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Crop loss due to Root (wilt) and Leaf Rot Diseases and Oryctes Infestation of Coconut in the disease affected areas in Kerala, South India

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ABSTRACT

Root (wilt) and leaf rot are the major diseases seriously affecting the yield of coconut in Central and Southern Kerala. Of the pests *Oryctes rhinoceros* L. is the most important, attacking the tender leaves and spathes. The root (wilt) disease affected areas on the west coast of India consist of seven districts of Kerala state viz. Ernakulam, Idikki, Kottayam, Alleppey and Quilon districts in full and part of Trichur and Trivandrum districts where a survey was conducted using a multistage sampling procedure during 1971-76 to estimate the total production and the loss in coconut yield due to incidence of root (wilt) and leaf rot and *Oryctes* infestations. Among the 7 districts surveyed the total annual production of nuts was maximum in Alleppey district (406 million nuts). Ernakulam, Kottayam and Quilon districts produced annually 357 million, 337 million and 331 million nuts respectively. The average yield per palm was found to be very low in the severely disease affected districts (Alleppey 31 nuts, Kottayam 32 nuts and Idikki 35 nuts). The average yield of a healthy palm free from disease and *Oryctes* infestation was also high in Trichur (61 nuts) and Ernakulam (60 nuts) districts.

The loss in yield was estimated to be about 75% for trees in the advanced stages of the disease and 25 to 50% in the early stages. The loss due to *Oryctes* infestation was found to vary from 1 to 6 nuts per palm in different districts. The loss of nuts due to disease and pest was maximum in Kottayam district (125 million nuts annually) followed by Alleppey district (113 million nuts). In Quilon and Ernakulam districts, loss due to disease and pest was 73 million and 58 million nuts respectively. In Trivandrum and Trichur districts the total loss was only 14 million nuts and 8 million nuts respectively. The overall loss of production due to the diseases and *Oryctes* was estimated at 419 million nuts which would amount to 20% of annual production in the disease affected tract.

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INTRODUCTION

With 1.1 million ha under coconut, producing about six thousand million nuts annually, India ranks third in the world in area and production. Kerala accounts for about sixty per cent of the total production in India and for about 1/8th of the total world production. However, the productivity of palms in Kerala is very low when compared to Tamil Nadu, the second largest producing State in India. Coconut is attacked by a number of insect pests and pathogens. Among the pests *Oryctes rhinoceros* L. is the most important, atacking the tender leaves and tspathes and causing damage to the crown of the palm. Ramachandran (1961) observed a reduction of 4.9% in yield due to *Oryctes* infestation. Root (wilt) and leaf rot are the major diseases of coconut palm in Kerala, seriously affecting the yield of coconuts in south and central Kerala. An earlier study conducted (Ramadasan and George - unpublished) to assess the crop losses due to root (wilt) with special reference to scientific cultivation revealed that in the early stage of disease the loss in yield was about 40 per cent whereas in the advanced stage it rose to about 80 per cent. A survey conducted earlier revealed that over 0.25 million ha of coconut plantations are affected by these diseases (Gopinatha Pillai *et al*; 1973). George *et al* (1976) estimated the loss in yield due to root (wilt) and leaf rot diseases at 340 million nuts annually. The disease was prevalent in the north up to Irinjalakuda situated 10 miles south of Trichur town and in the south up to certain isolated pockets in Trivandrum district. There are indications of the prevalence of this disease in isolated pockets in the northern districts of Kerala and the adjoining areas in Tamil Nadu and Karnataka states. George *et al* (1979) estimated the percentage of palms affected by root (wilt) and leaf rot at different stages and infested by *Oryctes* in the disease affected areas in Kerala. The incidence of both the diseases was maximum in Alleppey and Kottayam districts which are in the central part of the disease tract. The percentage of occurrence and the intensity of the diseases decrease towards the north and south of this area. In this paper estimates on the loss in nuts due to root (wilt) affected areas are presented.

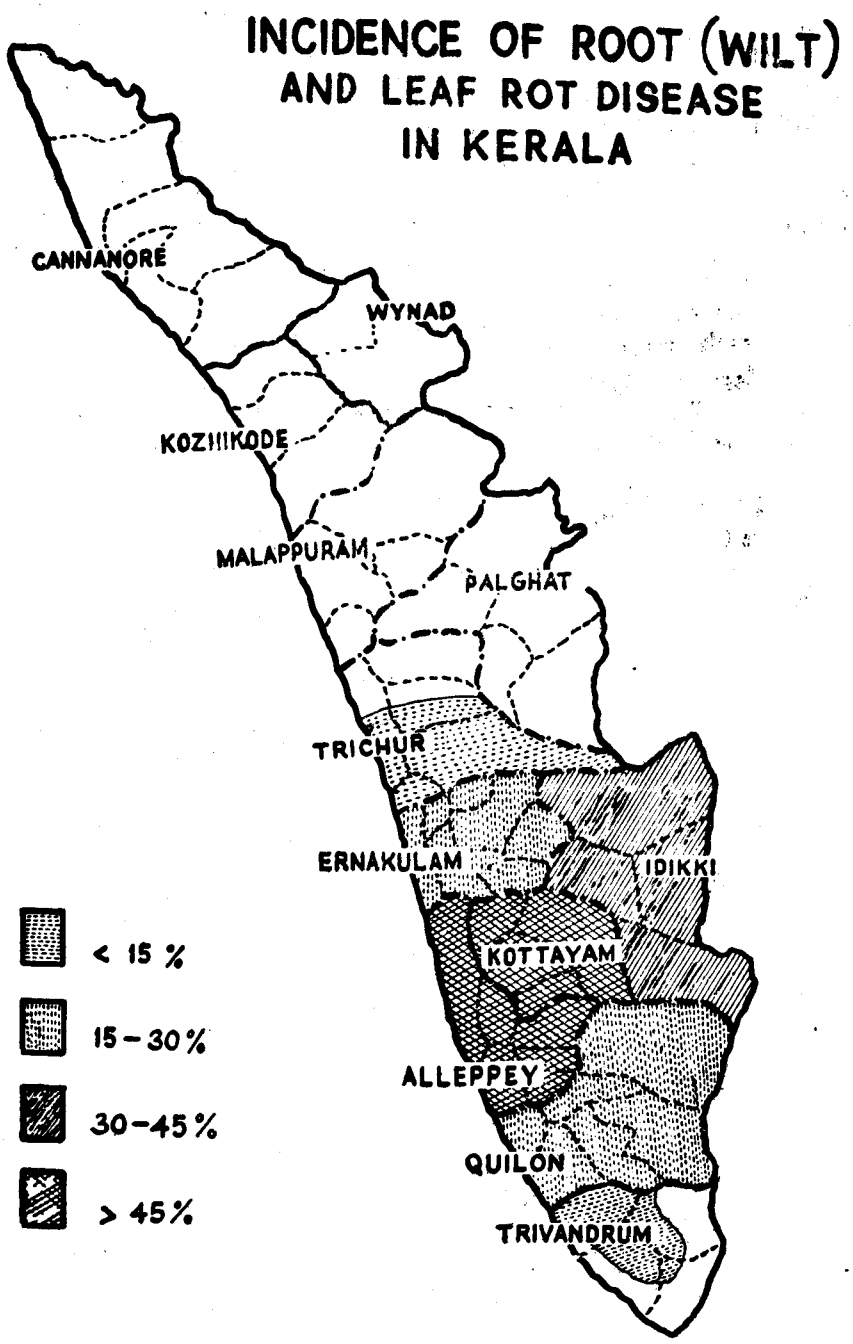
MATERIAL AND METHODS

The root (wilt) disease affected coconut tract on the west coast of India (Kerala) consisting of Ernakulam, Idikki, Kottayam, Alleppey and Quilon districts in full and part of Trichur and Trivandrum districts was surveyed during 1971-76. Except in Alleppey district, three stage sampling procedure was adopted. About 20% of the revenue villages from a district were selected at random as the first stage units. Four clusters of five survey subdivisions from each of these villages were selected at random as the second stage units. Total number of coconut palms were grouped as healthy (H), *Oryctes* infested (O), disease early (D.E.), disease early with *Oryctes* infestation (D.E.+O), disease advanced (D.A.) and disease advanced with *Oryctes* infestation (D.A.+O). Three palms each from the first two subgroups and two palms each from the remaining four subgroups selected at random, formed the third stage units. The number of palms under the above categories and the average yield per palm were estimated using the procedure given by Sukhatme and Sukhatme (1970) for the two stage and three stage sampling respectively with suitable modifications. In Trichur district the survey was conducted only in 50% of the villages which lie in the south of Trichur town and in Trivandrum district only villages where disease was located, which also came to 50% of the total villages, were covered (Figs.1 and 2). In Alleppey district 102 plots were selected by simple random sampling and a cluster of 20 palms were selected from each plot. In addition to the six categories of the palms, the middle stages of disease were classified separately as disease moderate (D. M.) and disease moderate with *Oryctes* infestation (D. M+O) in the case of Alleppey district. The total number of palms and mean yield per palm in each category were estimated adopting the regression method taking the estimated number of bearing palms in Alleppey district and the mean yield per palm from the forecast reports of the land utilisation survey conducted by the Bureau of Economics and Statistics, Trivandrum as the population value (Anonymous, 1975). The losses were estimated based on the population figures by George *et al* (1979) for other districts.

RESULTS AND DISCUSSION

A perusal of Table 2 shows that the average yield per palm

was found to be high in Trichur district (59 nuts/tree) followed by Ernakulam district (50 nuts) and low in Alleppey (31 nuts), Kottayam (32 nuts), and Idikki (35 nuts) districts where the disease was found to be very severe. The average yield of a healthy palm (free from disease and *Oryctes* infestation) was also found to be very high in Trichur (61 nuts) and Ernakulam (60 nuts) districts. In the severely disease affected districts the average yield of an apparently healthy palm was also low (40 nuts in Alleppey, 39 nuts in Quilon and 44 nuts in Kottayam). The loss in yield was estimated to be about 75% in the advanced stages of the root (wilt) disease and 25 to 50% in the early stages of the disease. The loss due to *Oryctes* infestation was found to vary from 1 to 6 nuts per palm in different areas [Table-3]. In the early stages of disease the average reduction in yield per palm varied from 8 to 34 nuts and in the advanced stages of disease the average reduction varied from 28 to 46 nuts in various districts.



Among the southern districts of Kerala, Alleppey produced the maximum number of nuts (406 million nuts per annum) Ernakulam, Kottayam and Quilon produced annually 357, 337 and 331 million nuts respectively (Table-1). Trichur district produced 306 million nuts from the surveyed area which is only about 50% of the total area. The higher production is due to the higher productivity, low incidence and the high average stand per ha. The average stand per ha in Trichur district was estimated to be 121 palms per acre whereas in Quilon district it was as low as 59 palms because here, coconut is grown mixed with other trees such as arecanut, jack, mango etc. In Trichur district, relatively more area was under pure plantations than in other districts. In Trichur district, the number of palms in the advanced stages of the disease was very low and hence the estimates of yield per palm in the advanced stages of disease as well as the loss in yield could not be worked out. Though the number of palms affected by disease in Trichur district is low, drastic reduction in yield of palms in early stages of the

disease was noticed. The average yield of palm in the early stage of disease was even less than 50% of a healthy palm. In Idikki district also the reduction was more rapid. In Kottayam, Alleppey and Trivandrum, about 25% reduction in yield was observed in the early stages of disease. In the advanced stages of disease the trend in decline in yield was over 50 and almost the same in all the districts (Table-2).

The total loss of nuts due to pests and diseases was maximum in Kottayam district (125 million nuts annually), closely followed by Alleppey district (113 millon nuts) (Table-4). The loss in yield due to *Oryctes* infestation was maximum in Kottayam district (17 million nuts) where the average loss per palm (6 mts) was maximum (Table-3). The total loss in yield due to *Oryctes* infestation alone was also very high (14 million nuts) in Quilon district because of the maximum number of *Oryctes* infested palms (5 million palms), though the per palm loss is only 2.7 nuts. The total loss in yield due to disease alone was also maximum in Kottayam district (36 million nuts) and the extent of damage in Alleppey district was almost the same (Table-4). The loss in yield in diseased palms with *Oryctes* infestation could not be apportioned between the disease and pest. The interaction between pest and disease was found to be positive in some districts and negative in other districts. Hence the overall losses due to pests and diseases were estimated. In Ernakulam and Quilon districts the total losses were of the order 73 million and 57.8 million nuts respectively whereas in Trivandrum and Trichur districts the losses were relatively less (14 million and 8 million nuts respectively). The overall loss in yield due to pests and diseases in the root (wilt) affected area was thus estimated at 419 million nuts annually which is about 12% of the total production of nuts in Kerala. The estimates on the production of nuts in various districts is in broad agreement with the official estimates (Anon., 1975).

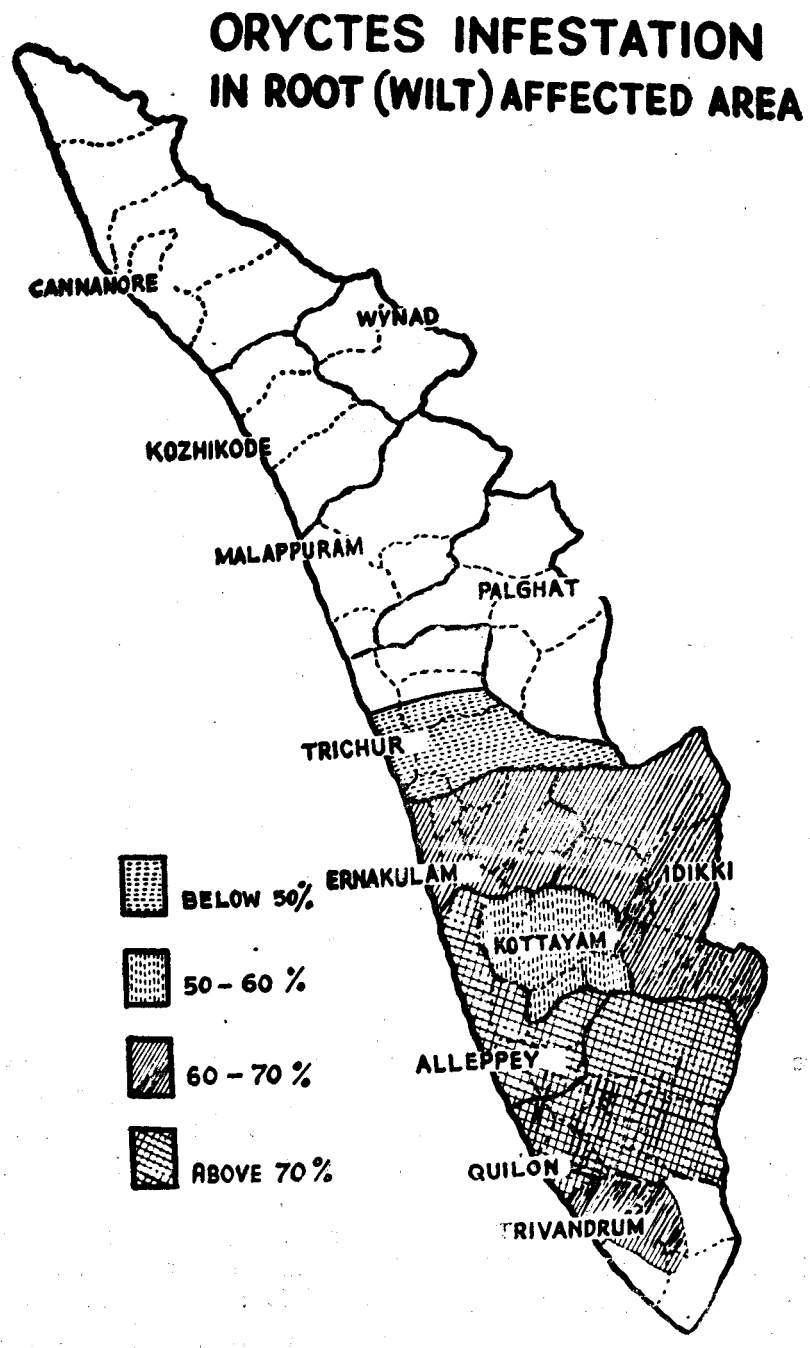


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TABLE – 1

Estimated number of nuts (million) produced under various categories of palms

Category of palms	Trichur	Ernakulam	Idikki	Kottayam	Alleppey	Quilon	Trivandrum*
Healthy [H]	196.71	124.34	24.93	117.67	77.30	57.68	57.33
Oryctes infested [O]	103.58	161.66	29.51	106.04	153.67	181.90	112.70
Disease early [D. E.]	3.54	33.17	4.82	40.76	22.39	15.6	7.57
D. E. + *Oryctes* infested[D.E.+O]	1.89	26.50	9.97	48.86	69.33	30.48	5.97
Disease moderate[D.M[	—	—	—	—	13.93	—	—
D.M. + O	—	—	—	—	45.37	—	—
D. Advanced[D.A]	Negligible	6.67	1.77	9.04	7.83	2.31	Negligible
D.A. + O	Negligible	4.90	2.65	14.86	16.13	42.71	Negligible

*In Trichur and Trivandrum districts only 50% of the villages were covered under the survey

TABLE - 2

Estimated average yield of nuts / palm under various categories

Category of palms	Trichur	Ernakulam	Idikki	Kottayam	Alleppey	Quilon	Trivandrum
H	60.75 [7.94]	59.97 [10.17]	47.92 [1.85]	44.17 [3.84]	39.62	38.86 [4.21]	47.17 [13.26]
O	60.00 [5.80]	57.86 [9.01]	43.33 [1.70]	37.97 [4.37]	38.36	36.14 [2.58]	44.33 [8.58]
D.E.	28.25 [3.04]	40.19 [12.44]	23.67 [0.83]	31.14 [4.47]	29.15	24.75 [6.36]	31.63 [9.97]
D.E.+O	27.00 [2.18]	38.27 [5.86]	25.83 [5.44]	23.88 [5.61]	32.17	26.34 [4.27]	30.73 [18.03]
D.M.	—	—	—	—	26.29	—	—
D.M.+O	—	—	—	—	26.96	—	—
D.A	—	15.56 [8.84]	14.13 [1.88]	14.25 [1.50]	12.48	8.01 [1.62]	—
D.A.+ O	—	13.50 [5.0]	13.17 [1.43]	14.45 [2.99]	11.73	10.28 [2.34]	—
Mean	58.89	49.78	34.78	32.19	31.00	36.70	42.78

(Figures in Parenthesis are S. E. of estimates)

TABLE - 3

Average loss (yield of nuts/palm) due to disease and pest in various categories in different districts

Category of palms	Trichur	Ernakulam	Idikki	Kottayam	Alleppey	Quilon	Trivandrum
O	0.75	2.11	4.59	6.20	1.20	2.72	2.84
D.E.	32.50	19.78	24.25	13.03	10.47	14.11	15.57
D.E.+O	33.75	21.70	22.09	20.29	7.45	12.52	16.44
D.M.	—	—	—	—	13.33	—	—
D.M. + O	—	—	—	—	12.66	—	—
D.A.	—	44.33	33.79	29.92	27.14	30.85	—
D.A.+O	—	46.47	34.75	29.72	27.89	28.58	—

TABLE - 4

Reduction in yield (loss) of nuts (in millions) in various stages of disease and pest incidence

Category of palms	Trichur*	Ernaku-lam	Idikki	Kotta-yam	Alleppey	Quilon	Trivan-drum	Total
O	1.29	5.90	3.13	17.32	5.05	13.69	7.22	53.60
D.E.	4.06	16.32	4.49	17.06	8.04	8.90	3.72	63.04
D.E.+O	2.36	15.03	8.53	41.52	16.06	14.49	3.20	101.19
D.M.	—	—	—	—	7.07	—	—	7.07
D.M. + O	—	—	—	—	21.31	—	—	21.31
D.A.	—	19.05	4.24	18.99	17.02	8.89	—	68.19
D.A. + O	—	16.85	7.00	30.56	38.35	11.87	—	104.63
Total	7.71	73.15	27.84	125.45	112.90	57.84	14.14	419.03

*In Trichur and Trivandrum districts the estimates relate to 50% of the villages only (covered under the survey)