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For many years now the Central Plantation Crops Research Institute (CPCRI) has been conducting a number of scientifically designed experiments on various aspects of the cultivation of plantation crops. Apart from conventional experiments which are primarily designed to estimate the optimal combinations of the inputs required for coconut cultivation, these include new experiments to explore the economics of mixed cropping with perennials such as cacao and pepper and inter-cropping with annuals such as tapioca, sweet potato, yams, ginger and turmeric on the garden land under coconut. The experiments involving trials of different crop-combinations are intended to study both the prospects of increasing productivity per hectare and the agronomic desirability of the crop combinations.

The results of these studies conclusively show that with the recommended spacing of coconut, which requires a distance of 7.5 metres between neighbouring palms, the efficiency of the basic resources for crop production - sunlight and soil - can be enhanced to a significant extent from the present level through inter/mixed cropping and optimal use of manures, fertilisers and irrigation water. This paper is an attempt to examine the implications of these findings to the planned development of the garden lands of Kerala. Since data relating to

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actual farming conditions, particularly with respect to costs of cultivation and the extent of inter-cropping already taking place, are not available, the discussions here rely a great deal on guesswork and the conclusions must, therefore, be regarded only as tentative.

The paper concentrates on physical magnitudes: of incremental benefits that could be derived and additional costs to be incurred in the process of change to the new technology. The socio-political factors that may retard or promote the process are not discussed. Section 1 summarises the results of the experiments and shows the potential yield of a hectare of garden land under optimal farming conditions. The possibility of mixed and inter-cropping rests on the spacing of coconut palms. In this context a question that arises is whether it is economically beneficial to reduce the density of an overcrowded plantations and raise the yield of the remaining palms through optimal farming practices. The question is investigated in Section II. Inter cropping possibilities are not unknown to the farmers of Kerala. This makes it necessary to obtain estimates of area under exclusive coconut cultivation where inter cropping can be introduced; in Section III an attempt is made to estimate the areas and work out the crop combinations for each area taking into consideration the agro-climatic conditions. Section IV describes the structure of the distribution of land and its implications. A summary follows in Section V.

I Experimental Results

If coconut palms are planted sufficiently wide apart, it is possible to raise not only seasonal crops such as tapioca but also perennials such as cacao and pineapple in the space available between the palms. While information on optimal spacing, both from the agronomic and economic points of view is still imperfect, studies on the rooting pattern of coconut indicate that a density of 175 palms per hectare (corresponding roughly to a distance of 7.5 metres between adjacent palms) provides ample scope for inter/mixed cropping, during early years of establishment upto 8 to 10 years and later from the 20th year. Higher densities would considerably reduce the availability of sunlight and also restrict the net area available for raising inter/mixed crops. It may be added that, since the ground coverage by the leaf canopy of coconut would allow little sunlight to infilter, a few crops like colocasia alone can be grown during the period when the age of the palms is between 8 to 20 years.

The present average yield per bearing palm is estimated at 30 nuts per annum under actual farming conditions in Kerala. But there is wide variability and the average yield can be as low as 15 nuts per bearing palm per year in grossly neglected plots. The CPCRI experiments show that the average yield can be raised to 60 nuts per annum under rainfed conditions and 100 nuts under irrigated conditions provided good agronomic practices are followed. This would require, in particular, the application of chemical fertilisers. The experimental data indicate that for a one hectare rain-fed plot planted with 175 palms, i.e., with recommended

spacing, the gross returns, when the trees reach 20 years of age (the second stage when inter/mixed cropping becomes possible), would be of the order of Rs.6,300 (assuming that the price of coconut is Rs.0.60 per nut); the corresponding costs would be of the order of Rs.2,233 thus yielding a net income of Rs.4,067 from coconut cultivation alone (at prices prevailing during June 1976).

The additional income generated by inter-cropping would depend on the crop planted: for crops that are commonly preferred such as tapioca and different types of yam an additional expenditure of about Rs.3,000 is necessary if the maximum potential yields are to be realised. The additional expenditure will be mainly on account of labour charges and the application of fertilisers. The value of the inter-crop output[1] ranges between Rs.5000 to Rs.7000 and the additional net income between Rs.2,000 and Rs.3,000. Crop-wise details are presented in Table 1. Both the costs and returns are estimated at the prevailing prices and wage rates (See Appendix 1 for details).

The CPCRI experiments thus show that it is possible to generate a net income of Rs.7,000 to Rs.8,000 from a one-hectare plot of garden land under rainfed conditions. If irrigation is available the potential income is much larger since it will then be possible to plant perennials such as cacao and pineapple. Even if half the area is irrigated, it is possible to realise incomes of the order of Rs.10,000 from one hectare of garden land, through a combination of mixed and inter-cropping (See Table 1 under (D)). Needless to say, the extension of inter-cropping would also generate additional employment; it can be over 100 man days per hectare per annum (Table 1).

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1 The most remunerative crop appears to be ginger (See Table 1); however there is an element of high risk involved in its cultivation. Soft-rot can destroy the whole crop; besides, the price of ginger tends to fluctuate rather widely.

Table 1. Net Returns per annum from 1 hectare of Garden Land under Optimal Conditions of Spacing (for plantations above 20 yrs in age)

Value in Rupees

Intercrop	Cost of cultivation of intercrops & mixed crops	Value of intercrop output	Net Returns From inter crop or mixed crop	Net Returns Total including coconuts	Additional employment Man days	Additional employment Woman days	Additional output of intercrops (tonnes)
1	2	3	4	5	6	7	8
. Elephan Yam	3246	6425	3179	7246	123	8	12.85
. Tapioca	2122	4204	2082	6149	93	12	10.51
. Sweet Potato	2055	3325	1280	5347	56	26	9.53
. Ginger(Rio-de-Jeneiro)	4730	14420	9690	13757	108	24	11.57
. Turmeric (Armour)	4568	5162	594	4661	108	24	12.93
. Coleus	2035	4800	2765	6832	92	23	6.00
. Yams (Dioscorea alata)	2827	6360	3533	7600	64	12	12.72
. Lesser Yam (Dioscorea esculants)	2827	5400	2573	6640	64	12	9.00
Banana	7272	11000	3728	7795	170	--	20.00
(A) 50% of Area for Tapioca and the rest for the other intercrop							
Elephant yam	2684	5314	2630	6697	108	10	
Sweet Potato	2088	3770	1682	5749	74	19	
Yams	2474	5282	2808	6875	79	13	
Banana	4697	7602	2905	6972	132	6	
(B) Mixed Cropping with pepper, cacao, and pineapple (Suitable for irrigated holdings larger than 1 Acre)	3979	11800	7821	15661	142	21	
(C) Mixed cropping with Pepper and Pineapple only) (Suitable for holdings less than 1 acre in size)	3695	6400	2705	6772	189	20	
(D) 50% area under Model (B) and the rest under intercrops							
Tapioca	3051	8002	4951	10905	118	17	
Elephant Yam	3613	9112	5499	11453	132	15	
Sweet Potato	3017	7568	4551	10504	99	24	
Yam	3403	9080	5677	11631	103	17	
(E) 50% Area under Model (C) and the rest under inter-crops							
apioca	2908	5302	2394	6460	141	16	
lephant Yam	3470	6412	2942	7009	156	14	
weet Potato	2875	4868	1993	6060	122	23	
ams	3261	6380	3119	7186	127	16	

Returns from coconut alone are estimated at Rs.4,067/- per ha (175 palms@ 60 nuts per palm and @ 60 paise per nut yielding Rs.6,300 and costs estimated at Rs.2,233 per ha)

Notes to Table I

1. Model (B) of mixed cropping requires irrigation: Coconut yields are estimated at 100 nuts per palm correspondingly; thus the returns from coconut cultivation are different from those given earlier (under rainfed conditions). Output figures for this case are: 17,500 coconuts, 750 kg of dry cacao beans, 40 kg of dry pepper and 4000 kg of pineapple. It is preferable to have fairly large plots under Model (B) for such plots ensure that (i) loss in yield of cacao is minimised, (ii) sizable quantity of cacao will be available for marketing (it is difficult to market small quantities) and (iii) irrigation installations are more effectively utilised.

2. Model (C) of mixed cropping is suitable for rainfed conditions. Since cacao is not planted as in (B), the yield of pineapple is considerably increased. The output figures for this case are: 10,500 coconuts (@60 per palm under rainfed conditions), 10,000 kg of pine apple (@ 0.70 kg per sucker) and 40 kg of dry pepper).

3. Under the inter-crop models covered by items(1) to (8) at the top of the table, pepper can also be grown: this will imply additional costs of Rs.235/- per ha and the resulting 40 kg of dry pepper yield Rs.400 the net additional income generated thus works out to be Rs.177 per hectare.

There are no data on how the costs and returns vary over plots of different size. In particular, it is not possible to say whether economies or diseconomies of scale operate in the cultivation of the inter-crops. However, since the experiments conducted at the CPCRI were all based on small plots, the above calculations can be taken as valid for small sized plantations. Thus, for example, a plot of 50 cents can generate an annual net income of about Rs.1,200. Since the recommended fertiliser dose is on a per-hectare basis and the labour input increases proportionately, it may not be possible to reduce the cost per hectare significantly on plots of large size.

It needs to be pointed out that the above estimates do not include investment costs which would vary considerably from plot to plot and depend on a number of conditions. For example, if inter-cropping of tapioca is to be introduced on land on the lower slopes, measures against soil erosion have to be taken since tapioca cultivation on such land introduces a significant tendency towards soil erosion. In general, investment on land improvement is an essential pre-condition for inter-cropping. No attempt is made in this paper to estimate investment costs.

II Economic Implications of Different Farming Practices

To begin with, let us take a purely hypothetical case of a plot of 25 cents where 17 palms are grown under conditions of total neglect. If the yield is taken at 15 nuts per palm per year the return work out to be Rs.135 (@Rs.0.60 per nut); the only costs involved are the wages to be paid for harvesting amounting to Rs.36 (4 mandays @ Rs.9 per day). The land thus yields a net income of Rs.100 per annum approximately. On the other hand, if better farming practices were followed, which require ploughing, digging basins and applying adequate quantities of fertilisers, the total returns would increase to Rs.612 (at 60 nuts per palm per year) and the costs to Rs.240. Thus good management would increase the net income from Rs.100 to Rs.372. But an additional cost of Rs.200 per annum is to be incurred which the farm owning only 25 cents of land may find beyond his means. The calculation refer to pure coconut plantations; if inter cropping is to be considered the costs to be incurred would be higher. In any case, the illustration clearly shows that a mere demonstration of the technical possibility of raising the income from small farms is not enough; the actual feasibility of increasing yields would depend to a great extent on the availability of credit to small farmers.

This is only one aspect of the problem posed by poor farming practices. Another relates to the requirement of optimal spacing necessary for inter and mixed cropping. When the density of palms is very high, it is necessary to cut down some palms to make inter cropping possible. This would involve loss of income to the farmer in the

short-run. Further, raising the income would crucially depend on both the application of fertilisers and inter cropping. On a pure coconut plantation, a reduction of the density combined with the use of fertilisers for increasing the yield may not raise the income sufficiently high to offset the loss incurred by removing some of the palms. The precise magnitudes depend on the relationship between yield rates and density. The data required for estimating such a relationship, under varying agronomic conditions, are not available. However, on the basis of data collected in the villages, Muttathody and Chengla (both in Kasargod Taluk) we have estimated the following relationships for pure coconut plantations.

$$\text{Mu tathody:} \quad Y = 0.4868\ D - 0.0014\ D^2 \quad \ldots\ldots(1)$$

$$\text{Chengla :} \quad Y = 0.2566\ D - 0.0006\ D^2 \quad \ldots\ldots(2)$$

Where Y stand for the yield of nuts per bearing palm per year and D for the density of number of palms per hectare. The relationship differs in the two villages partly because of differences in the age distribution and partly because of other factors such as soil fertility. Under actual farming conditions it is not only the density of plantations that varies; so does the proportion of the bearing trees in total. In Mu tathody and Chengla the proportion is 67 and 30 per cent respectively. It is now possible to give estimates of total yield from one hectare of garden land in these two villages corresponding to varying densities and under actual farming conditions which, among other things, implies little fertiliser consumption.

Table 2: Yield per Hectare: Pure Coconut Plantations Under Varying Densities and Actual Farming Conditions

Number of palms per hectare	150	175	250	300
Number of bearing palms: Muttathody (based on survey data on age distribution)	101	117	168	201
Chengla	45	53	75	90
Yield per bearing palm: Muttathody	42	43	34	20
Chengla	25	27	27	23
Total yields (nuts per hectare per annum)				
Muttathody	4242	5031	5712	4020
Chengla	1125	1431	2025	2070

It can be seen that the yield per bearing palm declines with increasing density. But the density that maximises the yield per palm need not neoessarily maximise the yield per hectare which is the product of the yield per palm and the density. Simple calculations based on equation (1) and (2) show that densities of 232 and 289 trees per hectare are optimal for Muttathody and Chengla respectively, from the point of view of maximisation of yield per hectare under existing management practices. By a curious coincidence, however, in the case of Muttathody the density that maximises the yield per bearing palm turns out to be 175 palms per hectare, which is precisely the same as the density corresponding to the CPCRI recommendation.

A comparative picture of costs and returns for a one-hectare plot under alternative farming practices can now be given assuming that only 67% of the trees are of full bearing age (See Table 3). The estimates correspond to Muttathody.

Table 3: Costs and Returns per annum from 1 Hectare of Coconut Land Under Alternative Farming Conditions

	Density (No.of palms)	No.of bearing palms	Yield per bearing palms	Total nuts	Returns (Rs)	Costs (Rs)	Net income (RS)	Remarks
A) Pure Coconut Plantation (under ordinary condition	232	155	.38	5890	3600	NA	NA	Density is very high yield per palm low.
B) Pure Coconut Plantation (under good management)	175	117	60	7020	4200	2000	2200	Costs incurred on fertilizer and labour
C) With Inter-cropping (tapioca or yam)	175	117	60	7020	10000	5000	5000	Data based on Table 1 (approximate figures)

The first row (A) in Table 3 closely corresponds to the "average farm" in Kerala although it is based on the Muttathody data. For the State as a whole it is estimated that the density is 250 palms per hectare, the yield per bearing palm is 30 nuts per annum and the proportion of bearing trees in total is two-thirds.[2] With such densities inter cropping may not be very successful. A comparison between rows (A) and (B) shows that it may not be economical to reduce the density and increase the yield per palm (almost doubling it) through the use of fertilisers. This requires an expenditure of Rs.2,000 and results in an annual net income of only Rs.2,200. We do not have data on actual costs corresponding to case (A) but considering that actual fertiliser consumption is likely to be negligible, it appears that the gross income of Rs.3,600 per hectare from overcrowded plantions implies a larger net income than that corresponding to good farming conditions (Case B). However, as can be seen from row (C), inter-cropping makes considerable difference to net income. But as we have already pointed out the possibility of inter cropping in hitherto pure plantations would require not only investments on land improvement but also the provision of credit to small farmers.

2 based on data in Agricultural Statistics in Kerala, Bureau of Economics and Statistics, Kerala, 1975

III Extension of Inter-Cropped Area

As already remarked inter cropping is not unknown in Kerala. Crops such as tapioca, yam and bananas are widely intercropped with coconut in different parts of the State. However, data on the precise extent of this type of farming are not available. Published data allow for only a very rough approximation to the area under coconut that could be additionally brought under inter crop cultivation.

For this purpose we first estimate the area sown more than once. This would include areas double and triple cropped on both the wet and dry lands. Some estimates of the wet land area which is sown more than once with paddy are available. From this it is possible to derive the dry land area cropped more than once.

The rough estimates of the classification of wet land area for 1966-67 into single, double and triple cropped areas are given in Table 4. From this the ratio of net to gross area under rice is computed and given in column (3) of Table 5. Assuming that this ratio is valid for the period 1971-74, estimates of dry land area under more than one crop are derived by subtracting the wet land area cropped more than once from the total area sown more than once. From the total area under coconut we subtract the dry land area under more than one crop to get estimates of area under pure coconut cultivation. These estimates are given in table 5.

The procedure adopted for estimating the area available for extending inter-cropping - which yields an estimate of 300 thousand hectares - leads, however, to an upward bias in the estimate. The reasons are many. First, crops such as cereals other than rice, pulses, and vegetables are grown on wet land as second, or third crops; over 75 thousand hectares are under

these crops. Second, only 60 to 80 per cent of the land under a pure coconut plantation can be made available for the inter-crop (because the existing palms occupy the remaining space). Third, as we have already noted, both because of the high density of plantations and the lack of suitability of land, not all land under pure coconut cultivation can be brought under inter-cropping. Based on these considerations, it appears that no more than 1'75 thousand hectares, which can be estimated to be exclusively under coconut cultivation, would be available for the extension of inter-cropping. It can be seen that this area is concentrated mostly in four districts: Alleppey, Ernakulam, Malappuram and Cannanore.

The implications of the CPCRI experimental data on mixed and inter cropping can thus be seen to be different for the different areas of Kerala. In the four districts mentioned in the last paragraph, planned development of the garden land would require considerable land improvement as a pre-condition for the introduction of inter cropping on land under pure coconut cultivation. In the other districts, where already inter cropping seems to be taking place to a significant extent, the prospects for raising yields would depend on the introduction of better farming practices which include optimal spacing and the application of chemical fertilisers.

Recently an attempt has been made to delineate the different areas of Kerala into homogeneous agro-climatic zones for the purpose of evolving optimum cropping patterns.[3] The zoning is based on four parameters namely altitude, rainfall characteristics, soil types - especially the profile characteristics - and topographic features, which broadly determine the cropping possibilities.

3. Report of theCommittee on Agro-Climatic Zones and Cropping Pattern, April 1974, Dept. of Agri., Government of Kerala (Mimeographed)

Classification of Wet Land Area (1966-67)

(Acres)

District	Area cropped once	Area cropped twice	Area cropped thrice	Total
Trivandrum	1860	47125	736	49721
Quilon	3503	64844	73	68420
Allepney	76515	69910	25	146450
Kottayam	36088	32812	35	68935
Iddikki	2258	9189	-	11447
Ernakulam	39808	63827	8825	112460
Trichur	51606	84382	6050	142038
Palghat	31369	157793	5429	172994
Calicut	58826	34178	128	93132
Cannanore	76038	45865	2618	124521
Kerala	430289	725252	23848	1179389

Source: Unpublished material available at the Bureau of Economics and Statistics. These data are very crude approximations and should not be used for any purpose without the permission of the Bureau.

Table 5

Estimates of Dry Land Area Available for Extension of Inter Cropping

(Thousands of Hectares)

	Area sown more than once All crops	Gross area under rice	%net to gross rice area	Net area under rice	Rice area sown more than once	Dry land area sown more than once	Area under coconut	Dry land area available for extension of inter cropping
	1	2	3	4	5	6	7	8
Trivandrum	95	40	50.6	20	20	75	77	2
Quilon	132	51	51.3	26	25	107	106	-
Alleppey	73	89	67.7	60	29	44	80	36
Kottayam	74	42	67.7	28	14	60	69	9
Idikki	38	14	55.5	8	6	32	23	-
Ernakulam	46	99	58.0	52	37	9	59	50
Trichur	107	112	59.5	67	45	62	56	6
Palghat	50	183	54.5	100	83	-	23	23
Malappuram	47	92	57.9	53	39	8	69	61
Kozhikode	112	65	73.0	47	18	94	95	1
Cannanore	48	98	70.9	69	29	19	90	71
Kerala	782	874	60.4	528	346	436	740	304

Notes: Column (3) is based on Table 4. Data in columns (1) and (2) are annual ~~averages for the three year period~~ 1971-72 to 1973-74 and taken from Agricultural Statistics in Kerala, Bureau of Economics and Statistics, 1975

Col (4) is obtained as the product of cols (2) and (3). Col (5) is Col (2) minus Col (4). Col (6) is Col (1) minus col (5). Col (7) is based on published data from the source mentioned above. Col (8) is Col (7) minus Col. (6). The totals do not add up to the given figure because of the various approximations used.

According to this classification Kerala is divided into 13 agro climatic zones as follows. I: Onnattukara, II: Coastal sandy, III: Southern Midland, IV: Central Midland, V: Northern Midland, VI Northern Midland - Malappuram Type, VII: High land, VIII: Palghat type, IX Red Loam, X: Chittur Black soil, XI Lowlands Kuttanad, XII: River Bank and XIII: High Ranges.

The different Taluks of the four districts, Alleppey, Ernakulam Malappuram and Cannanore belong mostly to the zones I to VI as shown in Table 6. Coconuts are grown mostly on the lower slopes of these areas; inter crops that can be grown on such coconut land, taking into consideration the agro-climatic conditions, are indicated in Table 7 (which is based on the unpublished work of Dr. K.N.Shyamasundaran Nair and is reproduced here with his kind permission).

Table 6

Division of Alleppey, Ernakulam, Malappuram and Cannanore into Agro-climatic Zones

District/Taluk	Zone	District/Taluk	Zone
Cannanore		Ernakulam	
1. Kasargode	VI	1. Cochin	II
2. Hosdurg	VI	2. Perur	II
3. Thaliparamba	V	3. Alwaye	III
4. Cannanore	V	4. Kunnathunad	III
5. Tellicherry	V	5 Muvattupuzha	III
6. North Wynad	XIII	6. Kanyannoor	I
Malappuram		Alleppey	
1. Ernad	VI	1. Shertalai	II
2. Tirur	VI	2. Ambalapuzha	II
3. Parinthalmanna	III	3. Kuttanad	XI
4. Ponnani	II	4. Tiruvalla	IV
		5. Changanoor	IV
		6. Mavelikara	I
		7. Karthigappalli	I

Source: Report of the Committee on Agro-Climatic Zones and Cropping Patterns, April, 1974, Department of Agriculture, Government

Table 7

Mixed and Inter-Cropping Possibilities for Garden Land in Lower Slopes in Selected Zones

Zone	Main crop	Mixed Crops	Inter-crops
I	Coconut		Tapioca, Fodder Grass and Banana
II	Coconut		Banana, Plantain and Fodder Grass
III	Arecanut		Plantain and Banana
	Coconut	Nutmeg, Cinnamon	Tapioca and Fodder Grass
IV	Arecanut	Pepper, Nutmeg and Cinnamon	Plantain, Banana, Ginger, Yams
	Coconuts (upper slopes)		Tapioca and Fodder Grass
V	Arecanut	Pepper, Nutmeg	Plantain, Banana, Ginger, Tapioca
	Coconut	Nutmeg	Plantain, Banana, Ginger, Tapioca
VI	Arecanut or Coconut	Pepper, Nutmeg	Plantain, Banana, Ginger, and Tapioca

Source: Unpublished work of Dr. K.N.Shyamasundaran Nair

Distribution of Area under Coconut Cultivation : 1970-71

Size of holdings (Hectares)	Alleppey			Ernakulam		
	Area under coconut as % of total area in size group	% of coconut area irrigated	% share of coconut area	Area under coconut as % of total area in size group	% of coconut area irrigated	% share of coconut area
0.04 - 0.25	51.14	28.71	28.65	37.41	5.42	19.00
0.25 - 0.50	30.24	33.18	15.58	21.95	9.70	12.44
0.50 - 1.00	29.62	28.14	21.60	16.08	10.54	15.79
1.00 - 2.00	21.55	25.61	16.54	16.95	13.74	23.48
2.00 - 5.00	25.70	22.39	15.45	15.27	18.31	21.41
Above 5.00	9.16	35.06	2.18	10.96	8.72	7.88
All classes	29.31	27.80	100.00	17.98	11.73	100.00

Size of holdings (Hectares)	Malappuram			Cannanore		
	Area under coconut as % of total area in size group	% of coconut area irrigated	share of coconut area	Area under coconut as % of total area in size group	% of coconut area irrigated	% share coconut area
0.04-0.25	28.33	5.00	13.82	44.45	3.63	16.85
0.25-0.50	21.43	4.51	14.20	27.41	3.98	16.23
0.50-1.00	18.03	6.76	20.17	17.68	4.72	21.67
1.00-2.00	17.13	7.74	25.43	11.96	6.92	22.25
2.00-5.00	11.16	16.66	19.97	3.68	9.25	16.17
Above 5.00	4.82	3.96	6.41	3.24	13.09	6.83
All Classes	14.55	8.24	100.00	12.46	6.21	100.00

Source: The Third Decennial World Census of Agriculture, 1970-71, Report for Kerala State, Bureau of Economics and Statistics, Kerala.

IV. The Distribution of Garden Land According to Size

The question we investigate in this section relates to the proportion of garden land operated by small farmers in whose case the availability of credit will play a crucial role in the feasibility of any programme of development involving inter cropping. Credit is needed both for investment and for the introduction of good farming practices which require not only the use of modern inputs but also the thinning of overcrowded plantations which entails losses of income to the small farmer in the short run.

We again concentrate on the four districts, Alleppey, Ernakulam, Malappuram and Cannanore. If we regard operational holdings below one hectare in size as those belonging to small farmers, the area of land under coconut operated by them appears to account for quite a large proportion of the total area under coconut in all the four districts (it is as high as 65 per cent in Allepney and over one half of the total in the other districts). These estimates are based the the Third Decennial World Agricultural Census, 1970-71 (See Table 8). There are reasons to believe that the distribution of land as reported in this Census is none too reliable. According to the Land Reforms Survey conducted earlier (1966-67), which is generally considered to yield more satisfactory estimates, the percentage of dry land area operated by small farmers, operating in all (i.e. including both wet and dry land) an area less than 2.5 acres, is over a third of the total dry land area in Kerala as a whole; the percentage is somewhat higher in Alleppey and lower in Ernakulam and Cannanore (See Table 9).

Except in Alleppey, only a very small percentage of the area irrigated (Table 8); in Alleppey where it is as high as 27.8 per cent it appears that mixed cropping with perennials such as cacao which are highly remunerative, is possible on a wide scale mainly on the bigger holdings. For the other districts, where coconut cultivation is mainly under rainfed conditions, the possibilities appear to lie in the combinations given in Table 7.

Table 9: Percentage Share of Dry Land in Different Size Groups of Operational Holdings:1966-67

Size of holding (Acres)	Alleppey	Ernakulam	Cannanore	Kerala
0 - 2.50	44.8	31.4	21.9	35.6
2.50 - 5.00	28.1	15.1	15.3	18.5
Above 5	27.1	53.5	62.8	45.9
Total	100.0	100.0	100.0	100.0

Source: Land Reforms Survey in Kerala 1966-67, Report, Bureau of of Economics and Statistics, 1968

V. Summary and Conclusion

Experiments conducted at the Central Plantation Crops Research Institute show that it is possible to raise the yield of garden land through the introduction of mixed and inter-cropping. A hectare of land under coconut cultivation can generate a net income of the order of Rs.5,000 even on plantations where the proportion of bearing trees in total is two thirds, provided optimal farming practices, including the use of fertilisers, are followed. The implications of these experiments vary from region to region within Kerala. Although reliable estimates are not available, the published data indicate that inter cropping already takes place to a significant extent in all but four districts, viz. Alleppey, Ernakulam, Malappuram and Cannanore where roughly 175 thousand hectares under coconut can be brought under inter cropping. In areas where land under coconut cultivation is already sown with other crops such as tapioca, the realisation of maximum potential yields would depend mainly on creating optimal conditions such as spacing and the increased use of fertilisers. On the other hand, in the four districts mentioned above, where not much inter-cropping is appearing to take place, the prospects for raising yields hinge on massive investment programmes for land improvement which would make inter cropping possible.

Over a third of the area under coconuts appears to be cultivated by small farmers. In their case adoption of improved farming practices for raising the productivity of land and hence income depends not only on land improvement but also on reducing the density of plantations. reduction in the density has to be combined with inter cropping if incomes from small farms are to be raised. Hence such possibilities rest on the provision of adequate credit not only for inputs such as fertilisers but also to offset losses in income in the short run resulting from a smaller stand per hectare.

Appendix I

Prices and Wage Rates as on June 1976

(A) Market Prices (per tonne) of fertilisers:

i)	Murate of Potash	Rs. 811.00
ii)	Super Phosphate	Rs. 723.90
iii)	Urea	Rs.1784.20
iv)	Ultraphos	Rs.1465.20
v)	Ammonium Sulphate	Rs.1000.00
vi)	Green leaf	Rs. 65.23
vii)	Cattle manure	Rs. 70.00

(B) Market Prices (per Tonne) of different inter crops:

i)	Elephant Yam	Rs. 500.00
ii)	Tapioca	Rs. 400.00
iii)	Sweet Potato	Rs. 350.00
iv)	Ginger	Rs.1250.00
v)	Turmerin	Rs. 400.00
vi)	Coleus	Rs. 800.00
vii)	Yams	Rs. 500.00
viii)	Lesser Yam	Rs. 600.00

(C) Market price of coconuts:

Re.0.60 per nut with husk

(D) Daily wage Rates:

i)	Tree climbers	Rs. 10.00
ii)	Casual male worker	Rs. 9.00
iii)	Casual female worker	Rs. 7.00

Source: CPCRI, Kasargod, Kerala