



Food security through intercropping of tuber crops in coconut gardens- Opportunities under 'Subhiksha Keralam' initiative

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Background

Agriculture sector has suffered huge loss due to the COVID-19 pandemic induced lock down and subsequent disruptions in the agricultural supply chain. Taking into cognizance the problems experienced by farmers and other stakeholders due to the lock down, the Government of Kerala has been implementing various measures to overcome the crisis in farm sector. Kerala State has been traditionally food insecure due to its unique agro-ecological features favouring cultivation of perennial commercial crops and it heavily depends on other States to meet its basic food requirement. Of course, there has been an impressive gain in vegetable production in the State during the last few years due to implementation of specific schemes. In spite of this, the State produces only 60 per cent of its vegetable requirement. Further, Kerala depends on other States for 85 per cent of the total quantity of its total food grain requirement. It is a risk in the

long run for the State to depend heavily on other States for the supply of food commodities especially considering the continuing COVID 19 pandemic scenario.

Under these circumstances, Kerala government has initiated a comprehensive programme viz., 'Subhiksha Keralam' with the aim to increase food production and attain food self-reliance to the extent possible. Effective utilization of available land; fallow land, homesteads or terraces of houses, to increase food production is the basic approach of the initiative. Besides enhancing food production, interventions for processing and value addition to enhance income and employment opportunities are also envisaged under the initiative.

It is envisaged to implement the initiative ensuring large scale people's participation and through the coordinated efforts of various government departments viz., Agriculture, Animal Husbandry, Dairy Development, Fisheries, Water



Resources, Cooperative, Industries and various LSG institutions. It is also proposed to link the initiative to the activities under Haritha Keralam Mission, Kudumbasree Mission and MGNREGA, ensure involvement of Agriculture, Veterinary and Fisheries universities in the State and seek cooperation of educational institutions, public sector institutions, cooperatives, youth clubs, mass organizations and residents associations for effectively implementing the interventions under ‘Subhiksha Keralam’. Reports from various districts about the implementation of ‘Subhiksha Keralam’ initiative clearly indicate that it is quite possible to achieve the objectives of the project.

Food security through intercropping of tuber crops in coconut gardens

The scope for expanding the land area for enhancing food production is very much limited in Kerala and hence, efforts are needed to increase food and nutritional security and income per unit area per unit time through intercropping and integration of livestock and related enterprises. Moreover, area under food crops is declining and the general trend in the state depicts a shift in the cropping pattern from food crops to cash crops. Under these circumstances, utilisation of the potential for multiple cropping in coconut gardens to enhance food production in the state assumes much significance. Coconut plays a vital role in the agrarian economy of Kerala state and it occupies about 37.4 % of the net area sown in the state. It is highly amenable for multiple cropping and hence it is highly relevant that strategies for promoting cultivation of food crops as intercrops in coconut gardens are implemented to enhance food security in the state. Details of area under coconut cultivation in different districts in Kerala state is given in table 1.

Table1. District wise area under coconut in Kerala state (2018-19)

Sl. No.	District	Area (ha)
1	Kasaragod	65999
2	Kannur	83663
3	Wayanad	10121
4	Kozhikode	115706
5	Malappuram	104685
6	Palakkad	55502
7	Thrissur	79776
8	Ernakulam	39275
9	Kottayam	25514
10	Idukky	14514
11	Pathanamthitta	15816
12	Alappuzha	33755
13	Kollam	45473
14	Thiruvananthapuram	71158
	Total	7,60,946

(Source: Agricultural Statistics 2018-19, Department of Economics and Statistics, Thiruvananthapuram)

Agronomic feasibility of coconut based multiple cropping

Coconut as a monocrop does not fully utilize the basic resources such as soil and sunlight available in the garden. The active root zone of coconut is confined to 25 per cent of the available land area and the remaining area could be profitably exploited for raising subsidiary crops. The orientation of leaves in the coconut crown helps penetration of sunlight into the soil and provides opportunities for exploitation of land and solar energy for inter/mixed cropping. Coconut offers scope for intercropping in the initial stages of the growth of palms and mixed cropping in the later part of life of palms. The light incident on the interspaces in coconut decreases with the increase in the age of the plantation, and very little light reaches the ground when the palms are around 8-10 years because of short stature of palms and greater foliage. This intensely shaded situation lasts up to the age of 20 years. Thereafter, increasing amount of slant light and filtered light reaches the lower profile of the coconut canopy due to the leaf orientation and at about 30 years of age 30% of the total light incident in the area reaches the ground. The amount of light penetrating the canopy, thereafter increases with the age of the palm as the tree height increases.



Arrowroot



Cassava



Dioscorea

This characteristic feature of coconut offers scope for crop intensification in coconut gardens. In a coconut plantation, maximum solar energy is received for intercropping during the early stages (<8 years), minimum quantity is received at the early production stages (8-25 years), during which shade tolerant/loving crops can be intercropped and again it increases with the age of the trees.

Different tuber crops which can be raised along with coconut as intercrops depending on the availability of solar energy are listed in Table 2.

Table 2. Options of tuber crops for intercropping in coconut at various stages	
Age of coconut palms	Tuber crops
< 8 years	Cassava, Elephant foot yam, Yams
8-25 years	Elephant foot yam, Taro, Tannia, Arrowroot
> 25 years	Cassava, Elephant foot yam, Taro, Tannia, Yams, Arrowroot and Chinese potato

Desirable traits of roots and tubers as intercrops

- They have higher biological efficiency and ability to produce higher dry matter per unit area per unit time.
- They are adapted to marginal environments, poor soil and adverse climatic conditions and have great flexibility to adapt to mixed farming systems.
- Tropical tuber crops especially arrowroot, yams and aroids are shade tolerant or shade loving.
- They are shorter in stature than coconut and will hence never over-grow the main crop.
- Tuber crops such as cassava and yams are resilient to climate change and can withstand drought and heat to a certain extent and are less water demanding crops.

- These crops can be grown with less external chemical inputs and instead help to recycle the organic wastes available in the coconut garden.
- The harvested tubers of arrowroot, yams and aroids have good shelf life under well aerated storage and great market demand.

Tuber crops as intercrops in coconut

Experimental evidences indicates that yield was promoted by 5-15% in coconut under intercropping with tuber crops. In general, indigenous yams (greater yam and lesser yam), edible aroids (especially tannia and elephant foot yam) as well as arrowroot were suitable for intercropping. Of the various tuber crops, arrowroot produced higher rhizome yield (7%) under intercropping.

Crop management practices for tuber crops intercropped in coconut gardens

A brief summary of the management practices to be followed for intercropping tuber crops in mature coconut gardens of more than 25 years under rainfed conditions is given in Table 3.

The tuber crops partially meet the food requirements of a farm family and have always found a place in the homestead gardens in Kerala state. The agronomic feasibility and economic viability of coconut based multiple cropping, which involves growing a large number of crops including tuber crops, has been demonstrated under various research projects implemented by ICAR-Central Plantation Crops Research Institute in farmers' field. Growing tuber crops as intercrop is one of the options to increase the productivity and economics of the coconut based cropping system. Elephant foot yam, cassava and dioscorea were intercropped in selected coconut gardens under the NAIP project on 'Value chain in coconut'. These tuber crops are cheap source of food and energy and are capable enough

Table 3. Management practices for tuber crops intercropped in coconut gardens

Intercrop	Time of planting	Suitable variety	Method of planting, spacing and plant population per ha	Manures		Duration (months)
				FYM t ha-1	NPK kg ha-1	
Cassava	May-June	Sree Pavithra Sree Reksha Sree Vijaya Kalpaka	Mounds 90x90 cm (9,000 plants)	9	50:50:100	8-10
Elephant foot yam	March-April	Sree Athira Sree Padma Gajendra	Pits 90x90 cm (9,000 plants)	20	26:20:33	8-9
Greater yam	April-May	Sree Keerthi Sree Swathy Indu	Pits 90x90cm (9,000 plants)	9	80:60:80	8-9
Lesser yam	April-May	Sree Latha	Pits 75x75cm (12,000 plants)	8	60:30:60	7
White yam	April-May	Sree Priya Sree Haritha	Pits 90x90cm (9,000 plants)	9	80:60:80	8-9
Arrowroot	May-June	Local selection	Raised beds 30x15cm (1,30,000 plants)	10	50:25:75	9-10



of tuber crops in coconut gardens under ‘Subhiksha Keralam’ initiative

Farmer Producer Organisations (FPOs) in coconut sector and women SHGs under Kudumbasree Mission can be facilitated to take up interventions on intercropping of tuber crops in coconut gardens under ‘Subhiksha Keralam’ initiative. Apart from the coconut gardens owned by farmers who are willing to take up intercropping of tuber crops, coconut gardens neglected by land owners due to various socio-economic factors also need to be utilised for promoting tuber crops under ‘Subhiksha Keralam’. Appropriate institutional arrangements are to be made for utilising such coconut gardens for intercropping. LSGIs and State Department of Agriculture Development & Farmers’ Welfare can formulate and implement suitable schemes to incentivise intercropping of tuber crops in coconut gardens. Timely availability of quality planting materials of tuber crops is to be ensured for effective implementation of such interventions besides providing support for marketing. Awareness creation among farmers about the benefits of intercropping needs to be emphasized and interventions for promoting intercropping of tuber crops in coconut gardens need to be implemented in a campaign mode with active participation of farmers, FPOs and women SHGs. ■

to withstand biotic and abiotic stresses. The yield of tuber crops as intercrops in coconut garden in farmers’ field varied between locations and mostly influenced by the level of crop management and planting density of coconut palms. Analysis of interventions carried out by CPCRI in farmers’ field under the IPGRI – COGENT project on ‘Developing sustainable coconut based income generating technologies in poor rural communities in India’ also revealed the feasibility of intercropping tuber crops in coconut gardens. There is huge potential for growing tuber crops profitably as intercrops in coconut gardens and hence, ‘Subhiksha Keralam’ initiative needs to have specific strategies for promoting intercropping of suitable tuber crops in coconut gardens to attain food self-reliance to the extent possible as envisaged.

Strategies for promoting intercropping