E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; SP-7(6): 51-55
Received: 06-04-2024
Accepted: 10-05-2024

AM Barekar
M.Sc. Student, AICRP- On Station Research Centre on Integrated Farming System Research, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

SN Potkile
Assistant Professor, AICRP- On Station Research Centre on Integrated Farming System Research, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

JP Deshmukh
Associate Professor, AICRP- On Station Research Centre on Integrated Farming System Research, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

AN Paslawar
Professor, AICRP- On Station Research Centre on Integrated Farming System Research, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

BS Morwal
Assistant Professor, AICRP- On Station Research Centre on Integrated Farming System Research, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Corresponding Author:
AM Barekar
M.Sc. Student, AICRP- On Station Research Centre on Integrated Farming System Research, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Development of integrated farming systems model under rainfed condition

AM Barekar, SN Potkile, JP Deshmukh, AN Paslawar and BS Morwal

DOI: https://doi.org/10.33545/2618060X.2024.v7.i6Sa.812

Abstract
A research study titled "Development of Integrated Farming System Model under Rainfed Condition" was conducted during the kharif-rabi season of 2022-23 at the All India Co-ordinated Research Project on Integrated Farming System Research, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The model, designed for a one hectare area, incorporated various components such as crop cultivation, horticulture, goat farming, poultry, composting, kitchen gardening, and boundary plantation. The integrated farming system model demonstrated a system productivity of 7542 kg ha^{-1} of soybean equivalent yield. The combined gross monetary returns from crop, horticulture, goat farming, poultry, composting, kitchen gardening, and boundary plantation amounted to ₹333600, with a net monetary return of ₹205105 and a benefit-cost ratio of 2.60.

Keywords: Integrated farming system, components, productivity and profitability

Introduction
To address the complex goals of poverty reduction, food security, competitiveness and sustainability, many researchers advocate the farming systems approach for research and development. Farming systems represent a strategic combination of farm enterprises and available resources to ensure profitability while maintaining environmental and socio-economic balance. The objective is to enhance agricultural production, productivity, profitability, sustainability, food balance, environmental cleanliness, resource recycling, year-round income, resolution of fuel and fodder shortages, efficient input-output use, expanded agricultural opportunities, increased employment, improved farmer livelihoods and sustainable agricultural and eco-friendly practices. Comparative data on human and livestock populations (18% humans and 15% livestock) and available natural resources (2.3% land, 4.2% water, 1% forest, and 0.5% pasture and grazing lands) globally highlight the pressure on Indian agriculture. India accounts for 11.3% of the world's arable land, signifying its potential for current and future food security (Sati 2017) [7]. Despite economic progress over 70% of the population resides in rural areas where agriculture remains the primary employer engaging around 60% of the workforce. Post-independence, Indian agriculture underwent transformation witnessing revolutions in crop (green revolution), milk (white revolution), oilseed (yellow revolution) and fish (blue revolution) leading to self-sufficiency in most food commodities. However, these advancements primarily benefited larger, wealthier farmers leaving smallholders representing over 86% of farming families with average land holdings of less than 1.2 hectares at a disadvantage (Gangwar and Singh,2016) [2]. Land fragmentation is a central issue, with no scope for horizontal expansion due to population growth and declining per capita land availability. The IFS approach promotes ecological intensification and aims to reduce anthropogenic inputs while enhancing ecosystem functions like nutrient recycling, soil fertility and environmental performance. Well-managed IFS are deemed less risky due to enterprise synergies, product diversity and ecological reliability (Behera and France, 2016) [1]. Residue recycling and improved land-use efficiency are key features of IFS with component selection varying by region based on agro-climatic conditions, land type, water availability, farmer socioeconomics and market demand. Establishing effective linkages and complementarities between components is essential for developing holistic and sustainable farming systems (Paramesh *et al*., 2021) [5]

Materials and Methods

The research project titled "Development of an Integrated Farming System Model under Rainfed Condition" was carried out at the AICRP on Station Research Centre on Integrated Farming System Research, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during the kharif-rabi season of 2022-23. This study aimed to design and evaluate an integrated farming system model covering a one hectare area. The model included multiple components such as crop cultivation, horticulture, goat farming, poultry, composting, kitchen gardening, and boundary plantation were selected for the study purpose with a view to get income round the year from the IFS model as a whole.

Table 1: Details of the components in IFS model

Sr. No.	Components	Area (ha)
A	Cropping systems	-
1	Soybean	0.70
2	Chickpea	
B	Horticulture 90 plants each 5 m × 5 m distance	-
3	Custard apple + Drumstick	0.20
C	Livestock	
4	Goat (10 doe + 1 buck) *Berari*	0.03
5	Poultry (200 birds)	
	Giriraj birds 50 birds per batch two batches per season	
6	Compost 1 pit	
D.	Other	-
7	Kitchen garden	0.02
8	Boundary plantation	0.05
	Total	1.00

Results and Discussion

Crop Component

During the kharif-rabi season of 2022-23, the crop component of the integrated farming system model yielded two crops: soybean and chickpea. Soybean yielded grain and straw yields of 15.65 and 22.00 q respectively, while chickpea yielded grain and straw yields of 13.05 and 16.20 q respectively. The total gross monetary returns and net monetary returns from the soybean-chickpea cropping system were ₹140885 and ₹83105 respectively, with an economic benefit-cost ratio of 2.44.

Table 2: Yield of crop component in integrated farming system model

Crop component	Area (ha)	Yield (q)		Economics			
		Main produce (Grain)	By produce (Straw)	GMR (₹)	COC (₹)	NMR (₹)	B:C ratio
Soybean	0.70	15.65	22.00	70595	27580	43015	2.56
Chickpea		13.05	16.20	70290	30200	40090	2.33
Total	0.70			140885	57780	83105	2.44

*Soybean: ₹ 43 kg^{-1}, Chickpea:₹ 52 kg^{-1} & crop straw:₹ 1.5 kg^{-1}.

Horticulture Component

In the horticulture component of the integrated farming system model, 0.20 hectares were dedicated to cultivating custard apple and drumstick. Custard apple trees (*Balanagar*) were planted with a spacing of 5 × 5 m, while drumstick trees (*Co-1*) were intercropped with custard apple trees at a spacing of 2.5 × 2.5 m. The yield obtained was 10 q of custard apple and 0.375 q of drumstick. The total gross and net monetary returns from this horticulture component were ₹41500 and ₹31640, respectively, with a benefit-cost ratio of 4.21.

Table 3: Yield of horticulture component in integrated farming system model

Horticulture component	Area (ha)	Yield (q)	GMR (₹)	COC (₹)	NMR (₹)	B:C ratio
Custard apple	0.20	10	40000	9360	30640	4.27
Drumstick		0.375	1500	500	1000	3.00
Total	0.20		41500	9860	31640	4.21

*Custard apple: ₹ 40 kg^{-1} & Drumstick: ₹ 40 kg^{-1}

Livestock Component

The livestock component of the integrated farming system model comprised goats and poultry, with an allocated area of 0.03 hectares. The goat component included Berari breed goats (10 does + 1 buck). A total live weight of 123 kilograms was obtained from the goat component, with females weighing 69 kilograms and males 54 kilograms. Additionally, 720 kilograms of goat manure were produced and five kids were born during the 2022-23 period. For poultry, four batches of 50 Giriraj birds were raised annually for meat production, with each batch kept for a 75-day period. The entire flock yielded a live weight of 216 kilograms and a total of 410 kilograms of poultry manure were obtained. The combined gross and net monetary returns from the goat and poultry components were ₹109615 and ₹64765, respectively, with a benefit-cost ratio of 2.44.

Table 4: Yield of livestock component in integrated farming system model

Components	Yield (kg)	GMR (₹)	COP (₹)	NMR (₹)	B:C ratio
Weight (kg)	123	42765	17150	25615	2.49
Goat manure (kg)	720				
Poultry component					
Live weight (kg)	216	66850	27700	39150	2.41
Poultry manure (kg)	410				
Total		109615	44850	64765	2.44

*Goat female: ₹ 325 kg^{-1}, male: ₹ 350 kg^{-1} & Goat manure: ₹ 2 kg^{-1},
*Poultry bird live weight: ₹ 300 kg^{-1} & Poultry manure: ₹ 5 kg^{-1}

Compost Component

A single compost pit measuring 10 feet by 6 feet by 3 feet was utilized for composting on the farm. Waste or byproducts from each enterprise/component, which were decomposable served as raw materials for composting, resulting in a total of 1800 kg of compost. The gross and net monetary returns from the compost amounted to ₹7200 and ₹2128 respectively, with a benefit-cost ratio of 1.42.

Table 5: Yield of compost component in integrated farming system model

Compost component	Yield (kg)	GMR (₹)	COP (₹)	NMR (₹)	B:C ratio
Compost	1800	7200	5072	2128	1.42

*Compost: ₹ 4 kg^{-1}

Kitchen Garden and Boundary Plantation

The kitchen garden within the integrated farming system model encompassed vegetable and fruit crops such as cowpea, coriander, fenugreek, dill leaves, carrot, beet, tomato, radish, and papaya, covering an area of 0.02 hectares. The total yield from the kitchen garden was 111 kg. Additionally the boundary plantation included karonda and *glyricidia* over an area of 0.05 hectares, yielding 1000 kg and 85 kg respectively. The yield obtained from *glyricidia* through lopping practice was integrated into the compost. The total gross and net monetary returns from the kitchen garden were ₹ 4400 and ₹ 2550 respectively with a benefit-cost ratio of 2.38, while for the boundary plantation, the figures were ₹ 30000 and ₹ 20917 respectively, with a benefit-cost ratio of 3.30.

Table 6: Yield of kitchen garden and boundary plantation in integrated farming system model

Components	Area (ha)	Yield (kg)	GMR (₹)	COC (₹)	NMR (₹)	B:C ratio
Kitchen garden						
Cowpea, Coriander, Fenugreek, Dill leaves, Carrot, Beet, Tomato, Radish and Papaya	0.02	111	4400	1850	2550	2.38
Boundary plantation						
Karonda	0.05	1000	30000	9083	20917	3.30
Glyricidia		85				

*Karonda: ₹ 30 kg^{-1}

Integrated Farming System Model

The integration of various components on a one hectare area yielded a total system productivity in soybean equivalent yield to 7542 kg per hectare. The net returns obtained from the IFS model amounted to ₹205105. It was noted that combining two or more livestock components with the crop component resulted in higher system productivity but integrating crop, horticulture, goat farming, poultry, composting, kitchen gardening and boundary plantation led to higher component and system productivity. These findings align with previous studies by Ravisankar *et al*. (2007) [6], Gopinath *et al*. (2014) [3], Shankar *et al*. (2017) [8] and Kharche *et al*. (2022) [4].

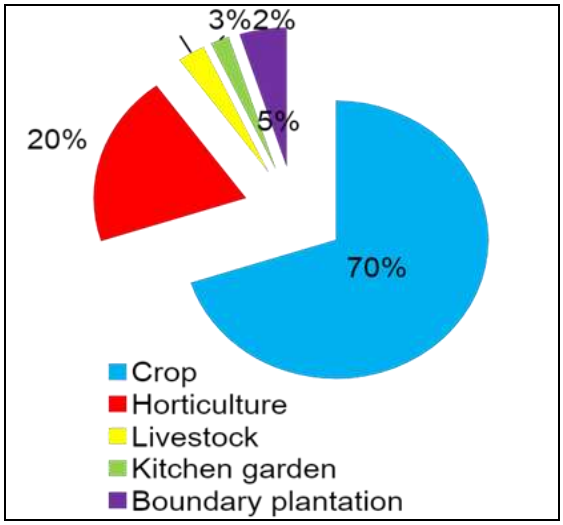

Fig 1: Per cent area allotted to different components in integrated farming system model.

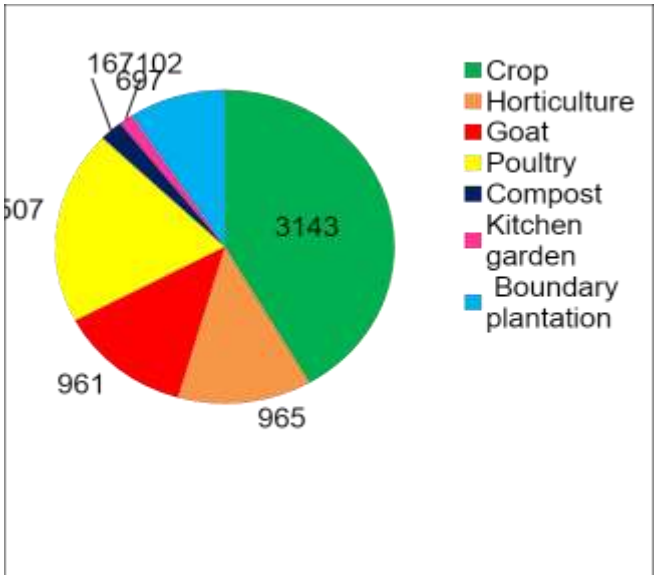

Fig 2: Component wise system productivity in integrated farming system model.

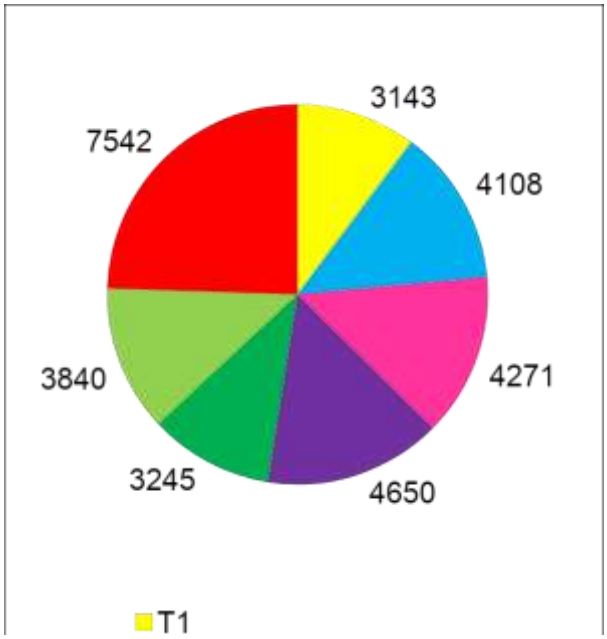

Fig 3: System productivity (kg) in integrated farming system model.

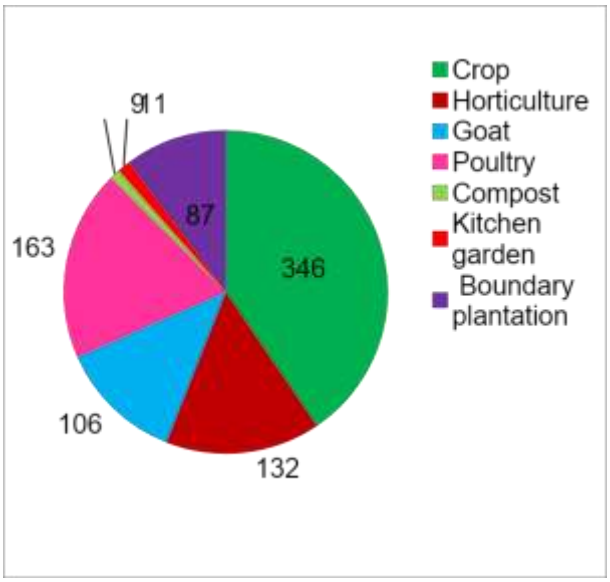

Fig 4: System economic efficiency (₹ day^{-1}) of integrated system model.

Table 7: Productivity and profitability of IFS model

Particular	Crop unit	Horti. unit	Goat unit	Poultry unit	Compost unit	Kitchen garden unit	Boundary plantation unit	Total
Productivity (kg ha^{-1})	3143	965	961	1507	167	102	697	7542
GMR (₹)	140885	41500	42765	66850	7200	4400	30000	333600
COC (₹)	57780	9860	17150	27700	5072	1850	9083	128495
NMR (₹)	83105	31640	25615	39150	2128	2550	20917	205105
B:C ratio	2.44	4.21	2.49	2.41	1.42	2.38	3.30	2.60

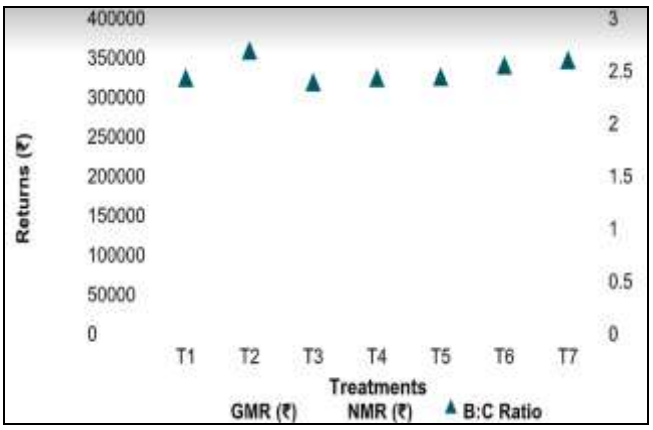

Fig 5: Economics of different integrated Farming system model.

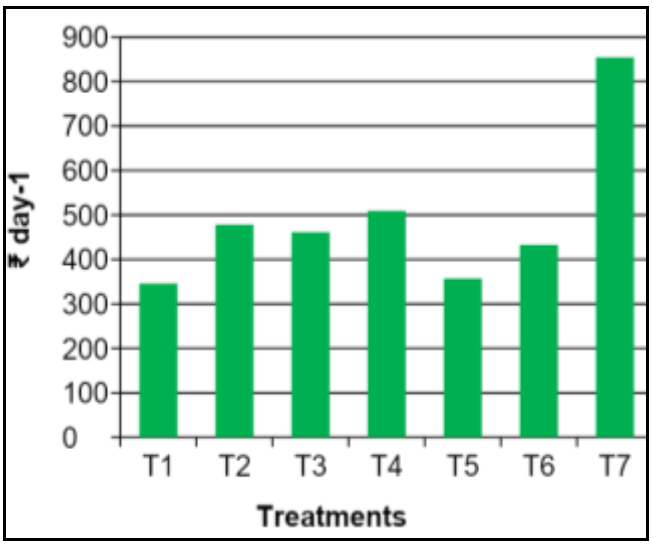

Fig 6: System economic in integrated farming System model.

Conclusion

The findings of the current investigation indicate that while integrating the maximum number of components crop, horticulture, goat, poultry, compost, kitchen garden, and boundary plantation resulted in higher system productivity and maximum gross and net monetary returns, it was observed that horticulture and boundary plantation achieved the maximum benefit-cost (B:C) ratio.

References

1. Behera UK, France J. Integrated farming systems and the livelihood security of small and marginal farmers in India and other developing countries. Advances in Agronomy. 2016;138:235-282.
2. Gangwar B, Singh JP. Modern concepts of Agronomy. Indian Society of Agronomy New Delhi; c2016. p. 146-147.
3. Gopinath KA, Srinivasarao C, Chary RG, Sreenath D, Osman M, Raju BMK, *et al.* Improving the productivity of rainfed farming systems of small and marginal farmers. Indian Journal Dryland Agric. Res. & Dev. 2014;29(1):52-56.
4. Kharche PP, Surve US, Pokharkar VG, Patil SC, Salgar SB. Yield, productivity and economics of integrated farming system under irrigated conditions of Western Maharashtra. Current Journal of Applied Science and Technology. 2022;41(12):13-20.
5. Paramesh V, Ravisankar N, Behera U, Arunachalam V, Kumar P, Solomon Rajkumar R, *et al.* Integrated farming system approaches to achieve food and nutritional security for enhancing profitability, employment and climate resilience in India. Food and energy security. 2021;2:321-344.
6. Ravisankar N, Pramanik SC, Rai RB, Nawaz S, Biswas TK, Bibi N. Study on integrated farming systems in hilly upland areas of Bay Islands. Indian Journal of Agronomy. 2007;52(1):7-10.
7. Sati VP. The future of food and agriculture in India: trends and challenges, 2017. https:/www.researchgate.net.
8. Shankar KA, Yogeesh LN, Prashant SM, Peer SP, Desai BK. Integrated farming system: Profitable farming to small farmers. International Journal of Current Microbiology and Applied Sciences. 2017;6(10):2819-2824.