran, Joint Director of Agriculture, Idukky
14. Sri.S.Vijayaraj, Assistant Director of Agriculture, Devikulam, Munnar
15. Agricultural Officer, Krishi Bhavan, Vattavada
16. Dr.P.R.Gopinathan Nair, Programme Advisor, KRPLLD, CDS, Thiruvananthapuram
17. Sri.T.P.Sreedharan, KRPLLD, CDS, Thiruvananthapuram
18. Dr. N.C. Narayanan, KRPLLD, CDS, Thiruvananthapuram

19. Dr.G.Gopikuttan, Head, Dept. of Economics, NSS College, Panthalam
20. Dr.G.Cristopher, Programme Officer, KRPLLD, CDS, Thiruvananthapuram
21. President, Vice president, Ward members, standing committee chairperson and block panchayat members of Vattavada
22. Village, panchayat, school, DPEP, ITDP and Anganwaadi staff, officials of Forest, Health and Agriculture department and
23. Farmers.

The principal investigator presented the salient findings of the study, focusing on the constraints in agricultural production and suggestions for improvement. There was discussion on the problems faced by farmers. A critical review of the study was given by Sri.S.Vijayaraj, Assistant Director of Agriculture, Devikulam. Experts on various aspects elaborated on relevant topics. State department of Agriculture offered their services for improving agriculture at Vattavada. The Kerala Agricultural Univeristy offered to conduct evaluation trials in vegetables and seed production trials in select crops. Farmer and then elected representatives also extended their full co-operation in making agriculture viable at Vattavada.

In appreciation of the sincere efforts undertaken by the KAU and the principal investigator, the panchayat honoured the Principal Investigator and Associate Dean by presenting golden shawls.

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