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Jefni Mol RJ

M.Sc. Scholar, Department of Agricultural Economics, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

SR Torane

Head and Professor, Department of Agricultural Economics, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

PJ Kshirsagar

Assistant Professor (Agricultural Economics), Regional Fruit Research Station, Vengurla, Maharashtra, India.

AS Shigwan

Assistant Professor, Department of Agricultural Extension Education, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

AD Rane

Professor and Associate Dean, College of Forestry, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India.

RV Dalvi

M.Sc. Scholar, Department of Agricultural Economics, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

Corresponding Author: Jefni Mol RJ

M.Sc. Scholar, Department of Agricultural Economics, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

Economics of rubber based farming systems in Kanyakumari district

Jefni Mol RJ¹, SR Torane², PJ Kshirsagar³, AS Shigwan⁴, AD Rane⁵, RV Dalvi⁶

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ABSTRACT

Economics of major rubber based farming systems in Kanyakumari district was studied in which a sample of 135 farmers were selected randomly from the Thiruvattar, Melpuram and Thuckalay blocks of Kanyakumari district of Tamil Nadu. It was revealed from the present study that, the Rubber + Tapioca farming system (FS IV) provides maximum per farm net returns to the tune of Rs. 310903, with a benefit cost ratio of 1.66, followed by Rubber + Banana farming system (FS II) amounting to Rs. 297561 with a benefit cost ratio of 1.62. The per farm total cost and gross returns in Rubber + Pineapple farming system (FS III) were Rs. 701925 and Rs.776826, respectively, in case of Rubber + Coconut + Black pepper farming system (FS V), the per farm net returns and benefit cost ratio were of Rs. 202332 and 1.36, respectively. As far as Rubber farming system (FS I) is concerned the benefit cost ratio was comparatively low (1.30). The study suggested that the farmers should be encouraged to adopt rubber based intercropping systems rather than relying solely on monocropping, as diversification helps to stabilize income and reduces dependence on single commodity.

Keywords: Farming system, Benefit cost, Net returns, Gross returns

Introduction

Agriculture sector engages nearly 60 per cent of the country's workforce and contributes approximately 17.30 per cent of national income, making it the largest employment generating industry in the nation. Despite this scale, farm income particularly on smallholdings, frequently fail to meet the basic needs of farming families. Irregular rainfall patterns, fragmented landholdings and unpredictable market prices compound the challenge, leaving many households economically insecure.

The farming systems prevailing across Tamil Nadu are highly varied, reflecting the state's range of agro-climatic conditions. Paddy-based, millet-based, pulse-based, plantation-based, and dryland farming systems each dominate particular geographic zones. In irrigated belts, the integration of crop production with live-stock has been widely adopted to enhance nutrient cycling and strengthen the sustainability of agricultural output over time.

Rubber based farming systems combine natural rubber cultivation with supplementary intercrops and allied agricultural enterprises to generate a sustained and diversified income stream throughout the whole year. As a long-duration perennial crop, it required six to seven years to reach its productive maturity. It presents a unique challenge and opportunity during its immature phase. Farmers in Kanyakumari district have historically utilized the inter-row spaces of young rubber plantations to cultivate short-duration crops such as banana, pineapple, tapioca, ginger, turmeric, vegetables, and fodder crops, which effectively generate income during the gestation period. The contribution of Kanyakumari district to the national rubber production is remarkable, which accounts for about approximately 3 to 3.5 per cent of India's total rubber cultivation area and output. It accounts for roughly 98% of the total natural rubber production within the state of Tamil Nadu. Recent district-level data indicates a planted area of around 28,400 hectares, from which approximately 21,600 tonnes of natural rubber are produced annually (Aju R. Justus and E. Raja Justus, 2023) [1]. The favourable combination of tropical climate, adequate rainfall, and suitable laterite soils make the district inherently well suited to rubber cultivation, and the crop's deep integration into the local agrarian economy underlines the importance of understanding and optimizing the farming systems built around it.

Data source and methodology

The study is based on primary data in Kanyakumari district. Three blocks of Kanyakumari district namely Thiruvattar, Melpuram and Thuckalay were selected purposively as these blocks have larger area under rubber cultivation in Kanyakumari district. Then, nine villages from each block were selected randomly. Total 135 farmers were selected for the present study by survey method. The data pertained to the year 2025-26.

Analysis of data

The standard cost concept was used to achieve the objective.

Cost A: It includes expenses incurred on all the purchased inputs, hired labour and imputed value of farm produced inputs. The items considered in Cost A are hired human labour, Manures, fertilizers, plant protection chemicals, growth regulators, depreciation, land revenue and interest on working capital, etc.

Cost B: Cost A + interest on fixed capital + rental value of owned land.

Cost C: Cost B + imputed value of family labour + supervision charges.

Results and Discussion

The existing farming systems followed by the sample rubber growers in the study area are presented in Table 1. It was observed that seven farming systems were practiced by the sample respondents in the

study area. The existing farming systems in the study area are I) Rubber followed by 17.78 per cent, II) Rubber + Banana followed by 19.26 per cent, III) Rubber + Pineapple followed by 16.30 per cent, IV) Rubber + Tapioca followed by 19.26 per cent, V) Rubber + Coconut + Black pepper followed by 16.30 per cent, VI) Rubber + Cocoa followed by 8.15 per cent and VII) Rubber + Arecanut followed by 2.96 per cent. Therefore, farming system VI and VII were considered as minor farming systems, as they were followed by less than 10 per cent of the farmers in study area. Consequently, these farming systems were deleted from the further analysis and the cost, returns and profitability of major farming systems (FS I to FS V) was worked out and presented in the subsequent section.

(Figures in parenthesis indicate percentage to total sample farmers selected for study)

Table 1. Existing farming systems in study area

Sr. No	Existing Farming Systems	No. of Farmers
1	Rubber	24 (17.78)
2	Rubber + Banana	26 (19.26)
3	Rubber + Pineapple	22 (16.30)
4	Rubber + Tapioca	26 (19.26)
5	Rubber + Coconut + Black pepper	22 (16.30)
6	Rubber + Cocoa	11 (8.15)
7	Rubber + Arecanut	4 (2.96)
Total		135 (100.00)

The information regarding per farm area under different crops grown in major farming systems followed by the sample farmers is given in

the Table 2.

Table 2. Farming system components and their per farm size (Area in ha)

Sr. No	Farming systems	Rubber	Banana	Pineapple	Tapioca	Coconut	Black pepper	Total
1	FS I -Rubber	0.90	-	-	-	-	-	0.90
2	FS II -Rubber + Banana	0.90	0.41	-	-	-	-	1.31
3	FS III - Rubber + Pineapple	0.94	-	0.84	-	-	-	1.78
4	FS IV – Rubber + Tapioca	0.82	-	-	0.63	-	-	1.45
5	FS V – Rubber + Coconut + Black pepper	1.16	-	-	-	0.26	0.25	1.67

Among the farming systems, FS III (Rubber + Pineapple) recorded the highest total cultivated area of 1.78 hectares, followed by FS V (Rubber + Coconut + Black pepper) with 1.67 hectares. FS IV (Rubber + Tapioca) occupied 1.45 hectares, while FS II (Rubber + Banana) covered 1.31 hectares. The sole Rubber farming system (FS I) had the smallest total area of 0.90 hectares. Rubber was the principal crop in all farming systems, occupying 0.82 to 1.16 hectare per farm, indicating its dominance in land allocation. In the intercropping systems, banana 0.41 hectares, pineapple 0.84 hectares, tapioca 0.63 hectares, coconut 0.26 hectares, and black pepper 0.25 hectares occupied comparatively smaller areas. The results indicate that farmers al-

locate the major share of land to rubber while utilizing the remaining area for compatible intercrops.

3.1 Rubber farming system (FS I)

It was observed from Table 3, that, it is the Rubber farming system in which only the crop (monocropping) was observed to be cultivated by sample respondents. The per farm gross returns and total cost were Rs. 387050 and Rs. 298214, respectively. Resulting in net returns of Rs. 88836 and a benefit cost ratio of 1.30. This demonstrates that rubber cultivation alone is economically viable and provides a reasonable profit to farmers.

Table 3. Per farm cost, returns and profitability of Rubber farming system (FS I) (Figures in Rs.)

Sr. No	Particular	Total cost	Gross returns	Net returns	B:C Ratio
1	Rubber	298214	387050	88836	1.30

(continued on next page)

3.2 Rubber + Banana farming system (FS II)

It was observed from the Table 4, that the components of this farming system are Rubber and Banana. The per farm total cost and gross returns in this farming system were Rs. 479265 and Rs. 776826, respectively. Resulting in net returns of Rs. 297561 and B:C ratio of 1.62 for

the Rubber + Banana farming system. Within the system, rubber contributed a gross return of Rs. 382556 with a B:C ratio of 1.31, while banana generated a gross return of Rs. 394270, a net returns of Rs. 206481, and the highest B:C ratio of 2.10. These findings indicate that integrating banana with rubber significantly enhances farm income and overall profitability compared to sole rubber cultivation.

Table 4. Per farm cost, returns and profitability of Rubber + Banana farming system (FS II) (Figures in Rs.)

Sr. No	Particular	Total cost	Gross returns	Net returns	B:C Ratio
1	Rubber	291476 (60.82)	382556 (49.25)	91080 (30.61)	1.31
2	Banana	187789 (39.18)	394270 (50.75)	206481 (69.39)	2.10
	Total	479265 (100.00)	776826 (100.00)	297561 (100.00)	1.62

(Figures in parenthesis indicate percentage to total)

3.3 Rubber + Pineapple farming system (FS III)

The information regarding the per farm total cost, gross returns and net returns of Rubber + Pineapple farming system is presented in Table 5. The per farm total cost was Rs. 701925, which generated a gross return of Rs. 937057 and a net return of Rs. 235132, resulting in an overall B:C ratio of 1.33. Within the system, rubber recorded a

gross return of Rs. 423121, a net return of Rs. 106255, and a B:C ratio of 1.34. Pineapple generated a gross return of Rs. 513936, a net return of Rs. 128877, with a B:C ratio of 1.33, contributing a slightly higher share of the total returns. These results indicate that the Rubber + Pineapple farming system is economically profitable and provides higher farm income through diversified cropping.

(Figures in parenthesis indicate percentage to total)

Table 5. Per farm cost, returns and profitability of Rubber + Pineapple farming system (FS III) (Figures in Rs.)

Sr. No	Particular	Total cost	Gross returns	Net returns	B:C Ratio
1	Rubber	316866 (45.14)	423121 (45.15)	106255 (45.19)	1.34
2	Pineapple	385059 (54.86)	513936 (54.85)	128877 (54.81)	1.33
	Total	701925 (100.00)	937057 (100.00)	235132 (100.00)	1.33

3.4 Rubber + Tapioca farming system (FS IV)

Table 6, presents the per farm cost, returns and profitability of the Rubber + Tapioca farming system (FS IV). The total cultivation cost of the Rubber + Tapioca farming system was Rs. 470988, with rubber accounting for 56.96 per cent and tapioca 43.04 per cent of the total cost. The system generated a gross return of Rs. 781891, of which

tapioca contributed 55.54 per cent, while rubber contributed 44.46 per cent. The net return realized from the farming system was Rs. 310903, with tapioca contributing a major share (74.47%) compared to rubber (25.53%). The overall B:C ratio was 1.66, indicating that the Rubber + Tapioca farming system was economically profitable.

Table 6. Per farm cost, returns and profitability of Rubber + Tapioca farming system (FS IV) (Figures in Rs.)

Sr. No	Particular	Total cost	Gross returns	Net returns	B:C Ratio
1	Rubber	268265 (56.96)	347640 (44.46)	79375 (25.53)	1.30
2	Tapioca	202723 (43.04)	434251 (55.54)	231528 (74.47)	2.14
	Total	470988 (100.00)	781891 (100.00)	310903 (100.00)	1.66

(Figures in parenthesis indicate percentage to total)

3.5 Rubber + Coconut + Black Pepper farming system (FS V)

As indicated in Table 7, that the components of this farming system are Rubber, Coconut and Black pepper. It was observed from the table 7 that the total cost and gross returns were Rs. 558199 and Rs. 760531, respectively. Resulting in net returns of Rs. 202332 and B:C ratio of 1.36. The total cost, gross returns and net returns in case of

rubber is Rs. 374412, Rs. 499480 and Rs. 125068, respectively. Resulting in the B:C ratio of 1.33. Coconut was another major crop, contributing 23.42 per cent of net returns in this system. The total cost, gross returns and net returns in case of coconut is Rs. 108862, Rs. 156239 and Rs. 47377, respectively, resulting into B:C ratio to the extent of 1.44. In case of black pepper, it generated a gross return of Rs. 104812, a net return of Rs. 202332, resulting in a benefit cost ratio of 1.40 with the total cost of Rs. 74925.

(Figures in parenthesis indicate percentage to total)

Table 7. Per farm cost, returns and profitability of Rubber + Coconut + Black Pepper farming system (FS V) (Figures in Rs.)

Sr. No	Particular	Total cost	Gross returns	Net returns	B:C Ratio
1	Rubber	374412 (67.08)	499480 (65.68)	125068 (61.81)	1.33
2	Coconut	108862 (19.50)	156239 (20.54)	47377 (23.42)	1.44
3	Black pepper	74925 (13.42)	104812 (13.78)	29887 (14.77)	1.40
	Total	558199 (100.00)	760531 (100.00)	202332 (100.00)	1.36

3.6 Comparative economics of major rubber based farming systems in study area

The comparative economics of major rubber based farming systems in study area is given in the Table 8. As indicated in the table 8, it was observed that Rubber + Tapioca (FS IV) was the most income earning farming system, in which the per farm net returns were maximum of Rs. 310901, followed by Rubber + banana (FS II) of Rs. 297561. The net returns in the case of Rubber + Coconut + Black pepper (FS V)

were Rs. 202332 and the net returns in the Rubber (FS I) was Rs. 88836. As far as profitability is concerned, it was found that in study area among the different farming systems, 1) Rubber + tapioca farming system (FS IV) was highest profitable farming system with the B:C ratio of 1.66, followed by 2) Rubber + Banana farming system (FS II) B:C ratio of 1.62. 3) Rubber + Coconut + Black pepper farming system (FS V) B:C ratio 1.36. 4) Rubber + Pineapple farming system (FS III) B:C ratio of 1.33. 5) Rubber farming system (FS I) had the low B:C ratio of 1.30.

Table 8. Comparative economics of major Rubber based farming systems in study area (Rs./farm)

Sr. No	Particular	Total cost	Gross return	Net return	B:C Ratio
1	Rubber (FS I)	298214	387050	88836	1.30
2	Rubber + Banana (FS II)	479265	776826	297561	1.62
3	Rubber + Pineapple (FS III)	701925	937057	235132	1.33
4	Rubber + Tapioca (FS IV)	470988	781891	310903	1.66
5	Rubber + Coconut + Black Pepper (FS V)	558199	760531	202332	1.36

3.7 Economics of major rubber based farming systems standardization on area basis

The per farm economics of farming systems are depicted in Table 3 to 8. Farmers allocation of that area was considered as a basis. The animal components or any other allied agribusiness component was not found in this study. Therefore, the attempt is made to standardize the farming system on an area basis to assess if any change in the per hectare economics as compared to per farm economics. Table 9, depicts the economics of major rubber based farming systems standardization on area basis. The Rubber + Tapioca farming system (FS IV) recorded the net return of Rs. 214414 per hectare, with a B:C ratio of

1.66, followed by Rubber + Banana (FS II) of Rs. 227146 per hectare, with a B:C ratio of 1.62. The Rubber + Coconut + Black pepper farming system (FS V) recorded a net return of Rs. 121156 per hectare and a B:C ratio of 1.36, while Rubber + Pineapple (FS III) recorded Rs. 132096 per hectare with a B:C ratio of 1.33.

The Rubber farming system alone (FS I) had the lowest net return of Rs. 98707 per hectare and the lowest B:C ratio of 1.30, indicating comparatively lower economic performance than the integrated rubber based farming systems. Overall, the results indicate that, FS II was the most profitable in terms of net returns, whereas FS IV was the most economically efficient based on the B:C ratio.

Table 9. Economics of major rubber based farming systems standardization on area basis

Sr. No	Particular	Total cost	Gross return	Net return	B:C Ratio
1	FS I				
	Rubber	331349	430056	98707	1.30
2	FS II				
	Rubber	252437	409168	156731	1.62
	Banana	113414	183829	70415	1.62
	Total	365851	592997	227146	1.62
3	FS III				
	Rubber	209000	279011	70011	1.33
	Pineapple	185340	247425	62085	1.33
	Total	394340	526436	132096	1.33
4	FS IV				
	Rubber	185148	307364	122216	1.66
	Tapioca	139673	231871	92198	1.66
	Total	324821	539235	214414	1.66

(continued on next page)

Sr. No	Particular	Total cost	Gross return	Net return	B:C Ratio
5	FS V				
	Rubber	230633	314231	83598	1.36
	Coconut	53480	72865	19385	1.36
	Black pepper	50138	68311	18173	1.36
	Total	334251	455407	121156	1.36

4. Conclusion

The per farm total cost of cultivation of Rubber farming system was Rs. 298214 and the gross returns were Rs. 387050, with the B:C ratio of 1.30. In case of Rubber + Banana farming system, the per farm total cost and gross returns were Rs. 479265 and Rs. 776826, respectively, resulting into net returns of Rs. 297561, with the B:C ratio of 1.62. Regarding the Rubber + Pineapple farming systems, the per farm total cost and gross returns were Rs. 701925 and Rs. 937057, respectively, the total net returns were Rs. 235132, resulting in a B:C ratio of 1.33. In regard to Rubber + Tapioca farming system, the per farm total cost and the gross returns were Rs. 470988 and Rs. 781891, respectively, net returns were Rs. 310903, with a B:C ratio of 1.66. In case of Rubber + Coconut + Black pepper farming systems, the per farm total cost and the gross returns were Rs. 558199 and Rs. 760531, respectively, with a net return of about Rs. 202332, resulting in a B:C ratio of 1.36.

Among all the systems, rubber + tapioca (FS IV) was most profitable (B:C ratio 1.66), followed by rubber + banana (FS II, 1.62), while sole rubber cultivation (FS I) was the least profitable (1.30), confirming the economic advantage of intercropping over monoculture.

The per hectare economics of rubber based farming systems shows that, Rubber + Banana farming system (FS II) was the most profitable in terms of net returns (Rs. 227146), while Rubber + Tapioca (FS IV) was the most efficient based on the B:C ratio (1.66). Thus, FS II and FS IV showed better economic performance compared to the other farming systems.

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