

EFFECT OF AGRO-TECHNIQUES ON THE ROOT (WILT) DISEASE OF COCONUT

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ABSTRACT

The various agro-techniques including planting techniques, nutritional and irrigation requirements of young and adult palms, inter and mixed cropping in coconut garden, crop-livestock - fisheries integration techniques etc. under the geo-pedo environments of Central and South Kerala for containing the root (wilt) disease of coconut are discussed.

The root (wilt) disease of coconut, noticed first in 1882 in Central Kerala, has now spread upto Trichur district in the north and Trivandrum district in the South. The disease has also been recently noticed in two villages of Kanyakumari district in Tamil Nadu. Palms of all ages are affected. The disease spreads at 1-4 km per year and has now affected about 12 million palms in 250,000 ha extending to nearly one third of the total coconut area of Kerala. The economic loss due to the disease is Rs. 300 million annually.

The research on the disease was started as early as in 1937 and intensified in 1948. The etiology of the disease has not yet been clearly understood. And therefore no specific control measures could be advocated. However, the results of research carried out so far by the CPCRI at its Regional Station, Kayangulam and elsewhere showed that a package of agro-technology could be drawn out for mitigating and/or arresting the disease. These are enumerated in this article. The climate of the region is of humid tropical with an annual rainfall of 2284 mm received in 120 rainy days. The soil types are loamy sand/sandy loam and poor in N,K, Ca, Mg and micronutrients. The management practices adopted for the main crop of coconut and the subsidiary crops grown in the coconut gardens are given in Table I.

1. Rejuvenation of the diseased garden

Rejuvenation of the plantation could be accomplished by replanting or underplanting after the removal of uneconomic palms which are of advanced stage of disease and replanting with

Table 1 Cultivation particulars of different crops.

Crops	Scientific name	Spacing (m)	Inorganic nutrients (kg/ha)			Organics crowding as basal (ton/ha)	Methods of fertilizer application	Additional labour utilized	
			N	P	K			Men	Women
Coconut	<i>Cocos nucifera</i>	7.5 × 7.5	0.34*	0.17*	0.68*	25*	1/3 in April/May & 2/3 in Aug/Sept.	—	—
<i>Intercrops</i> Cassava	<i>Manihot utilissima</i>	0.9 × 0.9	80	80	80	8	‡ of N&K and full P at sprouting of sets and the rest at 60 days after sprouting	93	12
Elephant Yam	<i>Amorphophallus companulatus</i>	1.0 × 1.0	80	80	80	8	‡ of N and full P&K at sprouting and the remaining 30 days after sprouting	123	8
Yam	<i>Dioscorea alata</i>	1.0 × 1.0	80	80	80	8	-do-	64	12
<i>Mixed crops</i> Cacao	<i>Theobroma cacao</i>	3.0 × 3.0	0.10*	0.04*	0.14*	12*	‡ in April/May & ‡ in Aug/Sept.	400	—
<i>Mixed Farming</i> Pusa Giant	<i>Hybrid napier</i> Var. Pusa giant	0.5 × 0.5	150	50	100	10	P&K as basal and N in 4 split doses under rainfed conditions & 8 split doses under irrigation	1000	—
Napier	<i>Hybrid napier</i> Var. NB-21	-do-	150	50	100	10	-do-	-do-	—
Guinea grass	<i>Panicum maximum</i> var. mackuni	0.4 × 0.4	150	50	100	10	-do-	-do-	—
Lucerne	<i>Stylosanthes gracilis</i>	0.2 × 0.2	150	50	100	10	-do-	-do-	—

*Kg per plant

quality planting material. In majority of the gardens palms of different age groups are often met with. Experimental evidences revealed that palms under pre-bearing age when contracted the disease, there is a progressive increase in the disease intensity, year after year, resulting in a marked reduction in nut yield and copra per palm (Robert Cecil, Unpublished). Hence palms under pre-bearing age, when take the disease, it is economical to remove and replant with quality planting material.

a) Underplanting

To maintain economic return from a garden, uneconomic palms have to be removed and underplanted with quality material. In such cases it is beneficial to remove uneconomic palms which are yielding less than 10—15 nuts per year (George, 1978). By regular eradication of disease advanced palms after adopting the scoring technique evolved by George and Radha (1973) and by regular underplanting and manuring of all the palms in a diseased garden, the mean yield per palm per year could be maintained at 35—40 nuts for twenty years (Radha and Shanta, 1976).

b) Replanting

The disease advanced uneconomic plantation can be rejuvenated by adopting replanting. Available data revealed that by rejuvenation of a diseased plantation after removing all the palms and replanting with D×T hybrids 3—4 per cent of the palms alone contracted the disease in 7—8 years (Kamalakshamma, unpublished). By underplanting a diseased garden 10—15% of the plants take the disease in 6—7 years (Radha, 1977).

The above studies have indicated that removal of the infective material by removing the bole and roots of the affected palms to the best extent possible and replanting with quality material by adopting either underplanting or replanting depending upon the condition, an economic return is possible from a diseased garden.

2. Nutritional management

Fertilizer studies carried out at this research station (1950—1962) showed that application of NPK at 240—240—480 g. with

Table 2. Effect of growing intercrops and mixed crops in adult root (wilt) affected coconut gardens on disease intensity of palms, yield response and economics (per ha).

	Disease index		Yield/palm		Yield/ha	Return from coconut @90 Ps Rs.	Cost of cultivation including subsidiary crops Rs.	Return from subsidiary crops Rs.	Gross return Rs.	Net return Rs.	Output/input ratio
	Pre-Expt. 1975	Post-Expt. 1978	Pre-Expt. 1975	Post-Expt. 1978							
Coconut alone	20.3	13.3	48.7	47.1	6755	6079	2850	—	6079	3229	1.13
<i>Intercropping</i>											
Coconut + Cassava	19.4	14.3	57.1	57.2	8470	7623	5030	5580	13203	8173	1.62
Coconut + Elephant yam	17.5	16.4	54.8	70.3	9835	8851	5065	2685	11536	6471	1.28
Coconut + Yam	19.4	18.1	70.7	76.2	10220	9198	5195	2730	11928	6733	1.30
<i>Mixed cropping</i>											
Coconut + Cacao	31.0	24.0	45.0	59.0	10325	9292	5773	6347	15639	9865	1.55

50 kg green leaf per palm per year and lime at 1.25 tons per ha increased the yield of diseased palms by 4 nuts while that of a relatively healthy palm by 8 nuts during the same period. In the absence of manuring and cultivation the annual reduction in yield was to the extent of 11 nuts per palm per year (Radha, 1977). Available data from a recent fertilizer study (Pillai *et al*, Unpublished) showed that application of NPK at 350—300—600 with 500 g MgO could be an economical dose for the sandy loam soil of the diseased tract. This is in partial agreement with the present recommendation except that of P (Anon, 1976a). In the light of the above studies application of 25—50 kg of green leaf with NPK at 340—170—680 and 3.0 kg dolomite (of 3.0 kg magnesium sulphate and 1 kg slaked lime) per palm per year could be recommended for the disease affected tract. Dolomite or lime may be applied separately, while magnesium sulphate may be applied along with NPK fertilizers.

3. Intercropping with tubers

Data (Table 2) show that intercropping in coconut garden decreased the disease intensity of palms which were of diseased early stage. Results of similar nature were reported by Menon and Nair (1978). Growing intercrops increased the nut yield of palms. Yam intercropped plot have the maximum nut yield followed by elephant yam and cassava. Among the intercrops, cassava recorded the maximum return per rupee invested followed by yam or elephant yam. The merits of raising crops in the interspace of coconut were reported by Nelliath (1973, 1976), Nair *et al* (1974) and Nair and Verghese (1976).

4. Mixed cropping with Cacao

Data (Table 2) show that mixed cropping with Cacao in coconut garden, the disease intensity of palms could be decreased by 25%. Mixed cropping with Cacao, the coconut yield could be enhanced by about 30% when compared to monocropping of coconut. The beneficial effects due to growing cacao in coconut garden have been attributed to the biomass added to soil through shed leaves and increase in soil fertility (Eernstman, 1968) and intense microbial activity in the rhizosphere of coconut, like

increasing the activity of nitrogen fixers and P-solubilisers, thereby enhance the soil fertility (Nair and Rao, 1977), decrease in soil temperature in coconut Cacao crop mixed combination (Verghese *et al* 1978). The net return per rupee invested was maximum in the case of mixed cropping with Cacao when compared to inter-cropping with tubers.

Table 3 Effect of growing fodder crops under rainfed and irrigated conditions on adult root (wilt) affected coconut garden on disease intensity and yield response.

	Disease index				Coconut Yield/palm			Increase due to irrigation (%)	Fodder Crops (tonnes/ha)			
	Rainfed		Irrigated		Rain-fed	Irrigated	Mean		Rain-fed	Irrigated	Mean	Increase due to irrigation (%)
	Pre expt 1975	Post expt 1977	Pre expt 1975	Post expt 1977								
Coconut alone	21.0	21.4	13.9	6.2	37.7	54.5	46.1	44.5	—	—	—	—
Coconut + Pusa giant	22.0	22.6	23.5	12.6	52.7	77.8	65.3	47.6	45.1	62.3	53.7	38.1
Coconut + NB 21	19.4	17.8	19.1	10.2	56.7	67.3	62.0	18.7	55.1	86.2	70.8	56.9
Coconut + Guinea grass	15.3	12.8	35.6	19.4	84.7	63.6	74.2	—	59.8	67.9	63.9	13.6
Coconut + Stylosanthes	21.2	20.7	36.9	15.4	44.8	55.8	50.3	24.5	23.0	18.6	20.8	—

5. Mixed farming with fodder crops

Data (Table 3) showed that growing fodder crops in the diseased garden reduced the disease intensity of palms in general. Marked reduction in disease intensity was noticed when fodder crops were raised under irrigation. Sahasranaman and Pillai

(1976) reported marked reduction in foliar yellowing of diseased palms due to mixed farming. Raising fodder crops, the coconut yield could be enhanced by 36%. The beneficial effects of mixed farming have been reasoned to the increase in the activity of rhizosphere microflora and consequent increase in N-fixers and P-solubilisers (Anon; 1976). Nair and Sahasranaman (1978) recorded highest yield by raising guinea grass under rainfed conditions while hybrid napier (NB-21) gave the highest yield under irrigated condition.

By irrigating coconut garden at 14 mm depth once in three days the yield of coconut could be increased by 44%. Sadanandan (Unpublished) observed 45—50% increase in coconut yield in cultivator's garden due to irrigation and rejuvenation of diseased garden. The overall increase in the nut yield of coconut due to raising fodder crops and feeding them to milch cows and recycling the cattle dung and urine to the coconut garden was 33.8% compared to 28% reported by Sahasranaman and Pillai (1976). They also reported that the net profit by mixed farming—maintaining 4 milch cows in one hectare under fodder crops in diseased coconut garden, was Rs. 1,918 - per year.

Generation of additional rural employment

As seen from Table I, generation of additional rural employment to the tune of 100, 400 and 1000 mandays per ha was possible by adopting intercropping, mixed cropping and mixed farming systems respectively in coconut gardens.

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