The Pharma Innovation Journal 2022; SP-11(10): 2083-2087

www.ThePharmaJournal.com

The Pharma Innovation

**ISSN (E): 2277-7695**
**ISSN (P): 2349-8242**
**NAAS Rating: 5.23**
TPI 2022; SP-11(10): 2083-2087

www.thepharmajournal.com
Received: 16-08-2022
Accepted: 20-09-2022

**Rudragouda F Channagouda**
AICRP on Integrated Farming Systems, AHRS, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Iruvakki, Shivamogga, Karnataka, India

**AY Hugar**
AICRP on Integrated Farming Systems, AHRS, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Iruvakki, Shivamogga, Karnataka, India

**Vijay S Danaraddi**
AICRP on Integrated Farming Systems, AHRS, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Iruvakki, Shivamogga, Karnataka, India

**Chandru Patil**
AICRP on Integrated Farming Systems, AHRS, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Iruvakki, Shivamogga, Karnataka, India

**Corresponding Author:**
**Rudragouda F Channagouda**
AICRP on Integrated Farming Systems, AHRS, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Iruvakki, Shivamogga, Karnataka, India

# An integrated farming system: Approach to doubling the farmer's income and better recycling of farm resources

**Rudragouda F Channagouda, AY Hugar, Vijay S Danaraddi and Chandru Patil**

**Abstract**
The Front line demonstration was conducted in the field of Shri. Dayanand Murthy, Ambalappad of Devaramarikunte village of Chitradurga district, Karnataka from April 2016 to March 2020 to study the "An integrated farming system- Approach to Doubling the Farmer's Income and Better Recycling of Farm Resources ". This study compared the income of Dayanand Murthy before and after adoption of integrated farming system. The most crucial intervention is the introduction of banana, arecanut, pomegranate, cluster apple, coconut, silver, hebbevu, red sandal and Jamun as inter crop in arecanut garden followed by cultivation of vegetable crops, sheep, poultry and fishery. Shri. Dayanand Murthy received a net annual income of about ₹ 5,97,550 through his promoting of Integrated Farming Practices as compared to non-adoption of integrated farming system (₹ 79500). Total 960 man-days were generated in integrated farming system model throughout the year. He recycles farm waste into healthy manure through vermicompost and biodigestor unit. His practice of integrated farming meets over 68% of nutrient requirement through recycling of bio-mass available within the farm itself. He had cultivated sunn hemp and horsegram as intercrop in arecanut and incorporated the bio-mass as green manure crop. In his farm produced 10 t of vermicompost and 2 t of cow dung with worth of ₹ 55,000. IFS model has produced about 38942 kg of recyclable raw material year$^{-1}$ from different components. Out of this, 17849 kg year$^{-1}$ of recycled produce has been generated and re-cycled within the system. The farmer adopted integrated farming system having a sustainable yield index of 0.72 and sustainable value index of 0.76 and system economic efficiency of 425, respectively.

**Keywords:** Economics, man-days, sustainable index, value index

## 1. Introduction
The fragmentation of land resources is posing a serious threat to future sustainability, food security, and profitability of Indian farming (Siddeswaran *et al*., 2012) [5]
Sustaining and enhancing agriculture productivity has been recognized as one of the key pathways of reducing and eliminating hunger, poverty and malnutrition. Agricultural sector is regarded as the key component of the economies of many developing nations, including India. Globally, agriculture accounts for a large share of GDP, it employs a significant proportion of the labour force, represents a major source of foreign exchange earnings, supplies bulk of basic food and provides subsistence and other income to the agriculture dependent growing population in the world (Rathore *et al*., 2009) [23].
The Indian marginal and small farmers are mostly concentrating on cereal-based crop production with high risks of climate anomalies such as floods and droughts. Due to these aberrations, farmers are unable to get sufficient income to sustain their family (Kumar *et al*., 2006) [13]. The IFS might assist to achieve food and nutritional security through the better use of available resources, introduction of legumes, vegetables, oilseed crops, or through agroforestry systems (Altieri *et al*., 2012, Wezel *et al*., 2014) [13].
The rising cost of food and energy, depleting water supply, diminishing farm size, soil degradation, imbalanced fertilizer use, excessive use of agrochemicals, and climate change are all contributing to the problems of agricultural production system (Paroda, 2012) [22] and (Parajuli *et al*., 2018) [19]. The complementary role of different components of IFS on small and marginal farmers is necessary to meet the food and nutritional requirement of the farm family Walli *et al*. 2016) [28].

These modern, specialized, and intensive agricultural practices affect the diversity in flora and fauna and increase vulnerability of resource poor farmers to weather and market fluctuations due to dependency on less agricultural commodities (Manjunath *et al*., 2018) [17], Paramesh *et al*., 2019a, Paramesh *et al*., 2019b) [20, 21]. Intensive agriculture systems in India are unable to provide regular income and employment, failing to achieve food, environmental, and energy security at the farm level.

Success of any technology is the essence of any institution in general and KVK in particular. It depicts the magnitude of work culture. The edifice of income generating activities followed up with field level demonstrations, transfer of technology skills, conducting of front line demonstration, trainings and other related activities of a KVK stand as a corner stone on which KVK is built Success stories or technology act as a catalyst in making institution more vibrant, work oriented and people friendly. They infuse a new life in the work culture of KVK and make them more responsive to the needs of farmers. KVK Chitradurga has its own share of technology in development of integrated farming system model.

The Indian economy is mainly predominant on agriculture. The 82% of farmers are small and marginal farmers whose acreage is less than 2 ha. These farmers play a pivotal role in Indian economy. Majority of these farmers practicing single crop cultivation (Dasharath *et al*., 2013) [4]. To overcome the problems of small resource poor farmers, diverse and risk prone environments, shrinking of land holding and growing demand of food commodities it is necessary to integrate land-based enterprises like dairy, fishery, poultry, duckery, field and horticultural crops, etc. (Obi *et al*., 2016) [18] within the bio-physical and socio-economic environment of the farmers to make farming more profitable and dependable (Behera *et al*., 2004) [2]. No single farm enterprise is likely to be able to sustain the small and marginal farmers without resorting to integrated farming systems (IFS) for the generation of adequate income and gainful employment year-round (Mahapatra, 1994) [15].

To overcome the problems encountered by specialized, input driven agriculture, the integration of crops, livestock, fishery components that sustains food, and nutritional security with regular and periodic income to farmers is vital (Gill *et al*., 2009) [11].

Efficiently managed IFS are expected to be less risky, as they benefit from enterprise synergies, product diversity, and ecological reliability (Behera and France, 2016) [3].

The components/enterprises in the IFS differ from region to region, depending on agro-climatic situations *viz*., the land type, water availability, socioeconomic condition of the farmers, and market demand (Devendra and Thomas, 2002, Singh *et al*., 2008) [9, 26]. There is a need to establish effective linkage and complementarities between components to develop effective holistic farming systems (Bell and Moore, 2012) [4]. Integrated farming helps for better nutrient recycling, soil formation, soil fertility enhancement, and improving environmental performance (Salton *et al*., 2014) [24].

The negative impact of IFS on $CH_4$ absorption may have been due to increased nutrient recycling in the system through organic farming practices and may have further improved the abundance and activity of methanotrophs (Zhou *et al*., 2008) [30] and possibly decreased air diffusion that could have impaired $CH_4$ diffusion (Chen *et al*., 2011) [7].

The IFS systems involving different land-based enterprises generated net returns of USD 5050 than conventional rice–wheat system (USD 1258 (Bhargavi and Behera, 2020) [5]

Integrated farming system is a reliable way of obtaining high productivity (Dadabhau and Kisan, 2013) [8] with substantial nutrient economy in combination with maximum compatibility and replenishment of organic matter by way of effective recycling of organic residues/wastes etc. obtained through integration of various land- based enterprises (Gill *et al*., 2010) [10]. This study was conducted with objective of improved the economic security of farmer and restore the soil fertility.

## 2. Material and Methods

The demonstration was made in the field Shri. Dayanand Murthy, Ambalappad of Devaramarikunte village of Chitradurga district, Karnataka during 2016-2020 (5 years) to study the "An integrated farming system- Approach to Doubling the Farmer's Income and Better Recycling of Farm Resources ". Base line survey was carried before adoption of integrated farming system. Data was collected after adoption of integrated farming system from 2016-2020 (5 years). This study compared the income of Shri. Dayanand Murthy before and after adoption of integrated farming system. The most crucial intervention is the introduction of banana, arecanut, pomegranate cluster apple, coconut, silver, hebbevu, red sandal and Jamun as inter crop in arecanut garden followed by cultivation of vegetable crops viz., chilli, brinjal, beans, onion as intercrop in arecanut orchard, sheep, poultry and fishery as secondary components that would attract remunerative price synchronised for smooth running family which would also fetch additional income. He also grow finger millet, sorghum, groundnut and redgram in counter part of the his farm.

Sustainable Yield Index (SYI) was calculated by using following formula

$$\text{Sustainable yield index (SYI)} = \frac{y-\sigma}{y\ max} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where, y=average yield of a treatment over the years, $\sigma$=standard deviation (SD) and y max= observed maximum yield of a plot over the years.

Sustainable value index (SVI) was calculated by using following formula

$$\text{Sustainable value index (SVI)} = \frac{y-\sigma}{v\ max} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where, y=average net profit over the years, $\sigma$=standard deviation (SD) and vmax=maximum net profit obtain in any of the year.

## 3. Results and Discussion

Integrated farming system provides an opportunity to increase yield and economics unit area$^{-1}$ unit time$^{-1}$ by virtue of intensification of crops and applied enterprises. The success story of Shri. Dayanand Murthy, Ambalappad, who is earning a net annual income of 5,97,550 from 5.5 a by adopting Integrated Farming Practices could well be the right signal for farmers of Chitradurga facing the problem of low yield, high cost of production coupled with unpredictable rainfall. The synergistic integration and better utilisation of resources by Shri. Dayanand Murthy stay from tiny Devaramarikunte village of Challakere taluk of Chitradurga District is a

progressive model farmer of the district. His traditional farming included only growing redgram and groundnut without any mixed cropping and other secondary components as dairy, poultry, sheep unit. The technical support from Krishi Vigyan Kendra (KVK), Chitradurga helped him to shore up and integrate his farming through introduction of improved varieties / hybrids in agriculture and horticulture crops, sheep unit, upgrading dairy unit, azolla as cattle feed, vermicompost, poultry, fodder bank and drudgery reduction through farm mechanisation at his farm.

Shri. Dayanand Murthy has developed his farm with a combination of Horti-Silvi-Pasture cultivation. He has 20 Sheeps, 15 turkey poultry birds, bee keeping, fish rearing; rat rearing that has drawn the attention of neighbouring villagers. To feed his small dairy unit (and sheep unit, he has established a fodder bank comprising COFS-31, Lucerne and azolla with the support of KVK, Chitradurga. He has also planted Co-3, sesbania and hebbevu all along the borders of his farm. The lusty silver oak and teak acts as a wind barrier to the arecanut garden as well as dairy animals. As a water conservation practice, he has adopted entire farm with micro sprinkler irrigation system. He makes live bunding, trunch cum bunding, farm pond and trenches for soil and water conservation adopted in their farm. To reduce drudgery, the farmer has opted for mechanisation to suit his farming and his practices. To recycle the wastes he has purchased roto] water & a cycle weeder that has helped him to reduce the cost of labour.

He recycles farm waste into healthy manure through vermicompost and biodigestor unit. His practice of integrated farming meets over 68% of nutrient requirement through recycling of bio-mass available within the farm itself. He had cultivated sunn hemp and horsegram as intercrop in arecanut and incorporated the bio-mass as green manure crop. In his farm produced 10 t vermicompost and 2 t of cow dung worth ₹ 55,000.

Shri. Dayanand Murthy earned a net annual income of about ₹ 597550 through his promoting of integrated farming practices (Bhati and Joshi, 2007) [7] as compared to non-adoption of integrated farming system (₹ 79500). This was mainly due to improved and more intensive cultivation of vegetables and agri culture and horticulture crop production with integration of dairy and sheep added more profit to the system (Korikanthimath and Manjunath, 2009, Kumar, 2011) [12, 14].

### 3.1. Employment Generation in Different Components

Total 960 man-days were generated in integrated farming system model throughout the year. Among the various enterprises in IFS model, the highest employment generation was observed in Dairy system (148 man-days) and closely followed by Sheep unit (148 man-days). Hence, Dairy and Sheep units generates more employment due to involvement of various activities *viz.*, open grazing and watching, cleaning sheds, feeding, milking, FYM/ drop collection and dumping, etc., as compared to other components.

### 3.2. Resource recycling from different components of IFS Model

The IFS model has produced about 38942 kg recyclable raw material year[1] from different components. Out of this, 17849 kg year[1] of recycled produce has been generated and re-cycled within the IFS system. It offers good scope for recycling of crop by-products and residues to the livestock and livestock waste intern used as valuable manure to cropping activity. Sujatha and Bhat (2015) [31] reported enhancement of nutrient use efficiency, nutrient recycling, and higher soil microbial activity when livestock and fisheries, etc. were integrated with crops.

### 3.3. Sustainable yield index, value index and system economic efficiency of Integrated farming system

The farmer adopted integrated farming system having a Sustainable yield index of 0.72 and sustainable value index of 0.76 and system economic efficiency of 425**.** It clarifies the benefits from different combinations/unit area, higher sustainability index and net returns was achieved in IFS system (Vittal *et al*., 2002) [27].

His adoptable practices would be a role model of Chitradurga district. He visited to abroad countries like Thailand, Russia, Dubai and Abu-Dhabi. He awarded as Best farmer of the District, Basavapatna national award and international ward from different countries.

**Table 1:** Income changes before after adoption of Integrated farming system

| Particulars | Area (5 a) | Net returns (₹) |
|---|---|---|
| Before adoption of integrated farming system | | |
| Groundnut | 3.5 | 55,000 |
| Finger millet | 2.0 | 24500 |
| Total income (₹) | | 79500 |
| After adoption of integrated farming system | | |
| Groundnut+Redgram | 2.0 | 65200 |
| Maize+Redgram | 1.0 | 25350 |
| Arecanut | 0.5 | 156000 |
| Coconut+Onion+Brinjal | 0.5 | 45000 |
| Pomegranate | 0.5 | 75800 |
| Dairy (5 cows) | 1.0 | 45200 |
| Sheep rearing | | 95000 |
| Poultry | | 35000 |
| Vermicompost | | 55000 |
| Total income (₹) | | 597550 |

**Table 2:** Resource Recycling from different components of IFS Model

| Components | Name of the farm waste | Quantity of farm waste produced from different components (kg year$^{1}$) | Total amount of recycled produce (kg year$^{1}$) |
|---|---|---|---|
| Crop component | Groundnut and maize | 12500 | 4150 |
| Animal component | Cow dung | 13600 | 8650 |
| | Sheep litter | 2600 | 2460 |
| | Shed waste | 1050 | 860 |
| Vegetable component (bhendi, ridge gourd, cluster bean, tomato, chilli) | Weed waste | 860 | 250 |
| | Stalk waste | 460 | 215 |
| Horticulture component (arecanut, coconut, banana) | Arecanut waste | 3540 | 418 |
| | Coconut waste | 325 | 75 |
| | Weed waste | 1630 | 260 |
| Boundary plants (ex-situ green manuring) | Glyricidia | 460 | 130 |
| | Weed waste | 1830 | 355 |
| Fodder component (Multi-cut hybrid Napier) | Weed waste | 87 | 26 |
| Total | | 38942 | 17849 |

**Table 3:** Sustainable yield, value index and system economic efficiency of irrigated IFS model

| Indices | Sustainable yield index | Sustainable value index | System economic efficiency |
|---|---|---|---|
| | 0.73 | 0.78 | 477 |

## 4. Conclusion

Integrated farming system is enhancing the productivity, economic returns, employment generation and maintaining soil health of farm and farm families. The complementary combination of farm enterprises has maintained sustainable production along with increasing farmer's income. Therefore, it is high time for the promotion of Integrated farming system concept and knowledge helps for doubling the income of the farmers as well as it meets the nutritional requirement of the farm family.

## 5. References


1. Altieri MA, Funes-Monzote FR, Petersen P. Agroecologically efficient agricultural systems for smallholder farmers: contributions to food sovereignty. Agronomy for Sustainable Development. 2012;32(1):1-13.
2. Behera UK, Jha KP, Mahapatra IC. Integrated management of available resources of the small and marginal farmers for generation of income and employment in eastern India. Crop Research. 2004;27(1):83-89.
3. Behera UK, France J. Integrated farming systems and the livelihood security of small and marginal farmers in India and other developing countries. In: Sparks, D.L. (Ed.). Advances in Agronomy. Elsevier. 2016;138:235-282.
4. Bell LW, Moore AD. Integrated crop-livestock systems in Australian agriculture: Trends, drivers and implications. Agricultural Systems. 2012;111:1-12.
5. Bhargavi B, Behera UK. Securing the livelihood of small and marginal farmers by diversifying farming systems. Current Science. 2020;119(5):854-860.
6. Bhati TK, Joshi NL. Farming systems for the sustainable agriculture in Indian Arid zone. In: Vittal, K.P.R., Srivastava, R.L., Joshi, N.L., Kar, A., Tewari, V.P., Kathju, S. (Eds.). Dryland Ecosystem: Indian Perspective. Central Arid Zone Research Institute and Arid Forest Research Institute, Jodhpur; c2007. p. 35-52.
7. Chen W, Wolf B, Zheng X, Yao Z, Butterbach-Bahl, K, Brüggemann N, *et al*., Annual methane uptake by temperate semiarid steppes as regulated by stocking rates, aboveground plant biomass and topsoil air permeability. Global Change Biology. 2011;17(9):2803-2816.
8. Dadabhau AS, Kisan WS. Sustainable rural livelihood security through integrated farming systems- A review. Agriculture Reviews. 2013;34:207-215.
9. Devendra C, Thomas D. Small holder farming systems in Asia. Agricultural Systems. 2002;71(1-2):17-25.
10. Gill MS, Singh JP, Gangwar KS. Integrated farming system and agriculture sustainability. Indian Journal of Agronomy. 2010;54(2):128-139.
11. Gill MS, Singh JP, Gangwar KS. Integrated farming system and agriculture sustainability. Indian Journal of Agronomy. 2009;54(2):128-139.
12. Korikanthimath VS, Manjunath BL. Integrated farming systems for sustainability in agricultural production. Indian Journal of Agronomy. 2009;54(2):140-148.
13. Kumar R, Pandey S, Pandey A. Plant roots and carbon sequestration. Current Science. 2006;91(7):885-890.
14. Kumar S, Singh SS, Shivani Dey A. Integrated farming system for eastern India. Indian Journal of Agronomy. 2011;56(4):297-304.
15. Mahapatra IC. Farming system research – A key to sustainable agriculture. Fertilizer News. 1994;39:13-25.
16. Maiti RK, Kumari A, Thakur AK, Sarkar NC. Bio resource and Stress Management. Springer Nature. c2016. p. 129-163 ISBN 978-981-10-0994-5. ISBN 978-981-10-0995-2 (eBook). DOI 10.1007/978-981-10-0995-2.
17. Manjunath BL, Paramesh V, Mahajan GR, Reddy KV, Das B, Singh NP. A five years study on the selection of rice based cropping systems in Goa, for west coast region of India. Journal of Environmental Biology. 2018;39(3):393–399.
18. Obi FO, Ugwuishiwu BO, Nwakaire JN. Agricultural waste concept, generation, utilization and management. Nigerian Journal of Technology (NIJOTECH). 2016;35(4):957–964.
19. Parajuli R, Dalgaard T, Birkved M. Can farmers mitigate environmental impacts through combined production of food, fuel and feed? A consequential life cycle assessment of integrated mixed crop-livestock system

with a green bio refinery. Science of the Total Environment; c2018. P.z 619-620, 127-143.
20. Paramesh V, Arunachalam V, Nath AJ. Enhancing ecosystem services and energy use efficiency under organic and conventional nutrient management system to a sustainable arecanut based cropping system. Energy. 2019a;187:115902.
21. Paramesh V, Parajuli R, Chakurkar EB, Sreekanth GB, Kumar HBC, Gokuldas PP, *et al*. Sustainability, energy budgeting, and life cycle assessment of crop- dairy-fish-poultry mixed farming system for coastal lowlands under humid tropic condition of India. Energy. 2019b;188:116101
22. Paroda R. Reorienting agricultural research for development to address emerging challenges in agriculture. Journal of Research. 2012;49(3):134-138.
23. Rathore VS, Singh JP, Beniwal RK. Rainfed farming systems of hyper arid north-western Rajasthan – An analysis. Annals of Arid Zone. 2009;48:125–131.
24. Salton JC, Mercante FM, Tomazi M, Zanatta JA, Concenço G, Silva WM., *et al*. Integrated crop-livestock system in tropical Brazil Toward a sustainable production system. Agriculture, Ecosystems and Environment. 2014;190;70-79.
25. Siddeswaran K, Sangetha SP, Shanmugam PM. Integrated farming system for the small irrigated upland farmers of Tamil Nadu. In: Proceedings of 3rd International Agronomy Congress. ICAR, New Delhi; 2012, 26–30 November.
26. Singh SP, Gangwar B, Singh MP. Economics of sugarcane-based farming system in western Uttar Pradesh. Agricultural Economics Research Review. 2008;21(1):109–117.
27. Vittal KPR, Maruthi, Sankar GR, Singh HP, Sharma JS. Sustainability index. Sustainability of Practices of Dryland Agriculture: Methodology and Assessment. All India Coordinated Research Project for Dryland Agriculture, Central Research Institute for Dryland Agriculture, Hyderabad; c2002. p. 4–9.
28. Walia SS, Aulakh CS, Gill, RS, Dhawan V, Kaur, J. Intensive integrated farming system approach-A vaccination to cure agrarian crisis in the Punjab. Indian Journal of Economics and Development. 2016;12(451):430-2322.
29. Wezel A, Casagrande M, Celette F, Vian JF, Ferrer A, Peigné J. Agroecological practices for sustainable agriculture. A Review. Agronomy for Sustainable Development. 2014;34(1):1-20.
30. Zhou XQ, Wang YF, Huang XZ, Tian JQ, Hao YB. Effect of grazing intensities on the activity and community structure of methane-oxidizing bacteria of grassland soil in Inner Mongolia. Nutrient Cycling in Agroecosystems. 2008;80(2):145-152.
31. Sujatha S, Bhat R. Resource use and benefits of mixed farming approach in arecanut ecosystem in India. Agricultural Systems. 2015 Dec 1;141:126-37.