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Coconut-livestock (Cow) based integrated farming system

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Abstract

The present investigation was undertaken to compare the performance of coconut-livestock (cow) based Integrated Farming System with coconut mono cropping system at Horticulture Research and Extension Centre, Arsikere during 2013 to 2021 in old coconut garden. Plants spaced at 7.5 m × 7.5 m. Two treatments viz., T1: Coconut + Fodder crops + Cow (IFS), T2: Mono crop of coconut are imposed as non-replicated trials in an area of 0.40 ha each. The experiment results revealed that the T1 has produced the highest average value with respect to yield of nuts per palm per year (100.82), Gross return (Rs. 3, 21,513/ unit) and net return (Rs.2, 28,595/ unit) and also B: C ratio (3.69). Besides, the model also generated more manure and added more nutrients to soil compare to T2.

Keywords: Coconut, integrated farming system, benefit, cost ratio

Introduction

India is an agrarian country, the Indian economy is predominantly agriculture based. Size of the land holding is shrinking over the period, which poses a severe challenge to the sustainability and profitability of farming (Murugan, 2015) [7] (Siddeswaran *et al.*, 2012) [10]. From the Green Revolution onwards, farmers are mostly concentrating on single enterprise based agricultural systems that lead to deterioration of soil health, increased risk of crop failure and downward trends in productivity (Rahman and Sarkar 2012) [9]. A system approach is the need of the hour for fulfilling the demand of ever increasing population without disturbing the ecological balance. Integrated farming system seems to be the possible solution to meet the demand for food production, stability of income, nutritional security and rural employment, particularly for the small and marginal farmers with limited resources. Coconut (*Cocos nucifera* L.) Is an important perennial crop of humid tropics and is mainly grown in the southern states of Kerala, Karnataka, Tamil Nadu and Andhra Pradesh, secures a top position by holding over two-thirds of the total production and area of cultivation in the country (CDB, 2020) [2]. India stands third in production with better productivity of nuts per hectare (Kalidas *et al.*, 2014) [3]. Since the adult palm of sole crop of coconut spaced at 7.5 m × 7.5 m apart, effectively uses only 22.3 per cent of land area, while the average air space utilised by the canopy is about 30 per cent and solar radiation interception is 40-45 per cent (Maheshwarappa *et al.*, 2013) [5]. Thus coconut gardens offers excellent opportunities for inclusion of suitable components to maximise the returns. Hence the present investigation was undertaken to compare the performance of coconut-livestock (cow) based Integrated Farming System with coconut mono cropping system.

Materials and Methods

Coconut-livestock (cow) based Integrated Farming System was conducted at Horticulture Research and Extension Centre, Arsikere during 2013 to 2021 in old coconut garden (Arsikere Tall) spaced at 7.5 m × 7.5 m. Two treatments viz., T₁: Coconut + Fodder crops + Cow (IFS), T₂: Mono crop of coconut are compared with each other in non-replicated trials in an area of 0.40 ha each. Fodder crop like Hybrid Napier (Co-3) and (*Stylosanthes hamata*) was grown in the interspace of coconut whereas Drumstick (*Moringa oleifera*) and Agase (*Sesbania grandiflora*) were planted at the border. The recommended package of practice was adopted for application of manure and fertilizers and all the required inorganic and organic manures were applied in two equal split during May-June and September-October months. The produces were harvested as and when ready and the mean was calculated. Five cows (HF-Holstein Friesian) are used for the milching purpose.

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The cost of labour, fertilizer, crop and livestock maintenance, plant protection measures and other miscellaneous overhead charges were treated as input cost of respective year. The returns (output) were computed in terms of rupees by combining the weighted average yield of different years under consideration with weighed average market prices prevailed during respective years. Coconut lots auction happens four times a year and individual nut price will be calculated by dividing the auctioned lot price by number of nuts per lot.

Results and Discussion

Influence of treatments on growth and yield of the IFS and mono crop system cultivation of coconut presented in Table 1. Mean of nine years data indicates that number of leaves on the crown is marginally more in T₂ (30.96) compared with T₁ (30.53), with respect to number of bunches per palm T₂ (12.55) recorded slightly more than the T₁ (21.51), number of buttons per palm recorded more in T₁ (241.10) compared with T₂ (233.18), with respect to nut yield per palm T₁ (100.82) recorded highest nut yield per palm than T₂ (96.76), Copra content was more in T₂ (149.86) than T₁ (148.67), with respect to Copra yield per palm, oil content and oil yield per palm T₁ (15.04, 67.00, 10.03) recorded highest than T₂ (14.47, 65.98, 9.65) respectively. Marginal increase in coconut yield due to application of inorganic fertilizer combined with organic manure has been reported by many workers (palaniswami *et al.*, 2007; Upadhyaay *et al.*, 2009; Krishnakumar and Maheswarappa, 2010; Maheshwarappa *et al.*, 2011) [8, 13, 4, 6].

Economics

The economics of the Livestock based farming system (T₁) and coconut based monocropping system (T₂) was analyzed in the terms of average gross return, net return and benefit cost

ratio. The average of nine years data presented in Table 2. The maximum average gross return obtained in T₁ is Rs. 3,21,513/ Unit. Whereas minimum average gross return of Rs.88, 584/ Unit were obtained in T₂. With respect to average net return T₁ recorded highest of Rs. 2,28,595/ Unit in comparison with T₂ which has recorded lowest average net return of Rs.63,945/ Unit. Benefit cost ratio was also calculated for both the models where T₁ recorded highest of 3.69 whereas T₂ recorded the lowest of 3.59. Even though marginal difference was noticed with respect to benefit cost ratio but efficacy of the model entirely depends on the actual net return received by the farmer. Similar findings were also reported by many studies (Swarnam *et al.*, 2016) [11].

Soil nutrient Status

The observations respect to soil nutrient status of the IFS and mono crop system cultivation of coconut presented in Table 3. After nine years of treatment initiation the soil organic carbon content differed among the treatments. In T₁ soil organic carbon content found maximum of 0.99 per cent whereas the minimum of 0.69 per cent was recorded in T₂. Among major soil nutrient content Nitrogen (N), Phosphorus (P₂O₅), potash(K₂O) was found highest in T₁ (242.00 kg/ha, 21.00 kg/ha, 162.00 kg/ha respectively), whereas lowest was found in T₂ (194.00 kg/ha, 18.99 kg/ha, 129.80 kg/ha respectively). Among two treatments T₁ (IFS) showed increased soil nutrient content of N, P₂O₅, and K₂O. The attributed reason was that the T₁ (IFS) model is dominated by milch cows, which produce more manure compared to T₂ (Mono crop of coconut). Tirukumaran (2002) [12], Esther Shekeinah (2005) [1] and Murugan (2015) [7] also had similar opinion compared to conventional practices, IFS model would produce more manure and in turn, nutrient addition.

Table 1: Influence to treatments on growth and yield of the IFS and Mono crop system cultivation of coconut

parameters	T1: Integrated Farming System (IFS) Cow									
	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	Average
No. leaves on the crown	31.10	30.10	30.40	31.10	30.00	30.20	30.40	30.50	31.00	30.53
No. bunches / palm/ year	12.10	125.00	12.00	12.50	12.50	12.60	12.70	12.70	13.50	12.51
No. buttons / palm / year	236.70	229.20	230.20	235.50	238.40	245.20	248.90	250.80	255.00	241.10
Nut yield/palm/ year	101.80	94.70	95.20	98.00	97.50	102.22	100.80	108.20	109.00	100.82
Copra content (gm/nut)	146.30	146.11	146.20	148.00	149.00	150.20	150.60	150.90	150.80	148.67
Copra yield/palm (kg)	14.89	14.31	13.91	14.50	14.52	15.35	15.18	16.32	16.43	15.04
Oil content (%)	65.80	66.44	66.50	67.30	67.00	67.50	67.50	67.50	67.50	67.00
Oil yield/palm (Kg)	9.80	9.50	9.25	9.61	9.55	10.26	10.26	11.01	11.09	10.03
parameters	T2: Mono crop of coconut									
No. leaves on the crown	30.60	30.30	30.80	31.80	31.00	31.20	31.00	31.10	30.90	30.96
No. bunches / palm/ year	12.30	12.20	12.30	13.00	12.80	12.90	12.80	12.70	12.00	12.55
No. buttons / palm/ year	231.10	222.5	223.50	226.50	230.50	238.50	240.30	240.00	239.80	233.18
Nut yield/palm/ year	97.30	98.10	98.50	96.00	96.00	98.00	97.00	98.00	92.00	96.76
Copra content (gm/nut)	149.60	150.50	152.50	153.20	152.5	146.20	148.30	148.50	147.50	149.86
Copra yield/palm (kg)	14.56	14.76	15.02	14.70	14.64	14.32	14.30	14.50	133.50	14.47
Oil content (%)	66.10	65.60	65.80	66.00	66.20	66.20	66.00	66.00	66.00	65.98
Oil yield/palm (Kg)	9.63	9.68	9.88	9.69	9.70	9.47	9.52	9.57	8.95	9.65

Table 2: Economics of the IFS and Mono crop system cultivation of coconut

		T1: Integrated Farming System (IFS) Cow									
		2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	Average
Input cost	Crop maintenance (Rs)	22100	15200	16,400	17800	16200	16000	18000	18500	20000	17800
	Cow Maintenance (Rs)	110100	73000	74500	76300	40000	45000	47000	46800	45663	62040
Cost of production(Rs)		132200	116800	121300	126100	71700	71000	76500	76800	71263	95963
Output cost	Coconut (Rs)	71260	79548	79968	89180	85800	107310	115896	121216	120960	96739
	Milk (Rs)	146260	163080	170505	178200	186351	197200	179800	154192	152793	169820

	FYM (Rs)	-	-	-	74000	-	36000	38500	38000	63000	27722
	Cow sold (Rs)	-	-	-	45000	48600	18000	39000	86700	-	26367
	Gross Returns(Rs)	217520	242628	250473	393680	320751	358510	373196	400108	336753	321513
	Net returns(Rs)	85320	125828	129173	267580	276451	287510	296696	323308	265490	228595
	B.C Ratio	1.65	2.08	2.06	3.12	4.47	5.05	4.88	5.21	4.73	3.69
T₂: Mono crop of coconut											
	Cost of production(Rs)	22100	22100	22700	23500	22850	28000	27000	27,500	26000	24639
	Gross Returns(Rs)	68110	82404	82740	87360	84500	102900	108640	109760	70840	88584
	Net returns(Rs)	46010	60304	60040	63860	61650	74900	81640	82260	44840	63945
	B.C Ratio	3.08	3.73	3.64	3.72	3.70	3.68	4.02	3.99	2.72	3.59

Table 3: Soil nutrient status of the IFS and mono crop system cultivation of coconut

Soil nutrient status		
	T ₁ (IFS)	T ₂ (Monocrop)
OC (%)	0.99	0.69
N (kg/ha)	242.00	194.00
P ₂ O ₅ (kg/ha)	21.00	18.99
K ₂ O (kg/ha)	162.00	129.80

Conclusion

The experiment results revealed that the Treatment T₁: Coconut + Fodder crops + Cow (IFS) has produced the highest average value with respect to yield of nuts per palm per year (100.82), Gross return (Rs. 3, 21,513/ unit) and net return (Rs. 2, 28595/ unit) and also B: C ratio (3.69). Besides, the model also generated more manure and added more nutrients to soil compare to treatment T₂: Mono crop of coconut. The income of conventional farming system was lower than the IFS. Addition of five mulching cow per unit is quite optimum with cultivation of fodder crops. Hence, it can be concluded that the IFS approach was more economical and would sustain the production and profit of coconut growers.

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