

Comprehensive income generation through coconut based cropping systems

● D. Rajakumar, H.P. Maheswarappa, S. Thiruvarassan, A. Selvarani and N. Shoba
CRS, Aliyarnagar (AICRP on Palms), (TNAU, Coimbatore)



Coconut is mostly a crop of small farmers in India and the income derived from the small and fragmented holdings is not adequate to meet the economic requirements of farmers. To address this issue, adoption of coconut based cropping systems including intercropping, multiple cropping, multi-storied and high density multispecies cropping systems is most suitable for increasing the production and productivity per unit area and thereby generating better income to coconut farmers.

Coconut palm has a wide range of attributes which make it fit for cultivation under diverse ecological conditions. In India, four South Indian states Kerala, Tamil Nadu, Karnataka and Andhra Pradesh are the main coconut growing states which together accounts for 90 per cent of area and 93 per cent of production. Tamil Nadu ranks third in area, first in production and second in productivity in the country and coconut occupies 4.7 per cent of the total cropped area of the state and is the largest horticultural crop grown in the state. Though it is grown in almost all the districts of the state, the major coconut growing districts are Coimbatore, Tirupur, Thanjavur,

Dindigal, Kanyakumari, Krishnangiri, Vellore, The Salem, Thirunelveli and Erode. It has been reported that there are 3.52 lakh coconut holdings in the state of which 95.4 per cent are less than 1.25 ha. Coconut farmers often face constraints like declining productivity due to drought, pest and diseases and fluctuating coconut prices resulting in lower income. To bring out sustainability in coconut based agriculture, it is necessary to increase the productivity of the crop as well as the income from the holdings.

Means of increasing income

One of the feasible ways to step up production and

enhance the income is to grow compatible annual or perennial crops along with coconut. Coconut is an eco-friendly crop which permits coexistence of multi-species plants during its different growth stages and thus the overall productivity of the land under this long-duration crop can substantially be increased. This besides giving immediate returns will also meet the varied needs of the farmer and provide gainful employment to family labour.

Coconut based cropping systems

Coconut based cropping system is a strategy to overcome the sub optimal utilization of bio-physical resources by coconut monoculture and thereby increase the farm income. A large number of compatible crops both annuals and/or perennials are grown under coconut in different geographic and agro-climatic regions. Many researchers have also attempted to evaluate the economic feasibility and biological productivity of coconut based cropping system models which can be classified as intercropping, mixed cropping, multiple cropping, multistoried cropping system and high density multi-species cropping systems.

Table 1: Yield of medicinal and aromatic plants and nut yield (per year) of coconut in medicinal and aromatic crops intercropping system

Treatments	Economic part	Yield (kg/ha)	Pre treatment nut yield (2005 - 07)	Mean nut yield (2007 -11)
Medicinal Plants				
Siriyangai (Andrographis paniculata)	Leaves	2030	115	124
Sitharathai (Alpinia galanga)	Rhizomes	5830	141	142
Karisalankanni (Eclipta prostrata)	Leaves	1820	120	125
Aromatic plants				
Patchouli (Pogostemon patchouli)	Leaves	1625	133	135
Lemongrass (Cymbopogon flexuosus)	Leaves	7510	121	124

Intercropping

It is the practice of growing seasonal, annual and biennial crops in association with young and adult coconut and stand simultaneously in the same area of land in the same year. Crops like banana, pineapple, papaya, ginger, turmeric and elephant foot yam are traditional important intercrops in coconut gardens. Economic returns are high with banana and pineapple, whereas,

vegetables are mostly grown for household consumption.

With an objective to find the feasibility of introducing elephant foot yam as a component of coconut based intercropping system in the Western and Eastern zones of Tamil Nadu, Coconut Research Stations (CRS) of Aliyarnagar and Veppankulam of Tamil Nadu conducted studies during 2009 to 2011 with Sree Padma and Gajendra varieties. In a total area of 0.4 ha of the experimental site, elephant foot yam occupied about 60 per cent of the area and the economics of cultivation was worked out. An average of 11,287 and 9756 kg of yam was harvested with a net income of Rs.77, 260/- and Rs.61,822/- per ha at Veppankulam and Aliyarnagar, respectively.

Medicinal and aromatic plants as intercrops

As many tropical medicinal and aromatic plants are well adapted to partial shade, moist soil, high relative humidity and mild temperatures, they could be intercropped with plantation crops. Study conducted at Aliyarnagar, indicated that there was



no reduction in nut yield of coconut due to intercropping of medicinal and aromatic plants. The reason for this beneficial interaction might be that the palms are benefitted by the manures and fertilizers given to the intercrops, elimination of weeds, soil interculturing and other management practices. Lemongrass and Sitharathai registered the highest additional net income of Rs. 21,129/ha and Rs.27,966/ha, respectively.

Multistoried cropping

This is the multispecies crop combination involving annuals and perennials with an existing stand of a perennial. In case of multi-storied cropping, the crops selected should have small, medium and large canopy



architecture and are to be planted in a systematic manner to exploit space both in vertical and horizontal

dimensions. The root system of all these crops will also have different foraging zones and thus help in mining nutrients from different soil layers. An example of successful multi-storied cropping was found to be combination of Coconut + Black pepper (Panniyur 1) + Banana (Robusta) + Elephant foot yam (Sri Padma) + Coriander, followed by the model with Coconut + Banana (Robusta) + Black pepper (Panniyur 1) (Table 2), which have provided higher net returns. By growing such multispecies in coconut garden, there was no reduction in the yield of coconut rather improvement in yield has been recorded .

High Density Multi-Species Cropping System (HDMSCS): It is the simultaneous cultivation of large number of species (annual, biennial and perennial) of crops having canopies of various heights (small, medium and large) and rooting pattern in the same field at higher plant density. This system ensures effective utilization of natural resources such as land, water, light and space and provides biomass for recycling in addition to providing maximum returns per unit area. It not only ensure economic returns to the farmers but also provides more employment opportunities for the farm family. The most profitable HDMSCS with coconut as main crops would be the inclusion of

Table 2. Yield and economics of various cropping system models at Coconut Research Station, Veppankulam (2007-10)

Models	Crops	Economic yield (kg / 0.5 ha)	Gross Income (Rs./ha)	Cost of Cultivation (Rs./ha)	Net Income (Rs./ha)
I. Mono crop			155750	82177	73573
II. Coconut + black Pepper + banana	pepper	66	271607	124177	147415
	Banana	16469			
III. Coconut + black pepper + banana + bhendi	pepper	66	255656	117253	143432
	Banana	5610			
	bhendi	4281			
IV. Coconut + black pepper + banana + Elephant foot yam + Coriander	pepper	66	315049	133580	175812
	Banana	6060			
	E.F. yam	9266			
	Coriander	647			
V. Coconut + black pepper + banana + turmeric + Coriander	pepper	66	218788	128635	89090
	Banana	5753			
	Turmeric	6499			
	Coriander	605			
VI. Coconut + black pepper + banana + pineapple	pepper	66	254488	122537	136087
	Banana	5613			
	Pineapple	2575			
VII. Coconut + black pepper + banana + tapioca	pepper	66	184926	112077	77272
	Banana	5595			
	Tapioca	8339			
VIII. Coconut + black pepper + banana + Mango ginger	pepper	66	248735	114462	143618
	Banana	5551			
	Mango ginger	9500			



Keys for successful cropping system management

Adequate supply of water, nutrients and labour are the major inputs needed for the success of the system. It is also likely that there will be negative interaction leading to adverse effect on the main crop (coconut) and/or the intercrop if the intercrops are not adequately and properly managed. Scarcity of water, lack of funds, price instability, lack of technical know-how on intercrop management, lack of awareness on profitability and problems of timely availability of inputs are the major constraints experienced by farmers in expanding intercropping. Though intercropping in coconut does not affect the productivity of the main crop, the selection of intercrops should be such that they make the best use of natural resources without unduly competing with coconut. ■

black pepper, cocoa, pineapple, banana and various vegetable crops as component crops with canopy at different heights. Apart from this there exist great scope for reducing fertilizer input and taking up organic farming in future with the recyclable

biomass generated in the system from different crops, which can be recycled in the form of vermin compost. The realised yield and economic returns from the system is given in Table 3.

Table 3. Yield and net return of high density multi-species cropping system at Coconut Research Station, Aliyarnagar (2012-14)

Treatment	Coconut (Nuts/ha)	Cocoa (kg/ha)	Banana (kg/ha)	Moringa (kg/ha)	Pineapple (kg/ha)	Net income (Rs./ha)
T1 - 75 % of RDF + organic recycling	16450	222	23100	6200	2700	3,07,657
T2 - 50 % of RDF + organic recycling	20650	259	23100	6500	2250	3,51,815
T3- Fully organic	16100	268	22750	7020	2200	3,10,822
T4 - Control (Coconut monocrop)	18200	-	-	-	-	99,823



Coconut as a sole crop utilizes biophysical resources sub-optimally and brings low returns per unit land area. Coconut based cropping system fetches more income and creates opportunities for employment generation with the advantage of better and more intensive utilization of land. Care should be taken in choosing appropriate intercrops during different growth stages of coconut since the biophysical, climatic and edaphic requirements of intercrops vary with the agro-climatic regions. With the effective management of such cropping systems, productivity per unit area and economic returns can be enhanced.