



# Coconut Based High Density Cropping System in Goa

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## Introduction

Goa, a small state of the Western Ghats comes under the ecological zone of the western coastal eco-zone of the country. Total area of the state is 14,113 ha out of which the net sown area is 1,40,935 ha and the total cropped area is 1,69,053 ha. Goa receives an annual rainfall of 280 cm and temperature ranging from 19 to 32°C. Among the horticultural crops, coconut stands second in area next to cashew in the state. The area under coconut is marginally increasing (24,958 ha to 24,975 ha) over the years. However, the average productivity was found to be nearly constant (4868 nuts/ha). During the last five years, the area under coconut is 458 ha while production is five million nuts, showing a positive trend in productivity.

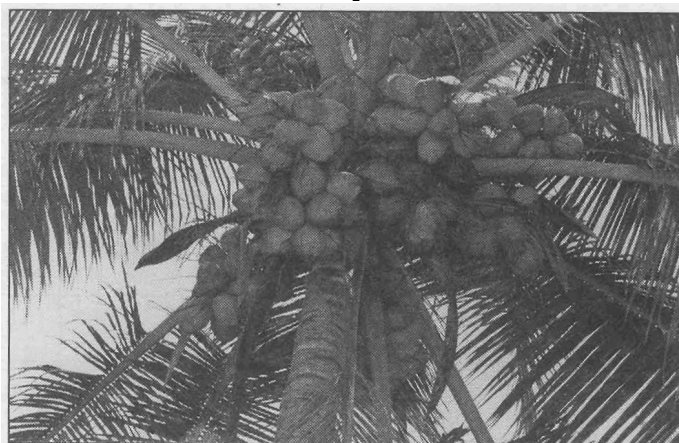
Monocropping of coconut with poor management has resulted in poor economic returns for the coconut growers in the state. However, vast scope exists for intensification of cropping in coconut with compatible crops like pineapple, banana and black pepper under good management improving the economic viability of coconut garden.

Different types of farming systems exist in Goa based on coconut. Other than mono cropping of coconut, mixed/cropping with fruit plants like citrus fruit, mango, arecanut, black pepper, etc, is also prevalent in the state. With a view to study these practices, I.C.A.R Research Complex for Goa, Ela, Old Goa, is maintaining different types of cropping systems in coconut gardens.

## Materials and Methods

The experiment was started in the year 2000-2001 in a twelve-year-old coconut garden (Cv. Benaulim) and the component crops used were pineapple (variety Giant Kew), banana (variety, Grand-nain-Williams) and black pepper (variety Karimunda). In coconut garden a spacing of 7.5 x 7.5 m was maintained, pineapple was planted with a spacing of 30 x 60 x 90 cm and banana with a spacing of 180 x 180 cm. A fertilizer dose of 500:320:120 g NPK/palm was applied to coconut in addition to 5 kg neem cake in a year. For banana, the general recommended dose of 200:100: 30 g NPK/ plant was applied in split dose and for pineapple a fertilizer of 16:4:12 g NPK/plant was given also in split dose. Pineapple was planted in the space between the palms in trench method while tissue culture banana was planted in the spacing between the palms and the pineapple. Banana was planted in the last week of October

2000, which started yielding in the month of October 2001. Pineapple was planted during June 2000 and fruits were harvested from April onwards till June. Yield and other parameters of different crop components were recorded. Glyricidia, a multipurpose tree was planted on the borders.



Coconut - Benaulim variety

Economics and other impact studies of the system have been done in detail.

## Result and Discussion

**Yield of coconut in the system:** The yield of coconut was recorded from the year 1996 onwards from an average of ten yielding palms. The number of yielding palms has also increased from

**Table 1. Average nut yield/palm in different years from 1996-2001 in the experimental block**

Year	Nut yield	Average no. of yielding palms	Average nuts/palm/year
1996	128	10.0	12.80
1997	291	12.5	23.28
1998	361	11.5	31.39
1999	603	16.67	36.17
2000	1213	23.0	52.73
2001	1317	25.33	51.99



**Table 2. Average nut yield/palm in different years from 1996-2001 in the experimental block**

Year	Nut yield in monocrop (15 palms)			Nut yield in intercroppd area (40 palms)		
	Av. yielding palms	Total nut production	Av. nut production	Av. yielding palms	Total nut	Av. nuts/palm
1999	4.33	91	21.00	12.33	513	41.60
2000	7.00	242	34.57	16.25	892	54.89
2001	4.66	195	41.84	21.00	1122	53.43
Total		528			2527	
<b>Average</b>	<b>5.33</b>	<b>176</b>	<b>32.47</b>	<b>16.52</b>	<b>842.33</b>	<b>49.97</b>

10 to 25 during the period of five years. Average nut yield also increased from 36.17 nuts/palm/year to 52.73 nuts/palm/year during the period 1999-2001 which shows the clear effect of different intercrops in the system in

(Anon. 1995). Further, it was found that in intercropping, the coconut yield was 53.43 nuts/palm/year whereas in monocrop it was 41.8 nut/palm/year in a period of two years showing a clear



**Table 3. Yield and other characteristics of banana harvested in different months**

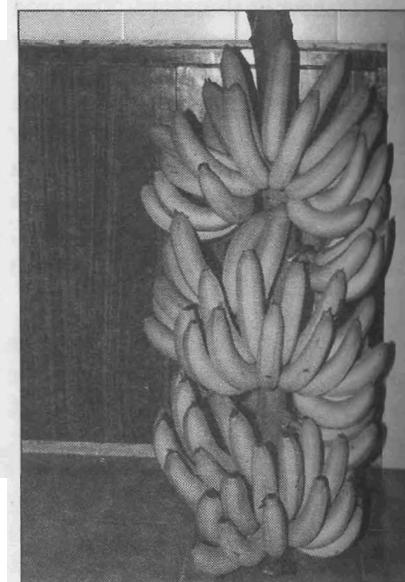
Months	No of bunches	No of hands	Average no of hands	No of fingers	Average no of fingers	Total weight (kg)	Average weight/bunch
October	3	27	9.00	339	113.0	96.10	32.00
November	12	95	7.92	1359	113.0	338.88	28.24
December	22	170	7.72	2300	104.5	401.08	18.23
January	11	95	8.64	1294	117.6	176.76	16.04
February	12	79	6.58	1121	93.0	171.68	14.03
March	15	108	7.20	1381	92.10	249	16.60
<b>Total</b>	<b>75</b>	<b>574</b>		<b>7799</b>		<b>1433</b>	
<b>Average</b>			<b>7.84</b>		<b>105.57</b>		<b>20.90</b>

improving the production and productivity of coconut. Similarly, an increase in coconut yield by 176 per cent as compared to pre-experimental period was observed due to the practice of HDMSCS at Kasaragod

impact of intercropping with better management in increasing the productivity of the system as a whole.

**Yield of banana in the system**

Tissue culture banana was ready for harvest by October 2001 just after eleven



Banana - Grand nain variety

**Table 4. Yield of pineapple harvested from the interspaces during each month in 2001-2002**

Month	No of harvest	No of fruits	Weight (kg)
April	4	34	73.0
May	8	303	459.0
June	4	388	479.0
July	1	1	2.50
November	2	9	10.0
February	2	11	19.0
<b>Total</b>	<b>21</b>	<b>726</b>	<b>1044</b>

months of planting. In the month of October only three bunches were harvested while a maximum of 22 bunches were harvested in the month of December 2001. A total of 75 bunches have been harvested weighing 1433 kg from the system till March 2002. Average bunch weight was found to be 21 kg bunch. The total production of banana from the system was 2894 kg from an area of 0.2 ha which was worked out to be 14470 kg/ha of coconut garden. Similarly, banana has been found to be one of the remunerative component crop in different models at Arsikere



Table 5. Economic analysis of the system

INPUT								
Crop	Labour		Cost of planting material (Rs)	Fertilizer		Irrigation		Total cost/ha (Rs)
	No/ha	Cost/ha (Rs)		Quantity (kg/ha)	Cost/ha (Rs)	Hrs	Rs	
Coconut	15	7400		89:89:214 (NPK)	4752	60	1800	13952
Pineapple	20	2000	1063x5 = 5315xRe0.5 /sucker = Rs. 2657	1.2:1.7:0.5 (NPK 1 trench x 60 trenches)	1.2x60x5=360 1.7x60x4.4=448.8 0.5x60x4.6=138 946x5=4730	40	1000	11333
Banana	25	2500	130x10=1300 1300	200:100:300 g (NPK/Plant)	0.45x130x5=292.5 0.62x130x4.4=357.5 0.495x130x4.6=296 946x5=4730	40	1000	24555
				Furadon Pack Neem cake Blitox x 500 Streptocycline 6gx10	Rs.80 2x5.5x130=1430 Rs. 105 Rs.105			
Black pepper	10	1000	80x5=400	-	-			1400.00
Glyricidia	5	500	-	-	-			500.00
<b>Total</b>								<b>51740</b>

OUTPUT					
Crop	Yield in exp.plot (kg)	Yield/ha (kg)	Actual amount (Produce x rate)	Gross return (Rs)/exp. Plot (0.2ha)	Income/ha (Rs.)
Coconut	1317	4271.50 nuts	1317x4	5268	26,340
Pineapple	1044.25	5221.25	1044.25x4	4177	20885
Banana	2894.08	14470.4	2894x5	14470	72352
Black pepper	-	-	-	-	-
Glyricidia	100 kg	500	100x2	200	1000
Wastes		4710.50	942.1x1	942.1	4710.50
Banana leaf & stem	481.1				
Coconut leaves	334.0				
Coconut petiole	127.6				
<b>Total</b>					<b>1,25,285</b>

\*Return = Rs. 1,25,285 - 51740 = Rs. 73,545 C: B ratio = 1:1.4

Karnataka) and Kahikuchi (Assam) and Pappankulam (Tamil Nadu) in terms of total harvest and net returns/ha/year (Anon. 1998).

**Yield of pineapple in the system**

Pineapple planted in the month of April 2000 started fruiting from April

2001, recording a yield of 73 kg from four harvests. Maximum yield of 388 number of fruits were obtained in the month of June 2001, weighing about 479 kg. A total yield of 1044 kg has been obtained till March 2002 from the system. Average fruit weight was found to be 1.73 kg whereas average

crown weight was 348 g. Average length of the fruit was found to be 19.88 cm with girth of 16.63 cm. Crown length recorded was 37.76 cm. The T.S.S. of the fruit ranged from 11 to 19 per cent. This was worked out to be an average production of 24538 kg from an area of one ha with 21.79 per cent of



area in the system was worked out from this. The most productive and remunerative combination under the west coast conditions was found to be coconut, pepper (trained on the coconut trunk), cocoa and pineapple as reported by Nelliath *et al.*, 1974.

**Biomass from the system**

As regards biomass, 298 kg of banana stems have been obtained from the system, which are being used for the preparation of compost. Coconut leaf wastes collected from the system was found to be 334 kg from an area of 3083 m<sup>2</sup> with 60 palms in the system. Other wastes recorded in the system (weeds, spathes and crown of pineapple) were worked out to be 127.6 kg from the system and most of the wastes are being used for the preparation of compost for recycling in the system



*Inter cropping of Giant kew variety pineapple*

**Economic Analysis of the System**

The gross income obtained from the system was Rs. 1,25,285/ha while the net return was found to be Rs. 73545/ha. The cost : benefit ratio of the intercropping system was found to be 1:1.4. In system studied by Sairam *et al.*, (1999), the gross margin realized ranged between Rs. 1750/ha during 1983-84 to Rs. 92,230/ha during

1996/97. In addition about 650 man days employment can be generated from the system from an area of one ha over a period of one year.

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**How to make Coconut Rolls**

**INGREDIENTS:**

- 250 gm potatoes (boiled and peeled)
- 125 gm paneer (crumbed)
- 1-cup breadcrumbs
- 4 tbsp coconut (grated)
- 2 tbsp coriander leaves (finely chopped)

- 1 tbsp corn flour
- 3-4 green chillies (chopped)
- lemon juice
- salt and pepper to taste
- oil for frying

**METHOD:**

Combine potatoes, paneer, coconut, coriander leaves, green chillies, lemon juice, salt and pepper well. Divide the potato mixture into equal parts and make long rolls. When all are done, keep aside. Meanwhile, add a little water to the corn flour and make a smooth thin paste. Dip the prepared rolls in the corn flour paste and roll over breadcrumbs. Heat oil and deep-fry the rolls till well browned. Serve hot preferably with tomato sauce, preferably.