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FLORICULTURE FOR ENHANCING PROFITABILITY OF COCONUT GARDENS



ICAR-Central Plantation Crops Research Institute
Kasaragod – 671 124, Kerala, India

भाकृअनुष - केन्द्रीय रोपण फसल अनुसंधान संस्थान

कासरगोड़, केरल - 671 124, भारत

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Floriculture for Enhancing Profitability of Coconut Gardens

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P.Chowdappa

Director, ICAR-Central Plantation Crops Research Institute
Kudlu P.O.,Kasaragod -671124, Kerala
E-mail: director.cpcri@icar.gov.in
Website : www.cpcri.gov.in

Compiled and edited by

K. Nihad
V. Krishnakumar
Ravi Bhat

Photo credit

E.R.Asokan

Cover design

K. Shyama Prasad

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Floriculture for enhancing profitability of coconut gardens

India has a long tradition of floriculture. References to flowers and gardens are found in ancient Sanskrit classics like the Rig Veda (C 3000-2000 BC), Ramayana (C 1200-1300 BC), Mahabharata (prior to 4th Century BC), Shudraka (100 BC), Ashvagodha (C 100 AD), Kalidasa (C 400 AD) and Sarangdhara (C 1200 AD). However, the social and economic aspects of flower growing were recognized much later. The offering and exchange of flowers on all social occasions, in places of worship and their use for adornment of hair by women and for home decoration have become an integral part of human living. With changing life styles and increased urban affluence, floriculture has assumed a definite commercial status in recent times. Appreciation of the potential of commercial floriculture has resulted in the blossoming of this field into a viable agri-business option. With the domestic demand for flowers of all shapes and hues growing at 25 per cent annually and offshore demand rising at an equal pace, the floriculture industry has been accorded 100 per cent export-oriented status to help the country to develop into an international hub of flower production, auction, distribution and retailing.

World trade on floriculture produces like cut flowers, ornamental plants, flowering plants, flower seeds and plantlets are gaining tremendous momentum. Many

countries, particularly the developed ones, are importing flowers to meet their internal demand. According to the National Horticultural Board (2015) the total area under flower cultivation in India is 2.55 lakh ha with a production of 17.5 lakh MT of loose flowers and 54.3 million numbers of cut flowers. The major flower growing states of India are Tamil Nadu (55000 ha), Karnataka (30600 ha), West Bengal (24900 ha), Maharashtra (23000 ha) and Andhra Pradesh (20400 ha). The share of Kerala towards floriculture is negligible. The export value of flowers from India is Rs.4559 million which accounts only 3.2 % to the total value of horticultural crops. The loose flowers which have higher market demand in India are jasmine, marigold, coxcomb and *Gomphrena*. The cultivation of jasmine is labour intensive, whereas, marigold, *Gomphrena* and coxcomb are less laborious and can be grown as potential intercrops in coconut gardens of Kerala where labour is highly expensive.

Coconut is one of the major plantation crops of India covering an area of 21.4 lakh ha. The palms are perennial in nature and have a longer gestation period of 5-7 years. But unlike other plantation crops, coconut palms offer greater scope for intercropping mainly due to the wider spacing of 7.5 m adopted for planting. Coconut palms use only 25% of total land area due to its unique root and canopy



structure. The unutilized soil resources and under storey sunlight in plantations can be used effectively by growing compatible inter crops which do not affect the growth and yield of palms. Due to shading, plantations of palms during their early bearing phase are not very ideal for intercropping. Intensive intercropping with high value low volume crops not only provides additional farm income, but also increases the yield of palms. Loose flower crops come up well in full sunlight. Root (wilt) disease affected coconut plantations offer more light penetration giving ample opportunity for growing intercrops which require higher light intensity. Growing flower crops of higher market demand is a promising venture which can be effectively adopted in root (wilt) diseased coconut

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plantations. Flower crops have shallow root system, thus, demanding continuous irrigation which in turn favours the growth and yield of diseased palms. Intercropping also encourages biodiversity, by providing a habitat for a variety of insects and soil organisms that would not be present in a single-crop environment. This in turn can help in limiting outbreaks of crop pests by increasing predator biodiversity. In addition, flower crops improve the arrival and dispersal of honey bees that are important in coconut foraging and pollination. Intercropping utilizes space, nutrients and light effectively providing continuous employment coupled with enhanced remuneration to the farming community.

Heliconia as intercrop

Heliconia are tropical ornamentals mostly indigenous to the Neotropics (North of Mexico to the South of Brazil). *Heliconia* takes its name from Mount Helicon, the home of the ancient Greek gods. The genus includes about 100 species along with a large number of hybrids and cultivars. Recently *Heliconia* has gained much importance as one of the major commercial cut flowers in the tropics. Among the tropical flowers, *Heliconia*



Heliconia as inter crop in coconut garden

is outstanding for its diversity in form, colour, size and particularly, its vase life. *Heliconia* flowers are actually highly modified leaves called bracts, which may be erect, pendulous or spiraling in the shapes of bird's beaks, lobster claws or fan shaped and with colors of reds, pinks, gold, oranges and splashes of a mixture of colours. Its cultivation has now become a major factor in the agricultural economy of many countries such as Thailand. The requirement of light for growth and flowering of *Heliconia* varies from species to species. There is great potential for growing shade loving *Heliconia* as intercrop in coconut gardens. About 50 per cent of Indian production of cut flower *Heliconia* comes from the coconut farms located in the West Godavari district of Andhra Pradesh. In Kerala, where open areas are scarce and the cropping pattern is dominated by coconut palms, there is immense potential for exploiting it as a viable intercrop.

The list of some popular commercial varieties of *Heliconia* in India

Type	Variety	Scientific name	Market value (2014-15) (Rs per inflorescence)
Erect type	Iris	<i>Heliconia stricta</i>	20-30
	She	<i>H. orthotricha</i>	20-25
	Sunrise	<i>Heliconia stricta</i>	25-30
	Jaquini	<i>H. caribaea</i> x <i>H. bihai</i>	45-50
	Kawauchi	<i>H. bihai</i> X <i>H. caribaea</i>	40-50
	Caribbean	<i>H. caribaea</i>	60-70
Pendant type	Sexy Pink	<i>Heliconia chartacea</i>	50-60



Caribbean varieties



Iris



Jacquini



Sexy Pink



She



Sunrise



Kawauchi



***Heliconia stricta* 'Iris': A potential intercrop in coconut gardens**

For *Heliconia* cut flower industry, the characteristics of interest are:

- ◆ Production of inflorescences during the whole year;
- ◆ Short flowering cycle;
- ◆ Light flowering stems for lower transportation costs;
- ◆ Stems longer than 80 cm;
- ◆ Stems with diameter thick enough for better resistance to handling and for lighter total weight of inflorescence;
- ◆ Inflorescences with no wax and no hair; and bracts arranged in one plane for easier handling and packing;
- ◆ Inflorescence length of more than one meter;
- ◆ Firmness of bract;
- ◆ Bract with few or no flowers inside ; and
- ◆ Post harvest durability or vase life of more than seven days.



Heliconia stricta 'Iris' : A potential intercrop in coconut plantations

Heliconia stricta 'Iris' is a commercial variety with all the above preferred characteristics. Based on the inflorescence characters -fresh weight of stems (101 -200 g), stem diameter (10.1-30.0 mm), stem length (50.1-150.0 cm) and spike length (10.1-30.0 cm) – Iris variety is categorized under High Performance group. Depending on the marketing channel, a single inflorescence of *Heliconia stricta* 'Iris' can fetch Rs. 20 to Rs. 250 in the national market. Large flowers of this variety with more than one meter length can fetch \$2 to \$18 each in the International markets. At least 4 to 5 marketable inflorescences are produced in the first year of planting itself. It produces 45-50 inflorescences/ clump/year in the subsequent years. *H. stricta* needs to be replanted in every 3-4 years.

Unlike other cut flowers such as anthuriums and orchids, *Heliconia* 'Iris' comes up well in the natural microhabitat of coconut

canopy. Studies conducted at ICAR-CPCRI recorded that growing *Heliconia* for a period of three years in coconut plantations increased the yield of coconut by more than eleven percentage. There was improved soil moisture retention in coconut rhizosphere due to frequent irrigation which resulted in reduced button shedding and increased fruit setting.

Planting material

Rhizomes taken from seven months old healthy vegetative sucker are to be used for planting.

Planting

Planting can be done except during winter and heavy monsoon seasons. However, ideal time for planting Iris is from August to November. For commercial cultivation, at least 250



Planting of *Heliconia* rhizomes



Sprouted rhizomes

plants are to be planted which requires 25 cents of coconut plantation. The rhizomes are planted in pits of size 30 cm x 30 cm x 30 cm at 1.5 m leaving a distance of 2 m around the coconut basins. The pits are refilled with topsoil mixed with dried cow dung (1 kg/pit) and bone meal (250 g/pit). Mulching with dried leaves or coir pith is to be done after planting. Rhizomes start sprouting at 45 days after planting.

Irrigation

Heliconia plants always require moist soil. It needs to be irrigated once in two days during summer. The frequency of irrigation can be reduced to once in four days by providing mulching with coir pith compost during February-March.

Manuring

Heliconia 'Iris' can be grown either as purely organic or integrating organic manures and chemical fertilizers. The manures and fertilizers are applied at quarterly intervals beginning from three months after planting. For organically grown *Heliconia*, 200 g vermicompost and 100 g neemcake are applied per plant at three months interval. Dried coconut leaves can be converted to vermicompost using earthworms of *Eudrillus* sp. Half the dose of vermicompost and neemcake (100 g and 50 g per plant) along with 13:5:13 NPK (5 g/plant) can be given at three months interval for integrated method of cultivation.



Effect of cropping system and nutrition on inflorescence characters and BCR

Treatment	Inflorescence length (cm)		Carotenoid content (ppm)		BCR	
	OC	IC	OC	IC	OC	IC
17:17:17NPK	64.2	70.5	109.5	769.1	0.83	1.58
13:05:13NPK	88.8	101.7	100.6	827.1	1.30	2.73
VC(200g)+NC(100g)	105.6	104.7	91.7	1264.3	2.50	3.90
½(VC+NC)+bio*	78.7	97.2	85.8	1031.2	1.20	2.58
½(VC+NC)+13:05:13NPK	83.8	103.3	91.4	1008.7	1.90	3.38
M ^{mp}	84.2 ^b	95.5 ^a	95.8 ^b	980.1 ^a	1.55 ^b	2.89 ^a
CD ^{mp}	2.4		54.3		0.17	
CD ^{sp}	6.2		100.1		0.12	
CD ^{spxmp}	8.8		141.7		0.16	
CD ^{mpxsp}	8.2		136.6		0.22	

OC- Open condition, IC- Intercrop in coconut garden, VC-Vermicompost, NC-Neem cake, bio*-biofertiliser mixture *Azospirillum* and phosphobacteria @5 g/plant

In both the conditions, drenching diluted cow dung slurry in the ratio of 1:10 at six monthly intervals enhances the production of quality inflorescence.

Thinning of eight months old suckers with less than 7 cm diameter should be carried out monthly for promoting production of more number of quality inflorescences.



Prophylactic spraying

Plant protection

No major pest is recorded in *Heliconia* 'Iris'. However, fungal rotting of leaves is common during heavy monsoons. Prophylactic spraying with carbendazim 50% WP @ 1 g/l is to be adopted for controlling leaf rot.

Yellowing

Yellowing of leaves during the early growth stages is noticed in *H. stricta*. This is mainly due to nutrient deficiency, particularly of potassium. If yellowing persists, one time application of 60 g muriate of potash per plant is recommended at vegetative phase.



Typical yellowing

Harvesting

Heliconia 'Iris' starts flowering at eight months after planting. The harvesting is usually done before 9 am or after 4 pm by cutting the rhizome at ground level along with the inflorescence. After cutting, the outer leaves are to be stripped off and the top most leaf blades are cut leaving the petiole. The inflorescences have 10-12 days of vase life and can be used in stage decorations, bouquet making, long flower arrangements etc.

Inflorescences of around one meter length and nine centimeter stem girth with two or more open bracts are selected for sale. Smaller inflorescences can be used for value addition such as bouquets and table top arrangements. The cut end of the inflorescence stem is dipped in tap water for about an hour to remove the field heat. These are then washed in water for removing soil and dust. The excess water is wiped off and inflorescences are graded based on their length. Inflorescence with fewer flowers inside the bracts are ideal for



Removing field heat

marketing as it will reduce time and cost of cleaning and minimize occurrence of insects, odours from water accumulation and organic matter deterioration.

Grading

Inflorescences of *Heliconia 'Iris'* can be graded based on their length, stem girth and spike width.



Grades of inflorescence



Grades	Length of inflorescence (cm)	Stem girth (cm)	Spike width (cm)
Grade I	>100	>9	>25
Grade II	75-100	7-9	20-25
Grade III	<75	<7	<20

Packing

Inflorescence can either be packed individually or in bulk. Bulk packing needs minimum of 42 inflorescences and inflorescences of uniform size are packed in a single box. Different materials such as aluminum foil, butter paper and news papers or recycled papers can be used for wrapping the inflorescence.

Individual packing boxes of 100 cm x 10 cm x 45 cm sizes are used for packing single inflorescence. A total of three boxes are packed inside a paper box of size 120 cm x 45 cm x 45 cm. These boxes are provided with air vents on opposite sides.

Bulk packing is the usual method adopted by *Heliconia* farmers. The packing cost can be substantially reduced if recycled paper is used for wrapping the inflorescence. The inflorescence will keep its quality for 24 h under this method.

Low cost packing method



Packing of inflorescences using recycled paper can be done in two ways:

Bulk method: First two layers of recycled papers are spread at the bottom of the box. Six inflorescences are arranged in a layer such that three will be facing opposite direction. The bracts of each layer of inflorescence are protected from vibration injury by covering with a sheet of recycled paper. A total of seven layers of inflorescences can be packed inside a box of 120 cm x 45 cm x 45 cm size holding 45 inflorescences per box.

Individual method: In this method individual inflorescence is wrapped separately with recycled paper. The bracts of individual inflorescence is covered and packed in layers of three in opposite direction. In this method 5-6 layers of inflorescence can be packed inside a box of size 120 cm x 45 cm x 45 cm holding 30-36 inflorescences per box.



Bulk packing



Wrapping individual inflorescence in news paper



Packing box for Heliconias

Marketing channels

Heliconia inflorescences can be marketed either directly to consumers or through middle men. The major value chains of *Heliconia*'Iris' existing in our country are listed below:

Direct marketing

It can either be sent directly to star hotels or can be used for value additions such as flower arrangements or bouquets. Bouquet making and flower arrangements are profitable value additions which can be adopted by women self help groups located in major cities. By adopting direct marketing, farmer will get maximum benefit.



Flower bouquet

a. Farmer → Hotels in cities (Rs. 200-250/- per inflorescence)

Inflorescence of Grade I is used in this marketing channel. The requirement of inflorescence at a time will be limited to five numbers. In this value chain, individual inflorescence is packed in smaller paper boxes and these packed boxes are then arranged in a bigger box.

b. Farmer → Bouquets / flower arrangements (Rs. 100-150/- per inflorescence)

This method of marketing can be adopted by women self help groups or youth living in cities. Inflorescences can be used for making bouquets and flower arrangements. Inflorescences of Grade III can be effectively used for bouquet making and table top arrangements. Grade I and II can be used for long arrangements and stage decorations. Value addition by this method is highly profitable and sustainable. A single inflorescence fetches up to Rs.100-150/. Flower arrangements with *Heliconia* are gaining popularity because of its extended vase life. Entrepreneurship of bouquet making can be easily adopted



Long flower arrangement

by house wives or residential associations in major cities. Groups of 15-20 families with 5-10 plants each in their courtyard is enough for starting the enterprise.

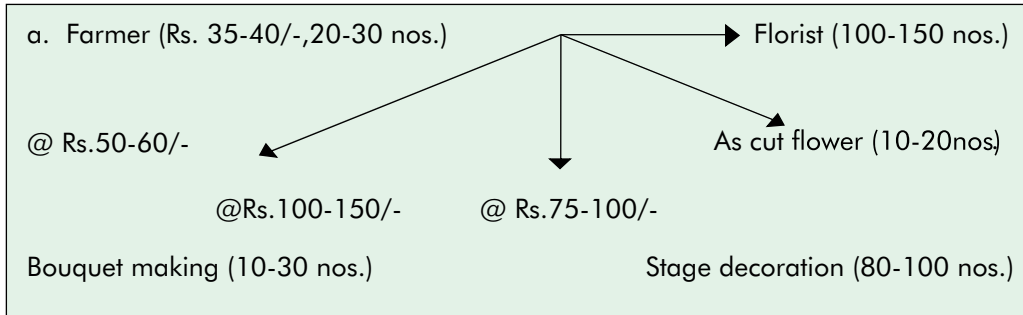
Indirect marketing

There are various value chains in indirect marketing. Involvement of middle men in this marketing channel results in lesser price realisation by the farmers.

The major indirect marketing channels existing in India are listed below.

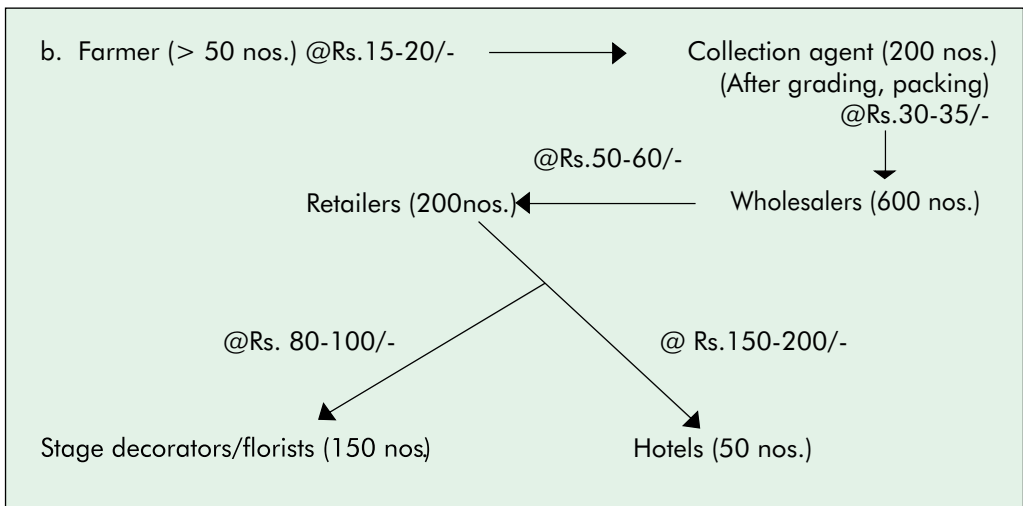
The price of individual inflorescence and minimum number of inflorescences required during each step of transaction is given in parenthesis.

In this method, farmers sell their produce to local florists or florists in major cities in India. The demand for *Heliconia* in local markets of village is less. But its demand in major cities is increasing due to its unique



shape and increased vase life. The demand of these flowers is higher in Bengaluru, Goa, Hyderabad, Mumbai and New Delhi markets. Inflorescence of Grade I fetches Rs.35- 40/- . Cleaned, air dried and packed inflorescences are marketed to

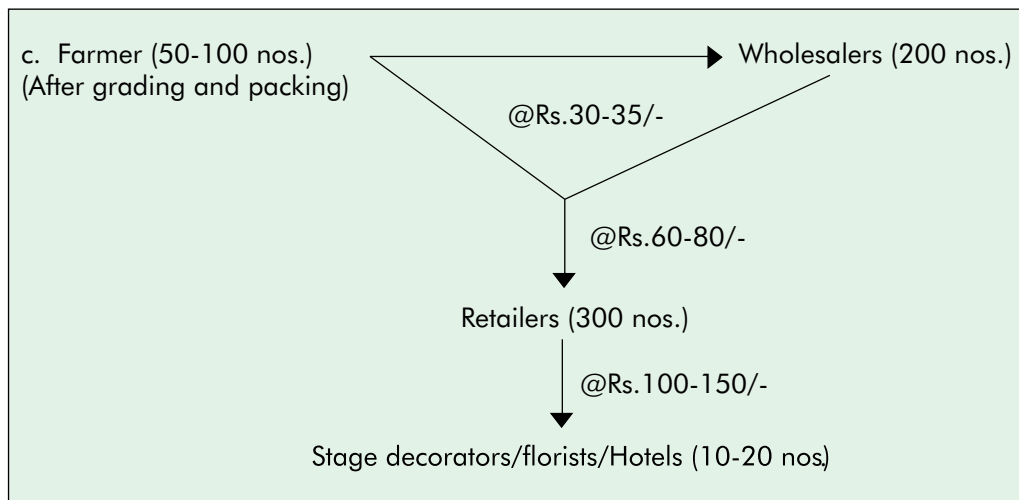
retailers based on their demand. Usually the demand of inflorescence among local florists is 20 to 30 numbers per day. They use the flowers for bouquet making or sell to stage decorators.



Collection agents collect inflorescences from the farmers at a minimum price of Rs. 15-20 per inflorescence. They collect inflorescences of Grade I and II. After collection, the inflorescences are further graded, cleaned and packed in paper boxes. The packed boxes are sold to major *Heliconia* buyers in India such as

Hindustan Flowers, Pearls n Petals etc.

Farmers can directly market the inflorescence to the salers after grading and packing. The wholesalers give the transportation and packaging charges as extra in addition to the price of inflorescence.



Economics of cultivation

The economics of intercropping *Heliconia stricta* "Iris" for three years in one hectare of coconut plantations is given below:

The initial cost of cultivation is very high due to the cost of planting material which may require financial support from banks etc. The cultivation of *Heliconia* opens up scope for employment generation and youth empowerment through export, value addition such as bouquet making, flower arrangement, stage decoration etc. Additional labour employment of 1000

man days/ha in the first year, 1800-2000/ha in second year and 2500 man days/ha in third year is expected.

Scope in international markets

Heliconia are emerging as an important new cut flower in India which can be grown as intercrops in plantation crops without any hi-tech facility. At present, marketing is concentrated in domestic markets of major cities in India which itself is fetching high profit. Measures should be taken for channelizing the marketing of *Heliconia* in India and abroad. The scope of exporting

Year	Input cost (Rs.)	Returns (Rs.)		Net returns (Rs.)	Benefit cost ratio
		Inflorescence @ Rs. 20/-	Rhizomes @Rs. 60/-		
I yr	5,87,000	96000	-	-4,91,000	-
II yr	10,20,000	21,60,000	9,00,000	30,60,000	3:1
III yr	16,00,000	27,00,000	21,60,000	48,00,000	3:1



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needs to be explored. The major constraint of exporting is the weight of inflorescence. A single inflorescence of many commercial varieties weighs even up to 750g. *Heliconia stricta* 'Iris' is a potential variety for exporting as it has the qualities of grade I flowers such as more than one meter inflorescence length, inflorescence stem girth, plane arrangement of bracts, unique

colour, lesser number of flowers inside the bract coupled with lesser inflorescence weight (up to 250 g). The flower wealth of India can be boosted by giving brand names and exporting it to developed countries such as USA, Australia and UK where the demand for these tropical ornamentals is very high.



Marigold- *Gomphrena* sequential intercropping

Marigold (*Tagetes erecta*) of Compositae family and *Gomphrena globosa* (Globe amaranth) of Amaranthaceae family are two potential commercial flower crops that are gaining global popularity as specialty loose flowers. These can be used both as fresh and dry flowers for making various floral decorations. Marigold flower is also an important source of carotenoids with application in the food industry and colouring fabrics. Flowers of Marigold and *Gomphrena* retain the freshness and colour for longer period making it preferred items among floriculturists.



Marigold as inter crop in coconut garden



Gomphrena as inter crop

Loose flower crops require soils rich in organic matter with full sunlight but scarcity of open area is a limiting factor for increasing the area under these crops in Kerala. Higher light availability in root (wilt) disease affected coconut garden offers greater scope for intercropping loose flower crops which require higher light intensity. Introduction of annual ornamentals in the interspaces of coconut garden not only enhances the aesthetics but also gives additional farm income in a short period of time.

Season of planting

Marigold flowers fetches higher price during seasons of wedding and religious festivals (December- April), whereas *Gomphrena* is preferred only during Onam season (August- September) for floral rangolies (drawings). The supply of marigold flowers from major producing states such as Tamil Nadu and Karnataka is meager during December to February due to unfavorable weather conditions. But in Kerala the weather condition during this season is favourable for growing Marigold. Considering these, Marigold - *Gomphrena* sequential intercropping can be introduced in root (wilt) disease affected coconut gardens of Kerala for better economic returns.

In Marigold-*Gomphrena* cropping system, Marigold can be cultivated during October to April by supplying adequate quantity

Floriculture for Enhancing Profitability of Coconut Gardens of organic and inorganic nutrients. *Gomphrena* can be grown as a catch crop during May-September utilizing the crop residues. By adopting this sequential cropping, we can ensure continuous growing of flower intercrops with flower production during months of peak demand.

Planting material

Seeds collected from shade dried mature flowers can be used for sowing. It is recommended to use seeds purchased from reputed dealers.

Sowing

The seeds can be sown in shallow pots or in raised beds. The pots are filled with potting mixture containing soil, sand and compost or dried leaf powder in the ratio of 2:1:1. The mixture is levelled and seeds sown in line at a shallow depth. The sown seeds are then covered with newspaper for maintaining humidity. The news paper is removed as soon as the seeds start germinating. Then the seedlings are gradually transferred to full sunlight.



Levelling the potting mixture



Making small trench for sowing seed

Seeds can also be sown in raised beds of 45 cm height, 1.5 m width and 2 m length. The top soil is mixed with vermicompost @ 1 kg/m². Before sowing, seeds are mixed with broken rice for uniform spreading of seeds and protection from ants. The seed beds are then covered with dried coconut fronds. The fronds are removed in three to four days time when the seeds start germinating.



Seed sowing



Seedling nursery



Main field preparation

The field is ploughed and made into a fine tilth. Raised beds of 4m length, 3m width and 15cm height or trenches of 15 cm depth are taken at two meters from the base of coconut palms for transplanting the seedlings.



Field layout



Making trenches

Well drained soil is needed for growing both *Marigold* and *Gomphrena* as water stagnation will result in rotting of seedlings. Raised beds are preferred in places prone to flooding. During summer months, it is better to grow the plants in trenches. As *Gomphrena* is grown during rainy season, they are transplanted in raised beds.

The plants require frequent irrigation during summer season. In order to reduce the frequency of irrigation, husk burial can be adopted. For moisture conservation, a layer of coconut husks can be laid



Raised beds



Trenches

with concave surface facing upwards at the bottom of trench. Husks are buried in trenches of 60 cm and drenched with systemic fungicides such as Carbendazim 50%WP. The trenches are covered with top soil.



Husk burial in raised beds



Husk burial in trenches

Transplanting

The seedlings are transplanted when they produce three to four functional leaves. Marigold seedlings are transplanted at 45 cm x 45 cm spacing and *Gomphrena* seedlings at 60 cm x 60 cm spacing.



Gomphrena seedlings



Marigold seedlings

Manuring

Basal dose of dried cowdung @ 3kg/m² and vermicompost @ 1.5 kg/m² is mixed with soil before transplanting the seedlings of Marigold. Chemical fertilizer supplying 56:60:60 kg NPK ha⁻¹ is given ie; 12.5 g urea, 36.5g rockphosphate and 10.0 g MOP per square meter at 15 days after transplanting. Care should be taken so that the fertiliser should not touch the stem of plants. At thirty and forty five days after planting, plants are sprayed with vermicompost extract (1:10 VCE) and the residue is drenched in the basins.



Fertiliser application

Vermicompost extract preparation

Vermicompost extract (VCE) is extracted from vermicompost with tap water, 1:1(w/v), in plastic jars. The mixture is stirred well and kept in room temperature for 24 hours. The recovery of extract from vermicompost is estimated as 57 per cent. Based on the recovery, the quantity of vermicompost required per square meter is worked out as 0.5kg. VCE thus produced is diluted with water (1:10) and sprayed to plants @1.7 l/m². The remaining residue is given as soil drench.

Manuring in *Gomphrena*

The residual nutrients from Marigold crop is utilized for growing *Gomphrena*. The improved soil nutrient and microbial population along with soil enzyme assay helps in growing *Gomphrena* till 60 days after transplanting (DAT). An additional dose of 18:18:18 NPK (5 g/plant) can be given at fortnightly intervals from 60 DAT till two weeks before the final harvest (150 DAT).

Intercultural operations

After transplanting, the seedlings require shade for first two weeks. This can be provided by erecting shade nets or individual staking with small twigs.



Shading

First weeding is done at two weeks after transplanting just before application of first dose of chemical fertilizers. Care should be taken to keep the field weed free.

Marigold plants are prone to lodging when grown in raised beds. In order to avoid lodging, staking is given at 60 DAT. Staking can be done to individual plants. If the plants are planted in a line then line staking can be given using rope by erecting two bamboo sticks on either ends of the line.

For Marigold, pinching and disbudding is done up to 45 DAP. Pinching helps in proper branching and increased flowering. The flower bud needs to be removed till 45 DAT. This helps in production of bigger flowers.



Staking



Pinching and disbudding

Plant protection

Fusarium wilt is common in marigold plants. If noticed the affected plants are uprooted and destroyed along with the rhizosphere soil. The remaining plants are sprayed with Carbendazim 50%WP @1 g/l.



Rotting of plants



Ringing

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Cutting off the seedlings by grasshopper is a major problem. The attack can be prevented by providing a shield around the seedlings using mango or jackfruit leaves.

Harvesting and marketing

The flowers are harvested during evening hours as the dew drops on the flowers reduce the keeping quality. Fully opened flowers along with peduncle are harvested



Harvested marigold flowers

for sale. For Marigold, grading of flowers before marketing ensures better price. Small sized flowers of less than 5 cm diameter can be used for making garlands.

Additional Income

Additional benefit from unit intercropped area in coconut garden (60% area) by introducing Marigold-Gomphrena sequential cropping system is given below:



Harvesting of Gomphrena

Commodity	BCR	Quantity/ha of intercropped area	Unit price (Rs)	Benefit (Rs)
<i>Tagetes</i> flowers (kg)	3.4	2800	50	140000
<i>Gomphrena</i> flowers(kg)	2.6	1750	40	70000
Additional number of coconuts		531	15	7965
Total additional income				217965



Popularising the technology

Efforts are being made for popularising the Marigold-*Gomphrena* and *Heliconia* intercropping in coconut among the farmers through training programmes and field level demonstrations.



Training for farmers and extension officials

Field evaluation trial at Thrikkunnapuzha panchayath

Field evaluation on intercropping marigold in young coconut plantations of Thrikkunnapuzha panchayath was done



Marigold plants grown in raised bed at Thrikkunnapuzha panchayath

during October 2011 to April 2012 in an area of 100 cents. The seedlings were planted in raised beds. Staking of plants was done at the time of flowering to avoid lodging. It recorded a BCR of 1.9.

Technology evaluation at Kadakkarapally panchayath

Field level technology evaluation of nutrient management studies by ICAR-CPCRI



Marigold plants grown in trenches at Kadakkarapally panchayath



Heliconia Iris for sale in local markets

in Marigold under adult coconut palms was done at Kadakkrapally panchayath during August 2012 to February 2013. The seeds collected from mature flowers were shade dried and sown in raised beds. The seedlings were transplanted in trenches. Lodging was not noticed in plants at the



Stage decoration

time of flowering. It recorded a BCR of 2.6. The sequential intercropping of marigold followed by *Gomphrena* was found to be successful in the experiment. This technology needs to be popularised among the farmers through extension agencies.



Conclusion

Coconut is a major plantation crop in coastal humid tropic. However, growing coconut as mono crop, coupled with lack of proper management, often leads to realization of uneconomic returns by the small and marginal farmers. Intercropping of annuals, biennials and perennials in coconut gardens offers scope for effective utilization of natural resources like water, light and space. It not only enhances productivity of the cropping system, but also results in enhancing farm income and providing higher employment opportunities to the farm families. Intercropping also provides congenial microclimatic

conditions in coconut garden resulting in increased production of coconuts as well.

Floriculture, an expanding business venture, has high potential in coconut plantations. *Heliconia*, marigold and *Gomphrena* are compatible flower crops which can be successfully grown as intercrops under the natural shade of coconut palms. Introducing flower crops of higher market demand in coconut gardens enhances the farm income and ensures aesthetic values promoting ecotourism. It also opens scope towards horticulture therapy.