



Integrated Management in Root (Wilt) Affected Coconut Garden - A Success Story

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Coconut, a homestead crop of small and marginal farmers of Kerala, is mainly grown under rainfed conditions. The average size of holdings is as small as 0.2 ha in size. Raising of other compatible crops in interspaces in coconut garden is a common practice. The advantages of intercropping in coconut gardens as perceived by homestead farmers and collected through a brain storming session with them are given below :

- Helps utilize the interspaces
- Maximum utilization of sunlight and other natural resources
- Provides additional food requirements and other social needs
- Better opportunity for recycling organic residues of all the crops in the system to increase the soil fertility
- The farm family can be engaged in agricultural activities themselves
- A garden of good intercrops gives satisfaction to the farm family
- Increases the population of natural enemies in the system. i.e. spiders, etc.
- The farm family gets the full fuel needs from the system
- Provides additional income
- Byproducts of nutritional value are utilized by the family. (e.g. green leaves, banana bract and peduncle, amorphophallus stem, leaf bases of colocasia, xanthosoma, etc for local dishes.)
- Extra time of the family can be properly utilized.

- Microclimate becomes pleasant
- Reduces weeds
- Sustainable cropping system
- Reduction of cost
- Able to get fresh produce directly from the field for homestead purposes
- Can grow a wide variety of crops and crop mixes
- Can accommodate other enterprises like backyard poultry, cattle rearing, etc

Demonstration of Root (wilt) Management Practices

A demonstration plot was maintained within the Institute campus adopting all the recommended practices of root [wilt] management including the usual inter cropping.

The root [wilt] management practices adopted are furnished below:

- Control of leaf rot disease (cut and remove rotten portions of the spindle only and the adjacent two innermost fully opened leaves. Pour 300ml of fungicidal solution containing 2ml of Contaf 5%EC or 3g Dithane-M-45 around the spindle leaf. Apply 20 g Phorate 10G/30g Furadan mixed with 200g fine sand around the base of the spindle against pests. Adopt this in April - May and October - November).
- Organic manure application (apply 50kg/palm/year)
- Application of balanced dose of chemical fertilizers (apply 500g nitrogen, 300g phosphorus, 1000g potassium/palm/year)

- Application of magnesium sulphate (500g MgO/palm/year in one region and 1 kg in other region)
- Growing green manure in coconut basins (sowing crops like sunnhemp, mimosa, etc.)
- Drip irrigation (32 litres water/day)
- Mulching the base of coconut (mulch with coconut leaves and other organic materials during October- November)
- Recycling of organic residues
- Adoption of other need based pest protection
- Growing suitable intercrops (intercrops cultivated are banana, tubers, amorphophallus, pineapple).
- Removal of disease advanced palms and planting of quality seedlings with proper spacing.

Effect of Integrated Root (wilt) Management Practices

West Coast Tall variety of coconut was planted in the plot. The intercrops cultivated are banana, turmeric, [amorphophallus, dioscorea, colocasia, pineapple, etc. Palms of different age groups ranging from 10 to 60 years were selected for the study. The percentage of the palms were 10% and below, 16% were 11-20 years of age, 49% were 21-30 years of age, 19% were 31-40 years, 9% were 41-50 years and 8% were 51-60 years of age. The average yield of coconut palms during the period 1996-2000 showed a steady increase. The average yield and

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from a plot of one hectare is shown in Table 1. The Table indicates that in a well managed plot in the root (wilt) affected area the average returns per palm was found to be 200-270. In the said plot, drip irrigation was started in the late 1998. The comparatively lower yield in 1999 and 2000 was due to eriophyid incidence, which resulted in

sustained as well as improved by the adoption of the recommended root [wilt] management practices.

Intercropping as a component in the root [wilt] affected gardens

The common intercrops cultivated in farmers' gardens are banana, pineapple, tubers like elephant foot yam, dioscorea and colocasia and

Table 1. Yield of coconut in the root (wilt) affected garden

Year	Nuts/ha	Nuts/palm/year	Value# of nuts (Rs/ha)	Value of* byproducts (Rs/ha)	Total gross returns (Rs/ha)
1996	8225	47	37103	1000	47013
1997	8400	48	42100	1000	43000
1998	7175	41	28700	1000	29700
1999	7000	40	42000	1000	43000
2000	9275	53	41738	1000	42738

*Value of coconut in their respective years was the auction prices of coconut as per farm records. Byproducts include coconut leaves, petioles and other fuel materials.

nut shedding and subsequent yield reduction. But with the adoption of eriophyid mite control measures, the average yield increased to 53 nuts per palm per year. The total return was calculated based on the existing prices during the period concerned.

Root (wilt) incidence versus the yield

A further analysis of the root [wilt] incidence of the palm presents another view of the yield profile. The root [wilt] diseased palms are classified into apparently Healthy [AH], Disease Early [DE], Disease Middle [DM] and Disease Advanced [DA] based on the disease indexing method developed by PCL. Table 2 indicates the average yield and the percentage of disease incidence.

The data indicate that the yield can be sustained as well as improved by adopting the recommended management practices in coconut root [wilt] affected gardens. Even the yield of disease advanced palms could be maintained to the level of 28-30 nuts per palm. It is quite evident from the Table that the yield gap and productivity of the existing palms in the root [wilt] affected gardens can be

vegetables. But it is seen that the crops are not systematically planted or managed to maximize income and production. The intercrops such as banana, tubers and pineapple were grown in root (wilt) affected coconut gardens. Care has been taken to provide the management practices

Table 2. Yield and root (wilt) intensity of palms

Disease incidence	Average yield of palms (nuts/palm/year) and percentage of disease intensity			
	1998	1999	2000	%increase
Apparently healthy	38 nuts (10%)	43 nuts (10%)	54 nuts (10%)	42%
Disease early	45 nuts (10%)	42 nuts (12%)	59 nuts (13%)	31%
Disease middle	42 nuts (70%)	41 nuts (65%)	55 nuts (69%)	31%
Disease advanced	29 nuts (10%)	28 nuts (13%)	30 nuts (8%)	3.5%

(Percentage of palms given in parenthesis)

separately to the main crop and the intercrops. Table 1. and 2 also indicate that even though intercropping has been practised, the yield of coconuts has not been affected adversely. The cultivation practices of the intercrops grown are summarized in Table 3.

Economics of Intercropping in Coconut Gardens

Inter cropping is found to be a profitable and additional income generating enterprise in coconut growing areas. Coconut along with banana and pineapple was found to be the most profitable option as inter crop, when compared to other individual crop combinations. Besides the additional income / profit, intercropping renders the cropping situation sustainable, meets the farm family needs and maintains eco-friendly surroundings. As farmers consider several other factors also in taking decision to select and cultivate crops for intercropping, they prefer various combinations of crops in the homesteads.

In the demonstration plot various intercrops such as banana, elephant foot yam, dioscorea, and pineapple were planted and the yield was taken for analysis. In total, 115 coconut palms, 500 banana of different varieties (poovan, palayankodan, njalipoovan, vegetable varieties and tissue culture plantlets of robusta, palayncodan, karpooravally, nendran, etc.) 100 numbers each of elephant foot yam and

dioscorea and 3000 pineapple suckers were accommodated (Table 4). The average yield of coconut was 53 nuts/palm/year; banana - 10 kg; elephant foot yam - 6kg; dioscorea - 3kg and pineapple - 2kg per plant. The cost of the produces were taken as follows.



Table 3. Management practices of intercrops

Crop	Spacing	Fertilizer recommended	Variety
Coconut (May-June)	7.5 x 7.5m	50 kg organics 300:500:1000g NPK/palm/yr	Hybrids/local
Banana (April-May)	Pit size 50cm ³ Spacing 2.4 x 1.8m [robusta], 2 x 2m [nendran] and 2.13 X 2.13 m for poovan/ palayankodan, etc	10 kg organics/pit 190:115:300g NPK/plant[nendran] 200:200:400g NPK/plant [other varieties]	Robusta, Poovan, Njalipoovan, Karpooravally, Palayankodan, Nendran, etc
Amorphophallus (Feb-March)	Pit size 60 x 60 x 45 cm Spacing 90 cm	2-2.5 kg organics per pit 40:60:50 kg NPK./ha	Local
Dioscorea (March-April)	Pit size 45 cm ³ Spacing 1x1 m	10-15 tons/ha organics 80:60:80 kg NPK/ha	Sreepriya, Sreesubhra, Sreerupa, Sreekeerthi
Pineapple (May - June)	70 cm between rows & 30cm between plants	25t/ha of organics 320:160:320 kg NPK/ha	Kew

(Recommended planting time is given in bracket)

Table 4. Intercrops in coconut garden in root (wilt) affected area

Crops	No. of plants	Total Edpenditure (Rs)	Total return (Rs)	Net return (Rs)	Returns/Plant (Rs)
Coconut	115	14145	24380	10235	89
Banana	500	17000	35000	18000	36
Elephant foot yam	100	2100	30000	900	9
Dioscorea	100	1500	2700	1200	12
Pineapple	3000	12000	24000	12000	4

Table 5. Returns from different crop combinations with coconut (1Ha)

Crop combination	Gross cost	Gross return	Net return	Cost benefit ratio
Coconut alone	21525	38100	16575	1:1.77
Coconut + banana	52425	108100	55675	1:2.06
Coconut + elephant foot yam	48525	77100	28575	1:1.60
Coconut + dioscorea	40870	73200	32330	1:1.79
Coconut + pine apple	33400	62100	28700	1:1.86

Coconut @Rs. 4/nut; banana @ Rs. 34/kg and elephant foot yam @ Rs. 21/kg dioscorea @ Rs. 9/kg and pineapple @ Rs. 4/kg at the time of harvest.

The total cost of the intercrops came to Rs. 46745 and the total return was Rs. 89080 per year. The net return was Rs. 42335 per year from the intercrops. This includes all management cost and labour charges. The cost benefit ratio comes to 1:1.91. If the farmer's family can invest their labour and practice judicious organic recycling, the net return can be further increased.

Based on the above observations, the yield of intercrops in HDMCS gardens is a good comparison of the individual crops. The combination with coconut is given in Table 5. The results of the demonstration shows that by adopting the recommended root wilt management practices, the yield of coconut palm can be increased and sustained.

Intercropping will not in any way reduce the returns from the coconut palm rather it improves and adds to the returns per unit area. Every crop should be given due consideration while managing such a farm.

The summary of the results of the demonstration is as below:

- Root (wilt) management practices increase the yield and health of palms.
- It is economically viable and feasible and permits adaptation by farmers to suit their local resources.
- Intercropping/high density cropping in root (wilt) affected coconut gardens improves income and soil health, besides satisfying family needs and utilizing the interspaces.
- More efforts are required in creating awareness and knowledge among extension workers and farmers to improve technology transfer and utilization at farm level.