



Integrated Management of Root (wilt) Affected Coconut Palms - An Yield Gap Analysis

Suitable management practices for combating the root (wilt) disease has been developed as early in 1960s by Central Plantation Crops Research Institute. Eventhough the average coconut yield increased from 5246 nuts/ha since 1951-52 to 6847 nuts/ha in 2000-01, with an additional yield of 1601 nuts per hectare, the yield improvement is less satisfactory in India. In this paper the authors P. Anithakumari, Rema Bai and N. Sasidharan analysed the results of demonstration plot yields and yield gap in root (wilt) affected areas. One of the major reasons for yield gap in South Kerala region is the prevalence of root wilt diseases of coconut. But the knowledge and adoption of root wilt management practices were low among the farmers. The studies have shown that the yield difference is mainly due to the management of space, selection of quality planting material and the nature of shade in homesteads.

Introduction

Coconut is essentially the 'Kalpavriksha' of the small and marginal farmers of the State. Moreover it is a social crop entwined closely with the socio-political and economic scenario of Kerala. Root (wilt) disease of coconut is a debilitating disease affecting the health and yield performance of the crop. Suitable management practices for combating the disease has been developed as early in 1960s by Central Plantation Crops Research Institute. This is efficient and feasible in improving the yield and thus reducing the gap in yield. This has been proved in experimental stations and farmers' field in various localities under rainfed/irrigated in West Coast Tall (WCT) or hybrids.

Study conducted in Alappuzha district showed that the awareness, knowledge and adoption as well as skill in identification of disease symptoms were very low among the coconut cultivators. An appraisal study about the training needs among the extension officials also indicated very low level of

knowledge and skill regarding scientific technologies of coconut. Studies have shown that adoption of integrated management practices can increase the average yield up to 92 per cent, improve the health and vigor of the palms and manage other pests and diseases.

An examination of yields of coconut over the previous two or three decades indicated that the yield improvement is less satisfactory. But the research and development had gone a long way with meaningful output consisting of efficient technologies for field utilization and several policy frame work. Since 1951-52, the average coconut yield increased from 5246 nuts/ha to 6847 nuts/ha in 2000-01, i.e. with an additional yield of 1601 nuts per hectare. But an analysis of

the productivity of major coconut producing states covering 91 per cent of total area and production indicated that Kerala and Karnataka States recorded productivity lesser than the national average.(CDB, 2000).

The yield gap indicates the scope for bridging it through better strategies of research and developmental efforts. Prakash (1989), Anithakumari and Kalavathy (2001) and Batugal (1996) indicated that in improving coconut yield the major constraints are lack of awareness and knowledge about the recommended technologies, fragmented small holdings and closer spacing, wide spread prevalence of root (wilt) disease, lack of adequate management, inadequacy of quality planting materials, existence of more number of old and senile palms and low genetic potential of existing palm population. In addition, one of the major reasons for reduction in coconut yield in South Kerala region was the prevalence of root (wilt) disease in coconut. (Prakash, 1989). The yield loss due to the disease was estimated to be 980 million nuts/ annum (Anon.1985). The disease is reported to be severe in the southern districts and mild in other districts of Kerala State (Table. 2).

The Table.2 shows that among the root (wilt) affected districts, Idukki, Kottayam and Kollam districts indicate the maximum yield gap with the highest average yield of the State. Even though Palakkad had only sparse incidence of root (wilt) disease, it recorded lower productivity of 4754 nuts/ha which is 1078 nuts lower than the productivity of Alappuzha district which recorded the highest root (wilt) disease incidence in the State. This clearly shows that the

Table 1. Gap in coconut productivity among major coconut growing states

States	Area ('000 ha)	Productivity (Nuts/ha)	Gap with highest (Nuts/ha)
Andhra Pradesh	102.5	10660	0
Tamil Nadu	323.5	9763	897 (8.4%)
Kerala	936.3	5870	4790 (44.9%)
Karnataka	333.8	5255	5405 (50.7%)



Table 2. Gap in coconut productivity among the districts of Kerala State

Districts	Area (Ha)	Disease incidences	Productivity (Nuts/ha)	Gap (nuts)	Gap (%)
Thiruvananthapuram	91362	2.09	6655	1425	17.6
Kollam	79906	25.97%	4993	3087	38.2
Pathanamthitta	22769	37.80%	5753	2327	28.8
Alappuzha	61270	48.03%	5435	2645	32.7
Kottayam	43272	36.50%	4645	3435	42.5
Idukki	23696	33.56%	3883	4197	51.9
Ernakulam	68110	33.00%	5961	2119	26.2
Thrissur	88307	06.15%	6908	1172	14.5
Palakkad	45857	Sparse	4754	3326	41.2
Malappuram	107142	Sparse	6692	1388	17.2
Kozhikode	131061	Sparse	8080	0	0
Waynad	10843	Sparse	2490	5590	69.2
Kannur	95257	Sparse	5406	1601	19.8
Kasaragod	56183	Sparse	6479	2674	33.1
State	925035		6140	1940	24.0

yield reduction due to root (wilt) disease can be overcome through adoption of integrated management practices recommended.

The CPCRI (Central Plantation Crops Research Institute) had been recommending an integrated approach to manage the root (wilt) disease of coconut. But studies showed that the knowledge and adoption of root (wilt) management practices were very low among farmers. (Anithakumari and Kalavathy, 2001). Hence to improve the knowledge and adoption, CPCRI had laid out several trials and demonstration plots in farmers' field in various locations; to demonstrate the utility, feasibility, and practicability of the technologies recommended. In this paper an attempt is being made to analyze the results of the demonstration plot yields and the yield gaps in root (wilt) affected areas.

Methodology

Integrated management practices such as application of balanced dose of fertilizers, leaf rot control including prophylactic measures, organic manure and green manure application, need based plant protection measures and other cultural operations were adopted

by farmers covered under the demonstration plots. Schedule of operations was prepared for implementation and consultation has been done with the farmers and extension officials. Interaction sessions with the scientists and farmers were conducted at CPCRI (RS), Kayamkulam regarding the research activities and present recommendations on root (wilt) disease. Extension literature in local language were given to the farmers. Benchmark survey of the plots and the farmers were also done and data documented. The disease index and yield were recorded as per the methodologies developed by CPCRI. (Nambiar and Pillai (1985). Percentage analysis and mean were employed for analysis.

Results and Discussion

The yield data from the following situations were utilized for the

Table 3. Reduction of yield gap in HDMCS of root (wilt) affected areas

Year	Average yield (nuts/palm/year)	Increase in productivity and income	Yield gap reduction	CB ratio
1998	41			1:1.54
2001	63	22 Rs. 17820/ha/year	54	1:2.40

(Present rate of Rs. 4.50 per nut was taken for 180 palms per hectare)

comparison of plot wise or area wise yield gap analysis.

***Institute Campus Demonstration**

1. High Density Multiple Cropping System Model in root (wilt) affected garden.
2. Coconut as monocrop in root (wilt) affected area.

***Demonstration Plots in Farmers' Fields**

1. WCT in root (wilt) affected area.
2. Hybrids in root (wilt) affected area.

***Yield gap among different root (wilt) disease index palm and leaf rot-affected palm**

Reduction in yield gap through adoption of integrated management practices for root (wilt) affected coconut

- I. HDMCS model in root (wilt) affected garden

The HDMCS model had component crops such as various varieties of banana, clove, nutmeg, pineapple and pepper. The results are obtained after adopting all recommendations of integrated management practices during the period 1998 to 2001.

Even if intercropping is practiced in coconut gardens, the yield of the palms are not adversely affected. An increase of 54 percent in the average yield along with the added income of intercrops makes the technology suitable for adoption by the small and marginal coconut farmers of root (wilt) affected areas. This also provides opportunities for organic recycling, maximum utilization of available resources and feasible for homesteads.

II. *Adoption of integrated management practices for root (wilt) affected coconut (WCT) gardens* root (wilt) management practices is Rs.29180 @ Rs.4.50 per nut.

The additional income from one hectare by adoption of the integrated The table 4 shows that the maximum increase in the average yield was observed in apparently healthy palms

Table 4. Yield gap reduction in various disease category palms

Disease Index	Percent of palms	Average yield (1998-99)	Average yield (2000-01)	Increase in yield	Reduction yield
Apparently Healthy	20.00	49 nuts	94 nuts	45 nuts	92.00
Disease Early	22.00	42 nuts	77 nuts	35 nuts	84.00
Disease Middle	56.00	41 nuts	69 nuts	28 nuts	54.00
Disease Advanced	2.00	33 nuts	35 nuts	2 nuts	6.00
Total	100.00	39 nuts	75 nuts	36 nuts	92.00

Table 5. Yield gap of plams of various disease index with apparently healthy palms

Disease index	Percentage of palms	Average yield (nuts/palm)	Difference in yield	Yield gap (per cent)
AH	20.00	94	0	0.00
DE	22.00	77	17 nuts	18.00
DM	56.00	69	26 nuts	27.00
DA	2.00	35	59 nuts	63.00

Table 6. Yield of yield gap in farmers' fields in WCT and Hybrids

Category	Average yield (98-99) nuts/palm/year	Average yield (2000-01) nuts/palm/year	Increase in yield & income nuts/palm/year	Yield gap reduction (%)	Increase in income	Increase in C B Ratio
West coast Tall gardens	31 (5580 nuts/ha)	46 (8280 nuts/ha)	15 (2700 nuts/ha)	49.00	Rs. 12150/ha/year	1:1.16 to 1:1.70
Hybrid Gardens	36 (6480 nuts/ha)	67 (12060 nuts/ha)	31 (5580 nuts/ha)	86.00	Rs. 25110/ha/year	1:1.35 to 1:2.50

Table 7. Management gap in root (wilt) affected areas

Situation	Average yield (nuts/palm/year)	Difference in yield	Yield gap (per cent)	Cost benefit benefit ratio
Research station yield (WCT)	75			1:2.8
Farmers' garden yield (WCT)	31	44 nuts	142	1:1.16

Table 8. Yield gap reduction by adopting leaf rot management practices

Leaf rot	% Palms	Average yield	Increase in yield	% Increase in yield
No leaf rot	82% (1998) 91% (2001)	41 (1998) 77 (2001)	36 nuts	88%
Lef rot in spindle	18% (1998) 6% (2001)	34 (1998) 55 (2001)	21 nuts	62%

and the minimum in disease advanced palms. But the potential for increase in the yield in the palms up to disease middle stage was in the range of 54 to 92 per cent. The data further indicated that the yield gap could be reduced by 92 per cent by adoption of the integrated management practices recommended by CPCRI in West Coast Tall gardens planted with proper spacing with quality planting materials. Similar results were earlier reported by Muralidharan *et al.* (1991).

Further analysis of the data showed that the yield gap among the palms of various disease indexes is maximum for the apparently healthy and the disease advanced palms. In addition, the yield gap among the diseased palm increased with the intensity of the disease. Hence by adopting the management practices as a package the health of the palms can be sustained along with the economical yield.

III. *Demonstration of integrated management practices in existing farmers' gardens.*

Table 6 indicates that the yield gap reduction in root (wilt) affected gardens can be better achieved by adopting hybrid varieties of coconut along with the recommended management technologies. The yield gap reduction is 86 per cent in hybrids and 49 per cent in West Coast Tall through the adoption of integrated root (wilt) management practices.

IV. *Research station and farmers' field*

Table 7 shows that by adopting the integrated management practices for root (wilt) affected coconut gardens as recommended by Central Plantation Crops Research Institute, the yield gap could be reduced by 142 percent even with WCT palms.

V. *Yield versus leaf rot disease*

The leaf rot disease causes major reduction in yield and health of root (wilt) disease affected palms besides the loss of photosynthetic area and



appearance of the palm. But farmers are not aware of the management practices and hence the adoption is very low. The average yield of the leaf rot affected palms is only 34 nuts/palm/year. This observation is being supported by the findings of Thampan (1996). The data in Table.8 indicates that the yield of leaf rot affected palms can be improved by 62 percent within three years besides control of the disease. The feasibility and economic benefit of the recommendation is also evident from the data.

Reasons for the yield gap

The major reasons indicated for wide yield gap are as follows.

- 1. Poor management of palms in root (wilt) affected area with reference to quality seedling, crop establishment, crop protection, regular crop nutrition, timeliness of adoption and operation and integration of all these factors in the coconut farming system.
- 2. Research and extension mainly focused on yield improvement; rather than adopting the system to have output suited to the resource base and socio-economic situation of small and marginal farmers.
- 3. Coconut is a perennial crop and due to its unique physiological characters, observability of the technology is low and time consuming. It's tall nature limited the contribution of family labour.
- 4. Coconut based homestead system is a complex system involving not only

the crops but also the family members in which the consideration and objectives are also very delicate and need based when compared to commercial cultivation.

- 5. The yield difference between the research station and the farmers' plot itself comes to 44 nuts/palm/year, which comes to 142 per cent yield difference over the farmers' yield. This yield difference was mainly due to spacing, management, quality of planting materials and prevalence of shade in homesteads. Since spacing adopted is lesser than that recommended, scientific and profitable adoption of High density multiple cropping system or coconut based cropping- systems by maximum utilization of natural resources would not be possible for farmers.
- 6. Existing gaps in awareness, knowledge and adoption of root (wilt) management practices (Anithakumari 2001).
- 7. Lack of extension support/activities among the farmers of root (wilt) affected areas.

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