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

NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; 9(1): 631-638
Received: 25-10-2025
Accepted: 28-11-2025

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Sustainable economic analysis of integrated farming systems in the Mandya under southern transition zone of Karnataka for need-based technology application and capacity development

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DOI: https://www.doi.org/10.33545/2618060X.2026.v9.i1i.4753

Abstract
The paper has attempted to expand the evaluation criteria of farming systems beyond profitability. The proposed methodology has been exemplified with a study conducted in a village in Nagamangala Taluk of Mandya district under Sotheren Transition Zone of Karnataka. The data on the inputs and outputs of a system and their utilization were collected through a well-structured pre-tested schedule from 40 sample farmers, in such a way that it captured the material flows into and out of the components of the given farming system. The data pertaining to Profitability and sustainability of different integrated farming systems module of Nagamangala taluk of mandya district under Southern Dry zone were analyzed. All the modules were showing positivity with respect to net income and B:C which indicates that the different integrated farming systems practiced by farmers are in profitable and sustainable condition. Among all combination of Agriculture, Horticulture crop along with livestock farming like daity, Sheep and goat rearing and fishery resulted in higher net income (Rs. 2,65,000) and BC ratio (2.95) followed by the module having Agriculture, Horticulture crop along with sericulture as other component and livestock farming like daity, Sheep and goat rearing resulted in second highest net income (Rs. 3,43,000) and BC ratio (2.75). From the study and analysing the data we can conclude that in any integrated farming system selection of different component are very important which complimentary and supplementary to each other to get higher benefit and long term sustainability. The farming systems that can minimize the need for external inputs have a key role in sustaining agricultural systems in the rainfed agriculture. Such an expanded analysis of farming systems will be useful in planning for technology generation and transfer in the Indian agriculture.

Keywords: Farming system, Livestock, Economics, Mandya

Introduction
India's economy is predominantly driven by agriculture, with small and marginal farmers at its core. Since the Green Revolution, Indian farmers have largely shifted towards single enterprise-based agricultural systems, which have led to deteriorating soil health, increased risk of crop failure, and declining productivity. As population growth, urbanization, and income levels rise, the demand for animal-based food products is also increasing, further intensifying the competition between crop cultivation and livestock production. This situation highlights the urgent need for a systems-based approach that can meet the growing food demand without disrupting ecological balance. The integrated farming system (IFS) presents a promising solution for addressing these challenges, particularly for small and marginal farmers with limited resources. It offers a sustainable way to enhance productivity, reduce dependence on chemical fertilizers, and ensure ecological soundness. Additionally, it promotes efficient resource management and supports income stability and nutritional security for farmers. In this context the present study was conducted on Economic Analysis of Integrated Farming Systems in the Mandya district for need-based Technology Application and Capacity Development with the following objectives 1. To identify the existing integrated farming system Nagamangala tulaku of Mandya district under Southeren Dry Zone 2.

To study the profitability and sustainability of farming 3. To study the source of technologies, critical inputs availability and accessibility of technical guidance to the farmers. 4. To develop need based technology matrices and appropriate components to strengthening IFS models based on the study outcome

Weather parameter

Mandya comes under Southern dry zone and it has arid and dry climate for most of the year except during winter which is slightly cool but mild. It experiences bimodal rainfall with one peak at May/June and the other in September/October. Nagamangala, and Srirangapatna Taluks of district receive lowest rainfall. South West monsoon showers occupy the major part of annual rains. They are very much erratic and scanty. Dry spells prevail from the 2nd week of July and extend up to end of August, sometimes even up to first fortnight of September. This causes severe moisture stress to early sown crops and affects the crop growth and yields. Mean minimum temperature ranges from 14º to 30º C, but occasionally touches 12º C during December. Mean maximum temperature ranges from 27º to 39º C which is mostly noted in May month. This track has relatively low humidity. Wind velocity is high during July/August and February/March months. This Zone receives substantial rainfall, averaging 750 mm annually. The rainy day's ranges from 45 days to 64 days in the zone. This rainfall is primarily influenced by the south west and north east monsoons, which play a significant role in sustaining agricultural activities.

Major soil type

Red sandy loam soil is predominantly prevailing which are ranging from red gravelly to red loamy soils in Mandya districts, red loam derived from granite, gneiss and schists.

Source of irrigation

The river Cauvery is the major source for an extensive irrigation system (parts of Mandya and Mysuru district) and for hydroelectric power. The river has supported irrigated agriculture for centuries and served as the lifeblood of the ancient kingdoms and modern cities of South India. River Hemavathi being the main tributary of Cauvery joins Krishnaraja Sagar (KRS) at Srirangapatna. River Kabini (also called as Kapila) originates in Heggadadevankote flows through Nanjangud and joins cauvery at T. N. Pura (Thirumalakoodala Sangama). It provides irrigation to parts of Krishnarajpet before joining cauvery near KRS Shimsha, a seasonal river provides irrigation to limited area in parts of Maddur and Malavalli taluks and finally joins Cauvery near Bluff (Panditehalli) in 18 Malavalli taluk. A Hydro-electric generating station is located at Hilakul provides irrigation for parts of Channapatna taluk.

Land holding and cropping intensity

Average Cropping Intensity for the Mandya (Southern Dry Zone) is 136% (state average - 121.09) indicating the prevalence of multiple cropping and better irrigation facilities.

Pattern of land allocation for different crop in Mandya (Southern Dry Zone) marginal farmers devoted the maximum land to vegetables and fruits (22.95%), followed by pulses (22.34%) and cereals (19.23%) whereas the lowest area was allocated for plantation crops (3.11%). However, small, medium and large farmers allocated maximum land to commercial crops followed by vegetables and fruits and cereals, whereas the lowest area was allocated for pulses and millets**.**

Major crops

The Mandya (Southern Dry Zone) has major cereal crops *viz*. Paddy, Ragi, Maize, Sugarcane, Horse gram, Cowpea, Black gram. Among the horticultural crops coconut, vegetables, banana are main crops.

Paddy is cultivated over 146283.09 hectares, making it one of the predominant crops of the Southern Dry Zone. The total production of the zone is 672271 tonnes. The productivity of the Zone is 4320 kg/ha, while that of Mandya is 4540 kg/ha. Second important cereal crop of the Zone is Ragi. Which occupied 152524 ha area with production of 190335 and productivity was 11204 kh/ha. Mandya district alone occupied 63583 ha area in the Southern Dry Zone. Pulse crop *viz* Cowpea, blackgram, Horse gram, are majorly growing in the district. In southern dry Zone Horse gram covered the area of about 57309, with a production of 38868 tonnes and productivity is 618 kg/ha.

Amon the horticulture crop tomato occupied an area of about 10847 ha with a production of 152270 metric tonnes and productivity was 12739 kg/ha. Coconut is important plantation of Mandya district covered highest area of 67106 ha area with a production of 600934 thousand nuts and productivity was 8955 nuts/ha.

Livestock Population and productivity

The Southern Mandya district has a diverse livestock population contributing significantly to the region's agricultural economy and livelihoods. Mandya district has the highest cattle, pig, poutry and has highest fish production of 23019 metric tonnes.

Farming system

The cropping system in Mandya district Rice-based cropping systems. These include rice-rice, rice-pulses, rice-fallow, rice-vegetables, and rice-maize. Among the horticultural crop coconut was occupied area followed by different vegetable crops like tomato, brinjal, cabbage and flower crops.

Material and Methods

Indian agricultural landscape is continually facing challenges due to environmental changes, market fluctuations, and the pursuit of improved livelihoods. In response, integrated farming systems (IFS) have emerged as a promising strategy to address these multifaceted challenges in agriculture, particularly in regions vulnerable to environmental uncertainties. Small farmers usually adopt IFS models integrating agriculture, livestock, forestry, and fisheries. However, the specific components within IFS vary significantly based on agro-climatic conditions, land types, socioeconomic statuses of farmers, and market dynamics (Paramesh *et al*., 2022) [2]. The IFS indicates potential for enhancing farmer well-being and global food production.

Hence the study was undertaken to assess the integrated farming system existing in the Nagamangala taluk of mandya district, Karnataka made through survey.

Sample and sampling technique

To assess the various aspects of integrated farming system followed in the particular agro-ecological situation including present status, income generation and profitability. The farmers were selected based on the components they were following and have adopted in the farm.

Data collection

The prepared questionnaire was used to collect the necessary information to record all the required data for the study from the respondents to identify the IFS adopted, its advantages,

drawbacks and income deviations. Two types of data *viz*., baseline data - general information of the taluks and detailed data of respondents including basic information of the farm and nutritional aspects of the family was collected via discussion with the respondents.

Analytical Technique

The components existing the farm primarily component wise, the total cost and returns were estimated and then evaluated as per the integrated farming system's average total cost, return, gross margin and benefit cost ratio. Later the data was compelled component wise from all the talukas and descriptive statistics (vis., frequency and percentages) were used to analyse the demographic and socio economic characteristics of the respondents. The data was processed using MS Excel and findings interpreted to identify the socio-economic variables, the major IFS system adopted by farmers and reasons for preferring IFS and constraints. The study also highlighted the research gaps prevailing and proposed research for development of technology. Similarly the extension gaps occurring in IFS and priorities and strategies to be adopted based on perception by farmers and research scientist. Hence providing the suitable recommendations for the technology development through the introduction of new varieties, technology and capacity development programmes.

Results and Discussion

Table 1: Gender wise classification of the respondent farmers of Nagamangala Taluk of Mandya district under Southern Dry Zone of Karnataka

Sl. No.	Gender	Zone (n= 40)	
		Frequency (No.)	Percentage
1	Male	38	97.50
2	Female	2	2.50
Total		40	100

Results: All the randomly selected for the study were male respondent (97.05 %), only 2.50 % were female respondent.

Table 2: Caste wise classification of the respondent farmers in Southern Dry Zone

Sl. No.	Caste	Zone (n= 40)	
		Frequency (No.)	Percentage
1	GEN	6	15
2	OBC	29	72.5
3	ST&SC	5	10
Total		40	100

Results: Data with respect to caste indicated in table 2 shows that majority of selected farmer belonging to OBC (72.50) followed by General (15) and lastly 10 % farmers were belonging ST&SC.

Table 3: Land holdings of the households in Southern Dry Zone

Sl. No.	Category	Land holding (in acres)	Zone (n=40)
			Percentage
1	Land less	0	7.65
2	Marginal farmers	0.1 to 2.5	78.78
3	Small farmers	2.51 to 5	13.54
4	Big farmers	>5.00	0.02
Total			100

Results: Data presented in table 3 indicated that, among 40 IFS respondent farmers from Nagamangala of Mandya district majority were having marginal land holdings between 0.1 to 2.5 acres (78.78 %), about 13.54 % and 0.02 % farmers were small and big farmers respectively.

Table 4: Major occupation of the households in Southern Dry Zone

Sl. No.	Category	Zone (n= 40)	
		Frequency (No.)	Percentage
1	Agriculture	80	100
2	Business	-	-
3	Dairy	-	-
4	Goatery	-	-
Total			

Results: All the selected farmers for the IFS studies had Agriculture (100 %) as the sole occupation

Table 5: Subsidiary occupation of the households in Southern Dry Zone

Sl. No.	Subsidiary occupation	Frequency (No.)	Percentage
1	Dairy/ Livestock	23	57.5
2	Fishery	03	7.5
3	Silviculture	02	5
4	Poultry	03	7.5
5	Sericulture	03	7.5
6	Entrepreneur	02	5
7	Apiculture	02	5
8	Goat	02	5

Results: Among all the subsidiary activity adopted by households the major activities among the selected IFS farmers was Dairy/livestock which accounts about 57.5 per dent followed by, Silviculture (5), sericulture (7.5 %), Fishery (7.5), poultry (7.50 %), entrepreneur (5%), apiculture (5%) and Goatary (5%). This is mainly due to major cropping system was paddy-pulse, paddy-ragi so, availability of fodder as feed is year around because of this majority of the farmers the subsidiary activity was dairy and livestock to get additional income.

Table 6: Major farming system present in Agro-climatic region

Sl. No.	Major farming system already practice	Number farmers practice	Farming system practice by farmers (%)
1	Agri+Horti	06	15
2	Agri+Horti+Dairy	10	25
3	Agri+Horti+ livestock	12	30
4	Agri+Horti+livestock+fishery	02	5
5	Agri+Horti+silviculture	01	2.5
6	Agri+Horti+ livestock+ enterepreneur	02	5
7	Agri+Horti+ livestock+poultry	02	5
8	Agri+Horti+Dairy+goat+apiculture	01	2.5
9	Agri+Horti+Dairy+sericulture	02	5
10	Agri+Horti+Dairy+sericulture+livestock	02	2.5

Results: The majority of the selected IFS farmers from Nagamangala taluk of mandya district under Southern Dry Zone adopted Agriculture, Horticulture based livestock system (30.00 %), followed by Agriculture/Horticulture - Dairy (25 %) and Agriculture/Horticulture - silviculture (2.5 %). Major crops in agriculture/horticulture component were Paddy, Ragi, Sugarcane, Maize, and Horticulture crops like coconut, vegetables, and flower crops. Livestock farming *viz.*, Dairy, goatary, poultry, sheep etc,.Fodder is grown by majority of the IFS farmers (80%).

Table 7: Profitability and sustainability of farming systems in agro climatic situations

Sl. No.	List the IFS model	Gross returns (Rs/year)					Total gross return of IFS model (Rs/year)	Total cost of production of IFS model (Rs/year)	B:C	Employment generation
		Component -1	Component -2	Component -3	Component - 4	Component -5				
01	Agri+Horti	130000	335000	-	-	-	465000	215000	2.16	410
02	Agri+Horti+Dairy	363000	258000	65000	-	-	686000	290000	2.30	490
03	Agri+Horti+ livestock	325000	334000	34000	-	-	693000	282000	2.46	495
04	Agri+Horti+livestock+fishery	260000	390000	25000	108000	-	783000	265000	2.95	550
05	Agri+Horti+silviculture	355000	445000	18000	-	-	818000	320000	2.56	434
06	Agri+Horti+Dairy +sericulture+livestock	260000	340000	35000	256000	45000	936000	343000	2.72	725

Results: The data pertaining to Profitability and sustainability of different integrated farming systems module of Nagamangala taluk of mandya district under Southern Dry zone were analyzed. All the modules were showing positivity with respect to net income and B:C which indicates that the different integrated farming systems practiced by farmers are in profitable and sustainable condition. Among all combination of Agriculture, Horticulture crop along with livestock farming like daity, Sheep and goat rearing and fishery resulted in higher net income (Rs. 2,65,000) and BC ratio (2.95) followed by the module having Agriculture, Horticulture crop along with sericulture as other component and livestock farming like daity, Sheep and goat rearing resulted in second highest net income (Rs. 3,43,000) and BC ratio (2.75). From the study and analysing the data we can conclude that in any integrated farming system selection of different component are very important which complimentary and supplementary to each other to get higher benefit and long term sustainability.

Table 8: Important factors considered by farmers in the selection of existing farm system in agro- climatic zone

Factors	Level of important
Household dietary diversity	10
Combination of farm enterprises for risk	2
For regular income	1
For regular family employment	7
For soil health management	8
Better recycling of farm resources	6
Feed/fodder for animals	9
Family livelihood	5
Reduced cost of purchased inputs due to higher input use efficiency	4
Higher returns/unit area	3
Helps in clean production/disposal of farm waste	11
Shield against climate change/adverse climate	12
Less dependent on external inputs	13
Customs, sentiment and believes	14

Results: The data pertaining to important factors considered by the farmers while selecting the existing farm system in southern dry zone the respondents have ranked regular income is firsts criteria to select IFS followed by Combination of farm enterprises for risk and Higher returns/unit area. The least importance to Customs, sentiment and believes were given by the selected farmers in zone.

Table 9: Constraints of farmer in managing existing farming system

Factors	Level of constraints
Lack of technical advice/know-how	9
Non-availability of farm credit	6
Lack of improved variety seed/planting materials/breed	4
Lack of irrigation water	8
High cost of inputs (seed/fertilizer/pesticides, etc.)	1
Buildup of pests and diseases in IFS	2
Inadequate and /or irregular supply of electricity	5
Scarcity of farm labour/Labour intensive	3
Social factors (in adopting piggery, poultry, goatery)	10
Not suitable to adopt mechanization in farm operations	7
Marketing difficulty	12
Climate change related impacts adversely affecting IFS	13
Specialized skills required in managing the IFS	12
Non availability of quality inputs/supply	11

Results: The major constraints faced by the IFS farmers were ranked based on their perception. It was found that majority reported (i) High cost of inputs (seed/fertilizer/pesticides, etc.) to be the major constraint followed by (ii) Buildup of pests and diseases in IFS. (iii) Scarcity of farm labour/Labour intensive (iv) Lack of improved variety seed/planting materials/breed were ranked third by majority of the respondent

Table 10: Identification of problem, constraints and options as per farmer opinion

Sl. No.	Name of component under the FS	List identified problem and constraints	Reduction (%) due to constraints	Scientific option available to address the constraint
01	Agriculture/ Horticulture Crops	• Lower yield • Labour scarcity for transplanting and weed management • Incidence of blast disease in paddy and ragi • Incidence of pest stem borer and leaf folder in paddy • Low yield in pulses • Non availability of disease tolerant varieties • Higher incidence of sucking pest in vegetables • Incidence of fruit borer in vegetables • Higher incidence of damping off due to blight in vegetables • Depletion of soil fertility • Poor management of coconut plantation • Climate change related yield reduction • Improper post harvest management • Poor market linkage with fluctuating market price	40-60 30-35 25-30 25-30 30-35 20-25 30-35 30- 40 30-35 20-25 35-40 25-30 20-25 20-25	• Need accessibility to good hybrid with yielding capacity at nearby outlets • Improved implements for management of weeds which are suitable for different stages of crops and for fragmented land and integrated weed management approach is required • Integrated management of blast (Seed treatment and need based use of chemicals) and prophylactic spray during cloudy condition • Integrated management (Use of Neem cake, pheromone traps, release of trichograma parasitoids) and need based use of chemicals • Introduction of improved pulse varieties resistant to diseases and integrated nutrient and pest and disease management • Need improved varieties/Hybrids tolerant to pest and diseases (vegetables) • Integrated management of sucking pest via use of physical methods (Sticky traps) and chemical spray as prophylactic • Integrated management of fruit borer via use of physical methods (Sticky traps) and pheromone traps and chemical spray • Integrated management of blight in vegetables - use of bio-agents (Trichoderma, pseudomonas) and need based use of chemicals • Advisory to use soil test based nutrients and application of organic manures in sufficient quantity • Integrated nutrient, pest and disease management (Use of neem cake, green manures, soil test based use of fertilizers, bioagents - trichoderma and pseudomonas, use of Bordeaux mixture, use of pheromone traps (Rhinocerous beetle, Red palm Weevil) • Advisories suitable for climate change • Capacity building on processing and value addition and creation of cold storage facilities • Introduction to online market linkages for higher prices
02	Livestock	• Lack of awareness with respect to balanced ration • Low milk yield • Lack of knowledge on cultivation of green fodder round the year (including grasses and legumes) • Incidence of Foot and Mouth Disease • Low meat yield • Low egg yield • Lack knowledge on scientific management of weaning calf/lamb/kid • Unaware of timely deworming • lack of availability of Grazing lands • Climate extremes can lead to land • degradation as more animals compete for water and pasture resources.	40-45 30-35 25-30 25-30 30-35 25-30 20-25 30-35	• Nutrient management with balanced ration during feeding • Selection of improved breeds • Information on cultivation of high yielding multi-cut fodder hybrids and legume crops • Timely vaccination

03	❖ Sericulture	• Low productivity due to pest and disease • Lack of information and expertise on rearing of improved hybrids such as double hybrids • Improper sanitation and fumigation practices • Deteriorated leaf quality • Market facility available at far off places • Poor soil fertility • Lack of availability of local market • Dermestid beetles management	30-35 35-40 30-35 25 25-30 30	• High yielding, pest and disease resistant mulberry varieties and chakis • Need to develop proper spacing and tree mulberry cultivation practices • Use of micronutrient mixtures seri boost for improved leaf quality • Use of yellow sticky traps and pheromone traps for uzi management during rearing • Use of suitable bed disinfectants and suitable hormones for synchronised maturity • Market facilities at local level with nominal price • Green manuring and use of seri suvarna practice for improving soil health

Results: The major problems experienced by farmers are lower yield or lesser productivity due the problems like poor and marginal soil fertility, difficult in timely pest and disease management, poor nutrient, water, weed management, climatic or weather abnormalities untimely rainfall, early withdrawal of monsoon, late onset of monsoon, flood and drought etc., and other factors like timely availability of agricultural input *viz*., high yielding varities/hybrids, fertilizers. Labor availability is major problem for doing timely all agricultural operations, costly inputs and wages and post-harvest loss may lead to lesser yield to farmers with higher cost of production. In case of livestock/dairy the major problems faced by farmers are lesser milk yield due imbalance in nutritional food, year around availability of green fodder which is rich in crude protein and other minerals, high cost of feed, lack of veterinary support during emergencies, timely vaccination, deworming etc were unaware by the farmers. The reduction percentage of each of the problems along with their scientific options are detailed in Table 10.

I. Research gaps

Table 11: Research gaps as perceived by the research scientist

Sl. No.	Name of component under the FS	List identified research gap	Research priorities identified	Research strategies proposed
01	Crops	• Mono-cropping system • Lack of improved varieties/hybrids • Lack of scientific management practices • Suitable machinery for the mechanization in the small land holdings • Lack information on combined application of organic and inorganic sources of nutrients • Integrated control measures for the pest and diseases • Non availability of quality seeds/samplings of improved varieties/hybrids	• High yielding varieties/hybrids • Pest and disease tolerant varieties/hybrids • Varieties with capacity to abate the abiotic and biotic stress • Integrated nutrient management practices • Integrated pest and disease management practices	• Research work on promising high yielding pest and disease tolerant, abiotic and biotic stress tolerant, location specific short duration varieties and hybrids • Mechanization suitable to small and marginal land holdings • Use of data collected from field survey to correlate soil status and yield and pest and disease resurgence • Integrated management approaches for pest and diseases
02	Livestock	• Non availability of improved breeds • Inadequate facilities for veterinary disease management at suitable time • Low productivity • Imbalanced nutrition management • Non availability of year around fodder • Require low cost hatchers and • Breeds suitable for year round egg laying • High cost for feed • Low milk yield • Issues in marketing of livestock and livestock products • Fluctuating market	• Requires need to improve more breeds suitable for local area • To upgrade knowledge on symptoms of diseases • Require high yielding multi-cut fodder crop rich in crude protein suitable for local area in all aberrant conditions • Availability of vaccination and medical facility • Lack of availability of balanced ration/feed in local places • Infertility in cattle's	• Research on to develop more number of improved breeds and available at affordable price • Need to develop suitable diagnostic kits with specifications to recognize the diseases timely • Work needed to improve nutritionally rich fodder crops as soil fertility is declining • Need to identify best cropping system in order to address poor nutrition • Need to develop schedule for use of vaccination kits to improved breed • Need to develop balanced ration of feed formulation with high crude protein and minerals

		demands can impact the livestock industry		
03	Sericulture	• Rearing of bivoltine double hybrids • Pest and disease management • Symptoms of chemical spray effect on worms • Silkworm maturation period in cross breed worms • Non spinning worms • Leaf roller and sucking pest management • Workers in the sericulture industry can suffer from respiratory diseases	• Require improved bivoltine hybrids • Schedule for identification of diseases and maintenance • Need to develop symptoms identification on effect of any chemical spray • Need develop products to form uniform maturity • Organic based pest and disease management	• Develop more number of double hybrids suitable for local area • Develop schedule and diagnostic kit to identify diseases in early stages of the batch • Need to study the symptoms in worms on feeding contaminated leaf to avoid loss of batch without spinning of silk • Organic based pesticide/ insecticide without affecting worms

Results: Research priorities and strategies were identified by the scientists based on the problems faced by the farmers in each sector. The major research gaps identified in the crop component were practice of mono-cropping systems *viz*., paddy-paddy,paddy-ragi, lack of improved high yielding pest and disease resistant varieties/ hybrids, unscientific weed, water, nutrient, pest and disease management. With respect to livestock non availability of improved breeds, year around green fodder with good quality, imbalanced nutrition ration and high cost of feeds, Issues in marketing of livestock and livestock products, Fluctuating market demands can impact the livestock industry. In case of sericulture the major research gaps were unawareness about rearing of bivoltine double hybrids, Pest and disease management problems, chemical spray effect on worms, Non spinning worms, difficulty in managing Leaf roller and sucking pest management and Workers in the sericulture industry can suffer from respiratory diseases.

I. Extension gaps

Table 12: Extension gaps as perceived by the research scientist

Sl. No.	Name of component under the FS	List identified Extension gap	Extension priorities identified	Extension strategies proposed
01	Crop	• Non availability of high yielding, disease resistant variety/ hybrids at local market • Timely accessibility of agricultural inputs to famers • Lack of information and knowledge on post-harvest loss • Lack of knowledge on market facility and linkage • Lack of timely information on water, weed, nutrient management • Timely diagnostic survey and recommendation information not available to farmers • Lack of information on processing and value addition of product • Lack of information on certification, licensing and branding	• Develop regional seed and input production centre to ensure local availability of quality inputs • Training required on integrated crop management practices with different cropping system • Value addition to agricultural produce, packing, labelling, and market linkage information required • Conduct diagnostic field visit by extension scientist and broadcast management practices to be followed through different ICT	• Conduct capacity building programme on integrated crop production practices, post-harvest handling of produce and value addition till its marketing facilities. • Conduct diagnostic field visit by extension scientist and broadcast management practices to be followed through different ICT
02	Livestock	• Lack of information on scientific rearing • Availability of veterinary center in local areas in emergencies • Inadequate knowledge on processing and value addition for Livestock product • Lack of information on vaccination programme Issues in marketing of	• Provide timely information on vaccination to villagers • Develop mobile or immobile health service facilities to veterinary animals • Create established market facility for livestock's and its value added products	• Conduct capacity building programme on scientific livestock rearing methods • Conduct community vaccination programme on communicable diseases regularly • Though the use of ICT conducts regular training and provide timely information • Conduct regular field visit and group discussion to address the present problem

		livestock and livestock products		
03	Sericulture	• Lack of information on bivoltine silkworm rearing • Limited information on improved varieties of mulberry and its cultivation • Timely information about pest and disease management • Non availability of quality inputs for silkworm rearing in local areas • Required market facilities at local areas	• Develop regional centre to ensure local availability of quality inputs • Provide timely information on bivoltine silkworm rearing • Information need to provide on prevailing pest and disease management is required • Create established market facility in local areas	• Conduct capacity building programme on improved mulberry and scientific bivoltine silkworm rearing • Provide timely information on pest and disease management by using mass media and mobile advisory services. • Provide information through mobile messages regarding market prices of cocoons

Results: The major Extension gaps as perceived by the research scientist are Non availability of high yielding, disease resistant variety/ hybrids at local market, timely accessibility of agricultural inputs to famers, lack of information and knowledge on post-harvest loss, market facility and linkage and lack of timely information on water, weed, nutrient management, timely diagnostic survey and recommendation information not available to farmers, unaware about processing and value addition of product, certification, licensing and branding. In case of livestock the major extension gaps were lack of information on scientific rearing, availability of veterinary center in local areas in emergencies, inadequate knowledge on processing and value addition for Livestock product, lack of information on vaccination programme Issues in marketing of livestock and livestock products.

Table 13: Suggestion of new components for farming systems in different agro climatic situations based on the study

Sl. No.	Prevailing Farming System (IFS)	Net returns (Rs/year)	Suggested IFS Model	Expected Net returns (Rs/year) in suggested IFS Model	Per cent increased (%)
01	Agri+Horti	250000	Agri+Horti+Dairy	300000	20.00
02	Agri+Horti+ Dairy	396000	Agri+Horti+Dairy+fishery	471000	18.93
03	Agri+Horti+livestock+ fishery	518000	Agri +Horti +livestock +silviculture fishery+sericulture	630000	21.62
04	Agri+Horti+Silviculture	498000	Agri+Horti+Silviculture+ Livestock	603000	21.08
06	Agri+Horti+Dairy +sericulture+livestock	593000	Agri+ Horti+ livestock +sericulture+ +fisheries	688000	16.02

Results

Out of 40 responded IFS farmers 10 IFS modules/components are seems to be similar and among all the Integrated Farming Systems analysed it was found that the B:C was higher than one. Based on the survey it can be concluded that the cultivation of agriculture and horticulture crops in combination with livestock component like dairy, poultry, goatary, fishery and sericulture and silviculture etc will have higher income and B:C and increase in income upto 21.62 percent on an average.

Description of the recommended IFS Model for the Nagamangala Taluk of Mandya district under SDZ

The IFS model recommended is Agri +Horti +livestock +silviculture + fishery+sericulture. In the crop component the recommended crops are Rice/Coconut - Banana - Vegetables - Fruit crops, based on the suitability of crops to dryland, midlands and maidan. In a one-hectare land the average net returns expected from this enterprise combination is Rs.630000.The average returns were arrived by assuming the spacing and an average number of animals kept by an IFS farmer. However, in the case of an innovative farmer, it is possible to make higher returns. Hence, the system ensures economic viability, environmental sustainability, and year-round income to the farmers.

References

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