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RESEARCH NOTES

TRENDS IN AREA, PRODUCTION AND PRODUCTIVITY OF COCONUTS IN KERALA

The last decade or so has been characterised as a period of general stagnancy in Kerala's agriculture which is a reflection of the stagnancy in the major crops like rice and coconut.[1] The performance of coconut, which is grown in nearly 30 per cent of the net sown area of the State, is marked by the near stagnancy in area and decline in production and productivity. A variety of factors must have contributed to the persistence of these trends about which not much is still known. An attempt has been made in this paper to analyse some of these factors. The paper sets out with an analysis of the changes in area, production and productivity at the all-India level clearly placing Kerala in the larger context (Section I). Section II analyses the changes in area under coconut in Kerala, and Section III examines the factors governing the changes in the productivity (yield per hectare) of the crop.

I

CHANGES IN THE AREA UNDER COCONUTS: ALL-INDIA AND STATES

The area under coconuts in India which was about 622 thousand hectares in the early fifties had increased to 1,200 thousand hectares by the mid-eighties.[2] During this period the production of coconuts in the country had increased from 3,582 million nuts to 6,887 million nuts (Table I). Thus corresponding to an increase of about 92 per cent in the area, there was an increase in production by the same proportion.

TABLE I. TRENDS IN THE AREA UNDER PRODUCTION AND PRODUCTIVITY OF COCONUTS IN INDIA

Year (1)	Area ('000/ha.) (2)	Per cent change (3)	Productivity (nuts/ha.) (4)	Per cent change (5)	Production (million nuts) (6)	Per cent change (7)
1950-51	622	-	5,758	-	3,582	-
1960-61	717	15.27	6,740	12.36	4,639	29.51
1970-71	1,046	45.89	5,807	-10.35	6,075	30.95
1984-85	1,193	14.05	5,773	- 0.59	6,887	13.37

Source: Government of India. Statistical Abstract of India, Ministry of Planning, New Delhi (various issues).

The increase in area under and production of coconuts was neither uniform over the period nor in the different States in which coconut plantation is grown. The period of the fifties showed moderate increases in area under, production and productivity of coconuts in the country. In the sixties, while the area under the crop showed rapid increases, productivity showed a slow decline thereby depressing the increases in production. The period of the seventies and the early eighties showed some increases in area but the increases in production were lower owing to the marginal decline in productivity. Thus over the whole period productivity increased first, but declined to the initial level by 1984-85 and the source of output growth had been increase in area under cultivation.

Within India, the States of Kerala, Karnataka and Tamil Nadu are the major producers of coconuts. The trends in area under and productivity of coconuts in these three States have been disparate over the period of our analysis. During the fifties Kerala showed a moderate increase in the area and Tamil Nadu and Karnataka showed no increase at all. The sixties were a period of rapid increases for all States. The seventies and the early eighties showed a mild decline in the area in Kerala and moderate increases in Tamil Nadu and

Karnataka (Table II). The productivity increases were only marginal in Kerala during the fifties and negative since then.[3] While Karnataka showed a moderate increase in productivity during the fifties and stagnancy since then, Tamil Nadu showed no increase till the end of the fifties and consistent increases thereafter.

The net result of the disparate trends in the area under and productivity of coconuts in the three major coconut producing States is that Kerala which was the major producer of coconuts accounting for over two-thirds of the Indian production during the fifties and sixties now accounts for only half of it. Given that area expansion had stopped since the early seventies and yield decline continues since the sixties, some serious malady seems to be affecting the coconut sector in Kerala. What are these factors inhibiting the expansion of area under coconuts in Kerala and how do they account for the decline in productivity?

II
CHANGES IN THE AREA UNDER COCONUTS IN KERALA

The changes in the area under coconuts in Kerala cannot be analysed in isolation of the overall area expansion in the State during the last thirty years or so. The expansion of area in the State during the period is marked by two distinct phases.

TABLE II. TRENDS IN THE AREA UNDER AND PRODUCTIVITY OF COCONUTS IN KERALA, TAMIL NADU AND KARNATAKA

(area in '000 ha. and productivity in nuts/ha.)

Year	Kerala		Karnataka		Tamil Nadu	
	Area	Productivity	Area	Productivity	Area	Productivity
1951-52 to 1953-54	430	6,511	90	4,266	55	7,836
1958-59 to 1960-61	475(10.5)	6,842(5.1)	92(2.2)	5,108(19.7)	56(1.8)	7,661(-2.2)
1968-69 to 1970-71	730(53.7)	5,389(-21.2)	136(47.8)	4,963(-2.8)	105(87.5)	8,904(16.2)
1978-79 to 1980-81	659(-9.7)	4,693(-12.9)	165(21.3)	4,970(0.1)	116(10.5)	9,396(5.5)
1981-82 to 1984-85*	678(2.8)	4,718(0.5)	186(12.7)	5,207(4.8)	138(19.0)	10,631(13.1)

Source: Same as in Table I.

* Excluding the year 1983-84.

Notes:- Figures in parentheses are percentage changes.

The first phase upto 1974-75 is marked by an expansion in the net sown area - from 1,839 thousand hectares in 1957-58 to 2,208 thousand hectares in 1974-75. The second phase since 1974-75 is marked by stagnancy in the net sown area.

For the purpose of analysing the area under coconuts the whole period may be divided into three sub-periods: the period upto 1968-69, the period between 1968-69 and 1974-75, and the post-1974-75 period. The first sub-period may be called the period of moderate growth, the second that of slow growth and the last, the period of decline. When the area changes are analysed districtwise, it is seen that there was a clear division between the northern districts of the State and the southern. Although the southern districts of Trivandrum, Quilon, Alleppey and Kottayam showed some increases in the area under coconuts during 1960-61 to 1968-69, Alleppey and Kottayam showed mild declines during the period 1968-69 to 1974-75 (Table III) and in the post-1974-75 period, all the southern districts except Trivandrum showed a fall in the area under coconuts (Table IV).

TABLE III. DISTRIBUTION OF AREA CHANGES ACROSS THE DISTRICTS OF KERALA

('000 ha.)

Districts	1960-61 to 1968-69		1968-69 to 1974-75
	Area under coconut (Δ)	Net sown area (Δ)	Area under coconuts (Δ)
(1)	(2)	(3)	(4)
Trivandrum	18.84	4.37	3.38
Quilon	20.29	19.45	22.41
Alleppey	5.73	8.75	- 1.60
Kottayam	20.03	16.69	- 6.96
Ernakulam	18.60	22.12	8.27
Trichur	12.93	8.98	8.41
Palghat	14.42	44.78	3.07
Kozhikode	33.00	39.34	23.22
Cannanore	41.97	82.31	1.88
Kerala	185.30	246.79	62.11

Source: Government of Kerala. Statistics for Planning (various issues).

Note:- (Δ) Denotes change during the period over the figures at the beginning of the period.

The period upto 1968-69 was one where all the districts reported increases in net sown area and increases in the area under coconuts (cols. 2 and 3, Table III). So the increases in net sown area along with whatever declines in the area under other miscellaneous crops were being planted under coconut, rubber and other plantation crops. It is rather difficult to come to any definite conclusions regarding crop substitutions in this period given the limitations of the data owing to the system of data collection followed in Kerala.[4] However, the dominant factor seems to be the increase in net sown area and its allocation under various crops in all the districts. The allocation has favoured coconuts in all the districts except Palghat and Cannanore.

The situation seems to have changed in the post-1968 period. Two factors must have been operating to boost the area under rubber at the expense of coconut in the southern districts, especially in Kottayam and Alleppey (col. 4, Table III). Firstly, the price controls were removed and prices of rubber started moving up. Secondly, the incidence of the root-wilt disease was spreading in Kottayam and Alleppey (see next section), depressing the profitability of coconut cultivation. These forces gained momentum in the post-1974-75 period and the substitution of rubber for coconut and tapioca became clearly evident in all the southern districts of the State except Trivandrum. (It may be noted that Trivandrum is free from root-wilt disease.) In the three districts of Alleppey, Quilon and Kottayam, productivity declines are sharp and the declines in the area under coconut are also sharp. These areas have come under rubber as the figures indicate (Table IV).

In this context, the distinction between the southern and northern districts need to be highlighted further. In the southern districts the area under rice has not shown much of a decline whereas the area under tapioca and coconut has shown a decline. In the northern districts the area under rice and tapioca has tended to decline while the area under coconut and rubber has increased. The absence of root-wilt in the northern districts and the spread of the disease in the southern districts must be at the back of these emerging patterns.

Given that all the available land area has been cultivated in Kerala and that the scope for bringing more area under coconut is rather limited, productivity is the key to increasing production in the State. It is important, then, to analyse the factors affecting the productivity of the crop in Kerala.

TABLE IV. CHANGES IN AREA UNDER SOME MAJOR CROPS IN KERALA (1975-76 TO 1984-85)

(*ha.*)

Districts	Plantation crops*	Rice	Tapioca	Coconut	Cashew
(1)	(2)	(3)	(4)	(5)	(6)
Trivandrum	+ 6603	- 5828	- 19406	+ 2900	+ 1003
Quilon and Alleppey	+ 26797	+ 7591	- 46599	- 30300	+ 1554
Kottayam	+ 24738	+ 3551	- 15345	- 9990	+ 360
Idukki	+ 14449	- 601	- 782	+ 3570	+ 113
Ernakulam	+ 16211	- 1406	- 6727	+ 4950	+ 434
Trichur	+ 1569	+ 1010	- 6490	+ 11740	+ 1114
Palghat	+ 5769	- 14496	+ 4550	+ 8510	+ 1604
Malappuram	+ 2832	- 18345	- 12631	- 8060	- 519
Kazhikode and Cannanore	+ 17989	- 50097	- 6681	+ 11360	+ 22143

Source: Same as in Table III.
* Includes rubber, tea, coffee and cardamom.

III
CHANGES IN THE PRODUCTIVITY OF COCONUT PALMS IN KERALA

For a tree crop like coconut, productivity may be analysed in terms of the following formula:

Productivity per unit area = (Productivity per bearing palm) × (proportion of bearing palms) × (number of palms per unit area).

In the above formula, though the stand (number of palms per unit area) varied across regions within the State, it was unlikely to have varied over the years and hence this may be ignored. Changes in the proportion of bearing palms are brought about by disparate increases in the area at different periods of time, given the replanting practices and the age at bearing. Now, the age at bearing would not have changed much for the spread of high-yielding varieties (HYVs) and irrigation, the two major factors bringing down the age at bearing, have been insignificant. The demand for HYV seedlings has never been very great and has, in fact, come down in the recent past (see Sivanandan, 1985) and the story of irrigation shall become evident as we see later. The rapid growth of area under coconuts in the sixties seems to have affected the proportion of bearing palms to some extent; the proportion has declined from 0.66 in the early sixties to 0.63 in the late seventies and has continued to be the same till 1982-83. Since then it must have increased marginally. However, such a decline in the proportion of bearing palms would hardly explain about 5 per cent of the decline in productivity per unit area. But what is of marginal significance at the aggregate need not be so at the district level. Those districts which reported sharp increases in area have shown sharper declines in productivity per unit area (see Sivanandan, 1985). The correlation between the rate of growth in area and the rate of growth in yield per unit area across districts was negative and significant (r=-0.54). Because of this inverse relation, the detailed exercises on productivity changes carried out by Das (1983) and Sivanandan (1985) cannot be used. To evaluate the changes in productivity of coconut palms, the only meaningful measure is, then, the per palm productivity.

The per palm productivity of coconuts has been declining during the last twenty years (Table V). What are the factors accounting for such a steady decline in yield?

TABLE V. AVERAGE PRODUCTIVITY PER BEARING PALM IN KERALA

Year	Average productivity (nuts per palm)	Index
1961-62	41	100
1967-68	37	88
1973-74	33	79
1980-81	31	74
1984-85	31	74

Source: Suseelan (1986).

The per palm productivity is sensitive to the age composition of bearing palms. This sensitivity is due to the initial increase in yield of the bearing palm till a certain age at which the stabilisation of yield takes place and the later decline in yield when the palm crosses a certain age.[5] Under average management conditions in Kerala, though coconut palms start bearing between the ages of 7 and 12 years, the yield stabilises only around the age of 20 and the phase of yield decline is said to begin around the age of 50. Hence the age between 20 and 50 may be considered as the peak bearing age.

In the mid-sixties, the percentage of palms in the peak bearing age was 44 which came down to 37.57 by the mid-seventies and then increased to 50 by the mid-eighties (Table VI).

TABLE VI. AGE DISTRIBUTION OF COCONUT PALMS IN KERALA

Age groups (years)	Percentage of palms in the different groups		
	1964-65	1974-75	1984-85
Below 20	46.87	31.28	27.51
20 to 50	44.01	37.57	50.07
Above 50	9.12	31.15	22.42

Source: 1. Government of Kerala. Comprehensive Report of the Survey for the Correct Estimation of Area under and Production of Coconuts in Kerala.

2. Government of Kerala. Statistics for Planning (various issues).

Notes:- The figures for 1974-75 and 1984-85 are generated using the time-series data on area under coconuts on the base of the age distribution provided in Source 1. The figure for 1974-75 is very close to the figure thrown up by the survey on cost of cultivation.

If the proportion of palms in the peak bearing age were the dominant factor governing the per palm productivity, the latter should have been declining till the mid-seventies and increasing since then. The productivity did decline till the mid-seventies but has not shown any increase since then. So, the relationship between changes in the percentage of palms in the bearing age and the changes in yield does not seem to be direct and clear cut. Similar is the conclusion obtained when the relationship between the increase in the percentage of old palms (above 50 years) and the changes in the yield is considered. For instance, the two districts with similar increases in the percentage of old palms are Trivandrum and Trichur - from about 10 per cent in 1965-66 to about 15 per cent in 1984-85 - both of which are not affected by the disease to any great extent (Table VII). But the per palm yield declined in Trivandrum and showed a marginal increase in Trichur. Thus the relationship between changes in the age composition of bearing palms and yield seems to be complex mediated through other factors.

TABLE VII. CHANGES IN YIELD, PERCENTAGE OF OLD PALMS AND INCIDENCE OF THE DISEASE ACROSS THE DISTRICTS OF KERALA

Districts	Percentage change in yield (1972-73 to 1981-82)	Percentage of palms above 50 years		Incidence of root-wilt disease	
		1965-66	1984-85	1971-76	1984-85
(1)	(2)	(3)	(4)	(5)	(6)
Trivandrum	-23	9.78	15.30	10.06	2.29
Quilon	-19	0.99	19.23	27.05	35.46
Alleppey	-20	6.15	18.22	54.50	81.67
Kottayam	-20	8.97	26.50	49.75	82.96
Ernakulam	0	4.18	10.14	26.02	44.97
Trichur	5	9.95	15.67	4.53	3.75
Palghat	5	5.82	NA	-	-
Malappuram	0	-	NA	-	-
Kozhikode	0	1.71	NA	-	-
Cannanore	21	8.09	NA	-	-

Source: 1. For col. (2), Bureau of Economics and Statistics, Government of Kerala, Trivandrum.
2. For col. (3), Survey conducted by the Indian Coconut Committee.
3. For cols. (4) and (6), CPCRI (1985).
4. For col. (5), George *et al.* (1979).

Notes:- 1. Incidence of the disease is computed by taking the percentage of disease affected palms to the total number of bearing palms.
2. The figures given in col. (6) are computed from Table I of CPCRI(1985) and are different from the figures reported in Table II of CPCRI(1985). This had to be done because of the inconsistency in the tables of CPCRI(1985).

Moving over to the other factors what comes to the mind is the incidence of diseases, especially root-wilt, which has been increasing in many districts and the yield depressing effects of which are severe. For instance, a root-wilt affected palm is seen to yield only 26 per cent of the yield of a root-wilt free palm. During the early sixties the incidence of diseases was around 5 per cent for the State as a whole, the incidence being much higher than the State average for the districts of Alleppey and Kottayam. As no separate information was collected on root-wilt, it is difficult to estimate the incidence of the same, but it may be presumed that the higher figures observed for some of the districts must largely be due to the incidence of root-wilt. For the seventies and eighties, information on the incidence of root-wilt is available and it is observed that the incidence has increased manifold (Table VII). Though its intensity has increased the regional spread has remained the same, confined to the region between Trichur and Trivandrum.

To assess the impact of the incidence of disease on the decline in yields, it may be instructive to compare Kottayam with Quilon. Both showed similar increases in the proportion of old palms whereas the incidence of the disease showed a sharper increase in Kottayam. But the yield declines are of the same order in both the districts, showing that the impact of the incidence of the disease on yield declines was not direct. Further, making use of the yield profile, especially the decline after a certain age, and the increase in old palms, the decline in yield attributable to the increases in the percentage of old palms was computed. The residuals do not show much of a correspondence with the increases in the incidence of the disease.

Thus the decline in the yield of coconuts in Kerala attributed to the root-wilt disease and the existence of large proportion of old palms (Bavappa,1983; Thampan 1986) do not seem to be pure effects, they seem to be confounded by other factors such as cultivation practices and input use.

The data on cultivation practices and input use are scanty but whatever data that exist (not presented here) point to the low levels of input use in Kerala. Among these practices, irrigation plays an important role in shaping the yield profile of the coconut tree and we turn to it now.

Coming to the influence of irrigation on yields, it is observed that within agro-climatic zones, irrigation is not a significant variable explaining variations in yield across taluks (Appendix). However, irrigation seems to play a different role. Earlier it was stated that beyond a certain age, as the age at bearing advances, the yield tends to decline. This relationship becomes qualitatively different when a high percentage of irrigation is introduced. As is evident, agro-climatic zones II and IV contain taluks which are well irrigated and in these zones the yield levels seem to be scattered and not related to the proportion of aged palms whereas in the other zones, which are rainfed, yield levels fall with a higher proportion of older palms. The inference that may be drawn from the above finding is that irrigation delays the age at which the decline in yield sets in, which under rainfed conditions sets in around the age of 45 or 50 years, thereby effectively lengthening the peak bearing period. This inference sets at naught the attempt at linking the decline in yield with the proportion of palms in the peak bearing age for the peak bearing age itself is governed by the varying moisture regime. Probably, irrigation arrests the yield depressing effects of the disease as well. This plausibility is indicated by the comparison of figures corresponding to Quilon and Ernakulam in Table VII.

Thus the decline in yield which was often associated with a higher proportion of older palms or the incidence of the disease seems to be governed by the pattern of input use, especially irrigation. The predominantly rainfed cultivation of coconuts in the State leads to the earlier onset of the declining phase, thereby curtailing the effective peak bearing period of the palms. It is through the length of the effective peak bearing period that the age composition of palms affects the average yield. Further, the interaction between the levels of input use, especially irrigation and the incidence of the disease points to the fact that the low input use facilitates the incidence and maturity of the disease bringing in its trail sharp decline in yield. The villain of the piece, then, seems to be low input use rather than the spread of the disease or the increasing proportion of old palms, the latter only mediating the depressing effects of the former.

CONCLUSIONS

The low levels of input use and the stagnant per palm yields of coconut in itself may at best be a partial story, completion of which calls for an analysis of the vast inter-mixed cropping potential of the coconut gardens and the trends in its utilisation over the last decade or so. Such an analysis is not easy given the limitations of the system of data collection alluded to above. However, the spread of the cultivation of cocoa, nutmeg and other spices in the last ten or fifteen years does point to something taking place under the coconut canopy which cannot be called a sign of stagnancy.

D. Narayana and K.N. Nair*

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* Centre for Development Studies, Trivandrum.
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APPENDIX
IRRIGATION AND YIELD OF COCONUTS ACROSS AGRO-CLIMATIC ZONES IN KERALA

Agro-climatic zones (1)	Taluks (2)	Yield per root-wilt free palm (3)	Land irrigated (percentage of area) (4)	Percentage of root-wilt free palm above 50 years (5)
I	Quilon	74	4.00	28.13
	Karunagapally	74	0.00	15.04
	Karthigapally	77	0.00	3.78
	Mavelikara	93	0.00	5.13
II	Ambalapuzha	106	71.75	12.29
	Shertalai	74	68.62	25.78
	Vaikom	70	13.90	16.15
	Cochin	87	5.32	12.98
	Parur	70	41.77	5.06
	Chavakkad	45	62.95	19.43
	Kodungalloor	64	71.12	11.56
III	Trivandrum	80	3.10	9.36
	Chirayinkil	74	0.67	17.31
	Kottarakara	61	0.00	18.52
	Chenganoor	95	0.00	7.69
	Mallapally	103	0.81	9.38
	Thiruvalla	96	5.85	5.63
	Pathanamthitta	70	0.00	20.78
	Adoor	66	0.00	4.76
	Changanacherry	67	0.00	28.29
	Kottayam	65	2.35	12.50
IV	Alwaye	72	92.15	2.58
	Kunnathunad	77	46.89	5.53
	Kannayannoor	79	20.88	11.84
	Mukundapuram	89	65.39	15.03
	Thalapally	51	34.66	10.08
	Trichur	61	55.09	15.73
VII	Pathanapuram	59	0.00	15.32
	Kunnathur	51	0.00	1.75
	Ranni	79	0.00	13.68
	Kanjirapally	107	0 00	Small sample
	Meenachil	46	0.00	29.69
	Thodupuzha	63	7.39	16.67
	Kothamangalam	91	15.79	3.93
	Muvattupuzha	88	13.92	18.03
	Nedumangad	75	1.76	16.31
IX	Neyyattinkara	81	9.40	15.82
XI	Kuttanad	108	0.74	10.17
XII	Devikulam	75	0.00	Small sample
	Peermade	90	21.97	Small sample
	Udumbanchola	74	1.35	0.00

Source: CPCRI (1985).

Note:- The numbering of agro-climatic zones in CPCRI (1985) is not in conformity with the Report on Agro-Climatic Zones. We have adopted the numbering of the latter.

NOTES

1. For an analysis of the agricultural stagnation in Kerala, see Kannan and Pushpangadan (1988).

2. See Kuttappan's thesis (1979) for a detailed discussion of area increases between 1948-49 and 1972-73.

3. There are serious problems in analysing the yield per unit area of a tree crop like coconut which has a long gestation period, the facets of which we delve into in Section III.

4. Among the two different systems of collection of area statistics in vogue in India, Kerala follows the non-reporting system. The system called the Land Utilisation Surveys was begun in 1954 and was based on a sample of slightly over one per cent of the total number of plots in the State. Since 1975-76 a different scheme known as Timely Reporting Scheme was introduced in the State. So the data of the two periods are not comparable.

With regard to the area estimates of crops like coconut, there is a further problem. In these cases what is estimated is the tree population and area is the ratio of the estimated population and the estimated norm, *i.e.*, number of trees per hectare. So these estimates are area figures in a nominal sense; what is real is the tree population of the crop which need not be the only crop in the area under consideration.

The yield estimates of coconuts were based on the enquiry of Taluk Statistical Inspectors till 1975-76. From 1976-77 crop-cutting experiments were being conducted. These estimates are often at variance with the estimates thrown up by other agencies.

5. For an excellent characterisation of the yield profile, see Mukherjee (1981).

6. To evaluate the impact of irrigation on shaping the yield profile of coconut trees, time-series data should have been the ideal. But no such data are available. Instead, we use here cross-section data on talukwise yield and age composition of root-wilt free coconut palms from CPCRI (1985).

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