Chronicle of Bioresource Management 2023, 7(4):072-076

Chronicle of Bioresource Management
An International E-magazine

December, 2023 | Popular Article

Open Access
Corresponding Author
Rayapati Karthik
e-mail: karthikrayapati48@gmail.com

Citation: Karthik et al., 2023. Integrated Farming System (IFS) - A Way to Maintain the Sustainability and Enhance the Income. Chronicle of Bioresource Management 7(4), 072-076.

Data Availability Statement: Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

Conflict of interests: The authors have declared that no conflict of interest exists.

Keywords:

Integrated farming system, sustainability, green revolution

Article History

Article ID: CBM4916
Received on 20th September 2023
Received in revised form on 04th November 2023
Accepted in final form on 15th November 2023

Integrated Farming System (IFS) - A Way to Maintain the Sustainability and Enhance the Income

Rayapati Karthik[1], M. Venkata Ramana[2], Ch. Pragathi Kumari[3], M. Sharath Chandra[3] and M. Santhosh Kumar[3]

Abstract

India's agriculture production has increased six fold, but, at the cost of degradation of natural resources. The development took place in well-endowed regions and the smallholder farmers are less benefitted. To tackle such problems, farming systems approach has been widely recognized. The integration of mono-crop farms with agroforestry, fisheries and animal husbandry can play a significant role in better utilization of resources, enhancing farm household income and security of the farmers. The integrated farming system (IFS) approach visualizes a change in the farming techniques for maximum productivity by optimal utilization of various resources. It minimizes the risk and provides stable and regular income throughout the year. IFS model enables to absorb CO_2 than the emissions which make it climate resilient compared to cropping systems and it reduces the dependence on external resources through efficient recycling of on-farm biomass and other resources.

1. Introduction

Climate change has been affecting the farming severely and overall productivity has been decreasing. The modern production systems have negatively impacted the nutrient balance as well as soil fertility (Karthik et al., 2022). Cropping and farming systems need to be practiced through which we can mitigate climate change and result in higher productivity. The IFS always result in higher productivity because of diverse products which leads to higher income compared to monocropping (Babu et al., 2023). Compared to the conventional farming system, the total net returns increased with the adoption of various enterprises and their suitable combination in the IFS (Kharche et al., 2022). It is possible for farm youth to make a regular income through IFS as a micro-business. A single component or a single crop-based business can lead to market fluctuations, so IFS minimizes the incidence of failure (Goverdhan et al., 2020).

In this climate change era, farmers need to produce more with less

Author's Address

[1]College of Agriculture, PJTSAU, Rajendranagar, Telangana (500 030), India
[2]Registrar, PJTSAU, Rajendranagar, Telangana (500 030), India
[3]AICRP on Integrated Farming System, PJTSAU, Rajendranagar, Telangana (500 030), India

water as many parts of the world have water scarcity. It is necessary to grow profitable crops and water usage has taken care of at the same time. Emphasis is on the farmers, scientists and policy makers to cultivate crops with more water use efficiency. There is ever increasing demand for meat across the globe but livestock need enormous water to produce meat and milk and even for their maintenance. The IFS balances the crop and livestock with low water usage as wastewater recycled from one component is utilized by another component.

Integration of varied enterprises like field crops, horticultural/fruit crops, timber trees, green manures, fodder, livestock, poultry, fish, and vermicompost in a farming system can improve the input use efficiency and carbon sequestration into soil and plant biomass which helps in mitigating greenhouse gas emission into the atmosphere. In this system, waste materials are effectively utilized by linking complementary components and thus utilizing the by-products as organic manures, which will ultimately improve the fertility status of the soil by averting pollution, reducing GHG emission and making the system climate smart.

2. Farming System Components

A typical IFS prototype design involves integration of location specific, socially acceptable modules such as crops including fodder, fruit crops, vegetables, dairy, small ruminants, poultry, piggery, aquaculture, mushroom, apiary, sericulture, agro–forestry *etc*.

2.1. Crop Production

Crop production is an important and major part of IFS where in crops/cropping systems are selected based on climate, soil, and water availability and best ICM practices are followed in order to realise potential production levels while utilising available resources efficiently and maintaining soil fertility by incorporating legumes into current cropping systems (Kumari et al., 2022). In sequential cropping, the previous crop should have a significant impact on the succeeding crop such as transfer of nitrogen from earlier crop leftovers, particularly legumes.

2.2. Livestock

Traditionally, farming in India used to be inclusive of different enterprises, particularly livestock, along with food crops to meet the diverse needs of farm families on subsistence basis. The dairy, small ruminants, backyard poultry *etc*, are the indispensable components of IFS, to meet the ever increasing demand for milk, meat and eggs.

2.3. Apiculture

Beekeeping is an agro-based activity which is being undertaken by farmers/landless labour in rural areas as an IFS practice. In India, the honey bee species *Apis cerana indica* and *Apis mellifera* are widely used by small and marginal farmers.

2.4. Sericulture

The practice of integrating mulberry cultivation, silkworm rearing, and silk reeling is known as sericulture. India is the world's second-largest producer of silk, after China. Sericulture necessitates a lot of effort in all phases, including off-farm operations like twisting, dyeing, weaving, and printing. It can be a viable option in IFS in irrigated ecosystems.

2.5. Mushroom Cultivation

One of the important areas for using agro-wastes to enhance income and impart a higher level of sustainability to the system is mushroom cultivation, particularly, in rice growing areas. It is considered as an important component of farming systems owing to its need for less space, better year-round employment and income generation potential, and suitability for small and marginal holdings.

2.6. Aquaculture

Aquaculture is seen as a promising and steady component of farming systems in irrigated coastal ecosystems.

2.7. Agroforestry

It is a key component of farming systems that has many potential advantages such as biomass productivity enhancement, soil fertility improvement, soil conservation, nutrient cycling, micro-climate improvement, carbon sequestration *etc*. In dry land areas, crops, silvipasture, agroforestry and raising livestock are the age old practices.

3. Predominant Farming Systems

Farming systems approach is an age old practice and not new to Indian farmers. Livestock was the integral part of the farm land holdings with diversified crops/cropping systems and other enterprises.

4. Advantages of IFS

The IFS not only enhance the farmers' income but also have multiple benefits such as reduction of GHGs, employment creation, livelihood security and betterment of soil health (Figure 1).

Table 1: Major farming systems and their spread in different states of the country

S l . No.	Farming systems	States
1.	Animal husbandry based	Gujarat and Rajasthan
2.	Poultry based	Andhra Pradesh, Telangana, Assam, Maharashtra and Tamil Nadu
3.	Crop husbandry based	Andhra Pradesh, Bihar, Chattisgarh, Odisha, Punjab, Tamil Nadu, Telangana, Uttar Pradesh, Uttarakhand
4.	Fisheries based	West Bengal, Odisha, Assam
5.	Fruit cultivation based	Jammu & Kashmir, Himachal Pradesh, Maharashtra, North-East and Sikkim
6.	Plantation based	Andaman and Nicobar, Assam, Kerala, Karnataka, Lakshadweep, Tamil Nadu and West Bengal
7.	Vegetable based	Himachal Pradesh
8.	Seed production based	Karnataka, Himachal Pradesh, Maharashtra, Tamil Nadu

(Gangwar and Singh, 2016)

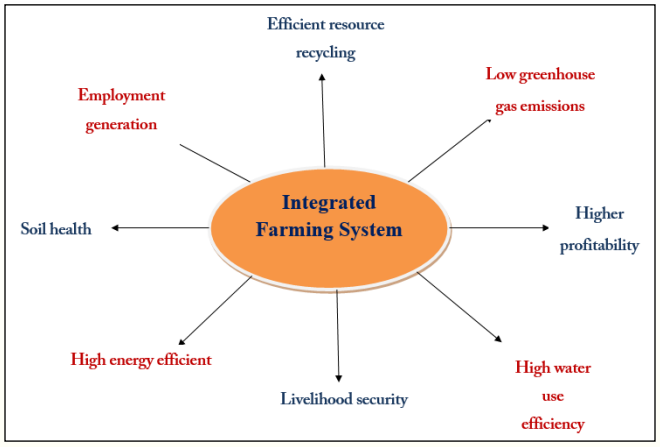

Figure 1: Benefits of integrated farming system

4.1. Income Enhancement

It is possible for farm youth to make a regular income through IFS as a micro-business. A single component or a single crop-based business can lead to market fluctuations, so IFS minimizes the incidence of failure. Compared to the conventional farming system, the total net returns increased with the adoption of various enterprises in the IFS. Higher income is mainly obtained in IFS models mainly due to crops fertilized with recycled manures along with inorganic fertilizers which minimized the cost of productionby saving an equivalent amount of chemical fertilizers and cost of purchase.

4.2. Climate Smart Approach

Deforestation, urbanization, and agriculture had a major impact on land use patterns across the globe which has led to the deterioration of resources ultimately resulting in higher emissions of carbon from the soil. Unscientific agricultural practices, forestry and/or other land uses are also potential sources of increased CO_2, CH_4 and N_2O concentration in the atmosphere, and their contribution is accounted to be around 22% of the anthropogenic GHG emissions (IPCC, 2019). Finding sustainable agricultural practices to cope with climate change is the need of the hour. The IFS are one of the best practices to reduce greenhouse gas emissions in a sustainable manner. The higher carbon sink in the IFS model was due to fruit trees and boundary plantation due to which the GHG emission is negative, so more intensification of crops or enterprises can be done.

4.3. Employment Creation

Unemployment is one of the major concerns in our country and it might reach the sky in the near future. It has created the need to work on systems thatcreateemployment for ever increasing population, particularly rural youth. The IFS might solve this crisis as it creates employment throughout the year. The IFS would generate more jobs as compared tothe traditional farming system which is mainly influenced by the number and type of enterprises and their maintenance. For small and marginal farmers, IFS is the best option. Enhancement in man-days involvement was due to cultivation of the crops and maintenance of livestock throughout the year unlike conventional systems.Employment generation was limited during the crop growing season only for sowing, interculture, and harvesting operations in conventional cropping systems.

4.4. High Water Use Efficiency

In this climate change era, farmers need to produce more with less water as many parts of the world have water scarcity. Emphasis is on the farmers, scientists and policy makers to cultivate crops with more water use efficiency. There is ever increasing demand for meat across the globe but livestock need enormous water to produce meat and milk and even for their maintenance. Shyam et al. (2023) at IARI, New Delhi reported that field crops + vegetables

+protected vegetables+agri-horticulture+mushroom + apiculture+vermicompost IFS model has recorded the lowest water footprint of 149 litre kg^{-1} whereas conventional rice-wheat and maize-wheat systems have recorded 1277 and 1024 litre kg^{-1}, respectively which supports the notion that a suitable designed IFS module is water-use efficient under marginal land holding. The IFS balances the crop and livestock with low water usage as wastewater recycled from one component is utilized by another component. Higher water productivity in the diversified systems was due to the multiple use of available water with the integration of different enterprises.

4.5. Livelihood Security

The degradation of our natural resources, soil, and water has become a matter of serious concern for the farmers, researchers, and policymakers, as these, in turn, impact the livelihood security for which solution could be an IFS with cropping system and other subsidiary livestock, boundary plantation, seasonable vegetables, horticultural crops, vermicompost, and farm pond. This system alleviates hunger, enhances livelihood security, and improves the quality of life in the changing climate on a sustainable basis. The IFS approach will play a major role to sustain livelihood security, especially forsmall and marginal farmers, and conserve the resource base through efficient resource recycling within the system.

4.6. Resource Recycling

The IFS provides an excellent opportunity for organic recycling and it reduces farmer's dependency on external or market purchased inputs. It offers good scope for recycling crop by-products.The crop residues are fed to the livestock and livestock waste acts as valuable manure for cropactivity. Effective recycling of waste materials and by-products lowers reliance on outside input leading to a stable production system. Sustainability in production systems can be achieved through proper resource recycling, soil fertility improvement and carbon sequestration by adopting IFS.

4.7. Energetics

The farming system is a resource management strategy to avail the maximum efficiency of a particular system. Since IFS are relatively less mechanized and encourage the use of internal inputs, energy use is much lower in IFS over conventional farms. By integrating allied farm enterprises energy intake is confined within a farm system. Empirical pieces of evidence from different parts of the globe suggest that an IFS is the most efficient in terms of energy efficiency and this input-output ratio of energy varies greatly in different systems.

4.8. Better Soil Health

In order to increase agricultural productivity in the long term, soil health must be protected. Manure from farm animals could be used to enhance nutrients which improve the fertility of the soil and reduce the use of synthetic fertilizers. The addition of organic residues such as animal and plant wastes, improves soil health and productivity over the long term. The IFS model has enhances the soil fertility over the years because of the usage of manures through residue recycling

5. Conclusion

Monocropping of cereals is not economical to the farmers and not good for soil health. Hence, adoption of IFS which integrates field crops with fruit crops, vegetables and livestock duly taking into account the components of climate, soil, water, land, labour, capital and energy *etc*, ensures food and nutritional security and ensures higher farm profits, is the need of the hour.

6. Future Thrust

The research should prioritize environmental security and ecological resilience, taking into account energy, water, and carbon footprints within Integrated Farming Systems (IFS). It is essential to compile a comprehensive database on IFS practices nationwide, assessing their suitability for various agricultural ecosystems and landholding sizes. This documentation should also include insights into the selection of enterprises within the system and the allocation of resources. Furthermore, there is a need to conduct investigations into the enduring sustainability and feasibility of established IFS models under varying agro-climatic conditions, especially when dealing with high-value crops.

7. References

Babu, S., Das, A., Singh, R., Mohapatra, K.P., Kumar, S., Rathore, S.S., Yadav, S.K., Yadav, P., Ansari, M.A., Panwar, A.S., Wani, O.A., 2023. Designing an energy efficient, economically feasible, and environmentally robust integrated farming system model for sustainable food production in the Indian Himalayas. Sustainable Food Technology 1, 126–142

Gangwar, B., Singh, J.P., 2016. Integrated farming systems. In: Rana, D.S., Ghosh, P.K., Shivay, Y.S.,

Singh, G. (Eds), Modern concepts of agronomy. pp 146. The Indian Society of Agronomy, New Delhi.

Goverdhan, M., Kumari, C.P., Reddy, G.K., Sridevi, S., Alibaba, M.D., Chiranjeevi, K., Kumar, M.S., 2020. Evaluation of integrated farming system model for resource recycling and livelihood security of small and marginal farmers of Telangana State, India. Current Journal of Applied Science and Technology 39(34), 17–26.

IPCC, 2019. Land-climate interactions, in: climate change and land: an IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and green house gas fluxes in terrestrial ecosystems. Summary for Policy Makers, 1–15.

Karthik, R., Dhaker, D., Raising, L., 2022. Performance of cereals under need based nitrogen management strategies: A review. Agricultural Reviews 43(3), 320–326.

Kharche, P.P., Surve, U.S., Pokharkar, V.G., Patil, S.C., Salgar, S.B., 2022. Yield, productivity and economics of integrated farming system under irrigated conditions of Western Maharashtra. Current Journal of Applied Science and Technology 41(12), 13–20.

Kumari, C.P., Ramana, M.V., Goverdhan, M., Reddy, G.K., Vinay, G., Kumar, M.S, Karthik R., 2022. Nutrient uptake and soil fertility status in crop sequences module for different integrated farming system models of Telangana State. Biological Forum -An International Journal 14(2), 1034–1040.

Shyam, C.S., Shekhawat, K., Rathore, S.S., Babu, S., Singh, R.K., Upadhyay, P.K., Dass, A., Fatima, A., Kumar, S., Sanketh, G.D., Singh, V.K., 2023. Development of integrated farming system model - a step towards achieving biodiverse, resilient and productive green economy in agriculture for small holdings in India. Agronomy 13(4), 955.