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Feasibility of ramie intercropping in coconut

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Abstract

Field experiments were conducted at ICAR Research Complex for Goa for three years during 2005 to 2008 to study the feasibility of growing ramie *(Boehmeria nivea* (L.) Gaud*)* as intercrop in coconut. Three treatments that included comparison of sole ramie grown under open conditions, sole coconut and coconut + ramie intercropping system were studied in a Randomized Block Design with six replications. Although sole ramie grown under open conditions recorded significantly higher green (7,843 kg / ha / harvest) and fibre yield (243 kg / ha / harvest) over intercropping with coconut (6,747 kg / ha/ harvest and 210 kg / ha / harvest, respectively), the per unit productivity of green yield was still higher under intercropped situations (0.90 kg / m^2/ harvest) over sole cropping (0.78 kg / m^2 / harvest) indicating the potential of ramie for intercropping in coconut. An improvement in coconut productivity was observed during the experimental period over the pre-experimental period with an additional 11 nuts / palm / year indicating that the ramie intercropping has a positive influence on coconut yield. It was found that sole cropping of coconut is not much remunerative (Rs.14,830 / ha net returns) while pure cropping of ramie could lead to a net return of Rs. 57,120 / ha / year. However, intercropping of ramie in the interspaces of coconut could fetch a total net return of Rs.81,607 /ha, showing the prospects for intercropping of ramie in coconut in the agro-climatic condition of Goa.

Keywords: Coconut, economics, fibre yield, green yield, intercropping, ramie

Introduction

Ramie is a semi-perennial shrub belonging to the nettle family *Urticaceae* and is native to the Oriental land. It is one of the principal plant fibres used for making cloth before the introduction of cotton in the Orient. Presently, China is the largest ramie growing country. Its cultivation is restricted to the North-Eastern States particularly Assam in India. Ramie yields longest tough, shiny fibre suitable for textile production. The textile produced from this fibre has better moisture absorbing capacity in comparison to the other fibres (Anonymous, 2007). Ramie can also be used as a forage crop with high nutritive value and as a source of stearic acid for the pharmaceutical industry (Milani,2002). Ramie can be grown in areas receiving 1500 to 3000 mm of rainfall with a warm humid climate.

It is more profitable to integrate a number of subsidiary crops with coconut than to grow it as a mono crop (Das, 1991). The systems approach will not only utilize the resources efficiently but will also give higher returns in coconut. However, selection of crop combinations with suitable management practices are to be given prime importance to harness full potential of the system (Manjunath, 2001). Ramie, being adapted to tropical humid climatic conditions with partial shade tolerance and semi-perennial in its growth habit, fits well in many of the multi-tier cropping systems in perennial crops along with other high value crops of the region. As such, the present study was planned to study the feasibility of growing ramie as an intercrop in coconut and further to know the economics of its cultivation in the local agro-climatic conditions.

Materials and Methods

The experiment was conducted during 2005 to 2008 in Randomized Block Design consisting of 3 treatments and 6 replications. The treatments included sole crop of ramie, ramie grown under coconut and sole crop of coconut. The study was conducted in a 22 year

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old garden of Benaulim and D x T hybrid coconut spaced at 7.5 x 7.5 m with black pepper variety Panniyur-1. Plot size of coconut + ramie + pepper multi tier cropping system was 13 m x 12 m in the interspaces of coconut palms keeping a block boundary of one metre. For the block involving sole ramie, plot size of 6 x 6m was prepared. The ramie variety 'R 67-34' was planted at a spacing of 60 cm x 30 cm. Recommended nutrients were supplied to coconut once during monsoon season (July). For ramie, nutrients were applied after each harvest through inorganic and organic sources.

The pH of the soil was slightly acidic (5.85) with organic carbon content 0.91 to 1.18 per cent. The soil had low available N (257 kg/ha) and P_2O_5 (7.9 kg/ha) and moderate potassium content (210 kg/ha).

All the recommended package of practices was followed for the crop including the fertilizers ($N_{30}P_{15}K_{15}$)**.** The light interception through the coconut canopy in the cropping system trial was measured using a Line Quantum Sensor at different places in the plot and the mean was worked out.

Periodical growth and yield parameters were recorded and the green yield of the crop was computed by harvesting the crop to the ground level and recording the weight in the net plot. The data was analyzed using standard statistical procedures as suggested by Gomez and Gomez (1984). The economics was calculated based on the prevailing market prices both for the inputs and outputs during the period.

Results and Discussion

Light transmission

Coconut, at the age of 22 years in the experimental plot allowed 40.9 per cent of photosynthetically active radiation through its canopy (Table 1). Ramie as a sole crop intercepted 82.6 per cent of photosynthetically active radiation at canopy level allowing only 17.4 per cent of light to pass through the ground level. However, when ramie is intercropped in coconut garden, a mean light interception of 53 per cent of open light conditions was observed at canopy level and 13.8 per cent of open light at ground level indicating a partial shaded condition.

Table 1. Per cent light transmission intercepted by different crop components under cropping systems trial

Treatment	Light transmission* at canopy level (%)	Light transmission at ground level (%)	Mean (%)
Sole Ramie	100	17.4	58.2
Sole Coconut	--	40.9	40.9
Coconut + Ramie + Pepper	53.1	13.8	33.5

*values are in comparison to open light condition

Growth and yield parameters of ramie

The pooled mean plant height and base diameter of ramie over three years during the experimental period indicated that ramie grown as an intercrop under coconut was taller (119.9 cm) than in open condition indicating that the crop under shaded conditions grows stout and tall (Table 2).

The total dry matter content in ramie during the experimental period indicated that as a intercrop, ramie recorded relatively higher dry matter content during all the three years and their mean (367.3 g/m^2 as compared to 321.3 g/m^2 in sole ramie) (Table 3). The production of increased dry matter in ramie may be due to the favourable climate under intercropped situations in turn favouring enhanced uptake of nutrients.

Green and fibre yield of ramie

The pooled green and fibre yield of ramie during the experimental period for three years (mean of twelve crops) is presented in Table 4. Although, no significant differences were observed during first year, both green and fibre yield differed significantly during second and third year as well as their pooled mean. Although sole ramie grown under open conditions recorded significantly higher green (7,843 kg / ha / harvest) and fibre yield (243 kg / ha / harvest) over the intercropping with coconut

Table 2. Mean plant height (cm) and base diameter (cm) of ramie under cropping system trial during the experimental period

	2005-06		2006-07		2007-08		Pooled mean	
	Plant height	Base diameter	Plant height	Base diameter	Plant height	Base diameter	Plant height	Base diameter
Ramie as sole crop	110.2	2.7	116.7	2.5	102.6	2.7	109.8	2.6
Ramie + coconut	132.5	3.3	123.0	2.6	104.2	2.8	119.9	2.9
C.D (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS

NS = Not significant

Table 3. Dry weight (g/harvest/ m^2) in ramie during the experimental period

	2005-06		2006-07		2007-08		Pooled mean	
Treatment	**Fresh weight**	**Dry weight**	**Fresh weight**	**Dry weight**	**Fresh weight**	**Dry weight**	**Fresh weight**	**Dry weight**
Sole Ramie	470.4	81.9	423.0	66.3	639.9	173.1	1533.3	321.3
Ramie + Coconut + Pepper	699.5	94.0	462.0	95.1	721.3	178.2	1882.8	367.3
C.D (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS

NS = Not significant

Table 4. Mean yield of ramie / harvest during the experimental period

	2005-06		2006-07		2007-08		Pooled	
Treatment	**Fresh yield (kg/ha)**	**Fibre yield (kg/ha)**	**Fresh yield (kg/ha)**	**Fibre yield (kg/ha)**	**Fresh yield (kg/ha)**	**Fibre yield (kg/ha)**	**Fresh yield (kg/ha)**	**Fibre yield (kg/ha)**
Sole Ramie	1253.0	38.8	9495.3	294.0	12780.2	396.1	7842.6	242.9
Ramie + Coconut + Pepper	1270.0	39.3	7724.6	241.4	11245.8	348.0	6748.8	209.6
C.D (P=0.05)	NS	NS	785.9	24.4	1082.7	33.5	672.4	20.9

NS = Not significant

(6,747 kg / ha/ harvest and 210 kg / ha / harvest, respectively), the per unit productivity of green yield was higher under intercropped situations (0.90 kg / harvest / m^2) over sole cropping (0.78 kg / harvest / m^2) indicating the potential of ramie for intercropping in coconut. Bandopadhyaya (1983) also reported higher yield of ramie under open sun as compared to partial to full shade condition. The fibre yield also followed the same trend as that of green yield with significantly higher record of fibre yield under sole cropped situations (243 kg / ha / harvest) in comparison to intercropping with coconut (210 kg / ha / harvest). However, the per unit productivity of ramie fibre was higher under intercropped situations (0.028 kg / harvest / m^2) than under sole crop (0.0243kg / harvest / m^2).

Coconut yield

An improvement in coconut productivity was observed during the experimental period over the pre-experimental period with an additional 11 nuts / palm / year indicating that the ramie intercropping had positive influence on the coconut yield (Table 5). This was evident as the coconut basins were left free from intercropping to avoid root competition and soil moisture and nutrients were separately managed both for the coconut and the intercropped ramie. The improved soil environment resulted in enhanced fruit set as was reflected in increased palm yield. In a study on high density multi-species cropping system at Kasaragod also, nut yield increased by 176 per cent compared to pre-experimental yield (CPCRI,1997).

Table 5. Productivity of coconut in pre experimental and experimental period

	Coconut + Ramie + Pepper	Sole coconut
Pre- experimental period		
No. of yielding palms in experimental block	10	16
Total nut production in experimental block / year	260	395
Total nut production / ha / year)	4628	4450
Productivity (nuts / palm / year)	26	25
Experimental period		
No. of yielding palms in experimental block	10	16
Total nut production in experimental block / year	371	423
Total nut production / ha / year	6601	4700
Productivity (nuts / palm / year)	37.1	26.4

Economics of cropping systems involving ramie

The economics of intercropping of ramie in coconut was worked out based on the yield recorded in each of the crop and the existing market rates both for inputs and outputs. It was observed that sole cropping of coconut is not much remunerative (Rs.14,830 / ha net returns) with a benefit :cost ratio of 1.80. Pure cropping of ramie could lead to a net return of Rs. 57,120 / ha / year with a BC ratio of 2.05. However, intercropping of ramie in the interspaces of coconut could fetch a total net return of Rs.81,607 /ha with a BC ratio of 3.03, showing better prospects for intercropping of ramie in coconut in the agro-climatic region (Table 6).

Table 6. Economics of cropping systems involving ramie for a year

Crop	Yield / ha / year	Gross returns (Rs/ha)	Cost of production (Rs/ha)	Net returns (Rs/ha)	BC ratio
Sole Coconut	4700	32,900	18,070	14,830	1.80
Sole Ramie	59,720 kg fresh yield 1,852 kg fibre	1,11,120	54,000	57,120	2.05
Coconut + Ramie	6601 No.+ 1260 kg fibre	1,21,807	40,200	81,607	3.03

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