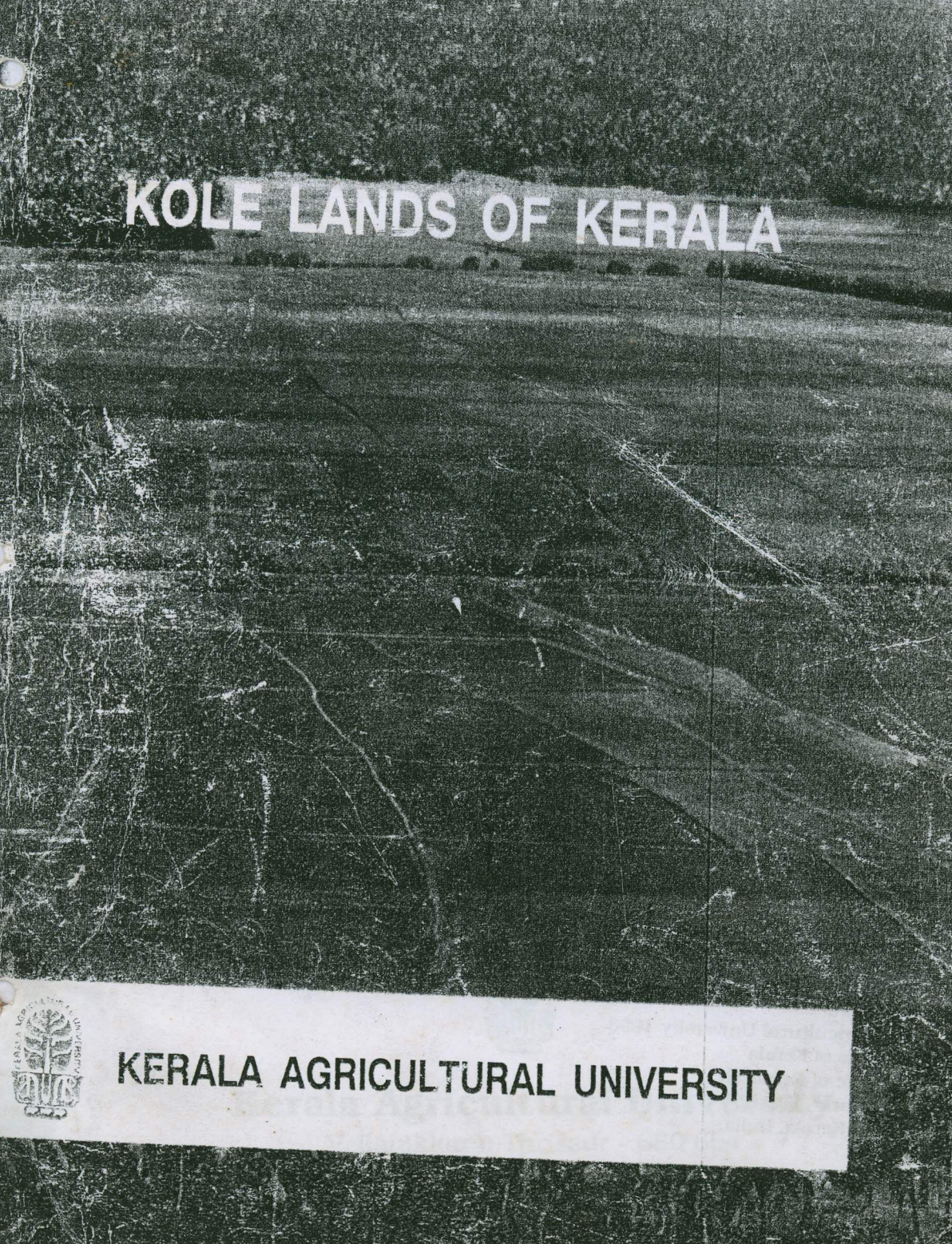
# KOLE LANDS OF KERALA



KERALA AGRICULTURAL UNIVERSITY

# KOLE LANDS OF KERALA

I. Johnkutty
V. K. Venugopal

Kerala Agricultural University
Vellanikkara, Thrissur - 680 654

# Foreword

The 'Kole land' forms one of the most fragile ecosystems in central Kerala. Rice is the principal crop in the area, the cultivation of which is often hazardous, risky and expensive. The term 'kole', a Malayalam word, denotes bumper yields, or high retruns under favourable conditions. The productivity of kole land rice is perhaps the highest in Kerala due to the inherent fertility of the soil and enthusiasm of the farmers to put into practice all known technologies of production. The concept of group farming has been well established in kole from early days by the activity of kole farming societies.

There is a dearth of research data on this tract, compared to 'Kuttanad', which warrants concerted efforts of scientists for overall improvement of kole lands. Further, no consolidated literature is available about kole, except for some project reports or isolated research papers. The authors have spent considerable time and energy in compiling the information in the present form giving a comprehensive account of the general agricultural characteristics of the situation, constraints in production and future strategies for improving rice yield.

This document is perhaps the first of its kind, bringing together a wealth of information on kole lands. I sincerely hope that this publication will be of immense use to all those connected with agricultural research and development. This publication assumes importance in the present context of celebrating 1993 as the 'Intensive Rice Production Year'.

Sd/-
**Dr. A. M. Michael**
Vice - Chancellor

Kerala Agricultural University
Vellanikkara
Dt. 18-3-1993

# Preface

About 42 percent of food grain requirement of India has to be facilitated by rice alone, which illustrates that the food self-sufficiency in the country will largely depend on the performance of rice. The area and production of rice in Kerala although accounts to only 1.5 percent of the national figures, the crop is quite vital to the state as it continues to be the most important staple food. The declining trend in the growth rate of food crop area at national level and in Kerala warns us the need to sustain the rice area and to boost up its productivity.

If 'Kuttanad' is considered as the rice bowl of Kerala, the 'kole lands' could be taken as the rice bowl of Thrissur and Malappuram districts. These kole lands extending from the Chalakudy river banks in the south upto Ponnani in the north lie below sea level similar to 'Kuttanad.' While the general topography of the Kuttanad land is almost flat, it is unique in kole lands that rice cultivable lands alone are below sea level, interspersed by hilly terrain, giving a saucer shape to the area.

Though rice cultivation in kole had been started as early as 18th century by reclaiming the Thrissur kayal lands by the adventurous farmers and successive improvements made upon the system and mode of cultivation, an effective momentum of research and development (R & D) of kole system has not yet been attained. The modernisation efforts on rice culture in kole has been lethargic possibly because of the less area compared to the Kuttanad system, wherein rice experimentation efforts dates back to 1916 and large volume of data have been generated which resulted in the betterment of rice cultivation in that situation. The infrastructural improvements in kole, like formation of bunds, canals etc are not under-estimated.

The cultivation in kole in early days was actually a gambling. The very name 'Kole' was derived from a Malayalam word meaning abundance or luck which means a bumper crop in favourable period, otherwise a complete loss. The uncertainty of crop could be averted to a greater extent by the construction of bunds, irrigation facilities etc. Even now the cultivation is associated with many constraints, risks and is expensive. Still the productivity of the crop in kole is perhaps the highest in Kerala, thanks to the inherent fertility of kole soils and developmental efforts of extension agencies. This system provides vast potential for improving the productivity and production if the enthusiastic kole farmers are fed with location-specific viable technologies.

An essential pre-requisite for launching concerted efforts on modernisation is acquiring information on the system and the presents status of R & D activities. About this centuries old land system a comprehensive and consolidated literature is lacking, except some project reports and isolated studies by KLDC and some other scientists. An attempt has been made in this book "Kole Lands of Kerala" to compile and consolidate the available information on various aspects of the situation. This is a document which embodies all the valuable information on the specific situation of 'Kole' which is a major constituent of the problem zone in Kerala. Even the list of 'kole padavus' at grass root level has been incorporated in this publication. I congratulate the authors for their sincere and devoted efforts for preparing this document. I am sure that this compendium will be of immense use to the extension personnel, research workers, planners, R & D project formulators and also to the students of agriculture and allied curricula.

Sd/-
**Dr. M. Aravindakshan**
Director of Research

Kerala Agricultural University
Vellanikkara
Dt. 27-1-93

# Acknowledgements

The authors express their deep sense of gratitude to many senior scientists of the University and officers of the agriculture and allied departments who have contributed much for this publication. In particular, they are indebted to **Dr. M. Aravindakshan,** Director of Research for the inspiration and help rendered at different stages during the preparation. The efforts taken by **Sri. N. Unnikrishnan Nair,** former Joint Director of Agriculture, Thrissur and currently the Co-ordinator, Kole Land Development Agency and **Sri. M. N. Thankappan,** Secretary and the Chief Development Officer, KLDA are gratefully acknowledged.

The authors also wish to express their gratitude to **Sri. Francis Xavier,** Construction Engineer, KLDC, Thrissur and **Sri. A. Raveendranath,** Additional Director, Soil Survey Unit, Thiruvananthapuram for providing the relevant reports. The consolidation of geographical distribution of 'kole padavus' in such an authentic manner would not have been possible but for the help of the extension officers of Thrissur and Malappuram districts. It is difficult to mention all those names here. But the help rendered by **Sri. P. A. Abdulla,** SDAO, Irinjalakuda and **Sri. P. J. Dasappan,** SDAO, Wadakkanchery require special mention. The authors express profound thanks to **Sri. V. Ramachandran Nair,** Professor, CSRC, Karamana and **Dr. K. M. Rajan,** Associate Director, RARS, Pattambi for their constant help and constructive suggestions, **Dr. Anilakumar,** Associate Professor, RARS, Pattambi, **Sri. P. R. Sathyan, Smt. Valsamma George** and **Smt. I. C. Sheela,** our colleagues who assisted at various stages in the preparation of the manuscript. Thanks are due to S/S. **V. Chandranandan, V. V. Satheesan** and **G. G. Nair,** Artists and photographers for layout and cover design.

Every effort has been made to acknowledge the help and services of all individuals and organisations who contributed in one way or other. Omissions, if any, are unintentional.

Since it is the first venture of its kind it is possible that some errors or mistakes have crept in. We look forward to the readers for their valuable suggestions for improvement of this publication.

**Authors.**

# CONTENTS

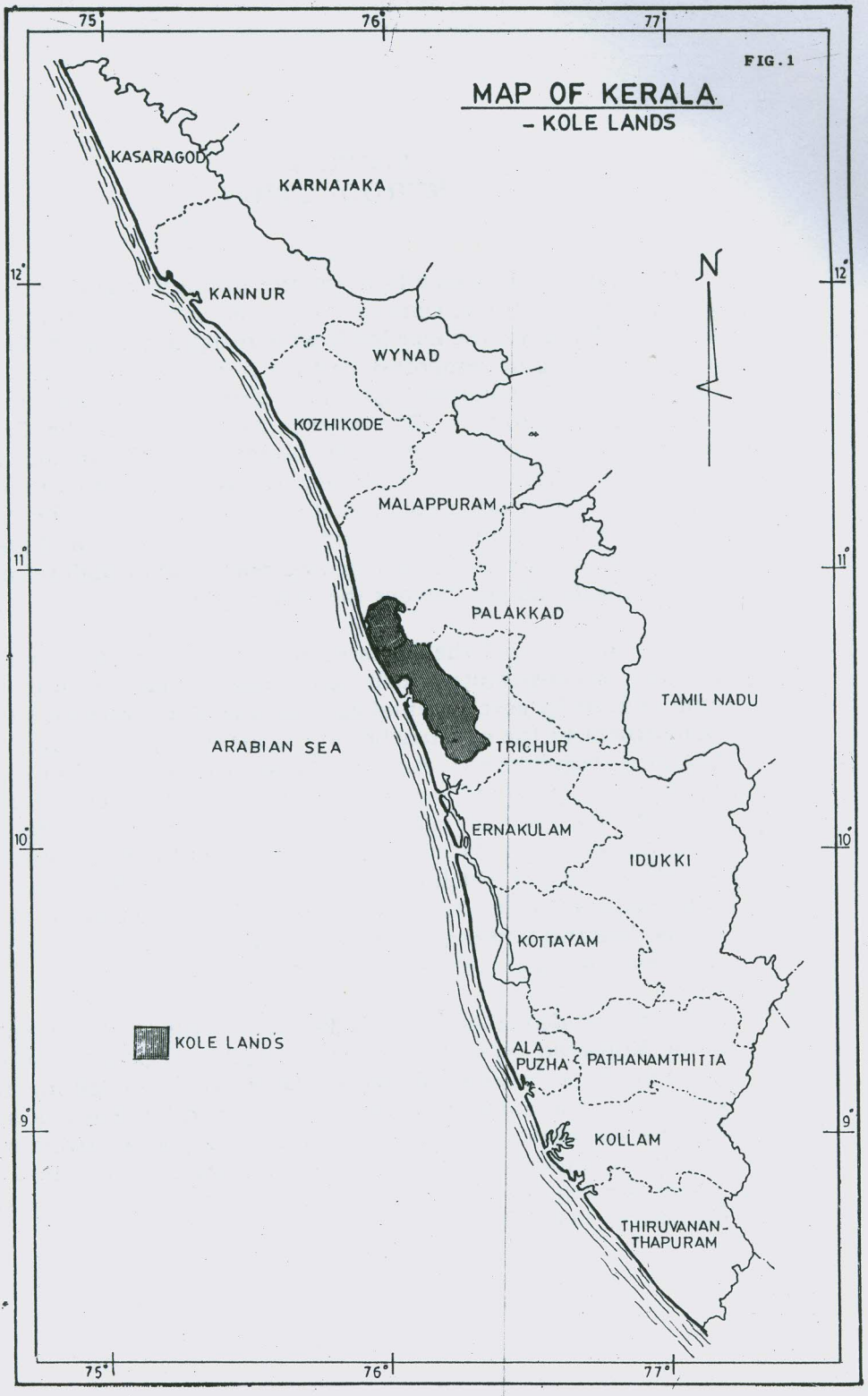
# CHAPTER 1
# INTRODUCTION

The 'kole lands,' which form the rice granary of Thrissur and Malappuram districts, compirse of a unique ecosystem in Kerala. In olden days, the kole lands were reclaimed from the kayal area by putting up temporary earthen bunds and cultivation of rice was done by enterprising farmers during the summer period from December to May. The water pumped out from the fields was stored in a network of canals intersperesed throughout the area. This water and the timely showers used to produce bumper crops, if other conditions were favourable. The crop had the risk of flood damage and success was often a chance. 'Kole' a Malayalam word indicated bumper yield or high returns in case floods did not damage the crop.

The cultivation of the kole area is even now associated with a number of constraints which can cause complete loss of the crop. Efforts by governmental agencies like KLDC and Irrigation Department in the construction of permanent bunds, drainage channels, regulators etc have minimised the risks and in some areas have facilitated the cultivation of an additional crop during the *mundakan* season. Inspite of the risks involved, farmers are enthusiastic about the cultivation because of the high inherent fertility of the soil which can produce bumper yields in favourable seasons. While the average productivity of rice in the state is less than two tonnes per ha, kole lands yield 4 to 5 tonnes per ha. Seven or eight tonnes per ha are not uncommon.

There is a dearth of research data about this tract compared to the 'Kuttanad' ecosystem. In this compilation, an attempt has been made to include all the available data highlighting the salient physiographic, geological and geomorphic features and soil characteristics. The problems confronting rice cultivation in specific situations have also been discussed, in addition to future strategies and research needs to minimise the risks involved in rice cultivation.

FIG. 1


MAP OF KERALA
- KOLE LANDS
75°
76°
77°
12°
11°
10°
9°
N
KASARAGOD
KARNATAKA
KANNUR
WYNAD
KOZHIKODE
MALAPPURAM
PALAKKAD
TAMIL NADU
ARABIAN SEA
TRICHUR
ERNAKULAM
IDUKKI
KOTTAYAM
ALA-
PUZHA
PATHANAMTHITTA
KOLLAM
THIRUVANAN-
THAPURAM
KOLE LANDS

CHAPTER II

# PHYSICAL ENVIRONMENT

This chapter outlines the geographical distribution, physiography, drainage, climate and geological features of the kole region.

## 2.1 Location and geographical distribution

The kole lands covering an area of 13,632 ha are spread over Thrissur and Malappuram districts extending from the northern bank of Chalakudy river in the south to the southern bank of Bharathapuzha river in the north. The area lies between 10°20' and 10°40' north latitudes and 75°58' and 76°11' east longitudes. The fields are geographically distributed in Mukundapuram, Chavakkad and Thrissur taluks of Thrissur district and Ponnani taluk of Malappuram district. The area from Velukkara in the south on the Chalakudy river bank in Mukundapuram taluk to Mullassery of Chavakkad taluk and Tholur-Kaiparampa areas of Thrissur taluk is designated as 'Thrissur kole' and the contiguous area from Chavakkad and Choondal to Thavannur, covering Chavakkad and Thalappally taluks of Thrissur district and Ponnani taluk of Malappuram district form the 'Ponnani kole' **(Fig. 1, 2 and 3).**

About 37 percent of the kole lands (5,001 ha) is cultivated during *mundakan* season. The gross area under rice is 18,632 ha which is 3.2 percent of the gross rice area in the state. As far as Thrissur and Malappuram districts are concerned the kole lands are the rice granary of the tract. The gross area of kole lands in Thrissur district is estimated as 16,606 ha which is 22.3 per cent of gross rice area in the district. Eleven per cent of the kole area (2,026 ha) is located in Malappuram district which accounts for 4 per cent of the gross rice area in the district. Table 1 presents the distribution of kole areas in Thrissur and Malappuram districts. The list of 'padavus' (Padasekharam) are presented in **Appendix 1.**

## Table 1. Geographical distribution of kole lands

I Thrissur kole: distributed in Mukundapuram, Chavakkad and Thrissur taluks of Thrissur district (10,187 ha)

II Ponnai Kole: distributed in Chavakkad and Thalappally taluks of Thrissur districts and Ponnani taluk of Malappuram district (3,445 ha)

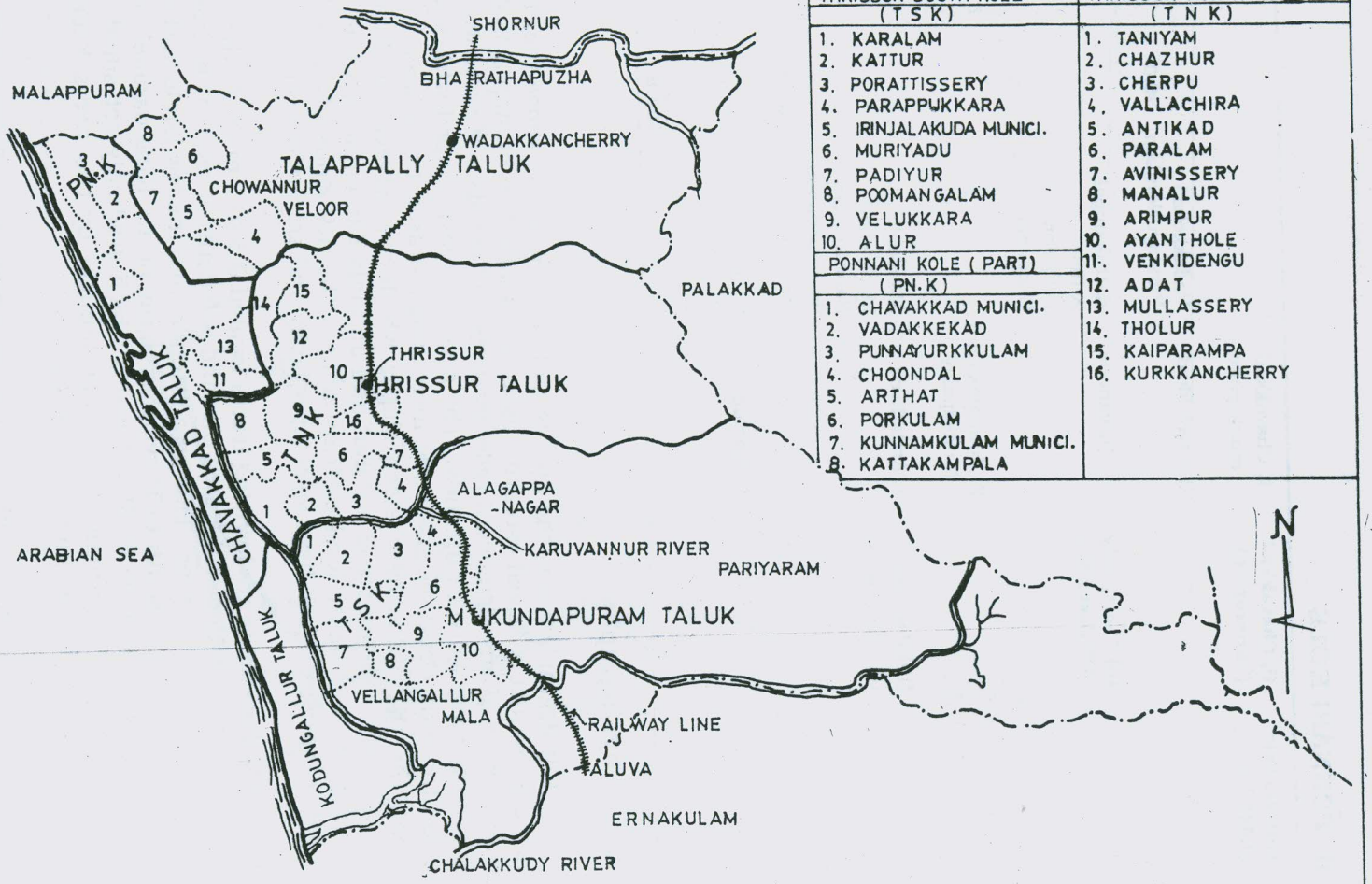
## I THRISSUR KOLE

| Name of kole | Taluk | Block | Panchayats | Area in ha | |
|---|---|---|---|---|---|
| | | | | Mundakan | Punja |
| a.Thrissur south kole (2,115 ha) | **Mukundapuram (Thrissur dt.)** | 1. Irinjalakuda | Kattur<br>Karalam<br>Porathissery<br>Muriyadu<br>Parappukkara | 448.0 | 1789.3 |
| | | 2. Irinjalakuda municipality | | - | 46.0 |
| | | 3. Vellangalur | Poomangalam<br>Padiyur<br>Velukkara | - | 251.5 |
| | | 4. Mala | Alur | - | 28.0 |
| | | | | **448.0** | **2114.8** |
| b. Thrissur north kole (8.072 ha) | **(i) Thrissur (Thrissur dt.)** | 1. Anthikkad | Manalur<br>Anthikkad<br>Chazhur<br>Thanniyam | 1527.6 | 1545.8 |
| | | 2. Cherpu | Avinissery<br>Vallachira<br>Cherpu<br>Paralam<br>Kurkkenchery | 1658.4 | 1785.6 |
| | | 3. Puzhakkal | Ayyanthole<br>Adat<br>Tholur<br>Kaiparampa<br>Arimpur | 766.6 | 3624.0 |
| | **(ii) Chavakkad (Thrissur dt.)** | Mullassery | Mullassery<br>Venkudengu | 496.1 | 1116.1 |
| | | | | **4,448.7** | **8,071.5** |

FIG. 2

# THRISSUR DISTRICT

## SHOWING PANCHAYATS OF KOLE LANDS




| THRISSUR SOUTH KOLE (TSK) | THRISSUR NORTH KOLE (TNK) |
|---|---|
| 1. KARALAM | 1. TANIYAM |
| 2. KATTUR | 2. CHAZHUR |
| 3. PORATTISSERY | 3. CHERPU |
| 4. PARAPPUKKARA | 4. VALLACHIRA |
| 5. IRINJALAKUDA MUNICI. | 5. ANTIKAD |
| 6. MURIYADU | 6. PARALAM |
| 7. PADIYUR | 7. AVINISSERY |
| 8. POOMANGALAM | 8. MANALUR |
| 9. VELUKKARA | 9. ARIMPUR |
| 10. ALUR | 10. AYANTHOLE |
| **PONNANI KOLE (PART) (PN.K)** | 11. VENKIDENGU |
| 1. CHAVAKKAD MUNICI. | 12. ADAT |
| 2. VADAKKEKAD | 13. MULLASSERY |
| 3. PUNNAYURKKULAM | 14. THOLUR |
| 4. CHOONDAL | 15. KAIPARAMPA |
| 5. ARTHAT | 16. KURKKANCHERRY |
| 6. PORKULAM | |
| 7. KUNNAMKULAM MUNICI. | |
| 8. KATTAKAMPALA | |

## II PONNANI KOLE

| | | | | | |
|---|---|---|---|---|---|
| Ponnani kole (3,445 ha) | **(i) Chavakkad (Thrissur dt.)** | 1. Chavakkad municipality | | - | 46.0 |
| | | 2. Chavakkad | Vadakkekad | | |
| | | | Punnayurkkulam | 36.0 | 503.5 |
| | **(ii) Thalappilly (Thrissur dt.)** | 1. Chowannur | Kattukampal | | |
| | | | Arthat | | |
| | | | Porkulam | | |
| | | | Choondal | - | 904.9 |
| | | 2. Kunnamkulam Municipality | | | 33.0 |
| | **(iii) Ponnani (Malappuram dt.)** | 1. Andathode | Alamkode | | |
| | | | Marancheri | | |
| | | | Nannamukku | | |
| | | | Perumpadappu | | |
| | | | Veliyamkode | 55.8 | 1351.6 |
| | | 2. Ponnani | Edappal | | |
| | | | Thavannur | 12.0 | 606.3 |
| | | | | **103.8** | **3,445.3** |

## 2.2 Physiography

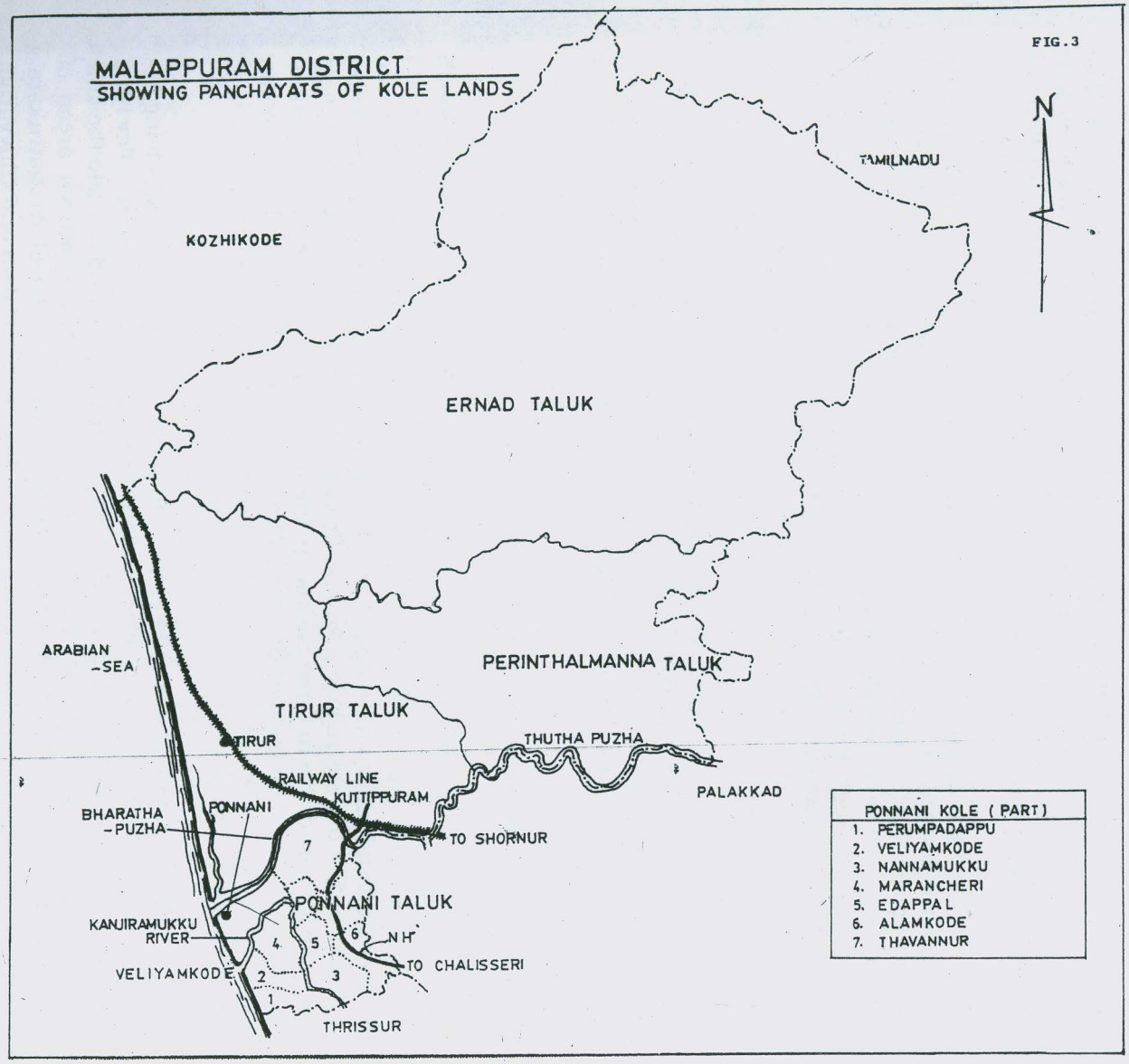
Physiographyically, the area is quite unique in the sense that the entire tract is a product of fluvial estuarine agencies modified by human activities. The area is devoid of any significant relief features and consists of extensive flat land surface interspersed with uplands. The area is saucer shaped with lowlands at the centre with elevation gradually increasing towards the fringes. The land around the rice fields have steep slopes which are terraced and put under perennials like arecanut and coconut and annuals like banana, yams etc. The slopes merge with fairly level plateau lands. The dry lands of the kole region adjoining the coastal belt have level topography and are under coconut.

The kole fields are lowlying tracts located 0.5 to 1 m below the mean sea level. In a major portion of the area the land is flat and it remains submerged for about six months in an year. This area extends from the low lands in the bank of Chalakudy river in the south to Thavannur in the north, lying parallel to the sea. These lands were formerly shallow lagoons which gradually got silted up. The flood waters in the kole areas are mainly brought by two rivers Kechery and Karuvannur which finally drain into the sea.

A net work of main and cross canals connect the different regions of the kole to the rivers. These canals also provide good external drainage. The earthen

FIG.3

# MALAPPURAM DISTRICT
## SHOWING PANCHAYATS OF KOLE LANDS



bunds separate the canals from the kole fields. Being a flood plain, water level may rise as high as 5.5 m during peak SW monsoon.

## 2.3 Rivers, water courses and drainage in Thrissur kole

**Karuvannur** and **Kechery** are the two major rivers in Thrissur kole region. These rivers in spate, discharge the flood waters into the low lying kole area and raise water level to more than three metres. The kole area functions as the flood basin for both the rivers.

The Karuvannur river has tow tributaries viz Manali and Kurumali. Kurumali is formed of two tributaries, Chimoni and Mupli. All these streams start from the Western Ghats and flow along steep slopes till they reach the plains where they take very meandering courses and join to form the main river in the plains. Eventhough there is high flood during monsoons, the river practically dries up during summer. When it reaches the west the river branches into two, one going directly to north joins the Chettuva lake and the other flowing south joins the Manakodi lake.

The Kecheri river flows down from Machad hills, traverses west and then turns south and joins the kole lands on the northern side draining finally into Enamakkal lake, which is connected to Chettuva lake. The river though small, has flash floods during monsoon. **Fig.4** depicts the river basins of Karuvannur and Kechery rivers.

### 2.3.1 Canal system in Thrissur North kole

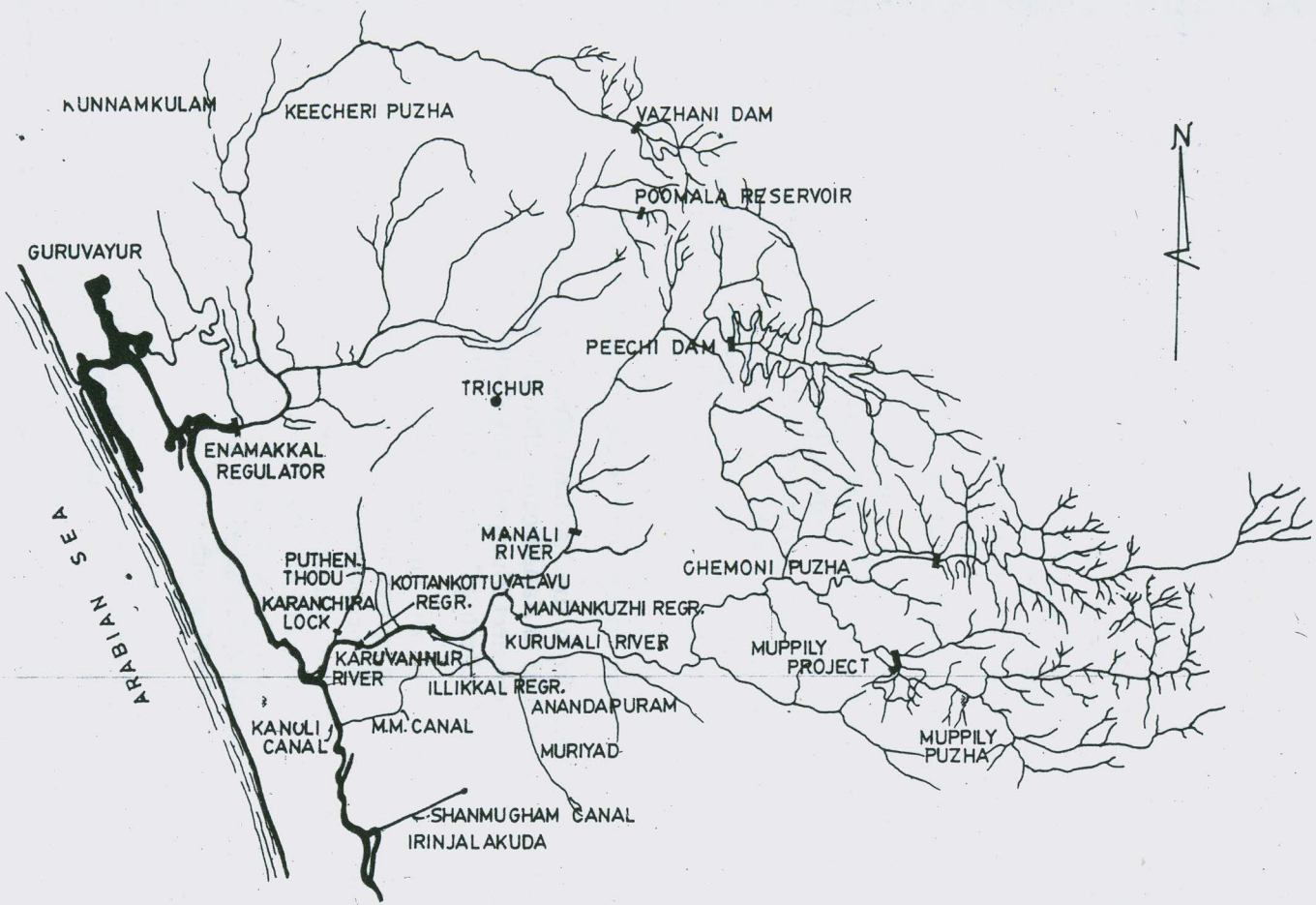
Except Kechery river, the streams that flow into this zone drain only small areas in the locality. As the streams enter the lowlying area, water spreads and submerges the whole fields. The main exit for all these flood waters are the Enamakkal and Idiyanchira regulators. To reach this point of drainage the water spreads out in the entire kole area and flows radially towards it. The north kole area itself is divided into three basins viz **the north,** covering Kechery, Peramangalam and Chemmen basins, **the central,** comprising of Puzhakkal Naduthodu, Chiyyaram and Kokkala basins and **the south,** consisting of Puthenthodu, Herbert canal and Chirakkal thodu basins. (thodu= channel)

The **Peramangalamthodu** enters the kole area along two valleys lying between the high lands of Adat, Mulloor and Oorakam. Through the next valley lying between Oorakam and Elavthur, the Kechery river **(Kadanthodu)** flows to the kole area. The **Kokkalathodu** drains the western and partly southern areas of Thrissur town. It joins the **Puthenthodu** at southern side of Aranattukara. Similarly, the **Chiyyaramthodu** which drains the Kanimangalam and Chiyyaram areas joins the Puthenthodu about one km south of Kokkala stream. The **Chettupuzhathodu** serves both as drainage and irrigation canal and it joins the Kottachal (approach to Enamakkal). The whole flood from Puzhakkal, Chiyyaram

FIG.4

# TRICHUR KOLE

## KEECHERI & KARUVANNUR RIVER BASINS



and Chettupuzha canals could be drained through Kottachal direct to Enamakkal if the approach is completed.

The down stream area can be drained through the Puthenthodu viz Karanchira to Karuvannur river when the water level is low. During NE monsoon the **Chirakkalthodu** and **Herbert canal** will drain their respective catchment areas into Karuvannur river since the water level in the river is low. Hence, there will be no submergence in kole fields during this season. The lock and the regulator at Karanchira are sufficient as far as the Puthenthodu is concerned. The **Enamakkal** and **Idiyanchira** regulators have been constructed as flood control structures in the northern kole. Both these regulators serve as salt barriers and divert part of the flood waters of northern kole to the back waters **(Kanoli canal)** and subsequently to the sea through **Chettuva azhi.** The distribution of canal system in north kole is depicted in **Fig. 5.**

### 2.3.2 Canal system in Thrissur South Kole

The canal system in the south kole is depicted in **Fig. 6.** The main discharge of water into the area is through **Thuppanthodu**. The Thuppanthodu enters the kole land from Villichira regulator. It flows down through a narrow gap at the northern side of Anandapuram and enters kole land. Another stream that flows into the area is the **Nedumthodu** draining Thommana and other areas lying on the east and north-east of Irinjalakuda town. This flows through Muriyadu kayal and joins the Thuppanthodu stream near Anandapuram bund.

In Chemmanda area, the **Panoli canal** flows through the north and northwest of Irinjalakuda and drains finally into the Chemmanda kayal.

The drainage water from the Karalam area flows into the Karuvannur river through Nandi sluice and to Kanoli canal through **MM (Muriyadu-Moorkanad) canal.** The MM canal connect Muriyadu kayal with Chemmanda kayal and serve as a drainage channel relieving floods in Muriyadu kayal lands.

From the Muriyadu area, the **Thamaravalayam canal** drains into Karuvannur river during monsoon and convey irrigation water from the river during crop periods. A regulator has been proposed in this canal to prevent entry of flood waters from the river. During summer, a bund is laid across the Thamaravalayamthodu to facilitate cultivation. The Kurumali river, the southern tributary of Karuvannur river, over-flows its banks during floods. Also there are several small openings in the flood banks on the southern side of Karuvannur river through which the flood waters enter the Villichira valley from the Kurumali river.

The water stored in Karuvannur and Kurumali rivers by the regulators at Kottenkottuvalavu, Illikkal and **Manjankuzhi** meet the irrigation demand partially. The Thamaravalayam canal (Nedumthodu), **Neerolithodu** (intake from Illikkal storage) and MM canals act as the feeders for Muriyadu, Chemmanda and Karalam fields.

FIG.5

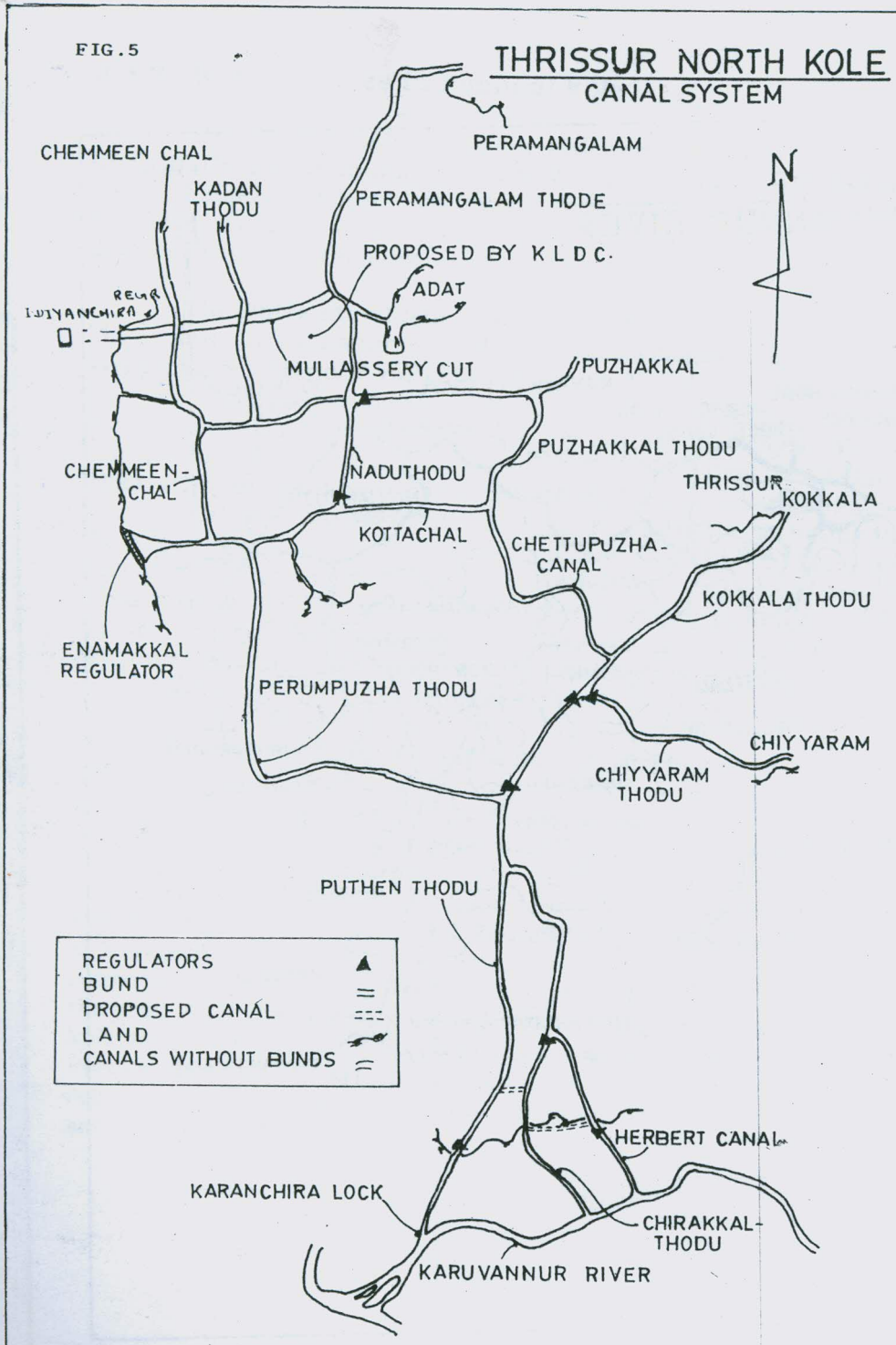
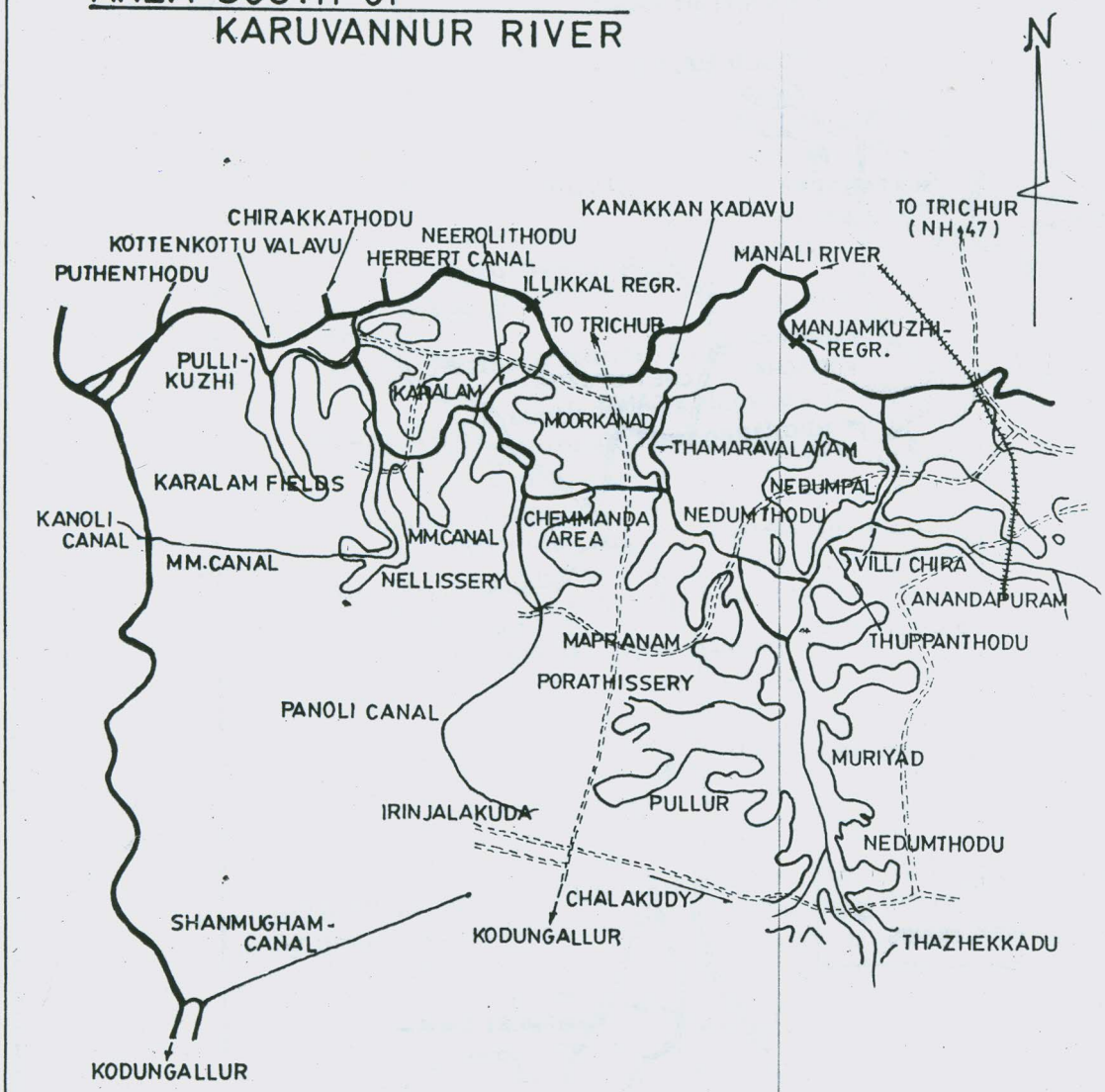

THRISSUR NORTH KOLE
CANAL SYSTEM
PERAMANGALAM
CHEMMEEN CHAL
KADAN THODU
PERAMANGALAM THODE
PROPOSED BY K L D C.
ADAT
N
MULLASSERY CUT
PUZHAKKAL
PUZHAKKAL THODU
CHEMMEEN-CHAL
NADUTHODU
THRISSUR
KOKKALA
KOTTACHAL
CHETTUPUZHA-CANAL
KOKKALA THODU
ENAMAKKAL REGULATOR
PERUMPUZHA THODU
CHIYYARAM
CHIYYARAM THODU
PUTHEN THODU
REGULATORS
BUND
PROPOSED CANAL
LAND
CANALS WITHOUT BUNDS
HERBERT CANAL
KARANCHIRA LOCK
CHIRAKKAL-THODU
KARUVANNUR RIVER

FIG.6

# AREA SOUTH OF KARUVANNUR RIVER



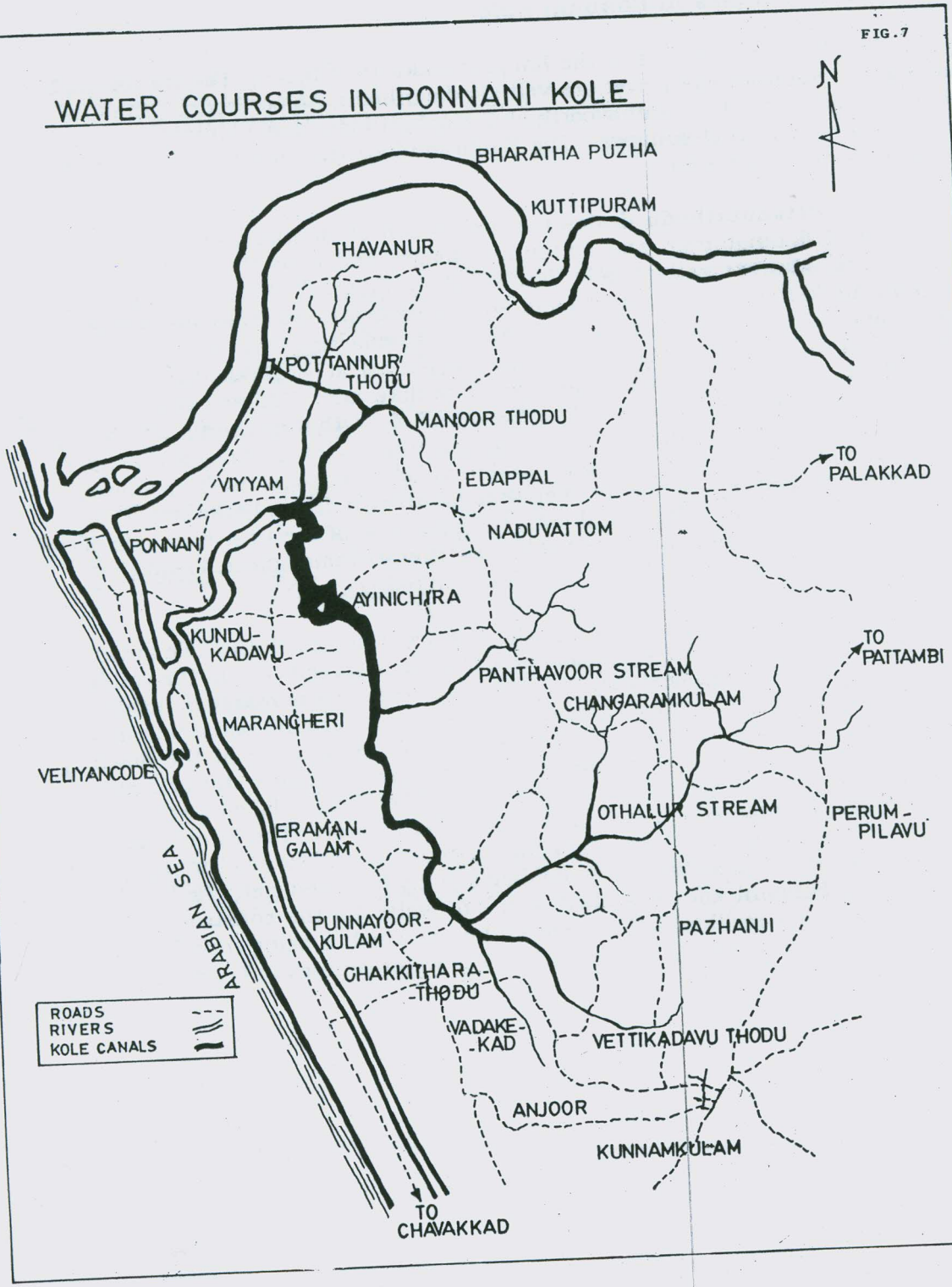
### 2.3.3 Water courses in Ponnani kole

The Ponnani kole lies in the Kanjiramukku river basin. The tributaries that join the Kanjiramukku river are Vettikkadavuthodu, Anjoorthodu, Othallurthodu, Pallikkarathodu, Panthavoorthodu, Manoorthodu and Pottannurthodu. All these dry up during summer. The Kanjiramukku river serves as the main drainage source of the area.

The **Pottannurthodu** drains the area south of Bharathapuzha namely Thavannur, Trikkanapuram and Pottannur villages and joins the upstream of Viyyam dam. **Manoor valiyathodu** drains Kaladi, Edappal, Vallamkulam, Manoor and Anakkara villages and it joins Pottannurthodu. **Panthavoor stream** drains the Kuttipala, Kumaranelloor and Alamkode villages. This joins the deep kole (central low area of kole where water stagnates) at Chelakkadavu. **Pallikkarathodu** drains part of Pallikkara, Nannamukku and othallur villages and joins the Othallur stream before reaching the deep kole. **Othallur thodu,** which is the largest one, drains Kottanchira, Chalissery, Kavukkodu, Katavalavu, Karikkad, Pazhanji and parts of Kattukampal and othallur villages and joins the deep kole at the upstream side of Uppungal ferry. **Vettikkadavuthodu** drains Porkulam, Kunnamkulam and Mangad villages and joins the deep kole at the upstream side of the junction of the Othallur stream. **Chakkitharathodu** drains Anjoor, Vadkkekad and Valathoor villages and joins the Vettikkadavuthodu.

During the rains, the inflow into the basin submerges all the kole areas. Since the natural slope of the streams is less, the water spreads out in the valley and submerges *mundakan* fields on the periphery. The area normally is flooded from June to January. In cropped areas bunds are formed around padasekarams which protect the crop from floods. The Viyyam dam is situated at the down stream end of kole lands. This regulator prevents ingress of salt water and also stores a large quantity of water. The Kanjiramukku river directly falls into the sea at Veliyamkode barrage which is closed during the summer. The Kanoli canal connects the river to Bharathapuzha at Ponnani and hence to the sea throughout the year. After the construction of Viyyam dam salinity has been controlled in the kole area. The Ponnani kole was filled with salt water till the construction of Viyyam dam and has residual salt content in the soil which is being considerably reduced by annual dewatering and irrigation. The water courses in Ponnani kole are depicted in **Fig. 7.**

FIG.7


WATER COURSES IN PONNANI KOLE
N
BHARATHA PUZHA
KUTTIPURAM
THAVANUR
POTTANNUR THODU
MANOOR THODU
TO PALAKKAD
VIYYAM
EDAPPAL
NADUVATTOM
PONNANI
AYINICHIRA
KUNDU-KADAVU
TO PATTAMBI
PANTHAVOOR STREAM
CHANGARAMKULAM
MARANCHERI
VELIYANCODE
OTHALUR STREAM
PERUM-PILAVU
ERAMAN-GALAM
ARABIAN SEA
PUNNAYOOR-KULAM
PAZHANJI
CHAKKITHARA-THODU
VADAKE-KAD
VETTIKADAVU THODU
ANJOOR
KUNNAMKULAM
TO CHAVAKKAD
ROADS
RIVERS
KOLE CANALS

## 2.4 Climate and season

The climate of the area is moderate. Extremes of heat or cold are not felt, the minimum temperature goes down to 21°C and the maximum may go upto 38°C. Atmosphere is always damp along the coastal belt due to high humidity. The crop growth is generally not inhibited by temperature but governed by rainfall alone. The rainfall distribution in the area is bimodal. The two well defined rainy seasons are south-west monsoon and north-east monsoon. The SW monsoon extends from June to september with the mean date of onset varying from 25th May to 1st June. The NE monsoon starts during the middle of October, and extends upto November. There is practically no rain fromDecember to April. The mean annual rainfall of the situation is 2757 mm, out of which 67.3 per cent is received during SW monsoon and 18 per cent during NE monsoon.

Special weather phenomena of depression storms are noticed during October and November in the Arabian sea which cause rains over the entire state. Frequent thunder is observed during pre-monsoon periods.

During SW monsoon, cloudy and overcast skies are seen and during NE monsoon, moderately cloudy to cloudy skies are observed. During the rest of the year, the sky is clear or partly cloudy. Due to overcast skies during SW monsoon, the bright sunshine hours are less than 4 h/day while in winter it is about 10 h/day. The mean monthly relative humidity varies from 85 to 95 per cent during June-September and is about 70 per cent in January.

Because of the land and sea breezes, easterly and north easterly winds occur in morning hours. The number of calm days are more in inland region than in coastal region due to the sheltering effect of Western Ghats. The maximum wind speed of 20 km/h is observed during SW monsoon and it decreases from Novermber onwards.

The pan evaporation is less than 3 mm/day during SW monsoon period and it gradually increases from October onwards and often exceeds 6mm/day during summer months. The mean pan evaporation in the kole tract is 5.8 mm per day.

## 2.5 Geological features

Geologically the kole area is a low lying plain running parallel to the sea representing piedmont type deposits silted up in flood plains with alluvium brought down by Kechery and Karuvannur rivers. At present, the region appears as a saucer shaped basin flanked by laterite hills in the western and eastern margins.

The valley-fill material is mainly of fine to coarser clastics including scree and talus material formed of gravel and sand of laterite composition mainly brought down from the adjacent hills. Some portion of kole area exhibits a lacus-

trine environment and contains black carbonaceous clay with a lot of plant parts and in some places withered tree trunks. These are evidences of the major role of fluvio-estuarine deposition in the development of this area. The presence of deep sandy layers also leads to the conclusion that part of these areas were under sea in the recent geological past.

The western margin of the kole lands have expanses of sedimentary rocks including sandstone and clay of Varkala formation. The coastal alluvium seen in the western extremities probably represent a sandbar extending north-south parallel to the coast. This is indicated by the sandy flats, the hills and lows observed in the area.

The eastern border of the kole area is characterised by lowlying hills which represent erosional valleys. The area is essentially a crystalline terrain. The laterite is underlain by crystalline rock and biotite gneiss under different stages of weathering. Bands of charnockitic rock are also observed in the western edges. The gneiss is traversed by dolorite dykes. The main exposures are seen in the south-east of Mala, in the vicinity of Irinjalakuda.

CHAPTER III

# SOILS

Studies conducted in the kole area reveal wide variation in morphological and physico-chemical characteristics of soils. The soil forming factors and salient features in respect of morphology and physico-chemical properties of kole soils are discussed in this chapter.

## 3.1 Soil forming factors

The soils of the kole area are mainly the product of weathering of river alluvial deposits and colluvium. Major portion of the area are occupied by river alluvium of recent origin. The deposits have mostly clayey texture and occupy the flood plain. The deposits of the slightly higher locations bordering the rivers and the coastal belt are of coarser texture. The flood plain is a deposition basin lying below sea level. This area is vulnerable to floods and the continued submergence of the area causes softening of the finer materials in the basin. The parent material and the relief appear to be the dominating factors that have influenced the formation of soils of the area.

The undulating hills bordering the eastern and western portions of the kole areas bring down colluvial debris. This makes the soil in the higher fringes of kole lands more coarser in texture and at times gravelly.

Certain areas of kole lands bordering the western extremes nearer to the sea exhibit a lacustrine composition and contain black carbonaceous clay with a lot of vegetable matter, withered tree trunks and lime shell deposits at lower depths. The subsurface exploration of kole lands show fine sandy deposits, revealing their sedimentary origin. It is believed that the kole area had a lush growth of vegetation. As a result of marine transgression the area was engulfed by the sea, which later on receeded as a result of geological upheavals.

The role of relief as a soil forming factor is of paramount importance in the formation of soils, in the area. The area of the flood plain located below sea level is subjected to periodical inundation by flood water and has a high water table resulting in impeded drainage conditions. The uniformly high percentage of clay in these soils and the frequent deposition of sediments and ill drained conditions have retarded soil profile development.

## 3.2 Soils identified in the area

Based on the physiographic position, soils of the area can be grouped into two viz (1) Soils of the flood plain, comprising of (i) Perumpuzha (ii) Anthikkad and (iii) Konchira series and (2) Soils of the slightly higher elevation occupying the outer fringes consisting of (i) Manalur (ii) Edathuruthy (iii) Ayyanthole and (iv) Kizhippallikkara series.

### 3.2.1 Soils of flood plains

#### (i) Perumpuzha series

This series represents the imperfectly drained very deep dark grey and fine textured alluvial soils. The texture of surface soil varies from clay loam to clay while that of subsoil is always clay. The $C_1$ horizon is stiff containing strong brown mottlings. The lower horizon is often loose with a massive structure. These soils have been developed over alluvium under impeded drainage condition and tropical monsoonic climate.

Anthikkad and Konchira soils are associated with this series. Soils under Anthikkad series are characterised by the presence of limeshells in the profile whereas Konchira series has an organic layer below.

*The description of a typical pedon is given below:*

| Horizon | Depth (cm) | Description |
|---|---|---|
| Ap | 0-20 | Dark grey (10 YR 4/1) when moist; clay, strong coarse sub-angular blocky structure, firm, sticky and plastic, abundant roots, clear smooth boundary (10-20 cm thick). |
| $C_1$ | 20-80 | Dark greyish brown (10 YR 4/2), clay, many strong brown moottlings (7.5 YR 5/6), coarse sub-angular blocky, firm, sticky and plastic, accumulation of clay, roots absent, diffuse smooth boundary (25-60 cm thick). |
| $C_2$ | 80-110+ | Dark greyish brown (10 YR 4/2), clay, massive structure, firm, sticky and plastic, roots absent (30-80 cm thick). |

#### Range in characteristics

Depth of solum is more than 110 cm. Clay or silty clay is the predominant texture of the solum. Grey colour dominates thoughout the profile, but the range is from dark yellowish brown to dark grey. Mottlings are noticed only in the second layer. Except in severe summer the water table seldom goes below one foot from the surface.

Dark grey is the common colour of the Ap horizon with hue of 10 YR, value 4 and chroma 1. Silty clay or clay is the type noticed. Structure is always subangular blocky. Colour of $C_1$ and $C_2$ horizon ranges from dark yellowish brown to dark grayish brown with hue of 10 YR, value 4 and chroma 1 to 3. The texture is either clay or silty clay with subangular blocky or massive structure. Few to many

mottlings are present in the $C_1$ horizon. Accumulation of clay is invariably noticed in the $C_1$ horizon in all the profiles studied.

These soils are distributed in the kole lands of Annakara, Elavally villages (Chavakkad taluk), Edakkulathur, Chalakkal, Karamukku, Chevoor, Veluthur and Ayyanthole villages (Thrissur taluk).

**(ii) Anthikkad series**

The series consists of imperfectly drained, very deep greyish brown alluvial soils having clay loam to clay surface texture underlain by subsoil having the same structure. The soils have been developed from alluvial deposits.

*The description of a typical pedon is given below:*

| Horizon | Depth (cm) | Description |
|---|---|---|
| Ap | 0-15 | Dark greyish brown (10 YR 4/2), clay, strong, coarse sub-angular blocky structure, firm, sticky and plastic, abundant roots, gradually smooth boundary (7-15 cm thick). |
| $C_1$ | 15-50 | Dark greyish brown (10 YR 4/2), clay, few brown mottlings present, strong coarse, sub-angular blocky structure, very firm, sticky and plastic, accumulation of clay, few fine roots, diffuse smooth boundary (15-40 cm thick). |
| $C_2$ | 51-110 | Dark brown (10 YR 4/3), clay, mixed with lime shells, massive structure, firm, sticky and plastic (60 cm thick). |

**Range in characteristics**

Solum thickness is always more than 110 cm. Clay is the dominant texture but ranges from clay loam to silty clay. Clay content of solum exceeds 60 percent. Dark greyish brown is the common colour but it varies from dark yellowish brown to dark grey with hue of 10 YR, value 4 and chroma 1 to 4. Few mottlings are noticed in the $C_2$ horizon.

The texture of the A horizon ranges from clay loam to clay having a dark greyish brown colour with hue of 10 YR, value 4 and chroma 2. The main colour (hue) of $C_2$ horizon is 10 YR with value 4 and chroma 1 to 4. Mottlings are few, having colours with 7.5 YR hue and high value and chroma. Structure varies from moderate medium to moderate coarse subangular blocky.

mottlings are present in the $C_1$ horizon. Accumulation of clay is invariably noticed in the $C_1$ horizon in all the profiles studied.

These soils are distributed in the kole lands of Annakara, Elavally villages (Chavakkad taluk), Edakkulathur, Chalakkal, Karamukku, Chevoor, Veluthur and Ayyanthole villages (Thrissur taluk).

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*The description of a typical pedon is given below:*

| Horizon | Depth (cm) | Description |
|---|---|---|
| Ap | 0-15 | Dark greyish brown (10 YR 4/2), clay, strong, coarse sub-angular blocky structure, firm, sticky and plastic, abundant roots, gradually smooth boundary (7-15 cm thick). |
| $C_1$ | 15-50 | Dark greyish brown (10 YR 4/2), clay, few brown mottlings present, strong coarse, sub-angular blocky structure, very firm, sticky and plastic, accumulation of clay, few fine roots, diffuse smooth boundary (15-40 cm thick). |
| $C_2$ | 51-110 | Dark brown (10 YR 4/3), clay, mixed with lime shells, massive structure, firm, sticky and plastic (60 cm thick). |

**Range in characteristics**

Solum thickness is always more than 110 cm. Clay is the dominant texture but ranges from clay loam to silty clay. Clay content of solum exceeds 60 percent. Dark greyish brown is the common colour but it varies from dark yellowish brown to dark grey with hue of 10 YR, value 4 and chroma 1 to 4. Few mottlings are noticed in the $C_2$ horizon.

The texture of the A horizon ranges from clay loam to clay having a dark greyish brown colour with hue of 10 YR, value 4 and chroma 2. The main colour (hue) of $C_2$ horizon is 10 YR with value 4 and chroma 1 to 4. Mottlings are few, having colours with 7.5 YR hue and high value and chroma. Structure varies from moderate medium to moderate coarse subangular blocky.

In texture and colour, $C_2$ horizon is identical to that of $C_1$ horizon. Structure is always massive. Content of lime shells generally exceeds 15 percent.

The associated perumpuzha and Konchira series are the competing series. Soils of Perumpuzha series do not contain shell particles in the profile, whereas the soils of Konchira series contain an organic layer below with high acidity. The soils are imperfectly drained with slow permeability and are distributed in the kole lands of Manalur, Puranattukara, Kanimangalam, Anthikkad, Vadanappally, Chittilappilly, Adat, Pullu, Inchamudy and Allappad in Thrissur district.

**(iii) Konchira series**

The series comprises of imperfectly drained, deep dark brown and fine textured alluvial soils deposited over organic debris. The depth of soil upto the organic layer varies considerably and occasionally the organic layer is seen quite close to the plough layer, resulting in medium acid soils. Uniform clay structure in the subsurface horizons is a typical character of these soils. These soils are developed over fine textured alluvial sediments modified under lacustrine environment.

*A typical pedon of the Konchira series is described here.*

| *Layer* | *Depth (cm)* | *Description* |
|---|---|---|
| Ap | 0-15 | Dark brown (10 YR 3/3) when moist, silty clay, moderate, medium, subangular blocky structure, firm, sticky and plastic, abundant roots, clear smooth boundary (5-15 cm thick). |
| $C_1$ | 15-33 | Very dark greyish brown (10 YR 3/2) when moist, clay, strong, coarse, sub-angular blocky, firm, sticky and plastic, gradual wavy boundary (25-40 cm thick). |
| $C_2$ | 33-57 | Black (10 YR 2/1) when moist, clay, massive structure, friable, sticky and plastic, organic matter mixed with soil, clear wavy boundary (5-10) cm thick) |
| II C | 57-110+ | Decomposed organic debris. |

**Range in characteristics**

The thickness of the soil upto the organic layer varies considerably. It ranges from 20-120 cm. The texture is clayey throughout the subsoil, with very

little variation. Stratification is not uniform. The colour shows wide variation ranging from dark yellowish brown to black. The structure is mostly medium coarse subangular blocky.

The colour of the surface layer ranges from dark grey to dark brown with hue of 10 YR, value 3 and 4 and chroma 1 to 3. Texture varies from clay loam to clay. The colour of second layer ranges from dark brown to very dark greyish brown with hue of 10 YR, value 3 and chroma 2 and 3. This layer is identical to the surface layer as far as texture and structure are concerned. The third layer is usually very thin and is followed by decaying organic debris. This layer is often difficult to distringuish from the organic layer below. The texture is clay and the structure, massive. The colour is mostly black. The organic layer contains plant residues at varying stages of decomposition and this layer is medium acidic in reaction.

The associated perumpuhza and Anthikad series form the competing series. The former includes soils that are developed from alluvium that have a mottled $C_1$ horizon. They lack the presence of organic layer below. The Anthikad series is also alluvial, but is characterised by the presence of lime shells in the 3rd layer.

These soils are mainly distributed in Vallivattom, Muriyadu, Manalur, Kanimangalam, Irimbranellur, Porathissery, Anandapuram, Madaikkonam, Poomangalam, Chittilappilly, Pullazhi, Veluthur and Alappad villages in Thrissur district.

### 3.2.2 Soils of outer fringes

#### (i) Manalur series

This series includes very dark greyish brown loamy alluvial soils overlying loamy subsoils with a decrease in clay content down the profile. These soils are usually located on level lands with slope gradient below 3 per cent on the upper reaches of kole lands. They are developed over alluvial deposits during floods. The soils are well drained with moderate permeability. Edathuruthy series compete with these soils.

*The description of a typical pedon is given below:*

| *Horizon* | *Depth (cm)* | *Description* |
|---|---|---|
| Ap | 0-10 | Very dark greyish brown (10 YR 3/2), Clay loam, moderately medium subangular blocky structure, friable, slightly sticky and slightly plastic, abundant roots, clear and smooth boundary (10-15 cm thick). |

| | | |
|---|---|---|
| $C_1$ | 10-35 | Dark brown (10 YR 4/3), loam, weak fine granular structure, friable, non-sticky and non-plastic, roots absent, diffuse boundary (20-35 cm thick). |
| $C_2$ | 35-110+ | Dark yellowish brown (10 YR 4/4), loam, many prominent red and yellow mottlings, massive structure, friable, non-sticky and non-plastic, roots absent (60-80 cm thick). |

**Range in characteristics**

The depth of solum is always more than 120 cm and the range is between 120-180 cm. It is difficult to locate the underlying bed rock. Wide variation in texture is noticed within the solum which ranges from loamy sand to clay loam. Colour ranges from light yellowish brown to very dark grey with hue of 10 YR, value 3 to 6 and chroma 1 to 4.

The texture of A. horizon ranges from sandy loam to clay loam. The colour is greyish brown with hue of 10 YR, value 3 to 4 and chroma 1 and 2. The $B_2$ horizon has a colour ranging from light brownish grey to dark grey with hue of 10 YR, value 4 to 6 and chroma 1 or 2. Texture varies from sandy loam to clay loam. Structure is either medium sub-angular blocky or massive. The $C_2$ horizon is commonly lighter in texture and it varies from loamy sand to loam with more of coarse sand. The colour ranges from yellowish brown to dark greyish brown with a hue of 10 YR, value 4 or 5 and chroma 2 or 4. This horizon is characterised by the presence of prominent mottles of yellow and red in grey matrix. The colour of mottles usually dominates.

Soils of this series are distributed in Manalur, Kanimangalam, Annakara, Brahmakulam, Porathissery, pullur, Padiyur, Vadakkumkara, Thekkumkara, Kallettumkara, Oorakam, Karamukku and Vadakkumuri villages in Thrissur district.

**(ii) Edathuruthy series**

These are very dark greyish brown alluvial soils having sandy loam to clay surface texture underlain by clay loam to silty clay sub-soils. An increase in fine sand is noticed with depth. The $C_2$ horizon is embeded with fine shiny mica flakes. These soils are seen in flat to gently slopy lands bordering streams and rivers. They are developed over alluvial deposits by rivers and show weak profile development and are moderately well drained with moderately rapid permeability.

*The description of a typical pedon is given below:*

| *Horizon* | *Depth (cm)* | *Description* |
|---|---|---|
| Ap | 0-15 | Dark greyish brown (10 YR 4/2), clay, coarse granular structure, very friable, slightly sticky and slightly plastic, abundant roots, clear smooth boundary (8-15 cm thick). |
| $C_1$ | 15-75 | Dark yellowish brown (10 YR 4/4), clay, moderate, medium, sub-angular blocky, friable, yellow and dark mottlings present, clear wavy boundary (40-60 cm thick). |
| $C_2$ | 75-110+ | Dark brown (7.5 YR 3/2), s ilty clay, moderate sub-angular blocky, friable, sticky and plastic, fine mica flakes present. |

## Range in characteristics

Thickness of the solum is always more than 110 cm. Clay fraction forms the major portion of the soil mass. Fine mica flakes are seen embeded in the $C_2$ horizon. Stratification is not uniform. Occasionally a light textured layer is also observed, just below $C_2$ horizon. Clay is the most common texture of solum. Colour of the solum ranges from dark yellowish brown to dark greyish brown.

Regarding colour, A horizon has a hue of 10 YR with value 4 and chroma 1 to 2. The texture ranges from sandy loam to clay. The structure is mostly granular. Colour of $C_1$ horizon is either 10 YR or 7.5 YR, value 3 and chroma 2 to 4. The main texture of $C_2$ horizon is clayey, while clay loam and silty clay textures are also noticed. The $C_2$ horizon with dominant dark brown colour is characterised by the presence of fine mica flakes.

The competing series includes the Manalur series which is also developed from alluvial sediments. In this series, coarse sand predominates in the lower layers and have an abundance of red and yellow mottles in grey matrix. The mottled colour dominates the matrix colour. This series is mainly distributed in Kizhppallikkara, Cherpu, Edathuruthy, Kattur, Karalam, Thottippal, Edathirinji and Parappukkara villages.

### (iii) Ayyanthole series

The soils of Ayyanthole series are dark greyish brown and very deep with surface texture varying from sandy loam to clay. They possess highly mottled clay subsoils. The clay content increases with depth. These soils occur as intermittent patches in flat low lying valley portions interspersed with topped ridges and

plateaus. They are mostly developed on colluvium derived from biotite gneiss as a result of the deposition of finer particles from the neighbouring slopes. Due to colluviation the laterite debris below are buried down.

*The description of a typical pedon is given below:*

| *Horizon* | *Depth (cm)* | *Description* |
|---|---|---|
| Ap | 0-10 | Dark greyish brown (10 YR 4/2) when moist, clay, moderate coarse subangular blocky structure, friable, sticky and plastic, abundant roots, clear smooth boundary (7-10 cm thick). |
| $C_1$ | 10-35 | Dark yellowish brown (10 YR 4/4) moist, clay, moderate coarse, subangular blocky structure, firm, sticky and plastic, coarse, distinct common yellowish brown mottlings present, few roots present, clear wavy boundary (15-25 cm thick). |
| $C_2$ | 35-70 | Dark brown (10 YR 4/3) clay, moderate, coarse, sub-angular blocky structure, firm, sticky and plastic, highly mottled layer with many prominent red (10 YR 4/8) mottlings present, clear wavy boundary (40-60 cm thick). |
| $C_3$ | 70-110+ | Very dark greyish brown (10 YR 3/2), loose clay, massive structure, sticky and plastic, few yellow mottlings, (35-60 cm thick). |

## Range in characteristics

Solum is very thick and is always 110 cm. It is very difficult to trace the underlying rock. stratification is not uniform in the profile. The thickness of the mottled layer varies considerably. Certain profiles therefore fail to reveal the underlying loose clay layer. Abundant mottlings are noticed in the $C_2$ horizon, whereas they are sparsely seen in the $C_1$ and $C_3$ horizons. Clay texture predominates throughout the profile. The common colour of the solum is dark greyish brown.

Colour of A horizon is dominantly dark greyish brown, with a range from dark yellowish brown to dark greyish brown with hue of 10 YR, value 3 to 4 and chroma 2 to 4. Surface texture ranges from sandy loam to clay. Structure is mainly medium to coarse sub-angular blocky. The $C_1$ horizon is more or less identical to A horizon in colour and structure except for the presence of distinct yellow and brown mottlings. Dark brown is the common colour of $C_2$ horizon. Clay forms the major textural grade of this horizon with coarse sub-angular blocky structure. An underlying loose clay layer is noticed in very deep profiles.

Kizhpallikkara series compete with these soils. Profiles under Kizhpallikkara series have a dominant grey colour throughout and are developed over alluvial and colluvial sediments. These soils are distributed in Cherpu, Thottippal, Chazhur, and Ayyanthole villages.

**(iv) Kizhppallikkara series**

Soils grouped under this series represent very deep dark grey colluvial deposits showing wide variation in surface texture. The subsoil texture is usually clay with prominent mottles of red and yellow colour. The grey matrix colour dominates throughout the profile due to impeded drainge. These soils occur on level to gently slopy lands in the intervening mid upland. They are developed as a result of movement and superficial deposition of soil products from the neighbouring areas by colluviation and alluviation. It is imperfectly drained with slow permeability.

*The description of a typical pedon is given below:*

| *Horizon* | *Depth (cm)* | *Description* |
|---|---|---|
| Ap | 0-8 | Dark grey (7.5 YR 4/0), Clay, moderate coarse sub-angular blocky structure, firm, sticky and plastic, abundant roots, clear smooth boundary (8-16 cm thick). |
| $C_1$ | 8-25 | Dark grey (10 YR 4/1), clay, moderate coarse sub-angular blocky structure, firm, very sticky and plastic, few yellowish brown (10 YR 5/6) mottlings present, diffuse boundary (15-25 cm thick). |
| $C_2$ | 25-110+ | Dark greyish brown (10 YR 4/2), clay, moderate coarse sub-angular blocky structure, firm, very sticky and plastic, many prominent red (2.5 YR 4/6) mottlings present, (80-100 cm thick). |

**Range in characteristics**

Thickness of solum is always more than 110 cm but ranges from 110 to 150 cm. Wide variation is noticed in the surface texture. The sub-soils remain clayey throughout, with increase in percentage of clay noticed down the profile. Grey soil colour predominates throughout the profile. Horizon differentiation is weakly expressed. Prominent red mottlings are noticed in abundance in the $C_2$ horizon.

The colour of surface horizon ranges from dark grey to dark greyish brown. The textural range is from clay-loam to clay. The structure varies from

medium granular to medium subangular blocky. Dark grey or very dark grey with hue of 10 YR is the main soil colour of the $C_1$ horizon but dark greyish brown colour is also noticed in the mottled layers. Texture varies from clay loam to clay. Clay texture predominates in the lower layer. The structure is medium to coarse sub-angular blocky.

Ayyanthole series competes with these soils. The soils are mainly distributed in the Muriyadu, Kizhippillikkara, Karalam, Thottippal and Thanniyam villages in the kole area.

*The morphology of the kole soils described above reveal that there is no clear horizon development, due to impeded drainage conditions and high water table. The colour of the surface horizon varies from dark yellowish brown to dark brown. Greyish colour is noticed in the sub-surface horizon especially in soils of upper fringes. The sub-surface layers of soils of the flood plain varies from black to very dark grey.*

*Structure is mostly massive under field conditions but on air-drying the soils become very hard because of high content of clay and sesquioxides. The heavy texture is also responsible for the slow permeability of the soils. Imperfect drainage conditions and high water table in kole lands are the results of its physiographic positions.*

*The soils of the outer fringes have sandy loam to clay surface texture. They have mottled sub-surface horizons and are formed mainly from colluvial sediments from the adjacent hills. These soils also have massive structure, and impeded drainage conditions and slow permeability but have better external drainage because of higher physiographic positions.*

## 3.3 Physico-chemical characteristics

### 3.3.1 Mechanical composition

The mechanical composition of soils **[tables 2 (a) and 2 (b)]** reveals wide variation in texture, ranging from sandy loam to clay. The surface and subsurface layers of the profiles have more or less same texture. The samples from Chettupuzha, Manakkody-Varyam, and Pullu showed clay texture while sandy soils were observed in Anjumuri, Kanjani, Manalur, Kannoth, Mullasseri, Anthikad and Alappad. Intermediate textures of loam, sandy clay loam and clay loam were observed in other locations as reported by Sheela (1988). The highest clay of 70 percent was observed in pullu area. Reports by Hameed (1975) reveal predominantly clay texture from all locations. The data from the above investigations clearly bring out the sedimentary nature of the soils of the area.

Table 2(a). MECHANICAL COMPOSITION OF SOILS

| No. | Location | Depth cm | Coarse sand % | Fine sand % | Silt % | Clay % | Textural class |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| I | a. Chettupuzha | 0-20 | 14.0 | 2.8 | 38.3 | 42.9 | Clay |
| | b. " | 20-40 | 15.9 | 4.9 | 47.0 | 29.2 | Clay |
| | | Mean | (14.95) | (3.9) | (42.7) | (36.0) | |
| *II* | a. *Manakkody-Varyam* | *0-20* | *6.2* | *2.4* | *39.2* | *47.8* | *Clay* |
| | b. " | 20-40 | 3.8 | 2.0 | 32.5 | 58.9 | Clay |
| | | Mean | (5.0) | (2.2) | (35.9) | (53.4) | |
| III | a. Manakkody-Anjumudi | 0-20 | 69.2 | 3.1 | 22.2 | 3.5 | Sandy loam |
| | b. " | 20-40 | 70.4 | 8.0 | 15.0 | 5.0 | Sandy loam |
| | | Mean | (69.8) | (5.6) | (18.6) | (4.3) | |
| IV | a. Eravu | 0-20 | 50.4 | 15.3 | 26.0 | 5.5 | Sandy loam |
| | b. " | 20-40 | 35.8 | 21.4 | 14.2 | 27.0 | Sandy loam |
| | | Mean | (43.1) | (18.4) | (20.1) | (16.3) | |
| V | a. *Kanjani* | 0-20 | 68.6 | 21.4 | 5.6 | 2.5 | Sandy |
| | b. " | 20-40 | 56.6 | 27.2 | 6.5 | 7.0 | Sandy |
| | | Mean | (62.6) | (24.3) | (6.0) | (4.8) | |
| VI | a. Manaloor | 0-20 | 33.9 | 22.3 | 32.6 | 8.0 | Sandy loam |
| | b. " | 20-40 | 34.5 | 24.8 | 21.8 | 16.7 | Sandy loam |
| | | Mean | (34.2) | (23.6) | (27.2) | (12.4) | |
| VII | a. Thekke Konjira | 0-20 | 31.7 | 19.8 | 20.0 | 23.2 | Sandy clay loam |
| | b. " | 20-40 | 42.3 | 22.7 | 6.0 | 26.4 | Sandy clay loam |
| | | Mean | (37.0) | (21.3) | (13.0) | (24.8) | |
| VIII | a. Kannothu | 0-20 | 40.6 | 16.6 | 33.4 | 9.0 | Sandy loam |
| | b. " | 20-40 | 36.3 | 16.9 | 40.9 | 5.7 | Sandy loam |
| | | Mean | (38.5) | (16.8) | (37.2) | (7.4) | |
| IX | a. Mullasseri | 0-20 | 51.1 | 13.2 | 30.8 | 2.7 | Sandy loam |
| | b. " | 20-40 | 67.1 | 6.7 | 18.0 | 6.3 | Sandy loam |
| | | Mean | (59.1) | (10.0) | (24.4) | (4.5) | |
| X | a. Anthikad | 0-20 | 48.7 | 15.1 | 26.3 | 7.7 | Sandy loam |
| | b. " | 20-40 | 66.9 | 10.3 | 16.3 | 5.5 | Sandy loam |
| | | Mean | (57.8) | (12.7) | (21.3) | (6.6) | |
| XI | a. Chazhur | 0-20 | 33.5 | 11.6 | 27.5 | 25.7 | Sandy clay loam |
| | b. " | 20-40 | 21.9 | 22.5 | 42.0 | 12.6 | Loam |
| | | Mean | (27.7) | (17.0) | (34.8) | (19.2) | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| XII | a. Alappadu | 0-20 | 59.3 | 23.3 | 14.0 | 2.4 | Sandy |
| | b. " | 20-40 | 48.8 | 22.2 | 24.7 | 3.7 | Sandy |
| | | Mean | (54.0) | (22.8) | (19.4) | (3.1) | |
| XIII | a. Pullu | 0-20 | 7.1 | 4.9 | 15.0 | 70.0 | Clay |
| | b. " | 20-40 | 4.3 | 5.4 | 31.7 | 56.0 | Clay |
| | | Mean | (5.7) | (5.2) | (23.4) | (63.0) | |
| XIV | a. Pazhuvil | 0-20 | 21.2 | 19.6 | 22.4 | 33.6 | Clay loam |
| | b. " | 20-40 | 22.8 | 14.1 | 26.8 | 34.0 | Clay loam |
| | | Mean | (22.0) | (16.9) | (24.6) | (33.8) | |
| XV | a. Cherpu | 0-20 | 14.9 | 17.7 | 22.9 | 42.3 | Clay loam |
| | b. " | 20-40 | 15.0 | 21.0 | 27.6 | 35.6 | Clay loam |
| | | Mean | (15.0) | (19.4) | (25.3) | (39.0) | |

Source : Sheela (1988)
Mean values are given in paranthesis

## Table 2(b) MECHANICAL COMPOSITION OF SOILS

| Lab. No. | Name of field | Depth cm | Coarse Sand % | Fine Sand % | Silt % | Clay % | Textural class |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1. | Pullazhy Kole | 0-22 | 2.3 | 3.5 | 23.8 | 62.0 | Clay |
| | " | 22-44 | 7.4 | 5.7 | 15.0 | 59.3 | Clay |
| | | | (4.9) | (4.6) | (19.4) | (60.7) | |
| 2. | Muriyad Kole | 0-22 | 27.4 | 7.3 | 31.8 | 24.3 | Silty loam |
| | " | 22-44 | 10.0 | 6.3 | 15.8 | 60.5 | Clay |
| | | | (18.7) | (6.8) | (23.8) | (42.4) | |
| 3. | Jubily Padavu Kole | 0-22 | 2.0 | 15.1 | 14.3 | 60.0 | Clay |
| | " | 22-44 | 6.3 | 15.3 | 15.0 | 60.0 | Clay |
| | | | (4.2) | (15.2) | (14.7) | (60.0) | |
| 4. | Muthuvammal Kole | 0-22 | 10.1 | 9.6 | 15.0 | 59.3 | Clay |
| | " | 22-44 | 0.5 | 5.2 | 12.5 | 66.3 | Clay |
| | | | (5.3) | (7.4) | (13.8) | (62.8) | |
| 5. | Olampakkadavu Kole | 0-20 | 2.8 | 16.7 | 18.8 | 54.8 | Clay |
| | " | 22-44 | 0.6 | 14.0 | 18.8 | 50.3 | Clay |
| | | | (1.7) | (15.4) | (18.8) | (52.6) | |

Source : Abdul Hameed (1975)
Mean values are given in paranthesis

### 3.3.2 Chemical characteristics

The chemical characteristics of kole soils reported by Hameed (1975) are presented in **table 3.**

The organic matter content of the upper layer varied from 2.07 per cent to 4.16 per cent, while in the sub-surface layer it was 1.37 to 9.7 per cent. In general the upper layers were mineral in nature. Sub-surface accumulation of peat was observed in some areas and the organic matter content in this layer varied from 28.91 per cent to 69.91 per cent. Thus it was evident that there was deposition of mineral alluvial material over peat.

The soils of the kole area in general are acidic with pH ranging from 2.6 to 6.3. The pH decreased with depth in the profile. The low pH of soils in the deep layers of the profile are evidently due to the effect of organic matter. The phenomenon of pH increase by flooding have been observed in kole soils. When the pH of wet soil samples drawn after dewatering in *mundakan* season was estimated, the values ranged from 5.6 to 6.9 which reveals that in the early stages of *mundakan* crop, acidity is not serious, but it resurges later due to intermittent wetting and drying. The problem is aggravated by lack of proper drainage. The electrical conductivity varies from 0.16 to 15 ds/m. The high values observed are mainly in areas vulnerable to sea water inundation, whereas in areas away from sea reach, the conductivity is fairly below the toxic limit.

The total nutrient content were fairly high in kole soils. The total nutrient content was 0.14 to 0.57 per cent for nitrogen, 0.02 to 0.24 per cent for $P_2O_5$ and 0.09 to 0.60 per cent for $K_2O$. In respect of CaO the levels were high ranging from 0.19 to 2.08 per cent. The lower layers of the profiles registered higher values possibly due to the influence of the limeshell deposits observed. The MgO content ranged from 0.03 to 0.9 per cent.

The CEC of the surface soils varied from 12.6 to 48.6 me/100g. The higher CEC values are clearly the effects of clay and organic matter content of the soils. The sedimentary nature of the deposits also indicate the presence of 2:1 type of clays.

The above observations in respect of physico-chemical characteristics and morphology of the soils reveal similarities to those of Kari soils of Kuttanad and the swamp soils of Kattampally.

Table 3. PHYSICO-CHEMICAL PROPERTIES OF SOILS

| Sl. No. | Location | Depth | Organic matter | pH | Conductivity | Total % | | | | | CEC mc/ 100g |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | cm | % | | ds/m | Nitrogen | $P_2O_5$ | $K_2O$ | CaO | MgO | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 1. | Pullazhy kole | 0-22 | 4.16 | 6.3 | 0.69 | 0.43 | 0.24 | 0.17 | 0.55 | 0.06 | 38.36 |
| | | 22-44 | 8.15 | 5.6 | 2.86 | 0.39 | 0.22 | 0.15 | 0.80 | 0.11 | — |
| | | 44-66 | 47.89 | 3.9 | 15.00 | 0.32 | 0.11 | 0.19 | 2.08 | 0.30 | — |
| 2. | Muriyad kole | 0-22 | 2.90 | 4.6 | 0.64 | 0.32 | 0.09 | 0.09 | 0.33 | 0.03 | 12.60 |
| | | 22-44 | 4.37 | 4.2 | 0.16 | 0.29 | 0.05 | 0.10 | 0.33 | 0.05 | - |
| | | 44-66 | 28.96 | 3.5 | 1.27 | 0.57 | 0.05 | 0.24 | 1.89 | 0.36 | — |
| 3. | Anthikkad Kole | 0-22 | 2.67 | 4.7 | 0.58 | 0.30 | 0.10 | 0.19 | 0.41 | 0.30 | 27.11 |
| | | 22-44 | 1.55 | 4.5 | 0.48 | 0.14 | 0.03 | 0.16 | 0.41 | 0.32 | — |
| | | 44-66 | 4.78 | 4.1 | 3.13 | 0.30 | 0.02 | 0.60 | 1.05 | 0.90 | — |
| 4. | Jubily padavu | 0-22 | 2.07 | 4.5 | 0.95 | 0.31 | 0.11 | 0.21 | 0.30 | 0.38 | 48.60 |
| | | 22-44 | 1.37 | 4.3 | 0.85 | 0.14 | 0.04 | 0.34 | 0.35 | 0.58 | — |
| | | 44-66 | 2.17 | 4.6 | 1.38 | 0.23 | 0.03 | 0.57 | 0.39 | 0.67 | — |
| 5. | Muthuvammel kole | 0-22 | 3.70 | 3.8 | 1.01 | 0.37 | 0.14 | 0.18 | 0.22 | 0.11 | 36.68 |
| | | 22-44 | 9.70 | 3.8 | 0.90 | 0.46 | 0.08 | 0.30 | 0.34 | 0.16 | — |
| | | 44-66 | 50.38 | 3.1 | 4.35 | 0.25 | 0.04 | 0.24 | 0.66 | 0.18 | — |
| 6. | Thekke Konchira kole | 0-22 | 2.85 | 4.50 | 1.06 | 0.35 | 0.10 | 0.19 | 0.22 | 0.24 | 31.61 |
| | | 22-44 | 7.59 | 4.20 | 0.85 | 0.47 | 0.09 | 0.17 | 0.27 | 0.22 | — |
| | | 44-66 | 69.90 | 3.00 | 15.00 | 0.48 | 0.05 | 0.12 | 1.06 | 0.38 | — |
| 7. | Olampakkadavu kole | 0-22 | 3.35 | 3.39 | 1.59 | 0.33 | 0.13 | 0.20 | 0.19 | 0.35 | 34.09 |
| | | 22-44 | 6.06 | 2.80 | 6.04 | 0.33 | 0.12 | 0.36 | 0.38 | 0.50 | — |
| | | 44-66 | 14.54 | 2.60 | 15.00 | 0.41 | 0.05 | 0.44 | 0.58 | 0.81 | — |

### 3.3.3 Fertility evaluation

The soil test particulars and fertilizer recommendations of some kole padavus in Thrissur district are given in **table 4.** The data reveal that the soils were acidic in reaction and the organic carbon status ranging from low to high. Though all soils were highly acidic in reaction they were mostly medium or high in available phosphorus revealing that P is not a limiting factor in kole soils. These soils were generally low in available potash. Out of the six locations, only two ranked medium with respect to available K. Detailed soil fertility investigations are

essential to asses the nutrient requirement of rice in kole soils for developing need based fertiliser recommendations for different regions.

Table 4. FERTILITY OF SURFACE SOILS

| Sl. No. | Location | pH | OC% | Rating | P (Kg/ha) | Rating | K (kg/ha) | Rating |
|---|---|---|---|---|---|---|---|---|
| 1. | Tholur | 5.18 | 0.53 | Low | 45.8 | High | 81.0 | Low |
| 2. | Adat | 4.80 | 1.89 | High | 30.0 | High | 163.0 | Medium |
| 3. | Chathan kole | 4.60 | 0.92 | Medium | 18.6 | Medium | 61.0 | Low |
| 4. | Chittilappilly | 4.61 | 0.63 | Low | 18.7 | Medium | 59.3 | Low |
| 5. | Chalakkal | 5.07 | 0.98 | Medium | 5.8 | Low | 158.0 | Medium |
| 6. | Ayyanthole | 5.40 | 0.85 | Medium | 7.0 | Low | 136.0 | Low |

Source: Agri Electronics Project, 1992.

### 3.3.4 Irrigation suitability

The interpretation of soil and land suitability for irrigation is done primarily for predicting the behaviour of soils under the altered regime brought about by irrigation.

Dilineation of land irrigability class is mainly based on the soil, topography of the land and drainage characteristics. Six irrigability classes of lands have been generally recognized. Lands under class 1 to 4 are suitable for irrigation, while class 5 is provisionally non-irrigable and the 6th is non-irrigable. All soils in one class have same degree of limitations and management problems. With increase in the number of the class, the degree of suitability decreases, cost of development and production increases and their payment capacity diminishes.

These broad groups are again subgrouped into sub-classes which are called **land irrigability units** that have the same kind of dominant limitations for sustained use under irrigation. Generally class 1 lands do not have any sub-class. The important factors like deficiencies in soils, topography or drainage conditions are responsible for placing the lands lower than class 1 and are indicated by letters 's', 't' or 'd' respectively for sub-classes. These symbols are added after the class number, for example 2s, 2d, 2sd. Thus the basic sub-classes are s, t, d, st, sd, td, and std. The soils of the kole area have been grouped under the following irrigability class and subclasses.

**(i) Class 2s**

Lands under this class have moderate suitability for irrigation. They are areas under Ayyanthole, and Kizhpallikkara series. The deficiencies of soil limit

the use of the land in growing a wide variety of crops under irrigation. The soils are very deep and the surface texture varies from sandy loam to clay. The lands are nearly level and bunded and do not require much development. The limitations to place the land under this class are either the low water holding capacity or low permeability of the soil.

**(ii) Class 2t**

Very deep soils of Manalur, Edathuruthy and Ayyanthole series having sandy loam to sandy clay texture are included in this unit. These lands have moderate limitations when used under irrigation because of uneven topography. Levelling of lands prior to irrigation is required.

**(iii) Class 2d**

Very deep soils of clay loam to silty clay texture grouped under Manalur, Edathuruthy and Ayyanthole series are included in this class. These lands have moderate limitations when used for cultivation under irrigated agriculture. Lack of suitable drainage outlets to drain the excess water during monsoon is the main limitation of these lands. Rising of water table during monsoon is yet another problem.

**(iv) Class 2st**

They include very deep soils coming under Edathuruthy, Manalur, Ayyanthole and Kizhipallikkara series. The texture of soils varies from sandy loam to clay. The deficiencies of soil and topography permit the cultivation of only a narrow range of crops in these lands under irrigation. Either low water holding capacity or slow permeability in combination with uneven topography is the major hazard. These lands have moderate suitability for irrigation. Soil improvement measures like application of organic matter and levelling of land will be required.

**(v) Class 2sd**

This class comprises of very deep clay soils grouped under Edathuruthy series. They have moderate limitation of soil and drainage, when used under irrigation. Low permeability, high water table and non-availability of sufficient drainage outlets during monsoon are the main limitations that have necessitated the placing of these lands under this class. Cost of development and cost of production in these lands are comparatively more.

**(vi) Class 2td**

Lands under this class comprise of very deep soils of sandy loam to clay loam surface texture grouped under Manalur and Edathuruthy series. Soil deficiencies are comparatively less. The unevenness of land along with the drainage problems permits the cultivation of a narrower range of crops in these lands. These lands are moderately suitable for irrigation.

CHAPTER IV

# FEATURES OF KOLE LANDS

## 4.1 Thrissur kole

The Karuvannur river divides the Thrissur kole lands into two regions, an area of 8,072 ha in the north is termed as 'North Kole" and an area of 2,115 ha in the south is known as 'South Kole'. The northern region extends upto Kaiparampa in the north and the South Kole upto Velukkara in the south. In olden days these areas served as flood moderating kayal lands for the flood waters of Karuvannur and Kechery rivers. Flood waters from the rivers along with the run off from the adjacent catchments keep the kole fields completely submerged.

The flood waters in kole lands in the northern region discharge through Enamakkal and Idiyanchira regulators into the back waters and find their exit to sea through the Chettuva azhi. The Kechery river in the north flows into the kole lands, while Karuvannur river in the south discharge into the back waters. The back waters are connected by Kanoli canal to the Chalakudy river. Hence the flooding of the kole lands is dependent on the meteorological conditions existing at various times in the Kechery and Karuvannur basins. The continued high levels in the back waters lead to continued submergence of the kole fields.

### 4.1.1 Thrissur south kole

This area is a lowlying tract with garden lands along the boundaries, the field level varying from 0.75 m below MSL to 2.5 m above MSL. Most of the fields are below the mean sea level and get flooded during monsoon. The area is far away from the back waters with no proper outlet for the flood waters which worsens the flood situation. The flood level is as high as 5.5 m during SW monsoon in some years and last for 5 to 10 days. Water level of 2 to 2.5 m in the kole fields is observed from June to January. Normally no cultivation is possible in the low lying areas during this period. The *virippu* in the higher fields are damaged by heavy floods of SW monsoon and similar floods occur in NE monsoon as well. Floods may cause damage to the bunds and hinder road traffic.

Only *punja* crop is raised successfully in these kole areas. The irrigation water required is drawn from three storages in Karuvannur and Kurumali rivers at Kottenkottuvalavu, Illikkal and Manjankuzhi. There is a good net work of canals in the lowlying areas. In some areas an additional crop *(Kadumkrishi)* is raised by dewatering flood waters after protecting the fields with bunds. But the floods during NE monsoon occasionally may cause heavy damage to this crop. A permanent bund has already been constructed at Dhanukulam. The construction of Madaikkonam, Anandapuram and Chithroli bunds are in progress. These bunds will protect the kole fields from floods and extend the *Kadumkrishi* areas.

Vasudev committee (1969) proposed the construction of new canals and improvement of the existing canals. An outlet to the Shanmugham canal and improvement of the MM canal has also been suggested for flood control.

The south kole is geographically divided into three regions: Karalam fields, Chemmanda kayal and Muriyadu kayal.

**(i) Karalam fields**

the Karalam fields having an area of about 400 ha lie on the western side of Kizhuthani-Karalam road. On the western side is Thannissery-Pullikuzhi road and in the southern side, Irinjalakuda-Kattur road. The Karuvannur river flows west along the northern boundary of the kole fields. The MM canal passes along the Karalam fields. The irrigation water is taken from karuvannur river through a main canal starting from Nandi sluice.

**(ii) Chemmanda kayal**

This area is situated 4 km north of Irinjalakuda town and is on the western side of Thrissur-Kodungallur road. The Kizhuthani-Karalam road passes along the western side and Moorkanad-Karalam road on the northern side. The important places along the boundaries are Karalam, Moorkanad, Mapranam, Porathissery, Nellissery and Chemmanda. The total area of the field is about 500 ha. The Chemmanda kayal has a central narrow strip extending from porathissery to Karuvannur with pockets on either side running into the surrounding garden lands. The Karuvannur river flows west on the northern side. The Neerolithodu, MM canal and Panoli canal are the important canals of this area. They supply irrigation water and discharge flood waters. The Chatrap kayal and Kodanthra kayal are the two reservoirs within the fields.

**(iii) Muriyadu kayal**

The Muriyadu kayal is situated 8 km north-east of Irinjalakuda town. The kayal has a narrow central strip running north-south from Karuvannur to Thommana, with many pockets running east and west into the garden lands. The important places around the kayal are Karuvannur, Thottipal, Rappal, Parappukkara, Nellai, Anandapuram, Muriyadu, Thommana, Pullur, Kuzhikkattukonam, Madaikkonam and Mapranam. The total field area is 1,215 ha.

The NH 47 and the railway line passes along the eastern side of the area. On the western side is the Thrissur-Kodungallur road and the Irinjalakuda-Chalakudy road passes along the southern side. The Parappukkara road crosses the region almost along the middle.

The Kurumali river flows westwards along the northern side which is joined by Manali river near Irattapuzha to form Karuvannur river. The Nedumthodu

(Thamaravalayam canal) running along the centre of the kayal joins the Karuvannur river at Kanakkankadavu. This canal has a dual function of discharging flood waters to Karuvannur river and supplying irrigation water to the fields. There is a temporary regulator at Thamaravalayam. The MM canal which is the only outlet for flood waters of this area starts from Nedumthodu near Thamaravalayam.

### 4.1.2 Thrissur north kole

The area on the northern side of Karuvannur river is a stretch of low lying lands extending from the Karuvannur river bank in the south to Kaiparampa in the north and is separated from the Kanoli canal by a stretch of coconut garden. This is an area lying 0.25 m to 2.25 m below MSL. The fields in which rice cultivation is done extend to the garden lands. The levels of the fields in the fringes vary from 0.25 m below MSL to 0.5 m above MSL. There is a system of drainage-cum-irrigation channels spread over the entire area. During SW monsoon period the canals are flooded and flood waters flow over the entire rice fields and the area resembles a lake. North-east monsoon is comparatively weak. *Punja* is the main crop in this area which is raised during the period from January to May (Summer). In certain padavus an additional crop is taken during the period, August/September to December/January.

For raising these crops temporary bunds with bamboo and earth are put up every year, around the padasekharams wherever permanent bunds are lacking. Water is pumped out of the fields into the canals and stored to the available capacity. The additional crop has proved to be a success but it delays the sowing of *punja* crop which may leads to pushing the crop season to pre monsoon showers. The punja crop was dependent on lift irrigation, occasional rains, the dry weather flow through the Karuvannur river and irrigation from Peechi dam. With the commissioning of the Chimoni dam there is no dearth of irrigation water for kole cultivation.

## 4.2 Ponnani kole

As in the case of 'Thrissur kole', the Ponnani kole' lands are also believed to be lagoons formed by the recession of the sea centuries back. A shallow portion of the sea along the western periphery of the main land was isolated and they were gradually silted up during rains making the lagoons shallow. The enterprising farmers then bunded the fields, dewatered and raised rice in summer months. A late NE monsoon or early SW monsoon does damage the crop occasionally. Also during summer, scarcity of water at the fag end of the season adversely affected yield. The total geographical area of Ponnani kole is estimated as 3,445 ha. Of this 1, 487 ha are located in Thrissur district and 1,958 ha in Malappuram district.

Ponnani kole is the drainage basin of several small streams that flow to the Kanjiramukku river. The narrow valleys lying between the high lands and the streams are levelled up as terraces and converted to rice fields. The slope of the

high land around the kole area is cultivated with perennials like coconut and arecanut and annuals like banana and tapioca. The high land, mostly level in topography, accommodates homestead farming systems with coconut, fruit crops etc. The kole lands being below sea level are submerged permanently. The accumulated drainage practically stagnates, as the flow towards sea is very slow. The cultivation of *virippu* crop is practically impossible in these kole lands. The main crop is *punja* raised during January-April. Towards the close of the NE monsoon, the bunds separating the deep kole from the rice fields are repaired, water from the fields are pumped out into the deep kole and sowing or transplanting done by January. Usually a short or medium duration crop is taken.

An additional crop during the usual *mundakan* season (September-December) is suggested for the entire area. For this the bunds must be formed above the flood level. By advancing the cropping seasons *punja* can be raised earlier. This will avoid late harvest which otherwise may be damaged by early April showers or drought condition if the NE monsoon ceases early. Some areas have been enclosed with permanent bunds with the assistance of Minor Irrigation Department. The bunds have not been properly formed and the height also is inadequate. The repairs of such bunds are costly. Unless the bunds are formed at proper height the *mundakan* crop would not be successful. Therefore this crop is not favoured by the farmers.

For the *mundakan* crop the rainfall during the fag end of SW monsoon and beginning of NE monsoon and the copious discharge from the streams provide sufficient water. For preparatory tillage in *punja* season, water from the stream flow is utilized. For the growth period, water stored in the deep kole, kole canals, and the streams is available. Nevertheless, shortage of water is often experienced.

CHAPTER V

# Sources of Irrigation Water

The sources of irrigation water for the kole area are **(1) Peechi Irrigation Project (2) Vazhani Irrigation Project (3) Chalakudy Project and (4) Chimoni Project. Peechi dam** is a straight gravity masonry dam built across the Manali river (one of the tributaries of Karuvannur river) at Peechi. Out of the total storage capacity of 110 $Mm^3$ (3883 M cuft) only 37 $Mm^3$ (1306 M cuft) of water is set apart for kole cultivation. This quanity could be increased slightly as per the availability of water. The supply is made during the Punja season either through Right Bank Canal (RBC) or through the river itself. The discharge for kole area is supplied from Peechi reservior through a 33" diameter sluice provided with RBC just below its take off. This sluice can discharge about 5.7$Mm^3$/sec (201 cusces). This discharge gets into the Manali river which later on joins the Karuvannur river. The circuitous route through the natural river course runs over a distance of 39 km before it reach the canals leading to the kole areas. Further when water is let out through the Manali river its flow is blocked by temporary bunds put up by farmers to store water in the rivers for irrigating garden lands near the river banks. The left Bank Canal (LBC) of the Peechi project which is expected to irrigate higher region of the Karuvannur basin provides water to the region left of the Manali river during second crop period. Two regulators have been constructed at Illikkal and Kottenkottuvalavu. More such regulators are to be constructed at the upstream sides, where temporary bunds are put up at present.

The other irrigation project in the basin is the **Vazhani Irrigation Project** across the river Kechery. It consists of an earthen dam with a 61 km canal system. This project serves only the ayacut above the kole areas. Further the temporary bunds (chiras) put across the natural water course down stream of the Vazhani dam reduces the dry weather flow to the kole areas. Therefore eventhough the kole areas from the outlet of the flood waters of Kechery rivers, the river provide practically no irrigation water to the kole areas at times of necessity.

**Chalakudy Irrigation Project** is a diversion scheme from Chalakudy river. It utilizes the run off of the river, as also the tail race water from the Sholayar hydel schemes above, to feed rice fields in Mukundapuram and Kodungallur taluks with a net work of canals on the right and left banks of the river. A portion of the ayacut is irrigated during the *punja* season also. However the quantity of water available for kole during this period is very little, since the storage in the Peechi reservoir is utilized for the *mundakan* crop itself in most of the years. The Chalakudy river water is sometimes used for kole lands by diversion through circuitous routes but it does not effectively serve the purpose.

**Chimoni Project** was started with the aim of converting the entire kole area into double crop fields, one from September to December (the additional crop) and the other from January to May (punja). During September-December there

will be sufficient water for irrigation both due to rainfall and river flow. From January to May there will be dearth of water for the summer crop. With the construction of a dam across the Chimoni river, the necessary storage of water for this purpose has become possible. The dam site is located in Varandarappally village in Mukundapuram taluk of Thrissur district. The live storage capacity of the dam is 172.5 $Mm^3$ (6089 M cuft) with a command area of about 17,000 ha. The project has been partially commissioned in 1991. As the water is let out through the river sluice for irrigation, there is no canal system for the dam. Two regulators have been proposed to be built, one at Thottumukku and the other at Vasupuram to serve as balancing reservoirs where temporary bunds are put up at present.

The other source of irrigation for the kole areas is the **stored water in the canal system** inside the kole areas. The canals are very narrow and hence no appreciable quantity of water can be stored in them. The water level in kole canals is kept to a maximum of 60 cm since the top level of the temporary bunds is 90 cm above MSL. Whenever a sudden rain occurs and water level rises, the level will be immediately brought down to + 60 cm by operating the Enamakkal regulator, Kottenkottuvalavu regulator and Karanchira lock and also by immediately stopping the supply of water from dams. Temporary storages are effected at Puzhakkal and Kanimangalam during December-January ie after the harvest of *mundakan* crop, by bunding up the water pumped out from the kole lands just before the commencement of punja crop. This water will be sufficient enough only for the first wetting and there is no control of the flows. If this practice is discontinued by alternative means, these lands can also be brought under punja crop.

CHAPTER VI

# CROPPING PATTERN IN KOLE FIELDS

In the kole land proper, two rice crops are taken viz kadumkrishi (additional crop) and punja. In the upper region of kole areas *virippu, mundakan* and *punja* crops are cultivated. The field level of a particular locality decides the period of cultivation. *The general seasons of rice cultivation are as follows:*

| | ***Season*** | ***Period*** |
|---|---|---|
| 1. | Virippu | April-August |
| 2. | Mundakan | August/September-December/January |
| 3. | Kadumkrishi | September/October - January/February |
| 4. | Punja | December/January - April/May |

## 6.1 Virippu

In higher rice fields around the kole lands which are flooded during heavy rains, the floods may last for four or five days only. Varieties capable of withstanding floods for a few days are used for this crop. The fields will be prepared dry and the seeds sown with the onset of first monsoon rain. By the time floods come, the crop will be 30-40 days old. In the main kole lands *virippu* is not feasible since the entire area would be flooded during this period.

## 6.2 Mundakan

Rice fields of medium elevation comeout of water when the floods subside by August. *Mundakan* crop can be raised in these fields. Irrigation has to be provided throughout the crop period.

## 6.3 Kadumkrishi

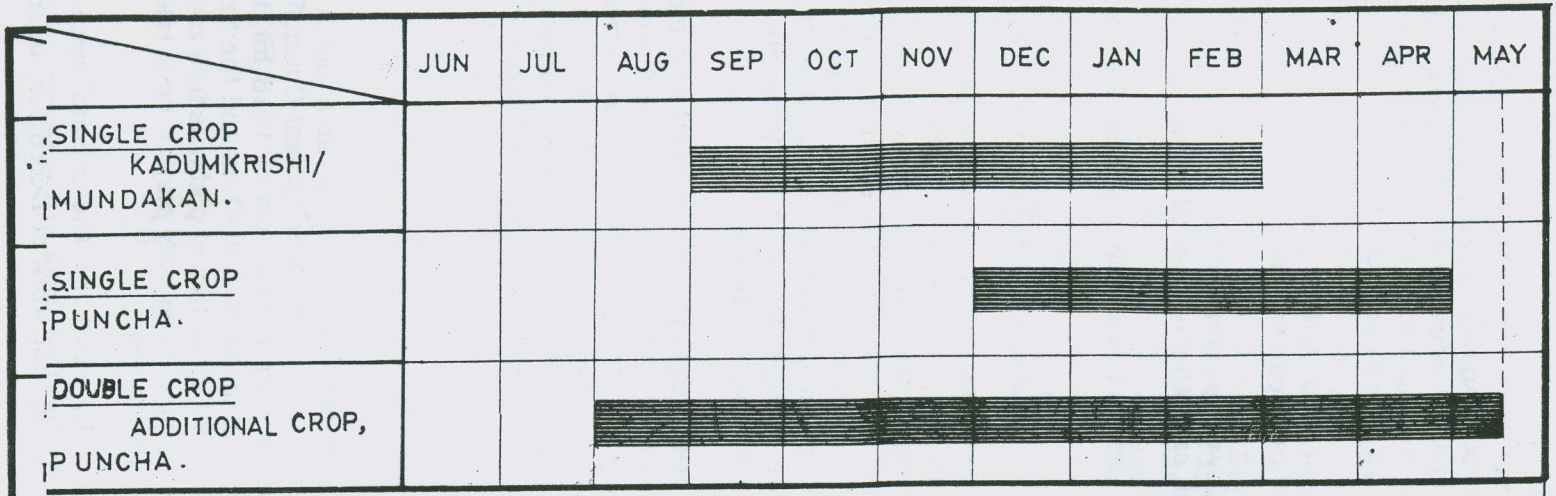
The cropping period for *kadumkrishi* in kole lands almost coincides with the Mundakan crop in normal lands but a bit later. This crop cultivated in September-January period, is possible only in areas protected by bunds. Towards the end of SW monsoon ie by September, the flood waters in the fields subside considerably. Water from the protected area will be pumped out in 10 to 15 days. When the water level falls, the bunds around the padavus are raised and strengthened by means of coconut cadjans, bamboo posts and laterite soil to a height of 1 to 1.5 m above the field level. When there is only 10 to 15 cm water in the fields, the crop is direct sown or transplanted. Continuous pumping out of the water is necessary for the major portion of the crop period. Towards the end of the crop period, irrigation water has to be supplied.

## 6.4 Punja

*Punja* crop is raised over the entire kole area. Temporary earthen bunds are put up around groups of rice fields in December-January wherever bunds

# RICE CROPPING PATTERN IN 'KOLE'

FIG.8




SINGLE CROP

KADUMKRISHI / MUNDAKAN : SEP/OCT — JAN/FEB

PUNCHA : DEC/JAN — MAR/APR

DOUBLE CROP

ADDITIONAL CROP : AUG/SEP — DEC/JAN

PUNCHA : JAN/FEB — APR/MAY

have not been taken for additional crop and the excess water is pumped out into the canals. The crop period is from December-January to April-May. In the early stages of the crop, water needs are met from the summer flow in the rivers and the storage in canals and at later stages water from dams are used for irrigation. *The following factors are considered in deciding the crop seasons.*

(i) The field should be kept fallow for at least 15 days after each crop and for a longer period at the beginning of monsoon season.

(ii) The first flood water should be allowed to enter the kole fields to increase its fertility by the deposition of silt and other organic matters.

(iii) Short duration varieties must be used to fit into the new cropping sequences.

(iv) As far as possible rain water should be used to the miximum benefit.

The kole lands are dewatered after protecting contiguous area of fields (Padavu) with bunds. In areas where permanent bunds are lacking temporary earthen bunds are constructed which are called 'Mattoms'. They leave a drainage channel between 'padavus'. The mattoms are formed with earth brought in country boats from outside. The sides of the mattoms are vertical, protected by bamboo posts and coconut kadjans. These posts and kadjans are to be replaced once in three years and the maintenance is expensive. The mattoms are not always trustworthy and breaches do occur during high floods.

Dewatering is generally done by **centrifugal pumps** or **'Petti and Para'** and rarely by country **'water wheels'** (Chakram). Petti and Para is an indigenous pumping device which consists of a vertical cylinder (para) in which an impeller works on electricity. The impeller pushes the water into the wooden box (petti) placed horizontally at the top of the cylinder. The outer end of the box is connected to the kole canal. This system is very effective for low head high discharge cases. The diameter of the cylinder and the box are dependent on the power of the motors.

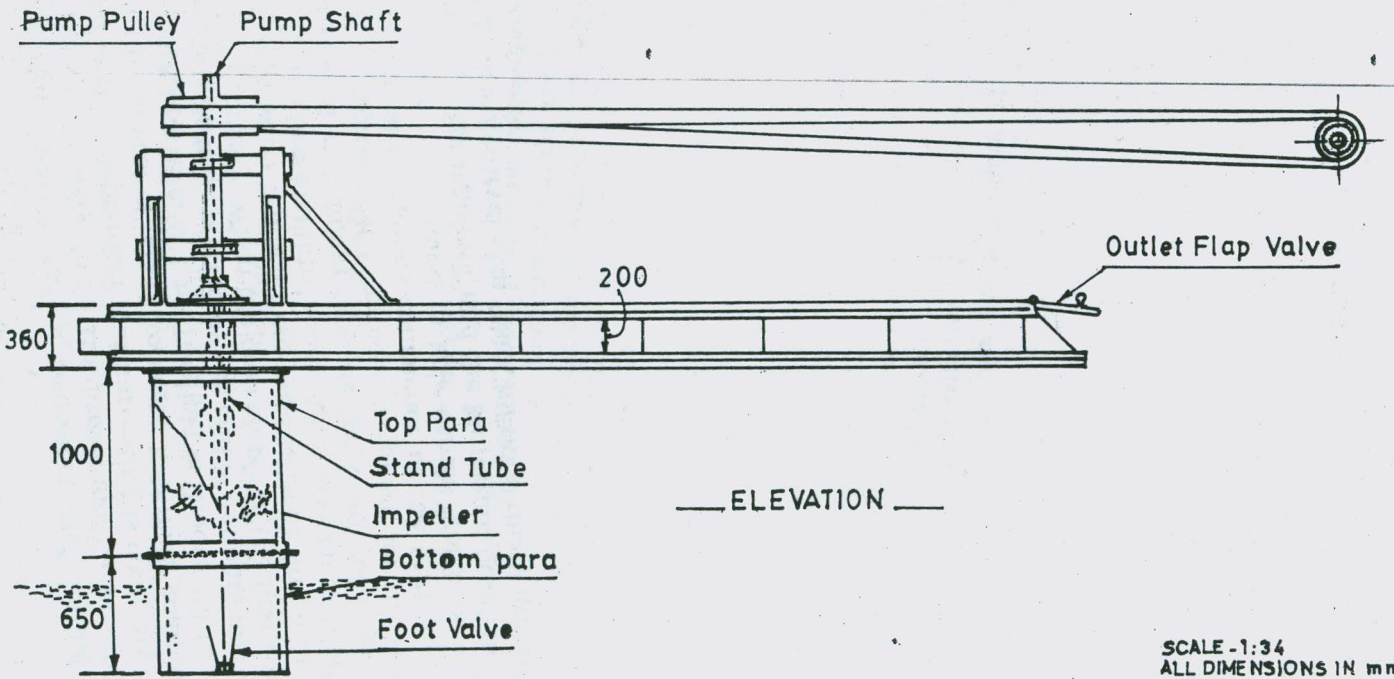
## 6.5 Zonal System of Cultivation

For successful cultivation of the *punja* crop, the kole area north of Karuvannur river is divided into three zones by the Kole Development Council in 1989. The first zone consists of 26 padavus with a total area of 1916 ha, the second zone comprises of 25 padavus covering an area of 1670 ha and the third zone of 31 Padavus has an area of 4486 ha. The allocation of padavus into zones may vary in different years. In the first and second zones only *punja* crop is taken and in the third zone an additional crop is also raised.

In the first zone dewatering [illegible] by the second week of Novermber and sowing will be completed by the first week of December. In the

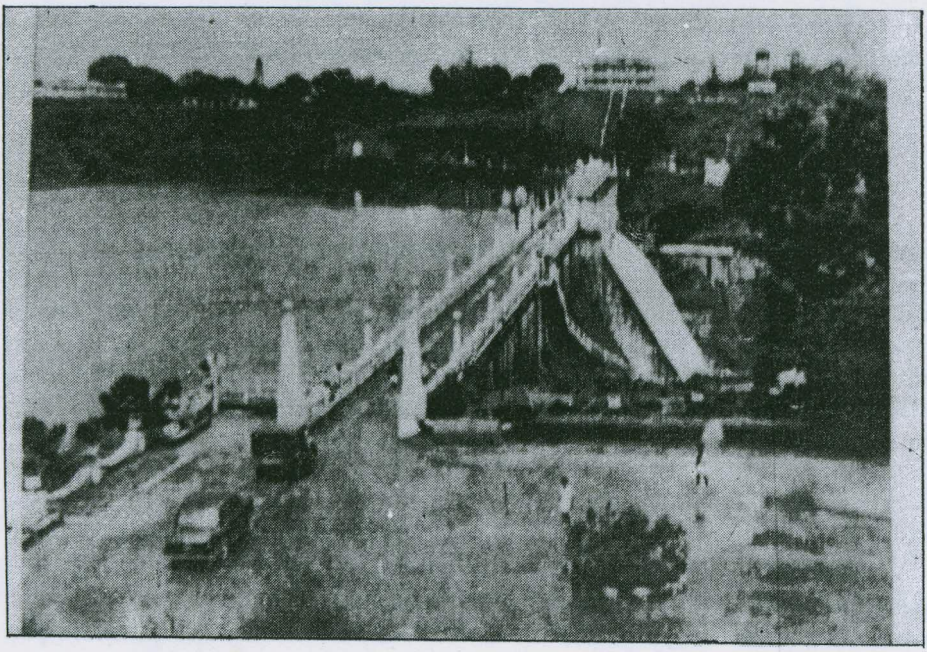
second zone dewatering starts by the end of December and sowing will be completed by the third week of January. In the third zone, *mundakan* crop would be sown before the third week of September and harvesting is completed by the end of December. After the harvest of *mundakan* crop it is made mandatory to flood the field for one month to a level of 1 m. The field is flooded till the end of January. Dewatering for *punja* is to be started by the end of January and sowing must be over by the end of February. When the crop starts in the first zone, the second zone gets flooded with water drained from the first zone and it acts as a source of irrigation water for the first and third zones. As soon as cultivation starts in the second zone, harvest of *mundakan* crop in the third zone, would be completed and water will be stored in it to provide irrigation for the first and second zones till the agricultural operations commence in the third zone. The water drained from the third zone is stored in kole canals which is used for summer irrigation. The Enamakkal regulator and the Munayam bund closes by 15th of December, keeping the water level +1m. The Chirakkal thodu and Herbert canal are closed by 15th August.

*Fig.9*

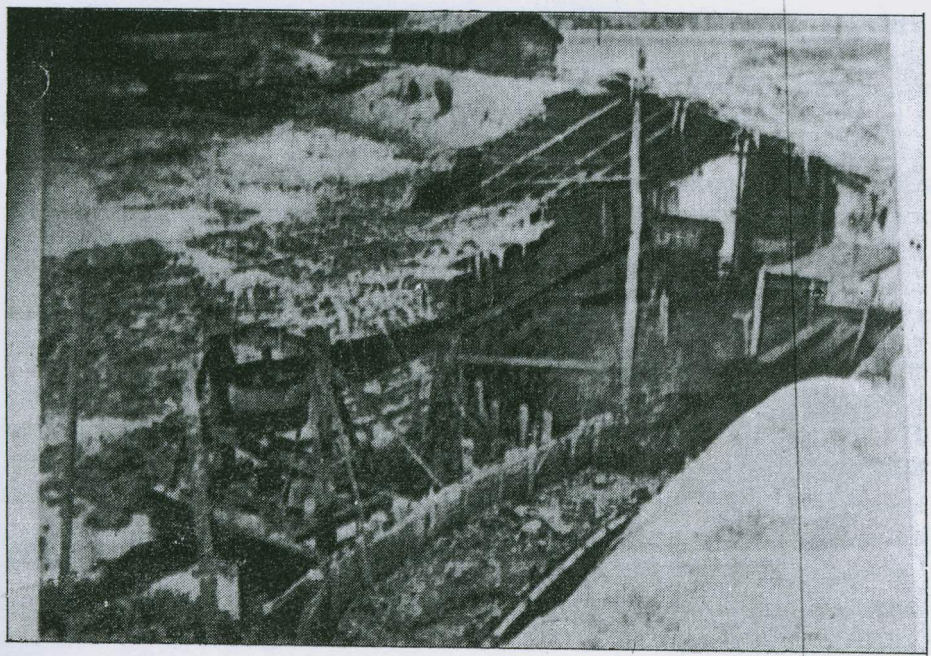



## PETTI AND PARA

COURTESY: Sri. K JOHN THOMAS, PROFESSOR OF AGRIL. ENGINEERING, K.A.U.



Peechi dam



Petti and Para

CHAPTER VII

# TECHNICAL AND SOCIO-ECONOMIC CONSTRAINTS IN KOLE CULTIVATION

## 7.1 Submergence and lack of drainage

Thrissur kole functions as flood basin for Kechery and Karuvannur rivers. The flood waters accumulated in kole lands have to find a long way to have an exit to the sea and hence water spreads out in the entire kole area and submerge the fields. The floods often spoil the bunds and damage the crop, if heavy rains occur in crop season. The problem of floods can be solved by (i) construction of storage reservoirs at the upper reaches of rivers (ii) construction of flood banks and channelisation of flood flows and (iii) cutting a direct outlet to the sea from the flood plains.

## 7.2 Irrigation problem

Though,there is sufficient water for irrigation in the *mundakan* season to supplement the rainfall and other sources, drought occurs in summer season since *punja* crop is entirely dependent on irrigation. It has been experienced in Thrissur kole that irrigation water supplied from Peechi for kole cultivation does not reach the entire area due to the topography of the lands and insufficiency of supply. Partial commissioning of Chimoni project has solved the problem to some extent.

In Ponnani kole there is no external source of irrigation water. If the crop is commenced late there will not be sufficient water in the deep kole area to be used for irrigation during the last phase of crop growth. Thus the crop may be either damaged or yield would be reduced substantially.

On the peripheral lands of streams where perennial and annual crops are raised, some land owners pump out water for irrigation which increases the problem of water scarcity.

## 7.3 Lack of permanent bunds

The majority of farmers are small and marginal, with the size of holdings ranging from 0.2 to 0.7 ha. The temporary bunds have to be repaired every year to be above the flood level of NE monsoon, which require investment. These temporary bunds are liable to be breached, which add to the cultivation expenses of the farmers. This can be solved by construction of permanent bunds.

## 7.4 Soil acidity

The soil is inherently acidic and hence, annual application of lime is essential for correcting the problem. This warrants high financial strain on the part

of farmers. The temporary wetting and drying condition in kole fields aggravates the problem of acidity. Injurious salts are also not washed out due to impeded drainage. Proper internal drainage system will solve these problems. A peripheral canal in each padasekharam to collect the land drainage has to be formed. The feasibily of sub-surface drainage must be explored.

## 7.5 Salt water ingression

The Thrissur kole is directly connected to the sea by the backwaters called the Kanoli canal through the Chettuva azhi. The main path of saline water intrusion is the channels connecting the kole lands to the backwaters at Enamakkal. Saline water gets into the kole lands also through the three canals, Puthenthodu, Chirakkalthodu and Herbertcanal from the Karuvannur river which is contaminated by saline water from the Kanoli canal.

The important structure constructed with the objective of preventing the ingress of salt water is the regulator at Enamakkal. But it is found from experience that it doesn't serve the purpose satisfactorily. The other structures with this function are the Karanchira lock and Kottenkottuvalavu regulator. These structures also fail to arrest the salt water ingression. The salt water enters the kole fields from the backwaters by leakage through the ends and bottoms of the shutters and also through subsoil percolation.

The Ponnani kole is connected to the sea through the Veliyamkode gap and Bharathapuzha river. This is a tidal basin. The salt water ingression into the kole area makes the water unsuitable for irrigation. This problem has been solved to a great extent by the construction of the Viyyam dam.

## 7.6 Improvement of agricultural technologies

The kole ecosystem is different from other agro-ecosystems in many aspects. The periods of cultivation are well defined, the soils are comparatively fertile and productive and the microclimate is favourable.

The main crop *punja* is raised from December to April and the *mundakan* crop in some pockets from September to December. If the NE monsoon ceases early, there is probability of drought at the fag end of *mundakan* and also in *punja* crop. So also, if the *punja* crop gets delayed, there would be flood damage in case the SW monsoon sets in earlier. Considering these aspects intense studies have to he conducted for evolving proper technologies for kole cultivation. It would be better to conduct onfarm studies to solve the existing problems and also to evolve cost effective technologies. *The studies proposed include:* (i) Choice of HYV varieties suitable for the soil, moisture conditions and the period available for cropping. Identification of varieties to suit double crop sequence, need prime importance, (ii) water management to utilize the optimum quantity of water for cultivation, (iii) technologies to enrich the soil by proper organic manuring including bio-fertilisers, (iv) manurial management trials to quantify the use of fertilisers for minimum

cost, maximum efficiency and higher yield, (v) other agronomic practices for maximising the yield, (vi) pest and weed management studies, (vii) partial mechanisation, (viii) post-harvest problems, (ix) economic aspects etc.

## 7.7 Shortage of quality seeds

The shortage of quality HYV paddy seeds is a major problem for large scale adoption of new varieties. It is calculated that about 1,600 tonnes of seed is required both for *mundakan* and *punja* seasons. Appropriate startegies have to be evolved for timely supply of sufficient quantity of better quality rice seeds.

## 7.8 High cost of cultivation

Due to the peculiar nature of the kole area the cost of cultivation is very high. Further, it is associated with a high degree of risk also. The recurring expenditure is also increasing year by year. By the construction of permanent bunds a substantial part of this expenditure can be saved. A major portion of the canals and river chanels have been silted up and for proper free flow of water they require desilting, deepening and proper maintnenance.

## 7.9 Partial mechanisation

Partial mechanisation is proposed to reduce the cost of cultivation and drudgery of agricultural labourers. Shortage of labourers at peak season is a problem for kole cultivation. Manual labour has become very costly. Modern machines suitable to the locality for tillage, harvesting, threshing etc can be utilized economically.

## 7.10 Land development works and infrastructure

Two more regulators have to be constructed at Kuthumakkal and Thamaravalayam. Work on Karanchira lock has to be completed. So also, land development activities like improvement of canal system have to be completed.

Engine sheds, dewatering equipments, farm roads, oil engines, petti and para etc have to be properly mainatined.

## 7.11 Marketing of the produce

The existing marketing and storage problems have to be solved to make kole cultivation profitable. Some institutional set up for procuring, processing and marketing will prevent the farmers from exploitation by middlemen, and improve their economic gains.

## 7.12 Transportation problems

Eventhough there are roads upto the boundary of kole fields, there are no transportation facilities within the padavus. With proper communication facilities along the entire kole fields quick movement of aggricultural produce and inputs for cultivation can be effected.

# CHAPTER VIII
# LANDMARKS IN KOLE DEVELOPMENT

Though some enterprising and adventurous farmers have started rice cultivation in kole lands by reclamation in the 18th century itself and gradual improvements in kole cultivation took place over a period of years, the development efforts gained momentum only after independence. The important land marks in the development of kole lands are briefly depicted in this chapter.

## 8.1 Thrissur kole

**8.1.1** With the advent of 'Grow More Food" compaign in 1951, improvements in kole cultivation was initiated by storing part of the pumped out water in the adjacent *mundakan* lands and using this storage for irrigation.

**8.1.2** With the commissioning of Peechi Irrigation System in 1958, the kole fields were included in the ayacut of that scheme and this brought the entire area under simultaneous punja crop. Throughout this period the water level in kole canals was kept to a maximum of +2 ft MSL as the top level of the temporary bund was at +3 ft MSL. Whenever a sudden rain occured and water level rose, the water level was immediately brought down to +2 ft by operating the Enamakkal and Kottenkottuvaluvu regulators and Karanchira lock and also by immediately stopping the supply of Peechi water.

**8.1.3.** The construction of Enamakkal weir and its conversion into a pucca regulator was effected by 1969, based on the report on the improvements to the kole cultivation by the Superintending Engineer (Irrigation) Thrissur.

**8.1.4** As decided by the Government of Kerala a feasibility study for the construction of permanent bunds and other improvements to the kole lands was conducted in 1969 by Dr. S. Vasudev, then professor in the College of Engineering, Thiruvananthapuram. His report contained proposals for permanent bunding of the kole fields and for improvement and widening of the kole canals with the objective of preventing the cultivable areas from becoming waterlogged. These works are undertaken by the Kerala Land Development Corporation (KLDC) and are in progress.

**8.1.5** In 1971 the Kerala PWD (Irrigation) revised the proposals of Dr. Vasudev and prepared a report on improvement of the kole lands, forming part of the Chimoni-Mupli kole project which was a comprehensive scheme covering an area of 20,200 ha. According to this report water for irrigating the kole lands during summer was to be provided by the Chimoni Irrigation Project. The report provided proposals for permanent bunding of padasekharams, widening and improving the kole canals for channelising

flood flows, construction of two salt water regulators across Kanoli canal at Chettuva and Vallivattom and also a direct cut to the sea at Kuttamangalam to moderate the flood position to the lower reaches of Karuvannur river. The construction of salt water regulators and the direct cut to the sea at Kuttamangalam have been shelved subsequently.

**8.1.6** Based on the above report, an integrated scheme viz Chimoni-Mupli Kole Project was drawn up by the Planning and Economic Affairs Department of Kerala Government in 1973 for seeking assistance from the World Bank. The project was not put through, as further discussions revealed that the cost of the sheme has to be reudced considerably to make it more attractive to the cultivators. Further the feasibility of taking a virippu crop during SW monsoon period had to be reconsidered.

**8.1.7** In 1976, the KLDC prepared a Project Report on Thrissur Kole Lands for construction and rectification of regulators and sluices and also for widening and improving the canal system. The necessity of early completion of the Chimoni Project had been emphasised in the report.

**8.1.8** The Chimoni Irrigation Project was prepared by the Irrigation wing of the PWD in 1975 and preliminary works on the project commenced in 1975. The project was partially commissioned in 1991.

**8.1.9** The KLDC prepared a Project Report for Thrissur kole Development in 1978 for overall development of Thrissur kole lands with the objective of taking an additional crop (mundakan) and providing irrigation for summer crop in the kole and nearby normal rice fields. Works for proper drainage of water from the kole fields, renovation and new construction of bunds, digging new canals and improving the existing canals etc were envisaged in the project.

Turfing on embankments, construction of new bridges, sluices for padasekharams, widening and bunding of Kokkala thodu, connecting Kokkala and Chiyyaram thodu to Chettupuzha canal, a canal from Anandapuram parallel to Anandapuram bund to join Nedumthodu near Konthipulam bridge etc are some works in progress, undertaken by the KLDC. Two regulators one at Koothumakkal and other at Thamaravalayam and an approach to Enamakkal at Kottachal for drainage from Kokkala, Chettupuzha, Puzhakkal and Chiyyaram have also been proposed.

**8.1.10** The Kole Land Development Agency which was formed in 1992 has urged construction of regulators at Koothumakkal and Thamaravalayam and also early completion of Idiyanchira and Karanchira locks. The Idiyanchira regulator has been proposed by the KLDC in 1976, to prevent the ingress of salt water to the nearby kole fields known as Thanneerkayal by diverting part of the flood waters of the northern basin of the kole lands

into the back waters and then to the sea through Chettuva azhi. The work has been almost completed.

## 8.2 Ponnani kole

**8.2.1** At Viyyam, the lower end of the kole area in the Kanjiramukku river, a barrage is constructed to store some fresh water and to prevent ingression of salt water in summer months. This is closed during summer and opened during monsoon.

In 1959 a study was made and a detailed Report for Improvement of Ponnani kole was submitted by Sri. P. Aravindakshan Achan, Chief Engineer, PWD. He suggested improvements in the Drainage, provision of side bunds and facilities for irrigation. Four proposals were made viz widening of regulator at Viyyam dam, deepening the deep kole, forming permanent bunds on both sides of deep kole and construction of lift storage schemes.

**8.2.2** In 1966 Sri. E. P. Jose, then Executive Engineer (Irrigation) Chalakudy proposed deepening of kole canals and in 1969 the Superintneding Engineer, Central Circle also submitted recommendations on similar lines. Though this was not done, improvement to Viyyam dam and construction of storage at vettikkadavu were later taken up and completed.

**8.2.3** During 1974 further studies were conducted by Executive Engineer (Investigation), Thrissur, In his report, four lift storage schemes at Panthavoor, Thattanthodu, Othallur and Anjilikadavu were suggested. Of these, the storage schemes at Othallur and Panthavoor were taken up by 1979.

**8.2.4** Supply of irrigation water from Cheerakuzhy scheme and pumping from Bharathapuzha were investigated and later dropped. Possibility of raising two crops, draining the water from kole fields direct to Bharathapuzha and taking in water direct from Bharathapuzha were studied.

**8.2.5** Sri. M. Mangala Bhanu prepared a project report on development of Ponnani kole in 1979 under the auspice of KLDC and suggested construction of permanent bunds, proper internal drainage systems and improving the Viyyam regulator.

## 8.3 Kole Farming Societies

In the early stages of kole cultivation various land development activities and other agricultural operations were performed by the farmers individually. Since the area was small the individual farmers had to bear more cost which reduced their profit and also caused more risk in farming. Later the works

connected with preparation of bunds, irrigation and drainage etc were carried out collectively for contiguous rice fields. This collection of contiguous rice fields is called the 'padasekharam' or ' 'padavu'. The land owners formed themselves into groups to form a padasekharam committee which is formulated in a democratic way under section 7 A of the Kerala Land Development Act, 1964 (17 of 1964) and registered under the Societies Act. Co-operative farming is now resorted to by combining the above units to reduce the cost of cultivation. The Kole Farming Society may have one or more padavus in its composition. For example the Jubily Thevar Padavu Committee consists of twelve padavus each with an area ranging from 20 to 250 ha. The societies look after the irrigation and drainage activities, arrange subsidies and other services from different agencies and decide the system of cultivation in consultation with the Department of Agriculture.

## 8.4 Kerala Land Development Corporation Limited (KLDC)

The Kerala Land Development Corporation Ltd (KLDC) is an undertaking of the Government of Kerala with its registered office at Alappuzha and administrative office at Thiruvananthapuram established under the KLDC Ltd (Special powers) Act, 1974 and (Special powers) Rules 1976 and registered under the companies Act, 1956 (Central Act of 1956). The main objectives of the corporation are (1) to promote, undertake, finance and execute land development schemes in Kerala for the development of agriculture and allied activities (2) to promote, undertake and execute on its own or on behalf of Government or others, schemes providing for land development, flood control, dewatering, irrigation, construction of godowns or other schemes and/or infrastructural works connected with development of agriculture or allied activities.

The Project Engineering Unit at Thrissur is undertaking works for the development of Thrissur and Ponnani kole, the important items being construction of permanent bunds, improvement of channels, regulators and other land developments for the kole.

## 8.5 Punja Special Office

As per the Kerala Irrigation Works (Execution of Joint Labour) Act 1967, the office of the Punja Special Office started functioning at Thrissur. The act envisages provision for facilitating the execution of certain iworks connected with irrigation, flood-control or drainage for the purpose of agriculture to be done by the joint labour of cultivators in the state of Kerala.

The Punja Special Officer (in the rank of Tahasildar from the Revenue Department) looks after primarily the pumping in and out of water from kole fields for facilitating cultivation. The Punja Special Officer (PSO), Thrissur conduct the works of both Thrissur and Ponnani koles. The normal procedure is to disburse pumping subsidies to the kole padavu committees (Rs. 375 per ha for *punja* and Rs. 470 per ha for *mundakan* in 1992) which supervise the drainage of water and irrigation for the farmers in the padavu.

For deciding different activities on kole cultivation such as division of kole into zones, number of crops in each zone, time of pumping out water, cropping period, agricultural technologies to be adopted etc, the Kole Development Council has been formulated with the Executive Engineer (Irrigation) Thrissur as the Chairman and Punja Special Officer, Thrissur as the convenor. The Joint Director of Agriculture, Thrissur and Sub-Divisional Agriculture Officer, Thrissur are members of the council. Engrineers of Electricity Board and Irrigation Department, Construction Engineer of KLDC, Thrissur and representatives of kole cultivators are also members of the council who collectively decide the system of cultivation every year.

## 8.6 Kole Land Development Agency

The different agencies engaged in the development of kole have been acting rather independently without any active co-ordination among them. Hence the Kole Land Development Agency was proposed in 1992 as a self contained agro-economic project for overall development of the kole areas by co-ordinating activities of different government departments and agencies engaged in kole development. This is formulated as an exclusive organisation responsible for the whole development of kole fields in Thrissur and Ponnani. The Primary objective of the agency is to raise Production and productivity of the kole lands. The improvement of the infrastructural facilities like construction of permanent bunds, canals, providing engine sheds, irrigation and dewatering equipments, petty and paras, construction of regulators, farm roads etc are charted out as activities of the agency. Above all, investigations, improvements and full adoption of agro-technologies have been taken up as an important mandate of this Agency.

The Kole Land Development Agency is constituted with the District Collector, Thrissur as Chairman and the Sub-Divisional Agricultural Officer as the secretary and the Cheif Development Officer. The agency is governed by a council consisting of twenty officials and twenty one non-officials. The Associate Director of Research (HQ), Kerala Agricultural Univiersity, Thrissur, The Executive Engineer of Irrigation and Minor Irrigation Departments of Thrissur and Malappuram, the Deputy Chief Engineer (KSEB) Thrissur, Construction Engineer of KLDC, Thrissur and Punja Special Officer, Thrissur are members of the council. The top level district officers of the Departments of Soil Conservation, Co-operation, Rural Development, Command Area Development, Planning Board and Officers of NABARD and Canara Bank are also members of the council. The Revenue Divisional Officer, Malappuram is the member from Revenue Department of that district. The members of Parliament and Assembly, President of Thrissur District Council and farmers' representatives are drawn as non-official members.

CHAPTER IX

# RESEARCH STATUS AND FUTURE STRATEGIES

Rice is the principal crop in kole lands, the cultivation of which almost resembles the Kuttanad system. Both these areas lie below the mean sea level and the land resource is developed around rice on account of the omnipresence of water spatially and temporally. Considerable efforts have been devoted to modernise rice cultivation in Kuttanad which dates back to 1916 when the Agricultural Experiment Station, Kuppappuram the precursor to the present Rice Research Station, Moncompu was established. Due to the sustained and dedicated research work, rice culture in Kuttanad was improved by evolving high yielding varieties with multiple resistance to pests and diseases and developing sound agro-techniques and crop management schedules. Possibly becuase of the lesser area in kole, compared to Kuttanad, modernisation efforts in kole rice culture have been lethargic though land development works have been done during the post-independence period. Productivity in kole lands could be improved by popularisation of the existing improved agro-technologies but location specific viable technologies are lacking for the situation. It was only after the launching of National Agricultural Research Project (NARP) in 1980, Kerala Agricultural University (KAU) initiated steps for the agro-improvement in kole and identified Agricultural Research Station, Mannuthy with the lead and verification function for rice in kole lands.

The ECF Centre (Experiments in Cultivators' Field) a joint venture of the KAU and ICAR, which started at Mannuthy in 1988 has been doing on-farm research in kole lands by testing on-station technologies and feed back problems. The on-farm research is designed with the goal of development, evaluation and refinement of client oriented need-based research under bio-physical and socio-economic conditions of the resource poor farmers. The confirmation and fine-tuning of the technologies under actual field conditions give confidence to the research workers, extension personnel and the farmers on the viability of the technologies. This type of extension workers-farmers-participatory research is an efficient tool for confirmation of technologies, better feed back and eventually solving the farm problems prevalent in the agro-ecosystem.

Another agency which has been engaged in the improvement of kole rice is the Agri Electronic Project of Kerala Agricultural University. The soil test fertiliser recommendations for different 'padavus' in Thrissur kole have helped the farmers to adopt judicious and efficient use of fertilisers and harness better yield.

Prime requirement for development of rice, as any other crop, is to ensure upgradation of the germ plasm and identify suitable cultivars for different farming situations with a seasonal and micro-seasonal perspective. The peculiar field situation and land utilization warrants careful choice of variety for each location. The first crop season in kole *(mundakan)* starts from September/October and the

second crop, *punja* ceases by April/May. A delayed *mundakan* may push the *punja* to the premonsoon showers resulting crop loss by floods. Moreover, delayed sowing of the first crop will result in water scarcity at the fag end of the season if the water from dams become inadequate. Under the group management concept multiplicity of varieties in a 'padavu' has to be replaced by the most suitable one for the location. Despite all the odds prevailing in the situation, the kole farmer aspires to have a bumper crop from his fertile lands in one or two seasons available in the year. Availability of high yield potential multiple resistant short duration rice cultivars would offer a better crop within the short seasons and it will provide sufficient inter-season gap in double cropped areas. The correct choice of high yielding rice varieties for different locations would be the first task of the researchers and it warrants location-specific rice breeding.

The on-farm research centre has identified some improved rice varieties for single and double crop kole lands in comparison with the popular varieties Annapoorna, Jyothy, Pavizham, Sabari and some non-descript varieties. Matta-Triveni, Kanjana (cul. 8756), Athira (cul. 8770) and Aiswarya (cul. 8772) perform well in *mundakan* season in double cropped areas. For *punja*, Onam, Bhagya and Annapoorna were found superior. These varieties with a duration less than 100 days offer better yield, avert water scarcity at the later stage of crop season, provide sufficent time for preparatory cultivation and effect the harvest before pre-monsoon showers. Experiments have also revealed that new medium duration varieties like Remya (MO. 10) or Kanakam (MO. 11) with duration of 120-125 days can be adjusted in single crop system for higher yield.

The Agricultural Research Station, Mannuthy has evolved an extra short duration rice (ESD) Cul 24-20 by crossing IR.8 and T. 140. The trials in farmers' fields have proved that this rice culture of less than 80 days duration with an average yield of 3.5 to 4 tonnes per ha is suitable for constraint conditions like water scarcity, or for resowing when crop damage due to flash floods or other natural hazards occur. Another ESD variety 'Kalinga' tested in this situation gave an yield of 3 to 3.5 tonnes per ha. These two extra short duration rice cultures have especially been preferred for cultivation in upper kole fringes making it possible to take an additional crop.

Better crop management starts with optimum seed rate. In kole lands very high seed rate, often more than 125-150 kg per ha is adopted which causes heavy infestation of pests and diseases. The problem is aggravated by the impeded drainage and high humidity. The very high seed rate is on the apprehension of seedling mortality in water-scarce situation experienced frequently before the commissioning of Chimoni Irrigation Project. Even now, the practice is followed which makes plant protection activitives very difficult, in addition to the escalation of production cost. The optimum seed rate for each land situation has to be worked out with a varietal, seasonal, soil fertility and management perspective.

Now more than ever the importance of adequate supply of plant nutrients is recognized to ensure efficient crop production. The kole farmers are aware that

they get enhanced yield by incremental doses of fertilisers thanks to the better inherent productivity of kole soils, due to high organic carbon content and cation exahange capacity. Higher levels of nitrogen and potash are recommended for kole rice. For short duration varieties it is 90-35-45 NPK kg/ha and for medium varieties 110-45-55 kg/ha. Agronomic Survey among the kole farmers reveal even higher application rates. It is to be remembered that the increased production should not be at the expense of long term health of soils. Further the fertiliser prices are soaring high. Research programmes will have to be chalked out to find out alternative ways and means for plant nutrients for the upkeep and sustenance of production. Possibilities of using green manure, composting of aquatic weeds, bio-fertilisers like blue green algae, azolla etc should be explored. We should exploit the maximum yield of the varieties by proper blending of all monetary and non-monetary inputs and availing highest fertiliser use efficiency in an integrated manurial system.

Among the crop production inputs, the highest share of cost goes to weed control. Manual weeding has become very costly and perhaps not possible or delayed in peak periods. The chemicals like benthiocarb, butachlor, nitrofen, 2, 4-D etc which has wide scale adoption in normal paddy cultivation systems for efficient and cheap control of weeds, do not find a proper place in kole cultivation. Location based weed management studies are needed for understanding the biotic factors and weed situation analysis for tuning the technologies,

Soils in the situation have been receiving continuously large amount of fertilisers and pesticides, the residues of which will be accumulating in alarming proportions leading to problems of pollution. The ecological hazard is aggravated by impeded drainage. The problem of soil acidity is also increased by the lack of proper drainage for washing out the acidic ions. Acidity is aggravated by intermittent wetting and drying of soil which could be corrected if proper drainage is possible. Detailed investigations are to be taken up in kole soils as attempted at Karumady by the Project on Agricultural Drainage and they may be put to large scale on-farm test in the situations. Feasibility of modern surface and sub-surface drainage dystems can be studied in collaboration with the Land Development Corporation and other kole development agencies.

Another thrust area of research should be evolution, evaluation and modification of farm machineries and implements to suit the needs of the situation. The present situation of ever escalating cultivation cost accompained by dearth of agricultural labourers necessitates the adoption of selective mechanisation. The peculiar topography and soil characteristics of kole lands warrant modification of the different machineries and implements for ploughing, seeding, transplanting, harvesting etc.

The extensive water surface in the estuaries, canal systems and the ponds in kole lands provide rich favourable environment for breeding and multiplication of fish species. Though at the time of dewatering the kole fields fish provides

substantial income for the farmers, scientific development of fishery in kole lands is yet to be initiated. Integrated farming systems involving duck and fish as components should also find a place in the research agenda for the situation.

*The kole lands provide an important environment for rice culture in the state. This situation covers substantial part of rice fields in Thrissur and Malappuram district. Indepth analysis of the different problems of kole has to be done and recommendations related to rice production and integrated farming with least pollution effects have to be formulated for a sustained rice farming in the ecosystem. The present research schemes involved in kole rice improvement such as on-farm research unit, are mostly of adhoc nature and with limited resources for kole research. To get the complex problems solved in a systematic manner a permanent research team solely for kole rice improvement has to be set up with adequate participation of extension personnel and the farmers. Only by extension workers-farmers-participatory research the problems in kole cultivation could be solved and modernisation accelerated. No time should be spared in taking up self contained research programmes for evolving strategies to maintain a long-term sustainable rice farming in the situation with minimum pollution hazards and ecological degradation.*

matta triveni - annapoorna

kanakam

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Karthika

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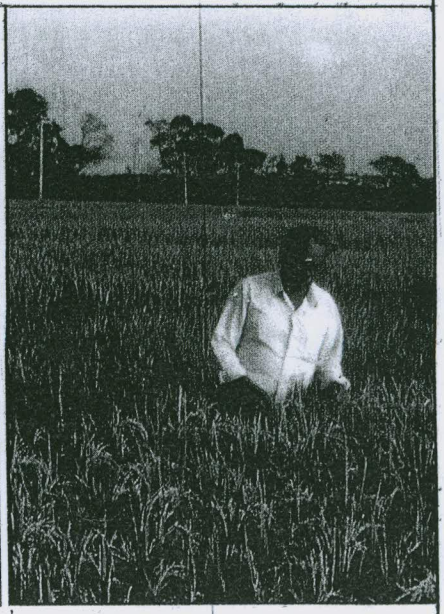

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# Geographical Distribution of 'PADAVUS' in Thrissur and Ponnani kole

## 1 THRISSUR KOLE

### A. THRISSUR SOUTH KOLE
MUKUNDAPURAM TALUK

| Name of padavu | Area in ha | | village | Panchayat |
|---|---|---|---|---|
| | Mundakan | Puncha | | |
| ***(i) Irinjalakuda block*** | | | | |
| 1. Vellani kole padam | — | 80.0 | Kattur Karalam | Kattur Karalam |
| 2. Kattur-Thekkumpadam (continuation to Karalam of this block & Padiyur of Vellangallur block) | — | 162.0 | Kattur | Kattur |
| 3. Karanchira Akampadam - Purampadam | 23.2 | 23.2 | Kattur | Kattur |
| 4. Chithravally kole | 37.6 | 37.6 | Makaikkonam | Porathissery |
| 5. Muthalakkulam kole | 10.0 | 10.0 | " | " |
| 6. Kadangode kole | — | 34.0 | " | " |
| 7. Kizhakkeppadam kole, Madaikkonam | — | 28.2 | Madaikkonam | Porathissery |
| 8. Kocheeppadam kole | — | 40.0 | " | " |
| 9. Chemmanda puliyampadam kole (extended to Karalam panchayat also) | — | 126.0 | Madaikkonam | Porathissery |
| 10. Painkili kayal | 29.4 | 12.5 | Porathissery | Porathissery |
| 11. Kizhakkepadam kole | 43.2 | 43.2 | " | " |
| 12. Karuvannur kizhakke punchappadam pumping scheme | 55.6 | 85.6 | " | " |
| 13. Kizhakke Punchappadam kole | — | 42.4 | " | " |
| 14. Thekke padam kole | — | 65.4 | " | " |
| 15. Anandapuram muriyadu kole | — | 369.0 | Anandapuram Muriyadu | Muriyadu |
| 16. Anurili harijan kole | — | 10.0 | Pullur | " |
| 17. Chirakkal padam | — | 10.0 | " | " |
| 18. Pullur, Irrinjalakkuda kole | — | 115.6 | Pullur Manavalassery Muriyadu | " |

| | | | | |
|---|---|---|---|---|
| 19. Thaliyathu kole | — | 13.6 | Muriyadu | " |
| 20. Thommana kole | — | 10.0 | Muriyadu | " |
| 21. R. 320 Chemmanda puliyam padam kole | 164.0 | 318.0 | Karalam Manavalassery | Karalam |
| 22. Chengani padam | 30.0 | 30.0 | Karalam | Karalam |
| 23. Kattur thekkumpadam | 50.0 | 50.0 | Manavalassery | Karalam |
| 24. Naduppadam mangandam | — | 30.0 | Thottippal | Parappukkara |
| 25. Konthipulam kole | — | 36.0 | " | " |
| 26. Karikkakulam kole | — | 16.0 | " | " |
| 27. Parappukkara nedumpal - padasekharam | — | 41.0 | Parappukkara Thottippal | " |
| | **448.0** | **1789.3** | | |

***(ii) Irinjalakuda municipality***

| | | | | |
|---|---|---|---|---|
| Kakkattu Kaippallithara kole | — | 46.0 | Irinjalakuda | Irinjalakuda municipality |
| | **—** | **46.0** | | |

***(iii)Vellangallur block***

| | | | | |
|---|---|---|---|---|
| 1. Poomangalam Padiyur Panchayat kole | — | 94.1 | Poomangalam Padiyur | Poomangalam Padiyur |
| 2. Kattur thekkumpadam | — | 85.4 | Padiyur | Padiyur |
| 3. Thommana kole (continuation to Alur and Muriyadu panchayats) | — | 72.0 | Kaduppassery | Velukkara |
| | **—** | **251.5** | | |

***(iv) Mala block***

| | | | | |
|---|---|---|---|---|
| Thommana kole | — | 28.0 | Thazhekkad | Alur |
| | **—** | **28.0** | | |

**B. THRISSUR NORTH KOLE**

A. THRISSUR TALUK

***(i) Anthikkad block***

| | | | | |
|---|---|---|---|---|
| 1. Anthikkad kole padavu Padasekharam (Pazhangaparambu & Kanjani kole) | 668.0 | 668.0 | Manalur Pullu Chazhur Anthikad | Manalur Chazhoor Anthikkad |
| 2. Alappad Pullu padavu | 325.0 | 325.0 | Alappad Pullu | Chazhur |
| 3. Pazhuvil Jayanthi padavu | 106.0 | 106.0 | Injamudi Alappad | " |
| 4. Athichal Kannamthuruthi Padavu | — | 33.0 | Injamudi | " |
| 5. Variyam kole padavu | 63.2 | 63.2 | Kurumpilavu | " |
| 6. Thrikkappallam Kadumkrishi Padavu | 5.6 | 5.6 | " | " |
| 7. Kurumpilavu Kadumkrishi padavu | 14.8 | — | " | " |
| 8. Manalurthazham padavu | 275.0 | 275.0 | Manalur | Manalur |
| 9. Vendarappadam | 70.0 | 70.0 | Kizhippillikkara | Tanniyam |
| | **1527.6** | **1545.8** | | |

***(ii)Cherpu block***

| | | | | |
|---|---|---|---|---|
| 1. Kappakkad kole padavu | 8.8 | 8.8 | Pallissery Venginissery | Avinissery Paralam |
| 2. Pallissery Avinissery samajam kole padavu | — | 18.0 | Pallissery | Avinissery Vallachira |
| 3. Jubily thevarpadavu (Manaleppad kole, Thuruthu, Karikkulam, Kila, Thevar, Changara, Kadayatti, Tharissu, Jubiliy, Injamudi, Chenathu, Mudakkole, Chovoorthazham, Pandaram Kole) | 879.0 | 879.0 | Cherpu Chevoor Oorakam Paralam Injamudi Kurumpilavu | Cherpu and Paralam of Cherpu and Chazhur of Anthikad block |
| 4. Chiyyaram samajam kole | 12.8 | 12.8 | Chiyyaram | Kurkkenchery |
| 5. Nedupuzha Karimpatta kole | — | 36.4 | Kanimangalam | " |
| 6. Kechery Kole padavu | 20.8 | 20.8 | Kurkkenchery | " |
| 7. Padinjarebhagam madhammathoppe | 18.4 | 18.4 | Kanimangalam | " |
| 8. Kizhakkebhagam madhammathoppe | 14.4 | 14.4 | " | " |

| | | | | | |
|---|---|---|---|---|---|
| 9. | Kanimangalam padasekharam | 215.0 | 215.0 | Kanimangalam<br>Pallissery<br>Venginissery | Kurkkenchery<br>Avinissery<br>Paralam |
| 10. | Olakkada kole padavu | — | 23.6 | Kurkkenchery<br>Kanimangalam | Kurkkenchery |
| 11. | Kizhakken kole porekkole | — | 17.2 | Chiyyaram<br>Kanimangalam | " |
| 12. | Akkarappatti | 10.5 | 10.5 | Kanimangalam | " |
| 13. | Kodannur tharissu | 41.9 | 41.9 | Kanimanagalam | " |
| 14. | Karamukku | 6.8 | — | " | " |
| 15. | Pallippuram paralam Kodannur kole | — | 28.8 | Kodannur | Paralam |
| 16. | Pallippuram Alappad kole | 196.0 | 196.0 | Pallippuram<br>Kodannur<br><br>Alappad | Paralam of Cherpu & Chazhur (of Anthikad block) |
| 17. | Pallippuram Akampadam padavu | 64.0 | 64.0 | Pallippuram<br>Kodannur | Paralam |
| 18. | Kodannur tharissu kole | 170.0 | 170.0 | Kodannur<br>Kanimangalam | Paralam<br>Kurkkenchery |
| 19. | Narayana kole | — | 10.0 | Paralam | Paralam |
| | | **1658.4** | **1785.6** | | |

***(iii) Puzhakkal block***

| | | | | | |
|---|---|---|---|---|---|
| 1. | Elthuruthu kole padavu | 29.2 | 29.2 | Aranattukara | Ayyanthole |
| 2. | Maninadan kole padavu | 33.2 | 33.2 | " | " |
| 3. | Marar kole | 25.0 | 25.0 | " | " |
| 4. | Chettupuzha kole padavu | 59.2 | 59.2 | Pullazhi<br>Manakkodi | Ayyanthole<br>Arimpur |
| 5. | Porathi kole padavu | — | 32.0 | Pullazhi | Ayyanthole |
| 6. | Pullazhi kole padavu | — | 291.0 | " | " |
| 7. | Paikkole padavu | — | 84.0 | Adat | Adat |
| 8. | Puthen kole padasekharam | — | 116.0 | " | " |
| 9. | Puthur karikka kole | — | 40.0 | Chittilappilly | Adat |

| | | | | |
|---|---|---|---|---|
| Adat Farmers Co-operative Bank padavu (Choorakkattukara kole, Karuthani Valley, Nalumuri kole, Akkattan kole, Kadavil kole and Onmpathumuri kole) | — | 670.0 | Adat Chittilappilly Puzhakkal Puranattukara Ayyanthole | Adat Ayyanthole |
| Thiruthumthazham kole padavu | — | 40.0 | Adat Chalakkal | Adat Tholur |
| Chathan kole puppilakkad kole | 137.0 | 137.0 | Chittilappilly Chalakkal | Adat Tholur |
| Chittilappilly chirukandathu padavu Kurumpadam Karshaka Samajam, Chittilappilly | - | 51.0 | Chittilappilly Tholur | Adat Tholur |
| Minikkali padam | — | 8.8 | Tholur | Tholur |
| Karimpana tharissu | — | 35.0 | Chalakkal | Tholur |
| Parappur sangam kole | — | 495.0 | Tholur Chalakkal Mullassery | Tholur of Puzhakkal & Mullassery of Mullassery block of Chavakkad taluk |
| Pandara kole | — | 37.6 | Chalakkal | Tholur |
| [illegible]akke Kalippadam, Parappur | — | 3.1 | Tholur | Tholur |
| Thazhathe kalippadam | — | 6.9 | " | " |
| Naikkan kole | — | 16.0 | " | " |
| Menchirappadam | — | 82.0 | Edakkalathur | " |
| Ponoorthazham padavu | — | 92.0 | Edakkalathur | Tholur |
| Valakkulam padavu | 14.6 | 14.6 | " | " |
| Vadakke ponoorthazham padavu | 20.0 | 20.0 | " | " |
| Mundur thazham kadavil kole | 49.0 | 42.0 | Anjur Peramangalam | Kaiparampa |
| Karuka kole | 41.0 | 29.0 | Anjur Peramangalam | Kaiparampa |
| Karimpadam kole | 18.0 | 15.0 | Peramangalam | " |
| [illegible]umuri kole padavu | — | 23.2 | Manakkodi | Arimpur |
| Eravu akampadam | 79.2 | 79.2 | Eravu | " |
| Chaladi pazham kole | 51.2 | 441.0 | Arimpur Velathur, Eravu | " |

| | | | | |
|---|---|---|---|---|
| 31. Arumudi-Rajamuttu kole | — | 106.0 | Eravu | Arimpur |
| 32. Vilakkumadam kole padavu | 210.0 | 210.0 | Velathur Manakkodi | " |
| 33. Krishnankotta kole-Kodayatti kole | — | 260.0 | Parakkad | " |
| | **766.6** | **3624.0** | | |

B CHAVAKKAD TALUK

***Mullassery block***

| | | | | |
|---|---|---|---|---|
| 1. Peruvalloor kole | 40.0 | 40.0 | Mullassery | Mullassery |
| 2. Pulloorppadam | — | 10.3 | " | " |
| 3. Thekke konchira | — | 79.2 | " | " |
| 4. Parappadam vadakkubhagam | 4.8 | 4.8 | Mullassery | Mullassery |
| 5. Parappadam kizhakkubhagam | — | 5.5 | " | " |
| 6. Parappadam kole | — | 13.2 | " | " |
| 7. Pavuttai kole | — | 13.0 | " | " |
| 8. Mathukkara padinjarubhagam | 91.0 | 91.0 | " | " |
| 9. Mathukkara thekkeppuram | — | 91.0 | " | " |
| 10. Elavathur | 44.0 | 44.0 | " | " |
| 11. Penakam kole, Irimpranallur | 55.0 | 55.0 | " | " |
| 12. Kanjirakkalam | 5.0 | 5.0 | " | " |
| 13. Sangam kole | 40.0 | 40.0 | " | " |
| 14. Manalpuzha kannothu kole | 137.0 | — | Mullassery (76 ha) Venkidengu (61 ha) | Mullassery Venkidengu |
| 15. Padinjare karimpadam | — | 137.0 | Venkidengu | Venkidengu |
| 16. Kizhakke karimpadam | — | 116.0 | " | " |
| 17. Vadakke konchira | — | 125.0 | " | " |
| 18. Thekke konchira | 79.8 | — | " | " |
| 19. Elamuthakole | — | 125.5 | " | " |
| 20. Ponnamutha kole | — | 120.6 | " | " |
| | **496.6** | **1116.1** | | |

# II PONNANI KOLE

## A. THRISSUR DISTRICT

### A. CHAVAKKAD TALUK

***(i) Chavakkad municipality***

| | | | | |
|---|---|---|---|---|
| Mathikkayal muttil kole-padasekharam | — | **46.0** | Manathala | Chavakkad municipality |

***(ii) Chavakkad block***

| | | | | |
|---|---|---|---|---|
| 1. Padinjaram punja | 13.0 | 13.0 | Kadikkad | Punnayur-kkulam |
| 2. Pananthara | 23.0 | 23.0 | " | " |
| 3. Kundam kole | — | 11.0 | Punnayur-kkulam | " |
| 4. Thazhathe punja kole | — | 10.0 | " | " |
| 5. Uppungal kole | — | 74.5 | " | " |
| 6. Kottilangalthazham padavu | — | 24.0 | " | " |
| 7. Parur padavu | — | 302.0 | Punnayur-kkulam Vadakkekad | " Vadakkekad |
| | **36.0** | **503.5** | | |

### B. THALAPPILY TALUK

***(i) Chowannur block***

| | | | | |
|---|---|---|---|---|
| 1. Kariappadam padavu | — | 5.3 | Pazhanji | Kattukampal |
| 2. Kaladi padavu | — | 6.7 | " | " |
| 3. Kurumkulam kole padavu | — | 5.3 | " | " |
| 4. Chittamthazham Union kole padavu | — | 85.2 | " | " |
| 5. Valiyadam vattakkayal | — | 51.0 | " | " |
| 6. Parakkuzhi | — | 30.0 | Kattukampal | " |
| 7. Pullanichal | — | 33.2 | " | " |
| 8. Valan kole veval kole | — | 23.6 | " | " |

| | | | | |
|---|---|---|---|---|
| 9. Pazhanji Joint Farming Society (Thekke Padavu & Vadakke padavu) | — | 310.0 | " | " |
| 10. Pappirithi Thamaravattom kole | — | 14.4 | Kattukampal | " |
| 11. Cheruvallypuzha Thekkethodi kole | — | 16.0 | Kattukampal Arthat Vadakkekad | Kattukampal and Arthat of Chowannur and Vadakkekad of Chavakkad block of Chavakkad taluk |
| 12. Cheruvallypuzha kole (Muthuvammel kole, Cheerampuly kole and Cherakkazha kole) | — | 89.0 | Anjur | Arthat |
| 13. Karuvanthazham kole | — | 71.0 | Mangad Kunnamkulam | Porkulam |
| 14. Mangad kole padavu | — | 18.7 | Mangad | " |
| 15. Kottiyattu kole | — | 53.2 | " | " |
| 16. Puthenthode karshaka samajam kole | — | 58.0 | Mangad Kunnamkulam | " |
| 17. Nambara Anakkundu Valiya kole padavu | — | 14.0 | Kattukampal Porkulam | Kattukampal Porkulam |
| 18. Parappur kayal | — | 20.3 | Eranallur | Choondal |
| | — | **904.9** | | |

***(ii) Kunnamkulam municipality***

| | | | | |
|---|---|---|---|---|
| 1. Adiyara kole padavu (Extension of Cheruvallypuzha kole of Arthat panchyat) | — | **33.0** | Kunnamkulam | Kunnamkulam Municipality |

## B. MALAPPURAM DISTRICT

A. PONNANI TALUK

***(i) Andathode block***

| | | | | |
|---|---|---|---|---|
| 1. Kolathumpadam thekkebhagam padavu | — | 25.0 | Alamkode | Alamkode |
| 2. Kolathumpadam thekkekettu | — | 10.0 | Alamkode | Alamkode |
| 3. Athanur puzhi kole & bundu padavu | — | 38.0 | " | " |

| | | | | | |
|---|---|---|---|---|---|
| 4. | Alappuram vempuzha koolan padavu | — | 38.0 | " | " |
| 5. | Kundamkuzhi kole | — | 24.4 | Marancheri | Marancheri |
| 6. | Thuruvanam kizhakke kole | — | 15.9 | " | " |
| 7. | Olampakkadavu kole | — | 10.5 | " | " |
| 8. | Mullamad kole | — | 78.0<br>22.0 | Marancheri<br>Edappal | Marancheri &<br>Edappal of<br>Ponnani block |
| 9. | Maradi kole | — | 27.2 | Marancheri | Marancheri |
| 10. | Naduppotta kole | — | 27.1 | " | " |
| 11. | Kummippalam padinjarubhagam kole | — | 12.6 | " | " |
| 12. | Erumbayil kettu kole<br>(Kanjiramukku karshakeseva samithy) | — | 10.0 | " | " |
| 13. | Cherakkadavu kole | — | 10.0 | Nannamukku | Nannamukku |
| 14. | Mannankkad kole padavu | — | 10.0 | " | " |
| 15. | Thrikkannappadam kole | — | 10.5 | " | " |
| 16. | Vempuzha Alappuram koolam kole | — | 99.7 | " | " |
| 17. | Muchikkal bundu padavu | — | 17.2 | " | " |
| 18. | Kolanchery bund padavu | 17.8 | 17.8 | Nannamukku | Nannamukku |
| 19. | Pazhanji joint farming kole | — | 40.5 | " | " |
| 20. | Kadukkuzhi kole padavu | 12.0 | 52.3 | Nannamukku<br>Perumpadappu | Nannamukku<br>Perumpadappu |
| 21. | Thuruthummel kole padavu | 16.0 | 172.0 | " | " |
| 22. | Neelayil kole | 10.0 | 87.0 | " | " |
| 23. | Cherayam kole padavu | — | 28.0 | Nannamukku | Nannamukku |
| 24. | Kolathumpadam thekkekettu kole<br>(Contd, to Alamkode Pt also) | — | 63.3 | Nannamukku<br>Alamkode | Nannamukku<br>Alamkode |
| 25. | Cheravallur thekkekettu kole | — | 56.4 | Perumpa-<br>dappu | Perumpa-<br>dappu |
| 26. | Cheravallur puram kole | — | 34.4 | " | " |
| 27. | Noonakkadavu kole | — | 84.0 | " | " |
| 28. | Edampadam kole | — | 34.0 | " | " |
| 29. | Valluvam payikkole | — | 34.0 | " | " |
| 30. | Pazhamchira kole | — | 16.8 | " | " |
| 31. | Kaithakkal kole | — | 10.0 | " | " |

| | | | | |
|---|---|---|---|---|
| 32. Naranippuzha kummippalam | — | 80.00 | Veliyamkode | Veliyamkode |
| 33. Arudi kole pâdavu | — | 12.0 | " | " |
| 34. Palakkal thazham | — | 25.0 | " | " |
| 35. Chelakkadavu | — | 12.0 | " | " |
| | **55.8** | **1351.6** | | |

***(ii) Ponnani Block***

| | | | | |
|---|---|---|---|---|
| 1. Kolothupadam kololompu | — | 62.2 | Edappal | Edappal |
| 2. Alekkayal | — | 8.0 | " | " |
| 3. Therettukayal | — | 71.8 | " | " |
| 4. Madayil kole | — | 42.8 | " | " |
| 5. Mannathi kole | — | 14.0 | " | " |
| 6. Pathodi kole | — | 5.0 | " | " |
| 7. Chellippadam | 12.0 | 12.0 | " | " |
| 8. Pazhamkulam kayal | — | 28.8 | " | " |
| 9. Ayilakkad kole | — | 120.0 | " | " |
| 10. Kolathu padam thekkebhagam | — | 33.0 | " | " |
| 11. Kolathu padam thekkekettu | — | 30.5 | " | " |
| 12. Maravancheri kayal | — | 13.2 | Thavannur | Thavannur |
| 13. Thavannur kayal | — | 9.8 | " | " |
| 14. Vellancheri kayal | — | 24.7 | " | " |
| 15. Ayinkalam kayal | — | 8.7 | " | " |
| 16. Moorikkayal | — | 10.0 | Kaladi | Thavannur |
| 17. Manoorkkayal vadakku padinjare bhagam | — | 53.0 | " | " |
| 18. Maniyurkkayal kishzkkubhagam | — | 27.6<br>13.3 | Kaladi<br>Edappal | Thavannur<br>Edappal |
| 19. Alakkayal | — | 10.3 | Kaladi | Thavannur |
| 20. Manoor kayal P.O. Polakkara | — | 7.6 | " | " |
| | **12.0** | **606.3** | | |