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Central Plantation Crops Research Institute

(*Indian Council of Agricultural Research*)

Regional Station, Kayamkulam -Kerala-690 533

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Dr H. P. Maheswarappa
Dr (Mrs.) P. Anitha Kumari

Central Plantation Crops Research Institute
(Indian Council of Agricultural Research)
Regional Station, Kayamkulam, Kerala-690 533

Phone : Head : 0479-2442004,
PABX : 0479-2442160, 2442104
FAX : 0479-2445733

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Dr V. Rajagopal
Director
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Text by:

Dr H. P. Maheswarappa

Dr (Mrs.) P. Anitha Kumari

Edited by:

Dr George V. Thomas

Mrs P. G. Kamalakshi Amma

Photographs by:

E. R. Asokan

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AGRONOMIC STRATEGIES FOR MANAGING ROOT (WILT) AFFECTED COCONUT GARDENS

Introduction

Coconut (*Cocos nucifera* L.) is a versatile crop providing food, medicine, health drink, shelter, fuel, timber and fibre. In recent years many coconut farmers have suffered economic difficulties due to unstable copra prices in the world and local markets. Being a small holders' crop in India, it does not provide adequate income and gainful employment to the dependent families. The productivity of coconut in Kerala state of India is as low as 6349 nuts per hectare (for the year 2002-03), mainly because of prevalence of root (wilt) disease, non-adoption of scientific agro-techniques coupled with crop being grown under rainfed condition. Coconut root (wilt) disease is a non-lethal, debilitating malady that affects the production potential of the palm. The disease is caused by phytoplasma, a vascular limited pathogen. The disease is transmitted by insect vectors, viz. lace bug and plant hopper. The most consistent and diagnostic symptom of the disease is the characteristic bending of the leaflets termed flaccidity, foliar yellowing and marginal necrosis of the older leaves. However, this disease is often found superimposed (65%) with leaf rot disease. The disease is prevalent in all districts of Kerala in varying severity, and the extent of incidence of the disease was highest in Alappuzha (48.03%) followed by Pathanamthitta (37.8%), Kottayam (36.5%), Idukki (33.56%), Ernakulam (33.0%) and Kollam (25.97%) districts. In the districts of Thrissur and Thiruvananthapuram the percentage of disease incidence was 6.19 and 2.09, respectively. The disease has also been noticed in districts of Tamil Nadu bordering Kerala and in Goa. There are no therapeutic control measures for the disease, however, research efforts have resulted in evolving viable technologies to increase the productivity of the diseased palms. In a situation where the coconut sector is threatened with recurring uncertainties, the need for a farm practice that augments the coconut farm income becomes clear and urgent.

Following are the agronomic techniques standardized at CPCRI (RS), Kayamkulam to increase the productivity of root (wilt) affected coconut gardens.

I. Integrated nutrient management system

Integrated application of green leaves, organic manures, balanced dose of inorganic fertilizers, biofertilizers and recycling of crop residues ensure availability of nutrients to crops and is necessary for maintenance of soil productivity and sustainable crop yields.

a) Green manure/cover crops:

The following are the benefits expected by growing the cover crops:

- Prevention of soil erosion.
- Checks unwanted weed growth in coconut basins during rainy season as it covers the soil.
- Addition of organic matter to the soil and thus maintaining the structure of the top soil.
- Improving aeration of the soil.
- Protecting the soil and roots of crops from excessive heat of the sun.
- Conservation of soil fertility by using available plant food which might otherwise be leached away.
- Fixation of atmospheric nitrogen in the case of leguminous plants.

The cover crops to be grown in coconut gardens should be tolerant to shade and preferably low growing. The latter requirement arises from the fact that gathering of nuts that fall in the ripe stage cannot be done satisfactorily if the cover crops grow high. Green manure crops are incorporated during the maximum vegetative growth of the crops to provide nutritional and organic manure benefits to the coconut palm. Following are the recommended green manure/cover crops for coconut basins based on their ability to produce large quantity of biomass during the rainy season; cowpea (*Vigna unguiculata)*, sunnhemp (*Crotalaria juncea*), mimosa (*Mimosa invisa)*, calopo (*Calopogonium mucunoides)* and kudzu *(Pueraria phaseoloides)*. These legumes are well nodulated by native bacteria belonging to *Rhizobium* sp. and they fix significant levels of atmospheric nitrogen and make available to the coconut palm.

Cowpea:

Sowing of green manure cowpea should be carried out during April-May months by broadcasting 125-150 g seeds in 1.8 m radius basins after application of

Fig. 1. Cowpea as green manure crop

first dose of (1/3rd) inorganic fertilizers recommended for coconut palm (Fig. 1). When cowpea attains maximum flowering, it should be uprooted and incorporated in the basins during September-October months along with 2/3rd fertilizer application. Cowpea crop yields about 20 to 25 kg of green biomass. On dry weight basis, whole plant of cowpea (root, stem, leaves) contains 2.77% N, 0.25% P and 2.33% K and incorporation of biomass in the basin, will contributes 134.3 g of N, 12.3 g of P and 113.7 g of K per basin per season (Table 1). By growing cowpea as green manure crop, the NPK requirement can be brought down to the tune of 27% of N, 3.5% of P and 12% of K as per the recommendations for coconut palm.

Table 1. Fresh weight, dry weight and N, P, K content and contribution by cowpea when grown as green manure crop in coconut basin

Year	Fresh weight* (kg/basin)	Dry weight* (kg/basin)	Nutrient content and contribution**					
			N content (%)	N contribution (g/basin)	P content (%)	P contribution (g/basin)	K content (%)	K contribution (g/basin)
2000	24	4.8	2.8	134	0.26	12.5	2.4	115
2001	25	4.9	2.7	132	0.25	12.2	2.3	113
2002	25	4.9	2.8	137	0.25	12.2	2.3	113
Average	24.6	4.87	2.77	134.3	0.25	12.3	2.33	113.7

*mean of 25 coconut basins during each year,**mean of 25 samples during each year

b) Organic manures:

Application of organic manures improves soil physico-chemical and biological properties, which ultimately enhances the yield. Apply any of the following organic manures (farmyard manure or green leaves or composted coir pith or vermicompost @ 25 kg per palm per year) along with the second dose of application of inorganic fertilisers (September-October) by opening basin to a depth of 30 cm in 1.8 m radius from the bole.

Ecofriendly vermicomposting technology:

The dried coconut leaves and other wastes in coconut plantations (Fig. 2) can be effectively converted into vermicompost with a help of epigeic, pigmented earth worm, *Eudrilus* sp (Fig. 3). Coconut leaves and other wastes can be vermicomposted by heap method or pit method or in coconut basin itself. The length and breadth of the vermicompost unit in tanks or pit can be as per convenience but the depth should be less than one metre. For compost preparation, coconut leaves weathered for 2 to 3 months are to be used. The leaves are used as such or after chopping into pieces. As the earthworms prefer organic matter in the initial stages of decomposition, the collected coconut leaves are to be treated with cowdung slurry @100 kg per tonne of leaves and allowed to decompose for 2 to 3 weeks. Sufficient moisture is to be ensured by sprinkling water. Earthworms at the rate of 1000 worms per tonne of coconut leaves are to be introduced. It should be mulched with available organic wastes such as dry grass, straw or coconut leaves. Depending on the extent of weathering of leaves used for composting, 70 per cent recovery of the compost is obtained within a period of 60 to 75 days (Fig. 4).

Fig. 2. Pit method of vermicomposting

Fig. 3. *Eudrillus* sp of earth worm

Fig. 4. Vermicompost produced from coconut palm wastes

c) Balanced dose of inorganic fertilizers·

An adult coconut palm requires nutrients at the rate of 500 g nitrogen, 300 g phosphorus, 1000 g potassium and 165 g to 500 g MgO per palm per year. To get the nutrients in the above level, application of 1.1 kg of urea, 1.5 kg Mussoorie rock phosphate, 1.7 kg muriate of potash and 1 kg of $MgSO_4$ (3 kg for Onattukkara series of soils) is necessary. The fertilizer should be applied in two splits, one-third during April-May and two-third during September-October under rainfed condition and in four splits during January, April, July and October under irrigated condition. The deficiency of boron nutrition could be corrected by applying 150 and 300 g of borax for seedlings and adult palms, respectively, in two split doses along with the recommended dose of fertilizers.

II. Mulching with coconut leaves

Mulching the manuring basin with coconut leaves provides beneficial effects during summer months by reducing direct heating of soil surface and reducing evaporation of soil moisture (Fig. 5). Coconut leaves can be used for mulching during October- November and retained till April-May. *In situ* vermicomposting can be practiced by introducing earthworms in the basins.

Fig. 5. Mulching with coconut leaves in basins

III. Water management and drainage

During summer months, the palm experiences mild to severe stress which affect the nut and copra yield. Depending upon the availability of water and cropping system practiced in the garden, suitable irrigation methods can be adopted. The following are the irrigation methods found suitable for coconut gardens.

a) *Basin irrigation:*

This method can be adopted in a coconut monocrop garden. Open a basin of 30 cm depth with the radius of 0.75 m, 1.0 m and 1.8 m for 1 to 2 year old seedlings, for 3 to 4 years old seedlings and adult palms, respectively. Quantity of water to be applied for different aged palms is given in Table 2.

b) *Drip irrigation:*

This method is effective for coconut monocrop garden in water scarcity area. For one to two years old seedlings, place two emitters 50 cm away from the base of the seedling, whereas, for three to four years old seedlings place three emitters, 75 cm away from the base of the seedling. For adult palms, four emitters should be placed one metre away from the bole at equidistance by opening a small pit measuring 25 cm^3 in laterite and red loamy sand soil (Fig. 6), whereas, for littoral sandy soil use six emitters per palm placed at equidistance. This system of irrigation ensures water saving and higher water use efficiency in the field as it is applied in the root zone. Quantity of water to be applied for different aged palms is given in Table 2.

Fig. 6. Drip irrigation layout

Table 2 : Quantity of water to be applied for coconut

System of irrigation	Age of the palm	Quantity of water (litre/palm)
Drip irrigation	1 to 2 years	10 litre per day
	3 to 4 years	20 litre per day
	Adult	32-35 litre per day
Basin irrigation	1 to 2 years	25-30 litre once in 2 days
	3 to 4 years	75-80 litre once in 4 days
	Adult	250-300 litre once in 4 days

c) *Perfo-irrigation or Sprinkler irrigation:*

This system is ideal for cropping systems to ensure uniform distribution of water to all the crops (Fig. 7). Under high density multi-species cropping system, irrigate the field to a depth of 20 mm once in 4 days, which results in higher water use efficiency.

Fig. 7. Perfo-irrigation in HDMSCS

manure and recycled in the garden. In the garden, integrated practices for coconut root (wilt) management are being practiced and for other crops recommended packages of practices are being followed. Details of crops grown and their population are given in the Table 3.

Table 3. Crops with their population and planting year in HDMSCS plot in root (wilt) affected coconut garden (1 ha.).

Crops	Population	Year of planting
Coconut: Adults	125 Nos. (1995-1998) 112 Nos.(1998-2002)	1965
seedlings (Underplanted)	152 Nos.	1995-'96
Nutmeg (local):	45 Nos	1993-'94
seedlings	25 Nos.	2001
Pepper :Karimunda	30 Nos.	1993-'94
Panniyur-1	25 Nos.	2001
Panniyur-2	25 Nos.	2001
Karimunda	22 Nos.	2001
Banana: (Poovan, Njalipoovan, Robusta, Nendran, Palayankodan, Karpooravalli):	500 Nos.	1993-'94 and replanted once in 3 years
Pineapple (Kew):	3600 Nos. (up to 2000) 1920 Nos. (from 2000)	1993-'94 and replanted once in 3 years
Tuber crops:		
Elephant foot yam (Local):	100 Nos.	Annual crops planted during pre-monsoon period of every year
Colocasia (Local):	100 Nos.	
Dioscorea (Local):	100 Nos.	
Cassava (M4)	100 Nos.	

B. Impact of management practices and cropping system:

The following are the integrated management practices for coconut in root (wilt) affected garden:

- Growing cowpea as green manure crop in the coconut basin during April-May months and incorporating in the basin when it attains maximum growth during September-October.
- Application of organic manure during September-October.
- Application of inorganic fertilizer: N:P:K-@ 500:300:1000 g/palm/annum

applied in 2 splits in the form of urea, rajphos, and muriate of potash (1/3rd during May-June and 2/3rd during September–October) along with $MgSO_4$ – 1.0 kg/palm/annum.

- Need based plant protection measures particularly for leaf rot control were carried out as per the recommendation. For leaf rot control, cut and remove rotten portion of the spindle only and the adjacent two innermost fully opened leaves. Pour 300 ml of fungicide solution containing 2 ml of contaf 5% EC or 3 g Dithane –M-45 around the spindle leaf.
- Mulching with coconut leaves during November to May months.
- Recycling the available biomass in the garden through vermicompost.
- Irrigation was provided with hose irrigation during initial years and later perfo irrigation was adopted and water to a depth of 20 mm was provided at the IW/CPE ratio of 1.0.

(i) Impact on coconut yield and copra content:

Nut yield of coconut palms under different intensities of root (wilt) disease is given in Table 4. It is evident that, over the years there was increase in nut yield in palms of all the categories of disease. Average of five years nut yield indicated that, increase was to the tune of 54.5%, 52%, 48.3% and 40.9% under apparently healthy, disease early, disease middle and disease advance categories of palms over pre-experimental yield. There was not much difference in the copra content per nut in the different disease categories. The out turn of copra per palm was less under disease advanced palms due to the production of less number of nuts per palm.

The average nut yield obtained was 65 nuts per palm per year during 2001-'02 and 62 nuts during 2002-'03 compared to pre-experimental yield of 30 nuts per palm per year. Addition of organic manure and growing and incorporation of green manure crops in the coconut basins might have improved the soil characteristics, which exerted positive influence on growth and yield of nut. Such a beneficial influence has been reported by many workers in coconut and high density multi species cropping system. Overall, there was reduction in flaccidity and yellowing symptoms of the palms, which was mainly due to irrigation and application of $MgSO_4$. Effective control measure for leaf rot disease also resulted in increase in photosynthetic area and in turn benefitted growth and nut yield.

Table 4. Nut and copra yield over the years as influenced by integrated management practices and HDMSCS

Disease category	Average nut yield (Nuts per palm per year)							Copra content (g/nut) (2001-2002)	Copra outturn (kg/palm) (2001-2002)
	Pre-exptl. (1991-'93)	1997-'98	1998-'99	1999-'00	2000-'01	2001-'02	Average of 1997-2002		
Apparently healthy	44	48	53	64	88	87	68.0	179.3	15.6
Disease early	40	45	42	59	84	74	60.8	182.4	13.5
Disease middle	36	42	41	55	74	55	53.4	181.7	10.0
Disease advanced	21	29	28	30	35	26	29.6	180.6	4.7

(ii) Yield of different crops:

The yield of coconut and other component crops in the system over the years are given in Table 5. An overall increase in yield of different crops in the system was noticed. The average per plant yield of different crops grown in the system is given in the Table 6. Among the banana varieties studied, palayankodan and karpooravalli produced the highest per plant yield. Pineapple crop also gave an average yield of 1.2 to 2.0 kg fruit per plant. Tuber crops such as elephant foot yam, dioscorea, cassava and colocasia also performed very well in the system. Pepper planted during 2001 started yielding 2 years after planting. The nutmeg planted during 2001 also started yielding 3 years after planting and the yield of adult plants was reasonable in the system (Fig. 9 to 18).

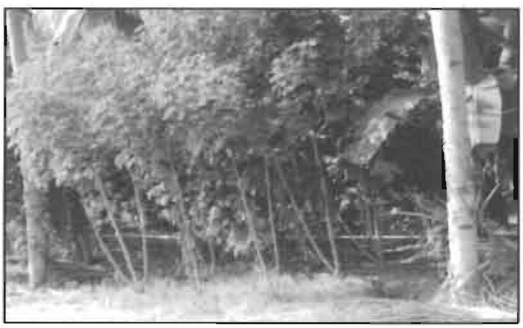

Fig. 9. Cassava as component crop

Fig. 10. *Dioscorea* as component crop

Table 5. Yield of coconut and component crops in HDMSCS in 1.0 hectare area over the years

Year	Coconut (Nos.)	Banana (kg)	Pepper (kg)	Pineapple (kg)	Nutmeg (kg) Mace	Nutmeg (kg) Nutmeg	Elephant foot yam (kg)	Dioscorea (kg)	Colocasia (kg)	Cassava (kg)
1993-'94	6149	975	-	-	-	-	280	310	205	-
1994-'95	6225	823	-	280	-	-	310	285	235	-
1995-'96	6115	912	25	385	-	-	230	260	-	-
1996-'97	6364	876	26	288	-	-	390	237	230	-
1997-'98	6053	660	28	320	5	8	350	260	-	-
1998-'99	4848	1339	32	298	8	13	360	289	187	-
1999-'00	6042	1102	28	315	12	20	355	305	-	-
2000-'01	8486	1030	26	268	14	23	302	387	-	-
2001-'02	6946	1792	35	-	10	25	204	222	568	568
2002-'03	5942	1752	20	87	6	18	146	-	-	172

Fig. 11. Banana and Pineapple as component crops

Fig. 12. Pepper trained on coconut

Fig. 13. Nutmeg as a component crop

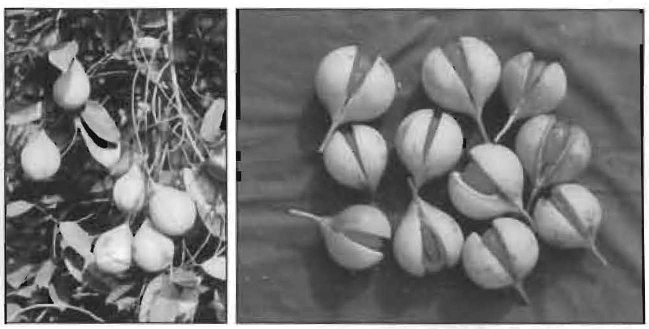

Fig. 14. Nutmeg Fruit

Table 6. Average yield of different crops in coconut based HDMSCS in root (wilt) affected garden

Crop/Variety		Yield/plant
Banana:	Poovan	15-20 kg/bunch
	Njalipoovan	14-19 kg/bunch
	Robusta	12-17kg/bunch
	Nendran	13-18 kg/bunch
	Palayankodan	20-24 kg/bunch
	Karpooravalli	22-25 kg/bunch
Pineapple (Kew)		1.2-2.0 kg /fruit
Elephant foot yam (Local)		7.5-9.0 kg/plant
Dioscorea (Local)		5.0-6.5 kg/plant
Colocasia (Local)		3.0-4.0 kg/plant
Cassava (M4)		7.0-9.0 kg/plant

Fig. 15. Njalipoovan banana variety as component crop

Fig. 16. Poovan banana variety as component crop

Fig. 17. Palayankodan banana variety as component crop

Fig. 18. Robusta banana variety as component crop

(iii) Recyclable biomass from the system:

The recyclable biomass obtained from different crops annually from one hectare of HDMSCS model is given below:

Coconut: 9515 kg

Banana: 2849 kg

Nutmeg: 52 kg

Weeds biomass: 2046 kg

The recyclable biomass of coconut and banana are being converted into vermicompost and recycled in the garden every year. The weeds are being slashed and left in the garden regularly.

(iv) Economics of the system:

The details of input cost for one ha of the system are furnished in Table 7. Over the years, the total cost of production has increased due to increase in labour cost which is the major constituent in the inputs. The total cost during the initial year was Rs 28,950/- (1993-94) and it increased to Rs 38,945/- per hectare during 2002-2003. The labour cost alone constituted 56 per cent of the total input cost, which indicates that the labour requirement was more in high density multi species cropping system wherein planting, replanting operations etc., need to be taken up in addition to normal operations. Hence adoption of coconut based HDMSCS provides additional employment for the farming family. In the system, crops like pineapple requires more labour for weeding operation and fertilizer application.

The total returns from the system are furnished in Table 8. From the data it can be clearly seen that, the total returns from the system was Rs 54,920/- during 1993-94 and it increased to Rs 86,871/- during 2002-2003 per hectare area. During 1999-2000 and 2000-2001, the price of coconut was very low and it resulted in lower returns from coconut, where as returns realized from intercrops were Rs 31,170/- and Rs 30,180/- per hectare, respectively. This indicates that, the system was able to provide more stabilized income to coconut farmers when the price of main crop coconut was low. The net return obtained from the system was Rs 25,970/- during 1993-94 and it was Rs 47,180/- during 2000-2001/-. The total variable cost involved in maintaining the system during 2001-2002 and 2002-2003 were Rs 38,214 and

Rs 38,945/, respectively per hectare. The net return obtained during 2001-02, was Rs 48,390/ (based on nuts sold), Rs 58,285/ (on copra equivalent basis) and the net return obtained during 2002-03, was Rs 47,926/ (based on nuts sold), Rs 66,201/ (on copra equivalent basis).

The cash flow analysis was performed using a discount rate of 12 per cent to assess the economic viability of the system. The analysis indicated that the system realized highly positive values of discounted incremental benefit. The benefit: cost ratio (BCR) and net present worth (NPW) were 2.28 and Rs 1,80,106, respectively, which indicated the additional return and economic worthiness of the system in the root (wilt) affected area.

Table 7. Details of input cost for coconut based HDMSCS (Rs./ha)

Year	Planting material	Org/inorg. fert.	Plant protection	Labour	Irrigation/ Misc.	Annuity	Total Cost
1993-'94	10500	2600	1100	12500	750	1500	28950
1994-'95	1000	3000	1500	12200	800	1500	20000
1995-'96	1100	3500	1600	13100	800	1500	21600
1996-'97	1200	7700	1800	14200	900	1500	27300
1997-'98	6200	8200	1950	16000	950	1500	34800
1998-'99	1200	9100	1975	17600	1000	1500	32375
1999-'00	1200	9800	2100	18200	1000	1500	33800
2000-'01	1400	10100	2200	21000	1050	1500	37250
2001-'02	1050	9864	1750	22800	1250	1500	38214
2002-'03	850	10045	1200	24050	1300	1500	38945

Table 8. Details of returns of various component crops and economic analysis of coconut based HDMSCS (Rs./ha) in root (wilt) affected garden

Year	Coconut*	Banana	Pepper	Pineapple	Nutmeg	Tuber crops	Miscellaneous	Total returns**	Net returns**
1993-'94	36587	7150	-	-	-	5080	3500	49170	21720
1994-'95	37038	6035	-	1867	-	4922	3500	53365	34865
1995-'96	38509	7296	3750	2823	-	3810	3800	59990	39890
1996-'97	40163	7008	3900	2112	-	5325	3800	62310	36510
1997-'98	42350	5280	3500	2346	2450	4726	3950	64600	31300
1998-'99	31609	10712	4000	2185	4475	5112	4000	62090	31220
1999-'00	37730	8081	3500	2310	7280	4810	4200	67910	35610
2000-'01	49744	8932	3120	1965	7875	4908	4500	81040	45290
2001-'02	46655	19707	2112	-	6500	6430	5200	86604	48390
2002-'03	50173	21024	1176	870	5100	2028	6500	86871	47926

*Coconut returns were worked out for 175 adult palms

**Rounded up figures

C. Mixed farming system:

The farming system approach is now gaining importance as it provides economic sustainability to farming and ensures sustainable productivity of crops. In India, there is less scope for horizontal expansion of cultivation due to paucity of land, therefore alternative is on diversification in agriculture and adoption of integrated farming system. Adoption of such system ensures increased food supply, recycling of crop/farm residues, restoration of soil fertility and conserving environment, increased employment potential for a coconut farmer etc.

Growing fodder crops as mixed crops in coconut garden coupled with integrating dairy enterprise in root (wilt) coconut garden ensures additional employment, income for a coconut farmer along with restoring soil fertility without affecting coconut yield.

A field trial at CPCRI, Kayangulam indicated that, among fodder crops, guinea grass (macuni variety), and hybrid napier (NB-21 and CO-3) (Fig. 19) grow well in coconut garden and provide green grass throughout the year under irrigated condition. Mixed farming system with dairy as a component enterprise with four cows are being maintained (Fig. 20).

Fig. 19. Hybrid napier(CO-3) grass

Fig. 20. Cows as component of mixed farming system

(i) Azolla as a feed for cows in coconut based mixed farming system:

Azolla is a small floating water fern, which harbours a symbiotic blue-green algae (BGA), *Anabaena azollae* responsible for the fixation and assimilation of atmospheric Nitrogen. Azolla in turn provide the carbon source and favourable environment for the growth and development of the BGA symbiont. In Azolla the endo-symbiont BGA is even carried through the sexual reproductive phase. The Azolla-Anabaena is a living floating nitrogen factory using energy from photosynthesis to fix atmospheric nitrogen.

Azolla is rich in protein containing almost 50-60% protein on dry weight basis. Azolla biomass also contains essential minerals like Iron, Calcium, Magnesium, Potassium, Phosphorous, Manganese etc., apart from appreciable quantities of vitamins A and B. It is also found to contain almost all of the essential amino acids, many probiotics, bio-polymers and β-carotene. The above mentioned bio-chemical constitution along with the rapid multiplication rate makes Azolla an ideal organic feed substitute for livestock apart from its utility as Bio-fertiliser for wetland paddy. It can be easily digested by livestock due to its high protein and low lignin content of plant body.

In this context, in coconut based mixed farming system involving dairy as one of the components, Azolla can be raised in pits lined with polythene sheets and the biomass generated can be used as a feed for cows.

(ii) Method of growing Azolla:

An artificial water body is made preferably under the shade of palms with the help of silpauline sheet of size 2.6 mX1.6 m. A pit of 2 m length and 1 m width and 20 cm depth should be dug as the first step. The pit is covered with silpauline sheet and spread over the pit (Fig. 21). About 10–15 kg sieved fertile soil is uniformly spread over the silpauline sheet. One kg of cow dung made into a slurry in 10 lit water is poured into the sheet, and 10-20 g rock phosphate also has to be added along with the cow dung. More water is poured to make the water level to a height of about 10 cm. Fresh and pure culture of Azolla (500 g to 1.0 kg) is inoculated in the pit. Azolla will fill the pit within 10-15 days

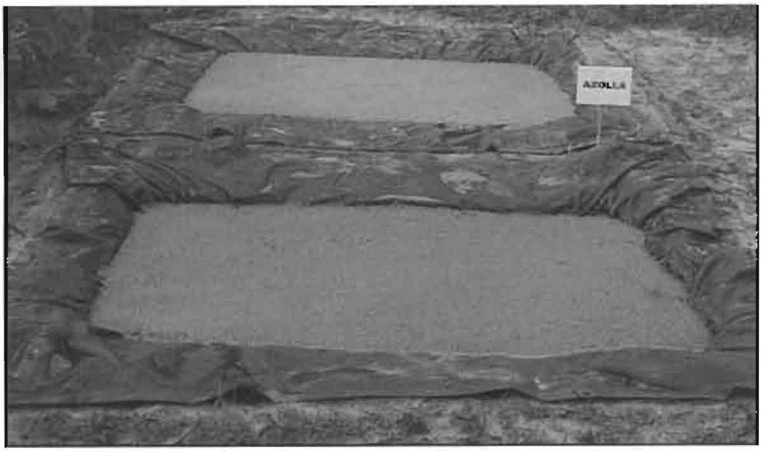

Fig. 21. Azolla culture

and about 0.5 kg to 1.0 kg Azolla can be harvested daily there after. Rock phosphate and cow dung at the rate of 10 g and 500 g, respectively, should be added once in five days to keep the Azolla in rapid multiplication phase and to maintain the daily yield of one kg per pit.

Summary

Coconut root (wilt) disease is a non-lethal, debilitating malady that affects the production potential of palm. There are no therapeutic control measures for the disease, however, research efforts have resulted in evolving viable technologies to increase the productivity of the diseased palms. In a situation where the coconut sector is threatened with recurring uncertainties, the need for a farm practice that augments the coconut farm income becomes clear and urgent. Adoption of suitable agronomic techniques results in increased and sustained productivity of root (wilt) affected coconut palms over the years. Integration with suitable cropping/farming system in root (wilt) affected garden ensures additional employment and income for a farmer and recyclable organic waste for recycling in the garden, which ensures sustainable productivity of the system over the years.