Intercropping in coconut garden and model coconut farms

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Competitiveness in the field of agriculture is possible through increased production with lesser cost of production. In our country, about 80 per cent of the coconut holdings are either small or marginal and the average holding size is around 0.22 ha. Income derived from such farms is quite insufficient to sustain even small families. They also do not provide gainful employment to sustain their basic needs. The monoculture system of cultivation of coconut, in most of the cases, leads to very low productivity and poor income.

Intercropping

With a spacing of 7.5 m in the square system, around 75 percent of the planted area of land is unutilized. This could be effectively utilized for raising compatible crops. The venation structure of the coconut crown and orientation of leaves allow part of incident solar radiation to pass through the canopy and fall on the ground. These features of coconut palms offer considerable scope for increasing production and productivity per unit area, time and inputs by more efficient utilization of resources like sunlight, soil, water and labour.

Crop diversification in coconut gardens is of greater significance and inter/mixed cropping is the best option to enhance income of the coconut farmers from a unit holding by using horizontal and vertical space more efficiently. Smallholders cultivate intercrops with coconut either as an old farming tradition, or because of increasing land occupation pressure, in order to make maximum use of cultivated areas by intensifying the farming system.

Banana grown as intercrop

In coconut based cropping system, careful attention should be given for management of different crops in order to exploit their genetic potential and available resources. Crops can be generally classified into four groups (Table 1) based on their reaction to sunlight/shade. Various crops should be selected based on the reactions to intensity of sunlight/ shade available in the coconut gardens.

Schedules for inter/mixed cropping are to be considered based on the canopy size, age and spacing of palms. From the initial time of planting seedlings till full development of canopy (up to 8-9 years), good light transmission is possible and, hence, this period is suitable for growing various intercrops with minimal competitions. During the subsequent growing period of young palms (9-25 years), there will be maximum ground coverage making the light availability to be low and hence shade tolerant crops can be cultivated as intercrops. During the growth phase of grown up palms above 25 years, there will be decrease in apparent ground coverage leading to gradual increase in the magnitude of light penetration

Table 1.

Classification of crops based on tolerance to sunlight/shade for intercropping

Sl.no.	Parameter	Effect on production/remarks	Example of crops
1	Non-tolerant to even slight shade	Drastic decline in yield even under slight shade. Cannot be grown successfully as intercrop	Paddy, Bhendi, sweet potato, leguminous plants, ground nut
2	Non-tolerant to shade	Yield decline increases with intensity of shade. Can be grown in border areas where more sunlight is available	Coleus, Brinjal, Tomato, Chilli, Dioscorea, Nendran banana
3	Tolerant to shade	Slight reduction in yield due to shade. Can be grown successfully when 50 % sunlight is available	Colocasia, Tapioca, Amorphophallus, Banana varieties other than Nendran
4	Shade loving	Yield increases to some extent with increase in shade. More ideal as intercrop than sole crop	Ginger, Turmeric, Arrow root, Kacholam

to the ground. Perennial crops can be cultivated in coconut garden as mixed crops. Availability of resources like rainfall, irrigation facilities, soil characteristics, labour, farmer's needs and market demand are the other factors to be considered while selecting the crops to be included as inter/mixed crops in coconut garden. Cultivating various annual intercrops on rotation basis will provide staggered income to the farmers.

1. Vegetables: Amaranth, Chillies, Bitter gourd, Snake gourd, Ash gourd, Tomato, Brinjal, Coccinia, Pumpkin, French bean
2. Fruit crops: Banana, Pine apple, Papaya, Guava, Lemon, Lime,Pomegranate, Sapota
3. Fodder crops : Hybrid napier, Guinea grass, Stylosanthes, Fodder cowpea, Hybrid bajra napier
4. Medicinal and Aromatic crops: Chittadalodakam, Karimkurinji, Nagadanthi, Vetiver, Indian long pepper, Kacholam, Patchouli
5. Flowering crops: Heliconia, Anthurium, Jasminum sp., Marigold, Gomphrena, Sunflower, Cox comb
6. Spices/Tree spices: Ginger, Turmeric, Vanilla, Black pepper, Nutmeg, Cinnamon, Clove
7. Tuber crops: Tapioca, Amorphophallus, Colocasia, Dioscorea, Yams (greater yam, lesser yam, African white yam),Taro, Sweet potato, Arrow root, Coleus
8. Pulse crops: Cowpea, Black gram, Green gram, Bengal gram, Red gram (short duration)-
9. Beverage: Cocoa, Coffee
10. Other crops: Mulbery, Glyricidia, Betel vine, Drum stick, Upland paddy

Planting of crops with varying rooting habitat at appropriate spacing would not only help avoid competition for water and nutrients, but enhance their use efficiency as well. In coconut garden when intercrops are to be planted, care should be taken to plant them (except for pepper) at least 2 m away from the radius of coconut. Nutrients and water should be applied for each crop separately as per schedule. Cultivating various types of crops in the coconut garden supplies good quantity of biomass for recycling and this helps to reduce the fertilizer requirement of the crops. Inclusion of compatible intercrops and their management practices will also help to improve the productivity of coconut. The details of agro management practices to be followed for some of the inter/mixed crops are given in Table 2.

Tapioca as intercrop in coconut garden

Table 2.

Management practices for intercropping in coconut garden

Intercrop	Time of planting	Method of planting, spacing	Manures		Duration (months)
			FYM (t/ha)	NPK (kg/ha)	
Tuber crops					
Elephant foot yam	March-April	Pits 90 cm x 90cm	20	26:20:33	8
Greater yam	April-May	Pits 90cm x 90cm	9	80:60:80	8
Lesser yam	April-May	Pits 75cm x 75 cm	8	60:30:60	7
White yam	April-May	Pits 90 cm x 90cm	9	80:60:80	8
Cassava	May-June	Mounds 90cm x 90cm	9	50:50:100	8-10
Vegetables					
Chilli	May-June (rainfed) Sept-Oct. (irrigated)	Transplant in shallow trenches / pits or on ridges 45 cm x 45 cm	20-25	75:40:25	
Brinjal	May-June (rainfed) Sept-Oct. (irrigated)	Transplant in shallow trenches / pits or on ridges 60cm x 60 cm for non-branching 60 cm x 75-90 cm for branching types	20-25	75:40:25	
Spices					
Ginger	First fortnight of April	Small pits at a depth of 4-5 cm. 25 cm x 25 cm	30	75:50:50	8-9
Turmeric	First fortnight of April	Small pits in the beds in rows 25 cm x 25 cm	40	30:30:60	7-9
Nutmeg	With the onset of southwest monsoon	Pits of 90cm x 90 cm x 90 cm at the centre of four coconut palms	10 kg per plant during first year, increase later on	20:18:50 g/plant during the first year, increase later on	
Fruit crops					
Banana	April-May (Rain fed) Aug.-Sept. (Irrigated)	Pits Poovan/ Palaynakodan- 2.1 m x 2.1m Robusta- 2.4 m x1.8 m	10 kg/plant at the time of planting	60-200 : 160-200 : 320-400 (in different split doses)	
Pineapple	May-June	Trenches (convenient length and 90 cm width and 15-30 cm depth) Double rows at 70 cm x 30 cm	25	320:160:320	
Beverage					
Cocoa	May-June	Pits Single row between coconut palms at the centre	15-20 kg/plant	100:40: 140 g / tree / year	

In coastal sandy soil, which is devoid of adequate soil nutrients and with low in water holding capacity, vegetable crops (amaranthus, pumpkin and ash gourd) and fruit crops (banana and pineapple) could be successfully grown as intercrops in coconut gardens by adopting appropriate soil moisture conservation measures viz., husk burial and coir pith application in the planting zone. In addition to the extra income realized by intercropping, it has a complementary impact on coconut productivity. This leads to the overall improvement in the productivity of the system as a whole. Among the tuber crops such as elephant foot yam, tapioca and diascorea, elephant foot yam was the most suitable intercrop under rain fed condition. Gajendra variety of amorphophallus is very well received by the farmers due to its good cooking quality and taste.

Model Coconut Farms

Sri Thankappan, Dwaraka, Krishnapuram of Alappuzha in Kerala owns 3.5 acres of coconut garden and cultivates various tuber crops, spices and different varieties of banana as intercrops. According to him Robusta and Njalipoovan are the most suited varieties of banana as intercrop. Elephant foot yam and colocasia are the most ideal tuber crops as they could be stored for longer time after harvest. He makes use of all the biomass for recycling through vermicomposting and applying to various crops.

Sri. Jospeh from Poovathussery of Ernakulam cultivates 70 nutmeg plants as mixed crop in his 1.25 acres of coconut garden. He could realize Rs.1.5 lakh through sale of nutmeg fruits and mace. He feels that the partial shade available in the coconut garden and irrigating the plants during summer are ideal for higher yield and income.

Sri.C.M.Mohamed, Vettom of Malappuram district in Kerala has successfully developed coconut based cropping model in his 10 acre coconut garden and cultivates 600 coconut palms, 200 arecanut palms, 150 nutmeg, 4,000 banana and different vegetables and root and tuber crops. The population of 150 coconut palms per hectare of coconut garden accommodates all other crops in inter-and intra-row spaces without causing mutual competition for growth resources.

Winner of the Kera Kesari award of Govt.of Kerala (2009-10), Sri M.M.Dominic of Anakkampoyil of Kozhikkode district maintains 12 acres of coconut garden. He has adopted a wider spacing of 12 m between palms to accommodate many inter/mixed crops including clove, nutmeg and cocoa apart from various tuber crops and medicinal plants. He adopts organic method of cultivation using vermicompost/farm yard manure.

Adoption of integrated farming in 6.5 acres of land owned by Sri J.Vijayan Pillai of Kottakkakam, Chavara of Kollam district was instrumental for the Karshakasree award of 2014. He maintains around 100 cows and uses the manure for various tuber crops, banana, vegetables and fodder grass intercropped in the coconut garden.

Coconut garden intercropped with tuber crops

Sri C.Sreekuraman, Karalmanna of Palakkad district cultivates 7 acres of coconut garden intercropped with tuber crops (elephant foot yam, colocasia, tapioca and arrow root), spices (ginger and turmeric) and cocoa. 1000 banana plants of various varieties (Nendran,Kannan, Kadali, Njalipoovan, Mysore Poovan),ginger varieties such as Mahima, Varada, Himalayan, Wayanad and Local as well as 1500 plants of elephant foot yam are successfully integrated in to the cropping system.

Cocoa, being a shade loving plant, is an ideal mixed crop in coconut gardens where the shade created by the adult palms is optimum for its growth. There is no serious competition for nutrients and moisture between the two crops because of the mutually exclusive rooting zones. Sri P.Y. Jose of Maruthonkara panchayat, Kozhikode district cultivates 200 cocoa plants in his coconut garden of 1.5 acres and earns around Rs.1.25 lakh as the price of cocoa pods are high.

Coconut garden intercropped with ginger

Conclusion

Coconut based cropping systems provide food security through food sufficiency; nutritional foods rich in vitamins and minerals (nutrients); employment generation from farm diversification; and ecological stability (environmental protection). Growing of intercrops in coconut gardens produces more food and agricultural products, thus ensuring food security of the people in rural and urban areas. At the same time, the practice generates jobs and livelihood, enhancing farm income and the purchasing power of people, thus alleviating poverty in farming communities. Moreover, successful farmers serve as inspiration and enterprise leaders in their communities, eventually treating coconut farming in an agribusiness way to create wealth and more capital resources.