ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF MUSHROOMS

By

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CERTIFICATE

Certified that this thesis, entitled **"Economic analysis of production and marketing of mushrooms"** is a record of research work done independently by **Mr. Renjith Raja R,** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, fellowship or associateship to him.

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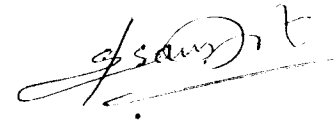

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Dedicated

To

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Introduction

I. INTRODUCTION

India is largely an agricultural country with 2.4 per cent (3 million sq. km) of the world's aerable land and with which to feed 16 per cent (950 million people) of the world's population. The population of India has a present growth rate of two per cent per annum and has reached one billion by 2000 AD. To feed the growing population with available food grains is arduous, as it is not possible to bring additional land under cultivation. Along with population explosion malnutrition is also invading our human wealth.

World average per capita food-energy consumption is 2800 calories per day as against 1998 calories in India. Consumption of proteins is also lowest in India (49g/day/ against 107 g in USA, 93 g in Japan and 91 g in UK) with a large proportion of vegetable origin. In order to abridge malnutrition all possible sources of protein production shall have to be exploited. One possible alternative is mushrooms (Sharma and Gupta, 1993)

According to the Indian council of medical research (ICMR), a balanced diet should have nearly 280 grams of vegetables including tubers and 90 grams of fruits per day. However, the average Indian consumed only 46 grams of fruits and 92 grams of vegetables in the eighties, which has now marginally improved in the last five years, particularly in urban areas due to higher income levels following economic reforms (Kaul, 1997). As per the recommendations of the ICMR, India will need about 60 million tonnes of fruits and 131 million tonnes of vegetables by 2002 to meet the requirement of population of about one billion. A well-balanced food along with minerals and vitamins promotes sound health and thus provides healthy manpower base for national development. In this necessary circumstance food having high nutritive value, especially edible mushrooms deserves mention as an alternative source of protein. Projections show that India needs about 4.5 lakh tonnes of mushroom with the major share going for processing industry.

Mushrooms are non-green edible fungi occurring seasonally all over the world in various habitats varying from sandy plains to thick forests. Being rich in

proteins, minerals and vitamins mushrooms are used as food from time immemorial. As food, its nutritive value lies between meat and vegetables, with twice the protein content found in vegetables except legumes (2-3 per cent). This protein has high digestibility of 70-90 per cent, (Maw and Flegg, 1975) and contain most of the essential amino acids (Rai and Sohi, 1988). The UN Food and Agriculture Organisation has recommended mushrooms as food supplementing proteins in developing countries where population depends heavily on cereals for food. Being low in fat and sugars, mushrooms are said to have anti-cancer properties according to the findings of the National Cancer Research Institute of Japan.

Mushrooms are important not only from nutrition point of view but also for disposal of agricultural wastes. Mushrooms lack chlorophyll and hence they thrive on dead and decaying matter. Presently, India produces annually 300 million tonnes of agricultural wastes of which only a part is used as cattle feed. If mushrooms are grown on these agricultural wastes, it will not only reduce environmental hazards by helping disposal of wastes but also convert these wastes into useful protein-rich food.

During recent years the world production and consumption of oyster mushrooms is reported to have increased tremendously. During 1990 its contribution is estimated to 24.1 per cent of the total world production of commercial mushrooms, ranked second to the button mushroom which shared 37.7 per cent (Bahl, 1995).

Mushroom cultivation is an ideal occupation for landless labourers and small and marginal farmers due to its indoor habitat, grows independently of sunlight, feeds on organic matter and requires no fertile soil. In addition to floor space, air space is also utilised profitably. It is a labour intensive indoor activity that can provide gainful employment to unemployed/under-employed people particularly women and the weaker sections of the society.

Prior to artificial cultivation of mushrooms, they used to be gathered from farmlands, fields, forests and meadows frequented by cattle and from haystacks and manure pits. Out of 2000 species of prime edible mushrooms, 80 have been grown experimentally, 20 are cultivated commercially and four to five species are produced on industrial scale throughout the world. White button (*Agricus bisporus)*mushroom,

oyster(*Pleurotus sp.)*mushroom, Woodear (*Auricularia sp.)*mushroom, Shiitake (*Lentinus edodes)*mushroom and Paddystraw (*Volvareilla volvacea)* mushroom are the important ones.

1.1. Mushroom production in India –past efforts and present status.

India started organised efforts in mushroom cultivation much earlier than the other countries, as early as 1939, in the Madras Presidency with straw mushrooms. The Indian Council of Agricultural Research (ICAR) started a scheme in Himachal Pradesh in 1961. The assistance from the Food and Agricultural Organisation (FAO) was received by the Government of India in 1966 for the development of white button mushroom. In 1982-83, an India –Holland project was started in Solan, Himachal Pradesh with the National Centre for Mushroom Research and Training (NCMRT) by the ICAR. NCMRT and Dr.Y.S. Parmar University of Horticulture and Forestry, Solan, HimachalPradesh have been the main centres of mushroom research training in India. Similar efforts were initiated by ICAR in other states with the sanctioning of All India Co-ordinated Mushroom Improvement Projects (AICMIP) in WestBengal, UttarPradesh, Punjab, Rajasthan, MadhyaPradesh, Maharashtra and TamilNadu since 1983.

Besides these all India efforts, the respective Agricultural Universities and Department of Horticulture in various states cater to the research and training needs of mushroom cultivation. Since 1989, the Agricultural and Processed Food Products Export Development Authority (APEDA) has been entrusted in encouraging investment in the private sector by providing market intelligence and data base to interested mushroom growers in India. Export Oriented Units (EOUs) viz., Ponds India (Pvt.) Ltd. at Ooty, TamilNadu, Flex at Dehradun, UttarPradesh, Tegs unit at Himachal Pradesh, Transchem Ltd. at Pune, Zuary (Farms and Foods Pvt.) Ltd. at Goa and Saptharshi Agro Industries Ltd. at Chengelpet in TamilNadu are involved in production and export of button mushrooms.

In spite of several efforts being made from time to time in India, none of these had a major break through as in Taiwan, Korea and China. India hardly figures in the list of world exporters of mushrooms, since the exports are of a negligible quantity of canned button mushroom which is collected from forests in North India.

The history of mushroom cultivation in different states in India presents a dismal picture of erratic crop production, repeated crop failures, high cost of production and narrow market. The three commercially important mushrooms grown in the country are white button, oyster and paddy straw mushroom. The country has predominantly tropical climate, while white button mushroom which contributes to 90 per cent of mushroom production in the country is a temperate species. Hence, its cultivation is confined to northern states dominated by Himachal Pradesh, Uttar Pradesh, Haryana and Punjab. Of late, entrepreneurs and growers from southern states viz., Karnataka, TamilNadu, Kerala, Andhra Pradesh and Maharashtra have taken up oyster and paddy straw mushroom cultivation.

1.2. Mushroom production in Kerala

The utilisation of mushroom as food is closely related to the history of mankind. Oyster mushroom (*Pleurotus* sp.) and paddy straw mushroom (*Volvariella* sp.) are the most common types grown in Kerala. Though white button mushroom (*Agaricus bisporus*) is also preferred by consumers, it is not popular among growers because white button mushroom is a temperate species and consequent lower bio-mass production in tropical conditions.

The availability of agricultural wastes in abundance and moderate climate prevailing throughout the year are ideal for mushroom cultivation. Kerala with its ideal tropical climate is quite suitable for the research and development activities in the field of mushroom.

Considering these factors, MithraNiketan, Vellanad, Thiruvananthapuram and College of Agriculture, Vellayani have been pioneering training programmes in mushroom since 1980. The prevalence of mushroom growers has resulted in a "Kerala Mushroom Growers Association" with Vizhinjam, Thiruvananthapuram, as its headquarters.

Oyster mushroom (particularly *Pleurotus sajorcaju)* has become very popular and many growers are engaged in its cultivation in Kerala. Its cultivation has been standardised on locally available paddy straw. Mushroom laboratory for spawn production was set up at the college of Agriculture Thiruvananthapuram. Training on

spawn and mushroom production to interested persons are also provided at the college of Agriculture, Vellayani and MithraNiketan, Vellanad, Thiruvananthapuram. Mushroom production in Kerala is likely to increase further due to the fact that more projects are expected to come up for exports as well as for domestic market in the future.

1.3. Objectives of the study

With this background the present study was taken up with the following objectives.

1. To work out the economics of mushroom production
2. To estimate employment generation potential of the enterprise
3. To study the marketing channel and marketing margins
4. To identify the constraints in mushroom production and marketing.

1.4. Scope of the study

Mehta (1993) while studying the scope of mushroom cultivation in India observed that this activity not only offered nutritious food for the growing masses but also put less pressure on the cultivable land as compared to agricultural produce.

Land is a very scarce factor as far as Kerala is concerned as she has to support about 4 per cent of the Indian population in about 1.03 per cent of the country's area. Being an indoor crop, mushroom had the added advantage of using aerial space and its production per unit area was always higher than that of other vegetables. Since it is a short duration crop, it is an open opportunity for all strata of society including women and children. Kohli (2000) reported that the whole coastal areas of India running into thousands of kilometers is a potent place to produce low cost mushrooms which could eradicate protein deficiency and malnutrition besides bringing an export market. Yet, the number of mushroom growers in Kerala has been declining in the recent years. Studies on the economics of mushroom production and marketing are very limited. The present study may throw light on the economic aspects and related constraints of mushroom production. It may also help the policy makers in analyzing the supply condition and drawing meaningful inferences.

1.5. Limitations

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

1.6. Plan of the work

The thesis is divided into seven chapters including the present one. The review of past studies in the related field is presented in chapter II. The third and fourth chapter deals with description of the study area and the methodological aspects respectively. This is followed by presentation of the results of the findings in Chapter V. The detailed discussion of the results is attempted in Chapter VI. The summary is given in chapter VII.

Review of Literature

II. REVIEW OF LITERATURE

This chapter presents a review of various past work relevant to the present study. The review, it is hoped, would throw light on the present status, strengths and weaknesses of the existing studies on the topic, from the points of view of methodology as well as substance. The review is presented under the following headings:

i) Economics of mushroom production

ii) Marketing of mushrooms

iii) Constraints in production and marketing of mushrooms

iv) Consumption pattern of mushroom

2.1. Economics of mushroom production

The economics of mushroom enterprise is analysed on the basis of the returns from mushroom production after accounting for the various costs. The volume of investment and returns varies with the type of mushroom produced. Hence, the reviews were categorized under the three subheadings as follows:

a) Economics of button mushroom production

b) Economics of oyster mushroom production

c) Economics of paddy straw mushroom production

2.1.1. Economics of button mushroom production

Kaura (1973) estimated the economics of a commercial button mushroom farm with 800 trays of 400 sq.mt bed area taking four crops in a year at the Mushroom Research Institute, Solan, Himachal Pradesh. He indicated that the non-recurring expenditure including the building, steam boiler, exhaust fans, ventilation ducts, insulation charges, fittings for electricity and water, containers for compost preparation etc., amounted to Rs.1,26,400. The recurring expenditure consisting of compost, spawn, labour charges, power and water charges, etc. amounted to Rs.40,040 per annum for four crops. The yield achieved at the rate of 6 kg per sq.mt with four crops a year was 9,600 kg. The net annual income worked out to Rs.18,990,which is approximately Rs.1,603 per month.

Delcaire (1978) compared the economics of production of white button (*Agaricus bisporus*) mushroom in the developed and developing countries. He reported that the production costs as $0.83-0.88 (U.S. dollars) per kg in Western countries as against average of $ 0.42 kg in Taiwan. He further reported that canning costs also varied between different countries with $ 20-21 (U.S) per 100 cans in Asiatic countries as against $ 24 in France.

Rai and Bhatia (1981) analysed the economic viability of mushroom farms using the break-even volume techniques. For this purpose, mushroom growers are classified as small, medium and large growers based on the spawned space per season. It was reported that large farmers having more than 400 square meter space spawned per season had to produce 3,781 kg of mushroom, medium farmers with 200 to 400 square meter space spawned per season had to produce 688 kg and small farmers with less than 200 square meter space spawned per season had to produce 189 kg of mushroom to meet their total expenses.

Shandilya and Agarwala (1982) compared the yield response and economics of white button mushroom production in insulated mushroom houses under controlled environment (physical and climatic) conditions (CEC) i.e., maintenance of temperature, humidity and regular air supply during cropping and in mudhouses under natural environment conditions (NEC). They indicated that the yield in CEC was higher as compared to the NEC by 115 kg in 50 sq.meter floor area, but the cultivation in NEC was successful with a capital investment of Rs. 2,422 per 100 trays which is less than that required for CEC. The net income in CEC was only Rs. 5,443 for 100 trays, when compared to NEC which gave a net income of Rs. 5,795.

Santiago *et al.* (1983) studied the economics of cultivation of temperate mushroom (*Agaricus bisporus*) in air conditioned room in Philippines. The results indicated that although using artificial cooling system in lowland cultivation of mushroom was expensive compared to commercial production in Baguio city, the return in investment was still good.

Kapoor *et al.* (1984) analysed the economics of button mushroom cultivation in Solan and Shimla districts of Himachal Pradesh. They classified the

selected 24 farmers on the basis of number of trays owned by them. Farmers having less than 250 trays were classified as category A and having more than 250 trays as category B. The total investment on an average farm having 211 trays was more than forty nine thousand rupees. The expenditure on civil works accounted for more than 77 per cent of the total investment on fixed assets. The average number of crops taken by all the growers was estimated to be 2.42 per annum and the average cost of cultivation for 2.42 crops per annum was Rs.34,436. The cost of cultivation per kilogram was estimated to be Rs.24-38. The annual gross-income of the mushroom grower with an yield of 2394 kgs was more than forty three thousand rupees. After meeting all the expenses incurred in the cultivation of mushroom, the average grower was earning about Rs.8,700 per annum and the average output-input ratio was 1.25.

Shandilya (1985) compared the yield and economics of button mushroom cultivation in polythene sacks and wooden trays under Solan condition in Himachal Pradesh. The average yield on the basis of four crops in winter months in a year was 12 kg per 80 kg of compost in polythene sacks compared to 12.8 kg per kg of compost in wooden trays. The capital cost was Rs. 31,000 and Rs. 23,000 respectively in the cases of wooden trays and polythene sacks. The recurring expenditure amounted to Rs. 4,650 and Rs. 4,950 in the case of wooden trays and polythene sacks respectively. The net returns after deducting the recurring cost, depreciation and interest charges from the gross income amounted to Rs. 2,804 and Rs. 3,656 respectively in the two cases. Hence, additional income of about Rs. 855/- could be ascertained from mushroom cultivation in polythene bags as compared to wooden trays, in winter months.

Chhabra (1987) studied the status of mushroom cultivation in Haryana state and indicated that mushroom production units were highly concentrated in Badana village of Sonepat district. Out of the 63 units, about 50 units had an annual turnover of Rs. one lakh, with the estimated production of 840 tonnes of fresh mushroom, valued at Rs. 1.68 crores. Badana village itself contributed 30-40 quintals of mushrooms per day.

Kapoor *et al.* (1987) studied the economics of button mushroom cultivation in Solan and Shimla districts of Himachal Pradesh. They estimated that the total investment on an average farm having 211 trays was about Rs. 4900. After meeting

all the expenses incurred in cultivation of mushrooms, the average grower was left with a net profit of about Rs. 8,700 per annum. The output-input ratio was found to be 1.25.

Ku and Lee (1989) gave the breakup of production cost for growing mushrooms in a plastic mushroom house with a bed surface area of 165 square meters in Taiwan during the crop year of 1985-86. The mean production costs of the farmers in ten villages indicated that mushroom growing in Taiwan was a labour-intensive, but energy-saving business. Expenditure on labour ranked first among all production costs, while that on materials and depreciation of mushroom houses ranked second and third respectively.

Tewari and Kapoor (1989) attempted an economic analysis of mushroom cultivation in Shimla and Solan districts of Himachal Pradesh. They found that compost was one of the main items of costs. It accounted for 43 per cent of the total costs followed by over-head cost (26 per cent) and labour 16 per cent). The study indicated that on an average the output-input ratio was 1.05. The rate of return on capital and net return were more in large farms than in medium and small ones due to economies of scale.

Prakash and Tejaswini (1991) studied the economics of medium sized white button mushroom farm around Bangalore with 600 trays taking 4 to 5 crops per annum. The gross yield obtained was 9450 kilograms with an average yield of 3.5 kg/tray The gross return estimated was Rs. 2,36,250 when it was sold at Rs. 25 per kilogram.

Chauhan and Sood (1992) estimated the economics of mushroom production in Kangra district of Himachal Pradesh and indicated that the total cost of mushroom production per ton of spawned compost worked out to Rs.2,416. The cost of production per kilogram of mushroom in small, medium and large farms were Rs.21, Rs.20 and Rs.21 respectively. The benefit cost ratio was found to be the highest (1.15) for medium farms as compared to small (1.08) and large (1.07) farms.

Suhag (1992) studied the importance of mushroom cultivation in Bhiwani district and opined that mushroom production as a subsidiary occupation lessened the farmer's dependence on main crops and provide subsidiary income. The venture sustained farmers during unfavourable circumstances, besides providing gainful employment to the family members.

While estimating the economics of cultivation of white button mushroom Vijay and Gupta (1994) observed that the non-recurring expenditure amounted to Rs. 14,000 and recurring expenses as Rs. 16,685. The yield was calculated at 12 per cent conversion, i.e., 1.2 tons from 10 tons of compost, sold @ Rs.30/kg resulted in a gross income of Rs. 36,000.The net profit after accounting for recurring expenses, depreciation and interest charges was Rs. 18,145 per year. The authors further analysed the economics of button mushroom cultivation by purchasing pasteurized compost from and observed that 57 per cent of recurring expenditure was spent on spawned compost. However, a net income of Rs. 11,800 could be earned in 3 months if pasteurized compost was used for growing mushrooms under Solan conditions.

Singh and Chaube (1995) estimated the economics of large scale controlled mushroom project with the capacity of 250 tonnes of mushroom per annum in Uttar Pradesh. They indicated that a net income of Rs. 45,00,000/- per annum could be earned with 100 per cent capacity utilization of the unit.

Singh and Kalra (1995) reported that the total cost of production of mushroom in Sonapet district of Haryana varied from Rs.21,395 in small farms (<800 trays), Rs.36,003 in medium farms (800-1400 trays) to Rs.60,748 in large farms (>1400 trays). Among the total costs, mud house formed the major component (21 per cent) as it was the main constituent of mushroom production. Among the variable costs, the compost accounted for the highest share in total cost (25 per cent). The small growers were found to earn Rs.15,275 as net returns over a period of six months while the medium growers earned Rs.38,287 and the larger growers earned Rs.91,252. The benefit-cost ratio was found to be the highest (2.50) in large farms as compared to small (1.61) and medium (2.06) farms. This indicated that large growers were most efficient in utilizing the resources required for mushroom production by spending the minimum to produce one kilogram of mushroom compared to medium and small farms.

While estimating the profitability of growing button mushroom in Punjab during winter (Oct-Mar) Kapoor *et al.* (1996) indicated that the total cost of the project with the capacity of 400 quintals of ready compost for spawning on 700 square meter of bed area involved Rs.1,53,000. The input cost calculated by accounting the full working

capital (Rs. 82,000) and 33 per cent as the depreciation of the construction cost worked out to Rs. 1,06,000. The net profit earned by the grower was Rs. 76,000 per crop.

2.1.2. Economics of oyster mushroom production

Sharma and Jandaik (1981) analysed the yield potential and economics of *Pleurotus* (Oyster) cultivation on wheat straw under Solan conditions. The total yield recorded from five flushes was 1264 gms per 1250 gms of wheat straw on dry weight basis in one bag. The total cost of cultivation with 200 bags per crop was Rs.1,450 including the cost of wheat straw, polythene bags, spawn, labour, water, electricity, pesticides and fungicides. The income @ Rs.10 per kg of mushroom was Rs.4,000. The cost of cultivation per kg of fresh Dhingri using wheat straw was Rs.3.50. Hence after investing approximately Rs.1,500 one could get returns worth Rs.4,000 in 65 days time.

In a study on the prospects of mushroom cultivation in India, Prakash *et al.* (1986) opined that mushroom could be cultivated on various scale ranging from a farm with 600 trays taking 4 to 5 crops per year to a small household of 30 beds with only one crop per year using one tonne of paddy straw. They observed that by using one tonne of paddy straw 100 kg of mushroom could be produced at a cost of Rs. 700. They indicated that diseconomies of scale operated in mushroom when cultivated on large scale countering the economic normalities. The benefit-cost ratio declined from 1.90 to around 1.60 when the production unit increase from 100 kgs mushroom to around 9000 kilogram mushroom, because of high and sophisticated investments.

Balasubramanian (1991)estimated the economics of spawn production and oyster mushroom cultivation with the production capacity of 5 kg per day i.e., 1,800 kg mushroom per annum. The capital investment amounted to Rs.11,000/-and working capital to Rs.13,200/-. The farmer with an anticipated yield of 1800 kg mushroom per annum could earn a net profit of Rs.17,200/-.

In a study on the cultivation of Oyster (Dhingri) mushroom in Haryana, Madan and Thakur (1991) found that oyster could be grown on a wide variety of substrates like wheat and paddy straw, saw dust, maize stalks, dried leaves and wastes from food industries which were easily available and cheap. The mushroom yield per unit of substrate varied from 2-3 kg, per 10 kg of substrate (wet basis) and the cost of

production of about Rs.4-8 per kg of mushroom was less than half in comparison to the selling price.

Prakash and Tejaswini (1991) estimated the economics of a medium sized oyster mushroom farm taking 20 crops per annum around Bangalore. The non-recurring expenditure amounted to Rs.1,610, while the recurring expenditure was estimated at Rs.50,000. The yield of mushroom @ 0.3 per cent was 4800 kg when sold @ Rs.15 per kg earned Rs. 72,000/-. The gross margin after deducting the variable cost was Rs.20,390 per annum.

A report by the Maruthi Agro Biotech Poultry consultants in Bangalore (1993) suggested that oyster mushroom cultivation could give a big aid to poultry farmers with additional income at times of crisis like the disease outbreak, fluctuating feed and chick costs, marketing upheavals etc. Vacant poultry sheds could be used and mushroom cultivation did not require extra labour. Besides poultry litter was an essential ingredient in mushroom cultivation for making compost.

Pahil (1994) analysed the techno-economic feasibility of mushroom production in Haryana and indicated that the total working capital incurred towards two crops of oyster and one crop of button mushroom production was Rs.33,811. The gross income per annum earned was Rs.67,700 while the net profit was Rs.33,900.

Vijayakhader (1994) analysed the feasibility of spawn multiplication and oyster mushroom cultivation by rural women in Bapatla. The study revealed that the cost of spawn multiplication in 100 bottles involved non-recurring expenditure of Rs.5,825. The estimated cost of cultivation of 2 kg of mushrooms per bed was Rs.15.30. The gross income from 2 kg mushroom @ Rs.30 per kg worked out to Rs.500 while the net income was Rs.45/-.

Lalitha (1996) worked out the economics of oyster mushroom cultivation and indicated that the total cost of producing 2 kg mushrooms was Rs.15 with a gross income of Rs. 60. The net income of Rs.45 obtained was therefore very profitable to growers.

2.1.3. Economics of paddy straw mushroom production.

While assessing the economics of paddy straw mushroom cultivation in south India, Peethambarn (1977) found that a bed of average size, made out of 10-15 kg straw yielded 3-4 kg mushrooms. The total cost involved in making a bed worked to Rs. 20/-. A crop of 4 kg mushroom @ Rs. 10/kg fetched Rs. 40/- within a period of 15 days.

Prakash and Tejaswini (1991) estimated the economics of paddy straw mushroom on a small seasonal farm taking three crops per annum around Bangalore. They reported that the total cost incurred was Rs. 4,010. The yield from 3 tonnes paddy straw resulted in 360 kg of mushroom. The gross income, from the sale of 360 kg mushroom @ Rs. 15 per kg, was Rs.5,400 with a net income of Rs. 1,390.

Phutela and Gupta (1995) analysed the economics of paddy straw mushroom cultivation under Indian conditions. They indicated that a grower could start a cottage scale growing unit with an initial investment of Rs. 5,500 and earn a net profit of Rs. 2,675 by growing five crops in a growing season.

2.2. Marketing of mushrooms

Munjal (1982) observed the prospects for commercial cultivation of *Pleurotus sajor caju* in India. He reported that a wild variety of this mushroom namely Kabul variety (*Pleurotus eryngii var. tesselatus*) fetched very high price in the markets of North India but it was not successfully cultivated.

Farr (1983) while analysing the diversification of mushroom industry with additional species in the US, indicated that wild mushrooms were a common sight in the produce market in many countries of Europe. But, of the many edible mushrooms only few were successfully cultivated as vegetable crop. Two important species *Agaricus bisporus* and *A. bitorquis* and *Lentinus edodes* accounted for 73 per cent (6.7 lakh tonnes) and 14 per cent (1.3 lakh tonnes) respectively of the total world market of 9, 16 lakh tonnes of cultivated edible mushrooms in 1975.

Chhabra (1987) observed that mushroom growers in Badana village of Sonepat district (Haryana) sold their produce at the rate of Rs. 18 per kg directly to

"KAEYTIS Canners". In the neighbouring city like Delhi the retail price ranged from Rs. 30 to Rs. 40 per kg resulting in higher market margin to middlemen. Hence, the author suggested that there was a need for intervention by the central agencies like NAFED, NDDB, etc., to bring down the consumer prices.

Ganney (1989) studied the status of mushroom marketing in U.K. and indicated that outlets for mushrooms were diverse although individual percentages for various sales outlets changed depending on market penetration or social changes. The author identified that 60 per cent mushroom sales of U.K. was through retail outlets, 33 per cent through catering or food processing outlets and the remaining small proportion directly to cans, during the period 1984-85. Although the information on the penetration of imported mushrooms was limited, the author opined that there was a growth of supplies to the larger retailers. Until 1985, retailers were mainly supplied with U.K. produce but in 1986, 26 per cent of mushrooms sold were produced at Holland.

While studying the marketing of mushrooms in Taiwan, Ku and Lee (1989) observed that the farmers had to bring their produce to mushroom collection stations in the production areas for weighing and removing casing soils. The canners or frozen-food factories sent lorries to the stations to collect mushrooms for processing once a day in the morning. The farmers were allowed to sell 50 kg of mushroom from a bed surface of 3.3 sq. meters at a guaranteed price. Mushroom beyond this quantity were usually sold to domestic fresh markets through regional distributor at variable prices.

While examining the role of rural women in mushroom cultivation, Pandey and Tewari (1990) reported that rural women could play a vital role in popularising mushrooms as protein-rich vegetable among the rural population. The marketing avenues being better for mushrooms in urban areas, rural women could form effective marketing links with the former cultivating the mushrooms and the latter helping to market them. They suggested that efforts should be made to popularise products like mushroom pickles, mushroom powder for soups etc., in order to develop mushroom marketing.

Chadha (1992) reported that mushroom market in India was largely accounted for by small and marginal farmers and more than 75 per cent of the annual

compared to channel I, the reason for this was attributed to the less number of intermediaries and less wastage due to direct marketing to the consumers.

Peters (1996) reported that the German mushroom production amounted to 57,000 tonnes in 1995 (1992 – 60,000 tonnes). But under more difficult market and price conditions, the production of mushrooms had decreased and was static since 1994. The author further reported that around 75 per cent of the crop was sold at the fresh market and the rest was processed predominantly as bucket mushrooms (blanched) for restaurants, caterers and pizza toppings. Observing the influence of increasing imports from Netherlands to Germany, the author opined that profit margins and prices for fresh mushroom were dependent on the quantum of Netherlands delivery.

Szmidt (1996) in his survey on marketing of mushrooms in Scotland reported that the prices varied considerably from £0.22/kg to £2.02/kg. Factors governing the mushroom prices identified by the author were the nature of outlet and grade of product. The various market outlets for mushroom in Scotland were wholesale, supermarkets, direct sales, farm gate sales, food processing and secondary wholesales. Contract sales and end users, such as caterers, held the middle ground of prices. Most mushroom farms in Scotland sold produce through more than one route.

2.3. Constraints in mushroom production and marketing

Paludan (1950) studied the difficulties of mushroom growing in Denmark and their influence on the general success of cultivation. He indicated that the cultivation of mushrooms failed due to the absence of cleanliness, ventilation and difficulty in sale of fresh mushrooms as consumers had got used to tinned mushrooms which fetched a low price.

Atkins (1955) studied the problems of mushroom growing in Great Britian and reported that the ever-present problem was the steady fall in the price of the mushrooms and the opposing tendency of cost of raw materials, particularly labour to rise. Most British growers were on a comparatively smaller scale and cost reduction by mechanization was limited.

Carey (1972) pointed out that during the production of mushrooms a moment's carelessness would virtually wipe out an expensive crop. In a similar manner,

large chunk of the profit. Lack of proper canning facility limited the export of mushrooms.

While commenting on the mushroom industry, Rai and Sharma (1994) remarked that mushroom growth in India was slow compared to other countries because, only the hills were considered suitable for cultivation. But these areas were backward and far from the main consumption centers. Nearly all the mushroom production was in the hands of generally ill trained small and medium growers who were susceptible to price and supply fluctuations. This often resulted in high cost, crop failure and unremunerative prices.

While studying the marketing and post-harvest management of paddy straw mushrooms, Phutela and Gupta (1995) found that the shelf-life of the straw mushroom was about 3 days when kept at 10-15°C. It deteriorated rapidly both at very low (4°C) and high (30°C or above) temperatures. Hence, marketable fresh mushrooms was to be disposed off quickly or to be dehydrated or processed into pickles to enhance its shelf-life. The authors reported that paddy straw mushroom due to its dark grey colour found limited acceptability in India, though it was nutritionally as rich as any other highly priced mushroom.

2.4. Consumption pattern of mushroom

Munjal (1982) indicated that mushrooms being highly perishable in nature was quickly moved to market as over 10 per cent of the produce was consumed fresh. Besides, various operations connected with the growing and disposal of mushroom crop, especially pickling of the mushrooms needed lot of labour.

Farr (1983) while discussing the possibilities of making additional species of mushrooms to consumers in US reported that out of 27 vegetables tested in Agricultural Statistics 1981, only lettuce and tomatoes had a higher cash value compared to mushrooms. But *Agaricus brunnescens* was the only fresh mushroom generally available in grocery stores in the US, while other countries such as Japan had a much greater variety of mushroom available to the consumer.

Rai and Sharma (1994) while observing the world demand and consumption cited that the group of six countries (G-6 countries), accounted for about 85 per cent of the world consumption. While USA consumed 30 per cent of the produce Germany, UK, France, Italy and Canada consumed 17 per cent, 11 per cent, 11 per cent, 10 per cent, 6 per cent respectively and the rest of the world consumed the balance(15 per cent). Though the USA, the biggest market for mushrooms from Asia preferred processed (canned) mushrooms, there was slight shift towards fresh mushrooms.

Vinay (1996) while analyzing the international consumption pattern of button mushroom reported that the USA topped the list accounting for 30 per cent of the consumption of *Agaricus* in 1990 followed by Germany (17 per cent), UK, France and Italy (11 per cent each) and Canada (6 per cent). Germany had the highest per capita consumption of 3.28 kg/head/year followed by France and UK (2.57 kg) and Canada (2.92 kg) and Italy (2.51 kg). Countries like the UK and Italy doubled their per capita consumption within a span of a decade from 1980 to 1990. Increasing availability of mushrooms coupled with increased awareness seemed to be the main reason for increase in per capita consumption.

Area of study

3. AREA OF STUDY

The present study was undertaken in Thiruvananthapuram district, as mushroom growing units on commercial basis are well established in this district. Thiruvananthapuram the southern most district of the state is situated between north latitudes 8°17' and 8°51' and east longitude 76°41' and 77°17'. It is bounded on the north by Kollam, Tirunelveli district in the east, Kanyakumari district in the south and the Arabian sea in the west.

3.1 Area

The district has four taluks, viz., Chirayinkeezhu, Nedumangad, Thiruvananthapuram and Neyyattinkara. The area of the district is 2192 sq.km. which accounts for 5.64 per cent of the total area of the state.

3.2 Land utilisation pattern

Land utilisation pattern in Thiruvananthapuram district is given in Table 3.1. It can be seen that nearly 23 percent of the land is covered under forests. More than two-third of the geographical area (67.08) is put under agricultural uses, with negligible area under cultivable waste and fallow.

3.3 Climate and Rainfall

Heavy annual rainfall, high humidity and more or less uniform temperature throughout the year are the climatic features of this district. Mean maximum temperature varies around 29.5°C to 34.9°C and mean minimum temperature around 22.8°C and 26.3°C. It receives both south west monsoon and north east monsoon. There are four seasons, the dry weather from December to February, hot weather from March and May, South west monsoon from June to September and North east monsoon from October to November. Relative humidity is usually higher, especially during June to December. Average monthly rainfall in Thiruvananthapuram district is given in Table 3.2.

3.4 Population

According to 1991 census reports, Thiruvananthapuram district supports a total population of 2946650 persons of which 1447594 are males and 1499056 are

Table 3.1. Land utilisation pattern in Thiruvananthapuram district (1996-97)

Description	**Area (in hectares)**	**As percentage to the total geographical area**
Forest	49861	22.81
Land put to non-agri uses	19716	9.02
Barren and uncultivable land	618	0.28
Permanent pastural and other grazing land	19	0.01
Land under tree crops	90	0.04
Cultivable waste	409	0.19
Fallow other than current fallow	426	0.20
Current fallow	828	0.37
Net area sown	146633	67.08
Total geographical area	**218600**	**100.00**

Source: Farm Guide 2000

Table 3.2. Average monthly rainfall in Thiruvananthapuram district

Months	Rainfall (mm)
January	0.4
February	0.5
March	2.1
April	66.4
May	238.0
June	280.0
July	119.7
August	152.0
September	355.8
October	431.4
November	269.9
December	165.3
Total	2081.5

Source: Farm Guide, 2000

females. Growth rate in population during the last decade was 13.2 per cent in the district. Density of population is 1341 persons per square kilometer with a sex ratio of 1041 females for every 1000 males. Literacy is 89.22 per cent.

The total income of the district (SDP), during the year 98-99 was 3196.55 crores and ranked IInd among other districts with a growth rate of 5.8 per cent, of which agriculture contributed 53815 lakhs. The per capita income in the district was Rs. 9907 as against the state average of Rs. 9807.

3.5. Occupational distribution

Occupational distribution of population in Thiruvananthapuram district is given in Table 3.3. Being the capital of the state with a number of Government institutions , other Quasi Government and private institutions and business concerns, employees other than agricultural labour occupies the first position which accounted for about 56.57 per cent of the total workers. It can be seen that total main workers in Thiruvananthapuram district is 888613. Agricultural labourers occupied the second position with 29.69 per cent to the total. Cultivators were only 11.47 per cent, household industrial workers were 2.26 per cent to the total main workers.

3.6. Water resources

The district has many water resources such as canals, tanks, wells, major, minor and lift irrigation projects. There are three main rivers in the district, viz., Vamanapuram, Karamana and Neyyar. Vamanapuram or Attingal, the longest river in the district passes through Palode and Vamanapuram reserve forests before entering the plain.

Edava, Nadayara, Anjengo, Kadinamkulam and Veli are the important backwaters of this district. The only major irrigation scheme in the district is the Neyyar Irrigation scheme. It can be seen from Table 3.4. that government canals constituted the major source of irrigation (59.81 per cent), followed by private wells which constituted 8.25 per cent of the total irrigation sources.

Table 3.3. Occupational distribution in Thiruvananthapuram district

Particulars	No. of persons
Cultivators	101965 (11.47)
Agricultural labourers	263851 (29.69)
House hold industry workers	20120 (2.26)
Other workers	502677 (56.57)
Total main workers	**888613 (100.00)**

Source: Farm Guide, 2000
(Figures in parenthesis indicate percentage to the total)

Table 3.4. Area under irrigation in Thiruvananthapuram district (source-wise) (1996-97)

Particulars	Area irrigated (in hectares)
Government canals	3395 (59.81)
Private canal	186 (3.28)
Government tanks	365 (6.43)
Private tanks	162 (2.85)
Government wells	9 (0.16)
Private wells	468 (8.25)
Minor and lift irrigation	319 (5.62)
Others	772 (13.60)
Total	**5676 (100.00)**

Source: Farm Guide, 2000
Figures in parenthesis indicate percentage to the total

3.7.Cropping pattern

Major crops grown in the district are Tapioca, coconut, paddy, pepper, betalnut, rubber, banana, jack, mango and tea (Table 3.5). Thiruvananthapuram district ranks second with regard to area of tapioca among the districts of the state. Coconut cultivation ranks at top in importance on the basis of the area under cultivation. The main pulse crop growing in the district are blackgram, greengram and horse gram, peas, beans etc. The main plantation crop is rubber which flourishes in hilly parts in the district. Paddy and tapioca are the most important cash-cum-food crops of the midland, though other crops are also cultivated.

3.8 Infrastructure

The district is well connected by air, rail, road and water communications. The aerodrome at Thiruvananthapuram is situated near Sanghumugham beach within the city limits about 3 km west of the city. Thiruvananthapuram is well connected by trains with all important places in the country. NH-47 from Cape-Comerin to Salem passes through Parassala, Neyyattin-kara, Thiruvananthapuram, Kazhakuttam and Quilon. The backwater, rivers and interconnecting canals give a good water communication system in the district.

Table 3.5. Cropping pattern in Thiruvananthapuram district

Crop	Area in '00 hectares	Percentage to total cropped area
Paddy	184	9.48
Betalnuts	16	0.82
Blackpepper	42	2.16
Jackfruit	57	2.94
Mango	54	2.78
Banana	50	2.58
Tapioca	318	16.38
Coconut	866	44.62
Rubber	279	14.37
Tea	10	0.52
Other crops	65	3.35
Total cropped area	**1941**	**100.00**

Source: Agricultural and fertilizer statistics, 1995

Methodology

IV. METHODOLOGY

The present chapter deals with the materials, methods and tools of analysis adopted in estimating costs, returns, efficiency measures and constraints in connection with production and marketing of mushrooms.

4.1. Location

This study on production and marketing of mushrooms was conducted in Thiruvananthapuram district. This district was purposely selected for the study because mushroom growing units on commercial basis are well established in Thiruvananthapuram district. The Mitra Niketan, Vellanad, College of Agriculture, Vellayani in Thiruvananthapuram district have been pioneering training programmes in mushroom production since 1980. The prevalence of mushroom growers in the district has resulted in the formation of Kerala Mushroom Growers Association with Vizhinjam (Thiruvananthapuram district) as its headquarters.

4.2 Selection of sample

The list of mushroom growers was collected from the Kerala Mushroom growers Association and the list of trainees provided by Mitra Niketan, Vellanad and the College of Agriculture, Vellayani. A sample of 100 growers was selected from the consolidated list who maintained a contact with the training institutes. Among the 100 sample farmers 36 were cultivating mushrooms and the remaining had given up cultivation because of several reasons which will be discussed in the coming chapters. These 36 respondents will form the core on which the main analysis have been carried out.

4.3. Collection of data

Data were collected from the respondents by personal interview method using a well-structured and pre-tested interview schedule. All the mushroom growers were post-stratified into following three categories based on the nature and extent of investment for the activity. The data collection was done during the period of April- August in the year 2000.

Category	Structure	Level of investment
Category-I	Temporary	upto Rs.15000
Category-II	Semi-permanent	Rs.15000-25000
Category-III	Permanent	above Rs. 25000

The information collected included the socio-economic conditions, income, cost associated, constraints in production and marketing etc. A separate schedule was prepared for collecting marketing details of mushrooms.

4.4 Analytical frame work

4.4.1 Costs and Returns

Assessment of cost and returns were carried out based on crop cycle. One crop cycle is of 45 days duration, and a maximum of 8 crop cycle is possible in a year. The profitability of a crop enterprise can be estimated by finding the relationship between the costs incurred and the returns from the crop. Separate analysis were carried out for estimating cost and returns of mushroom and spawn production.

4.4.1.1. Cost concepts

In farm management studies various concepts of costs viz. Cost A_1, Cost A_2, Cost B_1, Cost B_2, Cost C_1, Cost C_2 and Cost C_3 have been used (Acharya and Agarwal, 1994). The same was adopted in this study also.

(i)Cost A_1, approximates the actual expenditure incurred in cash and kind and it includes the following items of costs.

1. Value of hired human labour

The actual paid wage labour engaged in mushroom production was considered as value of hired labour. This included the labour employed in substrata preparation, spawning, application of sterilization chemicals, irrigation, harvesting and post harvest handling.

2. Value of Spawn (Seed)

Purchased seeds were evaluated on the basis of their purchase price. The same price was also used for evaluating farm-produced seeds.

3. Value of polybags

Expenditure on polybags has been evaluated by multiplying the physical quantity of polybags with their respective prices.

4. Value of paddy straw

Purchased paddy straws were evaluated on the basis of their purchase price. The same price was also used for evaluating farm-produced straw.

5. Value of sterilization chemicals

Expenditure on sterilization chemicals has been calculated by multiplying the physical quantities of different chemicals used by their respective price.

6. Depreciation

In the present study, straight-line method was employed for working out the depreciation. The average economic life of the depreciable items are as follows

1. Temporary-5 years
2. Semi-permanent-10 years
3. Permanent years-15 years
4. Equipments in mushroom production-5 years
5. Equipments in spawn production -8 years

The amount of depreciation to be charged during a year is worked out as follows.

$$\text{Depreciation} = \frac{\text{Original cost-Junk value}}{\text{Life of the asset}}$$

7. Interest on working capital

The interest rate at 12.5 per cent was calculated, which was the prime lending rate prevailing at the time of survey for short-term loans. The interest was calculated for half of the production period.

8. Miscellaneous expenses

This includes all other items, which have not been accounted for under item 1 to 7 above.

(ii)Cost A_2: Cost A_1 plus rent paid on leased in shed/building (land).In the present study no case of leasing was observed, hence, cost A_1 and A_2 are the same.

(iii) Cost B_1: It is equal to cost A_1 plus interest on own fixed capital. The item fixed capital included shed, racks, boilers, sprayers, tables and chairs, tubs and buckets and miscellaneous. The interest on fixed capital were calculated at the rate of 15 per cent per annum, which was the prime lending rate prevailing at the time of survey for long term loans.

(iv) Cost B_2: Cost B_1 plus rental value of own shed/building. In the present study value of the shed is accounted after depreciation, so rental value is not accounted. Hence, cost B_1 and B_2 are same.

(v) Cost C_1: Cost B_1 plus imputed value of family labour

The cost of family labour was imputed based on the prevailing rates paid to hired labour in the area during the period. No male hired labour was present in mushroom cultivation and as it is not a laborious work the wage rate for family male labour was taken as same as that of female hired labour. The wage rate was Rs. 100 per day for a labour.

(vi) Cost C_2: Same as cost C_1

(vii) Cost C_3: Cost C_2 plus 10 per cent of cost C_2 (to account for the value of management input of the farmer).

(viii)Explicit costs and Implicit costs

Total explicit costs (paid-out costs) and implicit costs (imputed costs) were also worked out separately for estimating benefit-cost ratio of mushroom production.

4.4.1.2. Return Measures

Income measures used for the present study are categorised into gross returns, returns over variable costs and net returns or returns over total costs.

(i) Gross returns:

Gross returns per crop cycle is the total value of output. It is nothing but the quantity of main product produced per crop multiplied by its price. The bye-product in mushroom production i.e. the compost was not considered for calculation of gross returns

as the mushroom growers in the study area did not use the compost for any purpose. Instead they disposed it off as garbage.

(ii) Farm business income: This is gross farm income minus cost A_1.

(iii) Farm family labour income: Gross farm income minus cost B_1

(iv) Farm investment income: This is calculated by summing up the net farm income, interest on fixed capital and rental value of owned shed/room.

(v) Net income: It is gross returns minus total costs.

4.4.2. Measures of efficiency:

The efficiency measures are the tools of farm management analysis, which help to measure the returns to particular segments of the farm business as returns to particular factors of production or returns from particular activities as well as in knowing the overall efficiency of the farm business.
(Kahlon and Singh 1981)

In order to determine the financial efficiency of spawn production and mushroom cultivation the following ratios were used.

(i) Benefit -Cost Ratio:

This is the ratio of total output to total cost of production both expressed in value terms and is computed as

$$\text{Benefit -Cost Ratio} = \frac{\text{Gross farm income}}{\text{Total expenditure}}$$

(ii) Operating ratio:

It expresses the proportion absorbed by operating expenses to the gross income and is estimated as

$$\text{Operating ratio} = \frac{\text{Total operating costs}}{\text{Gross income}}$$

(iii) Fixed ratio:

It represents the proportion absorbed by fixed expenses to the gross income and is estimated as.

$$\text{Fixed ratio} = \frac{\text{Fixed expenses}}{\text{Gross income}}$$

(iv) Gross ratio:

This show the ratio of total costs to the gross income. It represents the return per rupee of investment and is computed as

$$\text{Gross ratio} = \frac{\text{Gross income}}{\text{Fixed expenses}}$$

4.4.3. Resource use efficiency

Cobb Douglas production function has been fitted to the collected data in order to describe the relationship between the output and various inputs used for the production of mushroom. From the production function, elasticities of production of inputs were worked out, which in turn, have been used to calculate their marginal value products at their geometric means. Marginal productivity is the measure of the increase in total product, for the addition of one unit of a particular resource above its mean level while other resources are held constant at their respective mean levels. A significant difference between marginal value product and market price of individual inputs would indicate whether farmers are using on an average, their factors of production inefficiently or efficiently.

4.4.3.1. Units of measurement of variables

The choice of inputs for measuring the inputs and outputs is crucial as the selection of variable and mathematical model for analysis. Ideally inputs and outputs should be measured in physical unit of a homogeneous nature. Measurement of inputs and outputs in physical units is possible in experimental studies. But in actual farming situation these differ from farm to farm. Moreover heterogeneous capital forms have no common physical measurement. Consequently monetary units are commonly used to measure input categories of considerable heterogeneity. Similarly there are various qualities of physical output which can aggregate feasibly only in value terms.

4.4.3.2. Specification of the model

The model has been fitted for the sample as a whole. The specification of the model fitted for the crop is

$y = ax_1^{b1} x_2^{b2} x_3^{b3}$, which can be expressed in the log form as

$\log y = \log a + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + u$

where y represents the value of output in rupees, 'a' is the intercept, 'u' is the error term and b_1, b_2, b_3 are the regression coefficients or elasticities of production corresponding to each variable input.

The explanatory variables used in the function are as follows:

Y= Gross returns from the mushroom production

x_1 - value of paddy straw (Rs.)

x_2 - cost of spawn (Rs.)

x_3 - value of human labour (Rs.)

The function has been estimated by the ordinary least square technique. Coefficient of multiple determination (R^2) was tested for significance by applying 'F' test where

$$F_{(k, n-k)} = \frac{R^2}{1-R^2} \times \frac{N-K}{K}$$

Where k and (n-k) are degrees of freedom.

4.4.3.3. Returns to scale

By returns to scale, it is meant the behaviour of production or returns when all the productive factors are increased or decreased simultaneously and in the same ratio. If sum of the regression coefficients is not significantly different from one, constant returns to scale is indicated. If sum of regression coefficients is less than one, decreasing returns to scale is indicated, and if it is greater than one, increasing returns to scale is indicated.

4.4.3.4. Marginal productivity analysis

Marginal productivity is the measures of the increase in total product, for the addition of one unit of a particular resource above its mean level while other resources are held constant at their respective mean levels. Marginal value product is the marginal physical product represented in its value terms. Marginal value products of all inputs were

worked out at their geometric mean levels. In general, given the Cobb-Douglas type of production function, the marginal value product at geometric mean levels of inputs and output can be worked out as follows:

$$MVP\ X_i = \frac{\overline{Y}}{\overline{X_i}}\ b_i$$

$\overline{Y}$ = geometric mean of total returns Y

$\overline{Xi}$ = geometric mean of i^{th} input variable

The signficance of bi is tested using students t-test.

4.4.3. Marketing

Marketing denotes a series of activities involved in moving the goods from the point of production to the point of consumption. In the present study, important marketing channels in marketing of mushrooms were identified. The economic efficiency of marketing system can be measured as the ratio of the total value of goods marketed to the total marketing cost.

Economic efficiency of marketing is measured using Shepherd's index, which is as follows.

ME= $\frac{V}{I}$ 1 where 'ME is marketing efficiency, 'V' is the total value of goods marketed and 'I' is total marketing cost.

4.4.4. Constraints in production and marketing of mushroom

The following constraints for the production and marketing of mushroom were identified from the pilot study, discussions with the officials of training institutes and were used for the sample survey.

4.4.4.1. Constraints in production

1. Low yield due to seasonal variation
2. Low yield due to incidence of pest and diseases
3. High price for input
4. Inadequate availability of inputs
5. Poor quality of spawn

4.4.4.2. Constraints in marketing of mushroom

1. Low prices
2. Improper marketing facilities
3. Perishability of mushroom
4. Lack of awareness among consumers

The entrepreneur were asked to rank the production constraints from 1 to 5 and marketing constraints from 1 to 4 according to the order of importance perceived by each of them. A weight of 5, was given to the first ranking constraint, 4 to the second ranking constraint, 3 to the third ranking, 2 to the fourth and 1 to the fifth ranking production constraint. Similarly, weights are given from 4 to 1 to the marketing constraints also. These ranks were multiplied by the corresponding weights and total scores of each constraints were worked out.

Result

V - RESULTS

In this chapter, the results obtained from the study are presented. As stated in chapter 4, the data for the present study on 'Economic analysis of production and marketing of mushrooms' were collected from Thiruvananthapuram district. The results are presented under the following seven major heads.

5.1. Cultivation practices of mushroom and spawn production
5.2. General socio-economic characteristics of sample household
5.3. Employment generation from the enterprise
5.4. Economic aspects of mushroom production
5.5. Economic aspects spawn production
5.6. Marketing aspects of mushroom production
5.7. Constraints in the production and marketing of mushroom

5.1. Cultivation practices of mushroom and spawn production

5.1.1. Cultivation practices of mushroom

Pleurotus sajor caju is found to be the most suitable species for cultivation in Kerala (K.A.U.1996). It can be cultivated in the state all through the year. It can be grown on a variety of substrates also. Waste materials like straw, sawdust, bran etc., can be used as substrate. Plastic bags, wooden trays, baskets etc., can also be used as containers.

A small room with proper ventilation and provision to keep it moist is needed for the cultivation. In attached shed, it can be kept cool by periodically watering by gunny bags hung from the sides. Polythene bags or tubes can be used as containers for the cultivation. These bags or tubes must be about 20 to 30 cm in diameter and about 60 cm in length. If tubes are used, the free end is to be tied with a string. A few holes also are to be provided in the middle of the bag, for air passage. Paddy straw as fresh as possible are cut into small bits of 5-8 cm in length, soaked in water over night, removed and excess water allowed to drain away. Immerse the same in hot water (70-80^{0}C) for 30-40 minutes, drain the water and allow to cool down.

The treated straw is to be thoroughly spawned, usually at the rate of 2 per cent on weight basis of the straw. About three bottle of spawn is needed to spawn 10 kg of straw. The spawn is to be removed from the bottle with a forked stick and in case of straw, which is made into bits, the spawn can be evenly mixed with the straw and can be used to fill up the polythene bag.

Alternatively, the polythene bags are to be filled up first about 5-8 cm from the bottom with the straw bits and the spawn evenly spread over the same. Add a second layer with the straw about 10 cm height and repeat the spawning over this also. Similarly form a third layer and cover the tube/cover fully. Make the same compact, and the mouth of the tube is to be properly secured with rubber band.

After spawning, the beds are kept undisturbed for about 10-20 days, the beds can be arranged over a platform at a distance of about 15–20 cm from each other. These are incubated for spawn running and the best conditions for the same are a relative humidity of 70-80 per cent, and a temperature of 20-30^{0}C.

The spawn run can be judged from the whitish growth covering the bag completely. Periodically discard the contaminated ones. Once the spawn run is complete remove the polythene bags and keep the beds for sporocarp formation. The opened beds are to be kept moist, proper aeration of the room is to be provided and ensure that there is cross ventilation in the room. Sufficient amount of diffused light is necessary for normal fruit body formation.

Mushroom will appear within 4-6 days and the same can be harvested in another 2-3 days .The right stage of the picking is upcurving of the margin of the pileus or before the shedding of the white spores. Flush will continue to appear for a period of 4-6 weeks.

5.1.2. Cultivation practices of spawn production

Spawn or mushroom seeds are those which are grown on grains, which act as a substrata. The first series of spawn thus produced is known as mother spawn. Two to three series of spawn can be produced from this mother spawn. Quality of spawn declines as the series increases.

Material inputs required for producing spawn are spawn culture, wheat, non-absorbent cotton, utensils for boiling the grains, stove, autoclave etc. The grains are half boiled in drums or boilers and they are slightly broken with fingers. These grains are then cooled and 50 grams of calcium carbonate is added per kilogram of grain.

These grains are then filled in glucose drip bottles and plugged with cotton. The bottles are then kept in an autoclave for 2 hours for sterilization. Inoculate the culture into the grain bottles with inoculation needle by keeping the test-tube under the bunsen burner.

The bottle thus inoculated is kept in a clean room for the purpose of mycelium growth. Nearly after 15 days mycelium completes its growth in the bottle. This is the mother spawn. Discard those bottles, which doesn't have a pure white mycelium growth.

5.2. General socio-economic characteristics of sample household

The general features of mushroom growers would be very useful for proper understanding of their farming activities. In this section therefore, an attempt is made to present salient features of the social and economic conditions viz., farm size, family composition, educational status and economic status of the sample respondents. The general features of the sample growers are presented under the following headings.

5.2.1. Classification of sample farmers based on the nature of investment

The mushroom shed being the major item of investment in mushroom production, for the purpose of all the further analysis, farmers were classified based on the nature and extent of investment in sheds. Temporary, semi-permanent and permanent type mushroom sheds are established by the respondents with varying investment commitments (Table 5.1.). Category-I farmers were those who invested in temporary structures ranging from Rs. 8000 to Rs. 15000 for mushroom cultivation relying upon low cost materials. Category-II farmers depended on semi-permanent structures with an investment pattern ranging from Rs. 15000 to 25000. Category-III farmers used permanent structures with larger investments amounting over Rs. 25000. It can be seen from the table that around 14 per cent of the respondents had low-cost investments, 58 per

Table 5.1 Classification of mushroom growers based on nature of investment.

Particulars	Size group	Number of growers	Average size of holding(ha)
Temporary (up to Rs. 15000)	Category-I	5 (13.9)	0.16
Semi-permanent (Rs. 15000-25000)	Category -II	21 (58.3)	0.24
Permanent (above Rs. 25000)	Category -III	10 (27.8)	0.69
Aggregate		36 (100)	0.35

(Figures in parentheses show percentage to total)

Table 5.2. Average family size of mushroom growers(per household)

Size group	Average family size	Average male members	Average female members.
Category -I	3.8	1.8	2
Category -II	4.2	1.7	2.5
Category-III	4.9	2.2	2.7
Aggregate	4.3	1.9	2.4

cent belonged to the semi-permanent category and 28 per cent of them invested on modern and sophisticated capital items with high investments.

The average holding size of the sample respondents was 0.35 hectare. It was 0.16 ha, 0.24 ha and 0.69 ha respectively for Ist, IInd and IIIrd category of growers.

5.2.2. Family composition

Since mushroom is a labour intensive crop and is cultivated indoor, the family size can have a bearing on the scale of production. The data on family size and the number of males and females in each of the three categories were also collected and are given in Table 5.2. The average family size for the sample as a whole was 4.3 with 1.9 males and 2.4 females. Category wise analysis revealed that the average family size was 3.8 in Category-I, 4.2 in Category -II and 4.9 in Category –III with respectively 2.0, 2.5 and 2.7 females.

5.2.3. Educational status.

It is important to note that majority of the sample respondents were educated. Educational status of the respondents is given in Table 5.3. showed that none of the respondents were illiterate in category-I and III, while 14.29 per cent of them were illiterate in Category-II. It can be seen that majority of the farmers from Category-I and Category-II had high school level education with 60 per cent and 38.1 per cent respectively. In Category-III 50 percent of the respondents had completed graduation.

5.2.4. Economic status

A perusal of Table 5.4 showed that, out of the total annual income of Rs. 244720 for the sample as a whole, non farm income contributed Rs. 56200, farm income was Rs. 8097 and income from mushroom was Rs. 86163.25. Category wise analysis revealed that the non farm income was more when the income from mushroom was excluded.

Table 5.3. Educational status of sample respondents

Size Group	Illiterate	Upper primary	High school & pre-degree	Degree	Above degree	Total
Category-I	0 (0.0)	1 (20.0)	3 (60.0)	1 (20.0)	0 (0.0)	5 (100)
Category-II	3 (14.2)	2 (9.5)	7 (33.3)	8 (38.1)	1 (4.7)	21 (100)
Category-III	0 (0.0)	1 (10.0)	4 (40.0)	5 (50.0)	0 (0.0)	10 (100)
Total	3	4	14	14	1	36

(Figures in parentheses show percentage to the respective totals)

Table 5.4. Economic status of mushroom growers. (per year)

Size group	Farm income	Income from mushroom	Total farm income	Non-farm income	Grand total
Category -I	4700	45565.00	50265.00	32120.00	132650.00
Category -II	7310	70998.00	78308.00	52433.00	209049.00
Category -III	11450	138359.00	149809.00	76150.00	375768.00
Aggregate	8097	86163.25	94260.00	56200.00	244720

(Figures in parentheses show percentage to the respective totals)

5.3. Employment generation from the enterprise

5.3.1. Availability of family labour

From the Table 5.5 it can be seen that average labour force was 70.51 per cent of the family size for the sample as a whole, and it varied between 63.16 per cent to 75.51 per cent from category-I to III. Female labour contribution was about 42 per cent of the total labour force.

5.3.2. Members in the working force

Analysis was done on this part to identify the working force in mushroom production. Table 5.6 reveals absence of hired labour in category-I and 3.78 per cent, 32.61 per cent and 15.16 per cent respectively for category-II, category-III and aggregate where in only female hired labour was present. In actual working force in family, female labour was more than male labour, i.e. 63.64 per cent, 62.26 per cent, 41.30 per cent and 53.55 per cent respectively for the three categories in order and the sample as a whole.

5.3.3. Utilization of labour in mushroom production

Utilization of labour in mushroom production was worked out in actual working hours (@ 8 hours/day). The family labour were employed for 262.83, 261.15, 157.32 and 232.19 hours individually for category-I, II, III and aggregate. Hired labour was absent in category-I and working hours for category-II, III and aggregate was 10.81,160.26 and 51.27 respectively (Table 5.7).

5.4. Economics of mushroom production

The economic aspects of mushroom production was worked out on per crop cycle basis. The average crop cycle for the three categories and aggregate was 7.4, 7.00, 7.20 and 7.11 respectively. The average beds per crop cycle was 169.78, 275.61, 534.11 and 333.02 respectively for category-I, II, III and aggregate. The above fact is evident from Table 5.8.

5.4.1. Capital requirement of mushroom production

The working capital requirement of mushroom production for three categories of farmers is given in Table 5.9.

Table 5.5. Availability of family labour (Numbers per household)

Size group	Average family size	Average Male Labour Force	Average female labour force	Labour force
Category-I	3.80	1.00	1.40	2.40
		(26.32)	(36.84)	(63.17)
Category-II	4.20	1.10	1.85	2.95
		(26.14)	(43.18)	(69.32)
Category-III	4.90	1.70	2.00	3.70
		(34.69)	(40.82)	(75.51)
Aggregate	4.30	1.25	1.80	3.05
		(28.85)	(41.67)	(70.51)

(Figures in parentheses show percentage to total)

Table 5.6. Members in the working force(per household)

Size group	Hired labour		Family labour		Total labour
	M	F	M	F	
Category-I	0.0	0.0	0.80	1.40	2.20
	(0.0)	(0.0)	(36.36)	(63.64)	(100.00)
Category-II	0.0	0.10	0.9	1.65	2.65
	(0.0)	(3.78)	(33.96)	(62.26)	(100.00)
Category-III	0.0	1.50	1.20	1.90	4.60
	(0.0)	(32.61)	(26.09)	(41.30)	(100.00)
Aggregate	0.0	0.47	0.97	1.66	3.1
	(0.0)	(15.16)	(31.29)	(53.55)	(100.00)

(Figures in parentheses show percentage to total)

Table 5.7. Utilization of labour in mushroom production(Working hours)

Particulars	Category-I	Category-II	Category-III	Aggregate
Family labour	262.83	261.15	157.32	232.19
Hired labour	0.00	10.81	160.26	51.27

Table 5.8. Average number of crop cycle and beds

Size group	Average crop cycle	Number of crop cycles	Number of beds	Average Beds/crop cycle
Category-I	7.40	37 (14.45)	6282 (7.37)	169.78
Category-II	7.00	147 (57.42)	40514 (47.52)	275.61
Category-III	7.20	72 (28.13)	38456 (45.11)	534.11
Total	7.11	256 (100.0)	85252 (100.0)	333.02

(Figures in parentheses indicate percentage to the total)

5.4.1.1. Material inputs

Material inputs accounted for the lion share of working capital expenditure. At the aggregate level material inputs amounted to about 83 per cent of the total working capital expenditure. Cent per cent of the working capital contribution was from material inputs in category-I, 95 per cent for category-II and 70 per cent for category-III.

a) Spawn

Spawn or mushroom seed was identified as the most important and major item of cost among the material inputs for all the three categories of growers. It can be seen from the Table-5.5 that for the sample as a whole cost of spawn accounted for 45.01 per cent of the total working capital requirement and its share was to the extent of 49.84 per cent, 49.52 per cent, and 40.19 per cent respectively for the three categories of farmers.

b) Paddy straw

At the aggregate level the contribution of straw was to the extent of 21.67 per cent of total working capital expenditure. The cost for the three categories of growers was 26.86 per cent, 27.17 per cent and 16.18 per cent respectively.

c) Polybags

Paddy straws were filled in polybags on which the crop was grown. Aggregate expenditure for this accounted for 5.48 per cent of the total working capital requirement. For the three categories of growers the cost was 6.59 per cent, 6.24 per cent and 5.53 per cent respectively.

d) Sterilization chemicals

These chemicals were used for sterilizing the paddy straw and as a measure of crop protection. The commonly used chemicals were formalin and bavistin. The aggregate expenditure for this accounted for 8.60 per cent of the total working capital requirement. The expenditure for the three categories were 14.01 per cent, 10.01 per cent and 6.66 per cent respectively.

f) Miscellaneous

Miscellaneous expenditure included expenses on fuel, power, water charges etc., which at the aggregate level accounted for 2.09 per cent of the total working

Table 5.9. Working capital requirement of mushroom production for different categories of farmers (per crop cycle) (Rs)

Sl. No	Particulars	Category-I	Category-II	Category-III	Aggregate
1.	**Material inputs**				
	a.Paddy straw	442.70	762.81	1095.94	810.24
		(26.86)	(27.17)	(16.18)	(21.67)
	b.Spawn	821.35	1390.27	2722.50	1682.73
		(49.84)	(49.52)	(40.19)	(45.01)
	c.Polybags	108.57	175.18	374.32	204.69
		(6.59)	(6.24)	(5.53)	(5.48)
	d.Sterlization	230.86	280.77	451.39	321.54
	chemicals	(14.01)	(10.01)	(6.66)	(8.60)
	e.Miscellaneous	44.59	63.27	126.39	78.32
		(2.70)	(2.25)	(1.87)	(2.09)
	Subtotal	1648.07	2672.30	4770.54	3097.52
		(100.00)	(95.19)	(70.43)	(82.85)
2.	**Human labour**				
	a.Hired Labour	0	135.07	2003.30	640.99
		(0.00)	(4.81)	(29.57)	(17.15)
	Subtotal	0	135.07	2003.30	640.99
		(0.00)	(4.81)	(29.57)	(17.15)
	Working capital	1648.07	2807.37	6773.84	3738.51
		(100.00)	(100.00)	(100.00)	(100.00)

(Figures in parentheses show percentage to the total)

Table 5.10. Fixed investments by various category of farmers(per crop cycle)

Size group	Average book value(Rs)
Category -I	4428.00
Category -II	11476.19
Category-III	38191.70
Aggregate	17918.25

capital requirement. The expenditure for three categories was 2.70 per cent, 2.25 per cent and 1.87 per cent respectively.

g) Hired labour

Hired labour was highest in category-III(2003.30) which was about 30 per cent of the total working capital, followed by category-II (Rs. 135.07). Hired labour component was absent in category-I and at the aggregate level, it contributed for 17.15 per cent towards total working capital.

5.4.2. Fixed investments

The fixed investment of mushroom growers consisted mainly of mushroom shed, utensils and sprayers. The average investment pattern by various category of farmer is presented in Table 5.10. On an average the fixed investment of a farmer in book value was estimated at Rs. 17918.25. As expected, the investment was higher for category-II and III, who were producing mushroom in semi-permanent and permanent type sheds.

5.4.3. Source of substrate

Paddy straw was the substrate for growing mushrooms by all the respondents because it was locally available. Mushroom could be grown by purchasing paddy straw from paddy farmers. All the respondents were identified to be utilising purchased straw.

5.4.4. Explicit and implicit costs

Explicit costs are those which are paid out costs and are same as working capital. This cost accounted for 45.77 per cent of the total cost for the whole sample. Implicit costs were imputed cost and accounted for 54.23 per cent of the total cost.

The items in implicit cost were interest on working capital, depreciation, interest on fixed cost, family labour and supervisory cost. Out of this family labour was the major component of cost, which accounted for 65.53 per cent followed by depreciation and interest on fixed capital (8.53 per cent). In implicit costs, the cost was found to be decreasing from category-I to category-III in percentage. The total cost for the three categories of growers and aggregate was Rs. 5832.13, Rs.7306.21, Rs. 11193.77 and Rs. 8167.83 respectively (Table 5.11).

Table 5.11. Explicit and implicit costs of mushroom production for different categories of farmers (per crop cycle) (Rs)

Sl.No	Particulars	Category-I	Category-II	Category-III	Aggregate
A	**Explicit cost**				
1.	Material inputs	1648.07 (100.00)	2672.30 (95.19)	4770.54 (70.43)	3097.52 (82.85)
2.	Hired Labour	0.00 (0.00)	135.07 (4.81)	2003.30 (29.57)	640.99 (7.15)
	Total	1648.07 (28.26)	2807.37 (38.42)	6773.84 (60.51)	3738.51 (45.77)
B	**Implicit cost**				
1.	Interest on working capital	12.7 (0.30)	21.63 (0.48)	52.2 (1.18)	28.81 (0.65)
2.	Depreciation	265.95 (6.36)	302.72 (6.73)	587.96 (13.30)	377.63 (8.53)
3.	Interest on fixed capital	89.76 (2.15)	245.92 (5.47)	795.66 (18.00)	377.96 (8.53)
4.	Family labour	3285.46 (78.52)	3264.37 (72.56)	1966.49 (44.49)	2902.39 (65.53)
5.	Supervisory cost	530.19 (12.67)	664.20 (14.76)	1017.62 (23.02)	742.53 (16.76)
	Total	4184.06 (71.74)	4498.84 (61.58)	4419.92 (39.49)	4429.32 (54.23)
	Total cost	**5832.13 (100.00)**	**7306.21 (100.00)**	**11193.77 (100.00)**	**8167.83 (100.00)**

(Figures in parentheses show percentage to their respective total)

5.4.5. Cost concepts in mushroom production

As indicated in chapter IV the cost concepts used in this study are Cost A_1, Cost A_2, Cost B_1, Cost B_2, Cost C_1, Cost C_2, and Cost C_3.

Cost A, B and C in mushroom production for different categories of farmers is given in Table 5.12. Cost A_1, B_1, C_1, and C_3 per crop cycle were Rs 1936.72, Rs. 2016.48, Rs. 5301.94 and 5832.13 respectively for category-I, Rs. 3131.72, Rs. 3377.64, Rs. 6642.01 and 7306.21 respectively for category-II and for category-III the respective cost were Rs. 7414, Rs. 8209.66, Rs. 10176.15 and Rs. 11193.77 respectively. For the sample as a whole, the corresponding figures were Rs. 4144.95, Rs. 4522.91, Rs. 7425.30 and Rs. 8167.83 respectively. From the table it is evident that cost of cultivation per crop cycle was the highest for category-III.

5.4.6. Output per crop cycle

The yield from mushroom production per crop cycle is given in Table 5.13. The output in kg per crop cycle was 101.50,167.70,313.3 and 199.52 for category-I, category-II, category-III and the aggregate sample respectively. It can also be seen that the large scale operations had relatively higher mushroom recovery from straw. The value of unit of output was liable to seasonal fluctuations, here the average value of unit of output was taken as Rs. 60.67, Rs. 60.48, Rs. 61.33 and Rs. 60.74 respectively for the three category of growers and aggregate.

5.4.7. Income measures for mushroom production.

The profitability of crop production can be judged in a better way from the income measures, which include farm business income, farm family labour income, farm investment income and net income. To measure the profitability of crop production, income measures were worked out and the results are given in Table 5.14.

Gross income from mushroom production was Rs. 6157.43, Rs. 10142.53, and Rs. 19216.46 respectively for the three categories of growers. For the sample as a whole the gross income was Rs. 12118.60.

Table 5.12. Cost A, B and C in mushroom production for different categories of farmers.(per crop cycle) (Rs)

Sl.No	Cost	Category-I	Category-II	Category-III	Aggregate
1.	Cost A1	1936.72 (33.04)	3131.72 (42.86)	7414.00 (66.23)	4144.95 (50.75)
2.	Cost A2	1936.72	3131.72	7414.00	4144.95
3.	Cost B1	2016.48 (34.58)	3377.64 (46.23)	8209.66 (73.34)	4522.91 (55.37)
4.	Cost B2	2016.48	3377.64	8209.66	4522.91
5.	Cost C1	5301.94 (90.91)	6642.01 (90.91)	10176.15 (90.91)	7425.30 (90.91)
6.	Cost C2	5301.94	6642.01	10176.15	7425.30
7.	Cost C3	5832.13 (100.00)	7306.21 (100.00)	11193.77 (100.00)	8167.83 (100.00)

(Figures in parentheses show percentage to total)

Table 5.13. Output from mushroom production (per crop cycle) (Kg)

Size group	Output	Quantity of straw used	Recovery of mushroom from straw (%)
Category-I	101.50	198.15	51.22
Category-II	167.70	249.69	67.16
Category-III	313.30	401.74	77.99
Aggregate	199.52	277.96	71.78

Farm business income or profit at cost A_1 of mushroom for the three categories were Rs 4230.71, Rs. 7010.81 and Rs. 11802.46 respectively for one crop cycle and Rs. 7973.65 for the sample as a whole.

Family labour income worked out as gross income minus cost B_1, and the same for category-I was Rs. 4140.95, for category-II Rs. 6764.89 and for category-III Rs. 11006.8. For the sample as a whole the family labour income was estimated as Rs. 7595.69.

The net income or profit calculated as the gross income minus total cost of production was Rs. 325.30 for category-I. Net income was low for category-II(Rs. 2836.32) as compared with category-III (Rs. 8022.69).The net income for the sample as a whole was Rs. 3950.77.

Farm investment income is calculated by summing up the net income, interest on fixed capital and rental value of owned shed /room. This income for the three categories of growers and the whole sample were respectively Rs 415.06, Rs. 3082.84, Rs. 8818.35 and Rs. 4328.73.

5.4.8. Financial efficiency measures in mushroom production

The financial efficiency of each category was analysed by financial efficiency ratios and are presented in the Table 5.15. The aggregate Benefit-Cost ratio was 1.48. The Benefit-Cost ratio was the highest in category-III(1.72) followed by category-II(1.39) and low for category-I(1.06). It can be concluded that one rupee incurred towards total costs of production of mushrooms in each of the three categories earned Rs. 1.72, Rs. 1.39 and Rs. 1.06. The operating ratio which represents the efficiency of variable costs was 0.27, 0.28, 0.35 and 0.31 respectively for the three categories of growers and the sample as a whole or in other words Rs. 0.31 invested towards variable inputs earned a gross return of Re. 1.00. Fixed ratio which represents the efficiency of fixed costs was 0.09, 0.16 and 0.27 respectively for the three categories in order. Aggregate fixed ratio was 0.21 or in other words Rs. 0.21 invested towards fixed inputs earned a gross return of Re. 1.00.

Table 5.14. Income measures in connection with mushroom production (per crop cycle) (Rs)

Sl.No	Income measures	Category-I	Category-II	Category-III	Aggregate
1.	Gross income	6157.43	10142.53	19216.46	12118.60
2.	Farm business income	4230.71	7010.81	11802.46	7973.65
3.	Farm family labour income	4140.95	6764.89	11006.8	7595.69
4.	Farm investment income	415.06	3082.24	8818.35	4328.73
5.	Net income	325.30	2836.32	8022.69	3950.77

Table 5.15. Various efficiency measures in connection with mushroom production (per crop cycle)

Sl.No	Efficiency measures	Category-I	Category-II	Category-III	Aggregate
1	Operating ratio	0.27	0.28	0.35	0.31
2	Fixed ratio	0.09	0.16	0.27	0.21
3	Benefit-cost ratio	1.06	1.39	1.72	1.48

5.5. Economic aspects spawn production

Among the 36 mushroom cultivators 9 of them were found to be producing spawn by themselves. So a separate analysis on the economics of spawn production was also attempted.

5.5.1. Capital requirement for spawn production

Working capital requirement for producing one kilogram of spawn was worked out and are given in Table 5.16. The total working capital requirement for producing one kilogram of spawn was Rs. 12.83.

Wheat is the substratum on which the mushroom culture is inoculated. This is the major item of cost in working capital and it accounts for 38.97 per cent (Rs. 5) of the total working capital requirement. Calcium carbonate, polypropylene cover and miscellaneous expenses accounts 7.40 per cent (Rs. 0.95), 15.82 per cent (Rs. 2.03) and 9.59 per cent (Rs. 1.23) respectively. Hired labour component was 28.22 per cent (Rs. 3.62) of the total working capital requirement.

5.5.2. Explicit and implicit costs in spawn production

The Table 5.17. reveals that the total cost for producing one kilogram of spawn was Rs. 17.92. Explicit cost accounted for 71.60 per cent of the total cost and Implicit cost 28.40 per cent of the total cost. Here explicit costs were more than implicit cost.

The items in implicit cost were interest on working capital, depreciation, interest on fixed capital, family labour, and supervisory cost which accounted for 15.72 per cent, 12.18 per cent, 4.72 per cent, 35.36 per cent, and 32.02 per cent respectively of the implicit cost. Out of this family labour was the major contributor of cost followed by supervisory cost.

5.5.3. Cost concepts in spawn production

Cost concepts were worked out separately for spawn production also and is given in Table 5.18. Cost A_1, B_1, C_1, and C_3 per kilogram of spawn were respectively Rs. 14.25, Rs. 14.49, Rs. 16.29 and Rs. 17.92.

Table 5.16. Capital requirement for producing one kilogram of spawn. (Rs)

Sl.No.	Particulars	Cost
1.	Material inputs	
	a.Wheat	5.00 (38.97)
	b.Calcium Carbonate	0.95 (7.40)
	c.Polyproplene cover	2.03 (15.82)
	d.Miscellaneous	1.23 (9.59)
	Subtotal	9.21 (71.78)
2.	Hired labour	3.62 (28.22)
	Subtotal	3.62 (28.22)
3.	Working capital	12.83 (100.00)

(Figures in parentheses show percentage to the total)

Table 5.17. Explicit and implicit costs for producing one kilogram of spawn (Rs)

Sl .No.	Particulars	Cost
A	**Explicit costs**	
1.	Material inputs	9.21 (71.78)
2.	Hired Labour	3.62 (28.22)
	Total	12.83 (71.60)
B	**Implicit cost**	
	Interest on working capital	0.80 (15.72)
	Depreciation	0.62 (12.18)
	Interest on fixed capital	0.24 (4.72)
	Family labour	1.80 (35.36)
	Supervisory cost	1.63 (32.02)
	Total	5.09 (28.40)
	Total cost	**17.92 (100.00)**

(Figures in parentheses show percentage to their respective total)

5.5.4. Income measures for spawn production.

Income measures for one kilogram of spawn is given in Table 5.19. Gross income from spawn production was estimated as Rs. 40.00 for one kilogram of spawn

Farm business income or profit at cost A_2 was Rs 25.75, family labour income was Rs. 25.51 and net income from spawn production was Rs. 22.08. Farm investment income was worked out as Rs. 22.32

5.5.5. Financial efficiency Measures in spawn production

The financial efficiency analysis of spawn production was also done and the ratios are presented in the Table 5.20. The Benefit-Cost ratio was 2.23. So it can be concluded that one rupee incurred towards total costs of production of spawn earned Rs. 2.23. The operating ratio which represents the efficiency of variable costs was 0.32 or in other words Rs. 0.32 invested towards variable inputs earned a gross return of Re. 1.00. Fixed ratio which represents the efficiency of fixed costs was 0.08 or in other words Rs. 0.08 invested towards fixed inputs earned a gross return of Re. 1.00.

Resource use efficiency

A scientific study of input – output relationship based on production function analysis will provide a sound basis for crop production on a pattern that would guide the farmers to operate at the least cost and highest profit combinations (Dhondyal, 1989). In the present study Cobb Douglas production function has been used as an analytical tool to estimate the productivities of various inputs used in the production of mushroom. The model has been fitted for the sample as a whole. The estimated production functions is given below.

$$y = 1.8479 \quad x_1^{0.1558**} \quad x_2^{0.8220*} \quad x_3^{-0.1923**}$$

(0. 0743) (0.0826) (0.0941)

$R^2 = 0.92$

$R^{-2} = 0.91$

( ) figures in parentheses are standard errors

* significant at 1 per cent level of probability

** significant at 5 per cent level of probability

Table 5.18. Cost A,B and C in spawn production. (Amount in Rupees)

Sl.No	Cost concept	Cost
1.	Cost A_1	14.25 (79.52)
2.	Cost A_2	14.25
3.	Cost B_1	14.49 (80.86)
4.	Cost B_2	14.49
5.	Cost C_1	16.29 (90.90)
6.	Cost C_2	16.29
7.	Cost C_3	17.92 (100.00)

(Figures in parentheses show percentage to total)

Table 5.19. Income measures in connection with spawn production for one kilogram of spawn (Amount in Rupees)

Sl.No	Income measures	Income
1.	Gross income	40.00
2.	Farm business income	25.75
3.	Farm family labour income	25.51
4.	Farm investment income	22.32
5.	Net income	22.08

Table 5.20. Various efficiency measures in connection with spawn production for one kilogram of spawn (Rs)

Sl.No	Efficiency measures	Ratio
1	Operating ratio	0.32
2	Fixed ratio	0.08
4	Benefit-cost ratio	2.23

Table 5.21. Regression coefficients, marginal value product various inputs in mushroom

Variables	Regression Coefficient	Marginal value product
X_1	0.1558	0.2059
X_2	0.8220	1.0005
X_3	-0.1923	-0.2145
Σ bi	**0.7855**	

The coefficient of determination (R^2) explains the proportion of variation in the dependent variable explained by the independent variables included in the model. The explanatory variables included in the functions explained 92 per cent of the variation in the output.

The estimated regression coefficients (b_i) of the explanatory variables are the production elasticities of the respective factors (x_i). The production elasticities indicate the percentage by which the output 'Y' would change if input x_i changes by one unit. The regression coefficients, marginal value products and the marginal productivity at factor costs are given in Table 5.21.

In case of mushroom elasticity coefficient of input labour was found to be negative and significant. The rest of the coefficients had positive sign indicating positive effect on total output. Sum of the regression coefficients (Σbi) was found to be less than one, indicating decreasing returns to scale.

The resource use efficiency has been judged on the criterion that each factor of production is paid according to its marginal productivity. A significant difference between the marginal value products and price of individual inputs would indicate whether the farmers are using on an average, their factors of production efficiently or inefficiently. For efficient use of any input, marginal value productivity to factor cost ratio should be equal to one. When resources are used inefficiently, a reallocation of resources in the existing situation would increase the efficiency of production. In case of mushrooms the negative marginal value product for labour indicated that this input was used in excess quantity. Though the marginal value product of paddy straw was positive they were inefficient in the sense that an investment of additional rupee in these input would yield an additional returns worth less than a rupee, since the marginal value products was less than unity. A positive and significant marginal value product for spawn indicated that any additional expenditure on spawn, would increase the total returns (Y).

5.6. Marketing

5.6.1. Marketing channels

In the present study an attempt has been made to identify the important marketing channels and also to analyse the marketing efficiency of mushroom. Marketing

channels are the routes through which products move from producers to consumers. Three marketing channels were identified in the marketing of mushrooms and are given below.

1. Producer- Consumer
2. Producer-Bakery-Consumer
3. Producer- Hotel-Consumer

The sample growers sold their produce to bakery (who were retailers), hotels and directly to the consumers. The short channel is on account of the perishable nature of the produce. Consequently, the most important marketing channel identified for mushroom was direct sale from producer to consumer. Such direct sellers constituted 69.44 per cent of the total producers. Mushroom channelised through bakeries and hotels were 16.67 per cent and 13.89 per cent respectively. Producers sold their produce to bakeries for Rs. 15 per 250 gram pack of mushroom. These retailers sold this produce for Rs. 20. per packet. They earned a net margin of Rs. 20 per kilogram.

Only a few growers sold their produce to hotels (13.89). Since the data on handling and processing charges of mushroom as well as the prices of the mushroom delicacies charge by them were not available, further analysis of producer's share in consumer rupee could not be attempted. Distribution of the farmer respondents according to the type of buyers is given in Table 5.22.

5.6.2. Marketing costs and margins

In the present study, marketing efficiency is assessed on the basis of marketing costs and margins. In the marketing of agricultural commodities the difference between the price paid by the consumer and the price received by the producer for an equivalent quantity of farm produce is often known as farm retail spread or price spread (Acharya and Agarwal, 1999). Marketing margins and costs per kilogram of mushroom is conferred in Table 5.23.

In the case of mushroom out of the Rs. 80.00 per kilogram paid by the consumer 75 per cent went to the producer. The retailer reaped a net margin of 25 per cent for which they did not incur any cost. The marketing cost incurred by the producers was very low (Rs. 4.50). The net price received by the producer was Rs. 55.50 after deducting the marketing cost.

Table 5.22. Distribution of the farmer respondents according to the type of the buyers

Sl. No.	Product sold to	Number of growers
1	Directly to consumers	25 (69.44)
2	Retailers	6 (16.67)
3	Hotels	5 (13.89)
	Total	**36 (100.00)**

(Figures in parentheses indicate percentage to the total)

Table 5.23. Marketing margins and costs for mushroom(in Rs. per kilogram)

Sl.No	Shares	Amount	Percentage
1	Price received by farmer or Price paid by the retailer	60.00	75.00
2	Marketing cost incurred by the farmer	4.50	5.63
3	Net price received by the farmer	55.50	69.38
4	Price received by the retailer (consumer price)	80.00	
5	Marketing cost of the retailer	Nil	
6	Net margin of the retailer	20.00	25.00
7	Price paid by the consumer	80.00	100.00

5.6.3. Marketing efficiency

The efficiency of marketing system is measured using Shepherd's index which is as follows.

$ME = \frac{V-I}{I}$ where 'ME is marketing efficiency, 'V' is the total value of goods marketed and 'I' is total marketing cost.

The index of marketing efficiency was 1.48 for mushroom. The higher the ratio, the higher the efficiency of the marketing system. In the present study it can be seen that the net margins realised by the retailer were unduly high, and the marketing cost incurred were nil.

5.7. Constraints in mushroom cultivation

The constraints faced by mushroom growers in Thiruvananthapuram district were categorised into production constraints and marketing constraints. The farmers were asked to rank the production constraints from 1-5 and from 1-4 for marketing constraints according to the priority of each constraint

5.7.1. Production constraints

Broadly the problems faced by the mushroom growers in production are

1. Low yield due to seasonal variation
2. Low yield due to incidence of pest and diseases
3. High price for inputs
4. Inadequate availability of inputs
5. Poor quality of spawn

Low yield due to incidence of pest and diseases, high price for inputs and low yield due to seasonal variation were identified as the major production problem in the mushroom growing. The scores are presented in Table 5.24. They had a score of 115,114 and 113 respectively, indicating its prevalence.

Inadequate availability of inputs was the fourth important problem amid the respondents. This was identified with a score of 102 and had a rank of four among the other problems.

Poor quality of spawn was a fifth problem among the growers. This problem had a total score of 96 and was ranked fifth.

5.7.2. Marketing constraints

Broadly the problems faced by the mushroom growers in marketing are

1. Low prices
2. Improper marketing facilities
3. Perishability of mushroom
4. Lack of awareness among consumers

Lack of awareness among consumers about the prospects of mushroom and low prices were perceived as the major problem in the marketing of mushroom by mushroom growers with a total score of 96 and 93 respectively.

Improper marketing facilities was recognized as the next important marketing problem and was ranked three, followed by perishability of mushroom with a total score of 85 (Table 5.25).

Table 5.24. Constraints in mushroom production.

Score	5	4	3	2	1	Total Score	Rank
Constraints							
1. Low yield due to seasonal variation	5 (13.89)	12 (33.33)	9 (25.00)	3 (8.33)	7 (19.44)	113	3
2. Low yield due to incidence of pest and diseases	9 (25.00)	6 (16.67)	7 (19.44)	11 (30.56)	3 (8.33)	115	1
3. High price for inputs	12 (33.33)	6 (16.67)	4 (11.12)	4 (11.12)	10 (27.78)	114	2
4.Inadequate availability of inputs	7 (19.44)	5 (13.89)	9 (25.00)	5 (13.89)	10 (27.78)	102	4
5. Poor quality of spawn	3 (8.34)	7 (19.44)	7 (19.44)	13 (36.11)	6 (16.67)	96	5

(Figures in parentheses show percentage to total)

Table 5.25. Constraints in marketing of mushroom

Score	4	3	2	1	Total score	Rank
Constraints						
1. Low prices	10 (27.78)	11 (30.56)	5 (13.89)	10 (27.78)	93	2
2. Improper marketing facilities	9 (25.00)	10 (27.78)	3 (8.33)	14 (38.89)	86	3
3. Perishability of mushroom	9 (25.00)	3 (8.33)	16 (44.44)	8 (22.22)	85	4
4. Lack of awareness among consumers	8 (22.22)	12 (33.33)	12 (33.33)	4 (11.11)	96	1

(Figures in parentheses show percentage total)

Discussion

6. DISCUSSION

The results of the present study brought out in the previous chapter are discussed in this chapter under the following heads.

6.1. General socio-economic characteristics of sample household
6.2. Employment generation from the enterprise
6.3. Economic aspects of mushroom and spawn production
6.4. Marketing aspects of mushroom production
6.5. Constraints in the production and marketing of mushroom

6.1. General socio-economic characteristics of sample household

The general features of mushroom growers would be very useful for proper understanding of their farming activities. The results with regard to general socio-economic characteristics are discussed below.

6.1.1. Classification of sample farmers based on nature of investment

The mushroom growers were classified on the basis of nature of investment which is indicated earlier and shown in Table 5.1. Such a classification was selected because the production capacity varied according to the nature of investment. The investment pattern ranged from below Rs. 15000 to above Rs. 25000. Those with modern and sophisticated capital items were able to produce more. The present classification differed from Prakash et al. (1986) who classified mushroom growers in Bangalore on the basis of number of trays spawned per crop.

6.1.2 Family composition

The family size of the mushroom growers significantly influences the size and production capacity of the farms. As indicated earlier, mushroom is a labour intensive crop where most of the production activities like cutting of straw, spawning, watering, fumigating, packing and marketing are done by manual labour. These activities are simple, but need considerable care, which can be done by family members also. It can be seen from Table 5.2 that average family size increased from category–I to category-III

indicating that the investment pattern is highly relied upon average family size. Depending upon the availability of family labour, business can be expanded in a cost effective manner.

6.1.3. Educational status

The majority of the sample respondents were found to be educated as evident from Table 5.3. This implied that mushroom cultivation is popular among educated people. In category-III, 50 per cent of the respondents were degree holders, which shows that the level of education has a positive relationship with mushroom cultivation. Since the enterprise required rigorous training and educated people can easily understand the importance of the business in terms of profitability and nutritive value, they invest more on this enterprise.

6.1.4. Economic status.

In the present study it was found that major share of the income excluding income from mushroom was from non- agricultural activities. Still the growers concentrated on mushroom growing because of the short duration of the crop and high profitability. Duration per crop is around 40-45 days. Hence, growers can realise returns from 20 days of spawning upto 45 days. Total income was found to be increasing from category-I to III. This clearly shows that farmers having high income are investing more on mushroom production.

6.2. Employment generation from the enterprise

6.2.1. Availability of family labour

It is seen from Table 5.5 that the average family size increases from category-I to category-III. Hence, the availability of average male and female labour force in category-III is more.

6.2.2. Members in working force.

Mushroom cultivation is an ideal and profitable enterprise especially to housewives who in addition to attending their daily house hold chores can earn additional income from mushroom enterprise. Total members in working force for mushroom production was 3.1(per household). Since the work is not a labourious task female labour is doing almost all operations related to mushroom production. The female labour

otherwise go waste was effectively utilized for generating additional income to the family. Vijayakhader (1994) analysed the feasibility of mushroom production by rural women in Bapatla and concluded that mushroom cultivation would be under taken at the household level there by helping women to earn additional income. Pandey and Tewari (1990) reported that rural women could form effective marketing links in urban areas in popularising mushroom as a protein-rich 'vegetable'. In the present study out of the total working force available 53.55 per cent were females. This shows the pre-dominance of women in mushroom cultivation. This can be popularised among rural as well as urban women folk through proper extension methods as a leisure time enterprise and earning subsidiary income to their family.

6.2.3. Utilization of labour in mushroom production

Table 5.7. reveals that family labour was utilized more in category –I and II and more of hired labour in category-III. This difference can be attributed to the members in the working force.

The wage rate was taken as Rs. 100 per day for a labour. No male hired labour was present in mushroom cultivation and as it is not a laborious work the wage rate for family male labour was taken as same as that of female hired labour. The cost of family labour was imputed based on the prevailing rates paid to hired labour in the area during the period.

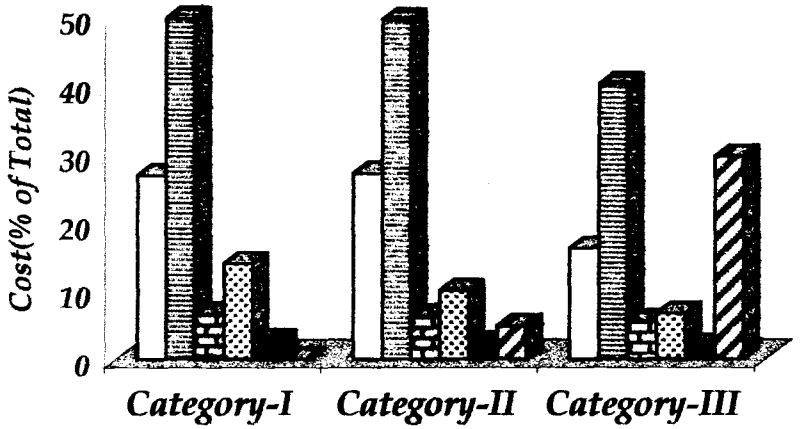
6.3. Economic aspects of mushroom and spawn production

The economic aspects of mushroom production was worked out on per crop cycle basis. The average beds per crop cycle increased from category-I to III revealing the capacity utilization as the investment increases.

6.3.1. Capital requirement of mushroom production

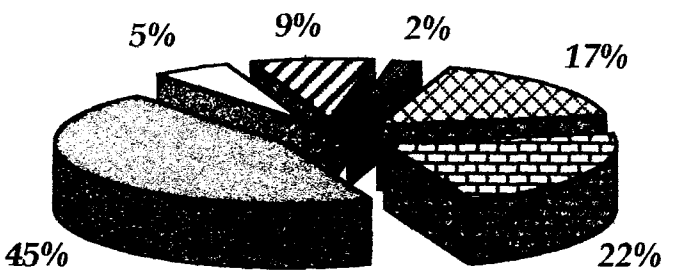
The working capital requirement of mushroom production for three categories of farmers is given in Table 5.9.

Spawn, paddy straw, polybags, sterilization chemicals and expenses on other items were the material inputs used in mushroom production. Among this spawn accounted for major share of cost (45.01 per cent) followed by paddy straw (21.67 per cent) at the aggregate level. It is also seen that the material cost is increasing in actual



a.Paddy straw
b.Spawn
c.Polybags
d.Sterlization chemicals
e.Miscellaneous
f.Hired Labour

Fig.1. Working capital requirement in mushroom production for different categories of farmers



a.Paddy straw
b.Spawn
c.Polybags
d.Sterlization chemicals
e.Miscellaneous
f.Hired Labour

Fig.2. Working capital requirement for mushroom production (Aggregate)

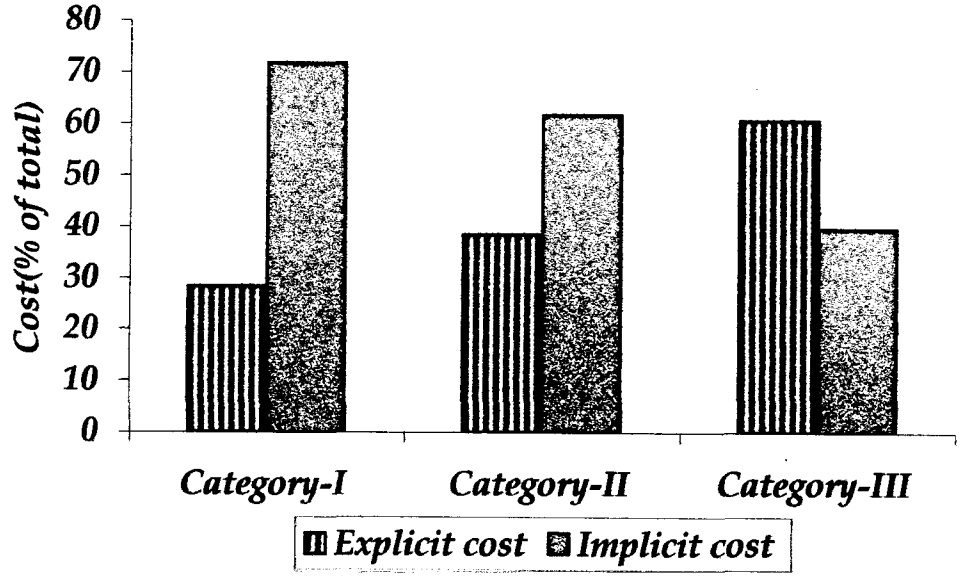


Fig.3. Explicit and implicit cost in mushroom production for different categories of farmers

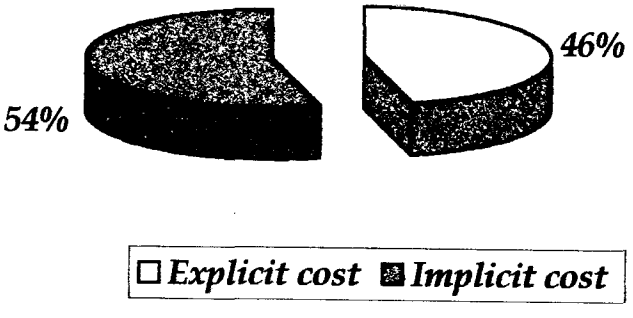


Fig.4. Explicit and implicit cost in mushroom production (Aggregate)

Kalra (1995) also indicated the same results while analysing the economics of mushroom production in Sonepat district of Haryana State.

6.3.5. Output per crop cycle

The quantity of output produced in category-III showed a higher amount because as the scale operation increases output in physical term also increases and large scale operators had relatively higher mushroom recovery from straw.

6.3.6. Capital requirement for spawn production

Working capital requirement for producing one kilogram of spawn was worked out and are given in Table 5.16.

Cost of wheat is found to be the major component and it accounts for 38.97 percent of the total working capital requirement. Hired labour ranked the second and it accounts for 28.22 percent of the total working capital requirement. The necessity of skilled labour for spawn production attributed such a high amount of hired labour. The total working capital requirement for producing 1 kilogram of spawn was Rs. 12.83.

6.3.7. Explicit and Implicit costs in spawn production

In the case of spawn production explicit costs were more as compared to implicit cost. This is mainly because hired labour accounted a major share in total costs, which is paid out cost. Spawn production is a labour intensive indoor process and requires skilled labour to carry out this activity.

6.3.8. Cost concepts in spawn production

Cost A, B and C in spawn production for farmers is given in Table 5.18. Cost A_1, B_1, C_1, and C_3 per kilogram of spawn were respectively Rs. 14.25, Rs. 14.49, and Rs. 16.29,17.92.

6.3.9. Income measures in mushroom and spawn production

Eventhough mushroom was found to be a profitable venture for category-III, its performance was dismal for category-I and only satisfactory for category-II. Category-I growers earned a net income of Rs. 325.30 per crop cycle. This is because family labour contributed a major share in cost for this category there by increasing cost

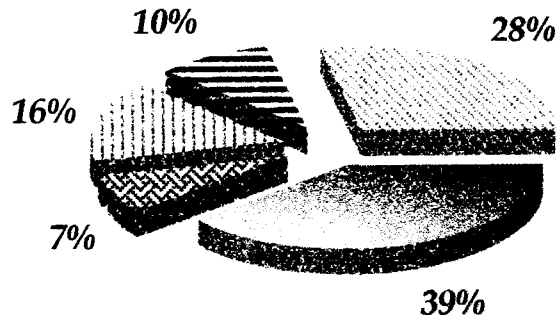


Fig.5. Working capital requirement for spawn production

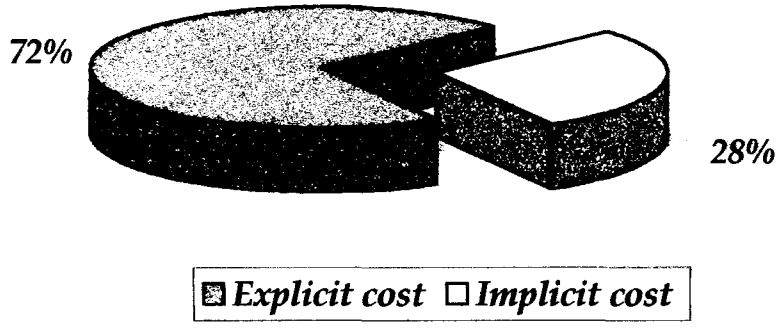


Fig.6. Explicit and Implicit cost in spawn production

C_1. Supervisory cost which is 10 per cent of the cost C_1 when added to the same increased the total cost. The category-II farmers didn't have a reasonable net income and they may go out of business in the near future. It is evident from Table 5.14. that net income increased with increase in investment. Kaura (1973), Kapoor et al (1987), Prakash and Tejaswini (1991) Chauhan and Sood (1992), Vijay and Gupta (1994) Singh and Chaube (1995) and Kapoor et al (1996) also reported substantial net returns in mushroom cultivation. The various income measures in mushroom production increased with the increase in nature of investment. These results are in confirmity with those of Sharma and Jandaik (1981) in Solan, Himachal Pradesh.

The income measures from spawn production is given in Table 5.19., showed that the growers earned a gross return of Rs. 40 per kilogram of spawn and the net income realised was of Rs. 22.08 per kilogram of spawn. The spawn was purchased in bulk by coir-pith manufacturers and is a profitable enterprise which enhanced the bargaining power and cost-effective marketing. This is in line with the observations of Vijayakhader (1994) where he observed that spawn multiplication and mushroom production are profitable enterprises when taken up by rural women in Bapatla.

6.3.10. Financial efficiency measures in mushroom and spawn production

The financial efficiency of each category was analysed by financial efficiency ratios and the ratios are presented in the Table 5.15. The Benefit-Cost ratio was highest in category-III (1.72) followed by category-II (1.39) and low for category-I (1.06). The operating ratio shows that the variable inputs employed were efficient. The category-II and III farmers are meeting relatively higher fixed investment to generate 1 Rupee as gross income, whereas category-I generates the same level gross income by meeting lesser investments. It is indicative of the inefficiency of fixed investments made, pointing to the under utilisation of the capacity by the category-II and III. Similar to the present study Singh and Kalra (1995) indicated that the B-C ratio was highest in large investment farms(2.50) compared to medium investment (2.06) and small investment(1.61) farms in Sonepat District of Haryana state. So it is evident that one rupee incurred towards total costs of production of mushrooms in each of the three categories earned Rs. 1.72, Rs. 1.39 and Rs. 1.06 respectively for category-III, category-II and category-I.

From the above observations it can be concluded that the incentives for continued operation is low for category-I and reasonable for category-II. While, it is for beneficial for category-III.

The financial efficiency of spawn production was analysed by financial efficiency ratios and are presented in the Table 5.20. The Benefit-Cost ratio was 2.23. So it can be concluded that one rupee incurred towards total costs of production of spawn earned Rs. 2.23. It can be concluded from this observation that the spawn production is efficient.

6.3.10. Resource use efficiency

The results of functional analysis using Cobb Douglas model of production function revealed that 92 per cent of the variation in output was explained by the regression model in case of mushroom.

The functional analysis revealed that in mushroom production, value of output was significantly influenced by variables paddy straw and spawn. The marginal value products of spawn was greater than one indicating that there is still scope to use these input and increase the yield of mushroom.

Elasticity coefficients of the variables paddy straw and spawn was positive and significant. Hence it would be profitable to increase further the use of these two inputs to increase the returns. The elasticity of coefficient was negative for the variable labour indicating over use of this input. This might be due to availability of more family labour. In the case of paddy straw, marginal cost was found to be greater than marginal value product which could be attributed to the over use of this resource. Sum of the regression coefficients in this was 0.79 indicating decreasing returns to scale.

6.4. Marketing

The analysis of costs and returns and the marketing channels of marketing of mushroom growers are discussed below. Distribution of the farmer respondents according to the type of buyers is given in Table 5.22.

Majority of the growers sold their product directly to the consumers, this is mainly because intermediaries were very less in mushroom marketing and as it is a perishable commodity, storing or reselling the same in anticipation of more profit was

not logical. This was contradictory with the study conducted by Chauhan and Sood (1992) who identified retailers as the major market intermediaries. In this study the retailers (Bakery) earned a net margin of Rs. 20 per kilogram for which they didn't incur any cost. This can be considered, as the cost for the risk that they bear as this is a perishable commodity.

Only a few growers sold their produce to hotels (13.89). Since the data on handling and processing charges of mushroom as well as the prices of the mushroom delicacies charged by them were not available, further analysis of producer's share in consumer rupee could not be attempted.

The marketing cost incurred included packaging cost, cost of cover, printing charges, cleaning and grading charges and transportation cost. The marketing cost per kilogram of mushroom sold was Rs. 4.50. The growers earned a net price of Rs. 55.50, which can be considered as reasonable. When sold through the retailer, producers share in consumers rupee was 75 per cent. Eventhough the retailer reaped 25 per cent share of the consumers rupee, it cannot be concluded that the efficiency of marketing of mushroom is low since, the producer is getting the same price either he sells directly to consumers or through retailer. Similar to this result, Singh and Kalra (1995) also reported that mushroom marketing in Sonepat district of Haryana was quite efficient due to less number of intermediaries between the producer and consumer.

6.5. Constraints in mushroom cultivation

The constraints faced by mushroom growers in Thiruvananthapuram district, who were in business, were categorised into production constraints and marketing constraints.

6.5.1. Production constraints

The sample growers indicated low yields due to incidence of pest and diseases as their major problem. This happens due to improper sterilization of straw or due to contamination through the air, the spores from the infected bags become air-borne thereby leading to contamination of all the bags in the cropping room. This leads to complete crop failure. Similar to the present study, low yield was reported as a constraint in mushroom production by Han et al. (1978) in Taiwan. However after a decade, Ku and

Lee (1989) reported that there was a steady increase in the mushroom yield due to the release of a highly productive and good quality strain in Taiwan.

Proper sterilization of straw, fumigation of the infected bags in the initial stages of disease attack and fumigation of cropping rooms and stands after completion of every crop is a must to eradicate attack of disease. Das et al (1993) indicated that attack of pests and diseases decreased yields and returns of mushrooms in Kerala.

High price for inputs was not a major problem among the growers. Some growers experienced labour problem mainly because these growers did not have adequate capital to pay wages to hired labour. The whole work from production to marketing was done by family labour by small growers.

Another problem identified in mushroom production was low yield due to seasonal variation. Mushroom requires a humid climate for its proper growth and a sharp decline in yield is reflected during the summer months. Production was found to be low during the months of March, April and May.

The reduction in yield can be controlled to considerable extent by watering the beds at frequent intervals and covering the floors with soil so as to retain the moisture and keep the room moist. Water dipped sacks can also be used as a covering on the walls. Sharma and Gupta (1993) found that low productivity resulted from poor environmental conditions in cropping house.

Inadequate availability of input was the next problem faced by the growers. This was a major constraint only for a small portion of the sample. Availability of paddy straw and spawn was a problem among the growers. As the paddy area is been decreasing in the state and none of the growers had paddy cultivation its availability was a problem. Only a small portion of the cultivators undertook spawn production so the availability of spawn at right time was of great concern to the other farmers. Mushroom can also be grown on other agricultural wastes and even small investment groups can undertake production of spawn atleast to meet their need for it.

Another problem faced by the mushroom growers was poor quality of spawn. Improper sterilization of the spawn substrate in mushroom labs often leads to growth of competitive fungi in the spawn bottle and the use of infected bottles for spawning lead to low yields.

Hence growers should be careful enough to look for full white coloured spawn at the time of purchase. Colours other than white mean infected spawn. Das et al (1993) also reported that poor quality spawn and incomplete technical know-how led to instability in mushroom cultivation in Kerala.

6.5.2. Marketing constraints

Many farmers reported that consumers were unaware about the nutritive value of mushroom. Hence, advertisement with regard to the nutritive value of mushroom as the cheapest and rich source of proteins, vitamins, minerals and fat free food needs to be done by the Government to encourage its consumption, which would lead to a rise in production. Rai and Sharma (1994) reported that the per capita consumption is lowest in India (about 20 g) compared to Germany (3.28 kg), UK (2.97 kg), Italy (2.51 kg), the USA (1.6 kg), etc.

Improper marketing facilities and perishability of mushroom were the other marketing problems reported by the sample growers. Since mushroom is a highly perishable product, its short shelf life is causing a major problem in marketing. Growers are supposed to harvest the crop in the early morning, clean it, pack in 250 grams capacity polybags and then transport it to the market for selling. This involves lot of time depending on availability of labour and quantum of produce and in the mean time, mushroom starts degenerating and losing its freshness.

Fresh and white coloured mushrooms attract demand in the market. Even a slight change in the colour of the product may lead to non-acceptance by the consumers. Hence, appropriate steps should be taken by the government to provide drying facilities for mushroom thereby encouraging more production and increasing number of growers in the state. Carey (1972), Singh (1977), Munjal (1982), Azad et al. (1986), Kohli (1990), Saxena (1993) and Phutela and Gupta (1995) reported perishability of mushroom as a major problem in marketing. Mushroom growers also reported lack of sufficient demand

in the market. It was interesting to note that the majority of the mushroom consumers in the study area were non-vegetarians. A big chunk of the population considers mushroom as a non-vegetarian food and shuns its consumption and some believes this as poisonous. This is a false perception and it has to be removed since mushroom is a vegetable like any other. Educating the consumers would help to increase the demand for mushroom. This again points out the need for strengthening the extension machinery to popularise this protein rich cheap vegetable among the people of Kerala.

6.5 Reasons for closure of certain mushroom enterprises

At the time of the survey the researcher observed that many farmers discontinued the enterprise. So it was decided to collect information on the reasons for the closure of the business with the hope that this would provide some guidelines for improving present situation of mushroom cultivation in Kerala.

The major aspect was in the field of marketing. As the presence of intermediaries were meager identification of consumers for its direct sale was a problem as many of the consumers believed this as poisonous and they preferred some other food product instead of purchasing mushrooms at a higher price than the former. As this is a perishable commodity storing this in anticipation of expected price would only create a loss to them.

Another problem identified was shortage of spawn. Production of spawn was concentrated in the hands of a few and its availability to all was restricted. Its production could not be undertaken by all due to its high investment cost and skilled labour requirement. Non-availability of spawn for longer periods leads to permanent closing of the business.

The quality of spawn was identified as another factor. Poor quality of spawn reduced the yield and in many cases there was a total absence of production. Thus all the efforts of farmers were wasted and discontinued the enterprise.

Lack of interest among the growers due to its high skilled labour requirement, marketing problems, requirement of utmost care due to its delicate nature, and feeling that it will not give proportionate returns for the effort put in and lack of

dignity in this field lead to a lose of interest in the field of mushroom production by many farmers.

Mushroom production was started by many of the farmers as self-employment programme and when they received other jobs, thereafter preferred latter as it seems to be more remunerative and effortless compared to the mushroom production.

Lack of experience was another factor, which made many of them to quit the enterprise. Training programmes were provided only at the time of initiation of the enterprises and they could not tackle many of the problems, which arise in between, and ultimately leading to the closure of the enterprise.

Attack of pest and diseases was another reason for which they moved out of the picture. Contamination of one bed would lead to contamination of all other beds in the room and ultimately suffered a great loss.

Absence of timely availability of paddy straw also negatively influence the mushroom production. Thus the reduction in paddy area indirectly affected adversely the mushroom cultivation in the state and thereby earning additional income through subsidiary occupation.

Summary

VII. SUMMARY

The present study entitled "Economic Analysis of Production and Marketing of Mushrooms" was undertaken during the year 1999-2000.

This study was conducted in Thiruvananthapuram district. This district was intentionally selected for the study because mushroom growing units on commercial basis are well established in the district. The Mitra Niketan, Vellanad and College of Agriculture, Vellayani in Thiruvananthapuram district have been pioneering training programmes in mushroom production since 1980.

The list of mushroom growers was collected from the Kerala Mushroom Growers Association and the list of trainees provided by Mitra Niketan, Vellanad and the College of Agriculture, Vellayani. A sample of 100 growers who maintained a contact with these institutes was selected from the list collected from these institutes. Among the 100 sample farmers, 36 were cultivating mushrooms and the remaining had given up cultivation.

Data were collected from the respondents by personal interview method using a well-structured and pre-tested interview schedule. All the mushroom growers were post-stratified on the basis of nature of investment into Category-I (Temporary upto Rs. 15000), Category-II (Semi-permanent Rs. 15000-25000) and Category-III (Permanent above Rs.25000)

Tabular analysis was used to study the socio-economic features of the respondents and to estimate the cost and returns, marketing cost and margins of mushroom cultivation. Cost concepts were used to estimate the income measures. The resource use productivity was studied using Cobb Douglas production function.

Total cost incurred for cultivation of mushroom was Rs. 5832.13, Rs. 7306.21, Rs. 11193.77 and Rs. 8167.83 respectively for the three categories of farmers

producing one kilogram of spawn was Rs. 12.83. Explicit cost accounted for 71.60 per cent of the total cost. Implicit cost accounted for 28.40 per cent of the total cost. The items in implicit cost were interest on working capital, depreciation, interest on fixed cost, family labour, and supervisory cost which accounted for 15.72 per cent, 12.18 per cent, 4.72 per cent , 35.36 per cent, and 32.02 per cent to the implicit cost respectively, out of this family labour had the major share of cost followed by supervisory cost. The total cost for producing 1 kilogram of spawn was Rs. 17.92. Cost A_1, B_1, C_1, and C_3 per kilogram of spawn Rs. 14.25, Rs. 14.49, and Rs. 16.29, 17.92 respectively.

Gross income from mushroom production was Rs. 6157.43, Rs. 10142.53, and Rs. 19216.46 respectively for the three categories of growers. For the sample as a whole the gross income was Rs. 12118.60. Gross income from spawn production was Rs. 40.00 for one kilogram of spawn.

Farm business income of mushroom for the three categories were Rs. 4230.71, Rs. 7010.81 and Rs. 11802.46 respectively for a crop cycle and Rs. 7973.65 for the sample as a whole. Farm business income of spawn is Rs 25.75.

Family labour income for category-I was Rs. 4140.95, for category-II Rs. 6764.89 and for category-III Rs. 11006.8. For the sample as a whole the family labour income was Rs. 7595.69. Family labour income was Rs. 25.51 in the case of spawn production..

The net income for category-I was Rs. 325.30. The low income is attributed to family labour which contributed a major share in cost for this category there by increasing cost C_1. Supervisory cost which is 10 per cent of the cost C_1 when added to the same increased the total cost. Net income was low for category-II (Rs. 2836.32) as compared with category-III (Rs. 8022.69). The net income for the sample as a whole was Rs. 3950.77. and net income from spawn production was Rs. 22.08.

Farm investment income for the three categories of growers and the whole sample were Rs. 415.06, Rs. 3082.24, Rs. 8818.35 and Rs. 4328.73. Farm investment income for spawn production was Rs. 22.32.

The Benefit-Cost ratio was highest in category-III (1.72) followed by category-II (1.39) and low for category-I (1.06). The operating ratio which represents the efficiency of variable costs was 0.27, 0.28, 0.35 and 0.31 for the three categories of growers and the sample as a whole. Fixed ratio was 0.09, 0.16, 0.27, for the three categories in that order. Aggregate fixed ratio was 0.21. The operating ratio shows that the variable inputs employed were efficient. Fixed investments are indicative of the inefficiency of fixed investments made, pointing to the under utilisation of the capacity by the category-II and III. The Benefit-Cost ratio in spawn production was 2.23. The operating ratio and fixed ratio were 0.32. and 0.08. respectively

In the present study Cobb Douglas production function has also been used as an analytical tool to estimate the productivities of various inputs used in the production of mushroom. The estimated production functions are given below.

$$y = 1.8479 \quad x_1^{0.1558**} \quad x_2^{0.8220*} \quad x_3^{-0.1923**}$$

(0.3173) (0.0743) (0.0826)

$R^2 = 0.92$

$R^{-2} = 0.91$

The explanatory variables included in the functions explained 92 per cent of the variation in the output. In case of mushroom elasticity coefficient of input labour was found to be negative and significant. The rest of the coefficients had positive sign indicating positive effect on total output. Sum of the regression coefficients (Σbi) was found to be less than one, indicating decreasing returns to scale.

In case of mushrooms the negative marginal value product for labour indicated that this input was used in excess quantity. Though the marginal value product of paddy straw was positive they were inefficient in the sense that an investment of additional rupee in these input would yield an additional return worth less than a rupee, since the marginal value product was less than unity. A positive and significant marginal value product for spawn indicated that any additional expenditure on spawn, would increase the total returns (Y).

In the present study an attempt were also made to identify the important marketing channels and also to analyse the marketing efficiency of mushroom. Three marketing channels were identified in the marketing of mushrooms were:

1. Producer- consumer
2. Producer-Bakery-consumer
3. Producer- Hotel-consumer

The most important marketing channel identified for mushroom was Producer-Consumer. Majority of the farmers (69.44 per cent) sold their produce directly to the consumers. While 16.67 per cent sold their produce to retailer (bakery). The producer received a return of Rs. 15 per cover (250 gram) of mushroom. The produce was sold for Rs. 20 per cover by retailer for which they earned a net margin of Rs. 20 per kilogram. The produce was sold to hotels only by few growers (13.89). In the case of mushroom out of the Rs. 80.00 per kilogram paid by the consumer 75 per cent went to the producer. The retailer reaped a net margin of 25 per cent for which they did not subject to any cost. The marketing cost incurred by the producers was very narrow (Rs. 4.50) and the net price received by the producer was Rs. 55.50 per kilogram after deducting the marketing cost.

The economic efficiency of marketing system was measured using Shepherd's index which is as follows.

$ME = \frac{V}{E} - 1$ where 'ME is marketing efficiency, 'V' is the total value of goods marketed and 'I' is total marketing cost. The index of marketing efficiency was 1.45 for mushroom. The higher the ratio, the higher the efficiency of the marketing system.

The constraints faced by mushroom growers were categorised into production constraints and marketing constraints

The problems faced by the mushroom growers in production were

1. Low yield due to seasonal variation
2. Low yield due to incidence of pest and diseases
3. High price for inputs
4. Inadequate availability of inputs
5. Poor quality of spawn

The problems faced by the mushroom growers in marketing were

1. Low prices
2. Improper marketing facilities
3. Perishability of mushroom
4. Lack of awareness among consumers

Policy implications

The policy implications emanating from the present study are as follows.

i. Extension education regarding the profitability and nutritive value of mushroom needs to be made extensive and effective especially among women since it is a nutritious food and can be taken up as an important source for generating additional income utilising leisure time.

ii. Promotion of mushroom cultivation needs to be strengthened through extensive extension service, as mushroom will also provide them more proteinecious food which is cheaper than conventional vegetables.

iii. Attack of pest and diseases was found to be a severe problem in mushroom production which led to recurrent crop failures which in turn led to decline in the number of growers over time. Therefore, effective technical guidance by mushroom experts need to be provided to the growers for contamination free spawn and mushrooms..

iv. Consumer awareness regarding the nutritive value of mushrooms has to be created more effectively through printed as well as visual media including news papers, radio, TV and extension propaganda to encourage mushroom consumption among the people. This will lead to increase in demand for mushroom growers to take up production on large scale.

v. The demand for mushroom shows a rising trend in the international markets during recent years. Hence efforts need to be made by the Government to provide training on product diversification such as drying, pickling etc. and to pool the produce of various growers and export it in dried form to other countries. This will fetch both gainful employment and higher incomes to growers.

vi. Provision of training on mushroom cultivation to interested growers at different locations in the state is important in promoting mushroom entrepreneurship in the state. The different stations of Kerala Agricultural University can be entrusted to do this job.

vii. In order to make mushroom enterprises more popular and widespread, the State Government should establish spawn production labs at different parts of the state. Proximity to a mushroom lab coupled with extension and training programmes relating to mushroom production would help people from all over the state take-up mushroom production.

viii. The spawn production should be undertaken on co-operative line as this is purchased in bulk by coir-pith manufacturers and is a profitable enterprise which would enhance the bargaining power and cost-effective marketing.

viii. Value addition through processing such as drying, making of pickles and extension activities in this line would promote the mushroom industry.

ix. Housewives and other unemployed women are to be mobilised to self-help groups to carry out mushroom production, processing and marketing it efficiently.

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ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF MUSHROOMS

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ABSTRACT OF THESIS

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Abstract

ABSTRACT

The present study entitled the Economics of Production and Marketing of Mushroom was undertaken during the year 1999-2000. This study was conducted in Thiruvananthapuram district. This district was purposely selected for the study because mushroom growing units on commercial basis are well established in Thiruvananthapuram district.

A sample of 100 growers who maintained contact with the training centres was selected. Each farmer was interviewed personally. Among the 100 sample farmers 36 were cultivating mushrooms and the remaining had given up cultivation.

All the mushroom growers were post-stratified on the basis of nature of investment into Category-I (Temporary upto Rs.15000), Category-II (Semi-permanent Rs.15000-25000) and Category-III (Permanent above Rs.25000)

Tabular analysis was used to study the socio-economic features, to estimate the cost and returns, marketing cost and margins of mushrooms. Cost concepts were used to estimate the income measures.

At aggregate level the total cost incurred for cultivation of mushroom was Rs. 8167.83. Material inputs accounted for about 82.85 per cent of the total working capital requirement for the sample as a whole. Hired labour component was absent in category-I . At aggregate level this accounted for 17.15 per cent total working capital requirement. Total working capital requirement for mushroom production was Rs. 3738.51. As compared to males, females were more in the working force, which shows the women's participation in mushroom cultivation. Explicit costs accounted for 45.77 per cent of the total cost. Implicit cost accounted for 54.23 per cent of the total cost. Cost A_1, B_1, C_1, and C_3 per crop cycle for the sample as a whole was Rs. 4144.95, Rs. 4522.91, Rs. 7425.30 and Rs. 8167.83.

The total working capital requirement for producing 1 kilogram of spawn was Rs. 12.83. Explicit cost accounted for 71.60 per cent of the total cost. Implicit cost

accounted for 28.40 per cent of the total cost. Cost A_1, B_1, C_1, and C_3 per kilogram of spawn Rs. 14.25, Rs. 14.49, and Rs. 16.29, 17.92 respectively.

Gross income from mushroom for the sample as a whole was Rs. 12118.60. Gross income from spawn production was Rs. 40.00 for one kilogram of spawn. Farm business income was Rs. 7973.65 for mushroom production and farm business income of spawn was Rs 25.75. For the sample as a whole the family labour income was Rs. 7595.69. and Rs. 25.51 in the case of spawn production.. The net income from mushrooms was Rs. 3950.77 and from spawn production it was Rs. 22.08. Farm investment income was Rs. 4328.73 and Rs. 22.32 for mushrooms and spawn production. The Benefit-Cost ratio was 1.48. The operating ratio which represents the efficiency of variable costs was 0.31. Aggregate fixed ratio was 0.21. The Benefit-Cost ratio in spawn production was 2.23. The operating ratio was 0.32. Fixed ratio was 0.08

Cobb Douglas production function fitted with returns (rupees) as dependent variable and expenditure on inputs like straw, spawn and labour as independent variables revealed that additional expenditure on straw and spawn could increase the output. The input human labour was found to be in excess use.

The most important marketing channel identified for mushroom was Producer-Consumer. Producers share in consumer rupee was 75 per cent. The retailer reaped a net margin of 25 per cent for which they did not incurred any cost.

The major constraint faced by mushroom growers in production was low yield due to incidence of pest and diseases and among the marketing problems the major constraint identified was lack of awareness among consumers.