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Working Paper No. 220

AGRICULTURAL DEVELOPMENT OF KERALA  
FROM 1800 AD to 1980 AD:  
A SURVEY OF STUDIES

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CENTRE FOR DEVELOPMENT STUDIES  
ULLOOR, TRIVANDRUM - 11

June 1987

## AGRICULTURAL DEVELOPMENT OF KERALA FROM 1800 AD to 1980 AD:

### A. SURVEY OF STUDIES

This paper attempts to survey the published literature on agricultural development of Kerala covering a period between 1800 AD and 1980 AD. The Survey covers both academic studies as well as government publications. The purpose of the survey is to highlight the nature and trends in literature and to identify areas which warrant further research. Agricultural development may be viewed from various angles.<sup>1/</sup> We may see it in terms of structure of production relations or in terms of productive forces, i.e., in terms of output, cropping pattern, techniques, trends in productivity etc. In our survey we view agricultural development in the second category i.e., productive forces. In order to get a connected picture of agricultural development, we present the survey in a chronological order starting from the 19th century. Among the erstwhile princely states of Travancore, Cochin, Malabar district and Kasargod taluk of South Canara district forming the present day Kerala, our survey is confined only on Travancore and Malabar. The survey is presented in five sections: I, agriculture in 1800 AD; II, agriculture between 1800 AD and 1860 AD; III, agriculture between 1860 AD and 1930 AD; IV, agriculture from 1930 AD and 1956 AD; and V, agriculture from 1956 AD and 1980 AD. In each section first we present a brief review of developments in agriculture and the survey of literature is presented subsequently.

Agriculture in 1800 AD

The erstwhile Malabar district of Madras Presidency comprising the northern region of present day Kerala, having an area of about 6262 square miles was conquered by the British in 1792 and was under colonial rule till 1947. Malabar was a region richly endowed with natural resources such as soil, climate, rainfall etc. favourable to the cultivation of grain crops and plantation crops.<sup>2/</sup> Agriculture was the chief economic activity of the people and provided livelihood to the entire population except for a few who were engaged in trade, commerce, cotton weaving, carpentry, smithy, fishing etc. The crops cultivated were paddy, coconut, arecanut, pepper, cardamom, ginger, jack fruit, mangoes, plantains etc. Paddy was the principal crop which produced rice, the staple food, mainly meeting the domestic food requirements. Paddy was cultivated in lowlying wet lands and the cultivation was mainly carried out with the help of rain except in a few places in Palghat region where small tanks and reservoirs were available.<sup>3/</sup> Traditional farming implements such as wooden plough was used for cultivation. Coconut was the second major crop.<sup>4/</sup> Coconut and coconut products were used for domestic consumption as well as for exports. Coconut and coconut products were the second largest export earner of Malabar accounting for about 37 per cent of the value of exports in 1804 AD.<sup>5/</sup> Pepper, the native crop of Malabar attracted foreigners to Malabar from very early times. The power struggles waged by the Portuguese, Dutch and English in the region were primarily with the objective of monopolising pepper trade. By the beginning of the

19th Century pepper was the single largest export item of Malabar accounting for 45 percent of the total value of exports.<sup>6/</sup>

We do not have much information about the productivity of the major crops. But from the available evidences we have to conclude that the productivity of the crops was generally low. Among the agricultural products, pepper, coconut and its byproducts, cardamom, ginger, timber etc. were exported; and the agricultural products accounted for about 99 percent of the total value of exports in 1804 AD.<sup>7/</sup> Our information about the categories of livestock for the period is meagre. According to Buchanan, Bulls, Bullocks, Cows, male and female Buffaloes were the important native cattle stock of Malabar.<sup>8/</sup> The native cattle were found to be of poor breed and smaller in size compared to the cattle of Coimbatore and Mysore. Malabar was largely a nonmonetised economy and most of the transactions that had taken place were by barter except the transactions in trading centres. This along with the lower demand for agricultural products resulted in low prices for agricultural products.

The colonial policy of extracting the largest share of agricultural produce as land tax;<sup>9/</sup> and strengthening the landlordism in Malabar<sup>10/</sup> had adversely affected the cultivation. Besides, the policy of importing large quantities of piece goods and other consumer goods discouraged the domestic Cottage industries. The policy of taxing skilled workers such as carpenters, ironsmiths, toddy tappers, boatmen and implements like looms, oilpresses, fishing nets, carts etc. also discouraged generation of productive activities and employment outside the agricultural sector.<sup>12/</sup>

We may also briefly describe the agricultural situation which prevailed in Travancore. The erstwhile princely state of Travancore

forming the southern part of present day Kerala, having an area of 7662 square miles, was endowed with favourable agro-climatic conditions most suited for the growth of a variety of crops. On the basis of physical features we may divide Travancore into three divisions viz., low land division, mid land division and high land division. <sup>13/</sup> Agriculture was the chief economic activity of the people and provided livelihood to the entire population except the few engaged in religious professions, weaving and spinning, pottery making, carpentry, masonry, smithy, trade, transport, commerce etc. The crops cultivated were paddy, coconut, arecanut, pepper, ginger, jack fruit, mangoes, plantains etc. Paddy, the principal crop was cultivated in two paddy growing regions viz., Kuttanad and Nanjanad region where <sup>14/</sup> irrigation facilities were available. Coconut, was the second major crop, and its cultivation was mainly concentrated in low land and midland divisions. Besides using it for domestic consumption, coconut and its byproducts were exported to foreign markets. Pepper was another major crop, and pepper had been exported to foreign markets from very early times. A peculiar feature of cultivation of pepper vine was its smallscale nature of cultivation. The peasants grew a little pepper vine in their garden land along with other crops. Monopolising pepper trade was the primary objective of the foreigners who came to this region and the earliest relations between the British and Travancore state were established on the basis of pepper contract. Due to the importance of the crop, government treated pepper, cardomom and other spices as state monopolies and the cultivators were forced to sell their products to government. By 1800 AD, Travancore was largely a non monetised economy and most of the transactions were made on barter basis.

Compared to Malabar the policies pursued in Travancore were different, even though Travancore accepted British suzerainty in 1795.<sup>15/</sup> In the process of subjugation of chieftains and extending the territorial boundaries, about one half of the cultivable land came under the ownership of the state by the end of the 18th Century.<sup>16/</sup> About half of the government lands were in the hands of tenants, who enjoyed fixity of tenure.<sup>17/</sup> The moderate land tax levied and the liberal policies aimed at safeguarding the interests of actual cultivators were helpful for agricultural development. The earlier rulers also took keen interest in irrigation and two dams were already constructed prior to 1800. Thus in Travancore, the material conditions as well as the policies pursued were much different from that of Malabar. This difference was the basic factor which led to two different patterns of agricultural development in the two regions in later periods.

Having made a brief review of the agricultural situation, let us attempt a survey of literature. The major source of information about agriculture of Malabar during the beginning of 19th century are official reports, prepared by colonial government as part of the exercises of administration. Most of the reports were on matters such as land revenue, revenue administration, land tenures and other problems of colonial administration. Among them, the reports which give some information about agriculture are: Report of Joint Commission (155), Francis Buchanan (164), Thomas Warden (158), Walker (156) and Thackery (157). The report by Buchanan, who visited Malabar in 1800 AD at the instance of the colonial government, is the most important report which gives us a lot of information about Malabar. The report presents <sup>graphic</sup> account of

the state of the economy and society prevailing in 1800 AD. The report gives detailed descriptive account of land ownership structure, land tenure, land tax, crops cultivated, cultivation practices, irrigation, cattlestock, trade, cottage industries etc. From Buchanan, one gets an excellent account of the agrarian relations existing among landlord, tenant and agricultural slaves.

Though we have a number of historical works on Malabar covering the period, only very few have dealt with agriculture. A study which makes some observation about agriculture is that of A. Dasgupta (108). Though the study focuses on the struggles of foreign powers to gain control over pepper trade between 1740 and 1800, the study gives a brief account of pepper cultivation, the role of traders and policies of native rulers on pepper cultivation.

Compared to Malabar, the writings on Travancore are very few. We get a rough picture about the agricultural situation from A.P. Ibrahim Kunju (193), Samuel Mateer (212, 213), Nagam Aiya (257 to 259). Ibrahim Kunju, while tracing the developments in administration during the 18th Century, briefly describes the state of the Travancore economy. The study gives a brief account about revenue administration, state trading of pepper and irrigation works executed during 18th Century. Samuel Mateer, an English missionary, who conducted missionary activities in Travancore for about 25 years has written about the social cultural and economic aspects of major castes in Travancore. The book also gives a brief descriptive account of the social and economic conditions of Travancore during the beginning of the 19th Century. Nagam Aiya's gazetteer on Travancore, is perhaps, the basic source from which we get information relating to agriculture, irrigation and general economic conditions.

## II

Agriculture between 1800 and 1860

During the period there had been a gradual increase in cultivation of some of the major crops of Malabar.<sup>18/</sup> A significant development was the introduction of coffee cultivation in Wynad by around 1840<sup>19/</sup> and the starting of teak planting by colonial government.<sup>20/</sup> The government had exempted coffee plantations from land tax to encourage Coffee planting. During the early years of planting, Coffee crops faced a set back due to problems such as wrong selection of soil and locality, ignorant and inefficient methods of planting, lack of roads in hilly places and difficulties experienced in procuring land for cultivation.<sup>21/</sup> But the cultivation has expanded since 1845 as evident from the increase in the exports of coffee.<sup>22/</sup> The change in the composition of exports of agricultural products during this period gives us an idea about the broad changes that had taken place. During this period pepper lost its glory as the single largest export earner of Malabar.<sup>23/</sup> By 1860's coconut and its byproducts like copra, coir, coir products and coconut oil accounted for 57 percent of the total value of exports.<sup>24/</sup> This implies the gradual development of agro processing industries like coir, coir products and oil mills. But during this period, the prices prevailing for most of the agricultural products remained very low and stagnant except the decade of 1850's.<sup>25/</sup> In the case of livestock, there had occurred an increase in its number since the 1820's due to the increase in rearing of sheep and goats in regions where Mappila muslims lived and also due to import of other categories of livestock from outside.<sup>26/</sup> On the



whole, except the encouragement given to coffee, the policy measures of the colonial government were not at all favourable to agricultural development. The policy measures were: the revision of land tax in 1805 and consequent reduction in share of produce of the cultivating tenant;<sup>27/</sup> the wrong interpretation of the various tenures by the Court in 1856 resulting in the loss of security of tenures for the cultivating tenant;<sup>28/</sup> the total neglect of irrigation and infrastructural works like road, inland waterways;<sup>29/</sup> the import of mill made cotton yarn, cloth and other products;<sup>30/</sup> and the taxation of skilled workers and productive implements.<sup>31/</sup> Recognising janmi as the absolute owner of land in 1818 and treating cultivable waste land and forest land as private property of janmis by Colonial government discouraged land transfers and land leasing to cultivating tenants for reclamation and expansion of cultivation.

Compared to Malabar, rapid changes had taken place in Travancore during the period. Available evidences suggest that during the period there had been a steady increase in the area and production under paddy. Besides, meeting the domestic requirements, paddy was exported since 1840's.<sup>32/</sup> The tax concessions and other encouragements given for reclamation of land in 1818<sup>33/</sup> encouraged reclamation of land from Vembanad backwater for rice cultivation since 1830's.<sup>34/</sup> The measure also encouraged the cultivation of cultivable waste lands. Coconut being a remunerative as well as export oriented crop, there had been rapid increase in area under the crop during the period.<sup>35/</sup> Coconut cultivation began to spread to waste lands, banks of rivers, backwaters, valleys and

hill slope . Due to the low monopoly procurement price, the pepper cultivation was discouraged during the period. But the abolition of pepper monopoly in 1860 and granting tax exemption to pepper cultivation, encouraged pepper cultivation.<sup>36/</sup>

Introduction of crops, tapioca and coffee were the major developments that had taken place during the period. Tapioca, which was introduced by around 1830's,<sup>37/</sup> began to spread rapidly in Southern and Central Travancore, and later emerged as a major food crop by 1880's. Tapioca began to be used as a substitute for rice by the poorer sections because of the rise in price of rice since 1860's. Though Coffee was introduced during the early parts of 19th Century, its cultivation in large scale was started only since 1840's.<sup>38/</sup> According to the earliest account on livestock, Travancore had about 3.82 lakhs cattle including Buffaloes and 27,000 sheep and goats in 1820's.<sup>39/</sup> Ward and Conner attributed climatic conditions, ignorance of cattle rearing among the people, inadequacy of the food given and poor breed as factors contributing to poor yield from cattle. Expansion of irrigation facilities by starting a department to execute public works and constructing a channel to increase the area under irrigation during 1830's were the other notable developments.<sup>40/</sup>

We may conclude our discussion with the following observation . Compared to Malabar, Travancore witnessed rapid changes in agriculture mainly due to the favourable conditions created by governmental measures. The measures are: acquisition of land belonging to 378 wealthy temples in 1812 thereby bringing about a less than two thirds of the cultivated area under the ownership of the state,<sup>41/</sup> government regulation in 1818

encouraging cultivation of waste lands, reclamation of land etc. through tax and other concessions; expansion of irrigation facilities, abolishing restrictive trade practices like pepper monopoly and encouragements to new crops.

The literature covering the developments of Malabar during the period are mainly official reports. The reports which give some information about agriculture are Thomas Warden's report of 1813 (160), Ward and Conner (162), P. Clementson (161), Sullivan (175) and Robinson (176). Ward and Conner's report, based on a survey, is the first report which gives a talukwise description of Malabar. The report is a significant document for the study of agriculture because it contains comparable talukwise details about agriculture such as crops cultivated, cultivation practices, irrigation, cattlestock etc. that existed during 1820's. Clementson, the principal Collector of Malabar, in his report describes the important items of goods exported and imported from Malabar and the general situation of agriculture, industry and other sectors. Anticipating fall in land revenue due to fall in agricultural production, he recommends providing for agricultural credit and irrigation by government. He also reviews the agricultural, industrial and trade policies of the colonial government and argues for changed policies. Though Sullivan's report is on the socio-economic conditions of Malabar, the report also points out the unfavourable land tenures standing in the way of expansion of Coffee planting in Wynad. Robinson's report is about the history, condition and prospects of the taluk of Wynad. The report gives the early history of coffee planting, the initial difficulties faced by coffee planters in Wynad, expansion of area under plantations, and coffee exports from 1840 to

1857. According to the report, a major problem of coffee planting in early years was the difficulty in acquiring large areas of waste and forest land available in Wynad due to the policy of treating the land as private property of janmis.

The literature on Travancore covering the period are rather few. The two official publications which give information on agriculture are Ward and Conner (268) and Nagan Aiya (259). Ward and Corner's memoir is a geographical survey which gives a descriptive account about Travancore during 1820's. Nagan Aiya's manual is the basic source of information relating to the developments in agriculture and economy during the period. The notable works covering the period are that of Samuel Mateer (213) and Dick Kooiman (194). Though Samuel Mateer mainly examines the sociology of the people, he gives a detailed account of the developments in major crops during 19th Century upto 1870's. One chapter of his book is exclusively devoted to the discussion of agriculture: the major crops cultivated; methods of cultivation; yield; price; and exports. He provides a detailed discussion about the various aspects of individual crops like paddy, coconut, arecanut, Tapioca and Coffee. He also traces the history of Tapioca crop, its introduction into Travancore and the rapid expansion of the crop. In another chapter he traces a detailed history of the coffee crop, its introduction, early experiments in planting, the spread of leaf disease, policies of the government to promote coffee and the decline in Coffee cultivation. One gets an excellent account of the history of Coffee up to 1880's from the account of Samuel Mateer. The work is very significant for the study of agriculture because it provides a detailed

historical account of two crops introduced to Travancore viz., Tapioca and Coffee. The main theme of Dick Moiman is the effect of missionary activities in 19th Century Travancore. He has attempted a detailed examination of the involvement of missionaries in early coffee planting activities and the overall benefits enjoyed by native south Travancore Christians as a result of it. A notable aspect of the study is that it gives a historical account of the Coffee crop during 19th Century.

### III

#### Agriculture between 1860 and 1930 AD

During the period except for a few crops there was a steady increase in area under major crops, in Malabar. The proportion of area under cultivation had increased from 28.7% in 1890-91 to 47.6% in 1930-31.<sup>42/</sup> While the area under coconut and ginger registered a steady rise, the area under paddy declined since 1920-21.<sup>43/</sup> But the spread of a disease known as "wilt of pepper" during the early decade of the present century had considerably damaged the cultivation of pepper.<sup>44/</sup> The arecanut crop showed a decline in cultivation during the second half of the 19th Century due to fall in price, higher cost of irrigation, lack of markets etc.<sup>45/</sup> Among the crops, Coffee attained the highest rate of growth in area during the period. Coffee cultivation was also started in other taluks like Eranad, Walluvanad and Kurumbranad besides Wynad. The area under Coffee increased from four to five thousand acres in 1840's to 35,000 acres in 1882; and further increased to 40,500 acres in 1905.<sup>46/</sup> The other significant development was the starting of cultivation of tea and rubber on an experimental basis by

the end of the 19th Century and their commercial cultivation during the beginning of the present century. By 1930, tea cultivation spread to about 12,000 acres<sup>47/</sup> and rubber to 9,200 acres.<sup>48/</sup> The composition in exports also changed by 1870's and coffee emerged as the single largest export earner from Malabar.

By 1870's Malabar began to import large quantities of grain and the total share of the imports accounted for about 61 percent of the total value of imports.<sup>49/</sup> Except for the price of coconut, arecanut and ginger, the general price level that prevailed for agricultural products were favourable (marginal rise).<sup>50/</sup> But there was considerable variation in the price of each commodity for different taluks probably due to the lack of developed market facilities and transport facilities.<sup>51/</sup>

In case of livestock while certain categories such as Bulls, Bullocks and sheep registered a fall in number, there had been an increase in male and female Buffaloes, young stock and goats.<sup>52/</sup> The changes that occurred in Malabar can be understood on the basis of the shift in population from agriculture. By 1881, about 80 percent of the population was engaged in agricultural activities.<sup>53/</sup> This implies that during a period of 80 years from 1800 the shift in population from agriculture was roughly about 10 percent. During this period, except the interest shown in plantation crops, starting of a railway line between Palghat to Mangalore<sup>54/</sup> and spending a meagre amount for irrigation works,<sup>55/</sup> there was no major change in colonial policies.

Compared to Malabar, rapid changes had taken place in Travancore agriculture. The period witnessed a steady increase in the cultivation of all major crops except paddy and coffee. Paddy cultivation was badly affected by the import of large quantities of rice from other colonial territories to Travancore consequent on the removal of duty on paddy by the colonial government in 1861.<sup>56/</sup> This resulted in a fall in prices, which discouraged paddy cultivation and initiated a gradual change in cropping pattern in favour of coconut. But the area under coconut registered a rapid increase and coconut and its byproducts accounted for nearly about 50 percent of the total export earnings of Travancore till 1910.<sup>57/</sup> Coconut crop also provided raw materials for a number of agro-processing industries like Coconut oil, coir, coir products etc. Production of pepper registered a steady increase as evident from the increase in the export earnings of pepper.<sup>58/</sup> The price hike in 1920's further gave a stimulus to cultivation of pepper. Cultivation of Tapioca expanded quickly and by 1880's Tapioca emerged as a major food crop. By 1930, the crop had spread to all except two taluks of Travancore.<sup>59/</sup> From 1860's onwards, the state followed a policy of giving active encouragement to plantation crops. Government offered liberal tax concessions, provided forests and waste lands either as grants or at very low prices and provided assistance or constructed roads connecting hilly plantation regions with trading centres.<sup>60/</sup> Besides this, vast areas of forest land were given to colonial companies on the basis of the agreement between state and companies.<sup>61/</sup> The coffee cultivation which reached the peak point by the end of 1860's began to

decline with the spread of Coffee leaf disease by 1880's.<sup>62/</sup> Tea which was introduced during 1860's began to be cultivated on a large scale during 1880's.<sup>63/</sup> The destruction of coffee due to leaf disease also prompted planters to switch to tea. By 1894, about 25,000 acres of land was brought under tea and the estates provided regular employment to about 18,000 people.<sup>64/</sup> The expansion of the Crop was so rapid that by the decade 1920's, tea became the second largest export earner accounting for about 27 percent of the total value of exports.<sup>65/</sup> Though experiments in rubber plantations were started around 1890 by European planters, planting on a large scale was started during the first decade of the present century.<sup>66/</sup> The expansion of plantation crops created large employment opportunities to unskilled people especially those belonging to lower castes and gave incentives to local people to start plantations. During the period between 1905 and 1931 there had been an increase in the livestock population except in the case of Buffaloes.<sup>67/</sup> On the whole, we may conclude that agricultural sector achieved rapid development during the period as evident from the reduction in population supported by agriculture from 69.5 percent in 1861 to 54.3 percent in 1931.<sup>68/</sup> We may attribute the following governmental measures for creating the favourable conditions for development. They were: land policy of 1865 granting full ownerships rights to holders of government pattom land; land proclamation of 1867 giving security of tenure to tenants of janmom lands;<sup>69/</sup> encouragements and tax concessions given for starting plantation crops; construction of roads to connect hilly tracts with trading centres;<sup>70/</sup> encouragement for reclamation activities; and expanding irrigation facilities.



The literature on Malabar covering the period may be broadly classified into three categories: official reports; statistical reports; and academic studies. The important official reports which give information about agriculture are: Cameron's Report (178); Report of the South India Planter's Enquiry Committee(183). Report on Nilambur teak plantations (180), Logan's report on land tenures (181), Logan's Gazetteer (191, 192) and Inne's Gazetteer (190). Cameron's report was primarily intended to assess the cost of cultivation of two pieces of land and to find out how the total produce was shared between tenant, landlord and government. A notable aspect of the report was that it gives a detailed account of all items of cost of cultivation, cultivation practices, yield of crops etc. prevailing during 1860's. The South Indian Planter's Enquiry Committee was mainly concerned about the labour issues in plantations, but their report gives a historical account of the tea and coffee plantations in Malabar. Report on Nilambur teak plantations, prepared by the Forest Conservator makes an assessment of teak plantation policy of government and recommends extension of planting. The report provides a detailed account of the early teak planting, the difficulties experienced in planting, problems of acquiring land, and the expansion in area under teak from 1842 to 1860.

Among the official reports during the period, the most important reports were Logan's land tenure report and Logan's manual. Logan traced the history of various land tenures of Malabar on the basis of unrefutable historical evidences and

questioned the colonial theory that janmi was the absolute owner of the soil. Logan argued that due to misinterpretation of the traditional land tenures and the wrong tenure policy followed by the colonial government, the old customary relations between janmi, Kanakkaran, and actual cultivator had been destroyed. And the Janmi had thrown at the expense of the Kanakkaran and cultivator, resulting in widespread agrarian discontent. Logan's main position was that the persons who ought to be protected are the actual cultivators and the agrarian discontent that existed can only be satisfied by giving security of tenure and other measures through legislation. In his report he also gives a detailed account of the major crops cultivated, cultivation practices, credit facilities and causes of indebtedness of cultivators. Logan's report can be considered as the first original study conducted on the evolution of land tenures in Malabar. Logan's gazetteer published in two volumes in 1887 give a wide range of information about people, physical features, history, land tenures, land revenue settlements, general statistics and talukwise gazetteer. The Gazetteer may be considered as the basic reference book on any aspect of the social, political and economic history of Malabar. Following the pattern of the Gazetteer and incorporating the later developments another gazetteer was edited by Innes C.A. and published in 1908. Later incorporating the developments up to 1933, the Gazetteer was republished in the present form.

The statistical publications which give agricultural statistics during the period are statistics of Malabar 1873-74 (179) agricultural statistics published by government of India (150 to 154) and Government of Madras (187). The agricultural statistics published since 1884-85 gives a lot of basic statistics on agriculture such as area cultivated, classification of area, crops cultivated, area under irrigation,

livestock, agricultural stock etc. The season and crops report of Madras Presidency published since 1804 also provide similar statistical information.

Among the studies, the village surveys conducted in three villages in Malabar and edited by Slater (143) is a notable study. Though the surveys are in the nature of general socio-economic surveys the survey gives information about landownership pattern, types of tenures, wages of agricultural labourers, indebtedness of cultivators, crops cultivated, cultivation practices, agricultural implements used, cattlestock and the non agricultural activities which existed in the villages. We may take up the other studies in the next section as the studies also cover the later developments.

Compared to earlier periods the literature position about Travancore is better during the period. Besides the official publications such as Nagam Aiya (259), Velupillai (266) and Report on Industrial Survey (228), we have also a few academic studies. Nagam Aiya's manual published in 1906 is the basic source which gives developments till the end of 19th century. The manual is also considered as more authentic compared to the later manual by T.K. Velu Pillai. Following the pattern of Nagam Aiya and incorporating the latter developments upto 1940, Velupillai had compiled a manual and published it in four volumes. The manual gives more emphasis on the developments in agriculture and economy relating to the first four decades of the present century. Though the manual is a compilation of information from different departments and other sources, the manual may be considered as the basic source of information about agriculture. The industrial

Survey of Travancore, conducted in 1917, is a notable survey because it gives a talukwise account of the economic activities of the people. The survey provides an account of the area under cultivation, occupational distribution of population, the agro based industries and the industrial activities of each taluk. The data of the report can be used to study the agro based industries prevailing in different taluks of Travancore.

Compared to Malabar more academic attempts were made to study certain aspects of Travancore agriculture relating to the period. Among them, the notable studies are: T.C. Varghese (514); Robin Jeffrey (211); Uma Devi (216); Michael Tharakan (202) and Tharian George et al. (215). T.C. Varghese traces the tenurial developments in Travancore since 1850's and examines the impact of the land tenure measures on agricultural development. He attributes the expansion of cultivation in plains and high lands due to the favourable land tenure measures and encouraging policies of the government to promote plantation crops. The author also examines the other factors such as rise in prices of plantation crops, expansion of transport services, increase in credit facilities, availability of cheap labour and inflow of foreign capital, which contributed to the expansion of plantations. Comparing the impact of land tenures on agricultural development, Varghese comes to the conclusion that the rate of agricultural development was highest in Travancore compared to other regions mainly due to favourable land tenures. The study may be considered as a significant contribution on the agrarian history of Kerala.

The central theme of Robin Jeffrey's work is the disintegration of the matrilineal joint family and the decline of Nayar dominance in Travancore for the period between 1847 and 1908. Jeffrey attributes factors such as land reforms, abolition of commercial monopolies, the encouragement given to European planters and a big programme of public works as contributory factors for the transformation of the economy into cash economy. The analysis gives an overall picture about the changes that had taken place in economy and society during the second half of 19th Century. A significant aspect of the work is that the author has presented all major governmental measures which accelerated the process of agricultural development during the period. Uma Devi has examined the state policy towards the cultivation of cash crops in Travancore between 1860 and 1920. She argues that Travancore government was forced to take encouraging policies for promoting cash crop cultivation mainly due to the compulsion from the colonial government. She argues further that the policies had adversely affected the interest of paddy cultivators in Travancore. In this context we may note that the paddy cultivators in Travancore suffered not due to expansion of cash crops, but due to the removal of import restrictions and the consequent inflow of imported cheap rice. Later Travancore government had not taken any steps to impose import restrictions. In spite of the above shortcomings, the study has made a modest attempt to review the various policy measures taken to promote cultivation of cash crops. Michael Tharakan examines the socio-economic factors which contributed to the educational development during 19th century. Examining the structural changes that occurred in the agrarian economy during the 19th Century, he attributes the land tenure measures implemented between 1818 and 1867 as major

contributory factor leading to the commercialisation of the economy. A notable study on the development of tea plantation is that of Tharian George and Michael Tharakan. They have traced the developments of tea plantations in Kerala between 1880 and 1950. Here they have examined, availability of capital, legal and other institutions helping its deployment and the subsequent changes in the structure of plantation ownership, the existence of a large export market, the availability of relatively cheap labour, the legal and traditional institutions used to keep the labour disciplined and the abundance of land agro-climatically suited for tea growing, as favourable factors which promoted the development of tea plantations. The conclusion which emerged from the study is that tea industry in Kerala had developed as part of a colonial economy retaining some well known aspects of colonial economic relations.

#### IV

##### Agriculture between 1930 and 1956

During the period, though there had been an increase in total cropped area,<sup>71/</sup> the cultivation of some of the crops in Malabar were badly affected during 1930s due to the impact of depression. The area under paddy, which showed a decline since 1920's continued to decline during the subsequent decades.<sup>72/</sup> The low productivity and decline in cropped area under paddy resulted in the import of food grains. The Malabar Tenancy Committee observed in 1940 that productivity of rice had remained at almost the same level as at the inception of colonial rule.<sup>73/</sup> Due to decline in pepper production, Malabar also

lost its monopoly in world trade and pepper export declined to one percent of the world trade in pepper in 1940's<sup>74/</sup> In case of plantation crops the area under coffee declined while the area under tea and rubber registered an increase.<sup>75/</sup> Eventhough, there had been changes in cropping pattern, by 1950, paddy stood as the largest crop followed by coconut, arecanut, plantains, tapioca, rubber, coffee and tea.<sup>76/</sup>

In agricultural operations, a new development was the introduction of new technology, i.e. oil pumps and electric pumps for irrigation during 1930's.<sup>77/</sup> The adoption of the new technology continued and during 1940's there had been a rapid increase in the number of pumps used for lifting water. In the case of livestock, there had been an increase in number of cows, male and female Buffaloes and goats during the period. The overall changes that had taken place can be seen from the shift in population from agriculture. By 1940, agriculture provided livelihood to about 70 percent of the total population.<sup>78/</sup> During the period the colonial government continued to pursue the policies without much change.

Though Travancore agriculture achieved steady development, the only decade in which the development was halted was the depression period, roughly between 1925-26 to 1930-34.<sup>79/</sup> According to one estimate the price of agricultural products during the decade had fallen by 60 percent.<sup>80/</sup> As Travancore was closely linked to the world market, the depression had an immediate impact on the economy. The steep fall in prices affected almost all crops. It was reported that the price of paddy during the first half of 1930's was so low that paddy cultivation in Kuttanad and Nanjanad became uneconomic.<sup>81/</sup> The crops, tea

and rubber were very badly affected. According to one estimate about 75,000 people were thrown out of employment from rubber and tea cultivation.<sup>82/</sup> There was steep decline in the price of land<sup>83/</sup> and people experienced severe cash scarcity. In short the effect of the depression was so vast that it even shook the foundation of the agricultural economy.

The economy gradually recovered from the effect of depression by the end of 1930's. During the period between 1938 and 1948, there had been a steady increase in area under major crops except paddy, coffee and pepper.<sup>84/</sup> A notable development was the rapid increase in the area under rubber and tea. The composition of exports also changed and by 1930, tea emerged as the single largest export earner followed by coconut and its byproducts, pepper, rubber and ginger. The livestock population also registered an increase during the period except oxen. Besides taking relief measures to help farmers during depression period, the government continued to pursue the encouraging policies during the period.

During the period the major source of information about Malabar agriculture are the statistical publications of Madras Government (187, 188). Among the reports, the report which discusses about agriculture and general economic situation is the Malabar Tenancy Committee Report 1940 (186). The Committee also examines the state of agriculture and the major problems faced by the principal crops. Though a number of scholars had studied the political and agrarian developments, only very few have examined developments in agriculture. The notable studies are conducted by Adrian C Mayer (126), T.C. Varghese (514) and



Thomas W. Shea (147). Mayer's work, primarily a study on social change in Malabar, examines the effect of colonial policies and western influence on Malabar society. Here he put forward the argument that the effect of western impact was the sole factor responsible for the social and economic change that occurred. A major limitation of the study is that the author has completely ignored the adverse effects of the regressive and extractive policies pursued by colonial government in Malabar.

Varghese mainly traces the evolution of land tenures between 1850 and 1960 and its impact on the social and economic development of Kerala. Tracing the land tenures in Malabar during colonial period, the author examines the factors which prompted the colonial government to follow a regressive land tenure policy. He argues that the colonial government followed the regressive land tenure policy mainly taking into account the political considerations. Comparing the overall development that had taken place in three regions over one and a half centuries, Varghese concludes that Malabar is the region where the rate of development was the lowest. The land tenures in Malabar is identified as the most important factor which prevented the emergence of favourable conditions for development. The study may be considered as a significant contribution on the agrarian history of Malabar. Among the studies, a notable one is that of Thomas W. Shea. He has identified six barriers as important obstacles to economic growth in Malabar viz., immobility of caste structure; traditional occupational distribution of the elite; absence of systematic government in pre-British period; the pattern of land tenures; structure of family property laws; and the pattern of

population growth during 19th and 20th centuries. While explaining the barriers of economic growth; he puts forward a hypothesis that businessmen in Malabar made no concerted and systematic attempts to rationalise agricultural production and that because of their lack of interest in bringing about changes in productive techniques in agriculture, the development inhibiting social and economic barriers were never directly challenged. Shea's work is significant because he examines some of the important barriers of economic growth in Malabar. But the basic weakness of Shea's work is that he has completely ignored the role of the colonial government and the impact of its retrogressive and extractive policies on Malabar agriculture. We have sufficient evidence to show that the retrogressive and extractive policies pursued by the colonial power during their one and a half century rule with respect to land tenures, land taxation, taxation in non-agricultural sectors, trade, commerce, industry and infrastructure had stood as obstacles to agricultural as well as overall economic development.

The literature relating to the period in Travancore is mostly in the category of committee reports. The important reports are: Travancore Banking Enquiry Committee Report (233), Report of the Agricultural Debt Redemption Committee (236), Economic Depression Enquiry Committee (235), and Economic Survey 1941 (262). The Banking Enquiry Committee was constituted mainly to study about regulating and expanding indigenous, co-operative and joint stock banks with special reference to meet the credit requirement in agriculture. In the course of collecting information, the Committee conducted a few village surveys, which provide us information about the crops, aspects of cultivation and extent and magnitude of indebtedness of farmers. The

Agricultural Debt Redemption Committee was constituted to study the effects of depression on agricultural debtors and to suggest measures for giving relief to the farmers. The report gives a fairly good account of the effects of depression on cultivators and the agricultural sector. The Economic Depression Enquiry Committee, appointed to investigate the causes and magnitude of depression also provide a very good account of the effects of depression on agricultural sector. The economic survey in 1941, though conducted to study the socio-economic conditions of people, provides information about the extent and magnitude of debt of the cultivators.

Two notable academic studies relating to the period are that of Michael Tharakan (204) and George Kristoffel Lieten (196). Michael Tharakan examines the dimension and characteristics of migration of farmers from Travancore to Malabar between 1930 and 1950. The author attributes the rapidly increasing population and the subsequent pressure on cultivable land in Travancore in the early decades of the present century as major factors contributing to the migration of farmers from Travancore to Malabar. George Kristoffel examines the nature of changes that occurred in Travancore economy between the two world wars. After reviewing the tenancy developments, reclamation of Kayal lands, expansion of area under major crops and expansion of plantations, he concludes that there had been a steady increase in area under cash crops during the period, when the area under food crops remained stagnant. He attributes this to the favourable policies and encouragement given to foreign capitalists.

Agriculture between 1956 and 1980

Kerala state was formed in 1956 by bringing together the entire Malabar district and Kasaragod Taluk of South Canara district of the former Madras State and the erstwhile Travancore-Cochin State with the exception of Kanyakumari and Shencottah regions. During 1950's, the domestic production of rice in Kerala was sufficient to meet less than 50 per cent of the rice requirements of the State (85). And due to the deficit in rice production, the agricultural development strategies during the first two and a half decades of planning period centred around an objective of "attaining self-reliance in food by increasing rice production"<sup>86/</sup>. During the period between 1951 and 1980, out of the total plan expenditure in the State, agricultural sector including irrigation accounted for 31 per cent of the total plan expenditure.<sup>87/</sup> A major share of the amount was spent for promoting the paddy crop, through investment in irrigation, agricultural research and a number of special programmes designed to increase paddy production.

From a review of the growth in the area under crops, production and productivity of crops, we will get an idea about the magnitude and pattern of growth during the post-independence period. The trend in the growth in total cropped area between 1957-58 and 1979-80, may be classified into three phases.<sup>88/</sup> The first phase covers a period upto 1970-71 showing a steady increase; the second phase between 1970-71 and 1975-76 showing a marginal growth; and the third phase since 1975-76 showing a negative growth. By the middle of 1970's

almost the entire available arable land was brought under cultivation. In the case of paddy, which accounts for about 28 percent of the total cropped area, the expansion in area was practically over by 1970-71. Since the mid 1970's we notice a fall in the total <sup>89/</sup> cropped area under paddy. Tapioca, which accounted for about nine percent of the total cropped area showed a steady increase in area till mid 1970's, but registered a fall since then. The crops which showed a steady increase in the area are coconut, cashew, cardamom, coffee and rubber. Thus we can notice a shift in cropping pattern since 1970's in favour of plantation crops and commercial crops.

A review of the productivity of major crops shows that there has been ~~no significant~~ increase in the productivity in the crops like pulses, pepper, cardamom, cashewnut and coconut till the middle of <sup>90/</sup> 1970's. In fact, the productivity of the crops like pepper, cashewnut and coconut show a declining trend. But there has been a steady increase in the productivity of crops like paddy, sugarcane, arecanut, tapioca, tea and rubber. A review of the production of major crops reveals that the production of paddy and tapioca has shown a steady increase till mid 1970's, but registered a decline since then. There has been an increase in coconut production during 1960's, but during 1970's, the production shows a declining trend. The crops which achieved a steady increase in production are cardamom, tea, coffee and rubber.

A review of the growth of the agricultural sector shows that it achieved an annual average growth rate of about 2.3 per cent <sup>91/</sup> between 1960-61 and 1974-75. But since then the sector shows negative

growth.<sup>93/</sup> Instead of shifting the working population from primary sector to other sectors, there has been a reverse shift in working population since 1960's.<sup>93/</sup> The attainment of self-sufficiency in paddy production remains an impossible goal as the state still imports more than 50 per cent of food grains from outside the State.<sup>94/</sup> In spite of all the measures to increase the production of rice, the area under rice showed a decline since the middle of 1970's. There has been a shift in the cropping pattern in favour of plantation and commercial crops, which is contrary to the declared objective of expanding food crops.

We may attribute the policy of attaining self-sufficiency in paddy production and the consequent diversion of a major share of developmental efforts to attain the objective as the major factor, which led to the above pattern of development. With the objective of providing irrigation to paddy crop, too much emphasis was given to large and medium irrigation projects, at the cost of minor irrigation projects. As a result of this, paddy crop alone accounted for 82 per cent of the gross irrigated area in the State and irrigation projects were concentrated in the three paddy growing districts viz. Ernakulam, Trichur and Palghat accounting for about 73 per cent of the irrigated area by February 1978.<sup>95/</sup> Except for a few, all major agricultural development programmes are solely aimed at promoting paddy crop.<sup>96/</sup> Expansion of agricultural research was mainly aimed at promoting paddy crop.<sup>97/</sup> Thus, we may conclude that the major share of developmental efforts in agricultural sector are aimed at a non-feasible objective of

achieving self-sufficiency in paddy production, while sacrificing the development possibilities of a number of major crops having vast potentials of development.

Compared to earlier periods the position of literature is much better during the post-independence period. The literature available on agriculture is mostly in the form of statistical publications and official reports. Though a number of academic attempts are made to study agriculture, most of the serious studies have been conducted since the mid 1970's. For the purpose of this survey, we may classify the literature into the broad groups viz., food crops, non-food crops, irrigation, livestock and others.

Paddy, being the most important crop in Kerala got much attention from the academic scholars as well as official agencies. The scholars who made notable studies on paddy crop are P.G.K. Panikar, Jeemol Unni, P.K. Muralidharan and K.R. Minan. Panikar (324) examines the trend in the area, production and yield rate of rice in Kerala between 1960-61 and 1978-79, the reasons for the decline and its implications. The causes attributed to the decline are: fall in the price of paddy since 1974-75, rise in the cost of cultivation particularly due to increase in wages and improvement in the supply position of rice due to imports. In another study Panikar (322) presents the findings of a survey conducted in Palghat and Kuttanad areas to examine the socio-economic factors underlying the adoption of HYVS. A major finding of the survey is that the yield rate of HYVs are far less than the expected yield rate. The low yield is attributed to low response of yield to fertilizer, the physiological properties of

the new seed varieties prone to more incidence of pests and diseases, high and rising prices of fertilizer and plant protection materials leading to high cost of production. The study concludes that the rice economy in the study region is caught in a paradox of modernisation without commensurate improvement in net returns. Jeemol Unni (310 and 311) has made a modest attempt to examine the shift in cropping pattern of Kerala from 1960-61 to 1978-79. She classifies the growth in the gross area under three phases viz., (1) between 1960-61 and 1968-69 when the area under rice increase; (2) between 1969-70 and 1974-75 when the area under rice tended to stagnate and (3) between 1975-76 and 1978-79, when the area under rice fell sharply. The main finding of the study is that there has been a shift in cropping pattern in favour of coconut crop at the expense of paddy crop. Muraleedharan (317) examines the resource use efficiency in rice cultivation in Trichur district using data from the sample survey of 150 farmers. Cobb-Douglas production functions are fitted for high yielding varieties and non-high yielding varieties separately and also for the two varieties together. The analysis of the resource use efficiency at the aggregate and individual farm levels shows that inputs such as human labour, bullock labour, fertilizers and manures are not efficiently used in the study area. Ninan (320) has attempted to examine the relationship between labour use on the one hand and yield, farm size, crop operation and labour productivity on the other in the case of tapioca and paddy crops. The analysis reveals that average labour productivity of tapioca and paddy will rise only if per acre labour input were to decline.



Besides, the above studies the official publications on paddy crop are N.C.A.E.R. Survey, State Planning Board's evaluation studies, and Farm management studies by Kerala University. N.C.A.E.R. Survey (319) is one of the first official attempts to assess the problems and prospects of paddy crop. The survey published in 1962, warned against the policy of giving too much emphasis to paddy production and suggested encouraging plantation and cash crops as Kerala's topographical and climatic conditions are more suited to plantation and other cash crops. State Planning Board's (360 and 361) evaluation studies on High Yielding Varieties of paddy, examines the spread of HYVs in different parts of the State, the performance of HYVs, vis-a-vis the local varieties in terms of their input-output relationship and cost structure, cultivator's reactions, and the problems of implementation of the programme at different levels of administration. An important conclusion that emerges from the studies is that the cost of cultivation of HYVs, is 30 per cent higher than the cost of cultivation of traditional varieties and thus viewed from the point of economic viability the HYVs have only a slight advantage over traditional varieties. The Farm Management Studies (340 and 315) conducted since 1962-63 gave a large volume of highly useful data on the cost of cultivation of paddy.

The other category of literature about paddy crop is the statistical publication of Bureau of Economics and Statistics, (later Directorate of Economics and Statistics) the official agency of the State Government engaged in the collection and publication of statistics. Though the Bureau has published a large number of statistical

reports on various aspects of agriculture, the important publications which contain statistics on paddy crop are Agricultural Census (622 and 638) Agricultural Statistics (623 to 641) and Annual Crop Cutting Surveys (345, 346 and 349).

Land reclamation in Kuttanad region, the rice bowl of Kerala is a topic which attracted the attention of scholars. V.R. Pillai and P.G.K. Panikar (329) give a detailed account of the history of land reclamations in Kuttanad, the economy of Kuttanad, the economic aspects of reclamation, financing of reclamations, labour problems and make a critical assessment of the Kuttanad Development programmes implemented. The authors suggest the need for a comprehensive, integrated and development oriented plan for the overall development of Kuttanad. The Kuttanad Enquiry Commission (332) which was also constituted to enquire among other matters, the cost of cultivation in Kuttanad compared to similar areas of Kole lands in Trichur, give a number of recommendations for developing cultivation in Kuttanad. K.P. Kannan's (312) economic valuation of the Kuttanad Development Project is another significant study. Using UNIDO approach of project evaluation he makes an evaluation and identifies certain inadequacies of the project. The lack of required information on which the project estimates are made and lack of technical alternative of the scheme are identified as the major defects of the project. Among the other two studies of the author one is an economic evaluation of Trichur Kole land Development Project (313) and the other on the socio-economic and ecological consequences of water control projects in Kuttanad (314). The study by Indian Institute for Regional Development Studies on the development problems and prospects of Kuttanad, is

another notable study (309) which gives certain practical suggestions for improving the Kuttanad Development Scheme.

Coconut, rubber, tea and coffee are the major non-food crops in Kerala. Of this, the two crops which attracted the attention of scholars are coconut and rubber. The scholars who conducted studies on coconut crop are M. Kuttappan (383), P.S. George (375) and Chandan Mukherjee (374). Kuttappan examines the factors determining the production of coconut in Kerala. He puts to empirical test the hypothesis that farmers in Kerala respond favourably to changes in prices and profit in the allocation of resources. He has found that the response is significant only in the allocation of land not in non-land resources. The study shows that there had been a shift in cropping pattern in favour of coconut crop at the expense of paddy, tapioca and other crops. The continuous increase in the area under coconut is attributed to the higher profitability of coconut per hectare compared to paddy and tapioca. George makes an analysis of trends in coconut production between 1949 and 1973 and projects the growth of production for the next decade. Chandan Mukherjee tries to evolve a methodology for determining a replantation scheme for Kerala State, which he calls optimal strategy for replantation of coconut trees. The author presents an abstract theoretical model without taking into account the complexity of problems of coconut cultivation and problems of coconut cultivators. The State Planning Board has conducted an evaluation on a loan scheme for Kayal reclamation for coconut cultivation (371). They attribute the slow progress in the implementation of the scheme to the absence of development attitude on the part of the implementing agencies.

Sunil Mani (385), Arabinda Bhattacharya (373) and R.V. Jose (380) have studied the rubber economy of Kerala. Sunil Mani examines the intra-year variation in natural rubber prices during the 1970's and the role played by the rubber stock in explaining it. During the course of the analysis he presents a brief account of the rubber economy in Kerala, the pattern of distribution of small holdings and estates between 1955 and 1979 and the production trends. The other two studies dealt with the growth of rubber cultivation in Kerala. Among the Government publications, MCAER Survey (319) is an important publication, which provides a detailed examination of the problems and prospects of all major non-food crops.

Except for a few studies, the literature on irrigation is in the form of irrigation statistics. C.J. Joseph (280) has made an attempt to examine the economic aspects of minor irrigation on the basis of a case study at Piravom Village in Kerala. The study examines the effect of minor irrigation on the beneficiary households in terms of input use, output, productivity, profitability, asset formation and also the relative efficiency of lift irrigation and irrigation by means of cross-bars. The major conclusion emerging from the study is that minor irrigation has helped rice farmers in the state to intensify cropping, increases the application of modern inputs such as chemical fertilisers and pesticides, and to improve productivity of cultivation. Among the two types of minor irrigation existing in the village, lift irrigation which guarantees perennial supply of water is found to be more advantageous to the cultivators. D. Narayana et.al (281) have examined the impact of irrigation in stabilising and increasing the yield of paddy crop and the factors hindering the proper use of water

for paddy cultivation. The two main findings of the study are (1) the impact of irrigation in terms of stabilising productivity of paddy land and increasing it over time is seen to be only marginal in the State, and (2) the lack of any significant influence of irrigation on crop yields is due to poor management of irrigation water. In another study (282) the author presents certain issues of investments in minor irrigation projects by conducting a case study of a project in a remote village in North Kerala. M.V. George et.al.(279) have examined certain issues connected with irrigation development and the impact on paddy yields. They are of the view that the lack of adequate utilisation of the irrigation potential generated is the most serious problem facing the state at present. The State Planning Board (300) has conducted an evaluation of the minor irrigation schemes implemented during the first three years of the Fourth Plan. The major findings of the evaluation are: (1) there is inordinate delay in the execution of minor irrigation projects, (2) in spite of the large expenditure on minor irrigation the addition to cultivated area remained low; (3) most of the projects were mainly aimed at stabilising the second crop rather than raising an additional crop; and (4) the major reasons for under utilisation of the irrigation projects is the lack of adequate maintenance. Another evaluation (301) on the scheme for the free supply of pump sets to panchayat throws light on the reasons for the failure of the scheme. The publications which give statistical information about irrigation are Timely Reporting surveys (633 to 635), Agricultural Census (622 and 638) and publication of Public Works Department (283, 284, 294 to 296).

Among the studies on livestock issues of Kerala, the notable studies are those of K. Narayanan Nair and Shanti George. Narayanan Nair (421) has attempted to explain the inter-relationship between bovine economy of Kerala on the one side and human population and techno-economic, ecological and institutional factors on the other. He starts his analysis with a review of the livestock development policy in India, examines the normative and positive approaches adopted in studies of Indian bovine economy and presents a detailed examination of the density and sex ratio of bovine population, role of draught power in Kerala's agriculture, structure and trends in milk economy, bovine holdings and meat production and adjustment of bovine stock in Kerala's economy. The author attributes the virtual disappearance of the taboo on beef eating in the State during the last two decades, as one of the important factors that led to an increase in the efficiency of the bovine economy of the State. It is pointed out that this has enabled the farmers to weed out inefficient animals and to select the best younger stock for rearing, thus resulting in increased productivity of dairy stock in terms of quantity of milk and meat and the quality and the number of calves. In another study (423) the author attempts an overall evaluation of the trends in milk production and consumption in Kerala and the factors which have contributed to the increased production. Among the other two studies by the same author, one examines (420) the favourable impact that cow slaughter has had on the livestock economy and agricultural production of Kerala and the other (418) looks into Kerala's experience of milk production through cross-breeding technology. Shanti George (427) has conducted a livestock survey in Muttam Village in

Central Kerala in order to examine the implications of establishing a Milk Procurement Co-operative. The data gathered from the survey is also used to weigh one aspect of the present dairy policy viz. the establishment of Anand pattern milk procurement co-operatives in villages, by speculating on the effect such a co-operative would have on patterns of livestock holding and milk consumption if established in a village. Besides, the above studies, the statistical publications available on livestock economy of Kerala are Agricultural Census (622 and 638), National Sample Survey Report (430) and Quinquennial livestock census (431 to 433).

The other areas on which studies are available may be classified into Land Utilisation and cropping pattern, income distribution, forests, agricultural co-operatives and agricultural programmes. Regarding land utilisation and cropping pattern, Oommen (544) examines the problems of land utilisation during 1950's and suggests the need for a well-planned policy of land utilisation. In another study (542) the author presents the need for giving more importance to plantation crops in the third five year plan because of the peculiar cropping pattern of Kerala. The author has also attempted an examination of the existing cropping pattern of Kerala and argues the need for the readjustment in cropping pattern for optimising the agricultural income and output. Another study of the same author (545) is the analysis of productivity trends of all major crops of Kerala from 1949-50 to 1960-61. One area in which not much work has been done relates to agricultural income distribution. A pioneering study in this regard is that of Oommen (543) analysing the spatial and personal distribution of agricultural income.

The topic of Forests got only very little attention from scholars. The main objective of the Forest Resources Survey, conducted between 1970 and 1972 by Chandrasekharan (270) is to assess the extent of wood resources distributed by utilisation categories and size classes. The survey estimates the wood use, growing stock in the forests and consumption and supply of wood in Kerala. On the basis of wood supply and demand, the author has predicted the possibility of a wide gap between future supply and demand. The survey also points out the need for effectively controlling further withdrawals of forest land and to increase productivity of both natural and man made forests. To improve the wood supply situation, the survey emphasised the need for encouraging wood production in non-forest areas like tree farms, wood lots and wind belts etc. Sivasankaran Nair (272) applies the cost Benefit Analysis method for assessing the economic viability of a Eucalyptus project of the Kerala Forest Development Corporation. The N.C.A.E.R. Survey (319) gives a description of the types of forests, their regional distribution, major forestry problems during 1950's and suggests certain programmes for development of forestry. K. Balachandran Thampi, attempts to estimate the quantity, type and source of energy used for a typical eco-system and how system characteristics influence the energy consumption based on a sample survey of three villages in Trivandrum district (269). The study also examines the extent and form of dependence on coconut trees for domestic energy needs. A major finding of the study is that there is a close relation between the energy resource endowment and the types and sources of energy consumed by villages. Villagers use what is easily available to them.



Another finding of the study is that about 42% of the villagers are depending on coconut trees for their domestic energy needs. It is argued that the domestic energy crisis prevalent in other regions of the country is not manifested in Kerala due to coconut trees.

A few scholars have examined the agricultural co-operatives and co-operative credit in Kerala. Govindan Kutty Nair (404) has attempted to examine the problems of rural credit societies and to find ways and means to link them with the organised sector of the money and capital market of the country. The study examines the structure of primary agricultural credit societies, their weakness and limitations, government policy and institutional changes in agricultural finance and suggests a re-organisation of co-operative credit system. To rectify the deficiencies in the working of the co-operatives, the author suggests the conversion of the societies into co-operative rural banks. Among the other scholars, who have examined co-operative credit mention may be made about the studies of E.T. Mathew (408 and 409), K.S.L. Panikar (410) and Krishna Iyer (405 and 406). State Planning Board has also conducted an evaluation of utilisation of short term agricultural co-operative credit in Kerala to assess the extent and nature of misutilisation of short-term agricultural loans. It is found that one sixth of the borrowers surveyed diverted the loans for non-agricultural purposes. The borrowers with agriculture as the secondary source of income are found more prone to divert the credit than those with agriculture as the main source of income. The propensity to divert is found stronger in the case of sub-marginal farmers whose holdings are uneconomic. The other two

significant official evaluations of co-operative credit are the Report of the High Level Committee (411) and R.F.I.'s Study Team Report (414). The study team of the Reserve Bank of India examines the working of the three-tier co-operative credit structure for improving the working of the co-operatives.

Except for a few studies, reviews on agricultural programmes are conducted mainly by official agencies. V. Radhakrishnan et.al (555) have made an attempt to assess the impact of S.F.D.A's activities in Trichur on the basis of a field investigation. They have examined two schemes implemented in Trichur by S.F.D.A. viz., (1) assistance given for purchasing pumpsets and (2) assistance given for purchasing milch animals. They found that the scheme for purchasing pump sets has achieved a fair degree of success and has helped to increase the income of the beneficiaries. On the other hand, the other scheme is not successful, mainly due to the non-suitability of the scheme to the particular socio-economic conditions prevailing in the region. State Planning Board (602) has made an evaluation of SFDA Cannanore to ascertain the nature and quantum of benefits accrued to the small farmers in the matter of generation of income, employment and assets. They have found that among the 420 small farmers covered, 55% of the beneficiary farmers reported an increase in employment and about 83% reported an increase in the assets. On the average the beneficiary farmers appeared to have earned higher incomes compared to non-beneficiary farmers. A similar evaluation is also made about SFDA Quilon (606). Besides this, the State Planning Board has also conducted evaluation studies on Yela Development Programme (362), Intensive Agricultural District Programme (370) and Kerala Agricultural Development Projects (605, 607 to 610).

### Conclusion

Though a number of Government publications are available about Malabar covering the colonial period, no scholar has made any attempt to study its agriculture. Scholars, who examined Malabar problems mainly confined their examination to land tenures and agrarian issues. During the course of their examination a few have just touched on agriculture. And we may identify Malabar agriculture as an area where there exists a serious gap in research. For a better understanding of Malabar agriculture and Malabar economy, there is a need for further in-depth studies. Some of the topics identified for further studies are transformation of agriculture during colonial period, impact of introduction of plantation crops, impact of land tenures and colonial policies on agriculture and on the conditions of farmers, and issues connected with livestock development and agricultural practice.

Compared to Malabar, the literature available on 19th century Travancore is rather small. We have to rely mainly on the two manuals to get an idea about agriculture. For literature relating to 20th century, the position is relatively better. Among the three regions forming present day Kerala, Travancore witnessed fast changes since 19th century and achieved considerable development in agriculture compared to the other two regions. But not much of an attempt has been made so far to study the transformation of Travancore agriculture. And this area can be identified as one, where a serious gap in research exists. In this context we may identify the impact of colonial presence, land tenures, agricultural and other policies on transformation of agriculture, issues connected with livestock and agricultural

practices and the effect of depression on agricultural economy, as some of the areas, which need further studies.

A fairly good stock of literature in the form of studies, official reports and statistical publications is available about Kerala agriculture. But a serious deficiency in the literature is that while we have a fairly good stock of literature on certain areas, we have none in some other areas. Though Kerala has a number of important crops, the literature both studies and official reports mainly concentrate on one crop, paddy. The official agencies have been giving too much emphasis to paddy crop probably because of the policy of giving ~~over-emphasis on food self-sufficiency~~ by the Government. It may be noted that only a few attempts have been made by scholars to study the problems of the other major food crops in Kerala. Among the four major plantation crops, only a few attempts have been made to study tea and coffee. In the case of irrigation no serious attempts have been made to study the rationality of the irrigation policy, costs and benefits of major and medium irrigation projects and the irrigation problems of crops other than paddy. Like-wise no attempts have been made to study animal husbandry issues like dairy development, dairy co-operatives, price and marketing of dairy products and poultry problems. And we may identify, agricultural income distribution, agricultural credit, ~~agricultural marketing, agricultural practices, agricultural prices, mechanisation of agriculture and agricultural development programmes~~ as some of the areas which require more studies. The other areas which need current attention of the scholars are the decline of the agricultural growth rate fall in area and production of paddy, causes for the change in cropping pattern and fall in productivity of crops such as coconut, pepper and cashew.

Notes

(The research for the paper was done while I was affiliated as an I.C.S.S.R. Fellow at Centre for Development Studies. I thank the I.C.S.S.R., the CDS and the University of Calicut for providing assistance and help during the fellowship period. Prof. Chiranjib Sen, Prof. K.K. Subrahmanian, Prof. M.A. Qomman, Sri P.K. Michael Tharakan and Dr. Sumit Guha had gone through the earlier version of the paper and offered valuable comments and suggestions, which helped me considerably to revise the paper. Prof. Sarah Mathew of C.M.S. College gave some stylistic suggestions. I am extremely grateful to all of them).

1. For a discussion of the methodology on agricultural development see: I. Malassis, *Agriculture and the Development Process* (Paris: Unesco Press, 1975) and Herman M. Southard and Bruce F. Johnson (ed) *Agricultural Development and Economic Growth* (London: Cornell University Press, 1967).
2. A large portion of Malabar to eastward being mountains and hills overrun with forests. Some of the evergreen forests like Silent Valley and Attapady Valley are located in the district. The rainfall varies from 50 inches to 300 inches. The important rivers flowing from north to south are Valarpattanam, Anjarakkandi, Mahi, Kotah, Beypore, Kadalundi and Ponnani. For detailed description of geographic features see: William Logan *Malabar Vol. I* (Madras: Govt. Press, Reprint 1951) Chapter 1.
3. Buchanan in 1800 AD pointed out that agricultural operations in Malabar were mainly carried on with help of rain, except in few places of south Malabar where small water tanks and reservoirs were available. See: Buchanan, Francis A, *A Journey from Madras through the countries of Mysore, Canara and Malabar. Vol. II* (Madras: Hegginsbothams and Co., 1870) p. 69.
4. According to one estimate the total number of coconut trees in Malabar was about 61.45 lakhs in 1806 AD. Of this 50 percent were classified as productive and the rest unproductive. Source: Govt. of Madras, *Statistics of Malabar 1873-74*. p.4.
5. Clementson P, *A Report on Revenue and other matters connected with Malabar dated 31st December 1838* (Calicut: Collectorate Press, 1914) pp. 19-23.

6. The total value of exports from Malabar for the year 1804 AD was Rs.15.53 lakhs. Of this pepper exports accounted for 45 percent. Source: Clementson P, op.cit., pp.19-23.
7. Ibid., pp. 19-23.
8. Buchanan, Francis, A, op.cit., pp. 74-76.
9. In 1800 AD the colonial government fixed a revenue assessment in which 50 per cent of the produce was earmarked to the cultivator, 20 per cent to government and 30 per cent to the Janmi. But Buchanan who travelled through Malabar in 1800 AD pointed out that vast areas of rice land and coconut gardens remained deserted in northern Malabar due to the high land tax which prevailed. See: Buchanan, Francis A, op.cit., p.45.
10. The original system of land tenure of Malabar was customary sharing of produce, and each customary sharer being permitted to transfer his interest in land. Without understanding the customary land-relations that existed in Malabar for centuries, British interpreted the Janmi as the absolute owner of land. Further the wrong interpretation given by the colonial administration and Courts about the traditional tenures such as Kanam, Kulikanam, and Verumpattom had virtually resulted in the loss of security of tenure and reduced the share of the produce enjoyed by tenants. See: William Logan, Malabar, Vol. I, op.cit., p.604.
11. In 1804, cotton and other piece goods imported to Malabar accounted for about 59 per cent of the total value of imports. Source: Clementson P, op.cit., pp. 15-18.
12. Thomas Warden, Reports on the Revenue system in Malabar dt. the 10th June 1813 (Calicut: Collectorate Press, 1916) p.4.
13. The low land division had an area of 1371 square miles and comprised of flat alluvial and sandy tracts along the sea coast. A line of backwaters runs through this region from north to south. The midland divisions lies east of the low land division and has an area of about 2700 square miles and largely comprises of low hills and hillocks of varying sizes and heights. The high land divisions comprises the eastern tracts, mainly of dense forests and has a total area of about 3500 square miles. Source: Velu Pillai, T.K., Travancore State Manual Vol. I (Trivandrum: Govt. of Travancore, 1940).
14. The first dam in South Travancore was constructed across the Paralyar about a thousand years back. Another dam, Puthen dam was constructed by around 1750 AD. Source: Nagam Aiya V., The Travancore State Manual Vol.III, (1906) p.102.

15. The English East India Company had entered into a treaty with Travancore in 1795 according to which the Raja accepted British supremacy and the Company promised help to the state in the event of external aggression.  
Source: Nagam Aiyar, Travancore state Manual, Vol. I, op.cit. p. 402.
16. Varghese T.C., Agrarian Change and economic consequences - Land Tenures in Kerala 1850-1960 (New Delhi: Allied, 1970) p. 30 and 31.
17. Ibid., p.30.
18. The total number of coconut trees increased from 61.45 lakh in 1806 to 87.71 lakh in 1864. During this period arecanut trees increased from 44.26 lakh to 79.27 lakh and jack fruit trees from 8.79 lakh to 13.10 lakh.  
Source: Govt. of Madras, Statistics of Malabar 1873-74, p.4.
19. Report of South India Planter's Enquiry Committee (Madras: Govt. press, 1896) p.6.
20. Bourne, R, Nilambur Valley Working Plan, Vol. I (Madras: Govt. Press, 1921) p.4.
21. Robinson W., Report on the history, condition and prospects of the taluk of Wynad dt. 22nd August 1857 (Calicut: Collectorate Press, 1917) p.8.
22. The export of coffee from the ports of Calicut and Tellicherry increased from 399 cwts in 1844-45 to 2,946 cwts in 1856-57.  
Source: Robinson W., op.cit., p.10.
23. The total share of exports from pepper in Malabar declined from 45 per cent in 1804 to 11.6 per cent in 1865-66.  
Source: 1. Clementson P., op.cit., pp.19-23 and  
2. Statistics of Malabar 1873-74.
24. Statistics of Malabar 1873-74.
25. Logan had pointed out that during the early decades of 19th Century upto 1831, the prices of agricultural products were "abnormally low". Though there had been marginal increase in prices in 1831, 1833 and 1836, the general level of prices of agricultural products continued to remain low till 1852.  
Source: William Logan, Malabar Vol. I, p.614 and 718.
26. Ward and Conner, A Descriptive Memoir on Malabar, 1826 (Calicut: Collectorate Press, 1906).
27. In order to standardise the land tax rate new guidelines for land tax assessment were introduced in July 1805, The new definition of the gross produce in the assessment resulted in the lowering of the total share of the cultivating tenants, while

there was a rise in the share of the landlord and government. This in effect reduced the share of the cultivating tenant from 66 per cent of the total produce to 42 per cent in 1805.

Source: 1. William Logan, Malabar, Vol. I, op.cit p. 665 and  
2. Report of Mr. Thomas Warden, Collector dt. 19th March 1801 on the conditions of Palghat, Congnad etc. of the district of Malabar, p.8.

28. On 5th August 1856 the Sadr Court defined the various tenures and fixed the tenure of Kanam and Kulikanam as redeemable tenure after 12 years.  
For details see: Kurup K.K.N., William Logan - A Study in the Agrarian Relations of Malabar (Calicut: Sandhya Publications 1981), Chp. 3.
29. Till 1850, the entire amount spent for public works was for constructing and maintaining army buildings and communication network for army.  
Source: Statistics of Malabar 1873-74, p.19.
30. In 1842-43, of the total value of imports, cotton, silk and wollen goods accounted for 37 per cent. The import of metals accounted for 20 per cent.  
Source: Statistics of Malabar 1873-74, p.14
31. Taxes are levied on houses, shops, looms, oilpresses, gold and silversmiths, carpenters, ironsmith, Boatmen, Fishermen's net Pack Bullocks, carts etc. The total amount of tax collected from the above for the year 1833 was Rs.1.12 lakh.  
Source: Statistics of Malabar 1873-74, op.cit., p.23.
32. Samuel Mateer, Native Life in Travancore (London: W.H. Allen & Co., 1883) p. 218
33. In 1818, the government issued a royal proclamation with a view to encourage the cultivation of waste lands and making permanent improvement in land by guaranteeing the enjoyment of such land tax-free for the first ten years and imposing only a light tax thereafter, and recognising claims for cost of improvements on newly reclaimed land.  
Source: Travancore Land Revenue Manual (1915) Vol.IV, p.229.
34. Velu Pillai T.K., Travancore Sate Manual Vol. III, p. 312.
35. Samuel Mateer, op.cit., p.219.
36. Robin Jeffrey, The decline of Nayar Dominance (New Delhi: Vikas, 1976) p.96.
37. Samuel Mateer, op.cit., p.221.



38. Ibid., p.225
39. Velu Pillai, T.K., Travancore State Manual, Vol. III, p.380
40. Ibid., p.420
41. Varghese T.C., op.cit., p.31.
42. Govt. of India, Agricultural Statistics of British India for the years 1890-91 to 1894-95, Vol. I, and Govt. of Madras, Season and Crop Reports of Madras Presidency for the years 1930-31.
43. The area under rice had increased from 6.09 lakh acres in 1890-91 to 8.88 lakh acres in 1920-21, but declined since then. Source: Agricultural Statistics of British India, and Season and Crop Reports of Madras Presidency, op.cit.
44. Report of the Malabar Tenancy Committee (1940) Vol. I (Madras: Govt. Press, 1940) p.14.
45. Ibid., p.15
46. William Logan, Malabar Vol II, op.cit., p.12 and Govt. of India, Agricultural Statistics of British India for 1900-01 to 1904-05.
47. Report of the South India Planter's Enquiry Committee, op.cit., p. 7.
48. Innes C.A., Malabar Vol.I (Madras: Govt. of Madras, 1951) p.227.
49. The share of the coffee exports in 1876-77 accounted for 33 per cent of the total value of exports. The import of paddy, rice and other grains accounted for 61 per cent of the total value of imports in 1876-77. Source: William Logan, Malabar Vol.II, p.35 and 36.
50. William Logan, Malabar Vol. II, op.cit., pp. 252-256
51. Ibid., pp. 252-256
52. Govt. of India, Agricultural Statistics of British India for the years 1890-91 to 1894-95 and Govt. of Madras, Season and Crop Reports of Madras Presidency for the year 1930-31.
53. In 1881 Census, 20 per cent of the persons were classified as employed in non-agricultural sector viz., professional, domestic, commercial, industrial workers and clergy. Source: William Logan, Malabar Vol. II, op.cit., p.6 and 7.

54. The railway line having a distance of 118 miles from Beypore to Palghat was opened for service between 1861 and 1888. The further extension from Calicut to Mangalore was completed between 1901 and 1907.  
Source: A Sreedharā Menon, Kerala District Gazetteers, Kozhikode and Cannanore.
55. Colonial government began to spend money for irrigation since 1878-79. The amount spent for repairing tanks, channels and small anicuts, for five years from 1878-79 to 1882-83 was Rs.7603.  
Source: William Logan, Malabar, Vol. II, op.cit., p.22.
56. The value of imported paddy and rice increased from 7.94 lakhs in 1869-70 to 226.87 lakhs in 1921-22.  
Source: Velu Pillai, T.K., Travancore State Manual Vol. III, pp. 90-93.
57. Statistics of Travancore and Trade Statistics of Travancore, various issues.
58. The share of the total value of export of pepper increased from 3.55 per cent in 1870's to 10.79 per cent in 1920's.
59. The taluks are Kartikappally and Devikulam.
60. In 1862, the government prepared a set of rules for grants of forest land, and among others, one specific condition laid down was that one fourth of the forest land thus given should be cleared and planted within the first three years. Due to large demand for forest land for coffee cultivation, the grant system was replaced by a system of auction sales in 1865 at a price of Rupee one per acre.
61. In 1878, an area of about 215 square miles had been leased out to Kannan Devan Hill produce Company, a British Company.
62. Since 1890, the export earnings from Coffee was below one per cent of the total export earnings.
63. Nagam Aiya V, Travancore State Manual, Vol. III, op.cit., p.79.
64. Ibid., p.79
65. Statistics of Travancore and Trade Statistics of Travancore, various issues.
66. By 1818-19, about 46,476 acres of land was brought under rubber crop.
67. The total number of Buffaloes declined from 103,017 in 1905 to 93,149 in 1931.

68. Census of India 1901, Vol.26, Travancore (1903) pp.414-420 and Census of India 1941, Vol.25, Travancore p.38.
69. For details of land tenure measures implemented during the second half of 19th century see: T.C. Varghese op.cit., Chapter 4.
70. By 1930 about 50,000 acres of backwaters had been reclaimed
71. The share of total cropped area defined as net area sown plus land under miscellaneous trees and crops increased from 47.6 per cent in 1930-31 to 52.9 per cent in 1950-51.  
Source: Govt. of Madras, Season and Crop Reports of Madras Presidency for the agricultural years 1930-31 and 1950-51.
72. The area under paddy declined from 8.88 lakh acres in 1920-21 to 8.15 lakh in 1950-51  
Source: Season and Crop Reports, op.cit.
73. Report of the Malabar Tenancy Committee (1940) Vol.I, op.cit., p.14.
74. Ibid., p.14
75. The area under coffee declined from 40,507 acres in 1905 to 18,230 acres in 1949-50. The area under tea increased from 12,355 acres in 1930 to 15,362 acres in 1949-50. The area under rubber increased from 9247 acres in 1930 to 22,705 acres in 1949-50.
76. The area under paddy was 55 per cent, coconut 25.5%, arecanut 6%, plantain 4%, Tapioca 2.6%, rubber 1.5%, coffee 1.2% and tea 1 per cent in 1949-50.  
Source: 1951 Census hand book, Malabar District.
77. The number of oil engines with pumps for irrigation had increased from 57 in 1940 to 428 in 1951. The number of electric pumps increased from 8 to 54 during the period.  
Source: Season and Crop Reports 1939-40 and 1950-51, op.cit.
78. The Malabar Tenancy Committee was of the view that about 70 per cent of the people depend on agriculture for their subsistence in 1940.  
Source: Report of the Malabar Tenancy Committee, Vol. I, op.cit., p.14.
79. The period between 1925-26 to 1930-34 witnessed almost a continuous fall in prices of important agricultural products of Travancore.  
Source: Govt. of Travancore, Report of the Agricultural Debt Redemption Committee (1935) p.16.

80. The Agricultural Debt Redemption Committee had estimated that the prices of agricultural products during the decade had fallen to 60 per cent.
81. The price of paddy per standard para had declined from 26 chuckrams in 1924-25 to 12 chuckrams (one Rupee was equivalent 28 chuckrams) in 1931-32 in Kuttanad.  
Source: Report of the Agricultural Debt Redemption Committee, p.15.
82. The Travancore Economic Depression Enquiry Committee had estimated that about 75,000 people must have been thrown out of employment from rubber and tea cultivation.  
Source: Govt. of Travancore, Travancore Economic Depression Enquiry Committee Report 1931, p.21.
83. By 1933-34, the average price per one acre of land registered a fall of about 40% for wet lands and 13% for garden lands compared to the price prevailed in 1925-26.  
Source: Report of the Agricultural Debt Redemption Committee, p.19.
84. Statistics of Travancore, various issues.
85. At the rate of 10 oz. per adult per day as the minimum requirement of rice, the total deficit in rice production was estimated at about 53 per cent for the year 1959-60.  
See: Govt. of Kerala, Kerala 1961 - An Economic Review (1962) p. 25.
86. One of the major objectives of all plans in the state till the end of the Fifth Five Year Plan was to attain self-reliance in food by increasing rice production through intensive cultivation and institutional changes.  
See: State Planning Board, Draft Five Year Plan 1978-83, Vol. I (1978) p.1.
87. State Planning Board, State Plan Expenditure 1951-80 (1980) p.1
88. Bureau of Economics and Statistics, Agricultural Statistics in Kerala, 1975 (1975) p.17 and 18 and S.P.B., Economic Review 1981, p.37.
89. S.P.B., Economic Review 1981, p.37.
90. B.E.S., Agricultural Statistics in Kerala, 1975 p.43 and 44 and S.P.B., Economic Review 1981, p.39.
91. S.P.B., Economic Review 1976 (1977) p.98
92. S.P.B., Economic Review 1982 (1983) p.159

93. The percentage of working population in the primary sector declined from 56.10 per cent in 1951 to 46.95 per cent in 1961. But during 1960's there had been a reverse shift of working population and percentage of working population in the primary sector had increased to 55.98 per cent in 1971.  
See B.E.S., Fact Book on Man Power, 1966.  
p.20 and S.P.B., Economic Review Kerala 1972 (1973) p.24.
94. During the year 1981, the total import of rice and wheat accounted for about 56 per cent of the total availability of rice and wheat in the state.  
See: S.P.B., Economic Review 1981 (1982) p. 182.
95. Directorate of Economics and Statistics, Agricultural Census 1976-77, Vol. I (1982), p.36 and 37.
96. Except for the Small Farmer Development Agency and Kerala Agricultural Development Projects, the other important agricultural programmes such as Intensive Agricultural District Programmes, Intensive Agricultural area programme, Intensive paddy development Unit programme, High Yielding Variety Programme, programmes of Kerala Land Development Corporation are aimed only at promoting paddy crop.  
For detailed discussion of the agricultural programme  
See: B.E.S., The Third Decennial World Census of Agriculture 1970-71 - Report of Kerala State Vol. I (Trivandrum: B.E.S., 1973).
97. Out of the 40 agricultural research stations that were started in the State during 1950's, eleven were mainly meant for conducting paddy research. Of the total 1512 agricultural field experiments conducted in the 40 research stations between 1959-60 and 1974-75, 65 per cent of the experiments were related to paddy crop.  
See: B.E.S. Findings of Agricultural Field Experiments in Kerala (1959-60 to 1974-75) (1976).

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