CHAPTER 10

SPICES AND MEDICINAL PLANTS AS INTER CROPS IN COCONUT GARDENS

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1. Introduction

Coconut in India is primarily a crop of small farmers and about 98% of the coconut holdings in the country are less than 2.0 ha in size and more than 90% of them are less than 1.0 ha in extent. The income derived from such smallholdings is not sufficient to sustain even the small families. In addition, coconut as a monocrop provides employment only for about 135 man days per ha under rain fed conditions and consequently the family labour remains unemployed for larger parts of the year. Coconut based cropping/farming systems, involving cultivation of compatible crops in the interspaces of coconut and integration with other enterprises like dairying 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.

2. Resource Use in Coconut

A spacing of 7.5 m x 7.5 m in the square system is recommended for coconut (175 palms/ha) but in the homestead gardens of Kerala, the density is much higher (200 to 250 palms/ha) whereas in the malnad region of Karnataka state much wider spacings are adopted with densities as low as 120 palms per ha. Experimental evidences have shown that a sole crop of coconut, at the recommended spacing of 7.5 x 7.5 m does not fully utilize the available resources such as land space, aerial space, water and nutrients.

2:1. Rooting Pattern

Coconut palm like all monocots has a typical adventitious root system. Under favourable conditions, 4,000 to 7,000 roots are found in a middle-aged palm. Kushwah *et al.*, (1973) reported that about 74 per cent of the roots produced by a palm under good management did not go beyond 2 m lateral distance and 82 per cent of the roots were confined to the 31 to 120 cm depth of soil. Recent studies have confirmed that more than 80 per cent of the root activity was confined to a lateral distance of 2 m from the trunk (Maheswarappa *et al.* 2000). Thus 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.

2:2. Canopy Structure and Light Utilization

The venetian structure of the coconut crown and the orientation of leaves allow part of the incident solar radiation to pass through the canopy and fall on the ground. The leaves in a coconut palm crown are not randomly distributed, but clumped around few widely spaced growing points. This non-random distribution leads to low extention coefficient of around 0.65 for PAR. Age, spacing, varietal characteristics, leaf area and time of the day influence the light penetration through the canopy.

The amount of light transmitted ranges from 5% in a five to ten year old D x T hybrid at a density of 160 palms per ha to about 90% in a 60-70 year old plantation at a density of 120 palms per ha. Nair and Balakrishnan (1976) estimated that as much as 56 per cent of the sunlight was transmitted through the canopy during the peak hours (10-16 hours) in palms aged around 25 years. The diffused sunlight facilitates growing a number of shade tolerant crops in the interspaces.

Based on the growth habit of the palm and the amount of light transmitted through its canopy, the life span of coconut palm could be divided into three distinct phases from the point of view of intercropping.

1. Planting till full development of canopy (about 8 years): Good transmission initially, but decreasing with age-suitable for growing annuals/biennials.
2. Young palms (8 to 25 years): Maximum ground coverage and low canopy-poor light availability- less suitable for multiple cropping.
3. Mature trees (more than 25 years): Increase in trunk height; reduction in crown size - light transmission increasing with age - ideal for raising annual and / or perennial crops.

It is not very necessary always to fulfil all these exacting requirements to have successful crop combinations. But one must ensure that the correct crop is chosen. In most cases failure of inter/mixed cropping is due to the wrong choice of the crop(s).

In this chapter, problems and opportunities for cultivating different spices and medicinal plants are described:

Problems

- Diseases and pests
- Price fluctuation
- Marketing
- Processing facilities
- Availability of planting material
- Agrotechniques for cultivation

Opportunities

- Demand for organic produce in the international market
- Creating market facilities and processing
- Buy back system

3. Spices as Intercrops

Following are the important spices grown as inter/mixed crops in coconut gardens.

Black pepper (*Piper nigrum)*
Turmeric (*Curcuma longa*)
Ginger (*Zingiber officinale)*
Clove (*Syzygium aromaticum*)
Nutmeg (*Myristica fragrans*)
Vanilla (*Vanilla planifolia*)
Allspice (*Pimenta dioica*)

Cinnamon (*Cinnamomum zeylanicum*)
Cardamom (*Elettaria cardamomum*)
Chillies (*Capsicum anuum*)
Garcinia (*Garcinia indica*)

Ginger and turmeric are the important rhizome spice crops commonly intercropped in coconut gardens. Better performance under partially shaded conditions, fair market demand, easy processing and long storage life are some of the factors that favour growing these intercrops. Satheesan (1984) reported higher rhizome yield and higher curcumin content under intercropping stand compared to open space. Latha *et al.*, (1995) also reported higher fresh rhizome yield under partial shade conditions compared to open space. Babu and Jayachandran (1994) observed increased volatile oil content in ginger with the increase in the shade intensity.

Application of FYM+ Neemcake+AMF+*Trichoderma* resulted in higher yield of ginger when grown as intercrop in coconut garden (Sreekala and Jayachandran, 2006). Results of experiments conducted under the All India Research Project on Palms (AICRP) indicated successful establishment of ginger and turmeric in coconut gardens at Ratnagiri, Kahikuchi, Ambajipet and Veppakulam (AICRP, 2006).

Studies have indicated that under coconut based high density multispecies cropping system (HDMSCS) and mixed farming system, pepper variety panniyur 1 has performed better and yielded 1.2 to 1.5 kg/bush/year (CPCRI, 2004). Pepper yield (var.Karimunda) ranged from 1.2 to 1.4 kg/bush/year under coconut based HDMSCS in root (wilt) affected area (Maheswarappa and Anitha Kumari, 2005). Clove yield ranged from 1.2 to 1.4 kg dry clove per tree under coconut based HDMSCS (Reddy *et al.*, 2002). Nutmeg yielded on an average 1.0 to 1.2 kg mace and 7 to 8 kg seeds per tree per year under coconut based HDMSCS in root (wilt) affected area (Maheswarappa and Anitha Kumari, 2005).

Intercropping of tree spices like cinnamon, clove, nutmeg, garcinia, pepper and all spice in coconut gardens at Ratnagiri, Maharashtra increased the profitability of the system and there was increase in the nut yield of coconut compared to monocrop (Table 1)((Nagawekar *et al.*, 2002). Coconut + Nutmeg resulted in higher net profit of Rs 69,593/- per ha followed by coconut+cinnamon (Rs. 50,807/-per ha) compared to Rs 22,081/- per ha of coconut alone. Korikantmath *et al.* (2000) have described the yield pattern and economics of coconut based cardamom multistorey cropping.

Table 1. Average yield of coconut per palm in different blocks of spice crop at Ratnagiri.

Block/Yield	Cinnamon	Clove	Nutmeg	Allspice	garcinia	pepper	Control
Av. Pre-experimental yield	69.2	47.0	70.6 49.1	63.7	82.9	75.9*	
Yield after planting spices 1989 to 2000	120.6	91.2	120.3	88.6	93.2	102.2	-
% increase over control	74.1	93.8	70.5	80.3	46.4	23.4	-

* Average yield of 21 years.

Vanilla is another spice crop that comes up well in coconut garden. There is a demand for natural vanillin in the international market and hence its requirement will be increasing in the global market.

4. Medicinal Plants

Rajagopalan *et al.*, (1992) have reported 13 medicinal plants, which can be grown as intercrops in coconut garden. Studies conducted at CPCRI, Kasaragod have found that growth and yield of arrowroot and kacholam were higher when grown as intercrops in coconut garden than when grown in open space (Maheswarappa, 1997).

Arrowroot (*Maranta arundinacea*)

The starch is valued as a food for infants, invalids and convalescents. It is used in preparations of biscuits, cakes and jellies. Study conducted at CPCRI, Kasaragod revealed higher rhizome yield and improvement in qualitative characteristics under vermicompost, FYM and FYM +NPK treatments when grown as intercrop in coconut garden (Table 2) (Maheswarappa *et al.* 1999).

Table 2. Yield and quality characteristics of arrowroot as influenced by different treatments

Treatments	Fresh rhiz. yield (t/ha)	Starch(%)	Crude protein (%)
FYM: 26 t/ha	14.2	73.26	5.25
FYM: 34 t/ha	14.3	73.28	5.31
CCP: 32 t/ha	10.0	66.11	4.35
CCP: 42 t/ha	9.8	66.77	4.08
VC: 22 t/ha	14.7	73.30	5.26
VC: 30t /ha	14.9	73.30	5.30
FYM +NPK	17.1	73.24	6.00
NPK	12.5	73.23	5.28
Control	6.2	66.11	3.18
CD (P=0.05)	0.20	0.09	0.008

East Indian galanagal (Kacholam) (*Kaempferia galanga*):

The rhizome is the economic part. It is used as stimulant, diuretic, stomachic, carminative and flavouring agent.

- Oil finds use in perfumery and curry flavourings.
- Oleoresin

Study conducted at CPCRI, Kasaragod revealed higher rhizome yield and improvement in qualitative characteristic under vermicompost, FYM and FYM +NPK treatment when grown as intercrop in coconut garden (Table 3) (Maheswarappa *et al.* 2000).

Table 3: Yield and quality characteristic of east Indian galangal as influenced by different treatments.

Treatments	Fresh rhiz. yield (t/ha)	Oil (%)	Oleoresin (%)
FYM: 24 t/ha	5.5	1.99	3.65
FYM: 24 t/ha	5.5	1.95	3.75
CCP: 29 t/ha	3.8	1.90	3.52
CCP: 29 t/ha	3.9	2.00	3.52
VC: 21 t/ha	5.5	2.05	3.60
VC: 21 t/ha	5.5	2.05	3.75
FYM +NPK	6.2	2.02	3.85
NPK	5.1	2.01	3.77
Control	2.9	1.65	3.15
CD (P=0.05)	0.08	-	-

Following are the other medicinal plants being grown as inter/mixed crops in coconut garden at CPCRI, Kasaragod.

Shrubs/Herbs

- Oorila- *Desmodium gangeticum:* Root is the economic part
- Moovila – *Pseudartheia viscida :* Root is the economic part
- Chittadalodakam – *Adhatoda beddomei:* Whole plant has the economic value.
- Karimkurinji - *Nilgirianthus ciliatus:* Whole plant has the economic value.
- Nagadanthi – *Baliospermum montanum:* Root is the economic part
- Thippili – *Piper longum:* Dried spike and roots are the economic parts
- Panikkorkka – *Coleus aromaticus:* Leaves are the economic parts
- *Aloe: Aloe vera:* Leaves
- *Shatavari- Asparagus racemosus:* Roots
- Java long pepper – *Piper chaba: Dried spikes*

Grass

Vetiver/Ramacham – *Vetiveria zizanioides:* Root is the economic part: Used in ayurvedic medicine preparation and oil extraction.

Tree Species:

1. Sappan wood (Pathimugham) – *Caesalpinia sappan:* Heart wood and bark are the economic parts.
2. Bilva (Koovalam) – *Aegle marmelos:* roots, leaves, fruit, stem are of economic value.
3. Palakappayani – *Oroxylum indicum*: Whole plant along with roots
4. Coomb tree(Kumizhu) – *Gmelina arborea;* Whole plant along with roots
5. Poopathiri – *Stereospermum sauveolens:* whole plant with roots
6. Asokam – *Saraca asoca:* Bark and flowers have the economic value
7. Munja – *Premna serratifolia:* Roots, leaves, stem have the economic value.

Cultivation of medicinal plants like oorila and moovila, Nagadanti, Nilgirianthus, Adathoda has been found to generate an additional income of Rs 20,000/ to Rs 75,000/ per ha of coconut garden. Vetiver as an intercrop yielded 148 g of roots per plant

(1,050 kg/ha of coconut garden) and net income obtained form vetiver alone was Rs 70,000/-per ha. Growth of tree crops like sappan wood, bilva, comb tree and munja is satisfactory in coconut garden.

Organically grown spices and medicinal plants enjoy good demand in the domestic and international markets.

5. Conclusion

Coconut holdings are ideal for growing a variety of intercrops. Among these crops medicinal plant species have been found to be most ideal as they generate high income per unit area. As the demand for the produces of medicinal plants is on the increase, coconut farmers have to be encouraged to adopt intensive intercropping in their holdings for better income.

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