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IFS for Diverse and Resilient Farming System for Tribal Farmers of West Garo Hills, Meghalaya

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Abstract

This article attempts to analyse the impact of IFS on the livelihood of the farmers of West Garo Hills district (Meghalaya). In West Garo Hills, farmers are mostly small and marginal (<1.08 ha). They practice mono-cropping in low land farming due to unavailability of water supply during winter resulting in low productivity and poor income. Further climate change like erratic rainfall, flash floods, poor economic conditions and low average land holding of the farmers poses challenges to life and livelihoods. To alleviate the detrimental effects of climate change on farmers' income, diversification and efficient existing resource utilization through IFS can lead to higher and stable income for the farmers. Under NICRA Project introduction of IFS based on the model Fish-Duck-Horticultural crops at Marapara, Smt. Pronilla Sangma's field have not only led to increased income but also improved livelihoods, food security with environmental sustainability.

Keywords: Climate change, Environmental sustainability, Food security, IFS

Introduction

In Meghalaya about 82.5% of the population relies on agriculture for their living where majority of the farmers being smallholders and marginal farmers. Despite 82.5% of the population depending on agriculture, the net cropped land constitutes merely 9.87% of the State's total geographical area. The state experiences an annual shortfall of 1.22 lakh tonnes of food grains. The assets of small and marginal farmers in Meghalaya include numerous types, such as a small plot of land, a family garden, a few hens, one to two cattle and a fish pond *etc*. In West Garo Hills, Meghalaya, monoculture is the most common practice of farming which has led to low production, uncertainty of higher income and employment opportunity for farmers and an increase in pests and diseases. Moreover irregular pattern of rainfall followed by increase cost of cultivation has led to dissatisfaction in farming among the farmers which are mostly smallholder and marginal in category, thus posing a serious threat to the profitability and sustainability of agriculture in the region. In this context it is felt that there is an urgent need for integration of numerous farm enterprises for a productive, profitable and sustainable agriculture. Integrated farming system is considered as one of the most climate resilient approach and is suitable for smallholder and marginal farmers.

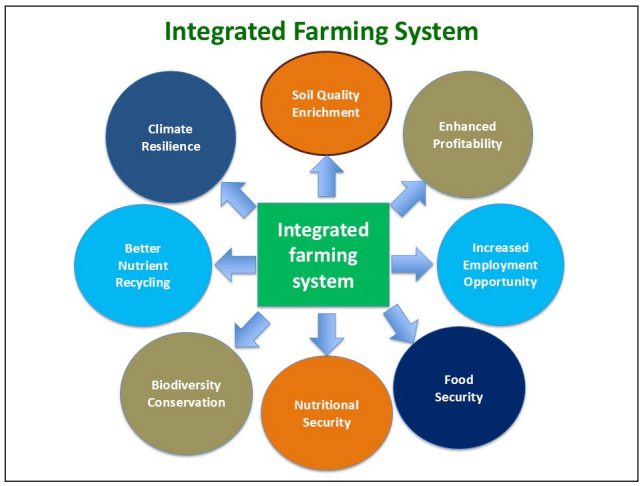

Figure 1: Integrated Farming System

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Integrated Farming Systems (IFS) are synergetic and holistic ways of agricultural production where two or more complementary products, like field and horticultural crops, livestock, aquaculture, poultry or duckery, apiculture and mushroom cultivation are planned in one farm unit (Figure 1). The system is governed by the cardinal principles of minimum competition and maximum complementarity among its components, reinforced by advanced agronomic management practices. Within an IFS framework, the by-products or wastes generated from one enterprise serve as valuable inputs for another, thereby ensuring efficient recycling of nutrients and minimizing external input dependency.

The fundamental principles of IFS encompass system diversification, resource optimization, synergistic interactions and long-term sustainability (Singh and Kumawat, 2023). Its overarching objective is to achieve environmentally sustainable income generation, improve household nutrition and food security and enhance ecosystem services (Gupta *et al.*, 2021). By integrating multiple enterprises, IFS provides continuous and diversified income opportunities throughout the year through the sale of various farm products.

Empirical studies in different agro-ecological regions of India explicitly show that mono-cropping or crop studies cannot address the increasing deeds of food and nutrition. Multi-component and integrated farming models should hence be considered to adopt in order to achieve efficiency in the recycling of resources on farms, economic stability and profitability. In addition, IFS helps in the enhancement of the health of the soil, environmental conservation, preservation of biodiversity and ecological resilience (Kumar *et al.*, 2018).

Components of IFS

Integrated farming systems (IFS) combine various inter related set of enterprises to optimize resource use and enhance sustainability. Key components include crop production, poultry, piggery, duckery, fishery, apiary, mushroom cultivation vermicomposting, fruit cultivation, agroforestry, water management and pest control, all designed to enhance productivity and profitability synergistically, ensuring that the by-products of one component serve as inputs for another to achieve optimal farm productivity. In brief IFS promotes a holistic approach to farming that supports food security and economic resilience.

Advantages of IFS

1. Integrated Farming System enhances productivity per unit area through the integration of crops and associated production processes.

2. Integration of diverse production systems offers a chance to enhance nutrient content in our diet besides alleviating malnutrition among the farming community.

3. Soil fertility and physical structure are enhanced by the implementation of suitable crop rotation, cover crops and organic compost. It also reduces nutritional losses.

4. Weeds, insect pests and diseases can be controlled by crop rotation and the effective integration of organic and inorganic nutrient sources.

5. Regular and stable income is possible from various products like eggs, mushroom, meat, honey, banana *etc.* of different activities thereby increasing the net return of the family.

6. Efficient recycling of waste materials and by-products reduces dependence on external inputs (*e.g.*, fertilizers, agrochemicals, feeds, energy), resulting in a stable production system (Kumar *et al.*, 2013).

7. IFS offers a stable and sustainable production system *via* varied crops and enterprises, hence aiding in risk mitigation and enhancing resistance to climate change (Ayyappan and Arunachalam, 2014).

Success Story of IFS from Marginal Farmer's Perspective

In Marapara village of West Garo Hills district, majority of the farmers are smallholders and marginal. The income of farmers from agriculture sector is not sufficient to run their families. One of the hard working and progressive farmer of the village, Smt. Pronilla M. Sangma, has been practicing agriculture since 10 years in a total land of 4 ha. She grows paddy, turmeric and vegetables in summer season, but due to undulating topography coupled with the constraints faced from the negative impacts of climate change and vulnerability, she was unable to get the expected income from her farm land.

To identify the problems of Smt. Pronilla M. Sangma, a survey of her farming situation was carried out by the officials of KVK, West Garo Hills. During the survey one pond of size 16 m × 14 m × 1.5 m near to her paddy field was observed (Figure 2). She was unable to reap the full benefits of the pond because of the unscientific rearing of fishes. Therefore, KVK experts organised a training-cum-method demonstration programme on Integrated Farming System in the village. After the training programme, Smt. Pronilla Sangma showed her keen interest and was motivated to implement Integrated Farming System in her farm. The experts of KVK renovated her pond and promoted cultivation of horticultural crops on the dykes and adjoining areas of pond by integrating with fishery and duckery farming. She was also supported with inputs like fingerlings (rohu, catla, mrigal, carps and bata); ducklings (Khaki Campbell); banana suckers (G-9). Thus Fish-Duck-Horticulture model was taken up by her in her farm land.

KVK, West Garo Hills demonstrated Fish+Duck+Banana based IFS model in Smt. Pronilla Sangma's pond. Size of the pond was 16 m × 14 m × 1.5 m. On an average annual yield of fish was found to be 110 kg after integration with ducks and banana plants. The average yield obtained from banana was 7.4 q and duck eggs 3,240 nos. (Table 1). Integration helped Smt. Pronills Sangma to earn extra revenue with good dividend. This particular model has yielded a net return of Rs. 58,160.00 unit^{-1}year^{-1}, with a B:C ratio of 2.33.

Integration of different components has helped in boosting income of Smt. Pronilla M. Sangma as she earned an income of Rs. 83,160.00 annually from her IFS model (Table 1; Figure 3). On seeing the success of Smt. M. Pronilla Sangma other farmers of the village also showed immense interest in taking up IFS with the above model. Besides, consumption

of fish, eggs and meat which are rich in protein, vitamins and minerals can provide an affordable alternative in their diet which in turn can reduce malnutrition.

The optimum utilization of the dike area by growing horticultural crops besides rearing duck (Khaki Campbell) and pisiculture for economic gains had made Smt. Pronilla M. Sangma a role model for farmers of the village. Her sustainable farming approach has been adopted by seventeen other small and marginal farmers of the resource poor areas in order to diversify and enhance farm productions. No doubt many challenges were faced initially by Smt. Pronilla M. Sangma but various simple scientific interventions like timely stocking of fingerlings; quantity of fish feed for starter and big fishes; vaccination in ducks; planting of improved variety of banana; maintaining proper spacing *etc.* helped in overcoming the challenges. Her IFS model was also appreciated by members of Zonal Monitoring Committee on their visit to NICRA village in the year 2021.

Figure 2: Beneficiaries pond before developing IFS model

In a nut shell integrated farming system which includes various components such crops; horticulture; livestock, aquaculture, sericulture, poultry and agro forestry makes farmers and his family self sufficient by ensuring year round economic stability, sustainability and profitability. The Integrated Farming System is a distinctive method for the comprehensive enhancement of rural communities and the preservation of natural resources and crop diversity. Moreover viable models should be developed by further research based on socio-economic and agro-ecological conditions of small and marginal farmers. Thus integrated farming systems possess significant potential to enhance the sustainability, climatic resilience and multifunctionality of agriculture.

Figure 3: Various activities from beneficiaries' pond after developing IFS model

Table 1: Output from Fish+Duck+Banana based IFS model

Components	Size of the pond	Before intervention	After intervention	Component wise return (Rs.) annually		Average % increase in income after intervention
				Before	After	
Fish-Duck-Horticultural crops (banana)	16 m × 14 m × 1.5 m	Average Fish production (without intervention of duckery and banana): 67 kg year^{-1} @ Rs. 300.00 kg^{-1}	Average Fish production: 110 kg year^{-1} @ Rs. 300.00 kg^{-1}	20,100.00	33,000.00	313.73%
			Duck (20 nos.), Average egg production: 3,240 eggs. Sold @ Rs 10.00 egg^{-1}	-	32,400.00	
			Average banana production from 37 plants were 444 hands *i.e.*, 12 hands per bunch. Each hand sold at average rate of Rs. 40.00. Therefore from 444 hand average income was Rs. 17,760.00	-	17,760.00	
			Total	20,100.00	83,160.00	

Conclusion

Consequently, it may be accepted that Integrated Farming System indeed has a positive impact in ensuring the food security among rural population and should be popularized. It also generates small and constant source of income as has been seen in the case of Smt Pronilla A. Sangma besides efficiently recycles agricultural by-products and optimally utilizes available resources. KVK, West Garo Hills as an extension agency can significantly contribute a pivotal role in bringing awareness besides encouraging adoption of Integrated Farming System among the farming community of the district.

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