ECONOMICS OF LEMONGRASS CULTIVATION IN KERALA

Thesis Submitted to
The University of Calicut for the
Degree of Doctor of Philosophy in Economics

by

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DECLARATION

I hereby declare that this thesis entitled **"ECONOMICS OF LEMONGRASS CULTIVATION IN KERALA"** is the record of bonafide research work done by me under the supervision of Dr. A.C. Kuttikrishnan Nambiar, Professor in Economics, University of Calicut, Aranattukara, Thrissur. I further declare that this has not been previously formed the basis for the award of any Degree, Diploma, Fellowship or other similare title.

Thrissur

21-11-2003

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CERTIFICATE

Certified that the thesis entitled **"ECONOMICS OF LEMONGRASS CULTIVATION IN KERALA"** is a bonafide piece of research work done by Sri. P.S. Jayapradeepu under my supervision and guidance. The thesis has not been previously submitted for any Degree, Diploma or other similar title.

Thrissur

21-11-2003

Dr. A.C. K. Nambiar

ACKNOWLEDGEMENT

I came to see extensive lemongrass cultivation in some remote areas of Idukki district, mainly by tribals. This reminded my childhood days, when my grandfather had lemongrass cultivation, which provided a major share of our family income. Some parts of the distillery is still in my possession. Then I came to understand the commercial importance and diversified uses of lemongrass oil, which is one of the most important essential oils produced in the world. Soon I began to study the activity in detail, which resulted in this explorative work. My attempt was appreciated by lemongrass cultivators and the public. In the study region, there are a number of people who helped me in data collection. I thank them all for their valuable help.

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CHAPTER I

INTRODUCTION, OBJECTIVES AND METHODOLOGY

1.1 Lemongrass oil

Lemongrass oil which commands high commercial value is obtained by the distillation of leaves of lemongrass coming under the genus Cymbopogon. Leaves of the plant possess pale-yellow coloured essential oil containing citral. Citral is the aroma-chemical that emit lemon like odour and hence the plant is called lemongrass[1]. Reference to these essences, perfumes, incences and scented waters is made in ancient scriptures like Vedas and Bhagwat Geetha (2000-4000 BC)[2]. When tombs of certain Egyptian Kings of the 20th and 21st dynasties (3000 years ago) were opened in 1881, the cent of Cymbopogon schoenanthus grass was readily detected by smell[3]. The genus Cymbopogon includes about 140 species[4]. There are 47 species of aromatic grasses in India[5].

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1 National Bureau of Plant Genetic Resources (1990), Cultivation Practices for Growing Lemongrass on Irrigated Lands in North, West and Central India, NewDelhi. p.1.

2 Directorate of Marketing and Inspection (1982), Report on Marketing of Lemongrass Oil in India, Ministry of Rural Development, Govt. of India, Faridabad.p.1.

3 Heiba,H.I. and Rizk, A.M. (1986), Constituents of Cymbopogon Species, Quatar University Science Bulletin, Vol. 6 p.53.

4 Verma, V and Sobti, S. N. (1984), Inter-Relationship of Some Species of theGenus Cymbopogon Spreng (Family Gramineae), Journal of Economic and Taxonomic Botany, Scientific Publishers, Jodpur.p.887.

5 Gupta, B.K. and Daniel ,P (1982), Aromatic Grasses of India and their Utilization-A Plea for Further Research, Pafai Journal, p.13.

Lemongrass makes wild growth in many tropical and semi tropical parts of Asia, Africa and in parts of Central America and South America[6]. For the extraction of oil, wild growth grass is now rarely used, as cultivation of the grass has become a common practice.

The major constituent of lemongrass oil is citral. It varies from 60 to 92 per cent depending on the variety of the grass, type of soil, application of manure and fertilizer and climatic conditions. The value of lemongrass oil is determined by the percentage of citral in the oil. The common method for the estimation of citral content in lemongrass oil is the sodium bisulphite addiction method. By adopting column chromatographic method citral having 99 per cent purity can be separated.

1.2 Types of lemongrass

Out of the two main types of lemongrass, Cymbopogon flexuosus Stapf (the East Indian lemongrass) is cultivated in Kerala. Cymbopogon citratus (the West Indian lemongrass) is grown mainly in Guatimala, Brazil and Cuba and is commonly known as American lemongrass. The Regional Research Laboratory, Jammu has identified the species Cymbopogon pendulus which is similar to East Indian lemongrass with white stemmed dwarf plant known as Jammu lemongrass. It has high oil recovery and is suitable for cultivation in Jammu and Kashmir and in some other north Indian states. Two varieties of lemongrass, the red and the white coming under Cymbopogon flexuosus are found in Kerala.

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[6] Pushpakumari (1988), Constituents of Lemongrass Oil, Ph.D. Thesis, Cochin University of Science and Technology, pp.17-18.

1.3 Cultivation

Lemongrass has high water requirement and hence frequent irrigation is essential for getting optimum yield in areas where rainfall is restricted to few months.

The crop is generally propagated through seeds. For the production of seed, plants having good growth is selected and maintained without cutting grass for distillation. When the seeds become ripe, it is collected and stored after drying. The seeds can be used for the next season and if it is stored for more than one season its germination capacity will be lost. Seeds are broadcasted by the beginning of monsoon. Seedlings are grown in nursery and is transplanted. Transplanting is better than direct sowing. Moreover it makes manuring and weeding easy.

The land has to be prepared properly by ploughing. For broadcasting 15 to 20 kg. seeds are required per hectare. After broadcasting the seed, small quantity of soil is put on it as covering. If sufficient moisture is there in the soil, the seeds will germinate within a period of one week. For transplanting in one hectare 8 to 10 kg seed has to be sown in 20 to 25 cents of land. Seedling can be transplanted from nursery within 60 to 70 days at a distance of 15 cm.

Weeding has to be done properly for the good growth of the plant. Intercultural operations are necessary to reduce weed growth and for maximum oil production. It is reported that herbage and oil yield are reduced upto 50 per cent due to weed competition. The oil will also be of poor quality. For optimum yield[7]

[7] Viramani, O.P., Srivastava, R and Srivastava, G.N. (1997), Lemongrass and its Cultivation in India, Farm Bulletin No.6, Central Institute of Medicinal and Aromatic Plants, Lucknow. p.14.

starting from February for about six times the field has to be irrigated. Application of fertilisers are not practiced for the crop. If fertilisers are applied it can increase grass production considerably. Studies conducted at the Lemongrass Research Station, Odakkali recommended an optimum dose of 100kg nitrogen, 70kg phosphorus and 100 kg potash per hectare per year[8]. Two and a half Metric Tonnes (MT) of wood ash should also be applied per hectare per year.

Lemongrass can be harvested three times during the first year and from the next year onwards it can be harvested five or six times a year. Studies have revealed that harvest can be done every 50 to 60 days. Timely harvesting is most important that delay decreases the quantity of oil. The plant cannot tolerate shade and oil yield will be reduced considerably if it is grown as intercrop.

1.4 Importance of lemongrass and lemongrass oil

Lemongrass oil is one of the most important essential oils produced in the world[9]. It is a good source for citral. Dr. Baker, S.G. says "Of the countless numbers of plants in the vegetable kingdom a large percentage possess peculiar aromatic odour by means of which plants may often times be characterised. The substance which impart these peculiar odours to plants consists of mixtures of compounds only in character and of a volatile nature. Hence the designation "Volatile oils" or these being the essence of plants, the "Essential oils"[10].

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[8] Nair, E.V.G., Chinnamma.N.P., and Pushpakumary, R(1979), A Quarter Century of Reserch at Lemongrass Reserch Station. Indian Perfumer, Vol.XXIII, No.3&4, P.219.

[9] Viramani, O.P.Srevastava, G.N.and Singh, D.V.(1987), Lemongrass and Cultivation in India. Central Institute of Medicinal and Aromatic Plants, Lucknow, p.1.

[10] Baker, S.G. (1921), Essential oils, Govt.of Travancore, Department of Industries, Bulletin No.IV, p.1

Though less known to layman lemongrass oil is put to many commercial uses. Studies also indicate vast scope for its use in many areas in future. Major constituents of lemongrass oil and their uses are given in Table 1.1. Column 8 of the table shows diversified uses of the constituents. It is reported that " Commercial lemongrass oil is known to contain 15-25 per cent non citral components. Since the major use of lemongrass oil is as a source of citral, the non citral portion does not find much value. It is at present used as a cheap perfume in soaps. However, an analysis of the non citral portion shows that it is in fact mainly a mixture of useful valuable alcohols like geraniol, neurol, geranyl acetate and a mixture of hydrocarbons. Since the quantity of alcohol and their acetate was found to be over 50 per cent, their isolation and separation into different components if achievable can be of great value. In such a situation non citral portion will command more attractive price than at present[11].

β inones, prepared from lemongrass oil is the basic material for the preparation of Vitamin A. α inones are used in perfumary, confectionary and in liquors. The oil finds use as a perfume for centing soaps, detergents etc. Apart from these, oil is directly used in many pharmaceutical preparations such as pain balm and in some disinfectants since its Rideal Walker coefficient (17.5) is the highest recorded for the indigenous essential oils[12]. The species medicinal importance can be further observed from the below paragraph noted

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[11] Cochin University of Science and Technology (1984), Project Report on Investigation of Composition of Different Varieties of Lemongrass Oil, p.15.

[12] Krishnan Kunji,p.p (1963), The Lemongrass Oil Industry in Kerala State, M.G.M. High School Magazine (Kalakusumam) Kuruppampady, p.77.

Table 1.1

Constituents of lemongrass oil (in the increasing order of boiling points) and their uses

Sl. No.	Name	Formula	Molecular weight	B.P/760mm	Refractive index	Density	Uses
1	2	3	4	5	6	7	8
1.	Myrcene	$C_{10}H_{16}$	136.23	171.5°	1.4709	d^{20} -.794	Intermediate in the manufacture of perfumes
2.	Methyl heptenone	$C_8H_{14}O$	126.21	173.11°	1.4434 (n_D^{14})	d^{15}-.8656	Adjunct in the scenting of soaps
3.	Limonene	$C_{10}H_{16}$	136.23	d-175.5°-176° 1-175.5°-176°	d-1.474 1-1.474	d^{21}-1.8402+ 0.8407	Wetting and dispersing Agent
4.	Dipentene	$C_{10}H_{16}$	136.23	177.6°	1.4744	..	-do-
5.	Methyle heptenol	$C_8H_{16}O$	128.21	178-180	1.4495	d^{15}-.8581	-do-
6.	Linalool	$C_{10}H_{18}O$	154.24	198.23° d-1.4673	1-1.4604 -0.8733	d^{20}-0.8622	In soaps and detergents, in perfumery
7.	Citronellal	$C_{10}H_{18}O$	154.24	208°	1.446	0.848 - 0.856	In soap perfume and insect repellent

Table 1.1 contd.

Constituents of lemongrass oil (in the increasing order of boiling points) and their uses

Sl. No.	Name	Formula	Molecular weight	B.P/760mm	Refractive index	Density	Uses
1	2	3	4	5	6	7	8
8.	n-decyl-aldehyde	$C_{10}H_{20}O$	156.26	208.25^0	1.4287	d^{20}-0.8502	...
9.	Citronellol	$C_{10}H_{20}O$	156.26	224.42^0	..	d- .885(d^{20})	In perfumery
10	Nerol	$C_{10}H_{18}O$	154.24	227^0	1.462	d^{15} - .8813	Manufacture of perfumes
11	Citral	$C_{10}H_{16}O$	152.24	228^0	1.462	d20- .8888 (a) - .8889 (b)	In the synthesis of Vitmin A.
12	Geraniol	$C_{10}H_{18}O$	154.24	229.65^0	1.4766	d^{20} - .8894	In perfumery
13	Geranyl acetate	$C_{12}H_{22}O_2$	198.24	242^0	1.4628	..	In perfumery
14	Farnesol	$C_{15}H_{26}O$	222.36	..	1.4877	d^{20}-0. 8871	In perfumery to emphasize floral perfumes

Source :- Pushpakumari (1988), Op. cit pp. 17-18

from Quatar University Science Bulletin. Because a host of medicinal properties have been ascribed to Cymbopogon species, folk medicine records many applications for this genus. Cymbopogon species have been used as a blood purifier, in rheumatism and cholera, the essential oils of some of their species have been reported to be used as carminatives, stimulatives, antiseptics, suedorofics and also in rheumatism and neuralgia. Roots and stems of these species are used in the antidotal treatment of snake bite and scorpion sting [13]. It is also reported that Cymbopogon flexuosus is believed by the Kukuto people in the eastern highlands of Papua New Guinea to prevent sickness[14].

Verma V, et al reports Cymbopogon is an important medicinal plant finding use in native medicine. The oils and infusions of many of its species are used in treating a variety of human diseases which include interalia, gout, rheumatism, sprains, cough, cold, fevers, various stomach troubles including cholera and leprosy[15]. Citral an important acyclic monoterpene present in the essential oils of many Cymbopogon species is a starting material for synthetic violet and non-toxic adhesives besides Vitamin A[16]. An infusion of fresh leaves is administered as a diaphoretic and stimulant in catarrh and febrile conditions. The oil is used as a carminative find application in chronic rheumatism and

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[13] Heiba, H.I. and Rizk, A.M. (1986), Constituents of Cymbopogon Species, Quatar University Science Bulletin, Vol.6, p. 55.

[14] Ibid, p.57.

[15] Verma, V, Rao P.G., Zutshi U Sobit, S.N. (1985), An Understanding of the Factors Influencing Citral Bisynthesis in Cymbopogon Khasianus. Indian Drugs Vol.22, No.6, March, 85, p.291.

[16] Ibid.

other painful affections[17]. In addition to the above uses there are other uses also for the oil and the grass. Spent lemongrass is used for manuring in combination with organic manures and also for making pulp for paper industry. The Nizam Paper Mill at Puthukottai in Tamilnadu is reported to have used lemongrass collected from forest as raw material. Also it has to be noted that spent grass, after distillation of oil, can be converted into silage by addition of gram flour. It contains about 7-8 per cent crude proteins with calcium and phosphorus. It can also be used as fuel for distillation process or could be made use as farm yard manure.

It is observed that if eggs are placed on dry lemongrass for hatching, it can protect chicken from the attack of insects. A spray of the infusion of lemongrass or a light spray of lemongrass oil can also serve the above purpose. In Kerala, spent grass is popularly used as mulching material for ginger and there is a popular belief that lemongrass mulch reduces the incidents of rot and other fungal diseases[18].Trials conducted in collaboration with the Department of Bio-energy, Tamilnadu Agricultural University, Coimbatore showed that spent grass in combination with cowdung could generate reasonable amount of methane under anaerobic decomposition[19]. Results confirm that heifers can achieve weight gain with the use of plant residues from lemongrass (West Indian) following their distillation[20].Cultivation of

[17] Krishnan Nambiar, V.P., Sasidharan N, Renuka C and Balagopalan N (1985), Studies on the Medicinal Plants of Kerala Forests,Kerala Forest Research Institute, Peechi, p.147.

[18] Thomas, J (1989), Status of Research on East Indian Lemongrass (Paper Presented at the Eleventh International Seminar on Essential Oils,Flavours and Perfumes, New Delhi,p.17.

[19] Ibid, pp. 17-18.

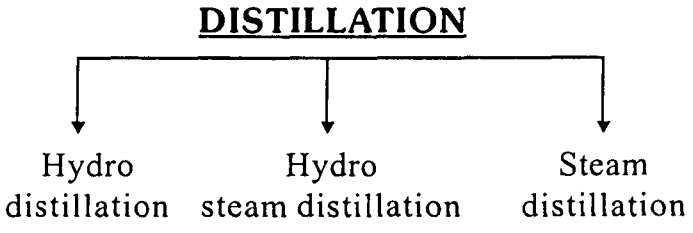
[20] Rosete, A(1987), Cuban Journal of Agricultural Science 21(3) pp. 259-263.

mushroom (pleurotus ostreatus) reached a biological efficiency of 113.01 per cent on lemongrass, 81.85 per cent on cinnamon and 56. 79 per cent on pepper[21]. Experiments have also proved that lemongrass oil is a good mosquito repellent and so it is a constituent in some mosquito repellent creams. Thus the grass and the oil have diversified uses.

1.5 Methods of distillation

Report on the Marketing of Lemongrass Oil in India says "Research on distillation of essential oils were started and the method of distillation developed long ago by about 3000 B.C. A terracotta distillation apparatus which is presumed to have been developed during the Indus Vally civilisation of Harappa (3000 BC) is kept in Texila museum in Pakistan. This historical evidence proves that separation of volatile and non-volatile constituents in a substance was developed in India as long as 5000 years"[22].

Thus it can be seen that distillation had a long history and the process got improved thereafter. There are three methods of distillation process as given below.



[21] Martinex Carrera, (1987), Rev. Mex Micol, pp. 119-124.

[22] Directorate of Marketing and Inspection (1982), op.cit,p.1.

1.5.1 Hydro-distillation (The conventional method)

Hydro-distillation (diagram No.1) which is the conventonal method was introduced in Kerala by a person from Cochin who was known as "Mestry". Even now all the lemongrass cultivators in Kerala adopts this method for distillation.

It is reported that " The current method of distillation adopted in Kerala is primitive and obsolete as it is based on hydro-distillation or direct-fired still. For good quality oil it is advisable to adopt steam-distillation"[23].

Components of the distilling unit

Still

The still is made of copper or tin and usually have 1.35 metres height and 0.7 metres diameter. In the middle of the still there is a hole through which the grass is filled. The hole is closed airtight by a lid having a handle. Still is placed on direct fire and distillation is conducted.

Cooling Tank

The tank is made of wood or tin. In a distillery at Kanthalloor, in Idukki District, concrete tank is used. In forest areas where cold water is avilable from stream, waste drum which is smaller than the wooden tank is in use. This will be sufficient due to the continuous flow of cold water by which condensation of oil vapour is quick. Moreover drum is cheaper than wooden tank. The practice of using drum in the place of wooden tank for cooling is usually seen in tribal centers.

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[23] Viramani O.P, Srivastava G.N, Singh D.V. (1987) op.cit, p.8.

Receiver

The mixture of lemongrass oil and water which come through the coil is collected in the receiver. As the specific gravity of lemongrass oil is less than that of water, it forms the upper layer. The receiver is so designed that the water (which form the lower layer in the receiver) flows out throug the outlet.

Working

In this method 130 to 140 litres of hot water from the cooling tank is poured in the still. After that 80 to 100 kg of grass which is kept in small bundles is filled in the still through the hole at the middle and closed airtight. Then the grass in the still is boiled in water and a mixture of lemongrass oil vapour and steam is produced which when passes through a coil dipped in cold water condense forming lemongrass oil and water. It is then collected in a dish which is kept at the end of the coil.

1.5.2 Hydro-steam distillation

Among the three prevalent distillation methods it was found that the water and steam distillation with a perforated disc at the bottom of the still is most suitable for a small grower to get maximum oil yield[24]. Water is fed at the bottom of the disc and lemongrass is filled over the disc. Water is boiled using direct fire and distillation is conducted using steam thus produced. As in the case of hydro-distillation the mixture of steam and oil vapour condense on cooling, forming oil and water. Lemongrass oil is separated and stored like the other method.

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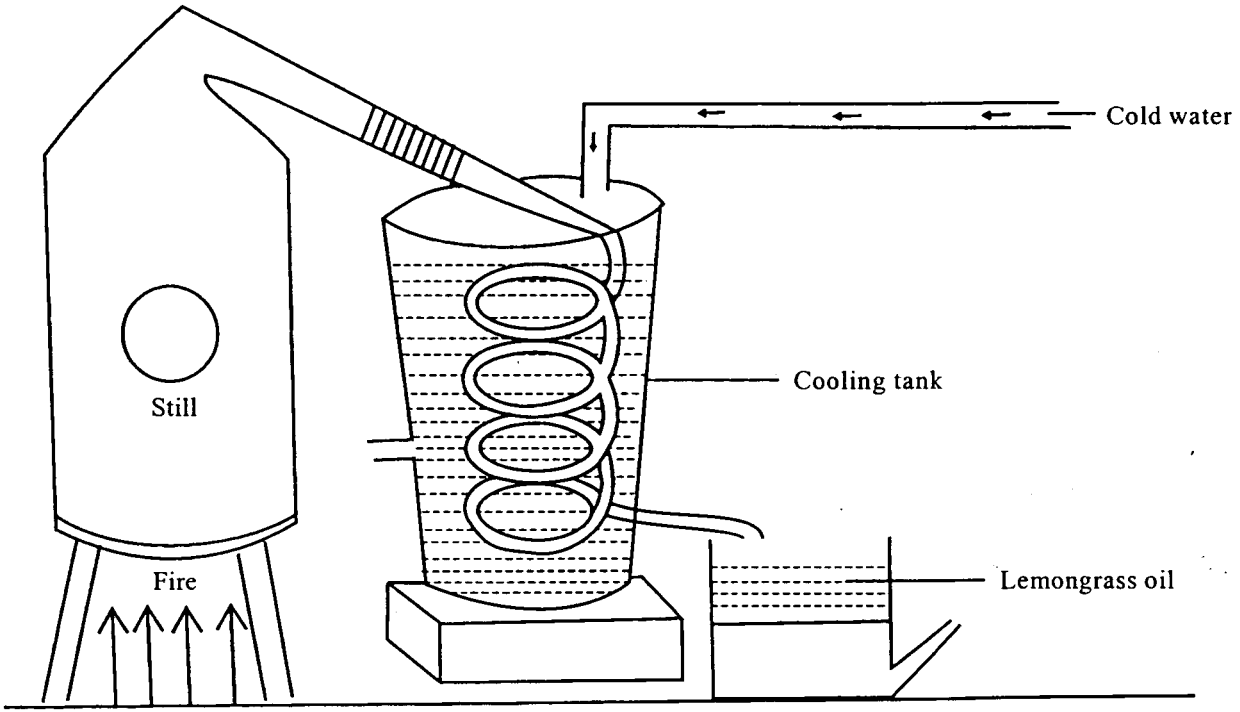
[24] Nair, E.V.G. (1981), Lemongrass. Extension Division, Kerala Agricultural University, p.3.

DIAGRAM 1

DISTILLING APPARATUS (HYDRO-DISTILLATION)



1.5.3 Steam distillation

This is the most advanced method which is suitable for large scale plantations. It is economical when compared to other two methods as steam distillation reduces labour charges and fuel consumption. As initial expense is high, it is not suitable for small scattered cultivators. For steam distillation (Diagram No.2) a separate boiler is required. Oil of good physiochemical property can be produced in this method of distillation.

1.6 Quality specifications for lemongrass oil

The Indian Standards Institution fixed a standard for the oil (IS:327-1952) in the year 1952. For agmarking lemongrass oil, it is graded with 'Special' and 'Grade A'. In the 'special' category citral content will be not less than 76 per cent (ie.76 to 80 per cent). The quality specification prescribed by Indian Standard Institution quoted by Nair, E.V.G[25] is shown below.

1. Colour and appearance	:	Dark yellow to light brown-red mobile liquid
2. Odour	:	Lemon like
3. Specific gravity at 30° C	:	0.888 to 0.898
4. Optical rotation	:	-3° to +1°
5. Refractive Index at 30 °C	:	1.4786 to 1.4846
6. Citral content, per cent by volume (sodium bisulphite assay)	:	A grade 76% to 80%, Special grade 80% and above
7. Solubility	:	Soluble in 3 volumes of 70%alcohol

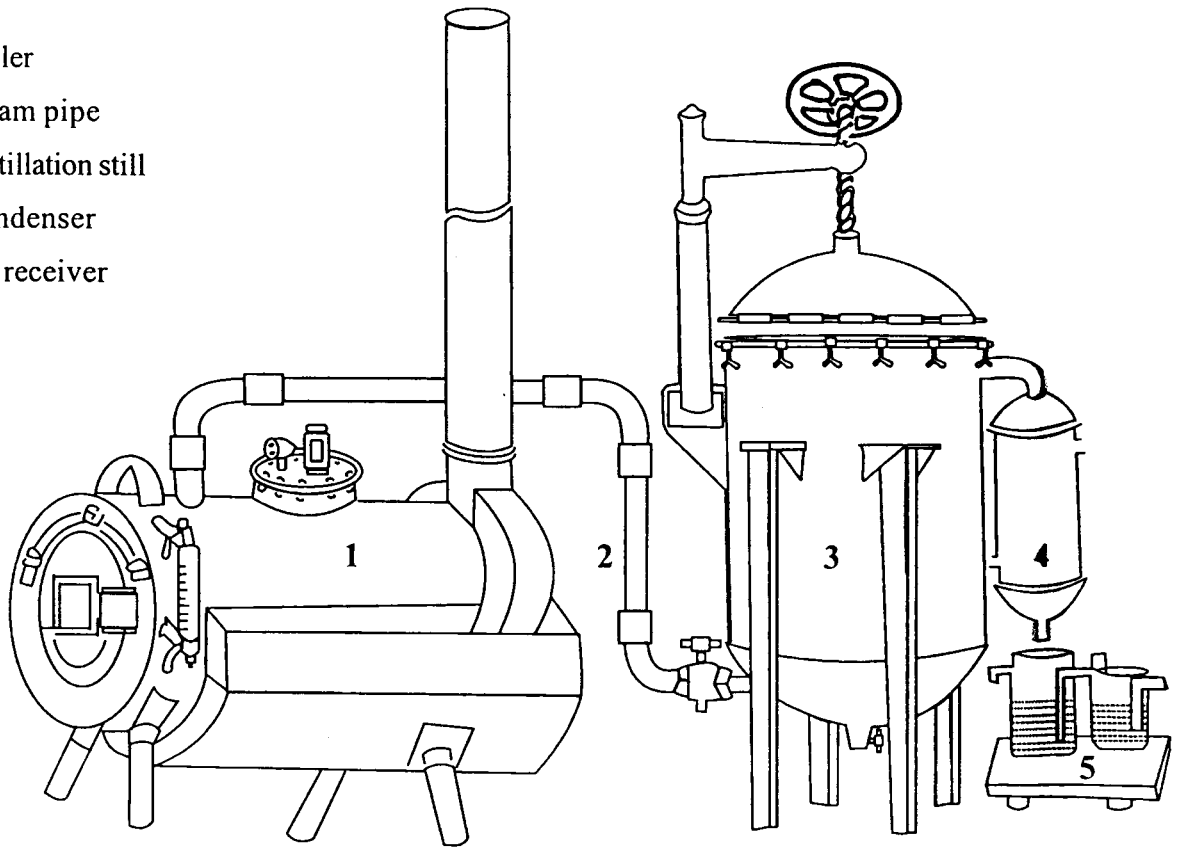
As per the liberalised export policy now lemongrass oil can be exported by giving a declaration and agmarking is not compulsory.

[25] Nair, E.V.G.(1981), op.cit, p.4

DIAGRAM 2

STEAM DISTILLATION UNIT

1. Boiler
2. Steam pipe
3. Distillation still
4. Condenser
5. Oil receiver



Source : National Bureau of Plant Genetic Resources. op. cit.

1.7 Status of lemongrass cultivation in Kerala

In the production of lemongrass oil, India enjoyed a monopoly position for a long time. This monopoly position, however, was lost with the out break of World War II due to shipping problems. This resulted in the extensive cultivation of the West Indian lemongrass (Cymbopogon citratus) in Gautimala and in few other Latin American states[26]. Even then India's export of essential oils come to Rs.160 million in the year 1987-88 out of which Rs.18 million, 11.25 per cent was the share of lemongrass oil. In value this comes next to sandalwood oil[27]. According to Dr.Michael[28] Kerala accounts for a significant share as more than 90 per cent of lemongrass oil originate from the state. This comes to 18 per cent of the total value of essential oil exports from the state.

1.8 Historical background

Though lemongrass as a wild plant can be said in existance in Kerala for a long time its commercial exploitation is only a century old. It was first noticed as a wild growth in the suburbs of Kallil Temple in Methala Hills[29] in Ernakulam district in eighteen eightees. During the period local people were not aware of the commercial importance of the plant. It is believed that the first distillation of lemongrass in Kerala using grass collected from the wild growth was done during eighteen eightees by a person from Cochin who was commonly known as 'Mestry' in Methala Hills. From our discussion in the area we noted that he was an agent of a foreign agency at Cochin who provided the technology of distillation. The distillation of lemongrass at that time was done as a secret process. Due to the ignorance of the commercial value of the oil, people did not took much interest in it. But shortly they started recognising the importance of the oil and entered into the business.

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[26] Thomas, J (1989), op.cit.

[27] Ibid p.2.

[28] Michael A.M (1992), Essential Oil Industry Facing Problems, Indian Express Daily (19th Sept. 92), p.12.

[29] Krishnan Kunji (1963), op.cit, p.76.

Table 1.2
Area under lemongrass cultivation in Kerala (1955-56 to 1998-99)

Sl. No.	Year	Area under lemongrass cultivation in Kerala (hectares)
1	2	3
1	1955-56	14085
2	1960-61	25712
3	1961-62	25395
4	1962-63	24764
5	1963-64	25188
6	1964-65	24036
7	1975-76	2315
8	1976-77	2332
9	1977-78	6930
10	1978-79	5954
11	1980-81	5898
12	1981-82	6371
13	1982-83	7177
14	1983-84	7320
15	1984-85	7762
16	1985-86	6461
17	1986-87	6805
18	1987-88	6142
19	1988-89	5018
20	1989-90	4621
21	1990-91	3416
22	1991-92	2458
23	1992-93	2027
24	1993-94	1722
25	1994-95	1976
26	1995-96	1693
27	1996-97	1639
28	1997-98	1209
29	1998-99	1538

Sources:- 1. For 1955-56 to 1986-87, Bureau of Economics and Statistics, Season and Crop Report of Kerala State (various issues), Govt. of Kerala, Trivandrum.

2. For 1987-88 to 1990-91, Directorate of Economics and Statistics(1993), Economic and Statistical News Letter under Area and Production of Important Crops, Govt. of Kerala, Trivandrum. p.5A.

3. For 1991-92 to 1998-99, Directorate of Economics and Statistics (2001), Statistics for planning, Govt. of Kerala, Trivandrum, p.61.

Though the commercial exploitation of lemongrass is more than 150 years old systematic cultivation and distillation of lemongrass commenced only in 1882 in Kerala[30]. Within a short period lemongrass oil became the most economical agricultural produce of the local people of Kuruppampady, Odakkali etc. of Kunnathunadu Taluk. Later on the cultivation spread to other districts also. Table 1.2 shows the area under lemongrass from 1955-56 to 1998-99. Column 3 of the table reveals that the area under lemongrass cultivation was subject to considerable fluctuation. Thus the area under lemongrass cultivation which was 14085 hectares in 1955-56 rose to an all time high figure of 25712 hectares by 1960-61, an increase of 82.55 per cent. By 1980-81 the area under cultivation came down to 5898 hectares which is only 22.94 per cent of the 1960-61 area. In the year 1998-99 the area under cultivation was 1538 hectares. So it can be seen from the above figures that the activity is on the decline in Kerala and now it is mainly concentrated in Idukki and Wayanad districts as revealed from table 1.3. Here it has to be mentioned that the actual area covered by lemongrass will be higher than these figures as a sizeable part of forest area is made use of by the tribals for lemongrass cultivation.

Considering the importance of the crop a number of institutions have been set up for the development of lemongrass cultivation and its processing. Let as make a brief reference to important among them.

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[30] Pillai, K.P. (1961), Lemongrass in India, Farm Bulletin No.16, Ministry of Food and Agriculture, New Delhi, p.26.

Table 1.3
District wise area of lemongrass from 1975 - 76 to 1998-99 (in hectares)

Sl. No.	District	1975-76	1980-81	1985-86	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	Thiruvananthapuram	---	53	48	28	23	18	4	3	1	1	2	2
2.	Kollam	---	45	27	10	7	8	8	2	1	5	---	---
3.	Pathanamthitta	---	---	15	7	5	3	---	---	---	---	---	---
4.	Alapuzha	---	8	5	1	1	---	---	2	---	1	---	---
5.	Kottayam	75	58	48	20	15	7	22	15	---	2	1	---
6.	Idukki	1321	1020	1819	1476	1058	816	821	898	940	987	796	1116
7.	Ernakulam	487	483	433	109	79	44	11	8	9	3	3	5
8.	Trissur	---	36	50	15	11	5	1	3	6	18	4	6
9.	Palakkad	---	103	262	39	48	71	53	62	19	36	4	2
10.	Malappuram	---	109	77	23	15	11	21	16	18	5	1	---
11.	Kozhikode	185	913	633	173	123	99	75	21	8	12	2	1
12.	Wayanad	---	---	1634	1085	824	775	540	657	599	476	355	332
13.	Kannur	247	3070	818	320	182	126	113	241	90	85	39	74
14.	Kasaragod	---	---	592	110	67	44	53	48	2	8	2	---
	Stage	2315	5898	6461	3416	2458	2027	1722	1976	1693	1639	1209	1538

Source:- Statistics for Planning (2001), Directarate of Economics & Statistics, Thiruvananthapuram, P.61

1.9 Functions and role of different institutions set up for the development of aromatic and medicinal plants cultivation and essential oil industry in India

1.9.1 The Aromatic and Medicinal Plants Research Station, Odakkali

Realising the necessity for evolving superior plant types and standardisation of various agro techniques for maximising oil production, Lemongrass Breeding Station was established in 1951 at Odakkali in Kerala under the Industrial Department of the Travancore Cochin State. It was developed to the status of a Research Station from 1.8.1954 and in 1972 it was handed over to the Kerala Agricultural University which later renamed the institution as Aromatic and Medicinal Plants Research Station[31].

The station concentrates on the development of a number of aromatic and essential oil yielding crops like lemongrass, vetiver, palmarosa, citronella, jamrosa, clocimium, cinnamon and eucalyptus. The station maintains the largest germplasm of lemongrass in the world with around 450 accessions collected from within and outside the country[32].

Other aromatic plants like Japanese mint (Mentha arversis) sweet basil (Ocimum basilicum) Jamrosa and glocimum (Ocimum gratissimum) were also introduced in the station for studying their adaptability[33].

It is the only research centre in India where intensive studies on East Indian lemongrass are being conducted for the past quarter of a century [34]. This Research Station is the second lemongrass Research Station in the world[35] first being in Puerto Rico which is in America. The lemongrass Research Station at Odakkali mainly concentrated their work in crop improvement, crop management and qualitative studies. Experiments were conducted for the

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[31] Thomas J (1989), op.cit. p.3.

[32] I bid, p.5.

[33] Thomas J, Geetha K and Shylaraj K.S. (1987) Glimps of Research at the Aromatic and Medicinal Plants Research Station, Pafai Journal, Oct-Dec, p.25.

[34] Nair E.V.G, Chinnamma N.P, Pushpa Kumari R(1979), op.cit,p.218.

[35] Malayala Manorama Company Ltd., (1960), Manorama Year Book,Kottayam, p.115.

advancement of advanced methods of distillation and as a result hyro-steam distillation and steam distillation methods were developed. But its benefits have not reached the common cultivators [36]. As Directorate of Marketing and Inspection observes " Although Lemongrass Oil Research Station Odakkali has done suitable research work, besides the work of Regional Research Laboratory Jammu, its benefits have not reached the lowest level in the field. If productivity is to be ensured, intensive extension work needs to be taken up by the Central and State Governments". O.D-19 variety developed at the Research Station is a superior one having high citral content in the oil. Two other varieties such as O.D-408 (selection) and O.D-440 (mutant) were tried at the research station. To our dismay we note that the variety is not being put to use by majority of the cultivators in our state especially the tribals. The Research Station has also undertaken production of seeds of other aromatic and medicinal plants [37]. The proposal for developing this Research Station to the status of a National Lemongrass Development Centre is under the active consideration of the Goverment of India[38].

An experiment was conducted to study whether lemongrass can be successfully cultivated in the sandy tracts where cultivable waste land is available. "The explorative study conducted on lemongrass varieties under the coastal sandy tract condition at the Estate of Kerala State Drugs and Pharmaceutical Ltd., Alleppey revealed that Lemongrass variety OD-19 can

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[36] Directorate of Marketing and Inspection (1982) op.cit,p.45.

[37] Mathrubhumi Daily, a National Daily in Malayalam (1990) (26th February 1990), Lemongrass Research Station to the National Level, p.7.

[38] I bid.

be grown commercially in coastal areas of Alleppey district for quality oil. Since KSDP require 30 to 50 MT of oil annually there will not be any problem for marketing the oil"[39].

1.9.2 The Lemongrass Oil and General Marketing Society Ltd., Kuruppampady

A Lemongrass Growers Society was formed on 25th November, 1951 at Kuruppampady about 5 Kilometres from Odakkali with a membership of 30 lemongrass cultivators and started functioning from 10th October,1955. The Society made spectacular progress initially and in the year 1960 it assumed the status of Lemongrass Oil Marketing Co-operative Society Ltd. As per the Bye-laws of the Society the main objectives of the society were "To arrange for the sale of lemongrass oil and other essential oils produced by the members or purchased by the Society to the best advantage. To advance loans to members on the security of their produce, raw or processed. To own or rent a Breeding Station with a Laboratory, Library attached for conducting Research in essential oils".

The Society had also undertaken lemongrass cultivation. In the year 1961 the Society cultivated 81.5 acres and in 1966 an additional area of 105.5 acres were added forming a total of 187 acres. Cultivation of lemongrass and marketing of the oil by the Society continued upto 1978 and at that time its membership was 555. But the Society had not fulfilled its other objectives of establishing Breeding Station, Laboratory, Library etc., for conducting research in essential oils.

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[39] Aromatic and Medicinal Plants Research Station (1985), Consolidated Project Report on Aromatic and Medicinal Plants, Kerala Agricultural University.p.2.

As lemongrass oil industry in Kerala met with some problems and started declining, the Society entered in other business also. Thus in the year 1980, the Lemongrass Oil Marketing Society Ltd., was renamed as The Lemongrass Oil and General Marketing Society Ltd. Currently it is engaged in other business.

1.9.3 The Kerala Lemongrass Producers Association

This was an organisation formed by the lemongrass producers for the promotion of its cultivation and to take care of the interests of the cultivators. The Association formed in 1952 in the larger interest of producers, drew the attention of the Government of India to the need for enforcing quality control of oil meant for exports. They found it as necessary to withstand competition from other countries. As a result in the year 1954 an agency for Agmarking was established.

1.9.4 The Cochin Lemongrass Oil Exporters Association

The Cochin Lemongrass Oil Exporters Association was formed at Cochin in 1955 to promote the common interests of the exporters of lemongrass oil in India. The Association played a major role in the promotion of lemongrass oil trade.

1.9.5 Regional Research Laboratory, Jammu

Regional Research Laboratory, Jammu set up under the Council of Scientific and Industrial Research has conducted research on different aspects of essential oil yielding plants including lemongrass. Introduction of RRL-16 (Jammu lemongrass) and CKP-25 varities were the major contributons of

the centre in the field of lemongrass. RRL-16 is a high yielding strain of Cymbopogon pendulus which is capable of producing 300 kg of oil per hectare per year. The additional advantage of Jammu lemongrass is that it grow well in the northern parts of India, especially the sub-himalayan areas and is reported to be resistant to frost[40]. CKP-25 is a new hybrid strain which is reported to have produced 387 kg of oil from one hectare of plantation[41]. Both the strains have good citral content. Studies on the growth of Jammu lemongrass at Lemongrass Research Station, Odakkali have shown that it is not a suitable variety for commercial cultivation in mid lands of Kerala on account of the climatic conditions.

1.9.6 Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow

The Institute was established in 1959 at Lucknow for research and development of aromatic plants in the country. As different medicinal and aromatic plants need different agroclimatic conditions, the institute has set up regional centres at Bangalore, Pantnagar, Kodaikanal, Boduppal and also in Kashmir. The Institute has been able to develop a new variety of lemongrass designated as CIMAP/LS-48 yielding 50 per cent higher oil per hectare compared to the best variety cultivated in the country so far[42]. A geraniol rich strain, GRL-1 was also developed at the Institute.

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[40] Krishnamoorthy S, (1989), Indigenous Essential Oils - Recent Developments and Perfumary Applications, Indian Perfumer 33(3), p.216.

[41] Paul S, Suresh Chandra, Ajith Singh, Balyan S.S and Kaul B.L (1990), Harvest Management Studies on Lemongrass (CKP-25)- A New Hybrid Strain, Indian Perfumer Vol.34, No.3, p.213.

[42] The Hindu Survey of Indian Agriculture (1988), The New Lemongrass Will Go a Long Way in Increasing Oil Production and Thereby Exports, M/s. Kasthuri and Sons Ltd., Madras, p.143.

1.9.7 Central India Medicinal Plants Organisation (CIMPO), Lucknow

The organisation was established in 1959 under the Council of Scientific and Industrial Research (CSIR). The major objectives of the organisation is to co-ordinate and channelise the present activities in the field of medicinal and aromatic plants carried out by various agencies and State Goverments. The Essential Oil Research Committee which was functioning under the Council of Scientific and Industrial Research was also taken up by the organisation.

1.9.8 Essential Oil Association of India

Essential Oil Association of India was formed in the year 1956 and registered as a society in 1958 under the Societies Registration Act of 1860, in Uther Pradesh. The main objective of the society is to promote and encourage the scientific practices in the production of essential oil .

The Association is publishing a quarterly scientific journal "Indian Perfumer". The journal is an important source of information in the field of essential oils, essential oil yielding plants, perfumery industries, perfumes etc. Other activities of the Association include the conduct of seminars, training in solving technical problems in establishing and running essential oil units.

1.9.9 Perfumers and Flavours Association of India

Perfumers and flavours Association is formed for the promotion of perfumery and flavours industries and allied aspects. The association publishes 'Pafai' journal with valuable articles on essential oils, perfumery and flavours industries.

1.10 Objectives of the study

Lemongrass oil is of high commercial value and is the major income of a number of cultivators, especially the hill tribes of Kerala. Though it is important, very little information is available about the nature of the crop and its cultivation practices. So a detailed study on the nature of the crop and its cultivation practices are very important.

Now lemongrass cultivation is concentrated in Idukki district. Though it is domenantly a tribal occupation non-tribals are also engaged in the occupation in a significant way. What is the social and economic background of the cultivating communities and whether the socio-economic conditions of tribals differ from that of non-tribals are important issues to be examined.

Lemongrass oil is one of the most important essential oils produced in the world. In India its production is more popular in Kerala. At the same time it is most disorganised and cultivated in fragmented lands. On the economic aspects such as cost of cultivation, productivity, profitability, employment potential, economic farm size, optimum farm size for a distillary etc of the crop, studies are lacking. So this study focuses attention on the economics of lemongrass cultivation.

It is evident that there is decline in the area of lemongrass cultivation. To a certain extent it is on account of various problems faced by the cultivators. No systematic attempts have so far been made to examine the problems faced by the cultivators, which will be helpful in developing the activity. So it is very important to study the problems of the cultivators.

At present a major part of lemongrass oil in Kerala is produced in remote areas by our tribals, which provide a major share of their household income. Therefore the status of lemongrass cultivation upon tribal economy of the region has to be studied in detail which will help in the formulation of tribal welfare programmes.

In view of these, the objectives of the study are to examine:-

1) The nature of the crop and its cultivation practices

2) The socio-economic status of the lemongrass cultivators

3) The economics of lemongrass cultivation

4) The problems of the cultivators

5) The status of lemongrass cultivation upon the tribal economy of the region

1.11 Methodology

There is dearth of data relating to lemongrass cultivation. So primay data has been generated for the study. As a complete study was not possible a sample study was conducted. As revealed from Table 1.3, the cultivation is concentrated in Idukki district and hence the district was selected for the study.

From Idukki district major lemongrass cultivation centre comprising of Marayoor and Kanthalloor Panchayats were identified after conducting a preliminary visit to some of the important production centres. From there lemongrass cultivating pockets were identified based on discussions with the local persons. As there is no organization for the cultivators, address of the

cultivating households were collected with the help of lemongrass oil dealers, social workers, heads of tribal colonies, local bodies, Krishi Bhavan, Government and non-Government organisations etc. As tribals are found to be the major cultivators of the region, to give proportionate representation, separate list for tribal and non-tribal cultivating households were collected. There was 380 tribal cultivating households and 257 non-tribal cultivating households in the selected centre. A sample of 40 per cent was drawn from each category by random sampling method. Thus 152 tribal cultivating households and 103 non-tribal cultivating households were selected. A questionnare was prepared and by personal interview method data was collected. The data was analysed by tribal and non-tribal cultivators. Data was also analysed by cross classifying the schedule by direct seeded, transplanted, manured, not manured, age, farm size etc.

One of the important objectives of the study is to analyse the effects on production on a unit change in labour and capital and therefore it will be ideal to state the functional relationships of these factors to a form like

$$O = K L^{\alpha} C^{1-\alpha}$$

Where O is output, K is a constant, L is labour input and C is capital input and α and $1-\alpha$ are production elasticities with respect to inputs. This is the Cobb-Douglas production function which was estimated with the help of computer. For estimation purpose, output was measured as kg of lemongrass per hecare, labour input in labour day and capital (non labour inputs mainly manure) in rupees per hectare.

1.12 Plan of the study

The findings of the study are presented in nine chapters. The first chapter gives a brief introduction covering the importance of lemongrass and lemongrass oil, status of lemongrass cultivation in Kerala, objectives and methodology of the study. In the second chapter review of some of the literature closely connected with the topic of research is made. A profile on the study area is given in the third chapter. Nature of the crop and its cultivation practices are presented in the fourth chapter. In the fifth chapter a socio-economic profile of the lemongrass cultivators is given. Economic aspects of the cultivation such as cost of cultivation, productivity, profitability, employment potential and marketing pattern are given in the sixth chapter. Role of lemongrass cultivation on the tribal economy of the region is given in the seventh chapter. In the eighth capter problems and prospects of lemongrass cultivation is examined. In the last chapter summary of the findings of the study and recommendations are given.

REVIEW OF LITERATURE

P.S. Jayapradeepu “Economics of lemongrass cultivation in Kerala ” Thesis. Department of Economics, Dr. John Matthai Centre Thrissur , University of Calicut, 2003

CHAPTER II

REVIEW OF LITERATURE

Studies on the economic aspects of lemongrass cultivation is conspicuous by its absence. At the same time studies on seed varieties and on botanical aspects, there are abundant literature both in India and abroad and therefore a brief reference to some of these studies are attempted here. A brief review on agricultural sector in general is also attempted.

An account of the history of essential oil industry is given by Srivastava.A.K. and Mrs.Roma Srivastava [1]. The article revealed that like human civilization, the history of essential oils also began in the east. It also pointed out that it was in the oriental countries such as Egypt,Persia, China and India that the process of distillation first conceived and actually put to use.

Review on the studies conducted on Cymbopogon species at the Lemongrass Research Station, Odakkali was done by Nair,E.V.G. and Chandrasekharan Nair K [2]. The review showed that transplanting of seedling is superior to direct sawing of seed. Cymbopogon citrates (American lemongrass) and Cymbopogon pendulus (RRL-16) were cultivated at Odakkali Research Station on an experimental basis. The study showed that the above varieties are not suitable for commercial cultivation under Odakkali

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1 Srivastava A.k. and Mrs.Roma Srivastava (1976), Essential Oil Industry in India, Indian Perfumer, Vol.XX, Part 5, p.99.

2 Nair E.V.G. and Chandrasekharan Nair K (1977), Review on the Studies Conducted on Cymbopogon Species at the Lemongrass Research Station, Odakkali, Indian Perfumer, Vol.XXI, No.3, pp.154-156.

conditions.It was also reported that application of 2.5 tonnes of compost made of spent grass with 1.875 tonnes of wood-ash per hectare per year were sufficient to supply enough materials for the crop. Another observation was that in the case of OD-19 an interval of 55 to 60 days was the best period for obtaining oil yield with high citral content when the plants were grown on hill sides. In the case of plain land 50 to 55 days interval is sufficient to get maximum grass and oil yield.

The Research Station conducted a project study on the possibility of lemongrass cultivation in the sandy tract (coastal area) of Kerala [3]. It showed that OD-19 can be cultivated commercially in coastal areas of Alleppey district.

Experiments were conducted by Chatterjee.S.K. and Ghosh.M.L.[4] to examine the possibility of cultivating East Indian Lemongrass (Cymbopogon flexuosus) and the West Indian Lemongrass (Cymbopogon citratus) in the hilly tracts of Gangestic Plains in West Bengal. It was observed that the plant yielded 0.3 per cent oil containing 61 to 65 per cent citral. The yield of herbage per hectare increased from the first year and reached maximum during the 3rd year after planting, the average being 10,000 kg per hectare per year. Yield of oil was maximum during the period generally before flowering. It was also reported that the West Indian type of lemongrass (Cymbopogon citratus) could also be grown successfully in these regions. The oil obtained from this plant had citral content between 60 to 70 per cent.

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[3] Aromatic and Medicinal Plants Research Station, Odakkali (1985),op.cit, pp.2-3.

[4] Ckatterjee S.K. and Ghosh M.L (1977), Cultivation of Essential Oil YieldingPlants in the Hilly Tracts and Gangestic Plains in West Bengal, Indian Perfumer Vol.XXI No.1, pp.31-40.

Jain N.K.[5] examined the prospectus of planting essential oil bearing grasses as an inter crop in tea plantations. As per the report, if such grasses were cultivated in the first two years, it can be used as mulch and help as a soil conservation crop in tea plantations. The report states "In this process of soil rehabilitation, the cultivation of aromatic plants, especially grasses like Ceylon Citronella (Cymbopogon nardus), Java Citronella (Cymbopogon winterianus Jowitt) Lemongrass (Cymbopogon flexuosus Wats) and Palmorosa (Cymbopogon martini Wats) as rehabilitation or cover crops, can be appropriately advocated. As a matter of fact a large number of tea estates in North East India are at present using their citronella or lemongrass for purpose of rehabilitating uprooted tea areas"[6].

Khosala S.N. reports that chemical weeding with gramoxone and 2,4-D in Cymbopogon pendulus increased oil yield without affecting the quality of the oil[7].

Atal C.K, in the article on essential oils expressed his opinion that the reason for the enormous growth of synthetic perfume in western countries is due to necessity as there is an absolute dearth of natural raw material. In his words, western people do not use highly spiced food not because, they do like it. They are in fact fond of spiced food but what forced them to adopt to

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5 Jain N.K (1979), Prospectus of Essential Oil Bearing Plants in Tea Plantations of N.E. India, Indian Perfumer, Vol.XXIII, No.1, pp.S20-S25.

6 1 bid.

7 Khosla, S.N. (1979), Chemical Weeding with Gramoxone and 2,4-D in Cymbopogon pendulus Wats - Nees ex stend (Jammu Lemongrass or RRL- 16), Indian Perfumer, Vol.XXIII No.2, pp.125-127.

their food habits is that the spices come from east and were expensive besides being rare. Synthetic flavours could not make a big headway because if these are used for internal daily it will create lot of pharmacological problems[8]. So there is great possibility for the production and marketing of essential oils.

The properties of four cultivars of lemongrass, a local variety, OD-19, OD-440 and Jammu lemongrass were studied at the Tamil Nadu Agricultural University, Coimbatore during 1980[9]. It was reported that the lowest height was recorded for jammu lemongrass and local selection recorded the highest height. In the case of tillers per clump the local variety had the highest number. Longest lamina was also noticed in the local selection. But oil percentage was high for Jammu lemongrass (0.58 per cent). The local variety and OD-19 gave only 0.33 per cent and OD-440, 0.31 per cent. The report concludes that lemongrass can be cultivated successfully in the plains of Tamilnadu.

Saha B.N and others observed that SD-68 strain of lemongrass performed well at Sepahijala (Agarthala). The studies showed that yield of herb and oil was significantly higher if three cuttings are done per year[10].

Selection studies for high oil yield and citral percentage in the oil were carried out in the open and self-pollinated populations of Cymbopogon

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8 Atal C.K (1979), Essential Oils in the 1980's Indian Perfumer Vol.XXIII, No.3, p.142.

9 Muthuswami S and Sayed S (1980), Preliminary Note on the Extraction of Lemongrass Oil, Indian Perfimer Vol. XXIV, No.4, pp. 226-227.

10 Saha B.N, Baruah A.K.S, Singh K.K, and Bordoloi (1980), Performance of SD-68 Lemongrass Strain at Sepahijala, Tripura, Indian Perfumer, Vol.XXIV, No.2, pp.85-87.

flexuosus and Cymbopogon khasianus[11]. Cymbopogon flexuosus was having high citral content while Cymbopogon khasianus had high oil percentage . This study was aimed at the production of a hybrid of the above two varieties having high oil yield and citral content. As limited success was made on this line, Cymbopogon pendulus was suggested as an alternative which can contribute for high citral genus to Cymbopogon khasianus.

Thappa R.K and others of the Regional Research Laboratory Jammu conducted studies on Cymbopogon flexuosus, Cymbopogon citratus and Cymbopogon pendulus during 1981. Among the three species, the oil from Cymbopogon pendulus was better in quality as well as in quantity[12]. An analysis of the oil from these three species showed about twenty components in each oil.

Work done on Indian essential oils at Forest Research Institute was reviewed by Gulati N.K and Suri R.K. during 1985. The report says, a systematic research work on the essential oils was started as early as 1906 at the Institute. This series was later on compiled by Rao et.al. An informative book on Some Useful Aromatic Plants of India was written by Badhwar, Rao and Sethi. Sood reviewed the work done on essential oils from 1947 to 1970. The authors further reported that Cymbopogon citratus (DC) Stapf (Farm Graminee) was cultivated as inter crop in eucalyptus plantation at Bhaniawala and Golatappar in East Dehra Dun forest division. On distillation they yielded 0.48 per cent of oil. The oil had 79.65 per cent citral.

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[11] Mrs. Rao, B.L, Verma V and Sobti S.N (1980), Genetic Variability in Citral Containing Cymbopogons; C.khasianus and C. flexuosus, Indian Perfumer Vol.XXIV, No.1,pp.13-16.

[12] Thappa, R.K, Agarwal S.G, Dhar K.L and Atal C.K (1981), Citral Containing Cymbopogon Species, Indian Perfumer Vol.XXV, No.1 p.15

Properties of a new chemo-mutant of lemongrass was discussed by Handique A.K. I is reported that through chemical mutagenesis a new strain of lemongrass has been isolated and established. Morphologically, it is similar to any other lemongrass but its oil is colourless and out of the two isomers of citral, only citral-a is exclusively present. citral-b is negligible. It is a new chemo-mutant of lemongrass, provisionally named LM-81[13].

Dutta P.K. and others of the Regional Research Laboratory, Bhuvaneswar conducted a survey on essential oil bearing plants[14] cultivation in Bhuvaneswar. The result showed that a number of essential oil bearing plants such as Palmorosa (Cymbopogon martini var motia) Citronella (Cymbopogon winterianus) Lemongrass (Cymbopogon flexuosus) Eucalyptus citriodora and Cinnamon (Cinnamomum zeylancium) are being succcssfully cultivated in Bhuvaneswar.

In a paper on Research and Development of Essential oils in the Punjab, Randhawa G.S and Mahey R.K examined the research and development work carried out at the Punjab Agricultural University, Ludhiana on essential oils[15]. It was reported that the farmers had organised into an association, the Punjab Essential Oil Producers Association, to safeguard their interests and tackled the problems of marketing of essential oils. An experiment was conducted

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[13] Handique A.K (1985), Develpoment of a New Chemo-Mutant of Lemongrass, Indian Perfumer, 29 (3-4), pp.139-145.

[14] Dutta P.K, Saxena H.O, Misra B.C, Paul S.C, Brahman M, Saheo S, and Patra (1985), Cultivation and Survey of Essential Oil Bearing Plants in Orissa Region. Indian Perfumer 29(1-2), pp.63-66.

[15] Randhawa G.S and Mahey R.K (1985), Research and Development of Essential Oil in the Punjab, Indian Perfumer 29 (1-2), p.99.

to find out the suitable plant spacing for the two varieties of lemongrass SD-68 and RRL-16. Result showed that closer spacing of 60cm x 45cm gave higher herb and oil yield over other wider spacings in both the varieties[16]. It is also proved that RRL-16 is superior to SD-68under Ludhiana conditions.

A good review on the status of agronomic research in Cymbopogon grasses in India was done by Pareek S.K.and Rajendra Gupta in 1985. The authors pointed out that co-operative distillaries have boosted production in several countries of south-east Asia and should be encouraged in India. Partnership with user industries in distillation would provide a cushion to the growers against price fluctuations and accord ready marketing facility for small growers in the country[17].

A study was conducted by Prasad L.K. and Rao M.S.S. from 1979 to 1983 on the effect of spacing and nitrogen on herb yield of Cymbopogon citratus and Cymbopogon flexuosus. Results showed that a spacing of 15 cm and 22.5cm with four levels of nitrogen viz, 0, 20, 40, 60 Kg. N/ha. is most suitable for maximum production . Eventhough there was no significant effect of spacing on cymbopogon citratus, increasing levels of nitrogen increased the yield upto 60 Kg. N/ha[18]. The experiment also proved that closer spacing of 15 cm. and increasing levels of nitrogen upto 60 Kg. per hectare significantly increased the herbage yield.

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[16] I bid p.102.

[17] Pareek S.K and Rajendra Gupta (1985), On the Status of Agronomic Research in Cymbopogon Grasses in India with Projections on Future Work, Indian Perfumer, 29(3-4), pp.215-224.

[18] Prasad L.K and Rao M.S.S. (1986), Effect of Spacing and Nitrogen on Herbs Yield of Cymbopogon citratus and Cymbopogon flexuosus, Indian Perfumer, 30(4) p. 457.

Comparative performance of OD-408, OD-440 and OD-19 were studied at the Aromatic and Medicinal Plants Research Station, Odakkali from 1981 to '84[19]. Results showed that OD-440 excelled other varieties in oil yield and oil content was maximum for OD-408, which is a white stemmed type.

It was reported that the price of lemongrass oil depend on the Chinese production and export of Litsea cubeba oil which is the major source of citral in the overseas market[20].

Krishnamoorthy S, reported the qualities of Jammu lemongrass[21] developed at the Regional Research Laboratory, Jammu. It grew well in the northern parts of India, especially the sub-himalayan areas and is reported to be frost resistant. It is capable of high oil production. Quality of oil is similar to that of East Indian lemongrass oil from Kerala, suitable for all commercial purposes.

Some essential oil yielding plants (Cymbopogon, Pogostemon and Matricaria) were tried for the possibility of commercial cultivation in the Gangestic plains of Hooghly district of West Bengal. The studies revealed that commercial cultivation can be done with Cymbopogon flexuosus, Cymbopogon Martini and Cymbopogon Winterianus. It was further pointed

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19 Kuriakose K.P, Rajan K.C and Alice Kurian (1987), Two Promising Types of Lemongrass (Cymbopogon flexuosus Stapf), Pafai Journal, Vol.9, No.1, pp.17-18.

20 Pafai Journal (1987), Vol.9,No.1, p.29.

21 Krishnamoorthy S (1989), Indigenous Essential Oils- Recent Development and Perfumery Applications, Indian Perfumer 33(3), pp.215-218.

out that Cymbopogon flexuosus (OD-19) crop proved to be promising[22] showing better growth, oil yield and oil quality and the crop may be commercially exploited in the area for diversification of crop pattern and upliftment of rural economy.

Three species of Lemongrass were tried at the Aromatic and Medicinal Plants Research Station, Odakkali, during 1987-88 to evaluate their comparative performance at varying levels of nitrogen under rainfed condition[23]. The species under trial were Cymbopogon flexuosus (Type 85 from NDUAT, Faizabad, U.P), Cymbopogon pendulus (RRL-16) and Cymbopogon citratus OD-439. Maximum height and tiller count were recorded in Cymbopogon flexuosus followed by Cymbopogon pendulus and the least in Cymbopogon citratus. The above trend was shown in herb yield. In the case of oil yield, Cymbopogon flexuosus and cymbopogon pendulus were found superior. Being a rainfed crop, two distinctive peaks in oil production were observed coinciding with two monsoons.

Studies on the control of iron chlorosis in lemongrass and citronella java were conducted at the Central Institute of Medicinal and Aromatic Plants. Chlorosis occurs due to iron deficiency when these crops are grown on alkaline/calcareous soils. Due to chlorine, plant height, tiller and dry matter

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22 Ghosh M.L (1989), Introduction and Scientific Growing of Some Essential Oil Yielding Plants in the Gangestic Plains of Hooghly District, West Bengal, Indian Perfumer 33(4), pp.286-290.

23 Thomas J, Geetha S and Joy P.P (1990), Short Note, Comparative Performance of Lemongrass Species , Indian Perfumer, Vol.34,No.3.

production were decreased markedly in lemongrass and citronella Java[24]. It is further reported that foliar application of Fe-EDTA, Fe-citrate and Fe SO_4+ glucose resulted in significant regreening in chlorotic lemongrass which was accompanied by significant increase in herbage and essential oil yield[25].

A field study was conducted by Paul S, and others during 1988 and '89 to investigate nitrogen requirement of new lemongrass strain, CKP-25. In the first year no significant difference in the herb and oil yield was noticed due to increase in nitrogen dose between 120 to 180 kg per hectare. Herb and oil yield increased considerably with the application of 180 kg of nitrogen per hectare. In 2nd year crop, the highest dose of 340 kg N/ha gave significant increase in both herb and oil yield over the other treatment. The herb (83.7 T/ha) and oil (383.7 kg/ha) yield under the treatment was 66.5 and 42.8 per cent higher than control[26]. It was further observed that there was no difference in citral content in both the years with the graded doses of nitrogen.

A pot experiment was carried out to study the effect of added nitrogen on nitrate reductose activity in lemongrass with four different levels of nitrogen ie, 1g, 2g, 4g and 8g supplied in the form of urea[27]. It was observed that

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24 Central Institute of Medicinal and Aromatic Plants (1991), Control of Iron Chlorosis in Lemongrass and Citronella Java, CIMAP News Letter, Vol.18, PP.1-2.

25 Ibid.

26 Paul S, Suresh Chandra, Balyan S.S, Ajith Singh and Mrs. Rao B.L. (1992), Nitrogen Requirement of New Lemongrass Strain CKP-25, Indian Perfumer 36(2), pp.75-80.

27 Anjan Barua and Bordoloi D.N (1992), Physiological Activities of Nitrogen on Nitrogen Reductose Activity, Effect on Herb Yield, Dry Matter, Nitrogen, Clorophyll A&B, Essential Oil and Citral Content in Lemongrass (Cymbopogon flexuosus Stapf),Indian Perfumer 36(1)pp.20-23.

increased level of nitrogen showed progressive increase in enzyme activity. As a result higher amount of chlorophyll pigments, dry matter, herb yield etc, were noticed upto 4g of nitrogen. But at 8g of nitrogen the enzyme activity was reduced considerably. In the case of oil and citral content no variation was noticed.

Dr. Ernest Guenther an authority on essential oils in his book 'The Essential Oils'[28] described various aspects of lemongrass cultivation in India and abroad. But he had not focused attention on the economic aspects of cultivation.

In an article on 'Oil of Lemongrass as a Source of Perfumery Products' Gopalan A.K and others explained a method for the preparation of Geraniol and Nerol from citral[29]. Geraniol is mainly obtained from palmarosa oil and citronella oil and has a delicate rose odour, used in the preparation of synthetic ottos and in soap industry. It is stated that geraniol can also be prepared by the reduction of citral. Nerol which is also used in perfume industry can also be prepared from citral. Eventhough the main source of geraniol is palmarosa oil or citronella oil, it can also be prepared by the reduction of citral. This reduction can be achieved either by the use of sodium amalgam in dilute alcoholic acetic acid, or by catalytic reduction or by fermenting yiest in the presence of citral.

The article further stated that citral is a good source for the alcohol nerol, derived from the isomer citral beta (nerol). By careful reduction of citral using a solution of aluminium isopropoxide in isopropyl alcohol Ponndorf

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[28] Ernest Guenther (1950), The Essential Oils, D. Van Nostrand Company, Inc., New York, pp.20-65

[29] Gopalan A.K, Barve B.S and Desikachar (1961), Oil of Lemongrass as a Source of Perfumery Products, Indian Perfumer, Vol.V, Part I, pp.29-35.

obtained a mixture of geraniol and nerol in which nerol content predominated. Although the odour of nerol is similar to that of geraniol, the former is a superior odorant so far as rose compositions are concerned as it provides a velvety blossom top note of freshly cut dark roses[30].

Method for the conversion of citral into geraniol is explained in detail by Nigam M.C and others in the article on Utilisation of Citral Rich Oils for Production of Geraniol [31].

A search for citral rich oil from cymbopogon citratus plants collected from the areas of Sherbang, Sajo, Lumla, Namtsering and Pharmey of Tawang Subdivision of Kameng District, Arunachal Pradesh was conducted at Regional Research Laboratory,Jorhat [32]. The study revealed that 0.78 per cent of oil on fresh weight basis was obtained from plants collected from Sherbang which had a citral content of 82.7 per cent. Another sample from Sajo had 0.90 per cent oil in the grass and the oil from this contained 78.9 per cent citral. This finding was a good step towards the search for citral rich essential oils.

Comparative performance of Cymbopogon citratus Stapf, the West Indian Lemongrass and Cymbopogon pendulus the Jammu Lemongrass were examined by Kole C, Biswas S and Sen S, under rainfed conditions of West

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30 I bid.

31 Nigam M.C, Dutta S.C, Bhattacharya A.K and Duhan S.P.S (1976), Utilization of Citral Rich Oils for Production of Geraniol, Indian Perfumer, Vol.XVIII, Part II, pp.55-56.

32 Rabha L.C, Baruah A.K.S and Bordoloi D.N (1979), Search for Aroma Chemicals of Commercial Value from Plant Resources of North East India, Indian Perfumer Vol.XXIII, No.3, pp.178-183.

Bengal. Estimation of the intraspecific and interspecific variation of some important morpho-economic characters along with the part-wise contribution towards the oil yield were also discussed [33].

Essential oil obtained from Cymbopogon flexuosus contain a number of constituents. Numerous investigations were conducted to establish compounds such as mycrene, p-cymene, methyl heptenone, citral a, citral b, geraniol, nerol, decyl aldehyde, farnesol, farnesal a terpineol and isopulegol. Studies were conducted using gas chromatography of the two varieties of Cymbopogon flexuosus viz. SD-68 and OD-19. The presence of hitherto unreported constituents such as terpinen-4-ol, β-terpineol, terpinyl acetate, borneol and nerolidol have been established. The investigations also revealed that limonene which was reported by the earlier workers as a doubtful constituent does not exist even in traces in the two essential oils[34]. The presence of citronellal was established by the authors.

In an article on Aromatic grasses Gupta B.K. and Daniel P[35] examined the possibiltity of exploiting the commercially unexploited species of aromatic grasses. As per the authors only ten genera and forty seven species were exploited for their essential oils. The authors further stated that out of the

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[33] Kole C, Biswas S and Sen S(1981), Growth and Performance of Cymbopogon citratus Stapf, the West Indian Lemongrass and Cymbopogon pendulus (Nees ex stend) Wats, the Jammu Lemongrass in West Bengal, Indian Perfumer, Vol.XXV, No.1, pp.56-60.

[34] Faiz Mohammed, Nigam M.C and Prof. Wasiur Rahman (1981), Detection of New Trace Constituents in the Essential Oils of Cymbopogon flexuosus, Pafai Journal, Vol.3, No.1, p.28.

[35] Gupta B.K and Daniel P(1982), Aromatic Grasses of India and Their Utilization - A Plea for Further Research, Pafai Journal (Jan-March),pp.13-27.

forty seven species only about twenty five species, including the currently exploited ones, have been analysed for their oil and their chemistry. A number of species, despite they being said to be aromatic/sweet-scented, virtually nothing is known about their oils or their chemical composition[36]. If a study on the wild species of the grass is conducted which may help to add at least a few more oils of commercial importance. This will contribute to the economy of our country. Hence a plea was made to the researchers of the various institutions in the country to undertake the desired investigations on the aromatic grasses occurring in their respective locations[37].

An attempt was made by Gupta B.K and Rubab Jaffer to review the work done on Indian Cymbopogons. The genus Cymbopogon is unique as all the species are aromatic. The article reviewed aspects such as anatomy, breeding, chemistry of the oil, embryology, cytogenetics, ecology, taxonomy, physiology etc. It was reported that less attention was paid to most of the aspects and suggested for further research which will enable us to have a better understanding and consequent better utilisation of these economically important grasses[38].

A study was conducted at the experimental farm of the Central Institute of Medicinal and Aromatic Plants, Lucknow[39] to identify three new species

[36] I bid p.13.

[37] I bid.

[38] Gupta B.K and Rubab Jaffer (1982), A Review of Work Done on Indian Cymbopogons with an Emphasis on the Need for More Research, Pafai Journal, Vol. 4, No.4 p.11.

[39] Nair R.V, Siddiqui M.S, Sen T and Nigam M.C (1982), Identification of Three New Species of Cymbopogon of Perfumery Value and Their Gas Chromatographic Evaluation, Pafai Journal (July-Sept) pp.21-23.

of Cymbopogon of perfumery value and their gas chromatographic evaluation. For this purpose a number of Cymbopogon species were procured from Kerala. Growth of the plants were satisfactory and found to be of potential value in the perfumery industry. It was also found that oil of two species richer in geranyl acetate and linalyl acetate can be directly utilized in the manufacture of perfume. Other species Jwarancusa (Jones) Schult was richer in citronellol and geraniol with better value than the Jawa citronella oil.

Sarin Y.K and Kapahi B.K, in 1984 reported that the present annual turnover of the aromatic plant raw material is estimated at around 300 millon U.S.dollars[40]. It is also reported that our country has more than 1200 species of aromatic plants. India has been a traditional producer of some important aromatic raw materials such as Sandal wood, Agar wood, Vetiver root, Roshagrass, Lemongrass, Ginger, Pepper, Jasmine, Costus root, Keora and Valerian[41]. As per the report some items have been added to the list during the last few decades which include Japanese mint, Java citronella, Celery seed, Cedar wood, Davana, Blue gum and Chirpine oleoresin.

A review of the research and development activities done on some essential oils was done by Krishnamoorthy S, during 1985[42]. The report briefly examined the efforts in this line in the last ten years in the use of new essential oils of Mentha citrata, Mentha piperita, Jamrosa, Cocimum and Jammu lemongrass for perfumery.

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40 Sarin Y.K and Kapahi B.K (1984), Plants as Raw Materials for Essential Oils and Aroma Chemicals, Pafai Journal, (April-June),pp.20-21.

41 I bid, p.20.

42 Krishnamoorthy S (1985), Research and Development on Some Speciality Essential Oils, Indian Perfumer, 29 (1-2), pp.31-36.

An experiment was conducted at the Lemongrass Research Station, Odakkali from 1963-64 to 1966-67 to study the effect of different intervals of harvest, on the yield of grass, oil content of lemongrass and citral. Significant difference was noticed in the yield and citral content. An interval of 45-55 days was identified as the optimum interval between harvests for better yield and quality of oil[43].

The Spices Enquiry Committee appointed by the Indian Council of Agricultural Research in its report provides some basic data on pepper, cardamom, ginger, turmeric, cashewnut and lemongrass. The report lays stress on the need for establishing co-operative marketing societies. The report suggests that such societies should own laboratories for the regular testing of the oil and its correct determination of citral content and other quality factors. Necessary facilities should be given by the Government, at the Central and the State in organising such co-operatives [44]. Regarding distillation, the report pointed out the following defects in the present equipment which will have to be remedied [45].

a) Wastage of fuel due to external heating.

b) Incomplete recovery of oil.

c) Deterioration in the quality of oil due to unregulated heating.

d) Improper cooling system causing wastage of oil due to over-heating.

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[43] Chinnamma N.P and Menon P.K.G. (1973), Effect of Harvest at Different Intervals on the Grass and Oil Yield and Citral in Lemongrass (Cymbopogon flexuosus Stapf), Agricultural Research Journal of Kerala, 11(2), p.121.

[44] Indian Council of Agricultural Research (1953), Report of the Spices Enquiry Committee, New Delhi, p. 141.

[45] I bid p.131.

e) Longer time for each distillation causing lower output.

f) Formation of boiler-scales inside the boiler causing its damage.

The report also states that steam distillation should be preferred as 20 per cent increase in the yield of oil has been obtained by adopting steam distillation under laboratory conditions. Further the citral content of the oil obtained by steam distillation was also found to be apparently higher. The report suggests for circulation of cold water for complete recovery of oil. It is observed that at present there is no proper arrangement for circulation of cold water. The author stressed the need for continuous flow of cold water by filling up an overhead tank. At present from the distillate collected in the receiver the water is allowed to drain off, eventhough it contains traces of oil. It would be better if it is left back into the boiler.

To prevent the formation of boiler-scale, stills made of stainless steel is preferred to copper. It is further stated that there is no authentic record of either the area under lemongrass cultivation or of the yield of oil in different producing areas.

Menon A.K, in his book 'Indian Essential oils a Review' explained various aspects of a number of essential oils including lemongrass oil. According to his study, yield of oil obtained from the distillation of lemongrass can be raised by closing the condenser valve of the still at frequent intervals during distillation. This allows pressure to build up with the result that the plant tissues are reptured, liberating additional oil. Lemongrass oil distilled by the intermittent method is proved to have a higher citral content than oil

distilled in the usual way[46]. The report also threw light into the research work carried by Varier in improving the quality and yield of oil. According to Varier the oil from the white variety (which could not be distinguished botanically) contains camphene and dipentene, but no citral. It is used as an additive for standardizing the aldehyde content of lemongrass oil[47].

A study was conducted by Chinnamma N.P and Menon P.K.G. on the effect of pre-treatment of lemongrass by way of chopping and wilting before distillation. The study revealed that there is significant increase in oil yield due to chopping and wilting of the grass [48].

Chandrasekharan Nair K[49] conducted a study on the effect of steam under different pressures on the distillation of lemongrass. It is seen that no significant difference in oil yield and citral percentage results in the extraction of the oil under different pressures.

It was reported by Nair E.V.G and Chandrasekharan Nair.K that the treatment of cut grass with 1.5 to 2 per cent sodium chloride solution increased the citral content but there was no increase in the oil yield[50].

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46 Menon A.K (1960), Indian Essential Oils a Review, Council for Scientific and Industrial Research, New Delhi, p. 19.

47 Ibid.

48 Chinnamma N.P and Menon P.K.G. (1973), Effect of Pre-treatment of Lemongrass (Cymbopogon flexuosus Stapf) on the Yield and Citral Content of Oil. Agricultural Research Journal of Kerala Vol.II, Part I, p.27.

49 Chandrasekharan Nair K (1974), A Study on the Effect of Steam Under Different Pressures on the Distillation of Lemongrass (Cymbopogon flexuosus). Agricultural Research Journal of Kerala 12(2), p.214.

50 Nair E.V.G and Chandrasekharan Nair K (1977), op.cit. p.154.

Optimization studies on the factors of processing of essential oils were made by Nair E.V.G and others[51]. The studies revealed that field drying of the cut grass reduced the oil yield and active chemical content in the oil. Dipping the chopped grass in sodium chloride solution for 24 hours was found to increase citral content. Comminution of plant material just before distillation is also favourable for better oil recovery. It is also reported that distillation of cut lemongrass with 20 Ib. pressure steam reduced the time of distillation and increased citral content.

Studies on Jammu lemongrass were conducted in the Regional Research Laboratory, Jammu to examine the effect of wilting the grass in winter and summer seasons and also to understand the effect of sodium chloride solution treatment, on oil recovery. Result showed a significant increase in oil content by wilting the grass for 48 hours in winter season. But there was a significant decrease in oil content in the summer season. Salt water treatment did not indicate any improvement in oil and citral content of chopped and unchopped Jammu lemongrass. At the highest concentration of 2 per cent sodium chloride solution a decrease in the citral content of chopped grass was observed, while Nair et. al (1977) have reported an increase in citral content of chopped cymbopogon nardus grass [52].

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[51] Nair E.V.G, Chinnamma N.P and Chandrasekharan Nair K (1980), Optimization Studies on the Factors of Processing of Essential Oils, Indian Perfumer Vol.XXIV, No.2, pp.110-114.

[52] Shahi A.K, Ajith Singh and Padha C.D (1981), Pre-Treatment Studies on the Volatile Oil and Citral Content of Jammu Lemongrass, Regional Research Laboratory, Jammu Tawi, p.14.

Datta D.K. and Borah U.C [53] explained different methods for the extraction of essential oils,some of them designed by the Regional Research Laboratory, Jorhat. Details on laboratory type of distillation plant, water and steam type portable plant suitable for small scale field operation and continuous distillation plant were given. The Regional Research Laboratory has also designed a direct fired water and steam distillary suitable for small cultivators. The still has a capacity of 200 Kgs. This plant is designed for the citronella growers of North Eastern regions. Details of a continuous distillation plant was also explained by the authors. Such plants are not reported to be in commercial use in India eventhough they are in commercial operation in USSR. In this process, material is continuously fed into distillation column after chopped into pieces. Steam is generated in a separate boiler and it is injected into the distilling columns at several points. The oil mixed with water vapour is condensed in a series of condensers and the oil is separated.

Economic Review 1989 revealed that under the tribal sub plan, 24 lemongrass distilling units were distributed to Scheduled Tribes in 1988-89[54] in Kerala for the improvement of the economic conditions of the tribals of the state.

Paul S and others conducted harvest management studies on lemongrass (CKP-25) during 1988-89. The result showed that "Maximum essential oil yield (313 kg/ha) was obtained when three cuttings/year were taken during 1st year at an interval of 108 days from planting and 92 and 91 days in between

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53 Datta D.K and Borah U.C (1986), Essential Oil Distillation, Indian Perfumer 30 (2-3), pp.345-354.

54 State planning board (1989),Economic Review, P.43.

the respective harvests. The second year plantation gave maximum essential oil (387 kg/ha) in the six harvests/year schedule following an interval of 150, 44, 45 and 62 days respectively"[55]. Citral percentage ranged from 83 to 85.

In an article on export potential of aroma chemicals Varshney S.C. pointed out that the projection made by the council for the 7th Five Year Plan has been surpassed by a quantum jump in actual performance during the last two years of the plan period as could be seen from the 27th Annual Report of CHEMEXCIL[56]. He pointed out that this was possible due to the liberal export and import policy announced by the Government. The export figures of essential oils for 1987/88, 88/89 and 89/90 were Rs. 1595.52, 1711.19 and 2958.40 lakhs respectively. In the case of lemongrass oil the figures were Rs. 182.80, 506.29, and 535.33 lakhs, which was a good sign in the trade.

Kedar Prasad Singh in an articlle[57] presented some useful data on herbs yield, oil content, oil yield and cost of major industrially important isolates of some important essential oils. The review indicated that lemongrass oil occupied the first position followed by citronella oil, palmarosa oil, Mentha piperita, Eucalyptus citriodora and mentha arvensios[58].

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55 Paul S, Suresh Chandra, Ajith Singh, Balyan S.S. and Kaul B.L (1990), Harvest Management Studies on Lemongrass (CKP-25) -A New Hybrid Strain, Indian Perfumer Vol.34, No.3, pp.213-216.

56 Varshney S.C (1990), Export Potential of Aroma Chemicals - A Case of Value Added Products, Indian Perfumer 34(3), pp.235-237.

57 Kedar Prasad Singh (1990), Recent Trends in Production Methods of Essential Oils, Indian Perfumer 34(1) PP.64-70.

58 I bid p.64.

Absorption and emission spectra of the oils of Cymbopogon species were recorded[59] in the visible and ultraviolet region. The results revealed that although the same group of organic compounds dominate in all the oils, Cymbopogon microstachys, Cymbopogon flexuosus and Cymbopogon jwarnacusa contained some additional organic compounds.

Germicidal and antifungal properties of essential oils and some of their constituents were given by Gupta Y. N.[60]. As per the report essential oils are used in pharmaceutical industry because of their properties like antiseptic, carminative, diuretic, expectorant, stimulative etc. It was also stated that from olden times, essential oils are used in gastric discomfort, flatulent colic and to stimulate appetite.

A study on the antifungal action of lemongrass oil observed that essential oil from a mutant strain of lemongrass (LM- 81) possessed remarkable antifungal activity against three soil-borne plant pathogens, viz Rhizoctonia solani, Sclerotium rolfsii and Sclerotinia sclerotiorum[61].

The uses of essential oils were given by Kapil V.B, Kumar S and Sinha G.K. It is reported that the important uses of essential oils are in the manufacture of various types of syrups and as flavouring agents. The study notes that[62]

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59 Rai A.K, and Singh A.K (1991), Visible and Ultraviolet Spectra of Oils of Some Cymbopogon Species, Indian Perfumer, 35(4), pp.188-191.

60 Gupta Y.N (1976), Germicidal and Antifungal Studies of Essential Oils and Some of Their Constituents, Indian Perfumer Vol.XX Part I-A, pp.45-48.

61 Handique A.K and Singh H.B (1990), Antifungal Action of Lemongrass Oil on Some Soil-Borne Plant Pathogens, Indian Perfumer 34(3), pp.232-234.

62 Kapil V.B, Kumar S and Sinha G.K (1976), Some Important Aromatic and Medicinal Plants of Kumaon Hills and its Surroundings, Indian Perfumer Vol.XVIII, Part II, pp 1-2.

" when taken internally, they exert a mild irritating action on the mucous membrane of the mouth and digestive tracts induce a feeling of warmth and increase salvation, hence they are used to stimulate and aid digestion. They are excreted through the lungs, skin and kidneys and during excretion by the bronchioles, they act as mild expectorants and are therefore included in cough mixtures, in-halants nasal and throat sprays etc". The report also present a list of Medicinal and Aromatic plants seen in Kumaon Hills and its surroudings.

Techno-Economic Survey conducted by the National Council of Applied Economic Research suggested that the present level of output of lemongrass oil may be raised through measures such as manurial trials, evolution of high yielding and quick maturing strains, control of pests and diseases, designing of efficient stills of small capacity to suit the needs of small growers[63].

Atal C.K. and Bradu B.L presented a report on RRL-16 (Jammu Lemongrass) a variety of Cymbopogon pendulus[64]. Trials showed that RRL-16 is superior to other lemongrass types both in herb and oil yield. It gave an yield of 294 kg of oil per hectare from second year. When compared to the varieties cultivated in Kerala it is a high yielding variety and can be cultivated profitably where favourable climatic conditions prevail. The oil from RRL-16 is also having high citral content.

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63 National Council of Applied Economic Research, New Delhi (1962), Techno-Economic Survey of Kerala, p.32.

64 Atal C.K and Bradu B.L (1976), Search for Aroma Chemicals of Industrial Value from Genus Cymbopogon -Part III, Indian Perfumer Vol.XX, Part I-A, pp.29-31.

A trial was conducted [65] under the climatic conditions of Jammu on the comparative yield performance of RRL-16 (Jammu lemongrass), OD-19 (Indian Council for Agricultural Research selection from Lemongrass Research Station, Odakkali) and SD-68 (Central Institute of Medicinal and Aromatic Plants selection). The experiment showed that herb yield as well as oil was 60 per cent more for Jammu lemongrass compared to OD-19 and SD-68. It was further observed that citral present in the three oils were upto B.P. standard.

A study was conducted by Balyan S.S and others[66] on the possibility of commercial cultivation of five strains of the genus cymbopogon under the agroclimatic conditions of Jammu. The result showed that RRL-16 (Cymbopogon pendulus) produced 248.6 Kg. of oil and RRL-59 (Cymbopogon flexuosus-Kolar) produced 264.6 Kg. Cymbopogon khasianus 175.2Kg, Cymbopogon winterianus (Java citronella) 325.5 Kg. and Cymbopogon flexuosus 250.9 Kg of oil per hectare. It was also seen that maximum grass and yield per hectare was obtained in the third year.

A study was conducted at the Lemongrass Research Station, Odakkali[67] on the relative performance of OD-19, SD-68 and RRL-16 and response to

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[65] Sobti S.N, Bradu B.L, Mrs. Rao B.L and Atal C.K (1979), Comparative Yield Performance of Jammu Lemongrass, OD-19 and SD-68, Indian Perfumer Vol.XXIII, No.I, pp.47-49.

[66] Balyan S.S, Shahi A.K, Chaudhary S.N, Ajith Singh and Atal C.K (1979), Performance of Five Strains of Genus Cymbopogon at Jammu, Indian Perfumer Vol.XXIII, No.2, pp.121-124.

[67] Nair E.V.G, Chinnamma N.P and Pushpa Kumari R (1979), Effect of Different Levels of Nitrogen on Three Varieties of Lemongrass viz. OD-19 (C. flexuosus) SD-68 (C. flexuosus Mutant) and RRL-16 (C.pendulus), Indian Perfumer Vol.XXIII, No.384, pp.202-204.

3 levels of nitrogen. The result puts SD-68, OD-19 and RRL-16 in order of superiority with regard to oil yield and citral content. The highest percentage of oil was seen in RRL-16.

Seven types of lemongrass collected from different sources have been studied along with OD-19[68]. It is observed that a type of grass collected from high-range (OD-408) was found superior to OD-19. Oil yield of OD-408 was 97.48 Kg. per hectare which is nearly fifty per cent higher than that of OD-19. Cost of cultivation being the same, profitability of OD-408 (high range variety) is high. Our discussion with the officials of Aromatic and Medicinal Plants Research Station, Odakkali revealed that eventhough OD-408 is a high yielding variety it is not suitable for commercial cultivation in mid-land due to the low draught resisting capacity of the variety. As the productivity and profitability of high-range varieties were not studied under high-range climatic conditions, present study focussed attention in this area also .

Experiment to determine the yield and citral content of OD-19 and RRL-16 under varying levels of plant populations (111000, 49000 and 27000 plants per hectare) and soil pH (4.8, 5.5, 6.5 and 7.5) was conducted at the Regional Research Laboratory, Jorhat[69]. Results showed that OD-19 excelled RRL-16 in grass yield and essential oil potential by 86.1 and 27.1 per cent

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[68] Nair E.V.G, Chinnamma N.P and Pushpakumari R (1980), Investigations on Some Types of Lemongrass (C.flexuosus Stapf), Indian Perfumer, pp.20-21.

[69] Singh R.S, Patak M.G and Bordoli D.N (1983), Citral of Lemongrass Under Different Plant Population and Soil pH, Pafai Journal (Jan-March), pp.33-36.

respectively. Significant increase in the herb yield (1113.15 q/ha) and oil 471.29 Kg/ha) was registered under maximum population (111000 plants/ha). Soil pH also has influence in the herb and oil yield of lemongrass.

Studies were conducted at the Central Institute of Medicinal and Aromatic Plants, Lucknow[70] to evaluate the comparative performance of L.S. 48 (Var. Pragati) of Lemongrass (Cymbopogon flexuosus) to clone-12 and OD-19. Var Pragati recorded the highest oil yield of 206 Kg per hectare while OD-19 produced only 143 Kg. under Lucknow conditions. In the case of clone-12 the yield recorded was 180 Kg. per hectare. Citral content in all these cases were 87 per cent.

Verma.P.K. and others of the department of plant breeding, Haryana Agricultural University conducted studies on economic cultivation of aromatic plants under Haryana conditions. It was reported that OD-58 variety of lemongrass was very well adaptable in the State. The grass yield was recorded between 500-600 quintal per hectare. It gave three cuttings in an year. The oil content in this variety ranged from 0.39 - 0.47 per cent, yielding about 200 - 250 litre of oil annually [71].

Under the genetic upgradation programme of aromatic grasses at CIMAP, Lucknow, a genetically superior clone No.29 was developed

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[70] Sharma J.R, Lal R.K, Mishra H.O and Naqvi A.A (1987), A Genetically Improved Clone - CIMAP/LS-48 (Var Pragati) of Lemongrass (Cymbopogon flexuosus), Pafai Journal, Vol.9, No.1, pp.17-19.

[71] Verma P.K, Sharma G.D, Punia M.S, Surinder Singh and Kaur G (1988), Economic Cultivation of Aromatic Plants Under Haryana Conditions, Pafai Journal Vol.10, No.2, p.30.

through appropriate genetic manipulation. This clone, now christened as Var Praman, registered its consistently superior performance for oil and citral yield over the best variety Pragati of Cymbopogon flexuosus and RRL-16 (developed at RRL Jammu) of Cymbopogon pendulus[72].

In a study conducted by Kuriakose K.P, Alice Kurian and Rajan K.C, selected mutants of lemongrass and compared with OD-19 variety for their yield performance. Oil yield and citral percentage was maximum for OD-19 variety whereas the grass yield was maximum for the mutants[73].

While the above review specially focussed on the various aspects of lemongrass cultivation a brief review may also be attempted on the studies on agricultural sector in general. This is important as some of the features and problems of the agricultural sector are common to all crops.

The role of agrarian structure in economic development is one of the most important problems for social science research in under developed countries like India. In this perspective, essay on Agricultural Economic

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[72] Central Institute of Medicinal and Aromatic Plants (1988), A Superior Var Praman of Lemongrass Developed, A Potential Source of Citral, Vol.15, No.4, p.2.

[73] Kuriakose K.P, Alice Kurian and Rajan K.C (1989), Comparative Yield Trial on Induced Lemongrass Mutants, Indian Perfumer 33(1), p.60.

Research and Economic Planning in India, S.R. Sen[74] has highlighted some of the basic weakness of research in the field of Agricultural Economics in India. The neglect of economic analysis and the lofty preference for philosophical essays have been identified by him as the two major deficencies in this field. Sen observes "the influence of statisticians on agricultural economics has become so great lately that if earlier studies on the subject were characterised by too heroic generalisations based on too few data, the more recent studies perhaps contain too much of statistics and too little of economic analysis". In his work on The Economics of Land Reform and Farm size in India Khusro [75] has also noted that "in most writings on questions of agrarian structure the framework of analysis is the framework of commonsense and the language of analysis is the language of public administration". On this issue Charles Bettelheim[76] has noted that the agrarian structure has the typical elements of feudalism. The elements identified by him were 1) absence of a labour market in a large part of the rural sector, 2) the personal subservience of the immediate producer to the land owner, 3) the excessive importance of land rent, 4) the underdeveloped marketing system resulting in little social division of labour, a low rate of accumulation and the use of produce mainly to satisfy immediate needs. Social anthropologists like Srinivas[77] have made a meaningful distinction

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[74] Sen S.R. (1966), The Strategy of Agricultural Development, Asia Publishing House, Delhi

[75] Khusro A.M. (1973), The Economics of Land Reforms and Farm Size in India, Macmillan Co., Limited., Delhi.

[76] Charles Bettelheim (1968), India Independent, Maggibon & Kee, London

[77] Srinivas M.N. (1962), Caste in Modern India and Other Essays, Asia Publishing House, Bombay.

between the book-view of reality and its empirical view. The book-view of reality is derived from written texts while the empirical view of reality is derived from direct observation based on intensive fieldwork or participant observation. Recent anthropological investigations based on participant observations have revolutionised the conception about Indian village society by showing the discrepancy between the book-view and the field-view. The above study is one such.

There are a number of regional studies on the issues of agriculture. Important among them were Amit Bhaduri's[78] study on study in Agricultural Backwardness Under Semi-fendalism; Pradhan H. Prasad's[79] study on the constraints of semi-fendal production relations; M.L. Dantwala, C.H. Shah and V.M. Rao[80] on the Agrarian Structure in a Raiyatwari Region and studies on tenancy relating to commercialised regions by Hammantha Rao and Vyas[81]. All these represent a new harvest of insights into the specificities of the agrarian structure achieved through application of new research technologies. An important pre-condition for any kind of useful work on the subject of agrarian structure seems to be the availability of a wealth of primary data on this subject.

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[78] Amit Bhaduri (1973), Study on Agricultural Backwardness Under Semi-feudalism, The Economic Journal Vol. 83 No. 329.

[79] Pradhan H. Prasad (1973), Production Relations: Achilles Heel of Indian Planning, Economic and Political Weekly, Vol. viii, No. 19.

[80] i) Dantwala and Shah C.H. (1971), Evaluation of Land Reforms, Vol. I, Department of Economics, Bombay University, Bombay. ii) Rao V.M. (1972), Land Transfers: Findings in a Ryotwari Region, The Economic and Political Weekly, September 1972.

[81] i) Vyas V.S. (1970), Tenancy in a Dynamic Setting, The Economic and Political Weekly, Vol. V, No. 26, June 1970. ii) Hanumantha Rao C.H. (1971), Uncertainty Entrepreneurship and Share Cropping in India, Journal of Political Economy, May-June 1971.

In fact, division of the country into certain identifiable agrarian regions is an important task before social scientists in India. In this respect it is pertinent to recall an important research proposal made by Daniel Thorner[82] regarding the preparation of An Agrarian Handbook for India. What Thorner had in mind was a guide book or handbook on the pattern of the agrarian relationships in the different regions of the country. Also some significant beginnings in the direction of studying at the micro level the peasant economy was made by Andre Beteille[83], Gough K[84] and Anand K. Chakravarthy[85].

In the agricultural labour front, serious concern has been expressed about the swelling ranks of agricultural labourers. On this there are two new points. According to one group of scholars the establishment of British rule was responsible for the emergence of a distinct class of agricultural labourers. Among the advocates of this view mention may be made of the work of S.J. Patel[86], H.D. Malaviya[87] and Kamal Kumar Ghose[88]. According to them in the ancient and mediaeval periods agrarian structure was characterised by

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[82] Daniel Thorner (1954), The Agrarian Handbook for India, The Agricultural Situation of India, Souvenir 1954.

[83] Andre Beteille (1966), Caste, Class and Power, California University Press, Bombay.

[84] Gough K. (1961), The Social Structure of a Tanjore Village, in M. Marriott (ed), Village India, Asia Publishing House, Delhi.

[85] Anand K. Chakravarthy (1974), Contradictions and Change, Emerging Patterns of Authority in a Rajasthan Village, Oxford University Press, Delhi.

[86] Patel S.J. (1952), Agricultural Labour in Modern India and Pakistan, Current Book House, Bombay.

[87] Malaviya H.D. (1955), Land Reforms in India, All-India Congress Committee, Delhi.

[88] Kamal Kumar Ghose (1969), Agricultural Labourers in India: A Study in the History of Their Growth and Economic Condition, Indian Publications, Calcutta.

self-employed and self-sufficient cultivators. The village community owned the cultivable land. The new tenure system, import of machine made goods, change in the customary laws etc. distorted the system and the peasants were turned into landless labourers. This view point has been criticised by several writers. Important among them were Dharma Kumar[89], Radhakumud Mukherjee[90] and V.R. Joshi[91]. It was stated as an over-simplification and according to them the gensis of the agrarian labourers as a class could be traced to the caste system and the influence it had on the nature of economic activities to be pursued by different groups.

A number of studies were conducted to reveal the living and working conditions of the agricultural labourers. Pioneering in this were the studies of Agro-Economic Research Centre. A notable contribution in making a comparative study of the economic conditions of landless labourers, cultivators - cum-labourers and cultivators in the Bombay-Karnataka region was that of Mavinkurve B.S.[92] A significant finding of the study was that on the basis of several norms, a considerable portion of cultivators - cum - labourers families were found to be in less favourable economic circumstances than was the case with the landless labourers. Many authors who contributed to the volume

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[89] Dharma Kumar (1965), Land and Caste in South India - A Study of Agriculture Labour in the 19th Century, Cambridge University Press.

[90] Radhakumud Mukherjee, History of Village Communities in Western India.

[91] Joshi V.R. (1958), Growth of Agricultural Labour with Special Reference to U.P., Indian Journal of Labour Economics, April-July 1958.

[92] Mavinkurve B.S. (1952), A Comparative Study of the Economic Conditions of Landless Labourers, Cultivators - cum - Labourers and Cultivators in Bombay, Karnatak, Indian Journal of Agricultural Economics, August 1952 PP. 59-70.

edited by Rao V.K.R.V.[93] and others among whom Shah's C.H.[94] contribution is notable, have tried several ingenious ways to make the results of the two enquiries comparable eg. by suitable changes in the price deflators. On the basis of this exercises most of the authors conclude that a closer examination of income, expenditure and indebtedness, data substantially alters the gloomy picture presented by the second Agricultural Labour Enquiries. A few other studies utilised the published data on agricultural wages to discuss the conditions of agricultureal labourers. In his study, Krishnaji N.[95] finds that between 1960-61 and 64-65 wages increased at a faster rate in those regions where they were relatively low and decreased where theywere relatively high. Rao V.M.[96] in his penetrating study has pointed out the weekness and strength of the published agricultural wage data which according to him are quite adequate to suggest directional changes, but are not good enough for intra-seasonal comparison.

The new agricultural strategy HYV programme is a significant development in Indian agriculture. A number of scholars have emphasised the role of new strategy in ushering a new era of fuller employment and adequate incomes in the countryside. With regard to the impact of the HYV on agrarian wages, the indicators are the cash wages have generally risen especially in the

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[93] Rao V.K.R.V. (ed.) (1962), Agricultural Labour in India, Asia Publishing House.

[94] Shah C.H. (1961), Agricultural Labour in 1956-57 - An Analysis of the Trend in Their Economic Conditions during 1950-51 to 1956-57, Indian Economic Journal, April 1961.

[95] Krishnaji N. (1971), Wages of Agricultural Labour, Economic and Political Weekly September 25, 1971.

[96] Rao V.M. (1972), Agricultural Wages in India - A Reliability Analysis, Indian Journal of Agricultural Economics, July 1972.

case of seasonal workers. However a comparison of the level of cash and real wages in the Punjab and Kerala between 1959-60 and 1968-69 by Pranab Bardhan[97] reveals that the real wages in certain parts of India have actually decreased in the latter year. This was probably due to the substitution of machines for man. Muthiah C[98] observes that it is the appreciable rise in demand for hired labour resulting from the introduction of various agricultural development programmes like IADP, HYVP, multiple cropping etc. during the crucial periods of plant growth which has decisively affected the labour market situation in Thanjavur. A study by Hanumantha Rao C.H.[99] on the effects of the green revolution on labour share in output reveals that about 17 per cent of the variation in labour income per acre is explained by the variation in output per acre. The elasticity of labour income per acre with respect to output per acre is less than unity indicating that, between different techniques studied, wage income per acre increased with the increase in output per acre. Ghosh K.K.[100] has studied the trends in wages in India over two periods, between 1891-1911 and between 1916-1946 with the help of the published data on wages and prices. His findings are that during the period 1, the daily money wage - rates showed a secularly rising trend; in 1911 it was almost double the initial rate in 1891. Secondly, there were marked regional variations in the wages, and there were also disparate movements in wage rates.

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[97] Pranab Bardhan (1970), Green Revolution and Agricultural Labourers, Economic and Political Weekly, July 1970, Special No. pp. 1239-46.

[98] Muthiah (1970), Agricultural Labour Problems in Thanjavur and the New Agricultural Strategy, Indian Journal of Agricultural Economics, July-September, 1970.

[99] Hanumantha Rao C.H. (1971), Green Revolution and the Labour's Share in Output, Agricultural Situation in India, August 1971.

[100] Ghosh K.K., Agricultural Labourers in India, Indian Publications, Calcutta.

Darling M.L.[101] contributed deep insights into Indian agriculture and its institutional framework. He analysed the inter-relation of the credit and the land system and showed a remarkable perception of the inter connections of social and economic life in the Punjab. Some of his observations on future trends are proved to be correct. The dynamism of rural economy that is witnessed by present-day Punjab was predicted by Darling in the following words: "In short, it may be said that in the whole of India there is no finer raw material than the Jat..... it would be difficult in any country to find a more remarkable combination of cultivator, colonist, emigrant and soldier. Educated and organised and relieved of the handicaps imposed upon him by customs and debt, he might well become the foundation of a new rural civilisation in the Punjab".

Mann[102] showed deep understanding of the agricultural situation in India in its manifold connections with the social institutional framework. According to him the crucial obstacle to rural progress was the social one, the institutional frame work of Indian agriculture. He also raised important issues pertaining to the methodology of agrarian studies and to the importance of field work in agricultural economic research. The need for first hand collection of facts was emphasized by him that "I want to insist on the thing because it is important in India. We shall never in this coutry get beyond vague generalisations with

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[101] Darling M.L. (1928), The Punjab Peasant in Prosperity and Debt, Oxford University Press, Madras, p.36.

[102] Harold H. Mann (1967), The Social Framework of Agriculture, Vora & Co., Ltd., Bombay.

regard to the social and economic conditions of the people unless we face the problem and go and get the facts first-hand for ourselves".

Mukerjee[103] was all the time emphasizing the need for recognising the peculiarities of the Indian socio-economic environment and for re-appraising western theories and concepts in the light of these pecularities. Joshi[104] made a distinction between land reforms as ideology and land reform as programme in an attempt to show that the ideological basis of the new political regime in India has shifted from the principle of inequality to that of equality. But this change according to him has not fully reflected even at the level of formulation of economic programmes, let alone at the level of their implementation. Therefore he underlines the need for institutional reforms. Yogendra Singh's[105] work on the changing power structure in the context of dynamic changes and organisational mobilisation from the sociological perspective, examines this issue. In Daniel Thorner's[106] The Agrarian Prospect in India, we find a classification of regions into 1) areas of least change 2) areas of some perceptible change and 3) areas of greatest change. This was considered as a very promising and fruitful line of enquiry, though from many later studies in land reforms it would appear as if all areas were areas of no change or of marginal change.

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[103] Mukerjee R. (1939), Economic Problems of Modern India, Volume 1, Macmillan & Co., London.

[104] Joshi P.C. (1971), Land Reform and Agrarian Change in India and Pakistan Since 1947 in Ratna Dutta and P.C. Joshi (eds), Studies in Asian Social Development, Tata Mc Graw - Hill, New Delhi.

[105] Yogendra Singh (1969), The Changing Power Structure of Village Community - A Case Study of Six Villages in Eastern U.P., Rural Sociology in India, Fourth Revised Edition, Popular Prakasham, Bombay.

[106] Daniel Thorner (1956), The Agrarian Prospect in India, University Press, Delhi.

A number of factors contributes for the rise in the price of agricultural price among them the institutional factors are important. A study by Jairath[107] indicates that the multiplicity of market fee system, existance of wide variation in the rates of market fees and its imposition on the buyers / sellers in different states, variation in the rate of commission agents on different types of crop produce and livestock along with imposition of development fund /cess, substantial market charges and entry tax/octroi inflate the cost of produce and widen the gap between the consumer and producer price. All these problems/ barriers need to be looked at the micro level and problems encountered in the interstate movement have to be smoothened to facilitate the free flow of goods. It is suggested that the Government should review Agricultureal Produce Market Acts of the states and unify them.

Problems and prospects of agricultural development in India was examined by a number of authors. One important problem in the dominance of the small and marginal farms and it is noted that 75 per cent of the total cultivators in India are small and marginal farmers. At the same time Misra[108] notes that though commercial banks and co-operatives have lended in a big way to agriculture, the small and marginal farmers are still finding great difficulty in getting loans from these institutions. The book also focusses on the nature of tensions and conflicts brought about by agricultural development.

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[107] Jairath M.S. (2002), Institutional Reforms - A Case Study of Agricultural Markets in India, Indian Journal of Agricultural Economics, Vol. 57, No. 3, July-September 2002.

[108] Baidyanath Misra (1990), Agriculture Development : Problems and Prospects, Ashish Publishing House, New Delhi.

Giriappa and Vivekananda[109] attempted to examine the growth in area, productivity, input use feature and land holding pattern in India. The study comes to the conclusion that the problem confronting the Indian agriculture is the shortage of inputs including land and water, low productivity growth and instability, ineffective land development and other land reform programmes. The need to modernise the production process, distributional equity and the need to preserve the scarce energy resources and the degradation of environment was also underlined by the study. The focus of Das[110] was on the land holding structure in Assam. The study reveals the domination of small peasents, the backwardness of their agriculture. The indications are also that it is a subsistence oriented farming. The disparity in the institutional finance to agriculture in Karnataka was the focus of the study of Dadibhavi[111]. It has been found that the total institutional finance to agriculture is significantly influenced by factors such as productivity per hectare, cropping intensity, road length per km of area, literacy rate, rain fall and urbanisation. The study also shows that cropping intensity, livestock, literacy rate, rain fall and urbanisation are the factors which have significantly influenced the commercial bank advances to agriculture in Karnataka.

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[109] Giriappa Somu and Vivekananda M. (1984), Agricultural Development of India, Agricole Publishing Academy, New Delhi.

[110] Das M.M. (1995), Landholding Structure, A Problem in Peasant Agriculture in Assam, Konark Publishers, Pvt. Ltd., Delhi.

[111] Dadibhavi R.V. (1987), Determinants of Regional Distribution of Institutional Credit to Agriculture, A Study of Karnataka in Dalip S. Swamy (ed.) Spe..... Diamensions of Indian Agriculture, Agricole Publishing Academy, New Delhi.

Laxminarayan[112] and others conducted a study on the impact of harvest combines on labour use, crop pattern and productivity. The study comes to the conclusion that harvest combines has so far made little impact on land productivity. The major impact was on the size of labour demand especially casual labour at harvest time. But the size of displacement of human labour and hence the social cost was noted as high in Punjab where mechanisastion has made rapid progress. Hariyana witnessed profound growth in agriculture. The development perspective of Hariyana was the subject matter of the study of Gupta[113]. The study notes that there is wide intra state variation in productivity. The variation in productivity was explained in terms of variation in input use, particularly irrigation, fertilisers and HYV seeds. The study notes that the cropping pattern of the state is by and large profit motivated. Further it has been noted that as there is little scope for increasing area under cultivation, increase in agricultural production in the state has to come through intensification and diversification of agriculture.

Thus from the above review it can be seen that a number of studies on the scientific aspects of lemongrass was conducted. Studies on the cultivation practices of other crops are also there. But the problems and prospects of these crops are different from lemongrass and lemongrass is a neglected area. However to examine the various economic issues like cost, productivity, profitability, labour intensity, viability etc. no methodological attempt was done. So this study focuses attention on the above aspects.

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[112] Laxminarayan H., Gupta D.P., Ramaswamy P. and Malik R.P.S. (1981), Impact of Harvest Combines on Labour Use, Cropping Pattern and Productivity, Agricole Publishing Academy, New Delhi.

[113] Gupta D.P. (1985), Agricultural Development in Hariyana, Agricole Publishing Academy, New Delhi.

THE STUDY AREA - A PROFILE

P.S. Jayapradeepu “Economics of lemongrass cultivation in Kerala ” Thesis. Department of Economics, Dr. John Matthai Centre Thrissur , University of Calicut, 2003

CHAPTER III

THE STUDY AREA - A PROFILE

3.1 Introduction

It is seen earlier that in Kerala lemongrass cultivation is concentrated in Idukki district and the study has been conducted in Marayoor and Kanthalloor Panchayats of the district. As the district has marked peculiarities an examination of the study area is important. This chapter portarys the geographic and socio-economic aspects of the area in a historical perspective. .

3.2 Idukki district

Idukki district, named after the mighty Idukki - Mala and also after the hydro-electric project, was formed by taking regions from the eastwhile Ernakulam and Kottayam districts and it actually came into existance on the 26th January 1972 as per the Government Notification No. 54131/C2/71/RD dated 24th January, 1972[1]. It is the largest district in the state occupying 13 per cent of the state area. Idukki district is bounded on the north by Thrissur district and Coimbatore district of Tamilnadu. On the south comes Pathanamthitta district. Madurai district of Tamilnadu comes on the east and on the west it is bounded by Kottayam and Ernakulam districts.

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[1] Directorate of Census Operations (1973), Census 1971 - District Hand Book (Idukki), Trivandrum, p.3.

Source : Department of Economics and Statistics (1996), Panchayat Level Statistics (Idukki District)

Idukki is a hilly district. "It lies between 9° 15' and 10° 21' of north latitudes and 76° 37' and 77° 25' of east longitudes".[2] Forest occupy a good portion of the district. Tea, cardamon, pepper, coffee and rubber plantations are extensively grown in the district. Idukki district is the major producer of lemongrass oil in the state. A number of hydro-electric projects like Idukki, Pallivasal, Senkulam, Neriamangalam etc. and famous wild life sanctuary Thekkadi are in the district. Munnar, the dream land of tourists, the highest peak Anamudi and the Marayoor sandal forests are in the Idukki district. A number of rivers are originating in the district. Idukki district has the second highest Scheduled Tribe population in the state. Thus the district in general has marked peculiarities from other districts. General particulars of the district are indicated in the following Table.

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[2] Directorate of Census Operations (1973), op.cit.

Table 3.1

Idukki district at a glance

Sl.No.	Particulars		District
1	2		3
1.	Geographical area	Sq. Km.	5019
2.	Taluks	Nos.	4
3.	Revenue Villages	No.	65
4.	Municipalities	No.	1
5.	Development Blocks	No.	8
6.	Panchayats	No.	51
7.	Population	Lakhs	10.77
8.	Male	"	5.46
9.	Female	"	5.33
10.	Scheduled Caste	"	1.57
11.	Scheduled Tribe	"	0.50
12.	Density	Per Km^2	215
13.	Sex ratio	(Per 1000 males)	975
14.	Households	Lakhs	2.33
15.	Literary rate - Total	%	86.94
	a) Male	"	90.82
	b) Female	"	82.96
16.	Main workers - Total	Lakhs	3.90
	a) Male	"	2.87
	b) Female	"	1.03
17.	Marginal workers - Total	"	0.39
	a) Male	"	0.15
	b) Female	"	0.24
18.	Work participation rate	%	39.71
19.	Post Office per lakh population	Nos.	27.62

Source : Department of Economics and Statistics (1996), panchayat Level Statistics.

The headquarter of the district is Painavu. There are 4 Taluks in the district viz. Peermade, Udumbanchola, Devikulam and Thodupuzha. It has 8 Development Blocks, 1 Municipality, 51 Gramapanchayats and 65 villages. Idukki district covers an area of 5019 sq. km., out of the total 38863 sq.km. area of the state (13 per cent). The district has a total population of 10.77 lakhs giving 215 persons per sq.km. This is nearly 28.70 per cent of the size of density at the state level (749 in 1991). Thus the district is sparsely populated. The total population comprised of 5.46 lakhs males and 5.33 lakhs females giving a sex ratio of 975 females per 1000 males against 1036 in the state. A prominent feature on the demographic front of the district is that the 1981-91 decadal population growth was 11.23 which was lower than the growth rate in the State (14.32 per cent). Another distinguishing feature of the district is larger rural population as 95.28 per cent of the population are rural while the corresponding share of rural population was 73.61 per cent at the State level. Literacy state is also low, 86.94 per cent against 89.81 per cent at the State level. While the literacy rate of Scheduled Castes in the district comes to 72.67 per cent (79.66 per cent in state) that of Scheduled Tribes comes to 62.78 per cent (57.22 per cent in state). Thus Scheduled Tribes appears as better in the district in literacy compared to the Scheduled Tribe population in other districts. Another distinguishing feature of the district is the participation in work as a higher percentage of population are workers. Accordingly while at the State level the main workers constituted only 28.53 per cent of the total population in Idukki, it was 36.21 per cent. Compared to any other district it emerged that the district has the highest work

participation rate (39.71 per cent). In the case of the share of marginal workers also while in the district the share comes to 3.62 per cent it was 2.91 per cent at the State level. The comparative distribution of main workers by industrial classification is shown in Table 3.2.

Table 3.2

Distribution of main workers by industrial classification (in percentage)

Sl. No.	Items	Kerala	Idukki
1	2	3	4
1.	Cultivators	12.20	19.43
2.	Agricultural labourers	25.60	22.16
3.	Livestock, forestry, fishing, hunting etc.	9.20	35.24
4.	Mining and quarrying	1.00	0.25
5.	Manufacturing househod industry	2.60	0.64
6.	Other than household industry	11.60	3.20
7.	Construction	4.00	1.62
8.	Trade and commerce	12.60	6.33
9.	Transport, storage and communication	6.00	2.39
10.	Other sources	15.20	8.74
	Total	100	100

Source : State Planning Board (2000), Economic Review

The occupational distribution of main workers diverges from that of the State and the district. The sector that accounted for the highest share of labour force in the district was livestock, forestry, fishing and hunting which accounted for nearly one third of the total workers. While the corresponding share at the State level was only 9.2 per cent. The share of agriculatural labour was slightly lower in the district, 22.16 per cent against 25.60 per cent in the State. At the same time cultivation as an occupation accounted for higher share in the district, 19.43 per cent while at the State level the share was 12.20 per cent only. Another notable difference is the share of industry in employment. While at the state level 14.20 per cent of main workers were employed in industry the share was only 3.84 per cent in the district. Comparatively the share of all other sectors was less in the district. Altogether it emerges that the employment is less diversified in the district, that majority 57.40 per cent found employment in livestock activity or as agriculture labour.

An important feature of the agricultural economy is the crop pattern. To know the status of the district from this angle, area under important crops of the district and state is shown in Table 3.3

Table 3.3

Area under important crops (1998-99)

Sl.No.	Crop	Idukki		State	
		Area in hectares	Percen-tage	Area in hectares	Percen-tage
1	2	3	4	5	6
1.	Paddy	3846	0.83	352631	6.39
2.	Sugarcane	2894	0.63	6160	0.11
3.	Pepper	49749	10.82	182384	3.30
4.	Ginger	1561	0.34	11107	0.20
5.	Turmeric	626	0.14	3706	0.07
6.	Cardamom	32686	7.11	41449	0.75
7.	Banana	1771	0.38	30521	0.55
8.	Other plantain	3364	0.73	50947	0.92
9.	Cashew	1143	0.25	91268	1.65
10.	Tapioca	7027	1.53	112774	2.04
11.	Jack	4704	1.02	85885	1.56
12.	Mango	2311	0.50	87317	1.58
13.	Tamarind	304	0.07	18305	0.33
14.	Pineapple	1109	0.24	8963	0.16

Area under important crops (Contd...)

Sl.No.	Crop	Idukki		State	
		Area in hectares	Percen-tage	Area in hectares	Percen-tage
1	2	3	4	5	6
15.	Sweet potato	22	0.01	1099	0.02
16.	Pappaya	502	0.11	12526	0.23
17.	Drumstick	541	0.12	19622	0.36
18.	Food crops	125432	27.27	1295298	23.47
19.	Cocoa	2820	0.61	8909	0.16
20.	Sesamum	21	0.01	3303	0.06
21.	Coconut	21444	4.66	882288	15.98
22.	Tea	23419	5.09	34690	0.63
23.	Coffee	10064	2.19	83699	1.52
24.	Rubber	38012	8.27	469924	8.51
25.	Lemongrass	1116	0.24	1538	0.03
26.	Fodder grass	1272	0.28	2578	0.05
27.	Non-food crops	122098	26.55	1621207	29.37
Total		459858	100	5520098	100

Source : Directorate of Economics and Statistics (2001), Statistics for Planning, pp.37 - 63

The Table shows a comparison of the area under important crops in Idukki district and in the State. It shows that the major crops covers an area of 459858 hectares in Idukki, while that of the State is 5520098 hectares. While food crops covers 27.27 per cent of the croped area in Idukki, it comes only 23.47 per cent at the state level. But in the case of non-food crops higher percentage of land (29.37 per cent) is utilised at the State level and at the district level it is 26.55 per cent. It is further noticed that highest percentage of the croped area (27.27 per cent) is devoted for food crops in Idukki district and the highest percentage (29.37 per cent) is recorded for non-food crops at the State level.

Pepper occupies 10.82 per cent of the cropped area in the district. Corresponding figure at the State level is 3.30 per cent. But in the State, Coconut occupies more area (15.98 per cent) compared to the district (4.66 per cent). It is also seen that in the case of Idukki district Rubber, Cardamom and Tea seperately covered over 5 per cent of the area. At the State level Rubber and Paddy covers an area over 5 per cent. It is important to note that Paddy occupies 6.39 per cent at the State level, at the same time at the district level it is only 0.83 per cent.

Coffee is another important crop in the district which covers an area of 2.19 per cent. At the State level it is 1.52 per cent. In the case of Tapioca in the State it occupies an area of 2.04 per cent and in the district it is 1.53 per cent. In the case of Jack no considerable difference in area coverage is there as the State figure and district figure are 1.56 per cent and 1.02 per cent

respectively. It is also noticed that Sugarcane, Ginger, Turmeric, Pineapple, Food crops, Lemongrass and Fodder grass are showing higher percentage of area in the district than the State figures. In the case of Sugarcane, Cardamom, Tea, Lemongrass and Fodder grass, share in the total area cultivated is more than 5 times higher in the district compared to the State area. In the district and at the State level a variety of other crops claimed the area though they were of less significant. Over all thus it can be seen that compared to the pattern at the State level, the agricultural economy of the district is diversified.

To know how for the district is industrialised, certain indicators were worked out and shown in Table 3.4

Table 3.4
Number of industries in Idukki and Kerala (1998)

Sl. No.	Details	Idukki	Kerala	Idukki (per population)	Kerala (per population)
1	2	3	4	5	6
1.	Number of factories	303	17719	3725	1797
2.	Employment	7887	443841	143	72
3.	Number of small scale units	5085	180091	222	177
4.	Loans of Kerala State Financial Corporation (Number)	1654	27009	---	---
	Amount (Rupees in lakhs)	6142	112550	---	---
5.	Employment in the public sector	16088	643684	70	49

Source : Directorate of Economics and Statistics (2001), op.cit.

The result shows that the district is industrially very backward. Thus in the district there was 1 factory per 3725 persons, at the State level it was 1 factory per 1797 persons. In terms of factory employment while at the State level there was 1 factory employment per 72 persons, it was 1 employment per 143 persons in the district. In the case of small scale industries for every 177 persons there was 1 unit at the State level and in the district it was 1 for every 222 persons. Another indicator shown in the table is the loan sanctioned by the Kerala State Financial Corporation. Out of 27009 sanctioned in the State involving an amount of Rs. 112550 lakhs the share of the district was 1654 cases (6.12 per cent) and Rs.6142 lakhs (5.46 per cent). This works out to an amount of Rs. 570/- per person in the district against Rs. 387per person at the State level. The district is also less favourably placed as far as public sector employment is concerned as at the district level while there was 1 public sector employment per 70 persons at the State level there was 1 public sector employment per 49 persons. Altogether it appears that the district is industrially backward and the development of modern sector leaves much to be deserved compared to the State.

Infrastructure like road and communication development is another indicator of the economic development of a district. To examine from this angle some of the indicators of development is shown in Table 3.5

Table. 3.5

Availability of infrastructure in Idukki and Kerala

	Items	Idukki		Kerala	
		Length in km	Area to which 1 km road is available	Length in km	Area to which 1 km road is available
1	2	3	4	5	6
1.	State highways	238	21.08	1890	20.56
2.	Major district roads	512	9.80	5971	6.50
3.	Other district roads	393	12.77	9557	4.07
4.	Village roads	378	13.28	2956	13.15
	Total	1521	3.30	20374	1.90

Source : Directorate of Economics and Statistics (2001), op.cit.

In the case of all types of roads the availability is less in the district. Thus for state highways, while the availability of road was 1 km for 21.08 sq. km. area in the district, at the state level it was for every 20.56 sq.km. area a km of road is available. While at the state level for every 6.50 sq.km there was 1 km. district road it is for every 9.80 sq. km. that there was 1 km. road in the district. Similar disparity existed in the case of other district roads and village roads too. It is further noticed that for every 1.90 sq.km. in the State and for every 3.30 sq.km. in the district 1 km road facility is available.

3.3 Marayoor panchayat

Marayoor panchayat is situated in the eastern slop of the Western ghat in the vally of Anamala boardering Tamilnadu. Covering an area of 108.07

sq.km. the panchayat is situated about 3000 ft. above the sea level. In the north is Tamilnadu, east Kanthalloor panchayat, south Kanthalloor panchayat and in the west Munnar panchayat and Tamilnadu. The total population of the village comes to 9970 giving a population density of 92 per sq. km. The panchayat belongs to the Devikulam Block Panchayat and the Devikulam Taluk.

The history of the panchayat goes as far back as the epic period. Lord Sree Rama is said to have lived in the village during his forest life. It is said that when Seetha Devi was attacked by the crow while drying the forest fruits Sree Rama cursed them and hence they would die if entered in the village. Also it is believed that Pandavas during their exile lived in the village. The number of caves found and the cave pictures found by the historians in the village indicate that the village history go back to 3000 years. This is an important centre of the district. Another attraction is that this is the only place where natural growth of sandal trees are seen. Also there is the attraction of Chinnar wild life sanctuary.

The village witnessed migration all along the period. When Tippu Sulthan attacked the Madhura of Pandya Raja, people out of fear left their home and they reached Marayoor. People of all sects were there but later they united under one caste. However again they were separated as five sections in search of livelihood and occupied five villages known as Karayoor, Keezhanthoor, Kanthalloor, Kottakudy and Marayoor separated under a Minister. So also later Tamil Hindus, Tamil Christians and Tamil Muslims migrated to this village around 1900 and they were also joined by migrants from Kerala areas like Palai, Kottayam, Thodupuzha, Muvattupuzha etc. and started agriculture on deforestation.

The first school was established in the panchayat in 1956-57 by a Tamil Brother Thomas Marayoor who established an Upper Primary School. Now there are 5 Malayalam medium and few English medium schools in the village.

Though agriculture was the mainstay of the people of the village the sector is faced with a number of problems. The convertion of paddy fields for other purposes, the indiscriminate growth of brick making units, the soil erosion and drought are the important problem. At present even lack of adequate labour force is also cited. The main crops grown in the village are tuber crops, paddy, banana, sugarcane and lemongrass. Fragmentation of holdings is another problem as can be seen from Table 3.6

Table 3.6

Number of operational holdings in Idukki district and Devikulam block

Sl.No.	Size (hectares)	Idukki district		Devikulam block	
		Number of holdings	Percen-tage	Number of holdings	Percen-tage
1	2	3	4	5	6
1.	Below 0.02	40055	18.97	10215	45.59
2.	0.02 - 0.50	96740	45.81	8460	37.76
3.	0.50 - 1.00	33022	15.64	1415	6.32
4.	1.00 - 2.00	30283	14.34	1655	7.39
5.	2.00 - 4.00	7954	3.77	395	1.76
6.	4.00 and above	3115	1.47	265	1.18
	Total	211169	100	22405	100

Source: Department of Economics and Statistics (1996), op.cit. p.26.

Due to fragmentation, agricultural holdings become uneconomic as it is difficult to apply scientific methods in small farms. The Table shows that there are 211169 operational holdings in the district and 22405 holdings in the block. Size of holding shows that 40055 (18.97 per cent) households at the district level and 10215 (45.59 per cent) at the block level are below 0.02 hectares. Higher rate of small holdings shows the backwardness at the block level to which the study area include. In the 0.02 - 0.50 hectares range there are 96740 (45.81 per cent) households at the district level and 8460 (37.76 per cent) at the block level. It is further noticed that from this range onwards higher size class is less at the block level compared to the district. This also indicates the backwardness of the block area.

It is reported that educational development in the village and the lack of interest in agriculture has led to a situation by which agriculture labour force in the village is on the decline. Out of 3210 families only 10 per cent is cited as depended on the agricultural sector for livelihood.

One co-operative bank and 2 nationalised banks are functioning in the panchayat.

The agricultural sector is depended on monsoon. Though there are irrigation canals they have become non functional.

Land maintenance is also less as agriclture has become unprofitable. Loss of crop is also quite substantial as natural calamities like wind, rainfall and mist leads to crop losses.

Wage rate comes to Rs. 50/- per male and Rs. 30/- per female during 1996. Cattle rearing is another source of livelihood. But this is also on the decline as paddy cultivation diclined, there is decline in forest area and restrictions on forest accessibility. Animal diseases are also on the rise. So also the farmers are not able to get a remunerative price as there are no marketing channels like milk co-operatives.

Industrially it is one of the most backward panchayat. Though there is 3 Khadi Board units it is dormant now. The only industry is a paper unit employing 27 persons.

Though the biggest power station is located in the district, several wards of the panchayat are yet to get electrified even after 27 years when the Idukki hydro-electric project was commissioned. For entertainment there is one theatre.

Housing condition is an indicator of the social and economic conditions of the households. Out of 3210 houses only 381 possessed reasonable housing features.

A multipurpose co-operative society came into existance as early as 1965. It became disfunctional from 1968. From 1973 it has been revived and is now functioning.

Marayoor is also a centre for tourist attraction as there are Chinnar 'Vanya Jeevi Samrakshana Kendram', Thoovanam waterfall, 'Muniyarakal', caves and cave engravings and the sandal forest. There are 744 Scheduled Tribe households spread over 23 colonies with a population of 3204 (1653 males and 1551 females).

The worlds biggest sandal tree is in the area. Moreover Marayoor is rich in herbal plants. The forest with sandals cover an area of 9500 hectares in the village.

The land use pattern in the panchayat is shown in Table 3.7

Table 3.7

Land use pattern of Marayoor panchayat(major crops)

Sl.No.	Crops	Area(acres)	Percentage
1	2	3	4
1.	Coconut	250	2.39
2.	Sugarcane	1900	18.17
3.	Paddy	625	5.98
4.	Tapioca	125	1.19
5	Pepper	75	0.72
6.	Ragi	300	2.87
7.	Lemongrass	2500	23.91
8.	Mulberry	300	2.87
9.	Arecanut	150	1.43
10.	Others	233	2.22
11.	Cultivable fallow	4000	38.25
	Total	10458	100

Source : Marayoor Grama Panchayat (1996) 'Vikasana Report, p.10.

The land use pattern of the village is shown in Table 3.7. It is quite revealing to note that out of an area of 10458 acres for which details were available 4000 acres (38.25 per cent) were cultivable fallow land. Out of the total cultivated land a quarter of the land was devoted for lemongrass cultivation. This was followed by sugarcane claiming 18.17 per cent of cultivated area and paddy 5.98 per cent. Thus the cropping pattern in the panchayat varies from that of the district and the state. Area devoted for other crops were far less.

It will be also interesting to look at the nature of employment. The same is shown in Table 3.8

Table 3.8

Nature of employment in Marayoor panchayat

Sl.No.	Nature of job	Number	Percentage
1	2	3	4
1.	Cultivation	105	2.59
2.	Agricultural labour	3329	82.02
3.	Animal husbandry	94	2.32
4.	Small scale industries	72	1.77
5.	Construction	65	1.60
6.	Transport and communication	139	3.42
7.	Trade	69	1.70
8.	Others	186	4.58
	Total	4059	100

Source : Marayoor Grama Panchayat (1996) op.cit. p.38.

Observably more than four fifth of the employed, worked as agricultural labour. Cultivation was reported as the employment in the case of 2.59 per cent and more or less equal size were engaged in animal husbandry. Thus land based activities absorbed most of the workers. Industry and teritiary sector share in employment was conspicuously low which again indicates the level of backwardness of the village and the absence of diversified employment opportunities.

3.4 Kanthalloor panchayat

Kanthalloor panchayat consists of Kanthalloor and Keezhanthoor villages. It is bounded on the north by Udmalpetta taluk of Tamilnadu, on the east Vattavada panchayat, on the south by Munnar panchayat and on the west by Marayoor panchayat. General Particulars of the panchayat are indicated in the Table 3.9.

Table 3.9

General particulars of Kanthalloor panchayat

Sl.No.	Items	Particulars
1	2	3
1.	Villages in the panchayat	Kanthalloor and Keezhanthoor
2.	Block panchayat	Devikulam
3.	Taluk	Devikulam
4.	Area	116.29 sq. km.
5.	Boundaries	North - Udmalpetta taluk of Tamilnadu
	East	Vattavada panchayat
	South	Munnar panchayat
	West	Marayoor panchayat
6.	Population (1991 census)	10265
a.	Male	5272
b.	Female	4993
c.	Density	88.49/Sq.km.

Source : Kanthalloor Grama Panchayat (1996), 'Vikasana Report' p.7

The panchayat come in the Devikulam block panchayat of Devikulam Taluk. The panchayat is spread over an area of 116.29 sq. km. Population (1991 census) of the panchayat is 10265 consisting of 5272 males and 4993 females. Density of population comes to 88.49/sq. km.

There are certain common features to the two panchayats of our study as far as history is concerned. Before we outline the features of the panchayats seperately this common features may be outlined.

When Tippu Sultan attacked the Madhura which belonged to the Pandya dynasty in Tamil Nadu, out of fear people left the place and settled in Periakulam Taluk. There were people of different castes and they settled with unity as a caste. However in the course of their search for livelihood they got separated and formed five villages (Anchunadu) known as Karayoor, Keezhanthoor, Kottakudy, Kanthalloor and Marayoor. Each was headed by a Minister. Later the Poonjar Raja conquered these settlements and brought under the Travancore state. After independence in 1952 two panchayats were formed, one with Marayoor and the other comprising of the other 3 villages of Keezhanthoor, Karayoor and Kanthalloor known as Kanthalloor panchayat. The fifth Kottakudy is still in Tamil Nadu. Most of the settlers were thus originally migrants of Tamil origin.

Notable social progress was made in the area around 1954 when the Travancore Cochin Chief Minister Sri. Pattom Thanu Pillai, who seeing the dominance of the Tamil speaking population to reduce their dominance

established colonies to settle Malayalees. Since then there were a flow of settlers in the village.

One of the notable change that occurred in the area was the agrarian change. The households traditionally were in possession of large land. But at the same time they were less able to cultivate due to adverse climate and attack of wild animals. Then many were not able to remit the land tax with the effect that most of the land were auctioned and they were converted to labour again. However later the land reform measures enabled many to gain the possession.

A variety of agricultural products are cultivated in the village including fruits, vegetables, pulses and grains. This is another feature of the village . Earlier this was one of the granaries of Kerala. However the paddy cultivation became uneconomic and hence paddy cultivation is on the decline. The settlers have planted Grantis and this has considerably affected spring water and not only this affected paddy cultivation but also has done considerable damage to the environment. Though this was known as agricultural area, only 6 per cent of the families derived more than 50 per cent of their income from agriculture. So also labour migrate to other areas for work. Though Grantis cultivation demand large labour, the availability of labour is said as on the decline.

A number of minor irrigation projects are there but they are not useful for agriculture.

There are two branch post offices and one primary health centre.

It is during the rule of Travancore-Cochin Rajas that a primary school came up in the panchayat. However by 1958 it was closed. At the same time with the arrival of the Christian missionaries there occurred notable progress. There is now 1 High School, 1 Upper Primary School and 3 Primary Schools. By 1979 came the High School. About 95 per cent of the teachers are from outside the district and there is lack of housing facilities. So their actual involvement is said as below expectation and has limited the educational progress.

Housing condition is an indicator of the socio-economic status of a society. So the housing status of the panchayat was examined. The panchayat mainly consists of agriculturists. A sizeable portion of the population consists of Scheduled Castes and Scheduled Tribes, who form the weaker section of the society. The social backwardness is reflected in the housing condition also. It was noticed that concrete houses are very rare. Most of the houses are thatched single room houses with floors polished using mud and cowdung.

Drinking water is a problem. Majority of the people depend on natural water sources like spring water for drinking. It is reported that there is scarcity of drinking water in the panchayat. As per panchayat statistics (1996) there are 75 public taps, 11 public tanks, 10 private wells, 4 public wells and 4 tube wells in the panchayat providing public drinking water facilities. Thus it is prima facie evident that public source of drinking water is very low in the panchayat.

Socio-economic status of women is a parameter to measure the economic status of the society. So the socio-economic status of women in the

panchayat was examined. It showed that even though various programmes towards women welfare is going on in the State the situation of women in the panchayat noticed no considerable change. The total population as per the 1991 Census was 10265 in the panchayat. Out of this, women population comes to 4993 (48.64 per cent). It was also seen that their literacy rate is 55 per cent. Another notable feature was that most of them were agricultural labourers and their wage rate was low. They are not coming in the educational field and also in social activities. Details of women workers are presented in the following Table.

Table 3.10

Workforce participation rate of women in Kanthalloor panchayat (1991 Census)

Sl.No.	Details of work	Nature of work	Percentage to total population
1	2	3	4
1.	Agriculture	403	8.07
2.	Agricultural labourers	1917	38.40
3.	Livestock	3	0.06
4.	Quarry workers	110	2.20
5.	Production of household utensil	1	0.02
6.	Production of other articles	12	0.24
7.	Construction work	1	0.02
8.	Industrial workers	5	0.10
9.	Service sector	76	1.52
10.	Part-time employment	123	2.46
11.	Unemployed	2342	46.91
All		4993	100

Source : Kanthalloor Grama panchayat (1996) op.cit, p.48.

It was seen earlier that women population in the panchayat is 4993. Work participation of women workers shows that 2342 (46.91 per cent) are unemployed. This include children, aged and disabled also. Agricultural labourers come to 1917 (38.40 per cent). Those who are engaged in agriculture is reported as 403 (8.07 per cent). It is further noticed from the Table that 123 (2.46 per cent) of the women population has part-time employment. Quarry workers come to 110 (2.20 per cent) and in the service sector, involvement of women is 76 (1.52 per cent). Others altogether constitute 22 (0.44 per cent). Thus the Table in general high-lights the better employment position of women in the panchayat.

Major livestock asset of the panchayat consists of cow, goat/sheep, buffalo, hen, rabit, duck and donkey.

The panchayat is very backward as far as industries are concerned. There is no large scale or medium scale industries in the panchayat. As per the records of the Industries Department there are 16 SSI units in the panchayat. But it is seen that there are some self employment units also. In some tribal centres production of traditional items using bamboo, reed etc. are seen.

The panchayat is blessed with natural beauty. Forest area in the panchayat comes to 17751.32 acres. It is rich of medicinal plants and various types of animals and birds. Tourists coming to Mattupetty, Kundala, Rajamala, Eravikulam and Chinnar can visit Kanthalloor also. 'Muniyaras', Perumala Sree Rama cave temple and the beautiful agricultural land will be of interest to tourists.

NATURE OF THE CROP AND ITS CULTIVATION PRACTICES

P.S. Jayapradeepu “Economics of lemongrass cultivation in Kerala ” Thesis. Department of Economics, Dr. John Matthai Centre Thrissur , University of Calicut, 2003

CHAPTER IV
NATURE OF THE CROP AND ITS CULTIVATION PRACTICES

4.1 Introduction

Lemongrass cultivation is concentrated in certain pockets particularly in the hilly regions where suitable environment exist for the crop in terms of land availability climate etc. The cultivation is also done mostly by the tribals though non-tribals are also engaged in a significant way. Recognising its commercial value institutional infrastructure has been created and new plant varieties have been evolved. To what extent the farmers have adopted them is an important issue. So also there are sound agricultural practices to be followed for the maximisation of the yield. Here again what are the practices followed at the field level and are they sound are questions needs to be examined. This chapter focusses on these issues mainly based on the primary data generated in the course of the survey and based on our field level observations.

Lemongrass was found growing as a wild growth in the suburbs of Kallil Temple in Methala hills in Ernakulam district of Kerala in eighteen eightees. During that period local people were not aware of the commercial importance of the plant. Lemongrass is a perennial grass which has the capacity to withstand draught and it is to a certain extent resistant to plant diseases. Animals usually do not eat the raw grass due to its aroma odour. The above factors were helpful for the extensive wild growth of the grass. However, grass of wild variety is less superior as its oil content and citral content are low.

It is believed that the first distillation in Kerala was done during eighteen eightees by a person from Cochin who was commonly know as 'Mestry' in the Methala hills. From our discussion in the area we noted that he was an agent of a foreign agency at Cochin which provided the technology of distillation. The distillation of lemongrass at that time was done as a secret process. Due to the ignorance about the commercial value of the oil, people did not took much interest in it. But shortly people started recognising the importance of the oil and began to learn the process of distillation to enter the business. Within a short period, lemongrass oil became the most economical agricultural produce of the local people of Kuruppampady, Odakkali etc, of Kunnathunad Taluk. Later on the cultivation spread to other areas such as Thodupuzha, Muvattupuzha, Wayanad, Taliparambu etc. During 1955-56 area under lemongrass cultivation was 14085 hectares. In the year 1975-76 area declined to 2315 hectares. During 1985-86, area under lemongrass is reported to be 6461 hectares. Now the activity is concentrated in Idukki district where the area under cultivation during 1998-99 was 1116 hectares as seen in Table 1.3

4.2 Plant varieties

According to the colour of the stem lemongrass in Kerala can be distinguished as the white stemed and the red stemed grass. The white stemed grass is seen cultivated in the high ranges of Idukki district only. In all other places red stemed grass is cultivated. It is observed that the white stemed grass has increased grass production in high ranges and also higher percentage of oil in the grass, eventhough citral percentage is low. It is not suitable for cultivation in low land and midland as life and herbage yield of the grass are less there. Moreover it is not adaptable to the climatic conditions. The

opposite happen in high ranges, where the herbage yield and the percentage of oil in the red grass are low eventhough citral content of the oil is high. Discussion in the area revealed that the white stemed variety was under cultivation in Marayoor and Kanthalloor for over 50 years.

4.3 Knowledge about other varieties

Profitability of a crop is directly related to the productivity of the crop. It is the basis of green revolution. High yielding varities are usually produced by hybridisation and mutation. In the case of lemongrass also, a number of high yielding varities are produced and the red stemed grass OD-19 having good herbage yield and higher oil content in the grass is produced at the Aromatic and Medicinal Plants Research Station. Other high yielding varieties produced at other research stations in India include RRL-16, CKP-25, LS-48 etc. The study revealed that 11 (4.31 per cent) cultivaters tried OD-19 variety in their farms. The variety is not suitable in high range climatic conditions due to poor growth. But citral content of the oil is higher than the white variety being cultivated there.

As to the awareness of the varieties and their adoption it was found that 84 (32.94 per cent) cultivators have knowledge of OD-19 variety. The cultivators have no idea regarding other varieties produced by other research organisations.

4.4 Type of land where lemongrass is cultivated

Types of land is a factor that determines the yield level of the crop. The yield will be usually higher when cultivated on hill slopes. Still the grass is cultivated both on hill slopes as well as on plain lands. Let us now examine the nature of land on which the grass is grown by the sample cultivators. The same is shown in Table 4.1.

Table 4.1
Type of land

Sl. No.	Type of land	Tribal households (No)	Non-tribal households (No)	Total (No)
1	2	3	4	5
1.	Hill slops	152 (100%)	59 (57.28%)	211 (82.75%)
2.	Plain land	Nil	44 (42.72%)	44 (17.25%)
Total		152 (100%)	103 (100%)	255 (100%)

(Figures in parentheses are percentages to total)

It can be observed that 211 (82.75 per cent) households cultivated lemongrass on hill slops and 44 (17.25 per cent) in the plain land. It is also found that all the tribal cultivators had grown the grass on the hill slopes. While 59 (57.28 per cent) of the non-tribal cultivators used hill slopes, the balance 44 (42.72 per cent) used the plain land.

4.5 Area under cultivation

It is seen earlier that area under cultivation declined considerably and the activity is now concentrated in Idukki district. Area under lemongrass from 1975-76 to 1998-99 shows that area ranged from 1209 hectares to 7762 hectares. The area under cultivation was 1209 hectares in 1997-98 which increased to 1538 hectares in 1998-99. It is also noticed that out of the 1538 hectares reported during 1998-99, 1116 (72.56 per cent) hectares were in Idukki district. Further it is noticed that, from 1992-93 onwards area under lemongrass has been increasing in Idukki. This shows that the activity is concentrated in Idukki district.

4.6 Source of seed

Among inputs, seed occupy an important role in the cultivation. Seed is obtained by collection of the same from wild growth grass in the forest, produced in own farm and purchased from open markert. Method of procurement of seed vary between tribals and non-tribals according to their surroundings as most of the tribal cultivatiors are living in interior forest region and non-tribals in villages. Therefore it is worthwhile to examine details on the source of seed which is examined here.

Table 4.2
Source of seed

Sl. No.	Source	Tribal households (No)	Non-tribal households (No)	Total
1	2	3	4	5
1.	Collected from wild growth grass of the forest	113 (74.34%)	39 (37.86%)	152 (59.61%)
2.	Produced in own farm	Nil	Nil	Nil
3.	Purchased	39 (25.66%)	64 (62.14%)	103 (40.39%)
Total		152 (100%)	103 (100%)	255 (100%)

(Figures in parentheses are percentages to total)

The Table shows that out of the 255 sample cultivators 152 (59.61 per cent) collected seed from wild growth grass of the forest and 103 (40.39 per cent) purchased seed from open market. Column number 3 of the Table shows that, out of the 152 tribal households, 113 (74.34 per cent) collected seed from

the wild growth grass of the forest. The advantage of this process is that only labour cost is incurred in it. In the case of non-tribals only 39 (37.86 per cent) are collecting seed from wild growth. Regarding purchase of seed from open market it is seen that 64 (62.14 per cent) non-tribal households and 39 (25.66 per cent) tribal households have purchased seed from open market. Another observation is that seed production in farms are not practiced by the cultivators. Mainly there are two reasons for this. For seed production grass has to be preserved without cutting for distillation for a long period. Moreover after seed production grass will dry up. During monsoon grass will grow but take one or two years to recoup the earlier position.

4.7 Mehod of planting

Two methods of planting are in practice. They are direct seeding and transplanting methods. Vegetative propagation is also possible. Plants grown from seeds have more life. Direct seeding give a higher yield during the first year of planting. But transplanted grass gave higher yield during subsequent years. Majority of the cultivators are practicing direct seeding due to high initial expenditure for transplanting operations and difficulty in raising nursery well in advance of monsoon, duc to lack of irrigation facilities etc..

Land has to be prepared properly by ploughing. For broadcasting 15 to 20 kg. seed is required per hectare. After broadcasting the seed, small quantity of soil is put on it as covering. If sufficient moisture is there in the soil, seeds will germinate within a period of one week. For transplanting 8 to 10 kg seed has to be sown in 20 to 25 cents of land. Seedling can be transplanted within 60 to 70 days at a distance of 15 cms.

4.8 Nursery

For transplanting, seedlings has to be grown before the onset of monsoon, for which adequate water source is necessary. This is a constraint for growing nursery. Moreover transplanting operation need higher initial investment. The transplanted crop is found to produce higher herbage yield and thereby higher oil production. Therefore it is important to examine the number of cultivators having nursery.

It is observed that out of the 255 cultivators 32 (12.55 per cent) have nursery and transplanted crop. Among than 18 (56.25 per cent) are non-tribals and 14 (43.75 per cent) are tribals. The low percentage of nursery for tribals are due to the difficulty for water before monsoon for raising nursery.

4.9 Drainage

The plant cannot withstand water-logging. So good drainage has to be provided in farms. Our observation on this line showed that cultivators are having knowledge about this and they have provided drainage in their farms.

4.10 Intercropping

Intercropping with Grantis (a type of Eucalyptus) is observed in some lemongrass cultivations. Intercropping will adversely affect the area of lemongrass and also create shade resulting in reduced grass production. Out of the 152 tribal households 7 (4.61 per cent) are observed as intercropped farms. In the case of non-tribal households out of 103, 6 (5.83 per cent) are seen as intercropped farms. Most of the tribal lemongrass cultivations are in the forest region. Intercropping by Grantis is seen lower in tribals than in non-tribals.

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4.11 Application of manures and fertilizers

Eventhough manure and fertilizer can increase grass production and thereby oil production, only some cultivators are applying manure and nobody is using fertilizer. It is observed that the cultivators are not fully aware of the method of chemical fertilizer application in lemongrass cultivation.

4.12 Weeding and earthing up

Weeding and earthing up are important recurring operations. Weed competition can reduce production by 50 per cent. Weeding is followed by earthing up. Manure or compost is applied by some cultivators at the time of earthing up. These operations are easier in transplanted grass, by which labour cost can be saved.

4.13 Harvesting and transporting

Timely harvest is important for good oil recovery and citral content. Young grass has low citral content with poor solubility in 70 per cent alcohol. It is observed that first cutting can be done 90 days after planting. After that within an interval of 60 to 65 days grass can be cut in the area. Three cuttings can be taken in the first year and in subsequent years 4 to 5 cuttings can be done. In the light of the above, harvesting practices were examined. In the area 4 to 5 cuttings are usually taken. Average interval between harvests is indicated in the following Table.

Table 4.3

Average interval between harvests (per year)

Number of cutting	Average interval (days)		
	Tribals	Non-tribals	All
1	2	3	4
1	88	90	89
2	63	65	64
3	63	60	62
4	65	60	63
5	86	90	87
Total	365	365	365

Table 4.3 shows the average interval between cuttings. The Table shows that first cutting is done after an average of 89 days from the last cutting, as grass dry during summer and grow well only during monsoon. For second, third and fourth cuttings an average of 64, 62 and 63 days are recorded. There is an average of 87 days between the fourth and fifth cuttings. Longer period here is due to poor growth of grass during summer. Both for tribals and for non-tribals the interval between cuttings ranged from 60 to 65 days during normal period. It is seen that cultivators have good knowledge in the scientific aspects of harvesting.

4.14 Distillation

Grass is transported to distillary. It has to be distilled within 48 hours for good results. Chopping grass into 3 cm length before distillation can increase oil recovery as it will result in exposing directly more oil grands. It is also

reported that dipping of chopped grass in sodium chloride solution for 24 hours can enhance citral content of the oil. Three types of distillations are reported. They are hydro-distillation, hydro-steam distillation and steam distillation. It is observed that all the cultivators are using hydro-distillation method. They are ignorent about chopping grass before distillation and treatment with sodium chloride solution.

Field study revealed that distillation is usually done within 48 hours. Those who have distillary are distilling grass before it is dried. Those who are not having distillary, sometimes the grass has to be kept over 48 hours. Rent for distillation is one ounce of oil per distillation.

4.15 Spent lemongrass

The residual plant material after distillation is known as spent grass. It can be used as compost, manure, cattle feed, manufacture of pulp and in mushroom cultivation. It is also used as a mulching material in ginger cultivation. The study revealed that a portion of spent grass is being used by the cultivators as cattle feed and also as manure.

4.16 Fixed investment

In the case of lemongrass, distillary is the only fixed investment, other than land. Cost of distillary ranges from Rs.3475/- to Rs. 3975/-. No irrigation is given to lemongrass. So investment on pump is not involved.

4.17 Age of plantation

Ageing decreases grass production of lemongrass. In the high range climatic conditions the crop give good yield upto 10 years. Grass production

is seen decreased thereafter . On this basis lemongrass cultivations are grouped into new (below 10 years) and old (above 10 years)

Table 4.4

Age of plant

Sl. No.	Community	Below 10 years (No)	Above 10 years (No)	Total (No)
1	2	3	4	5
1.	Tribals	51 (54.84%)	101 (62.35%)	152 (59.61%)
2.	Non-tribals	42 (45.16%)	61 (37.65%)	103 (40.39%)
Total		93 (36.47%)	162 (63.53%)	255 (100%)

(Figures in parentheses are percentages to total)

Age of plant was examined. It is seen from Table 4.4 that out of the 255 households 162 (63.53 per cent) have plantations above 10 years. Out of which 101 (62.35 per cent) households were tribals and 61 (37.65 per cent) were non-tribals. There are 93 (36.47 per cent) households having lemongrass below 10 years. In this category come 51 (54.84 per cent) tribal households and 42 (45.16 per cent) non-tribal households. Thus the table in general shows that most of the plantations are old. This indicates that there is need to replant for better productivity.

4.18 Time lag between cutting and distillation

Distillation of grass after cutting for one or two days is economical as more grass can be charged to the distillary. Further delay in distillation result in drying or decaying the grass, resulting in poor oil recovery. The study shows that nearly 8 per cent of the cultivators could not distill grass in time due to non-availability of distillary for rent distillation.

Table 4.5
Oil production (in tonnes)

Sl.No.	District	1975-76	1980-81	1985-86	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	Thiruvananthapuram	4	3	3	1	1	1	1	1	1	---	---	---
2.	Kollam	3	2	1	1	1	1	1	1	1	1	---	---
3.	Pathanamthitta	---	1	1	1	1	1	--	---	---	---	---	---
4.	Alappuzha	1	1	1	1	--	---	---	1	---	---	---	---
5.	Kottayam	4	3	3	2	2	1	3	2	---	---	---	---
6.	Idukki	70	126	163	99	71	55	55	60	63	66	53	74
7.	Ernakulam	57	50	47	13	9	5	1	1	2	1	1	1
8.	Thrissur	4	2	2	1	1	1	1	3	6	3	1	2
9.	Palakkad	12	47	24	7	9	13	10	12	4	8	1	1
10.	Malappuram	3	2	2	1	1	1	2	2	2	1	---	---
11.	Kozhikode	15	11	10	3	2	2	2	1	1	2	---	---
12.	Wayanad	---	28	29	18	14	13	9	11	10	8	6	6
13.	Kannur	94	24	31	9	5	3	3	6	3	3	2	3
14.	Kasaragod	---	18	9	3	2	1	1	1	1	4	---	---
	State	267	318	326	160	119	98	89	102	94	97	64	87

Source:- Statistics for Planning (2001), Directarate of Economics & Statistics, Thiruvananthapuram, P.88

4.19 Method of charging the grass

Laboratory studies indicate that chopping of grass into 3 cm. size and distilling can increase oil recovery. It is observed that all the cultivators are charging grass as bundles.

4.20 Burning of grass during summer

Burning of grass in summer is advantages as it can destroy weed growth and insect larva. This has been found to have revitalising effect on grass. During monsoon, gap filling has been found to increase grass production. It is observed that 43 (28.29 per cent) of the tribal cultivators and 12 (11.65 per cent) of the non-tribal cultivators are burning grass.

4.21 Oil production

District wise oil production for the period from 1975-76 to 1998-99 is given in the Table 4.5. Table shows that oil production during 1975-76 was 267 tonnes which rose to 326 tonnes in the year 1985-86. It declined to 64 tonnes in 1997-98. During 1998-99 oil production increased to 87 tonnes.

It is important to note that oil production except Idukki District declined but there is an increasing trend in Idukki. During 1975-76 share of Idukki district in the total oil production was 26.22 per cent. In the year 1990-91 share of Idukki district was 61.88 per cent. During 1995-96 Idukki district contributed 67.02 per cent of the state production. In the year 1998-99 share of Idukki district was 85.06 per cent. The table further shows that from 1992-93 onwards oil production increased in Idukki district. It increased from 55 tonnes in 1993-94 to 74 tonnes in 1998-99. Higher productivity and lower

input costs are the major factors for the increasing trend in cultivation and oil production in Idukki district.

4.22 Storing of oil

Experiments proved that prolonged storing of oil decrease citral content. It is also seen that antioxidants can prevent the loss of citral while storing. If the oil is kept air tight in aluminium containers and kept in darkness, oil can be preserved from the loss of citral for a longer period. It is observed that the cultivators are selling their produce immediately after distillation due to financial difficulties.

4.23 Sale of lemongrass oil

Lemongrass oil is sold to different dealers which include provision merchants, local dealers and co-operative society. A portion of the producers sell their product in the provision shop. Such producers buy provision goods and also receive money in advance on condition that the oil produced will be given to them. Others sell oil to the local dealer or society. Sale to wholesaler is rarely practiced.

4.24 Price trend

Price trend for lemongrass oil is seen from the wholsale price index given in Table 3.6. There is a steady increase in price for lemongrass oil. If the wholesale price index for major crops from 1995 is examined, it is seen that cashew nut and rubber recorded decrease in wholesale price. In the case of cashewnut the wholesale price index for the year 1995 was 3918.2 which decreased to 2667.0 during 2000. In the case of rubber the wholesale price

Table 4.6

Whole sale price index number of agricultural commodities-yearly average (commodity wise)

Base 1952 - 53 = 100

Sl. No.	Commodities	1980	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Upto March 00
1.	Rice	325.9	447.7	591.7	638.1	638.1	837.1	957.4	1161.9	1161.9	1161.9	1161.9	1887.5	1953.5
2.	Molasses	631.0	709.1	1081.8	1061.2	1190.6	1802.7	1781.1	1477.1	1563.5	2338.2	2130.0	1846.9	1841.5
3.	Pepper	129.6	369.1	309.0	334.9	269.6	315.9	531.2	735.5	714.24	1038.4	1920.4	1943.8	2045.6
4.	Ginger	294.4	1139.7	1882.4	1725.7	1731.5	1856.1	2891.8	4486.7	3418.2	3009.2	3607.7	5035.1	4547.4
5.	Turmeric	546.4	3476.5	2713.8	5127.0	7745.3	4498.7	3982.4	4088.4	5423.2	6337.5	11175.9	8943.0	7514.2
6.	Arecanut	427.8	613.1	1157.6	1835.5	1953.7	2147.2	2042.5	2233.9	2732.3	3242.5	3102.0	5727.9	4054.7
7.	Cardamom	759.4	942.2	1865.2	1546.8	2060.4	3062.6	1893.7	1526.3	1895.5	2690.5	2348.9	3307.6	2966.2
8.	Banana	596.1	1016.2	1367.8	1431.2	1566.7	1813.0	2229.3	2068.3	2153.1	1534.3	1659.7	1515.9	1489.6
9.	Gingelly/Sesamum	711.1	852.7	1647.6	1855.5	1602.2	1753.9	2019.4	2829.0	2457.9	2266.5	2808.5	3092.2	3177.0
10	Groundnut	579.1	916.7	1598.2	1978.9	1564.8	2082.3	1240.2	535.9	535.9	3298.2	3033.9	3390.1	3270.7
11	Cashew nut	767.5	1356.8	1560.6	1564.1	2573.3	3140.4	3237.1	3918.2	4273.7	3900.0	4318.1	3810.1	2667.0
12	Tapioca	404.3	650.6	1335.6	1335.6	1978.9	1845.4	1881.1	2211.6	2521.6	2803.1	2688.1	3211.5	3713.0
13	Coconut	835.2	1144.7	2246.9	2246.9	1910.2	2377.2	1913.6	2024.2	2542.5	3220.0	2672.6	3271.5	2958.5
14	Lemongrass oil	647.8	1317.9	2275.7	2275.7	2432.1	2400.2	2367.6	2713.3	4229.3	4182.2	4607.2	4867.6	4817.4
15	Tea	313.2	576.9	952.5	952.5	973.0	1078.5	985.6	1072.3	1352.3	1472.3	2116.8	2061.6	1884.4
16	Coffee	325.0	524.3	1058.1	1058.1	1162.1	1366.5	2154.7	3886.9	2542.1	2512.4	2638.2	2628.2	2415.3
17	Rubber	375.6	539.4	655.1	655.1	773.9	803.8	953.1	1560.7	1563.5	1313.6	846.8	855.4	908.8

Source:- Statistics for Planning (2001), Directarate of Economics & Statistics, Thiruvananthapuram, P.481

index decreased from 1560.7 to 908.8 during the above period. In the case of banana also a decrease has been noticed.

For lemongrass oil the wholesale price index was 647.8 in 1980. It increased to 2275.7 in the year 1990. It further increased in the year 1995 to 2713.3. It reached to an whole time high figure of 4867.6 in 1999. So the wholesale price index shows a favourable price trend for lemongrass oil.

4.25 Knowledge about citral test

Price of oil is to some extent is determined by the citral content. This awareness of the farmers is therefore an important factor. Thus knowledge about citral test among the cultivators was examined. It is seen that out of the 255 sample households 248 (97.25 per cent) are having knowledge about citral test. It is further noticed that all the 103 non-tribal cultivators have knowledge about citral test. In the case of tribals 145 (95.39 per cent) cultivators have knowledge about citral test and 7 (4.61 per cent) cultivators are ignorant about the test. Thus the study shows that only a few cultivators are ignorant about citral test and many of them are insisting the test. However agents of some ayurvedic, soap and agarbathi manufacturing firms are buying lemongrass oil without citral test as the importance of citral is not much important in these cases. Citral content is important where the oil is used for the manufacture of Vitamin A.

SOCIO-ECONOMIC STATUS OF LEMONGRASS CULTIVATING HOUSEHOLDS

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CHAPTER V

SOCIO-ECONOMIC STATUS OF LEMONGRASS CULTIVATING HOUSEHOLDS

Though lemongrass cultivation is dominantly a tribal occupation non-tribals are also engaged in the occupation in a significant way. What is the social and economic background of the cultivating communities and whether the socio-economic conditions of tribals differ from that of non-tribals are important issues worth examining. This chapter makes an attempt to depict the socio-economic conditions of the cultivators.

5.1 Religion/Caste

The religion/caste break up of households are shown in Table 5.1. The division reveals that out of 255 cultivators 152 (59.61 per cent) belonged to the tribal community. Next in importance comes Christians, 52 (20.39 per cent) and Other Backward Communities of Hindu religion 36 (14.12 per cent). The Scheduled Castes and Forward Castes accounted for 3.53 and 2.35 per cent of the total cultivators respectively. Thus the result reveals that there is significant participation of non-tribals also in the cultivation of lemongrass. Next to the tirbal households the largest participation came from the Christian community as they accounted for nearly one fifth of the total cultivating households. The balance belonged to the various denominations of Hindu religion.

Table 5.1

Religious composition of lemongrass cultivating households

Sl.No.	Name of religion	Number of households and percentage
1	2	3
1.	Scheduled Castes	9 (3.53%)
2.	Scheduled Tribes	152 (59.61%)
3.	Other Backward Communities	36 (14.12%)
4.	Forward Caste Hindus	6 (2.35%)
5.	Christians	52 (20.39%)
6.	Muslims	Nil
Total		255 (100%)

(Figures in parentheses are percentages to total)

5.2 Household size

Size of household is an indicator of the socio-economic status of a community. To get a perspective on the same, break up of the 255 households by family size is shown in Table 4.2. It can be observed from the table that 38 (14.90 per cent) households had a family size of 7-8 members and for 117 (45.88 per cent) households 5-6 members. It is followed by 91 (35.69 per cent) households with a family size of 3-4. Higher family size above 9 was not observed in none of the households. Low family size of upto 2 members was observed in only 9 (3.53per cent) households.

Table 5.2

Size of lemongrass cultivating households

Sl. No.	Family size	Scheduled Castes	Scheduled Tribes	Other Backward Communities	Forward Caste Hindus	Christians	All
1	2	3	4	5	6	7	8
1	Upto 2	Nil	6 (3.95%)	1 (2.78%)	Nil	2 (3.85%)	9 (3.53%)
2	3 - 4	4 (44.45%)	54 (35.53%)	12 (33.33%)	2 (33.33%)	19 (36.54%)	91 (35.69%)
3	5 - 6	3 (33.33%)	78 (51.31%)	14 (38.89%)	2 (33.33%)	20 (38.46%)	117 (45.88%)
4	7 - 8	2 (22.22%)	14 (9.21%)	9 (25.00%)	2 (33.34%)	11 (21.15%)	38 (14.90%)
5	9and above	Nil	Nil	Nil	Nil	Nil	Nil
Total		9 (100%)	152 (100%)	36 (100%)	6 (100%)	52 (100%)	255 (100%)

(Figures in parentheses are percentages to total)

Religion/Caste wise break up shows that on an average there was 4.89 members per household in Scheduled Castes followed by 4.79 members in

Scheduled Tribes. While Other Backward Communities had 5.44, members Forward Caste Hindus had 5.50 and Christians 4.98 members per household Further it can be seen from the Table that 3-4 member household dominates in Scheduled Castes, as 44.45 per cent of households are having 3-4 members. In all other communities 5-6 member households dominates as 51.31 per cent of the Scheduled Tribes and 38.89 per cent of Other Backward Communities, 33.33 per cent Forward Caste Hindus and 38.46 per cent of Christian households come under the group. In the 7-8 member households highest percentage of 33.34 is recorded for Forward Caste Hindus. Lowest percentage of 9.21 is seen for Scheduled Tribes. For Scheduled Castes, Other Backward Communities and Christians the percentage is 22.22, 25.00 and 21.15 respectively. In none of the households the size of family exceeded 8.

5.3 Sex ratio

Table. 5.3

Sex ratio of lemongrass cultivating households

SI. No.	Category	Male	Female	Total	No. of females per 1000 males
1	2	3	4	5	6
1	Tribes	366	362	728	989
2	Non-tribals	265	267	532	1008
	Total	631	629	1260	997

Sex division of the population reveled that out of the 1260 population 629 (49.92 per cent) were females. Sex ratio of lemongrass cultivating households

shown in Table 4.3 shows that for total population sex ratio is 997 females per 1000 males.Out of the 728 Scheduled Tribe population 366 are males and 362 females giving a sex ratio of 989 females per 1000 males. For non-tribals, total population in the sample is 532. Out of this 265 are males and 267 females. Their sex ratio is 1008 females per 1000 males. This shows that while male dominates among scheduled tribes, female dominates among non-tribals.

5.4 Nuclear families

In traditional Indian society joint family system was prevalent and majority of the people lived in villages. As the main occupation of the society was agriculture, joint family was the most self-contained social organisation. Due to industrialisation and urbanization joint family lost some of its utilities and it disintegrated gradually resulting in nuclear families. Data tabulated in Table 5.4 indicates the proportion of the nuclear families.

Table 5.4

Number of nuclear households

Sl. No.	Name of religion	Number of households	Number of nuclear households	Percentage
1	2	3	4	5
1.	Scheduled Castes	9	7	77.77
2.	Scheduled Tribes	152	109	71.71
3.	Other Backward Communities	36	26	72.22
4.	Forward Caste Hindus	6	4	66.66
5.	Christians	52	42	80.77
	All	255	188	73.73

The table shows that out of the 255 sample households 188 were nuclear households (73.73 per cent). Among various communities the share of nuclear family ranged from 66 to 81 per cent. Highest percentage (80.77) of nuclear families were noticed in Christian community. Forward caste Hindus recorded the lowest percentage of 66.66. Among the Scheduled Castes 77.78 per cent nuclear families exists and in the Scheduled Tribes it is 71.71 per cent. In the case of Other Backward Communities 66.67 per cent of families were nuclear families.

5.5 Age Structure

Table 5.5

Age structure

Sl. No.	Age group	Tribals	Non-tribals	All
1	2	3	4	5
1	Less than 14	216 (29.67%)	158 (29.70%)	374 (29.68%)
2.	15 - 29	181 (24.86%)	137 (25.75%)	318 (25.24%)
3.	30 - 44	133 (18.27%)	96 (18.05%)	229 (18.18%)
4.	45 - 60	119 (16.35%)	82 (15.41%)	201 (15.95%)
5.	61 and above	79 (10.85%)	59 (11.09%)	138 (10.95%)
Total		728 (100%)	532 (100%)	1260 (100%)

(Figures in parentheses are percentages to total)

Table 5.5 shows the age structure of the population of the cultivating households separately for tribals and others. In the total population children

(less than 14 years) constituted 29.68 per cent and aged (above 61 years) 10.95 per cent. Thus the dependents comes to more than two fifth of the total population indicating that for every 1.5 working person there was 1 dependent. In the total population of 1260, tribals constitute 728 (57.78 per cent) and non-tribals 532 (42.22 per cent). Category wise children below the age of 14 years accounted for 216 (29.67 per cent) among tribals and 158 (29.70 per cent) among non-tribals.

Then comes those in the workable age group between the age group of 15 to 60 years. It is seen that 433 (59.48 per cent) tribals and 315 (59.21 per cent) non-tribals come under the group. Persons having 61 and above age are treated as aged. Their strength comes to 79 (10.85 per cent) for tribals and 59 (11.09 per cent) for non-tribals. Most of them are dependents of the working group. On the whole it can be sean that the age composition of the population do not differ between the two communities. At the same time it is revealing to note that the size of dependency is on the higher side. Accordingly if we consider those in the below 15 and above 60 age group as the dependents, it can be seen that 40.52 per cent of tribals and 40.79 per cent of non-tribals were dependents. Thus in other words mean that for every 1.5 person in the working age group of 15-60 there was one person as dependent both among the tribals and the non-tribals.

5.6 Housing

Housing condition is also an indicator of standared of living of a household. In this context the housing conditions of the sample households are examined in Table 5.6.

Table 5.6
Housing conditions

Sl. No.	Community	That-ched (No)	Thatch-ed & tiled (No)	Fully tiled (No)	Tiled & concrete (No)	Fully concrete (No)	Total (No)
1	2	3	4	5	6	7	8
1	Scheduled Caste	3 (33.33%)	4 (44.45%)	2 (22.22%)	--	--	9 100%
2.	Scheduled Tribe	131 (86.18%)	12 (7.90%)	9 (5.92%)	--	--	152 100%
3.	Other Backward Communities	--	3 (8.33%)	16 (44.45%)	12 (33.33%)	5 (13.89%)	36 100%
4.	Forward Caste Hindus	-	-	2 (33.33%)	3 (50.00%)	1 (16.67%)	6 100%
5.	Christians	-	-	27 (51.92%)	16 (30.77%)	9 (17.31%)	52 100%
Total		134 (52.55%)	19 (7.45%)	56 (21.96%)	31 (12.16%)	15 (5.88%)	255 100%

(Figures in parentheses are percentages to total)

Houses are grouped into thatched, thatched and tiled, fully tiled, tiled and concreted and fully concreted. In the 255 sample households, 134 (52.55 per cent) are thatched, 19 (7.45 per cent) partly thatched and partly tiled, 56 (21.96 per cent) fully tiled, 31 (12.16 per cent) partly tiled and partly concreted, 15 (5.88 per cent) fully concreted. Out of the 152 Scheduled Tribe households 131 (86.18 per cent) are thatched, 12 (7.90 per cent) partly thatched and partly tiled and 9 (5.92 per cent) fully tiled. For Scheduled Caste 3 (33.33 per cent) are thatched, 4 (44.45 per cent) partly thatched and

partly tiled, and 2 (22.22 per cent) fully tiled. In the case of Other Backward Communities, out of the 36 sample households 5 (13.89 per cent) have concreted houses and 3 (8.33per cent) partly thatched and partly tiled. It is further noticed that 16 (44.45 per cent) were fully tiled and 12 (33.33 per cent) partly tiled and partly concreted houses. Regarding Forward Caste Hindus 1 (16.67per cent) house is fully concreted, 3 (50.00 per cent) partly tiled and partly concreted and 2 (33.33 per cent) fully tiled. Christian communities are having 9 (17.31 per cent) fully concreted houses, 16 (30.77 per cent) partly titled and partly concreted and 27 (51.92 per cent) fulled tiled houses. The table reveals that out of the 134 thatched houses 131 (97.76 per cent) are owned by tribals and this shows the low standared of living of the tribal cultivators. Highest percentage of concrete houses are seen in the case of Christians where out of the 15 concrete houses 9 (60.00 per cent) are owned by them.

5.7 Educational level

Educational level is an indicator of the socio-economic progress. In view of this, an attempt has been made here to analyse the educational standard of the members of the cultivating households.

Table 5.7
Educational level of lemongrass cultivating households

Sl. No.	Educational level	Scheduled Castes	Scheduled Tribes	Other Backward Communities	Forward Caste Hindus	Christians	All
1	2	3	4	5	6	7	8
1	Illiterate	9 (19.57%)	162 (22.25%)	11 (5.76%)	Nil --	9 (3.41%)	191 (15.16%)
2	Literate with no educational standard	12 (26.09%)	210 (28.85%)	21 (10.99%)	2 (6.45%)	15 (5.68%)	260 (20.63%)
3	Below primary	13 (28.26%)	250 (34.34%)	55 (28.80%)	8 (25.81%)	59 (22.35%)	385 (30.56%)
4	Below upper primary	10 (21.74%)	76 (10.44%)	62 (32.46%)	11 (35.48%)	91 (34.47%)	250 (19.84%)
5	Studied upto 10th standard	1 (2.17%)	15 (2.06%)	24 (12.57%)	6 (19.35%)	51 (19.32%)	97 (7.70%)
6	S.S.L.C. passed	1 (2.17%)	9 (1.24%)	14 (7.33%)	3 (9.68%)	25 (9.47%)	52 (4.13%)
7	Certificate of a technical course, diploma or degree	Nil	6 (0.82%)	4 (2.09%)	1 (3.23%)	14 (5.30%)	25 (1.98%)
All		46 (100%)	728 (100%)	191 (100%)	31 (100%)	264 (100%)	1260 (100%)

(Figures in parentheses are percentages to total)

Table 5.7 shows that out of the total population of 1260, illiterates constitute 191(15.16 per cent). A portion of the population 260(20.63 per cent) can read and write eventhough they have no formal education. It is further noticed that 385(30.56 per cent) persons have below primary education and 250 (19.84 per cent) below upper primary level. Those who have studied upto 10^{th} standard comes to 97 (7.70 per cent). The table also reveals that

52(4.13 per cent) persons passed S.S.L.C. and persons having higher education such as degree, diploma and certificate holders altogether come to 25 (1.98 per cent). Thus in general the population is left behind as far as higher education is concerned. The community wise educational standards given in the table reveals that Christians are educationaly forward as 39 (14.77 per cent) of them have education above S.S.L.C. and it is lowest among tribals 15(2.06 per cent). Among the Forward Caste Hindus 4 (12.91 per cent) and Other Backward Communities 18 (9.42 per cent) possessed education above S.S.L.C. At the same time the proportion of population with higher level of education was 0.82 per cent among the Scheduled Tribes, and none in the Scheduled Castes. More or less a similar picture is depicted by the rate of literacy. Accordingly while 21 (45.65 per cent) Scheduled Castes 372 (51.10 per cent) Scheduled Tribes and 32 (16.75 per cent) Other Backward Communities were either illiterate or lacked formal education, the proportion was less than 10 per cent among the other communities. Notably among the Forward Hindus none was illiterate.

5.8 Land ownership

In the area under study there is area owned and occupied. In the case of area owned there will be title deed or 'Pattayam'. But in the case of land occupied households have only possession right but no ownership right. In the light of the above, area operated is divided into area owned and area occupied and presented in Table 5.8.

Table 5.8

Ownership pattern of land (area in hectares)

Sl. No.	Community	Number of households	Net area owned	Net area occupied	Total Net area operated	Average area operated per household
1	2	3	4	5	6	7
1.	Scheduled Caste	9	4.445 (59.83%)	2.985 (40.17%)	7.430	0.826
2.	Scheduled Tribe	152	106.907 (46.18%)	124.594 (53.82%)	231.501	1.523
3.	Other Backward Communities	36	22.430 (71.91%)	8.760 (28.09%)	31.190	0.866
4.	Forward Caste Hindus	6	3.732 (77.62%)	1.076 (22.38%)	4.808	0.801
5.	Christians	52	37.288 (63.00%)	21.899 (37.00%)	59.187	1.138
Total		255	174.802 (100%)	159.314 (100%)	334.116	1.310

(Figures in parentheses are percentages to total)

The table shows that total area operated by the sample households comes to 334.116 hectares. Land operated are either area owned or occupied by the cultivators. Total area owned comes to 174.802 hectares which comes to 52.32 per cent of the total area operated and area occupied comes to 159.314 hectares which comes to 47.68 per cent of the total area operated. Community wise break up shows that total area operated by the Scheduled

Caste was 7.430 hectares out of which 4.445 (59.83 per cent) hectares were owned and 2.985 (40.17 per cent) occupied. So the average area operated per household is 0.826 hectares. Scheduled Tribes operated a total area of 231.501 hectares. Total area owned and occupied by them comes to 106.907 (46.18 per cent) and 124.594 (53.82 per cent) respectively resulting an average operated area of 1.523 hectares. In the case of Other Backward Communities total area operated is 31.190 hectares. They owned an area of 22.430 (71.91 per cent) hectares and occupred 8.760 (28.09 per cent) hectares. Thus the average area operated comes to 0.866 hectares. In the case of Forward Caste Hindus the 6 sample households totally operated an area of 4.808 hectares. Area owned and occupied by them comes to 3.732 (77.62 per cent) and 1.076 (22.38 per cent) hectares respectively resulting an operated area of 0.801 hectares. In the case of Christians total area operated comes to 59.187 hectares. They owned an area of 37.288 (63 per cent) hectares and occupied 21.899 (37 per cent) hectares.

It is seen from the Table that Scheduled Tribes have the highest occupied area per household and Forward Caste Hindus have the highest owned area.

5.9 Particulars of land operated and size of holding

Land is the most important asset in rural areas and is also the important source of income of rural labour housholds. In rural India land ownership is also a status symbol. In this context it will be worthwhile to look into the pattern of land ownership.

Table 5.9

Particulars of land operated and size of holding (in hectares)

Sl. No.	Category	Number of households	Area operated			Total net area operated	Area under lemongrass cultivation	Average household area operated	Average household area under lemongrass cultivation
			Owned/ occupied	Leased in	Leased out				
1	2	3	4	5	6	7	8	9	10
1	Scheduled castes	9	7.086 (2.13%)	0.708 (4.87%)	0.364 (2.66%)	7.430 (2.22%)	4.298 (2.79%)	0.826	0.478
2	Scheduled Tribes	152	239.899 (71.98%)	2.266 (15.60%)	10.664 (77.85%)	231.501 (69.29%)	97.078 (63.02%)	1.523	0.639
3	Other backward Communities	36	27.527 (8.26%)	4.695 (32.31%)	1.032 (7.53%)	31.190 (9.34%)	19.522 (12.67%)	0.866	0.542
4	Forward caste Hindus Hindus	6	5.273 (1.58%)	Nil	0.465 (3.39%)	4.808 (1.44%)	3.059 (1.99%)	0.801	0.510
5	Christians	52	53.50 (16.05%)	6.860 (47.22%)	1.174 (8.57%)	59.187 (17.71%)	30.093 (19.53%)	1.138	0.579
All		255	333.286 (100%)	14.529 (100%)	13.699 (100%)	334.116 (100%)	154.050 (100%)	1.310	0.604

(Figures in parentheses are percentages to total)

Among the sample households while total operated area comes to 334.116 hectares area per household comes to 1.310 hectares, owned / occupied area comes to 333.286 (an average of 1.307 hectares per household). Accordingly while 14.529 hectares were leased in (4.35 per cent of operated area) 13.699 hectares were leased out (4.10 per cent of operated area). Out of 334.116 hectares operated area, 154.050 hectares were under lemongrass cultivation (46.11 per cent of operated area) and the balance was devoted for other uses.

Community wise, data reveals that the average area operated by the Scheduled Tribes were the highest 1.523 hectares followed by Christians 1.138 hectares . The average size of operated area in the case of Other Communities more or less corresponded and was 0.866 hectares in the case of Other Backward Communities, 0.826 for Scheduled Caste and 0.801 in the case of Forward Caste Hindus. Thus the lowest area operated was by the Forward Communities. Coming to the size of lemongrass cultivation it can be seen from the table that the average operated area came to 0.604 hectares . Here again the Scheduled Tribes and the Christians operated the largest size of 0.639 hectares and 0.579 hectares respectively. The size of lemongrass cultivation by others were less and was 0.542 hectares by Other Backward Communities, 0.510 hectares by the Forward Communities and 0.478 hectares by the Scheduled Castes.

5.10 Tenancy

Details of households who leased in and leased out land was examined community wise. The same is shown in Table 5.10. The table shows that

total area leased in comes to 14.529 hectares and leased out 13.699 hectares. It is further noticed that out of the 31 household who leased in, 14 (45.16 per cent) Christian households leased in 6.860 (46.22 per cent) hectares and 9 (29.03 per cent) Other Backward Community households leased in 4.695 (32.31 per cent) hectares. The Table also shows that 7 (22.58 per cent) Scheduled Tribe households leased in 2.266 (15.60 per cent) hectares and 1 (3.23 per cent) Scheduled Caste households leased in 0.708 (4.87 per cent) hectare land.

There are 22 households who leased out land. Out of this 14 (63.64 per cent) Scheduled Tribe households leased out 10.664 (77.85 per cent) hectares, 3 (13.64 per cent) Christian households leased out 1.174 (8.57 per cent) hectares, 2 (9.09 per cent) Other Backward Community households leased out 1.032 (7.53 per cent) hectares, and 2 (9.09 per cent) forward Caste Hindu households leased out 0.465 (3.39 per cent) hectares. The table altogether shows that highest percentage of area leased in were by Christians and highest area leased out were by Scheduled Tribes.

Table 5.10
Details of households who leased in and leased out land

Sl. No.	Community	Leased in		Leased out	
		Number of households	Area	Number of households	Area
1	2	3	4	5	6
1.	Scheduled Caste	1 (3.23%)	0.708 (4.87%)	1 (4.54%)	0.364 (2.66%)
2.	Scheduled Tribe	7 (22.58%)	2.266 (15.60%)	14 (63.64%)	10.664 (77.85%)
3.	Other Backward Communities	9 (29.03%)	4.695 (32.31%)	2 (9.09%)	1.032 (7.53%)
4.	Forward Caste Hindus	---	---	2 (9.09%)	0.465 (3.39%)
5.	Christians	14 (45.16%)	6.860 (47.22%)	3 (13.64%)	1.174 (8.57%)
	Total	31 (100%)	14.529 (100%)	22 (100%)	13.699 (100%)

(Figures in parentheses are percentages to total)

5.11 Sources of land entitlement

Land is an important asset. It is transmitted to new generations by laws of succession. It is also possessed by purchase. Lemongrass cultivation being done in highlands and also in remote areas by tribals, knwoledge about land entitlement is an important aspect which is examined in the following table.

Table 5.11
Sources of land entitlements

Sl No.	Major sources	Number of tribal households	Number of non-tribal households
1	2	3	4
1	Inherited	135 (88.82%)	73(70.87%)
2.	Purchased	9 (5.92%)	18 (17.48%)
3.	Pattayam to land possessed	8 (5.26%)	6 (5.83%)
4.	Land reform measures	Nil	5 (4.85%)
5.	Gift at the time of marriage	Nil	1 (0.97%)
	Total	152 (100%)	103 (100%)

(Figures in parentheses are percentages to total)

Table 5.11 reveals that out of the 152 tribal households major source of land entitlement is by inheritance, where 135 (88.82 per cent) households received land by inheritance. It is followed by purchase, 9 (5.92 per cent) households. It is further seen that for 8 (5.26 per cent) tribal households pattayam was the major source of entitlement. Land reforms and gift at marriage had no influence on land entitlement.

In the case of non-tribals also inheritance was the major source of land entitlement as 73 (70.87 per cent) households possessed land by this source. Land purchase as a major source of entitlement was higher in non-tribals as it is 18 (17.48 per cent) for non-tribals against 9 (5.92 per cent) for tribals. This reveals mainly the purchasing power of the non-tribal households. Moreover pattayam as a source of land inheritance gave ownership to 6 (5.83 per cent) non-tribal households. Land reform measures

and gift at marriage constituted major source of land entitlement to 5 (4.85 per cent) and 1 (0.97 per cent) of non-tribal households respectively. The Table in general shows the higher economic strength of the non-tribals over tribals if land ownership is and indicator.

5.12 Ownership pattern of consumer durable goods

The possession of consumer durables can be considered as an indicator of the level of living of the households. In this context the possession of selected common consumer durables are indicated in Table 4.12. It is seen that the average value of consumer durables comes to Rs. 4184/-. In the non-tribal household value comes to Rs. 7526/- and in tribal household it is Rs. 841/-. The table further shows that 214 (83.92 per cent) households are having watch / clock, 172 (67.45 per cent) having furniture and 143 (56.08 per cent) having radio/two-in-one. It is also seen that 46 (18.04 per cent) households are having bicycle 42 (16.47 per cent) having fan and 39 (15.29 per cent) households possess television and 11 (4.31 per cent) households are having fridge. Autorikshow is absent in the sample. In the case of Scheduled Tribes television, fridge, sewing machine fan and scooter/bike are absent. The study altogether shows that the proportion owning consumer durables are far less among tribals.

Table 5.12
Ownership pattern of consumer durable goods (amount in Rs.)

Community	Items										
	Tele-vision	Radio/ Two-in-one	Fridge	Watch/ clock	Sewing machine	Bicycle	Auto-rikshow	Fan	Scooter/ Bike	Furniture	All
1	2	3	4	5	6	7	8	9	10	11	12
I Tribals											
No. of households	---	62	---	117	---	8	---	---	---	69	100
Total amount	---	24800	---	29250	---	8000	---	---	---	22080	84130
Average amount	---	400	---	250	---	1000	---	---	---	320	841
II Non-tribals											
No. of households	39	81	11	97	2	38	---	42	5	103	100
Total amount	221000	32400	77000	29100	2500	38000	---	37800	150000	164800	752600
Average amount	5667	400	7000	300	1250	1000	---	900	30000	1600	7526
III All											
No. of households	39	143	11	214	2	46	---	42	5	172	200
Total Amount	221000	57200	77000	58350	2500	46000	---	37800	150000	186880	836730
Average amount	5667	400	7000	273	1250	1000	---	900	30000	1087	4184

5.13 Ownership pattern of livestock assets

Livestock assets can provide significant supplementary income to the households. Details in ownership of the same is shown in Table 5.13.

Table 5.13

Ownership pattern of livestock assets

Sl. No.	Community	Item owned in Rs.			
		Cow/ Buffalo/Calf	Goat / Pig	Poultry	All
1	2	3	4	5	6
I	Tribals				
	No. of household	83	36	67	118
	Total amount	258130	32400	11792	302322
	Average amount	3110	900	176	2562
II	Non-tribals				
	No. of households	62	19	41	72
	Total amount	224440	16150	6068	246658
	Average amount	3620	850	148	3426
III	All				
	No. of households	145	55	108	190
	Total Amount	482570	48550	17860	548980
	Average amount	3328	883	165	2889

The Table in general shows that a total of 145 (56.86 per cent) households are having Cow/Buffalo/Calf, 55 (21.57 per cent) households own Goat/Pig and 108 (42.35 per cent) households have poultry. It is further noticed that average household livestock asset comes to Rs. 2889/-. The Table also shows that livestock assets for tribals are seen in 118 (77.63 per

cent) households and in the case of non-tribal households 72 (69.90 per cent) are having livestock. The average value of assets for tribals come to Rs. 2562/- and for non-tribals Rs. 3426/-. It is further noticed that cows/buffalo and poultry are commonly seen in the sample households. In general it is seen from the data that livestock assets are lower in the case of tribals.

5.14 Ownership pattern of jewellery

Gold jewellery is an important asset in Indian households. To wear jewellery is a social prestige. In this connection ownerhip pattern of jewellery is examined in the sample households and data has been presented in Table 5.14.

Table 5.14
Ownership pattern of jewellery

Sl. No.	Community	Number of households	Total amount (Rs.)	Average amount (Rs.)
1	2	3	4	5
1	Tribals	131	550200	4200
2	Non-tribals	103	1958000	19010
All		234	2508200	10719

Out of the total 255 households 234 (91.76 per cent) possessed jewellery on an average valued at Rs. 10719. Thus observably the jewellery ownership was undespread among them. However community wise there was considerable disparity. The table shows that out of the 152 sample tribal households 131 (86.18 per cent) are owning jewellery. Total value of it comes to Rs. 550200/- and average amount per household comes to Rs. 4200/-. In the case of non-tribals all the 103 (100 per cent) sample households are having

jewellery. Value of jewellery asset for non-tribals amounts to Rs. 19,58000/- resulting an average household asset of Rs. 19,010/-. Here also it is seen that tribal households are far behind in jewellery assets as the average amount of investment in the asset comes to Rs. 4200.

5.15 Household income

Table 5.15

Sources of total household income (Rs.)

Sl. No.	Community	Tribals	Non-tribals
1	2	3	4
1	Net income from agriculture	9697 (70.90%)	11783 (79.91%)
2	Agriculture labour	2567 (18.76%)	2241 (15.20%)
3	Business/petty trade	108 (0.79%)	203 (1.38%)
4	Collection of forest produce	962 (7.03%)	---
5	Other sources	345 (2.52%)	518 (3.51%)
	Total	13679 (100%)	14745 (100%)

(Figures in parentheses are percentages to total)

Income is the basis for sustenance of households. So a knowledge of the sources of income is important to evaluate the socio-economic status of the households, which is examined in Table 5.15. Average yearly household income of non-tribals comes to Rs. 14745/- and for tribals Rs. 13679/-. Among the sources of income net income from agriculture is the highest for both non-tribals and tribals. For non-tribals, agriculture provided Rs. 11783/- (79.91 per cent) of the total household income which is followed by Rs. 2241/- (15.20 per cent) from wage labour in agriculture. Other sources provided

Rs. 518/- (3.51 per cent). Business/petty trade provided least share to the income as it comes to Rs. 203 (1.38 per cent). Total household income of tribals come to Rs. 13679/-. Source wise break up shows that highest share of Rs. 9697 (70.90 per cent) is from agriculture. Wage labour provided Rs. 2567/- (18.76 per cent) to the total household income for tribals. An average amount of Rs. 962 (7.03 per cent) to tribal household is obtained from the collection of forest produce which is totally absent in non-tribal households. It is seen from the Table that income from agriculture sector is predominant over all other income to the sample households in the region.

5.16 Distribution of households by size of income

Table 5.16
Distribution of households by size of income

Sl. No.	Income range (Rs.)	Number of households		All
		Tribal	Non-tribal	
1	2	3	4	5
1	Below 9000	6 (3.95%)	---	6 (2.35%)
2	90001 - 10000	5 (3.29%)	2 (1.94%)	7 (2.75%)
3	10001 - 11000	23 (15.13%)	7 (6.80%)	30 (11.76%)
4	11001 - 12000	33 (21.71%)	36 (34.95%)	69 (27.06%)
5	12001 and above	85 (55.92%)	58 (56.31%)	143 (56.08%)
Total		152 (100%)	103 (100%)	255 (100%)

(Figures in parentheses are percentages to total)

Table 5.16 shows the distribution of households by size of yearly income. The table shows that out of the 255 sample households 143 (56.08 per cent) households have income above Rs. 12001/-, which is followed by

69 (27.06 per cent) households having an income between Rs. 11001/- and 12000/-. It is further seen from the table that 30 (11.76 per cent) households have income between Rs. 10001/- and 11000/- and 7 (2.75 per cent) households come under the income range of Rs. 9001 - 10000. It is also seen that 6 (2.35 per cent) households have income below Rs. 9000/-. The table further shows that 85 (55.92 per cent) tribal households have income above Rs. 12000/-, 33 (21.71 per cent) households have income between Rs. 11001 to Rs. 12,000/-. In the income class of Rs.10,001 - 11000/- there were 23 (15.13 per cent) tribal households. This is followed by 6 (3.95 per cent) below Rs. 9000/- and 5 (3.29 per cent) in the income class of Rs. 9001 - 10000/-. In the case of non-tribals also highest number of households 58 (56.31 per cent) come in the income group of Rs. 12001/- and above. It is seen that 36 (34.95 per cent) non-tribal households come in the range of Rs. 11001 - 12000. In the range of Rs. 10001 - 11,000 there are 7 (6.80 per cent) households and between Rs. 9001/- and 10000/-, 2 (1.94 per cent) households. No household is seen below the income of Rs. 9000/- among the non-tribals. The table shows that most of the tribal cultivators are placed in the lower income class.

Table 5.17

Percentage distribution of households by major source of income

Sl. No.	Sources	Scheduled Castes	Scheduled Tribes	Other Backward Communities	Forward Caste Hindus	Christians	All
1.	2	3	4	5	6	7	8
1	Net income from lemongrass	5 (55.56%)	103 (67.76%)	19 (52.78%)	2 (33.33%)	28 (53.85%)	157 (61.57%)
2	Other agricultural income	1 (11.11%)	16 (10.53%)	9 (25.00%)	2 (33.33%)	12 (23.07%)	40 (15.69%)
3	Labour (22.22%)	2 (17.76%)	27 (13.89%)	5	Nil (15.38%)	8 (16.47%)	42
4	Industry	Nil	Nil	Nil	Nil	Nil	Nil
5	Trade	Nil	Nil	Nil	Nil	Nil	Nil
6	Business	1 (11.11%)	Nil	2 (5.55%)	1 (16.67%)	2 (3.85%)	6 (2.35%)
7	Profession	Nil (0.66%)	1 (2.78%)	1 (16.67%)	1 (3.85%)	2 (1.96%)	5
8	Remittance	Nil	Nil	Nil	Nil	Nil	Nil
	Collection of forest produce	Nil	5 (3.29%)	Nil	Nil	Nil	5 (1.96%)
	Total (100%)	9 (100%)	152 (100%)	36 (100%)	6 (100%)	52 (100%)	255 (100%)

(Figures in parentheses are percentages to total)

5.17 Sources of income

In the analysis of income the source of income is an important factor that has to be considered. This is particularly the case as far as the households we study, as they are depended upon the agricultural sector for sustenance. This will also reveal their magnitude of depedance on lemongrass cultivation. Let us now examine the household income and its sources. Major source of income of the lemongrass cultivating households is shown in table 5.17. It is quite revealing to note that out of the total 255 households 157 (61.57 per cent) households have major source of income from lemongrass cultivation which is followed by wage labour 42 (16.47 per cent). Other agricultural income constituted a major source for 40 (15.69 per cent) households. In the case of 6 (2.35 per cent) households business provided the major source of income. The table further shows that profession and collection of forest produce provided major source of income to 5(1.96 per cent) households each. Thus it emerges that among the majority of sample households lemongrass cultivation constituted the major source of income.

It is also seen that 103 (67.76 per cent) Scheduled Tribe and 5(55.56 per cent) Scheduled Caste households have major source of income from lemongrass cultivation. In the case of Other Backward Communities, Forward Caste Hindus and Christians 19(52.78 per cent), 2(33.33 per cent) and 28(53.85 per cent) households respectively have major source of income from lemongrass cultivation. This shows that lemongrass cultivation stands as a major source of income to all the cultivating communities. Dependance on lemongrass cultivation was high in the case of Scheduled Caste and Scheduled Tribe households compared to others.

Income from other agricultural operation is the highest for Forward Caste Hindus as 2(33.33 per cent) households have income from this source. This is followed by 9(25 per cent) households of Other Backward Communities. For Christians, Scheduled Castes and Scheduled Tribes 12 (23.07 per cent), 1(11.11 per cent) and 16(10.53 per cent) households respectively derived major source from other agricultural output.

For 2(22.22 per cent) Scheduled Caste households labour constituted the major source of income which is followed by 27(17.76 per cent) tribal households. In the case of Christians and Other backward communities as the table reveal 8(15.38 per cent) and 5(13.89 per cent) households respectively have income from labour. In the case of Forward Caste Hindus there is no entry. For industry, trade and remittance also there is no entry. The table also shows that 1(16.67 per cent) Forward Caste Hindu, 1 (11.11 per cent) Scheduled Caste, 2 (5.55 per cent) Other Backward Communities and 2 (3.85 per cent) Christians have major souce from business. It is further noticed that 1 (16.67 per cent) Forward Caste Hindu, 2 (3.85 per cent) Christians, 1(2.78 per cent) of Other Backward Community and 1(0.66 per cent) Scheduled Tribe community have major source of income from profession. For Scheduled Castes there is no entry in the relevant column. Collection of forest produce as a major source of income is seen only for Scheduled Tribes where 5(3.29 per cent) households have major source of income from this source.

5.18 Borrowings

Sources of borrowings of lemongrass cultivators are presented in Table 5.18. The Table shows that borrowings are made from lemongrass oil dealers, banks, co-operatives, money lenders, friends and relatives etc to meet purposes like marriage of children, construction and maintenace of house, agriculture etc. Data in the table 4.19 shows that average borrowing of the sample comes to Rs. 3181/-. Average borrowing for tribels was Rs. 2806/- and for non-tribals Rs. 3842/-. Highest percentage of borrowing is made from banks and co-operatives as 40.18 percent of non-tribals borrowed from banks. In the case of tribals large borrowings (35.02 per cent) were from co-operatives. It is observed that a good share of the loan taken from banks and co-operative were on gold security. Next in importance come money lenders. For tribals and for non-tribals borrowings from money lenders comes to 24.09 per cent and 29.32 per cent respectively. From lemongrass oil dealers/provision merchants tribals borrowed 5.32 per cent while non-tribals borrowed 4.74 per cent. It is further noticed that 127 (83.55 per cent) of tribal households and 72 (69.90 per cent) non-tribal households borrowed. So the table shows that borrowing rate is higher for tribals and amount borrowed is higher in non-tribal households.

Table 5.18
Sources of borrowings of households (Rs.)

Community	Sources						Total
	Lemongrass oil dealer/provision merchant	Banks and other financial institutions	Co-operatives	Money lenders	Friends and relatives	Others	
1	2	3	4	5	6	7	8
I Tribals							
Number of households	31	19	29	41	13	14	127
Total amount	18970(5.32%)	70640(19.82%)	124800(35.02%)	85850(24.09%)	30500(8.56%)	25620(7.19%)	356380(100%)
Average amount	612	3718	4303	2094	2346	1830	2806
II Non-tribals							
Number of households	15	23	11	31	6	6	72
Total amount	13100 (4.74%)	111150 (40.18%)	50760 (18.35%)	81120 (29.32%)	16860 (6.09%)	3650 (1.32%)	276640 (100%)
Average amount	873	4833	4615	2617	2810	608	3842
All. Number of households	46	42	40	72	19	20	199
Total amount	32070 (5.07%)	181790 (28.72%)	175560 (27.73%)	166970 (26.38%)	47360 (7.48%)	29270 (4.62%)	633020 (100%)
Average amount	697	4328	4389	2319	2493	1464	3181

(Figures in parentheses are percentages to total)

5.19 Size of indebtedness

Size of indebtedness was examined to evalvate the spread of the same among tribal and non-tribal communities. The tabulated result is shown in Table 5.19

Table 5.19
Size of indebtedness

Sl. No.	Range (Rs.)	Number of households		All
		Tribal	Non-tribal	
1	2	3	4	5
1	Below - 1000	12 (9.45%)	2 (2.78%)	14 (7.04%)
2	1001 - 2000	16 (12.60%)	5 (6.94%)	21 (10.55%)
3	2001 - 3000	54 (42.52%)	8 (11.11%)	62 (31.16%)
4	3001 - 4000	31 (24.41%)	28 (38.89%)	59 (29.65%)
5	4001 - 5000	12 (9.45%)	16 (22.22%)	28 (14.07%)
6	5001 and above	2 (1.57%)	13 (18.06%)	15 (7.53%)
Total		127 (100%)	72 (100%)	199 (100%)

(Figures in parentheses are percentages to total)

The Table shows that 199 households have indebtedness. Out of which 127 are tribal and 72 non-tribal households. Their borrowings ranged from Rs. 500 to 7000. The table further shows that 54 (42.52 per cent) tribal households had borrowings between Rs. 2001-3000 which is followed by 31 (24.41 per cent) in the range of Rs. 3001 - 4000/-. It is further noticed that 16 (12.60 per cent) households had indebtedness ranging from Rs. 1001-2000 and 12 (9.45 per cent) households had indebtedness ranging from Rs. 4001-5000. Another 12 (9.45 per cent) households had borrowings below Rs. 1000/- and 2 (1.57 per cent) above Rs. 5001/-.

In the case of non-tribals 28 (38.89 per cent) households had indebtedness ranging from Rs. 3001-4000/- , 8 (11.11 per cent) from Rs. 2001-3000 and 16 (22.22 per cent) households ranging from Rs. 4001-5000. It is also noticed that 5 (6.94 per cent) households had borrowings ranging from Rs. 1001-2000, 13 (18.06 per cent) had above Rs. 5001/- and 2 (2.78 per cent) had indebtedness below Rs. 1000/-.

The table shows that highest percentage of tribal households are in the range of Rs. 2001-3000 and the non-tribals in the range of Rs. 3001-4000.

5.20 Occupational distribution of workers

The occupational structure of work force is an important criteria for the determination of the economic well being of households. Dependance on a single sector is not a good trend. Table 4.20 shows the occupational structure of the sample household. It is seen that out of the 584 workers 376 (64.38 per cent) were engaged in cultivation. Agricultural workers come to 120 (20.55 per cent). Those who are engaged in the collection of forest produce comes to 48 (8.22 per cent). In business / petty trade 17 (2.91 per cent) are engaged. It is further noticed that 23 (3.94 per cent) persons have other occupations. Community wise data shows that 343 (58.73 per cent) belonged to tribal community and 241 (41.27 per cent) non-tribal community. Most of them were employed as cultivators as 216 (62.97 per cent) of the tribal workers and 160 (66.39 per cent) of the non-tribal workers are in this occupation. Next in importance comes agricultural workers, where 64 (18.66 per cent) tribals and 56 (23.24 per cent) non-tribals are engaged. Another important occupation for tribals are collection of forest produce where 48 (14.00 per cent) are engaged. Non-tribals are not engaged in the collection of forest produce. Tribal workers engaged in other occupations comes to 9 (2.62 per cent) and non-tribals 14 (5.81 per cent). Regarding women participation 114 (33.24 per cent) of tribal workers and 92 (38.17 per cent) of the non-tribal

Table 5.20
Occupational distribution of workers

Sl. No.	Occupation	Tribals			Non-tribals			All
		Male	Female	Total	Male	Female	Total	
1	2	3	4	5	6	7	8	9
1	Cultivation	146 (63.75%)	70 (61.40%)	216 (62.97%)	98 (65.77%)	62 (67.39%)	160 (66.39%)	376 (64.38%)
2	Agricultural workers	28 (12.23%)	36 (31.58%)	64 (18.66%)	29 (19.47%)	27 (29.35%)	56 (23.24%)	120 (20.55%)
3	Business/petty trade	6 (2.62%)	---	6 (1.75%)	11 (7.38%)	---	11 (4.56%)	17 (2.91%)
4	Collection of forest produce	42 (18.34%)	6 (5.26%)	48 (14.00%)	---	---	---	48 (8.22%)
5	Other occupation	7 (3.06%)	2 (1.76%)	9 (2.62%)	11 (7.38%)	3 (3.26%)	14 (5.81%)	23 (3.94%)
	Total	229 (100%)	114 (100%)	343 (100%)	149 (100%)	92 (100%)	241 (100%)	584 (100%)

(Figures in parentheses are percentages to total)

workers are engaged in the above occupations. The table in general shows that workers are mainly engaged in agriculture.

5.21 Work participation rate

Work participation rate of the sample households is studied to assess the economic well being of the households. Population below the age of 14 years are treated as child. Those between 15 to 60 years are the working age group, from 61 years and above are considered as old. Work participation rate of the total population shows that 46.35 per cent are participating in some work. In the age group upto 14, the work participation rate is 6.68, where male participation rate is 7.07 and female participation rate comes to 6.25. This shows that children are also participating in work, eventhough in small rate.

The work participation rate of the working group (15 to 60) shows that 68.18 per cent are engaged in some work. Here 73.55 per cent of the males and 62.11 per cent of the females are engaged in some work. In the case of old (61 and above) population, the rate is 35.51 per cent. Here also male participation is higher (38.46 per cent). The female participation rate is 31.67 per cent.

Work participation community wise shows that 10.19 per cent participation for tribals in the age group of below 14. Out of which, rate for male comes to 10.91 per cent and 9.43 per cent for female. In the case of working age group (15 to 60) total participation rate was 66.74 per cent. Male participation rate was 73.85 and female participation rate 59.53. In the case of old population (61 and above) 40.51 per cent are engaged in some work. In this case also the male participation rate is higher. For non-tribals, participation rate of children is very low as it comes to 1.90 per cent. The working age group participation is 70.16 per cent, out of which male participation rate is 73.18 per cent and female participation rate 66.18 per cent. In the case of old age group (61 and above) the participation rate is 28.81 per cent. Here the male participation rate is 28.95 per cent and female participation rate 28.57 per cent.

Table 5.21
Work participation rate of population (age wise)

Community	Upto 14			15 to 60			61 and above			All
	Male	Female	Total	Male	Female	Total	Male	Female	Total	
1	2	3	4	5	6	7	8	9	10	11
I Tribals										
Total population	110	106	216	218	215	433	40	39	79	728
Total workers	12	10	22	161	128	289	19	13	32	343
Work participation rate (%)	10.91	9.43	10.19	73.85	59.53	66.74	47.50	33.33	40.51	47.12
II Non-tribals										
Total population	88	70	158	179	136	315	38	21	59	532
Total workers	2	1	3	131	90	221	11	6	17	241
Work participation rate (%)	2.27	1.43	1.90	73.18	66.18	70.16	28.95	28.57	28.81	45.30
All. Total population	198	176	374	397	351	748	78	60	138	1260
Total workers	14	11	25	292	218	510	30	19	49	584
Work participation rate (%)	7.07	6.25	6.68	73.55	62.11	68.18	38.46	31.67	35.51	46.35

The above findings show that male participation is more than female participation. Work participation of children and old are higher in tribal population as most of them are engaged in the collection of forest produce and fire wood collection.

5.22 Under employment

Under employment is a problem mainly faced by workers in agricultural sector. Therefore it is important to examine the under employment position of the 584 work participants of the sample. Details are presented in Table 5.22

Table 5.22
Under employment among work participants

Sl No.	Days under employed	Number of work participants
1	2	3
1	Upto 50	57 (36.07%)
2	51 - 100	43 (27.22%)
3	101-150	32 (20.25%)
4	151 and above	26 (16.46%)
Total		158 (100%)

(Figures in parentheses are percentages to total)

The table shows that a total of 158 work participants are under employed. Out of which 57 (36.07 per cent) had employment below 50 days. It is followed by 43 (27.22 per cent) workers having work from 51 to 100 days and 32 (20.25 per cent) workers between 101 to 150 days. It is further noticed that 26 (16.46 per cent) workers are getting work above 151 days. The data indicates that under employment is low among the work participants of the sample.

Table 5.23
Lemongrass cultivating households by income classes and their proverty status

Sl. No.	Category	Income (Rs.)					Total households	Households below provety line (Below Rs. 11,000)
		Below 9,000	9001-10000	10001-11000	11001-12000	12000 and above		
1	2	3	4	5	6	7	8	9
1	Scheduled Caste	Nil	Nil	2 (6.67%)	5 (7.25%)	2 (1.40%)	9 (3.53%)	2 (22.22%)
2	Scheduled Tribes	6 (100 %)	5 (71.43%)	23 (76.66%)	33 (47.83%)	85 (59.44%)	152 (59.61%)	34 (22.37%)
3	Other Backward Communities	Nil	Nil	3 (10.00%)	17 (24.64%)	16 (11.19%)	36 (14.12%)	3 (8.33%)
4	Forward Cast Hindus	Nil	Nil	Nil	2 (2.89%)	4 (2.80%)	6 (2.35%)	Nil
5	Christians	Nil	2 (28.57%)	2 (6.67%)	12 (17.39%)	36 (25.17%)	52 (20.39)	4 (7.69%)
	Total	6 (100%)	7 (100%)	30 (100%)	69 (100%)	143 (100%)	255 (100%)	43 (16.86%)

(Figures in parentheses are percentages to total)

5.23 Incidence of poverty

A serious challenge faced by the Indian economy is the problem of poverty. Rural labour, marginal and small cultivations are more prone to this problem. It will now be interesting to examine the incidence of poverty among the lemongrass cultivating households as a significant member belongs to the Scheduled Caste, Scheduled Tribe category who are much involved in the problem. To measure the incidence of poverty a cut off level income needs to be considered. Here a cut off level annual income of Rs. 11000/- (poverty cut off limit in the 9th plan) is considered as poverty line. Total households were divided into five income groups as indicated in Table 5.23. Column 9 of the Table shows that altogether 43(16.86 per cent) households falls bellow the poverty line. Category wise highest percentage of poverty is recorded for Scheduled Tribes where 34(22.37 per cent) come under the poverty line. It is followed by Scheduled Castes 2(22.22 per cent). Out of the 36 households of other backward communities only 3(8.33 per cent) households fall below the proverty line. It is further noticed that all the forward caste Hindus are above the poverty line. In the case of Christian communities 4(7.69 per cent) households have income below Rs.11,000/-. Thus the income data revelas that the incidence of poverty is some what low among the lemongrass cultivating households. Quite interestingly even amoung the Scheduled Cast, Scheduled Tribel households the incidence is observed as low compared to the overall incidence of poverty in the state.

ECONOMICS OF LEMONGRASS CULTIVATION

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CHAPTER VI
ECONOMICS OF LEMONGRASS CULTIVATION

Lemongrass oil is one of the most important essential oils produced in the world. In India its production is more popular in Kerala. At the same time it is most disorganised and cultivated on a fragmented scale. On the economics of lemongrass oil production studies are lacking. This chapter make an attempt to throw light on this aspect of production, productivity, cost and viability of lemongrass oil production.

6.1 Cost of cultivation

Estimation of cost of cultivation and the value of product is necessary for the formulation and implementation of schemes in agriculture. It is also helpful for fixing of floor and support price. Considering this, cost of cultivation of lemongrass is estimated as on 31st March 2001 using primary data collected through field study. For lemongrass oil production, two types of costs are incurred. They are the non-recurring cost and recurring cost. Recurring cost include yearly maintenance and harvesting. For processing, distillation cost is also incurred and this comes at the final stage.

6.2 Planting cost

For planting two practices are followed. They are direct seeding and transplanting methods. Average planting cost per hectare comes to Rs. 7038/- which ranged from Rs.5200/- to Rs. 9750/- as shown in Table 6.1 This is

due to community difference (tribals and non-tribals), difference in method of planting (direct seeded and transplanted), application of manure (manured and not manured) and farm sizes (small, medium and large).

Table 6.1

Variation in planting cost

Sl. No.	Size of cost (Rs.)	Number of households
1	2	3
1	Below 6000	18 (7.06 %)
2	6001 - 6750	31 (12.16 %)
3	6751 - 7500	119 (46.67 %)
4	7501 - 8250	64 (25.10 %)
5	8251 - 9000	12 (4.70 %)
6	Above 9001	11 (4.31 %)
Total		255 (100 %)

(Figures in parentheses are percentages to total)

Table 6.1 shows that highest number of households 119 (46.67 per cent) come in the cost range of Rs. 6751 - 7500 followed by 64 (25.10 per cent) households in the cost range of Rs. 7501 - 8250. It is further noticed that 31 (12.16 per cent) households come in the range of Rs. 6001 - 6750, 18 (7.06 per cent) below Rs.6000, 12 (4.70 per cent) between Rs. 8251 - 9000 and 11 (4.31 per cent) above Rs. 9001/-. Reasons for such cost difference are examined with the help of components of planting cost (Table 6.2). It can be seen from the table that average planting cost per hectare comes to Rs. 7038/-. The

planting cost components are cost of seed, land preparation and planting and manuring costs. Land preparation and planting costs mainly comprise of labour cost. This constituted 78.29 per cent of total cost while seed cost comes to nearly 15 per cent. The cost of manuring was 6.79 per cent of total cost.

Table 6.2
Components of planting cost

Sl. No.	Components of cost	Cost (Rs./ha) direct seeded and transplanted
1	2	3
1	Seed	1050 (14.92%)
2	Preparation of land and planting	5510 (78.29%)
3	Manure and its application	478 (6.79%)
	Total	7038 (100 %)

(Figures in parentheses are percentages to total)

The land preparation cost of Rs. 5510 (78.29 per cent) which is the highest of all the planting cost vary for tribal and non-tribal cultivators due to changes in labour cost. Labour charge for male per day in tribal area for the referance period (2000-01) ranged from Rs. 75/- to 85/- and for female it was Rs.50/-to Rs.60/-. At the same time in non-tribal area rate for male workers was between Rs.80/- to Rs.100/- and for female it was between Rs.60/- to Rs.75/- per day. Tribals cultivate lemongrass mainly in interior forest region, where tribals are the main labour force. Most of the tribals do not work in the farms of non-trbals as a customary practice. At the same time non-tribals are main workers in the farms of non-tribals. They usually do not go for work in tribal plantations as most of the plantations are in interior forest region. This difference in labour rates reflected in the planting cost. Moreover

direct seeded and transplanted plantations were there. For transplanted grass labour requirement was higher than for direct seeded grass. This also added to the planting cost difference

Cost of seed was another factor for cost charge. It comes to Rs. 1050 (14.92 per cent). In tribal area cost of seed per kg was around Rs. 60/- and in non-tribal area it was around Rs. 100/-. Tribals collected seed mainly from wild growth in the forest. Only labour charge was incurred there. Non-tribals mainly depended on seed brought from Palani hills of Tamilnadu, cost of which was higher than that of domestically collected seeds by the tribals. Usually planted grass is not used for the production of seed as it will adversely affect grass production in subsequent years. Another factor for cost difference was the method of planting. Higher quantity of seed was used for direct seeding than for transplanting.

Cost of manure is the lowest Rs. 478/- (6.79 per cent) in the cost structure as most of the cultivators were not in the practice of using manure, that too not in the recommended quantity. Due to this, variation is seen in the manure account.

Farm size was also a reason for difference in planting cost. Considering the nature of the crop and the area under cultivation farms are divided into small (upto 0.40 ha) medium (0.41 to 1.00 ha) and large (above 1.00 ha) to evaluate the effect of farm size in cost of cultivation, productivity and profitability. Regarding cost of cultivation low planting cost was seen for large farms as they were labour efficient. Impact of various factors in planting cost is tabulated in Table 6.3.

6.2.1. Factors influencing planting cost

Influence of community, farm size and cultivation pratices on planting cost are shown in the following Table.

Table 6.3
Factors influencing planting cost

Sl. No.	Factors influencing planting cost	Planting cost Rs/ha.
1	2	3
1	Community difference	
	a) Tribals	6654
	b) Non - tribals	8312
2.	Method of planting	
	a) Direct seeded	6734
	b) Transplanted	8846
3.	Use of mannure	
	a) Manured	7516
	b) Not-manured	6580
4.	Farm size	
	a) Small	8395
	b) Medium	7084
	c) Large	6718
	All	7038

The Table shows that an average of Rs. 7038/- per hectare was incurred for planting. Community difference is notable. Planting cost for tribal cultivators was Rs. 6654/- per hectare and for non-tribals Rs. 8312/- (a difference of 24.92 per cent). Higher planting cost for non-tribals was mainly due to increased labour charge in non-tribal areas. Method of planting adopted viz direct seeding and transplanting influenced the planting cost. Planting cost for direct seeded plantations were Rs. 6734/- per hectare and for transplanted plantations it was Rs. 8846/-. Higher planting cost recorded for transplanted cultivation was due to the additional cost incurred for raising nursery and for transplanting cost. Use of manure also influenced planting cost. For manured crop, planting cost was Rs. 7516/- and for not-manured it was Rs. 6580/-.

Influence of farm size was also recorded. Highest planting cost was seen in small farms (Rs. 8395/ha). Expenses towards labour was higher in small farms where labour cost was imputed. But at the same time due to labour abundance labour is employed even if they are less productive. In this sense there is inefficiency in labour use in small farms. Medium farms recorded a planting cost of Rs. 7084/ ha and large Rs. 6718/ha. Lower planting cost for large farms are mainly due to their labour efficiency.

6.3 Recurring cost

Recurring cost include annual maintenance cost, harvest stage cost (harvesting and transporting)and distillation cost. An amount of Rs.20858/- is incurred towards recurring cost per hectare which ranged from Rs.15,000/- to 25,000/- as shown in Table 6.4.

Table 6.4
Variation in recurring cost

SI.No.	Size of cost range (Rs.)	Number of households
1	2	3
1	Below 18000	26 (10.20 %)
2	18001 - 20000	48 (18.82 %)
3	20001 - 22000	102 (40.00 %)
4	Above - 22001	79 (30.98 %)
	Total	255 (100 %)

(Figures in parentheses are percentages to total)

Highest number of households 102 (40.00 per cent) is seen in the cost range of Rs.20001 - 22000 which is followed by 79 (30.98households above

Rs.22001/-. For 48 (18.82 per cent) households recurring cost was between Rs.18001 - 20000. In the case of 26 (10.20 per cent) households recurring cost was below Rs.18,000/-. Specific reasons are there for this cost range which is examined with the help of recurring cost components.

Table 6.5

Components of recurring cost

SI.No.	Components	Annual expenditure (Rs/ha)
1	2	3
1	Weeding	1676 (8.04%)
2	Manure and its application	664 (3.18%)
3	Earthing up	860 (4.12%)
4	Harvesting and transportation	9511 (45.60%)
5	Distillation (firewood and labour)	8147 (39.06%)
	Total	20858 (100%)

(Figures in parentheses are percentages to total)

Major share of recurring cost is incurred for harvesting and transportation. It amounted to Rs. 9511(45.60 per cent) of the total recurring cost. It is followed by Rs. 8147 (39.06 per cent) for distillation. For weeding an amount of Rs.1676 (8.04 per cent) was incurred. Cost for earthing up was found as Rs.860 (4.12 per cent). Least expenditure of Rs.664 (3.18 per cent) was recorded for manuring.

Hill tribes living inside the forest collect firewood from forest for distillation. Firewood collection is also a tribal occupation and only labour charge was incurred by tribals for firewood. At the same time most of the non-tribals buy firewood for distillation. These factors were responsible for variation in recurring cost.

For recurring operations like weeding, manuring, earthing up, harvesting and distillation, labour charge was the major factor. Here also labour cost varied due to community difference. As seen earlier labour was cheap in tribal centres. Farm size was also a factor which influenced recurring cost as labour cost was higher in small and medium farms. At the same time large farms are labour efficient.These altogether resulted in recurring cost variation reflected in Table 5.4

6.3.1 Distribution of distilleries

Table No. 5.6 shows that out of the 255 cultivating households 93 (36.47 per cent) come under small, 147 (57.65 per cent) medium and 15 (5.88 per cent) large. It is dfurther noticed that 14 (15.05 per cent) small farmers, 40 (27.21per cent) medium and 12 (80.00 per cent) large farmers have distilleries. The Table also shows that out of the 66 distilleries 44 (28.95 per cent) belonged to tribals and 22 (21.36 per cent) non-tribals. The table further shows that 8 (17.78 per cent) small cultivators, 27 (28.13 per cent) medium cultivators and 9 (81.82 per cent) large cultivators belonged to tribal community have distilleries. In the case of non-tribals 6 (12.50 per cent) small holders 13 (25.49 per cent) medium holders and 3 (75.00 per cent) large holders have distilleries. Both for tribals and non-tribals large and medium farms have higher percentage of distilleries. It is also seen that tribals have higher percentage of distrilleries than non-tribals as some of them received financial assistance from Tribal Development Department for the purchase of distilleries.

Table 6.6
Ownership of distilleries

Sl.No.	Farm size	Tribals		Non-tribals		All	
		No. of households	No. of distilleries	No. of households	No. of distilleries	No. of households	No. of distilleries
1	2	3	4	5	6	7	8
1.	Small	45 (29.60%)	8 (17.78%)	48 (46.60%)	6 (12.50%)	93 (36.47%)	14 (15.05%)
2.	Medium	96 (63.16%)	27 (28.13%)	51 (49.52%)	13 (25.49%)	147 (57.65%)	40 (27.21%)
3.	Large	11 (7.24%)	9 (81.82%)	4 (3.88%)	3 (75.00%)	15 (5.88%)	12 (80.00%)
	Total	152 (100%)	44 (28.95%)	103 (100%)	22 (21.36%)	255 (100%)	66 (25.88%)

(Figures in parentheses are percentages to total)

6.3.2 Cost of distilleries

Cost of distillery tabulated in Table 6.7 shows that an amount of Rs. 3475/- is needed for installing a distillery in tribal area. For non-tribals cost come to Rs. 3975/- due to the higher construction cost of the shed. Thus the average cost of distillery comes to Rs. 3725/-. In tribal area cost of boiler is Rs. 750/- (21.58 per cent), coiled coil Rs. 450/- (12.95 per cent) cooling tank Rs. 1000/- (28.78 per cent) and other assessories cost Rs. 100/- (2.88 per cent). For the transportation of still an amount of Rs. 100/- (2.88 per cent) has to be spent. Construction cost of the shed is Rs. 1000/- (28.78 per cent) in tribal area. In non-tribal area due to the increased material cost and labour cost expenditure for construction of shed comes to Rs. 1500/-. Other costs are same. Choola is seen constructed using stone and mud for which labour cost comes to Rs. 75/-. Maintenance is required for the still and shed. Average annual maintenance cost comes to Rs. 1125/-

Table 6.7
Cost of distillery

Sl. No.	Components	Tribals		Non-tribals		All	
		Cost Rs.	Percentage of total Cost	Cost Rs.	Percentage of total Cost	Cost Rs.	Percentage of total Cost
1	2	3	4	5	6	7	8
1	Boiler	750	21.58	750	18.87	750	20.14
2	Coiled coil	450	12.95	450	11.32	450	12.08
3	Cooling tank	1000	28.78	1000	25.16	1000	26.85
4	Other Assessories	100	2.88	100	2.51	100	2.68
5	Transportation expenses	100	2.88	100	2.51	100	2.68
6	Shed	1000	28.78	1500	37.74	1250	33.56
7	Construction of choola	75	2.15	75	1.89	75	2.01
Total		3475	100	3975	100	3725	100

6.4 Total cost (non-recurring and recurring)

Cultivation cost is incurred in two stages in the case of this crop viz. planting and maintenance cost and harvest stage cost. Planting cost is non-recurring, average of which comes to Rs. 7038/-. Maintenance cost and harvest stage cost are recurring which comes to Rs. 20858/- per hectare. Thus total cost of cultivation for lemongrass comes to Rs. 27896/- per hectare. This total cost is divided into material cost and labour cost as presented in the Table 6.8

Table 6.8
Total cost components (per hectare)

Sl. No.	Components	Cost (Rs.)	Percentage
1	2	3	4
I	Material cost		
1	Seed	1050	3.76
2	Manure (for planting & recurring)	900	3.23
3	Fire wood	4547	16.30
II	Labour cost		
1	Preparation of land and planting	5510	19.75
2	Application of manure	242	0.87
3	Weeding	1676	6.01
4	Earthing up	860	3.08
5	Harvesting and transporting	9511	34.09
6	Labour for distillation	3600	12.91
	Total	27896	100

Table 6.8 shows that labour cost comes to Rs. 21399/- (76.71 per cent) and material cost Rs. 6497/- (23.29 per cent) of the total cost. Major component of material cost is fire wood which comes to Rs. 4547/- (16.30 per cent). Share of seed comes to Rs.1050 (3.76 per cent) and total cost of manure for planting and recurring operations comes to Rs. 900/- (3.23 per cent).

Major component of labour cost is cost for harvesting and transporting, which amounts to Rs. 9511 (34.09 per cent). Next comes cost for preparation of land and planting, which comes to Rs. 5510 (19.75 per cent). It is followed by labour for distillation for which Rs. 3600 (12.91 per cent) is incurred. An amount of Rs. 1676/- (6.01 per cent) is spent for weeding and Rs. 860 (3.08 per cent) for earthing up. Labour cost for manure application comes to Rs. 242 (0.87 per cent).

The table in general shows that labour cost is three times higher than the material cost. Moreover highest share, Rs. 9511/- (34.09 per cent) comes to harvesting and transporting which is done by women.

It is significant to note here that there is large variation in the cost per hectare among the sample cultivators. While analysing the stage wise cost this has been brought out. In this context it will be intersting to observe the variation in total cost among the sample units. Distribution of sample cultivators by size of cost per hectare shown in Table 6.9.

Table 6.9
Variation in cost of production

Sl. No.	Cost range (Rs. per ha)	Tribal households (No)	Non-tribal households (No)	Total households (No)
1	2	3	4	5
1	Below 20000	11 (7.24%)	3 (2.91%)	14 (5.49%)
2	20001 - 25000	18 (11.84%)	8 (7.77%)	26 (10.20%)
3	25001 - 30000	93 (61.18%)	66 (64.08%)	159 (62.35%)
4	Above 30001	30 (19.74%)	26 (25.24%)	56 (21.96%)
	Total	152 (100%)	103 (100%)	255 (100%)

(Figures in parentheses are percentages to total)

As can be observed from the Table, out of the 255 sample households, highest number of households 159 (62.35 per cent) comes in the cost class of Rs. 25001 - 30000. It is further noticed that for 56 households, cost was above Rs. 3000/-. In the case of tribals highest number of households 93 (61.18 per cent) comes in the range of Rs. 25001 - 30000/- but in the case of non-tribals the proportion is high as out of 103 households 66 (64.08 per cent) comes in the same cost class. Both for tribals and non-tribals the lowest number of households come below Rs. 20,000. But here the percentage representation is less for non-tribals. This indicates that cost of cultivation is high for non-tribals.

6.5 Productivity

Productivity of a crop is the major factor which determine profitability. Productivity is determined by several factors. Inputs used for cultivation are the main factors which determine productivity. Seed, manure, fertilizer, pesticide, irrigation etc., are the general inputs. Under technical inputs come the use of technical knowledge at planting, maintenance, harvest and distillation stages. For lemongrass, variety of grass, use of manure and fertilizer, method of planting, effect of shade, age of plantation and farm size are the major factors which influence production. How far these factors influence oil production was examined. Average oil production of the sample cultivators was 64.445 kg per hectre. Production per hectre ranged from 25 to 80 kg. Variation is shown in the following table.

Table 6.10
Production range of lemongrass oil (per hectare)

Sl.No.	Production range (Kg)	No. of households
1	2	3
1	Below 40	6 (2.35%)
2	41 - 50	17 (6.67%)
3	51 - 60	46 (18.04%)
4	61 - 70	117 (45.88%)
5	Above 71	69 (27.06%)
	Total	255 (100%)

(Figures in parentheses are percentages to total)

Table 6.10 shows that highest number of households (117) (45.88 per cent) come in the production range of 61 to 70 kg per hectare. This is followed by 69 (27.06 per cent) households in the range of above 71 kg. The Table further shows that 46 (18.04 per cent) household come in the range of 51 to 60

kg and for 17 (6.67 per cent) households production is between 41 to 50 kg. An oil production below 40 kg was recorded for 6 (2.35 per cent) households.

Factors such as community difference (tribals and non-tribals), difference in method of planting (direct seeded and transplanted), use of manure (manured and not manured) effect of shade (shaded and non-shaded), age of plantation (new and old), farm size (small, medium and large) have separately and collectively influenced oil production, which were responsible for the difference in production as noted in Table 6.10. Influence of the above factors on oil production was examined and tabulated in the following Table.

Table 6.11

Productivity of lemongrass (per hectare)

Sl. No.	Category and factors influencing production	Oil production (Kg)
1	2	3
1	Community difference-	
	a Tribals	66.011
	b Non-tribals	61.773
2	Method of planting -	
	a Direct seeded	63.785
	b Transplanted	70.768
3	Use of manure-	
	a Manured	71.020
	b Not-manured	63.559
4	Effect of shade-	
	a Shaded	58.286
	b Non-shaded	65.023
5	Age of plantation-	
	a New (below 10 years)	72.625
	b Old (above 10 years)	60.522
6	Farm size-	
	a Small	74.218
	b Medium	62.916
	c Large	60.545
	All	64.445

It is seen from the Table that average oil production of the sample is 64.445 Kg per hectre. Influence of community on oil production was examined and it is found that tribal cultivators had an average oil production of 66.011 Kg while non-tribals had 61.773 Kg. The difference is due to increased grass production of tribal cultivations because of higher soil fertility and favourable climatic conditions of the forest region where majority of the tribal cultivations were seen.

Productivity was evaluated according to method of planting. Transplanted plantations produced 70.768 Kg and direct seeded plantations 63.785 Kg of oil per hectare. Higher productivity of the transplanted plantations were due to higher grass production of the transplanted grass.

Application of manure had positive effect on grass production and thereby oil production. While mannured plantations produced 71.020 Kg of oil per hectare, oil production from not manured grass was limited to 63.559 Kg.

Some lemongrass plantations were shade affected due to Grantis (a species of Eucalyptus) planting and other shade trees. Shade has an adverse effect both on grass production,oil recovery and quality of the oil. Our analysis in this line showed that non-shaded plantations produced 65.023 Kg of oil while shaded plantations had only 58.286 Kg per hectare.

Age of plantations was found to be an important factor which influenced grass production and thereby oil production. For the purpose of this study plantations are grouped into new (upto 10 years) and old (above 10 years). In the study it is found that new plantations had an average production of

72.625 Kg per hectare and old had 60.522 Kg. This is because new plantations had good grass production upto 10 years and ageing has an adverse effect on grass production. It is observed that plantations above 30 years are also in existance.

Farm size is yet another important factor which determined oil production. Production figures shows that small plantations produced 74.218 Kg, medium 62.916 Kg and large 60.545 Kg per hectare. Higher productivity of smaller farms are due to intensive cultivation practices adopted by these cultivators. Most of the plantations of this group are new, transplanted and manured.

Eventhough white and red stemed grass are under cultivation in Kerala, in the area under study (high ranges) only white stemed grass is being cultivated due to higher productivity than red stemed grass. Use of technical inputs, chemical fertilisers and irrigation are lacking in this cultivation.

6.6 Profitability

Profitability is the major factor which influence the area under cultivation of any crop. As cost of cutlivation and price of products are the factors which determine profitability, stability of these factors are important in agricuture. As the plant is a perennial crop yielding for years after planting, recurring expenditure is the major cost. A share in the planting cost @ Rs. 470/- per hectare (ie $1/15^{th}$ of the total planting cost) and depreciation of the distillary @ Rs. 1125/- per year are also accounted for the calculation of profit. For those who do not have distillary the amount estimated as depreciation can be accounted towards rent of the distillery. Receipt from

64.445 kg oil @ Rs.450/- per kg comes to Rs. 29,000/- and yearly share in planting cost, recurring expenditure and depreciation of the distillary comes to Rs. 22453/-. So the average profit per hectare per year is Rs. 6547/- which range from Rs. 595/- to Rs.9750/- due to community difference, difference in method of planting, use of manure, effect of shade, age of plantation and farm size.

Table 6.12
Average profit in lemongrass cultivation (per hectare)

Sl.No.	Components	Value
1	Average oil production of the sample	64.445 Kgs
2	Receipt from oil @ Rs. 450/- per kg.	Rs. 29,000/-
3	Yearly share in planting cost	Rs. 470/-
4	Expenditure (recurring only)	Rs. 20,858/-
5	Depreciation of distillary	Rs. 1,125/-
6	Total expenditure	Rs. 22453/-
	Net return	Rs. 6547/-

6.6.1 Variation in profit

Profit from lemongrass cultivation vary from Rs. 595/- to Rs. 9750/-. This is due to community difference, method of planting, use of manure, effect of shade, age of plantation and farm size. Range of variation is given in Table 5.13. It is seen from the Table that for highest number of households 87 (34.12 per cent) profit ranges from Rs. 6001/- to Rs. 7000/-. This is followed by 61

(23.92 per cent) households in the range of Rs. 7001 - 8000. For 33 (12.94 per cent) households income is between Rs. 8001/- and Rs. 9000/-. Income above Rs. 9001/- is seen for 11 (4.32 per cent) households. The table also reveals that 5 (1.96 per cent) households have income between Rs. 3001 and 4000/-, 6 (2.35 per cent) between Rs. 2001-3000, 4 (1.57 per cent) between Rs. 1001-2000 and 5 (1.96 per cent) below Rs. 1000/-. It is seen that higher profit is seen in new, transplanted and manured tribal plantations. Plantations below 2 years, too old and neglected have lower profit.

Table 6.13
Variation in profit (per hectare)

Sl. No.	Profit range (Rs)	Total
1	2	3
1	Below 1000	5 (1.96 %)
2	1001 - 2000	4 (1.57 %)
3	2001 - 3000	6 (2.35 %)
4	3001 - 4000	5 (1.96 %)
5	4001 - 5000	10 (3.92 %)
6	5001 - 6000	33 (12.94 %)
7	6001 - 7000	87 (34.12 %)
8	7001 - 8000	61 (23.92 %)
9	8001 - 9000	33 (12.94 %)
10	Above 9001	11 (4.32 %)
	Total	255 (100%)

(Figures in parentheses are percentages to total)

Table 6.14
Profit of different categories of plantations (per hectare)

Sl. No.	Components	Community		Method of planting		Manure		Shade		Age		Farm size		
		Tribal	Non-tribal	Direct seeded	Trans-planted	Manured	Not manured	Shaded	Non Shaded	New	Old	Small	Medium	Large
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Oil production	66.011	61.773	63.785	70.768	71.020	63.559	58.286	65.023	72.625	60.522	74.218	62.916	60.545
2	Receipt from oil @ Rs.450/- per kg.	29705	27798	28703	31846	31959	28602	26229	29260	32681	27235	33398	28312	27245
3	Planting cost* (annual)	444	554	449	590	501	439	470	470	470	470	560	472	448
4	Expenditure (recuring)	19868	22014	20691	21812	22794	20682	20117	21015	23110	19664	23242	20377	20217
5	Depreciation of distillary	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125
6	Total expenditure (3+4+5)	21437	23693	22265	23527	24420	22246	21712	22610	24705	21259	24927	21974	21790
7	Net return (2-6)	8268	4105	6438	8319	7539	6356	4517	6650	7976	5976	8471	6338	5455

* The plant give satisfactory yield for a period of 15 years in the area. So 1/15thof the planting cost is taken as annual Planting cost.

6.6.2 Profit of different categories of plantations

Profit worked out in Table 5.14 shows that highest profit of Rs.8471/- per hectare is recorded for small farms. It is due to the adoption of sound cultivation practices of production such as transplanting and manuring. This is followed by Rs. 8319/- for transplanted grass. For tribals profit is Rs.8268/- per hectare. Higher profit in this case is mainly due to low labour cost and firewood charges and high soil fertility. At the same time non-tribals have only a profit of Rs. 4 105/- due to increased labour cost and firewood charges.

Profit for new and manured plantations were Rs. 7976/- and Rs. 7539/- respectively. Good profit of these plantations were due to increased grass production. Non-shaded plantation have a profit of Rs. 6650/- while shaded grass have only Rs.4517/- due to low grass production. Direct seeded, not manured, old and medium size plantations have a net profit between Rs. 5900/- and 7000/-. For old plantations, profit per hectare is only Rs. 5976/- due to low grass production. A lower profit of Rs.5455/- is recorded for large plantations as some of them are seen neglected.

Thus profit can be increased considerably by adopting sound farm practices.

6.6.3 Profit from wild growth lemongrass per distillation

Distillation using wild growth grass is practiced by some tribals of Marayoor and Kanthalloor region at times of price hike and during unemployment period. Oil recovery is less in this case. Still this is practised as they get fire wood free and only labour is required. Thus the tribals are able to earn some income during unemployment seasons.

Table 6.15

Profitability of wild growth lemongrass per distillation (80 Kg)

Sl.No.	Components	Amount (Rs)
1	2	3
1.	Yearly share of planting cost	Nil
2.	Maintenance cost	Nil
3.	Harvest stage cost (harvesting transportation and distillation)	100
4.	Total cost	100
5.	Income from oil (0.300 kg) @ Rs. 450/- per kg	135
6.	Profit from one distillation (5-4)	35

Table shows the profitability of distilling 80 kg (one distillation) of wild growth lemongrass. Planting and maintenance expenses are not needed in this case. Out of the harvest stage cost of Rs. 100/- an amount of Rs. 75/- was met towards labour cost for harvesting, transporting and distillation. Cost of fire wood cost Rs. 15/- and rent of distillary comes to Rs. 10/-. Income from o.300 kg of oil at current prize of Rs. 450/- per kg is Rs. 135/- and a net profit of Rs. 35/- is obtained per distillation.

6.7 Employment potential

Unemployment and underemployment are the major problems confronted by the developing countries like India. Therefore labour intensive activity has paramount importance in such economies. In this context an investigation is made to evaluate the employment generation capacity of lemongrass cultivation. Details

of labour requirement are tabulated in the following table. In the cultivation of lemongrass and its distillation labour is employed at different stages such as seeding, transplanting, harvesting and distillation.

Table 6.16
Labour requirement in lemongrass cultivation (per hectare)

Sl. No.	Name of operation	Labour employed (Man days)		Total
		Male	Female	
1	2	3	4	5
1	Plantating operations-			
	a Direct seeding	38	29	67
	b Transplanting	46	52	98
	Average	40	34	74
2	Recurring operations-			
	a Weeding, manuring and earthing up	10	31	41
	b Harvesting	Nil	152	152
	c Distillation	37	Nil	37
	Total	87	217	304

Two methods of planting are in practice such as direct seeding and transplanting. For direct seding 38 male and 29 female mandays and for transplanting 46 male and 52 female mandays were employed. Higher labour requirement for transplanting is due to additional labour required for raising nursery and for transplanting operations. As seen earlier, only 32 (12.55 per cent) cultivators have transplanted crop out of which 18 (56.25 per cent) are tribals. Average mandays for planting operations (per hectare average of direct seeding and transplanting) of the samples are estimated, which comes to 40 (54.05 per cent) male and 34 (45.95 per cent) females, coming to a total of 74.

For recurring operations such as weeding, manuring and earthing up 10 male and 31 female mandays are required. For harvesting and distillation 37 male and 152 female mandays respectively were required. Thus it is seen that for planting operations a total of 74 mandays and for recurring operations 230 mandays are required resulting a total of 304 mandays per hectare. This shows the labour oriented nature of the crop.

6.8 Economic farm size

An economic holding according to Keatinge is "a holding which allows a man a chance of producing sufficient to support himself and his family in reasonable comfort after paying his necessary expenses"[1]. The size of economic holding depends on the fertility of soil, method of cultivation and nature of the crop. Here the case of lemongrass is examined. Specifically we examine the economic farm size for a household. It is assumed that the household depends exclusively on lemongrass cultivation for its sustenance. Here economic farm size for the sample, tribals and non-tribals are exmined separately.

Economic farm size is worked out for tribals and non- tribals separately. Also for the whole sample the economic farm size to realise cut off level family income is worked out. First are consider the farm size to sustain a household based on the data of the whole samples.

To arrive at an economic farm size from this angle a cut off level family income has to be considered to get the households placed at an equivalent income from lemongrass cultivation. We consider here a cut off level minimum

[1] Ruddar Datt and Sundharam KPM (1979), Indian Economy, S. Chand& Company Ltd, New Delhi 398.

family income of Rs. 11,000/- (poverty cut off limit in the 9th plan). Now based on the per hectare net income, the size of farm required can be worked out. The same is shown below.

Average income from one hectare	:	Rs. 29,000
Average expenditure for one hectare	:	Rs.22453
Net income per hectare	:	Rs. 6547
Poverty cut off limit	:	Rs. 11,000
Area required to produce a net income of Rs. 11,000/-	:	$\frac{11,000}{6547}$ = **1.680** hectares

Income from the sale of lemongrass oil from one hectare is Rs. 29,000. Average expenditure per hectare of the sample comes to Rs. 22453. So net income from one hectare is Rs. 6547/-. From these the area required to produce a net income of Rs. 11,000/- is estimated, which comes to 1.680 hectares.

Economic farm size for lemongrass is examined for tribals. Input cost is lower in tribal area. Soil fertility is higher in forest region where majority of tribal farms are seen. So net income is higher for tribals. The economic farm size for tribals is worked out below.

Average income from one hectare	:	Rs. 29705
Average expenditure for one hectare	:	Rs. 21437
Net income per hectare	:	Rs. 8268
Poverty out off limit	:	Rs. 11000

Area required to produce a net income of Rs. 11,000/-	:	$\frac{11,000}{8268}$ = **1.330** hectares

It is seen that average income from the sale of lemongrass oil from one hectare is Rs. 29705. Average expenditure for one hectare comes to Rs. 21437. Thus a net income of Rs. 8268/- is resulted. So the net income of Rs. 11,000 is generated from 1.330 hectares. Average area operated by tribal household is 1.523 hectares. It is seen that 32 (21.05 per cent) households have lemongrass cultivation above the economic farm size of 1.330 hectares. If family labour income is also inputed, economic farm size will become smaller.

Oil production is low for non-tribals due to low fertility of the soil as only a portion of the plantations are seen in the forest region. The favourable conditions such as soil fertility and climatic conditions of the forest region that the tribals have, is absent in the case of non-tribals. Moreover higher labour cost and firewood cost increased the cost of production. This has resulted in a lower net income than that of tribals. An economic farm size for non-tribals are estimated using the income and expenditure figures.

Average income from one hectare	:	Rs. 27798
Average expediture for one hectare	:	Rs. 23693
Net income per hectare	:	Rs. 4105
Poverty cut off limit	:	Rs. 11000
Area required to produce a net income of Rs. 11000	:	$\frac{11000}{4105}$ = **2.679** hectares

Average income per hectare for non-tribals comes to Rs. 27798/-. Average expenditure is Rs. 23693/-. Thus net income per hectare is Rs. 4105/-.

The estimation showed that 2.679 hectares of lemongrass cultivation is required to produce a net income of Rs. 11,000/-. The area for an economic farm size for non-tribals are seen double to that of tribals.

6.9 Optimum farm size for a distillery

In lemongrass cultivation and oil extraction as observed, the only fixed investment (excluding land) is investment in distillery. It is an essential investment for a farm as it will help the cultivator to cut the grass in time, distill the grass without wilting, can save rent of distillery and avoid transportation cost. If the cultivator has a distillery he can get spent grass and ash also. Further spent grass is a good cattle feed and can also be used as a manure. There are some constraint also for setting distillery in the farm. The distillery has high water requirement for the cooling system and can be installed only if there is abundant water source. The investment required for setting up a distillery is presented earlier. It is found that cost for setting a distillery ranged from Rs. 3475/- to Rs. 3975/-.

In the case of distillation, average time required for a distillation is 2 ½ hours and 3 distillation can be completed per day (8 hours). Average grass production of the sample is 15000 kg per hectare. In a process, 80 kg grass can be distilled and the still is used for 300 days per year. On this basis an economic farm size for a distillery is estimated.

Average grass production per hectare in a year	:	15000 kg.
Quantity of grass that can be distilled in a year (300 days) 80x3x300	:	72000 kg.
Area required to produce 72000 kg of grass	:	$\frac{72,000}{15000}$ = **4.80** hectares

Thus it is seen that grass produced from 4.80 hectares can be distilled in a year using a distillery. It has to be noted that the grass cutting has to be arranged in such a way as to get a regular supply of grass to the distillery.

6.10 Whether to own distillery or undertake rent distillation

Farmers can either own the distillery or rent distillation can be done. For ownership, a break even level of distillation has to be carried out as there are fixed costs. Depreciation is one such cost and it is seen that yearly depreciation cost comes to Rs. 1125/- per distillery. Maintenance cost and interest on investment are also there. But it can be made good if grass from near by cultivators are brought for rent distillation for which one ounce of oil per distillation is charged as rent. At the prevailing price thus the rent charge comes to Rs. 11.25 per distillation.

It is seen that the average per hectare grass production is 15 tonns for which 188 distillation is necessary. With these figures optimum farm size for rent distillation is estimated. This will help to decide whether to own or not to own a distillery.

a) Average yearly expenditure on distillery (Depreciation, maintenance cost and interest) : Rs. 2740

b) Average rent for distillation of grass from 1 hectare : Rs. 2115

c) Transportation charge of grass to distillery: Rs. 900

d) Value of spent grass and ash left after rent distillation : Rs. 1504

e) Total expenditure for rent distillation (b+c+d) : Rs. 4519

f) Area required to cover yearly expenditure on distillery : Rs. $\frac{2740}{4519}$ = **0.606** hectare

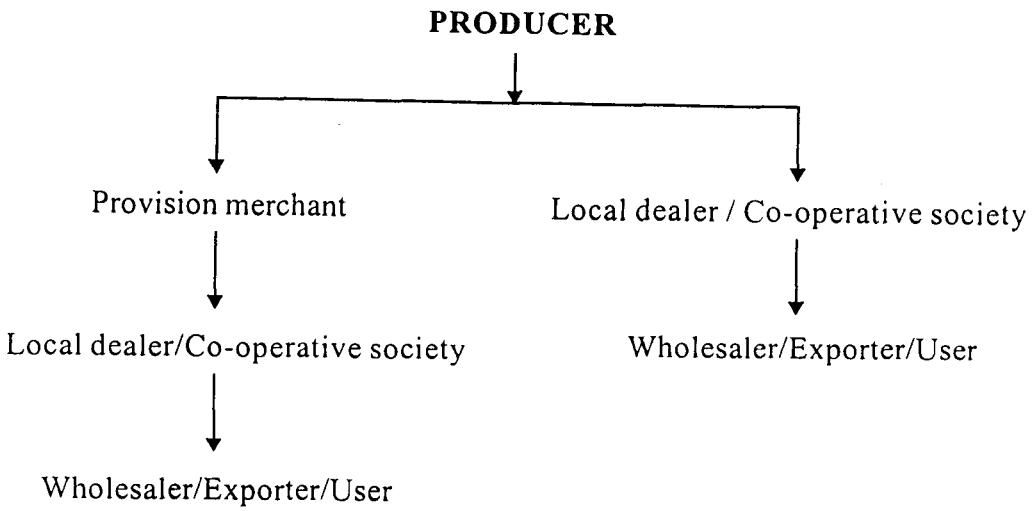
Average yearly expenses on distillery comes to Rs. 2740/- and total expenditure for rent distillation comes to Rs. 4519 per hectare. So for the sample the area required to cover the average yearly expenditure on distillery is estimated as 0.606 hectare. Thus it is seen that 0.606 hectare (1.50 acres) is the cut off area to decide whether to own a distillery or not. Upto the above area a cultivator can go for rent distillation without loss.

6.11 The existing marketing pattern and the role of middle men

6.11.1 Marketing pattern

Marketing is an important aspect in agricultural production. In agricultural marketing system, the farmer, the consumer and the middle men are involved. As lemongrass oil is not a food item for family use, marketing surplus and marketed surplus are the same. Whatever produced is marketed and this cultivation fulfil major share of the cash requirement of the cultivators. Apart from other agricultural products lemongrass oil being an unperishable item, can be stored for a number of years, eventhough slight decrease in citral content of the oil is noticed due to storage. Moreover being a handy item it is easy to transport. As lemongrass oil is an industrial raw material and also an export item, collection from the production centre and marketing to the user industry is through intermedieries, which is examined here.

Lemongrass oil is produced mainly in remote areas of the forest by the tribals. Middle men has good role in the marketing system. There are different channels through which the product is marketed. The channels are depicted below. It is observed that some cultivators get advance in cash or as goods



from provision merchants on condition that the oil produced will be given to him. For such a transaction the producers get a lower price. The citral content of the oil is also not ascertained. In this context it is important to examine the prevailing marketing system of the region.

Some producers sell oil direct to the local dealer who sell it to the wholesaler / exporter or user. It is observed that agents of some pharmaceutical firms purchase oil direct from the local dealer for medicinal purposes.

6.11.2 Sales pattern

In the study area `Kovilkadavu' in Marayoor Panchayat is the major market where there are nearly 18 lemongrass oil dealers including a co-operative society. Data on the sale of lemongrass oil is tabulated below.

Table 6.17
Sale of lemongrass oil

Sl. No.	Sales point	Number of households		All
		Tribals	Non-tribals	
1	2	3	4	5
1	Provision merchants	31 (20.39%)	14 (13.59%)	45 (17.65%)
2	Local dealer/			
	Co-operative society	121 (79.61%)	83(80.58%)	204 (80.00%)
3	Wholesaler	Nil	6 (5.83%)	6 (2.35%)
	Total	152 (100 %)	103 (100.%)	255 (100%)

(Figures in parentheses are percentages to total)

Table 6.17 reveals that out of the total 255 cultivators 204 (80.00 per cent) sold lemongrass oil to the local dealer or co-operative society. It is followed by 45 (17.65 per cent) cultivators who sold oil to the provision merchants. It is further noticed that 6 (2.35 per cent) cultivators sold oil to the wholesaler 121 (79.61 per cent) of the tribal households sold their oil to the local dealer/co-operative society. It is also observed that 31 (20.39 per cent) of them sold the oil in the nearby provision shop. In the case of non-tribals, 83 (80.58 per cent) households sold oil to the local dealer / co-operative society, 14 (13.59 per cent) in the provision shop and 6 (5.83 per cent) to the wholesaler. Further it is seen that higher rate of sale in provision shop is noticed among Scheduled Tribes.

6.11.3 Price spread

In the above marketing system it is important to examine the share of middlemen by looking into the price realised by various functionaries. The same is presented in 6.18.

Table 6.18
Share of middle men

Sl. No.	Category	Purchase price of oil per kg (Rs)	Sale price of oil per kg (Rs)	Gross income (expenditure and profit)(Rs)
1	2	3	4	5
1.	Provision shop	390	450	60 (63.16%)
2.	Local dealer/Society/Agents	450	470	20 (21.05%)
3.	Wholesale/exporter	470	485	10 (15.79%)

The Table shows that when the local dealers price is Rs. 450/- per kg of oil, a producer who sell oil in the provision shop get only an average of Rs. 390/-. Provision merchant sell it to the local dealer, society or agents for Rs. 450/-. He get a gross income of Rs. 60/- (63.16 per cent share). His profit is higher as no additional expenditure is incurred in this case. In the second stage transaction local dealer sell the oil to the wholesaler for Rs. 470/- ie. a gross income of Rs. 20/- (21.05 per cent share) is obtained from the transaction. Local dealer has to meet establishment expenses from the income. In the third stage the selling price of oil is Res. 485/- per kg. A gross profit of Rs. 15/- per kg of oil (15.79 per cent share) is obtained. Handling charges are met from the gross income. Selling price of the wholesaler / exporter is within the country. Export price is quoted taking into account the export expenses also. So a producer who sell oil in a provision shop get only 80.14 per cent of the wholesalers/ exporters selling price. Those who sell to the local dealer / co-operative society

get 92.78 per cent and those selling to the wholesaler get 96.91 per cent of the wholesalers / exporters selling price.

6.11.4 Standardisation, grading and marketing

Value of lemongrass oil is in proportionate to the citral content of the oil as citral is the industrialy important constituent of the oil. The Indian Standards Institution fixed a standard (15 : 327 - 1952) in the year 1952 for lemongrass oil. For agmarking lemongrass oil, it is graded with 'special ' and 'Grade A'. In the special category, citral content will be not less than 80 per cent and in grade A it will be not less than 76 per cent (ie 76 to 80 per cent). Market price of lemongrass oil is quoted for oil of 80 per cent citral. One per cent of the value is added or reduced for every one per cent increase or decrease in citral as the case may be. Facilities are there with the dealers to estimate the citral content of the oil. For getting quality oil, grading is very important. Lemongrass oil coming from various producers of different production centres has citral range from 60 to 92 per cent. This necessitates standardisation of oil for which oil having different citral contents are mixed to get the standard oil. Lemongrass oil is usually packed in 200 litres mild steel drums and exported.

6.12 Cobb - Douglas production function

Cobb - Douglas production function was examined for the sample and for tribals and non-tribals seperately. For the estimation, output was measured in Kg. of grass per hectare and labour input in mandays per hectare and capital input in value per hectare. Results are presented in Table 6.19.

Table 6.19
Cobb-Douglas prduction function
(Double log model)

Sl. No.	Sectors	Co-efficient capital	Co-efficient labour	Sum (C+L)	R^2
1	2	3	4	5	6
1.	Tribals	0.245 (3.85)	1.707 (11.04)	1.731	0.912
2.	Non-tribals	-0.064 (-0.83)	1.46 (16.88)	1.396	0.963
	All	0.0295 (7.564)	1.372 (16.97)	1.401	0.903

(Figures in brackets indicate t values)

The results are indicative of increasing returns as the t values are greater than 2.58 for 1 per cent significance level. As the Cobb-Douglas formula relates the product function by $Q = aL^pC^{1-p}$, the probability determines the more significant variable for the increase in product. In the case of non-tribals, the t value (-0.836) shows non-significance of the variable capital. Thus labour is significant in th case of non-tribals. But for tribals, the t value (3.858) of capital shows significance. So the variable capital is significant for tribals.

The co-efficient of determination (R - Square) is 0.903. As it tends to 1, shows the significance of the variables labour and capital in the production function.

It is significant to note that there is abundant labour force among non-tribals. At the same time they face unemployment problem. Result shows

that for non-tribals the probability determines the more significant variable labour, for the increase in production. In the case of lemongrass more labour can be employed for operations such as weeding, earthing up and gap filling in the existing cultivation. Old lemongrass cultivations can be replanted. It was reported that oil yield could be decreased by more than 50 per cent due to weed competition[2]. So more labour input can increase grass production considerably.

In the case of tribals the variable capital was found more significant. Manure is an important input and increase in manure application can increase grass production considerably in tribal lemongrass cultivation.

Thus Cobb-Douglas production function estimates indicates that there is scope for maxim ising productivity in lemongrass cultivation.

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[2] Thomas J (1989), op.cit, p.10.

ROLE OF LEMONGRASS CULTIVATION ON THE TRIBAL ECONOMY OF THE REGION

P.S. Jayapradeepu “Economics of lemongrass cultivation in Kerala ” Thesis. Department of Economics, Dr. John Matthai Centre Thrissur , University of Calicut, 2003

CHAPTER VII

ROLE OF LEMONGRASS CULTIVATION ON THE TRIBAL ECONOMY OF THE REGION

Man is a tribal animal. We must fully appreciate this fact if we are to understand one of the most important facets of human nature [1]. "The origins of the tribe lie in the earliest stages of human evolution. The patterns of organized agriculture which first produced modern nations and states are only 10,000 years old - a mere tick of the evolutionary clock. By contrast, the emergence of Man as a hunter-gatherer, the unique pattern of social behaviour which led immediately to a tribal way of life, occurred some five million years ago"[2].

The tribal population is found in almost all parts of the world. India is one of the countries noted for tribal concentration and tribals come to 8.08 per cent (1991 census) of the total population. It is seen that 1.10 per cent of the population of Kerala belong to tribes [3]. Under the Directive Principles of State Policy in Article 46 of the Constitution, it is laid down that "the State shall promote with special care the educational and economic interests of the weaker sections of the people and in particular, of the Scheduled Castes and the Scheduled Tribes and shall protect them from social injustice and all forms of exploitations".[4]

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1 Desmond Morris and Peter Marsh (1988), Tribes, Pyramid, London P.6

2 Ibid P.9

3 Verma R.C (1995), Indian Tribes Through the Ages, Publication Division, Ministry of Information and Broadcasting, Government of India, P.1.

4 Directorate of Census Operations, Kerala (1981), Primary Census Abstract for Scheduled Castes and Scheduled Tribes, p.4.

In Kerala there are 35 tribes. As a general phenomenon in Kerala also tribals constitute the weaker section of the society. Lack of education, semi-isolated life in forest region, customery practices and exploitations prevent the economic progress of tribals. Agriculture and collection of forest produce are their major occupations. Due to more and more restrictions in the collection of forest produce being imposed on tribals in the common interest of the nation, they now mainly depend upon the agricultural sector for their livelihood. Now the economy of Scheduled Tribes is manily based on agriculture. They mainly produce food grains for their use and not for sale. Tribal economy is a good example of subistance eoconomy. Lemongrass oil being a commercial product is sold and the income received from it mainly meet their cash needs. As lemongrass oil is a handy item, cost for transportation do not occur for it as in items like vegitables etc. Moreover lemongrass oil is not a perishable item like some other agricultural produce. It can be stored for years without much quality change. Its production is also dominantly in the hill tracts and the tribal population is mostly engaged in this activity. In this connection the status of lemongrass cltivation upon tribal economy of the region is examined.

7.1 Role of lemongrass in the economy of tribals

The importance of lemongrass cultivation in the overall economic life of the tribal population is examined with reference to income, employment, land use etc. First we consider the relative dependence of the population on lemongrass cultivation in terms of income generation. The relevant figures are shown in Table 7.1

Table 7.1

Households by major source of income

Sl. No.	Sources	Tribal households	Non-Tribal households	All
1	2	3	4	5
1.	Net income from lemongrass cultivation	103 (67.76 %)	54 (52.43%)	157 (61.57%)
2.	Other agricultural income	16 (10.53 %)	24 (23.30%)	40 (15.69%)
3.	Labour	27 (17.76%)	15 (14.56%)	42 (16.47%)
4.	Collection of forest produce	5 (3.29%)	Nil	5 (1.96%)
5.	Others	1 (0.66%)	10 (9.71%)	11 (4.31%)
	Total	152 (100%)	103(100%)	255(100%)

(Figures in parentheses are percentages to total)

Table 7.1 shows that out of the total 255 sample households, 157 (61.57 per cent) had major source of income from lemongrass cultivation. Income from labour was found as the major source to 42 (16.47 per cent) households. This is followed by other agricultural income which provided as the major source to 40 (15.69 per cent) sample households. Other sources such as business and profession provided major source of income to 11 (4.31 per cent) households. It is further seen that for 5 (1.96 per cent) households, income from the collection of forest produced provided the major source. Community wise details shows that both for tribals and non-tribals lemongrass cultivation provided the major source of income. In the case of tribals 103 (67.76 per cent) households and for non-tribals 54 (52.43 per cent)

households, this cultivation stand as the major source. Next in importance comes labour for tribals as it provided the major source to 27 (17.76 per cent) households. This is mainly due to the influence of lemongrass cultivation which is a labour oriented one. In the case of non-tribals other agricultural income come next to lemongrass as income from other agricultural operations provided the major source to 24 (23.30 per cent) households. This is followed by labour which provided 15 (14.56 per cent) households as a major source. For tribals income from other agriculture formed as a major source to 16 (10.53 per cent) households. Collection of forest produce has been found to be the monopoly of tribals. Forest produce collection formed the major source to 5 (3.29 per cent) tribal households. At the same time non-tribals are not engaged in this activity. For 1 (0.66 per cent) tribal household and 10 (9.71 per cent) non-tribal households income from other sources provide the major source. The table in general shows that income from lemongrass cultivation provide the major source of income to tribals.

7.2 Employment potential and women participation

In the agricultural sector unemployment and under employment are major problems which is severe in the case of women population of tribal community. It is seen earlier that labour provides a sizeable share of income to the sample cultivators. Average labour required per hectare is shown in the following Table.

Table 7.2

Average labour requirement

Sl. No.	Operation	Average labour required per hectare		
		Male No.	Female No.	Total No.
1	2	3	4	5
1.	Non-recurring	40 (54.05 %)	34 (45.95 %)	74 (100 %)
2.	Recurring	47 (20.43%)	183 (79.57%)	230 (100 %)
	Total	87 (28.62 %)	217 (71.38 %)	304 (100 %)

(Figures in parentheses are percentages to total)

The Table shows that for lemongrass cultivation a total of 304 mandays per hectare are required out of which 87 (28.62 per cent) are male and 217 (71.38 per cent) are female mandays. It is further noticed that for non-recurring operations such as direct seeding and transplanting an average of 74 mandays and for recurring operations such as weeding, manuring, earthing up, harvesting, transportation and distillation 230 mandays are required. Out of the 74 mandays for non-recurring operations 40 (54.05 per cent) are males and 45 (45.95 per cent) are females. In the case of recurring operations out of the 230 mandays 47 (20.43 per cent) are male and 183 (79.57 per cent) female mandays.

The Table shows that female labour requirement is double than that of male. This can reduce the gravity of unemployment and under employment among women population of the region, majority of them are tribals.

7.3 Labour share in lemongrass cultivation

Labour share in lemongrass cultivation is examined separately for tribals and non tribals to evaluate the influence of the cultivation in providing employment to the households. Details are indicated in the following Table

Table 7.3

Labour share in lemongrass cultivation

Sl. No.	Labour share (%)	Number of households		All
		Tribal	Non-Tribal	
1	2	3	4	5
1.	Upto - 20	-	2 (1.94 %)	2 (0.78 %)
2.	21 - 35	-	7 (6.80 %)	7 (2.75 %)
3.	36 - 50	14 (9.21 %)	16 (15.53 %)	30 (11.76 %)
4.	51 - 65	22 (14.47 %)	36 (34.95 %	58 (22.75 %)
5.	66 - 80	69 (45.40 %)	24 (23.30 %)	93 (36.47 %)
6.	81 and above	47 (30.92 %)	18 (17.48 %)	65 (25.49 %)
Total		152 (100 %)	103 (100 %)	255 (100 %)

(Figures in parentheses are percentages to total)

It is seen from Table 7.3 that out of the 255 households for 93 (36.47 per cent) households labour share ranged from 66 to 80 per cent. For 65 (25.49 per cent) households it is above 81 per cent. It is further noticed that in the range of 51 - 65 a total of 58 (22.75 per cent) households are placed. In the 36 - 50 and 21 - 35 ranges there are 30 (11.76 per cent) and 7 (2.75 per cent) households respectively. Lowest labour share of upto 20 per cent is seen in 2 (0.78 per cent) house holds.

Community wise break up shows that out of the 152 households 69 (45.40 per cent) households have labour share in the range of 66 - 80 per cent. This is followed by 47 (30.92 per cent) households having 81 and above per cent. In the range of 51 - 65 per cent there are 22 (14.47 per cent) households. Lowest percentage is seen in the 36-50 range. In the case of non-tribal households highest share of labour input in lemongrass is seen in the range of 51 - 65 per cent, where 36 (34.95 per cent) households come in the range. In the 66 - 80 per cent range there are 24 (23.30 per cent) households. It is further seen that 18 (17.48 per cent) households have 81 per cent and above labour share. In the case of 36 - 50 and 21 - 35 ranges 16 (6.80 per cent) households respectively are seen. Only 2 (1.94 per cent) households are seen in the 20 per cent and below range.

The table shows that for 116 (76.32 per cent) households have labour share from 66 per cent and above. In the case of non-tribals, only 42 (40.78 per cent) households have labour share in the above range. This shows that tribals have higher rate of labour input in lemongrass cultivation than for non-tribals. As unemployment is a major problem in tribal areas, lemongrass cultivation is an important activity that provides employment opportunities.

7.4 Community wise area under lemongrass

Community wise area under lemongrass is examined to evaluate its influence in tribal agriculture.

Table 7.4

Community wise area under lemongrass (in hectares)

Sl. No.	Operation	Female No.	Total No.
1	2	3	4
1.	Scheduled Castes	4.298 (2.79 %)	0.478
2.	Schedules Tribes	97.078 (63.02 %)	0.639
3.	Other Backward Communities	19.522 (12.67 %)	0.542
4.	Forward Caste Hindus	3.059 (1.99 %)	0.510
5.	Christians	30.093 (19.53 %)	0.579
	All	154.050 (100 %)	0.604

(Figures in parentheses are percentages to total)

Table 7.4 shows that 255 sample households are cultivating a total of 154.050 hectares which comes to 46.11 per cent of the total area operated. Community wise break up shows that 97.078 (63.02 per cent) hectares are cultivated by tribals. Next comes Christians who cultivate 30.093 (19.53 per cent) hectares. This is followed by Other Backward Communities. They have 19.522 (12.67 per cent) hectares of lemongrass cultivation. Scheduled Castes and Forward Caste Hindus have 4.298 (2.79 per cent) and 3.059 (1.99 per cent) hectares of the crop.

Average households area under lemongrass shows that Scheduled Tribes are having the highest area under lemongrass as

they possessed an average household area of 0.639 hectares. Christians, Other Backward Communities and Forward Caste Hindus are having an average household area of 0.579, 0.542 and 0.510 hectares of lemongrass cultivation respectively. Scheduled Castes households are having the lowest lemongrass area of 0.478 hectares. Thus the table shows that tribal households are having highest lemongrass area which has good impact on the economic status of tribals.

7.5 Land utilisation particulars

Land utilisation particulars of Marayoor and Kanthalloor Panchayats are given in the Table 7.5. The Table reveals the importance of the crop in the region, where tribals constitute nearly 17 per cent of the households.

The table shows that in Marayoor and Kanthalloor Panchayats, lemongrass occupy the major share in land utilisation where 1000 (38.71 per cent) hectares in Marayoor and 380 (30.23 per cent) hectares in Kanthalloor are under the crop. This is followed by Sugarcane (760 hectare) in Marayoor. In Kanthalloor 260 hectares are under grantis. Area of paddy comes to 250 hectares in Marayoor and 144 hectares in Kanthalloor. Other crops occupy only small areas. This shows the influence of lemongrass cultivation in the area under study where tribals are the major cultivators.

Table 7.5

Land utilisation of Marayoor and Kanthalloor Panchayats (in hectares)

Sl. No.	Name of crop	Name of Panchayat	
		Marayoor	Kanthalloor
1	Cocount	100	14
2	Rubber	5	--
3	Sugarcane	760	78
4	Paddy	250	144
5	Pulses	4	--
6	Vegetables	10	160
7	Plantain/Banana	20	10
8	Tapioca	50	20.80
9	Pepper	30	5.20
10	Arecanut	60	24
11	Ragi	120	--
12	Sweet Potato	20	--
13	Turmeric	8	--
14	Ginger	20	21.20
15	Kacholam	6	--
16	Lemongrass	1000	380
17	Mulbery	120	10
18	Garlic	--	30
19	Potato	--	60
20	Coffee	--	40
21	Grantis	--	260
Total Area		2583	1257.20

Source:- Vikasana Rekha (1996), Marayoor and Kanthalloor Panchyats.

7.6 Production of lemongrass oil

Production of lemongrass oil in Kerala shows that oil production in Idukki district is in an increasing trend eventhough total production decreased. Oil production in Idukki was 70 tonnes in 1975-76, 99 tonnes in 1990-91, 63 tonnes in 1995-96 and 74 tonnes in 1998-99. Increasing trend is due to good profitability of the crop in this region due to higher oil production and low cost of cultivation. Tribals being the major producers, this cultivation has good influence on tribal economy of the region.

7.7 Average income from lemongrass cultivation

Average income from lemongrass cultivation of tribals has been worked out to examine its influence upon tribal economy of the region. It was seen earlier that average family income of tribal households comes to Rs. 13675/- and net income from agriculture was Rs. 9697/- (70.90 per cent of the total income). It is found that average income from lemongrass cultivation comes to Rs. 6730/- (69.40 per cent of the net income from agriculture). So it is quite evident that lemongrass cultivation has a positive impact upon the economy of the tribal cultivators of the region.

PROBLEMS AND PROSPECTS OF LEMONGRASS CULTIVATION IN KERALA

P.S. Jayapradeepu “Economics of lemongrass cultivation in Kerala ” Thesis. Department of Economics, Dr. John Matthai Centre Thrissur , University of Calicut, 2003

CHAPTER VIII

PROBLEMS AND PROSPECTS OF LEMONGRASS CULTIVATION IN KERALA

Lemongrass oil is an essential oil which has got multiple uses. Spent lemongrass can also be used profitably. Further the oil is an export item which can earn vast foreign exchange. Still what is startling to note is that there is decline in the area under lemongrass cultivation. To a certain extent it is on account of various problems faced by the cultivators and we highlight some of these important problems in the following paragraphs.

8.1 Price

Price is an important factor that determine the profitability of any crop to the cultivators. In India the farmers are primarily depended upon the middle men for marketing. The result is that farmers are not able to realize a remunerative price. This is particularly true with the lemongrass cultivaters as it is much more disorganised an activity. During nineteen seventees there was violent price fluctuations for lemongrass oil which seriously affected the area under cultivation. During that period the price was too low that it can hardly meet the cultivation expenses and the cultivators neglected the crop in times of depression. Moreover the cultivators are not in a position to store lemongrass oil in expectation of better price due to financial problems. From

CHAPTER VIII

PROBLEMS AND PROSPECTS OF LEMONGRASS CULTIVATION IN KERALA

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1996 onwards an increase in price was noticed. Wholesale price index number of lemongrass oil is given in the following table to assess the present price trend.

Table 8.1

Wholesale price index of lemongrass oil

Base 1952-53 = 100

Sl.No.	Year	Wholesale price index
1	2	3
1	1980	647 . 8
2	1985	1317 . 9
3	1990	2275 . 7
4	1991	2275 . 7
5	1992	2432 . 1
6	1993	2400 . 2
7	1994	2367 . 6
8	1995	2713 . 3
9	1996	4229 . 3
10	1997	4182 . 2
11	1998	4607 . 2
12	1999	4867 . 6
13	Upto March 2000	4817 . 4

Source:- Statistics for Planning (2001) , Directorate of Economics and Statistics, Trivandrum, P. 481

The table shows that the price index (base 1952-53) which was 647.8 in 1980 steeply rose to 1317.9 by 1985 and to 2275.7 by 1990. Thus the decade was marked by price rise. There was no change during 1991. The next four years were marked by more or less mild fluctuation in the range of 2400.2 to 2713.3. In 1996 the index perceptibly rose to 4229.3 and there after fluctuated from 4182.2 to 4867.6. The data reveals that there is price hike in the post 1996 period with moderate price variation. If this trend continues area under lemongrass is likely to increase.

8.2 Fuel problem

In the cost structure firewood accounts for a major share as in the distillation of lemongrass firewood is used as fuel. In plain land firewood has become scarce and this led to a steep price increase in plain land which is stated to have adversely affected its cultivation in plain land. The cost of firewood is a major cost of production of oil. So there is an urgent need to modernize the distillary for maximising oil production per unit of fuel consumed.

Due to the scarcity and high price of firewood in plain land cultivation is now confined to forest areas where tribals are the major lemongrass cultivators. In tribal centres naturally fallen wood in the forest is enough to meet their requirements for lemongrass distillation. Even otherwise firewood is available at a cheap rate from the tribals, the activity gets concentrated in forest areas. In some plantations of the non-tribals, fast growing firewood trees like eucalyptus is planted in the boundaries and in a scattered way in the lemongrass plantations. As these trees are tall, lemongrass will get enough sunlight and it will not seriously affect the grass production, oil recovery and citral percentage.

From our discussion it is revealed that the cultivators experience some difficulties in growing firewood trees as in some cases the cultivation is done in forest land and the cultivators have only limited right in the land. As a result of this, trees cannot be grown there. In the case of tribals, most of the tribal hamlets are inside the forest and difficulties are there for firewood cultivation.

8.3 Wage rate

Lemengrass is a labour intensive crop and labour charge accounts for a major share in the cost of cultivation. Due to higher wage rate in the Agricultural secture, cultivation of labour intensive crops like lemengrass has been uneconomic. But wage rate in tribal areas like Marayoor and Kanthalloor are lower, resulting in a lower cost of production. So lemongrass is being profitably cultivated in the tribal areas, where the study is conducted.

8.4 Lack of high yielding variety of lemongrass

Lemongrass cultivation declined in Kerala as comparative profitability had changed in favour of other crops. It is observed that low productivity of lemongrass is a major reason for the decline of this cultivation. An improved variety of lemongrass OD-19 distributed for cultivation in Kerala is capable of producing 100 Kg. of oil per hectare yearly. At the same time other varieties developed in India such as RRL-16, LS-48, CKP-25 etc, are reported to be capable of high oil production. It is reported that CKP-25 can produce more than 375 Kgs. of oil per hectare. Cost of production being the same if high yielding varities suitable to low land, mid land and high land can be developed profitability can be doubled a number of times. Central Institute of Medicinal and Aromatic Plants has observed[1] that the main reason for decrease in production is due to very low yield per unit area of land from the existing varieties/clones which give poor remuneration to the farmers. So there is an urgent need for developing high yielding varieties of lemongrass suitable for cultivation in high ranges and also in midland and low land in Kerala.

8.5 Expansion of irrigation facilities

Lemongrass is usually grown as a rain fed crop. Consequent upon the

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[1] Central Institute of Medicinal and Aromatic Plants (1985), CIMAP Develops an Improved Clone of Lemongrass, Lucknow, Vol. 12, No.2, p.1.

introduction of various major and minor irrigation projects crops like paddy, banana, cocoa, coconut, arecanut etc, have competed away area under lemongrass cultivation as the relative profitability has changed in favour of such crops. To illustrate, in the Ernakulam district before the partial commissioning of the 'Periyarvali' irrigation project, lemongrass was grown even in the low land. After the introduction of irrigation facility, the cropping pattern shifted towards other crops by fully replacing lemongrass. Though on irrigated land, where water-logging do not exist, lemongrass is also more or less equally profitable, farmers are not aware and not much attempt has been made to educate them. This is another reason for the decline in the area under lemongrass cultivation.

8.6 Lack of incentives, technical advice etc.

It is also a fact that there is less promotion of the lemongrass oil production by the official machinery. In the case of several other crops much encouragement is being given. Thus it can be seen that incentives and technical advice given to crops such as Rubber, Tea, Coffee, Pepper, Cashew, Coconut etc. by the respective boards or through other agencies, helped to boost their cultivation. But in the case of lemongrass no such institutional set up exist, which affected the growth of lemongrass cultivation. In the words of Dr. M.S.Swaminathan[2] the Basic chemicals, Pharmaceuticals and Cosmetic Export Promotion Council is presently looking after the interests of lemongrass

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[2] Directorate of Marketing and Inspection (1982), op. cit, p. 46

oil and other essential oils. This is an industry which requires a systematic approach with adequate and concurrent attention to all the links in the production utilization chain. Therefore, an organisation say Essential Oil Board exclusively for essential oils is the only solution for it .

8.7 Lack of extension work

Most of the cultivators even now use the primitive method of distillation. In the conventional method of distillation a portion of the oil is lost due to technological drawback of the distillation process. The hydro-steam method of distillation with a perforated disc at the bottom, which is suitable for small cultivators was developed at the Aromatic and Medicinal Plants Research Station, Odakkali. The method is fuel efficient and superior to hydro-distillation method. Though it is suitable to small and medium farmers, to our dismay we note that most of the cultivators in Kerala are ignorant of it with the result that they still continue to adopt the conventional method of distillation. Thus, the lack of an effective extension work is yet another important reason for the stagnation and decline of lemongrass cultivation and its distillation.

8.8 Finance

In India for cottage and small scale industries lot of schemes have been evolved to provide adequate finance and other input requirements. Though distillation of lemongrass is a cottage industry it has not been explicitly recognised and hence many of the benefits enjoyed by other sectors of small scale and cottage industries are not available to the cultivators either due to

ignorance or due to apathy of the authorities. Since the cultivators are mostly tribals being illiterate, the problem becomes all the more significant.

8.9 Marketing

Marketing is another important problem faced by the cultivators. Earlier we have found that a large proportion of lemongrass oil is being exported. However its production takes place in remote rural areas and the cultivators do not have direct access to the market. As a result of this, a chain of intermediaries are engaged in the trade. In such a marketing structure a lion share of the profit goes to the middlemen and the cultivators are denied a fair price. The problem become all the more important in the case of tribals.

8.10 No suitable market for spent lemongrass

Spent lemongrass (grass after distillation) can be profitably used as cattle feed, manure and as a raw material for paper industry. At present an insignificant portion of the spent grass finds its use as manure and cattle feed with the result that the balance goes as waste. As an arrangement has not been evolved to profitably utilise this as a raw material in the pulp industry, this to a large extent can make the cultivation more remunerative.

8.11 Fragmentation of agricultural holding

Fragmentation of agricultural holding due to land reforms and population increase resulted in a number of uneconomic holdings for the cultivation of crops like lemongrass. Prior to the implementation of Land Reforms Act, lemongrass was cultivated extensively. When the Land Reforms Act exempted plantation crops such as tea, coffee, cocoa, rubber, cardamom

and cinnamon from ceiling limit no such exemption in the Act was given for the area under lemongrass cultivation though lemongrass had the status of a plantation crop. This to a certain extent has adversely affected the crop as at present it is cultivated on tiny fragmented fields.

8.12 Development of substitute material

Lemongrass oil is mainly used in the preparation of inones, an intermediary product for the manufacture of Vitamine A and perfumery. In Europian countries synthetic inones are developed which partially replaced lemongrass oil. India is also importing the synthetic inones and perhaps this might have led to the decline of the activity. Here it has to be pointed out that scarce foreign exchange resources the country will be able to save if lemongrass cultivation is encouraged. Further, as there appears to be a trend towards the use of more natural material in the world its popularisation can give a new impetus for the development of lemongrass cultivation.

8.13 Scarcity of water for distillation

Scarcity of water is a problem for lemongrass distillation in summer season. Lemongrass is a draught resistant plant which grow during summer also. Large quantity of water is required for the distillation. In some lemongrass cultivating areas drinking water itself is a problem during summer. In this scenario distillation of the grass becomes much more difficult.

8.14 Plantation of grantis(a variety of eucalyptus)

In Marayoor and Kanthalloor Panchayats of Idukki district, Grantis

(a variety of Eucalyptus) which is a fast growing tree, used for the manufacture of pulp and as fire wood is seen cultivated inside old lemongrass plantations. Lemongrass is a labour intensive crop. In the area under study also labour cost is increasing. So there is a tendency of cultivating labour saving crop. For planting Grantis major requirement of labour is only in the planting stage as recurring expenses are little. In this context some of the cultivators prefer planting Grantis in their lemongrass cultivation. This to some extend affected the area under lemongrass cultivation.

8.15 Prospects

It is seen that Kerala was the largest supplier of lemongrass oil in the world market. Due to various problems noted above oil production has declined considerably and the activity is now concentrated in Idukki district, where tribals are the major producers.

Lemongrass oil has diversified uses. It is commonly used as the basic raw material for the preparation of Vitamin A and also in soap industry. The oil is directly used in many pharmaceutical preparations such as pain balm and in some disinfectants. It is a good mosquito repellent and so is a constituent in some mosquito repellent creams. Insecticidal, antifungal and antibacterial properties are some among others. Now a major part of the oil is internally consumed by pharmaceuticals and its use is in an increasing trend. There is good demand for lemongrass oil in the world market. So any excess quantity produced can be exported.

There is large area of cultivable waste land in Kerala, especially in the Kannan Devan village of Idukki district. It is observed that the soil and climatic

conditions are suitable for lemongrass cultivation. From the discussion in the area, it is revealed that Tata Tea has lemongrass cultivation in their Vaguvara estate. This shows that lemongrass can be cultivated in a plantation basis like tea. Steam distillation can be profitably used for oil extraction. Firewood plantation can also be grown for lemongrass as it is now done for tea. If suitable high yielding varieties of lemongrass can be developed for different soil and climatic conditions of Kerala, green revolution for lemongrass can be achieved with the support of modern technology. Sothat we can regain our lost glory.

The need for encouraging the cultivation of grass and its oil extraction can be seen when considered several other factors. Pharmaceutical and cosmetic industries are the fastest growing sectors. An important source of demand for oil is from these sectors. At the same time in Kerala there are vast fallow area which are cultivable. For Example even in the Kanthalloor panchayat we have observed that 18.88 percentage of area is cultivable fallow land. Such land can be brought under lemongrass cultivation wherever possible. Also except deforestation that may occur on account of the demand for firewood, the crop is not only environmental friendly but also can to some extent control deforestation as spent grass can substitute forest based raw material for the manufacture of pulp. Further lemongrass is a labour intensive crop. Here again the role of women in its cultivation was found as significant. The state is also faced with the acute problem of unemployment. To a certain extent this problem can be alleviated by giving proper encouragement to crops like lemongrass. Besides as outlined above, this is an activity dominated by

the tribals. The poor socio-economic conditions and the need for their upliftment find reflection in the social programmes and policies of the state. It can reasonably be stated that crops like this if developed by sound state measures can go a long way in imporving the economic conditions of the tribals. Thus in selected areas where the crop can be popularised based on the consideration of agro-climatic and soil conditions, adequate state support may be provided.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

P.S. Jayapradeepu “Economics of lemongrass cultivation in Kerala ” Thesis. Department of Economics, Dr. John Matthai Centre Thrissur , University of Calicut, 2003

CHAPTER IX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

9.1 Summary and conclusions

An attempt has been made here to examine the status of lemongrass cultivation in Kerala, its problems and perspects.

The East Indian lemongrass oil of high commercial value is obtained by distillation of leaves of lemongrass Cymbopogon flexuosus Stapf. Leaves of the plant possess pale-yellow coloured essential oil containing citral. Citral is the aroma-chemical that emit lemon like odour and hence the plant is called lemongrass. Though lemongrass oil is known in trade for about 200 years systematic cultivation and distillation of lemongrass commenced only in 1882 in kerala. Among the world producers of lemongrass oil India stood first producing 85 per cent of the world produce. Since the outbreak of World War II the East Indian lemongrass oil was not readily available in the European countries due to shipping problems which resulted in the extensive cultivation of the West Indian type. Even then India produces a sizeable quantity of the oil and the contribution of Kerala is remarkable.

Lemongrass makes wild growth in many tropical and semi-tropical parts of Asia, Africa and in parts of Central America and South America. For the

extraction of the oil, wild grass is now rarely used, as cultivation of the grass has become a common practice. The major constituent of lemongrass oil is citral. It varies from 60 to 92 per cent depending on the variety of the grass, type of soil, application of fertilizer manure and climatic conditions. The value of lemongrass oil is determined by the percentage of citral in the oil. The common method for the estimation of citral content in lemongrass oil is the sodium bisulphite addiction method. By adopting column chromatographic method citral having 99 per cent purity can be separated.

Out of the two main types of lemongrass, Cymbopogon flexuosus Stapf (the East Indian lemongrass) is cultivated in Kerala. Cymbopogon citratus (the West Indian lemongrass) is grown mainly in Guatimala, Brazil and Cuba and is commonly known as American lemongrass. The Regional Research Laboratory, Jammu has identified the species Cymbopogon pendulus which is similar to East Indian lemongrass with the white stemmed dwarf plant known as Jammu lemongrass. It has high oil recovery and is suitable for cultivation in Jammu and Kashmir and in some North Indian states. Two varieties of lemongrass, the red and the white coming under cymbopogon flexuosus are found in Kerala.

Lemongrass oil is commonly used as the basic raw material for the preparation of vitamin A and also used in perfumery, confectionery and in soap industry. The oil is directly used in many pharmaceutical preparations such as pain balm and in some disinfectants. It is also a good mosquito repellent

and so is a constituent in some mosquito repellent creams. Insecticidal, antifungal and antibacterial properties are some other features of the oil. It is used as a blood purifier and in rheumatism. It is also used as carminatives, stimulatives, antiseptics and in antidotal treatment of snake bite and scorpion sting and also find use in cough, cold, fever,various stomach troubles etc. The grass is also used to flavour tea. Spent lemongrass is used for manuring in combination with organic manure and also used for making pulp for paper industry. Also it has to be noted that spent grass, can be converted into silage by addition of gram flour. It contains about 7-8 per cent crude proteins with calcium and phosphorus. It can also be used as fuel for distillation process or could be made use as farm yard manure.

It is observed that if eggs are placed on dry lemongrass for hatching, it can protect chicken from the attack of insects. A spray of the infusion of lemongrass or a light spray of lemongrass oil can also serve the above purpose. In Kerala, spent grass is popularly used as mulching material for ginger and there is a popular belief that lemongrass mulch reduces the incidents of rot and other fungal diseases. Trials conducted in collaboration with the Department of Bio-energy, Tamilnadu Agricultural University, Coimbatore showed that spent grass in combination with cowdung could generate reasonable amount of methane under anaerobic decomposition. Results confirm that heifers can achieve weight gain with the use of plant residues from

lemongrass (West Indian). Cultivation of mushrooms reached a biological efficiency of 113.01 per cent on lemongrass, 81.85 per cent on cinnamon and 56.79 per cent on pepper. Thus the grass and oil has diversified uses.

Studies on crop improvement and botanical aspects of lemongrass in the laboratory and campus conditions are abundant in Kerala, which has no relevance in the field operations. No systematic study has been made to explore the field operations of the crop. So the major data base of this study is compiled from primary data collected through field survey. However in some aspects primary data is supported by secondary data also. It is also found that our knowledge about the history of distillation, area under cultivation, farm practices, socio-economic status of the cultivators, cost of cultivation, productivity, profitability, employment generation capacity, problems faced by the cultivators, an economic farm size, marketing system, the role of middle men and the status of lemongrass cultivation on tribal economy of the region are little. In this context a focus on these aspects forms the subject matter of this study.

Lemongrass oil is of high commercial value and it is a major source of income for a number of cultivators. Though it is important, very little information is available about the nature of the crop and its cultivation practices, socio-economic status of the cultivators economics of the cultivation and the problems of the cultivators. As tribals are the major cultivators of the crop it

is important to examine the status of lemongrass cultivation upon tribal economy of the region. As no systematic attempt has so far been made to examine the above aspects, this study focused attention on them.

Lemongrass cultivation is concentrated in Idukki district. From Idukki district major lemongrass cultivation centre comprising of Marayoor and Kanthalloor panchayats were identified after conducting a pilot study. From there lemongrass cultivating pockets were identified. As there is no organization for the cultivators, address of the cultivating households were collected with the help of lemongrass oil dealers, social workers, heads of tribal colonies, local bodies, Krishi Bhavan, Government and non-Government organisations etc. As tribals are found to be the major cultivators of the region, to give proportionate representation, separate list for tribal and non-tribal cultivating households were collected. There was 380 tribal cultivating households and 257 non-tribal cultivating households in the centre. A sample of 40 per cent was drawn from each category using random sampling. Thus 152 tribal cultivating households and 103 non-tribal cultivating households were selected. A questionnaire was prepared and by personal interview method data was collected. The data was analysed by tribal and non-tribal cultivators. Data was also analysed by cross classifying the schedule by direct seeded, transplanted, manured, not manured, age and farm size of the cultivation. In the process of analysis simple averages, ratios and Cobb-Douglas production function were applied. The thesis consists of nine chapters.

It can be seen that distillation had a long history and the process got improved there after. Now there are three methods of distillation for lemongrass. They are hydro-distillation, hydro-steam distillation and steam distillation. The first distillation of lemongrass was made in Kerala during eighteen eighties using wild growth grass by a person from Cochin who was an agent of a foreign agency in Methala Hills in Ernakulam district. Considering the profitability of the activity the distillation system was copied by others which resulted in wide spread cultivation in Kerala. Later on in the low land due to pressure on land, increased labour and firewood costs, non-availability of a suitable high yielding grass variety, price fluctuation and spread of irrigation facilities changed the cropping pattern which adversely affected the area of lemongrass. Now lemongrass cultivation is concentrated in the high ranges of Idukki district.

According to the colour of the stem lemongrass in Kerala can be distinguished as the white stemed and the red stemed grass. The white stemed grass is seen cultivated in the high ranges of Idukki district only. In all other places red stemed grass is seen cultivated. It is observed that the white stemed grass has increased grass production and also higher percentage of oil in the grass eventhough citral percentage is low. It is not suitable for cultivation in low land and midland as the life and herbage yield of the grass are less there. Moreover it is not adapted to the climatic conditions. The opposite happen in high ranges, where the herbage yield and the percentage of oil in the red grass

are low eventhough citral content of the oil is high. Discussion in the area revealed that the white stemed variety was under cultivation in Marayoor and Kanthalloor for over 50 years. It is further noticed that 84 (32.94 per cent) cultivators have knowledge about OD-19 variety. The cultivators have no idea regarding other varieties produced by other research organisations.

It is observed that 211 (82.75 per cent) households cultivated lemongrass on hill slops and 44 (17.25 per cent) in the plain land. It is also found that all the tribal cultivations are in the hill slops while 59 (57.28 per cent) of the non-tribal cultivations are in the hill slop and the balance 44 (42.72 per cent) in the plane land.

It is seen earlier that area under cultivation declined considerably and the activity is now concentrated in Idukki district. Area under lemongrass from 1975-76 to 1998-99 shows that area ranged from 1209 hectares to 7762 hectares. The area under cultivation was 1209 hectares in 1997-98 which increased to 1538 hectares in 1998-99. It is also noticed that out of the 1538 hectares reported during 1998-99, 1116 (72.56 per cent) hectares were in Idukki district. Further it is noticed that, from 1991-92 onwards area under lemongrass has been increasing in Idukki. This shows that the activity is concentrated in Idukki district.

In the case of seed collection out of the 152 tribal households, 113 (74.34 per cent) collected seed from the wild growth grass of the forest. The

advantage of this process is that only labour cost is incurred in it. In the case of non-tribals only 39 (37.86 per cent) are collecting seed from wild growth. Regarding purchase of seed from open market it is seen that 64 (62.14 per cent) non-tribal households and 39 (25.66 per cent) tribal households have purchased seed from open market. Another observation is that seed production in farms are not practiced by the cultivators. Mainly there are two reasons for this. For seed production grass has to be preserved without cutting for distillation for a long period. Moreover after seed production grass will dry . During monsoon grass will grow but take one or two years to recoup the earlier position.

Two methods of planting are in practice. They are direct seeding and transplanting methods. Vegetative propagation is also possible. Plants grown from seeds have more life. Direct seeded gave a higher yield during the first year of planting. But transplanted grass gave higher yield during subsequent years. Majority of the cultivators are practicing direct seeding due to high initial expenditure for transplanting operations and difficulty in raising nursery well in advance of monsoon due to lack of irrigation facilities.

Land has to be prepared properly by ploughing. For broadcasting 15 to 20 kg. seed is required per hectare. After broadcasting the seed, small quantity of soil is put on it as covering. If sufficient moisture is there in the soil, seeds will germinate within a period of one week. For transplanting in one hectare 8 to 10 kg seed has to be shown in 20 to 25 cents of land. Seedling

can be transplanted within 60 to 70 days at a distance of 15 cms. The transplanted crop is found to produce higher herbage yield and thereby higher oil production.

The plant cannot withstand water logging. So good drainage has to be provided in farms. A study in this line showed that cultivators are having knowledge about this and they have provided drainage in their farms.

Eventhough manure and fertilizer can increase grass production and thereby oil production, cultivators are not applying manure in the recommended dose. It is observed that the cultivators are not fully aware of the method of chemical fertilizer application in lemongrass cultivation.

Weeding and earthing up are important recurring operations. Weed competition can reduce production by 50 per cent. Weeding is followed by earthing up. Manure or compost is generally applied at the time of earthing up. These operations are easier in transplanted grass, by which labour cost can be saved.

Timely harvest is important for good oil recovery and citral content. Young grass have low citral content with poor solubility in 70 per cent alcohol. It is observed that first cutting is usually taken within 90 to 100 days after planting. Subsequent cuttings are taken within an interval of 50 to 60 days. In th area 4 to 5 cuttings are usually taken. It is seen that cultivators have good knowledge in the scientific aspects of harvesting.

Grass is transported to distillary. It has to be distilled within 48 hours for good results. Chopping grass into 3 cm length before distillation can increase oil recovery as it will result in exposing directly more oil grands. It is also reported that dipping of chopped grass in sodium chloride solution for 24 hours can enhance citral content of the oil. Three types of distillations are reported. They are hydro-distillation, hydro-steam distillation and steam distillation.

Field study revealed that distillation is usually done within 48 hours. Those who have distillary are distilling grass before it is dried. Those who are not having distillary, sometimes the grass has to be kept over 48 hours. Rent for distillation is one ounce of oil per distillation.

As to the age of cultivation was examined it is seen that out of the 255 households 162 (63.53 per cent) have plantations above 10 years. Out of which 101 (62.35 per cent) households come from tribals and 61 (37.65 per cent) from non-tribals. There are 93 (36.47 per cent) households having cultivation below 10 years. In this category come 51 (54.84 per cent) tribal households and 42 (45.16 per cent) non-tribal households. In general it is seen that old plantations are higher than new plantations.

Burning of grass in summer is advantages as it can destroy weed growth and insect larva. This has been found to have revitalising effect on grass. During monsoon gap filling has been found to increase grass production. It is observed that 43 (28.29 per cent) of the tribal cultivators and 12 (11.65 per cent) of the non-tribal cultivators are burning grass.

Experiments proved that prolonged storing of oil decrease citral content. It is also seen that antioxidants can prevent the loss of citral while storing. If the oil is kept air tight in aluminium contriners and kept in darkness, oil can be preserved from the loss of citral for a longer period. It is observed that the cultivators are selling their produce immediately after distillation due to fiancial difficulties.

Lemongrass oil is sold to different dealers which include provision merchants, local dealers and co-operative society. Small portion of the producers sell their produce in the provision shop. Such producers buy provision goods and also receive money in advance with the condition that the oil produced will be given to them. Others sell oil to the local dealer or society. Sale to the wholesaler is rarely practiced.

Coming to the socio-economic status of lemongrass cultivators, religion / caste break up of households revealed that out of 255 cultivators 152 (59.61 per cent) belonged to the tribal and 103 (40.39 per cent) to the non-tribal communities. This reveals that there is significant participation of non-tribals also in the cultivation of lemongrass. Sex ratio of lemongrass cultivating households shows that out of the total population of 1260, males come to 631 and females 629 giving a sex ratio of 997 females per 1000 males.

Number of nuclear households in each community, the percentage distribution of population of lemongrass cultivating household by age group

and housing condition were studied. Out of the 255 houses 134 (52.55 per cent) were thatched, 19 (7.45 per cent), thatched and tiled, 56 (21.96 per cent) fully tiled, 31 (12.16 per cent) tiled and concrete, and 15 (5.88 per cent) fully concrete.

Educational level of the households shows that out of the total population of 1260, illiterates constitute 191 (15.16 per cent). A portion of the population 260 (20.63 per cent) can read and write eventhough they have no formal education. It is further noticed that 385 (30.56 per cent) persons have below primary education and 250 (19.84 per cent) below upper primary level. Those who have studied upto 10^{th} standard comes to 97 (7.70 per cent). It also reveals that 52 (4.13 per cent) persons passed SSLC and persons having higher education such as degree, diploma and certificate holders together come to 25 (1.98 per cent). Thus in general the population is left behind as far as higher education is concerned. The study in general shows the poor socio-economic conditions of the cultivators, especially the tribals.

Particulars of land operated by lemongrass cultivating households were studied. Out of the total 333.286 hectares owned /occupied, area leased in comes to 14.529 hectares and leased out 13.699 hectares. Total net area operated by the households comes to 334.116 hectares.

Sources of land entitlement was examined. It is observed that 135 (88.82 per cent) of the tribal and 73 (70.87 per cent) of the non-tribal households inherited land and the balance entitled by sources such as purchase, out of land reform measures, gift etc.

Ownership pattern of consumer durables, live stock and jewellery were also studied which shows that ownership of consumer durables and jewellery was low in tribal households.

Sources of household income shows that the average annual income of a tribal household was Rs. 13679/- and a non-tribal household Rs. 14745/-. Among the sources of income, net income from agriculture is the highest both for non-tribals and tribals.

Size of holding and ownership pattern are examined. Total net area operated by the sample household is 334.116 hectares. Land operated are either area owned or occupied by the cultivators. Total area owned comes to 174.802 hectors which comes to 52.32 per cent of the total net area operated and area occupied comes to 159.314 hectors which comes to 47.68 per cent of the total net area operated. Average household area of the sample comes to 1.310 hectares.

In the case of borrowings it is seen that average borrowings for tribals was Rs. 2806/- and for non-tribals Rs. 3842/-. Work participation rate of the sample shows that 6.68 per cent of children (below 14 years), 68.18 per cent in the workable age group (15 to 60 years), and 35.51 per cent of the old (61 and above) are participating in some work. Regarding occupational distribution of the sample it is seen that a total of 584 workers are in the sample, out of which 343 (58.73 per cent) belonged to tribal community and 241 (41.27 per cent) non-tribal community. Majority of them are engaged in agriculture.

Out of the total 255 household 157 (61.57 per cent) households have major source of income from lemongrass cultivation which is followed by labour 42 (16.47 per cent) households. Other agricultural income constitute a major source for 40 (15.69 per cent) households. In the case of 6 (2.35 per cent) households business provided the major source of income. Collection of forest produce provided major source of income to 5 (1.96 per cent) households. Profession provided a major source of income to 5 (1.96 per cent) households. It is also observed that 43 (16.86 per cent) households are under poverty line. Regarding under employment it is seen that 158 (27.05 per cent) work participants are under employed as they have work below 300 days.

Coming to the economics of lemongrass cultivation cost of cultivation, productivity, profitability, employment potential, economic farm size, optimum farm size and role of lemongrass cultivation in tribal economy of the region was studied. Under cost of cultivation planting cost comes to Rs. 7038/- community difference, method of planting, use of manure and farm size influence planting cost. For recurring operations cost per hector comes to Rs. 20858/-. Major recurring operations are weeding, manuring, earthing up, harvesting and transportation and distillation. Major share of recurring cost is incurred for harvesting and transportation. It amounted to Rs. 9511/- (45.60 per cent) of the total recurring cost. It is followed by Rs. 8147/- (39.06 per cent) for distillation. For weeding an amount of Rs. 1676/- (8.04 per cent) was incurred.

Cost for earthing up was found as Rs. 860/- (4.12 per cent). Least expenditure of Rs. 664/- (3.18 per cent) was recorded for manuring.

Incidence of ownership of distilleries was examined. It shows that out of the 152 tribal households 44 (28.95 per cent) households possessed distillery and out of the 103 non-tribal households 22 (21.36 per cent) possessed distillery. Distillery is the only fixed investment (excluding land) for lemongrass. Cost of distillery ranged from Rs. 3475/- to Rs. 3975/-. Abundant water source is necessaryfor distillary and this is a constraint in setting distilleries.

For lemongrass, cost is incurred in two stages. viz. planting cost, maintenance cost and harvest stage cost. Planting cost is non-recurring, average of which comes to Rs. 7038/-. Maintenance cost and harvest stage cost are recurring which comes to Rs. 20858/- per hectares. Thus total cost of cultivation for lemongrass comes to Rs. 27896/- per hectares. This total cost is divided into material cost and labour cost. Labour cost comes to Rs. 21399/- (76.71 per cent) and material cost Rs. 6497/- (23.29 per cent). Major component of material cost is firewood which comes to Rs. 4547/- (16.30 per cent)of the total cost. Share of seed comes to Rs. 1050/- (3.76 per cent) and total cost of manure for planting & recurring operations comes to Rs. 900/- (3.23 per cent).

Major component of total cost is cost for harvesting and transporting. Per hectare of the same comes to Rs. 9511 (34.09 per cent). Next comes cost for the preparation of land and planting, which comes to Rs.5510/- (19.75

per cent). Next in importance comes labour for distillation for which Rs. 3600/- (12.91 per cent) is incurred. An amount of Rs. 1676/- (6.01 per cent) is spent for weeding and Rs. 860/- (3.08 per cent) for earthing up. Labour cost for manure application comes to Rs. 242/- (0.87 per cent). The labour oriented nature of the crop is evident as labour cost comes to 76.71 per cent of the total cost.

Average oil production of the sample is 64.445 kg. per hectare. Factors such as community difference, method of planting, use of manure, effect of shade, age of plantation and farm size influence oil production. The extend of production variation is examined. Influence of community on oil production shows that tribal cultivators had an average oil production of 66.011 kg while non-tribals had 61.773 kg. The difference is due to increased grass production of tribal cultivators because of higher soil fertility and favourable climatic conditions of the forest region, where majority of the tribal cultivations were seen.

Productivity is evaluated according to method of planting. Transplanted plantations produced 70.768 kg. and direct seeded plantations 63.785 kg. of oil per hector. Higher productivity of the transplanted plantations were due to higher grass production of the transplanted crop.

Application of manure had positive effect on grass production and thereby oil production. While manured plantations produced 71.020 kg. of oil per hectore, oil production from not manured grass was limited to 63.559 kg.

Some lemongrass plantations were shade affected due to Grantis (a type of Eucalyptus) planting and other shade trees. Shade has an adverse effect on grass production, oil recovery and quality of the oil.

Age of plantation was found to be an important factor which influenced grass production and thereby oil production. For the purpose of this study plantations are grouped into new (upto 10 years) and old (above 10 years). In the study it is found that new plantations had an average production of 72.625 kg per hectare and old had 60.522 kg. This is because new plantations had good grass production upto 10 years and ageing has an adverse effect on grass production. Farm size is yet another important factor which determined oil production. Production figures shows that small plantations produced 74.218 kg., medium 62.916 kg. and large 60.545 kg. per hectare. Higher productivity of smaller farms are due to intensive cultivation practices adopted by the cultivators. Most of the plantations of this group are new, transplanted and manured.

Coming to profitability of the crop average profit per hectare is worked out as Rs. 6547/-. As receipt and expenditure vary due to community difference, method of planting, manuring, effect of shade age and farm size profit also vary. It ranged from Rs. 4105/- to Rs. 8471/-.

Labour requirement was also examined stage wise. For direct seeding 38 male and 29 female mandays and for transplanting 46 male and 52 female

mandays were employed. Higher labour required for transplanting is due to additional labour input for raising nursery and for transplanting operations. For recurring operations such as weeding, manuring and earthing up 10 male and 31 female mandays were required. For distillation and harvesting 37 male and 152 female mandays respectively were required. Thus it is seen that for planting an average of 165 mandays and for recurring operations 230 mandays were required resulting a total of 304 mandays per hectare. This shows the labour intensive nature of the crop.

Cobb-Douglas production function estimate was worked out for the whole sample and for tribals and non-tribals separately. For the estimation, output was measured in kg of grass per hectare and labour input in mandays per hectare and capital input in value per hectare. The results are indicative of increasing returns as the t values are greater than 2.58 for 1 per cent significance level. As the Cobb-Douglas formula relates the product function by $Q = aL^pC^{1-p}$, the probability determines the more significant variable for the increase in product. In the case of non-tribals, the t value (-0.836) shows non-significance of the variable capital. Thus labour is significant in th case of non-tribals. But for tribals, the t value (3.858) of capital shows significance. So the variable capital is significant for tribals. The co-efficient of determination (R - Square) is 0.903. As it tends to 1, shows the significance of the variables labour and capital in the production function.

An economic farm size for the sample is identified. It is found that 1.68 hectares of this cultivation can provide a family with an income of Rs.11,000/- (Poverty cut off limit in the 9th plan), which is taken as the cut off level income. In the case of tribals it comes to 1.33 hectares and for non-tribals 2.68 hectares. Optimum farm size for a distillery was identified as 4.80 hectares. Those who do not own distillery, distill grass on rent distillation. It was found that it is economical for a cultivator to go for rent distillation if the cultivated area is less than 0.606 hectares. Where as above this size of cultivated area it is observed as ideal to own the distillery.

The cultivators were confronted with a number of problems. In the cost structure cost of firewood account for a major share as in the distillation process firewood is used as fuel. In plain land firewood has become scarce and this led to a steep price increase. This has hurt the cultivators badly.

Lemongrass cultivation declined in Kerala as comparative profitability had changed in favour of other crops. It is observed that low productivity of lemongrass is a major reason for the decline of this cultivation. An improved variety of lemongrass OD-19 distributed for cultivation in Kerala is capable of producing 100 kg. of oil per hectare per year. At the same time it is reported that other varieties developed in India such as RRL-16, LS-48 and CKP-25 are capable of high oil production. It is reported that CKP-25 can produce more than 375 kg. of oil per hectare. Possibility of cultivating these varieties in the high ranges has to be tried.

It is a fact that there is less promotion of the lemongrass oil production by the official machinery. In the case of several other crops much encouragement is being given. Thus it can be seen that incentives and technical advice given to crops such as rubber, tea, coffee, cashew, coconut etc. by the respective boards or through other agencies helped to boost their cultivation. But in the case of lemongrass no such institutional setup was there which affected the growth of lemongrass cultivation. Therefore an organization say Essential Oil Board exclusively for essential oils is the only solution.

Price is an important factor that determine the profitability of any crop. In India the farmers are primarily depended upon the middle men for marketing and farmers are not getting a remunerative price. This is particularly true in the case of lemongrass cultivation as it is a much more unorganised activity. There is price fluctuation also. From 1996 onwards an increase in price was noticed. Wholesale price index number of lemongrass oil shows that there is price hike during 1996 and only moderate price variation is noticed thereafter. If this trend continues area under lemongrass is likely to increase.

Lack of extension work, finance, marketing problems, expansion of irrigation fecilities, fragmentation of agricultural holding, development of substitute material, scarcity of water for distillation, plantation of Grantis (a variety of Eucaliptus) are some other problems.

Impact of lemongrass cultivation on tribal economy of the region showed that for 103 (67.76 per cent) tribal households lemongrass cultivation was the major source of income. Land utilisation particulars of Marayoor and Kanthalloor Panchayaths (area of the study) reveals the importance of the crop in the region, where tribals constitute nearly 17 per cent of the households. In Marayoor and Kanthalloor Panchayats lemongrass occupy the major share in land utilisation where 1000 (38.71 per cent of major crops) hectares in Marayoor and 380 (30.23 per cent of major crops) hectares in Kanthalloor are under the crop. Moreover average net household income of the tribals from lemongrass cultivation comes to Rs. 6730/- (69.40 per cent of the net income of Rs. 9697/- from agriculture). All these show that lemongrass cultivation plays an important role in sustaining the tribal economy of the region.

An efficient and cheap cooling system being used by cultivators of Wayanad has been identified. It can be successfully used in some areas of Idukki district where good water source is available. Here, instead of the coiled coil system used for cooling, a 1 inch iron pipe having a length of 20 feet is needed, which can decrease the cost of cooling system from Rs. 1450/- to Rs. 380/-. So this cooling system may be popularised in some areas of Idukki district, where good water source is available.

The cultivation is being conducted by the weaker section of the society and majority of them are tribals. It is also seen that lemongrass provided as a

major source of income to 61.57 per cent of the cultivating households. Further it is a labour oriented crop as 76.71 per cent of the total cost is incurred as labour cost. Unemployment and underemployment are serious problems in the agricultural sector expecially in the tribal area. Now sufficient encouragement is not given to lemongrass cultivation at Government level. As it is a labour oriented crop and income from the cultivation provides good financial support to the cultivators who constitute the weaker section of our society, this cultivation may be encouraged.

9.2 Recommendations

Based on the above finding the following are the recommendations:

1. The existing old and uneconomic plantations shall be replanted with high yielding varieties of lemongrass, for which seed, fertilizers/manures and plant protection materials shall be supplied to the growers at a subsidised rate. Also planting subsidiary may be given to them. At present short term loan @ Rs. 10,000 /- per ha.(Rs.8000/- in cash and Rs.2000/- in kind) is being given to the lemongrass cultivators of Idukki district by the union Bank of India under the District Credit Plan 2001-2002 which maybe enhanced to 20000/- as the recurring expenses per hectare is estimated as Rs. 20858/-.

2. There must be arrangements to ensure price stability to the growers. For this remunerative price has to be notified for lemongrass oil. By purchasing oil at the notified price and by setting up a buffer stock, Goverment can ensure the notfied price to the growers. The condition of lemongrass oil market in Kerala is defective. There is oligopoly situation on the part of buyers and competition on the part of sellers. This can be checked by forming a buffer stock of lemongrass oil with the help of co-operative socieities. The main objective of buffer stock is to achieve equlibrium in supply and demand, which can ensure price stability. This will help to get a remunerative and resonable return to the growers. This will also help to achive a balance in supply and demand.

Financing the lemongrass oil stock must be met with the assistance of Government or the proposed Essential Oil Board. By withholding and releasing the required volume of produce properly, the agency can effectively achieve this goal. A buffer stock is the only permanent solution for the problem of price fluctuation in the lemongrass oil market and ensuring the notified price to the growers.

3. Tribals are the major producers of the oil and this activity has good influence on the economic status of tribals of the region. The activity is concentrated in Idukki district and the Grama panchayats where lemongrass can be successfully cultivated shall prepare appropriate schemes in co-operation with the Tribal Development department banks, Forest department, Agricultural department, Government and voluntary agencies for the development of lemongrass cultivation. This can help in improving the economic status of the cultivators especially our hill tribes.

4. Due to low productivity of the existing varieties of lemongrass, oil production is not at the desired level. Even the high yielding red variety of O.D-19 developed at the Aromatic and Medicinal Plants Research Station is not found suitable in the major production centres like Kanthallor and Marayoor Panchayat areas as the variety is not suited to the high range climatic conditions. This emphasis the need for developing a high yielding variety suitable for the region. RRL -16, (Jammu lemongrass) CKP-25 etc are very high yielding types of grass compared

to the existing local white variety or the red variety OD-19. So it is recommended that research has to be conducted to evolve a high yielding variety suitable for the climatic conditions of the high ranges. RRL-16 which is a frost resistant high yielding white variety of grass may also be tried in these regions.

5. Eventhough different institutions and agencies have made considerable research in crop improvement, farm management and related fields, benefits of the same have not reached to the cultivators. Literature on the productivity of lemongrass showes that proper application of manure and chemical fertilizer has high impact on grass production and oil content. Field study revealed that cultivators are not using chemical fertilizer for the crop for the reason that it will decrease the life of the crop. Eventhough some cultivators are using manure, they are using it not in the recommended quantity. Further irrigation can also boost grass production. Farms are not irrigated by the cultivators, even if it is possible. They fear that irrigation will decrease the life of the grass. So proper extension work has to be done to educate the cultivators regarding the optimum level of irrigation. It is said that 1 or 2 irrigations during summer is needed. Considering all these, it is seen that there is an urgent need to educate the cultivators regarding the application of chemical fertilizer, manure, plant protection materials and irrigation. This can maximise production per unit of cultivated area.

6. Lemongrass growers co-operative societies have to be set up in areas where the cultivation is concentrated. It is recommended that fuel efficient and steam distillaries may be set up under these societies. Spent grass may be utilised for the manufacture of pulp or other value added products so that the cultivators can get more return from their farm. Moreover this can to some extend control the deforestation.

7. Eventhough distillation of lemongrass is done as a small scale village industry, it is not included in the list of industries approved by the Khadi and Village Industries Board. So the cultivators are denied much benefits. As the cultivators belong to weaker sections of the society many are not able to afford the initial investment for setting a distillery. Thus a good number of the cultivators are distilling their grass on rent resulting in huge financial loss. To overcome this, lemongrass distillation may be recognised as a small scale and cottage industry and all facilities to such industries may be given to lemongrass distillation also. Moreover subsidy may be given to the cultivators for setting own distilleries.

8. Cost of distillation is a major cost in the recurring cost structure of which fire wood is a major component. A complaint raised against this cultivation is that fire wood for lemongrass cultivation is collected from forest which result in deforestation. Tribals are of the opinion that fire wood collection has been a tribal occupation from time immorial and they collect fire wood from forest for their home use and for lemongrasss

distillation. They sell fire wood to non- tribals by which they earn income. The practice of tea plantations can be adopted by the lemongrass cultivators whereby areas less suitable for lemongrass cultivation can be devoted for firewood plantation. For this seedlings of fast growing fire wood trees shall be given to lemongrass cultivators and other forms of encouragement be given. So also vacant government land may be made available for growing firewood trees.

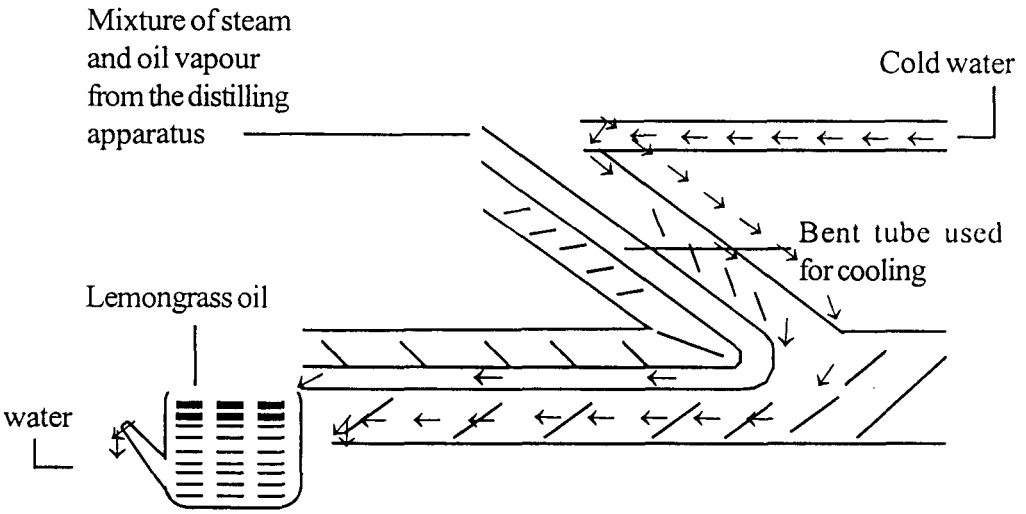
9. Lemongrass cultivation is the major source of income to 67.76 per cent tribal cultivating households in the area. To improve their financial conditions further, it is recommended that Government shall give the tribals fire wood collected from forest by the forest department at a collection cost or even at subsidised rates, through tribal co-operative societies. By this, tribals shall get fire wood for lemongrass distillation and the present argument of deforestation for the promotion of lemongrass cultivation can be overcomed.

10. It is evident from the cost structure of distillaries that 41.73 per cent of the cost comes to the cooling system comprising of the cooling tank and the coiled coil in the tribal area, out of which 28.78 per cent comes to the cooling tank. Moreover due to rusting, the cooling tank has to be replaced periodically. If the cooling tank can be replaced from the distilling system it will be of high advantage. Investigations were made to evolve an economic cooling system which can be used by an ordinary

cultivator. From the field study it has become evident that a method of cooling practiced by some cultivators of Wayanad district can be introduced in Idukki district also, where ever feasible. Cultivators of Idukki district have no knowledge about this low cost system. In this system a bent tube having 1 inch diameter and 20 feet length is fitted to the distilling apparatus. In this, the cooling tube is completely dipped in flowing cold water as shown in the diagram.

DIAGRAM 3

A CHEAP COOLING SYSTEM



The bent tube is dipped in cold water flowing through a wooden channel. Cultivators are of opinion that by using the above cooling system oil recovery is slightly increased and cost of cooling system can be reduced considerably.

11. In the construction of choola also the conventional method is in use. Fuel efficient choolas are designed by different institutions and agencies. Discussion in the field have shown hope for designing more efficient choola for use in lemongrass distillation. Use of a perforated metal sheet at the bottom of the choola was in use in years back. This sheet in due course become hot and emit heat. It also help fire wood blow continuously saving fuel. Now this sheet is not in use due to the high price of the metal sheet. After sometime old iron rods are used by some cultivators in the place of the perforateded sheet. Now this also is replaced by long stones due to the increased cost of iron bars. By using metal sheet fuel and distilling time can be saved due to heat emited by the perforated sheet. So use of perforated metal sheet may be encouraged. This may be supplied at a subsidised rate.

12. Out of the three methods of distillation which can be used for the extraction of lemongrass oil, all the cultivators are using the conventional method of water distillation. In the water and steam distillation method a perforated disc is fitted at the bottom of the still above the water level. Grass for distillation is filled over the perforated disc. When heated grass is distilled using steam produced from water stored at the bottom of the still. By using this fuel efficient method, both quantity and quality of oil can be increased. Distillery of this type can be manufactured with little extra cost. Training has to be given to the manufacturers regarding construction and to the cultivators for using it.

13. Growing scarcity of fire wood is an important constraint in lemongrass cultivation. To overcome this, fuel efficient steam distillaries may be set up, as far as possible in the co-operative sector in the centres where these is concentrative of this crop. By this considerable quantity of fuel and labour for distillation can be saved. Continuous distilling system reported to be in operation in Russia may also be experimented.

14. Lemongrass oil do not come under any commodity board while for several other crops to took after the improvement of cultivation, export of oil etc and also to provide technical advice to the cultivators there are specific Boards. A board such as an Essential Oil Board may be established to promote the activity as also to promote export.

15. Lemongrass is being distilled using the old distillation process. Due to unregulated heating and the distilling apparatus being made of tin, it is reported that the quality of oil is decreased. Stainless steel is reported to be best suited for the still. Due to the inferior quantity of oil sometimes it become difficult to compete in the export field. To avoid this, steps may be taken to get better guality oil by modifying the distillation process.

16. At present no proper statistics are being maintained regarding the area under cultivation, production of oil etc. Department of Economics and Statistics is the only Government agency which is collecting area under the crop and oil produced yearly. Figures reported by the department is below the actual figures as area under lemongrass inside the forest cultivated by the tribals are not fully accounted, where the activity is

concentrated. This affect planning in agricultural sector, especially for planning in tribal agricultural programmes. Therefor it is recommended that arrangements shall be made at Government level to get a better picture on the area under cultivation and oil production.

17. Area under lemongrass cultivation may be considered for exemption from land ceiling. This can help to boost the area under cultivation.

18. Lemongrass cultivation may be included in the waste land development programme.Vast areas of cultivable waste land in Kannan Devan Village may be tried with this crop, planting with suitable frost resistant varieties like RRL-16, on a plantation basis. Now tea is the major plantation in the area. Fire wood plantations for lemongrass can be grown in the same way as it is now done for tea. If this gole can be achieved we can have vast foreign exchange through the export of the oil.

19. Industries using lemongrass oil as raw material may be encouraged so as to convert lemongrass oil into value added products in pharmaceuti cal, perfurmery and other related fields. This can increase internal demand and the producers will get reasonable price for their produce.

20. A number of cultivators are engaged in the production of the oil and also there are a number of dealers handling the oil. But there are only few exporters. It is further noticed that possibilities of exporting the oil is not fully exploited. Appropriate measures may be adopted by the Goverment to tap fully the export market.

APPENDIX

ECONOMICS OF LEMONGRASS CULTIVATION IN KERALA QUESTIONNAIRE

BLOCK 1

IDENTIFICATION AND OTHER PARTICULARS OF THE FARMER

1. Name of the respondent :
2. Address :
3. Relationship to the head of the household :
4. Religion :
5. Whether belonging to SC/ST/OBC/Others :
6. Main occupation :
7. Subsidiary occupation :
8. Educational level :
   a) General :
   b) Technical :
9. Training if any (give particulars) :

BLOCK II
PARTICULARS OF FARM

	Owned	Leased in	Leased out
1. Total net area operated (in cents):			
2. Type of holding (Individual/ combined/ Institutional) :			
3. Terms and conditions of lease :			

BLOCK III
CROP PATTERN AND LAND UTILIZATION

Area (Cents)

A. Area under Seasonal Crops (Cents)

Sl. No.	Autumn Crop	I	UI	Winter Crop	I	UI	Summer Crop	I	UI
1.									
2.									
3.									
4.									
5.									

B. Area under Annual Crops (Cents)

Banana				Sugarcane				Betel leaves		Pineapple	Plantain	
A(I)	A(U)	C(I)	C(U)	A(I)	A(U)	C(I)	C(U)	I	U		A	C

C. Perennial Crops (Numbers)

Coconut				Arecanut				Cashew		Pepper		Jack
B(I)	B(U)	Y(I)	Y(U)	B(I)	B(U)	Y(I)	Y(U)	B	Y	B	Y	

Perennial Crops - (Contd.)

Mango	Palmyra	Tamarind	Rubber Area	Tea Area	Coffee Area	Cardamom Area	Nutmeg	Cloves	Cinnamon	Cocoa	Papaya	Drumstick

Perennial Crops - (Contd.)

D. Area Irrigated (Cents)

Lemon grass Area	Fodder grass Area	Green manure Area	Other oil seeds	Other fruits	Other trees	Net Area	Source	Number
(I)	(U)							

E. Land Utilisation (Cents)

Building and Courtyard	Other non agricultural uses	Barren and uncultivable land	Misc. tree crops	Pastures and grazing land	Cultivable waste	Other fallow	Current fallow	Net area under cultivation

BLOCK IV
PARTICULARS OF AGRICULTURAL INPUTS USED FOR LEMONGRASS CULTIVATION

1. Seed used (Hy.V/O.D-19/Improved/ Local) :

2. Colour of the stem (Red/White/Other colours (specify) and local name if any :

3. From where the seed was obtained :

4. Number of years this variety was under cultivation :

5. Have you ever cultivated other varieties. If so name of the variety and reason for changing it. :

6. Have you knowledge about O.D-19 variety :

7. Do you know about any other varieties used in Kerala/other States :

8. Whether fertilizers/manures used (Yes/No) :

9. If yes, trade name and quantity used per acre per year :

10. Whether irrigated or not :

11. If irrigated number of times per year :

12. Trade name and quantity of plant protection materials used per year :

BLOCK V
COST OF CULTIVATION AND EMPLOYMENT POTENTIAL OF LEMONGRASS

A. GENERAL PARTICULARS

1. Net area under lemongrass cultivation :

2. Type of land (High land/Mid land/Low land) :

3. Whether Owned/Leased/Forest land :

4. Age of the plantation 1 .....2 .....3. .....
   (Specify age and size of the plot)

5. Area under nursery :

B. COST OF RAISING NURSERY

I. Costs other than labour :-

	Quantity Kg.	Rate per quintel	Total cost
1) Seed			
2) Compost			
3) Manure			
4) Chemical fertilizers			
5) Irrigation			
6) Others (specify)			

II. Labour charges :-

	Man days			Wage rate		
	Male		Female	Male	Female	Total cost
	Own	Hired	Own Hired	Rs.	Rs.	Rs.
1) Preparation of land for nursery						
2) Sowing of seed						
3) Irrigation						
4) Weeding						
5) Earthing up						
6) Others (specify)						

C. COST OF CULTIVATION FROM 1st YEAR TO 6th YEAR AND FOR 2000-01

I. COSTS OTHER THAN LABOUR

Trade Name	Fertilizers / Manures / Compost — Quantity and rate: Ist year	2nd year	3rd year	4th year	5th year	6th year	2000-01	Cost for fertilizers/ Manures/ Compost (Rs.)	Other cost Rs.	Total cost Rs.
1	2	3	4	5	6	7	8	9	10	11
1. Chemical fertilizers										
2. Manures										
3. Compost										
4. Fuel for distillation										
5. Water charges, electricity charges etc. for irrigation										
6. Maintenance of still and shed										
7. Rent of land										
8. Others (Specify)										

II. LABOUR CHARGES

	Man days and wage rate																												Total Rs.	
	Ist year				2nd year				3rd year				4th year				5th year				6th year				2000-01					
	M		F		M		F		M		F		M		F		M		F		M		F		M		F			
	Own	Hired	Own	Hired	Own	Hired	Own	Hired	Own	Hired	Own	Hired	Own	Hired	Own	Hired	Own	Hired	Own	Hired	Own	Hired	Own	Hired	Own	Hired	Own	Hired	Own	Hired
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1. Preparation of land for transplanting / direct sowing																														
2. Application of chemical fertilizers/manures/ compost																														
3. Direct sowing																														
4. Transplanting																														
5. Earthing up																														
6. Harvesting																														
7. Transportation																														
8. Distillation																														
9. Weeding																														
10. Irrigation																														
11. Others (specify)																														

III PARTICULARS OF FIXED INVESTMENT

1. Do you own a still and shed (Yes/No) :

2. Particulars of still and other investments :

Sl. No.	Items	Year of construction/ purchase	Value Rs.	Expected life of the asset
1	2	3	4	5
1	Still			
2	Shed			
3	Pump Set Pump House			
4	Others if any (specify)			

BLOCK VI

PRODUCTIVITY AND MARKETING OF LEMONGRASS

	1st Y	2nd Y	3rd Y	4th Y	5th Y	6th Y	2000-01
1. Quantity of grass received :							
1st cut :							
2nd cut :							
3rd cut :							
4th cut :							
5th cut :							
6th cut :							
2. Quantity of lemongrass oil received :							
1st cut :							
2nd cut :							
3rd cut :							
4th cut :							
5th cut :							
6th cut :							
3. Method of distillation adopted :							
4. Whether distillation is conducted immediately after cutting or after wilting (specify days) :							
5. Whether grass is charged into the still in small bundles or after chopped into 3cm. size :							
6. Whether the chopped grass is dipped in sodium chloride solution for 24 hours before distillation :							
7. Whether burning of dry grass is practiced prior to the onset of monsoon :							
8. Whether you have provided drainage facilities in your farm :							
9. Details regarding intercropping :							

10. To whom you sell lemongrass oil :

11. Do you sell lemongrass oil immediately or during off season :

12. Whether he is a registered dealer or a local agent :

13. Do you get a reasonable price for the oil, if not why :

14. Have you knowledge about citral test :

15. Do you ascertain the citral percentage of the oil :

16. Citral content yearwise : Ist 2nd 3rd 4th 5th 6th 2000-01

17. What is the citral percentage of the oil obtained from the grass you cultivate (2000-01) : Ist cut 2nd cut 3rd cut 4th cut 5th cut 6th cut 2000-01

18. State the marketing problems :

19. Quantity of spent grass obtained in tonnes : Ist Y 2nd Y 3rd Y 4th Y 5th Y 6th Y 2000-01

20. Quantity of ash obtained in tonnes :

:

BLOCK VII

SOURCES OF BORROWINGS FOR LEMONGRASS CULTIVATION

Sl. No.	Sources	Amount Rs.	Year borrowed	Rate of interest	Amount outstanding Rs.
1	2	3	4	5	6
1	Lemongrass oil dealers				
2	Money lenders				
3	Banks				
4	Co-operatives				
5	Others (specify)				
	1				
	2				
	3				

State the problems regarding finance if any :

BLOCK VIII

PARTICULARS OF HOUSEHOLD MEMBERS

Sl. No.	Name	Sex	Relationship to the head of household	Age	Occupation		Income				Total Income
					Primary	Secondary	Primary Occupation		Secondary Occupation		
							No. of days	Wage rate	No. of days	Wage rate	Rs.
1	2	3	4	5	6	7	8	9	10	11	12

BLOCK IX

SOURCES OF HOUSEHOLD INCOME

Sl. No.	Sources	Income (2000-01) Rs.
1	Net income from lemongrass cultivation	
2	Other agricultural income	
3	Industry	
4	Trade	
5	Business	
6	Profession	
7	Remittance	
8	Others (specify)	

BLOCK X
PROBLEMS

1. Whether there is decline/increase in area during last five years. If so, size and reasons :

2. State the problems related to:-
   a) Price :
   b) Fuel :
   c) Distillation :
   d) Labour :
   e) Fertilizer/Manure :
   f) Diseases :
   g) Irrigation :
   h) Seed :
   i) Others (specify) :

3. Do you wish to continue lemongrass cultivation. If not, why? :

4. Are you cultivating lemongrass because no other crop can be grown there successfully :

5. For how many years you are in the field of lemongrass cultivation :

6. Do you possess your own distillery. If not, why? :

7. Do you sell spent grass and ash :

8. Do you get any assistance from Ag.dept/ Research Station, Odakkali/Block/Banks/ Co-operative institutions etc. for lemon-grass cultivation. If so state the nature:

9. Suggestions for the promotion of lemon-grass cultivation :

10. Your opinion about Government policy :

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