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Livelihood enhancement through Diversification: Transitioning from standalone poultry farming to integrated farming systems

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Abstract

Himalayan agriculture of Uttarakhand faces severe constraints viz. fragmented landholdings, rain-fed dependency, and biotic stress, leading to low income and often migration letting farm land fallow. This case study documents the successful transition of a marginal farmer in Bageshwar district from traditional subsistence farming to a sustainable Integrated Farming System (IFS) model. Through capacity building and technical interventions by Krishi Vigyan Kendra (KVK) Bageshwar, the farmer shifted from unscientific single farm enterprise (poultry farming) to a diversified system integrating poultry with high-value vegetable crops and fruit plantations. Economic analysis from 2014-15 to 2024-25 demonstrates that the IFS model provided superior stability compared to standalone poultry farming, particularly during market disruptions. While the only poultry unit has its Benefit-Cost (B:C) ratio dip to 1.87 during the COVID-19 pandemic (2019-20), the IFS model buffered the shock, maintaining a B:C ratio of 2.04. The system achieved peak optimization in 2024-25 with a net return of ₹,397,590 and a B:C ratio of 2.19, driven by on-farm resource recycling, value addition, and the inclusion of agri-tourism. The study concludes that IFS helps maximize profitability on marginal lands and serves as a viable strategy to ensure livelihood security and may promote reverse migration in hill ecosystems.

Keywords: Economic Viability, Hill Agriculture, Integrated Farming System (IFS), Livelihood Diversification, Mono-culture

Introduction

In Uttarakhand, more than 75% of the population relies on agriculture for their livelihood, with farming largely practiced at a subsistence level (Rana *et al.*, 2019) ^[13]. This situation reflects the broader realities of the Indian Himalayan hills, one of the most ecologically fragile areas, which has experienced considerable change due to harsh environmental conditions, habitat degradation, and fragmentation. Although the region is rich in natural resources, agricultural development is limited by many constraints, like inadequate infrastructure, restricted access to facilities, and a high exposure to natural disasters (weather and wild life). Together, these factors contribute to low farm incomes and the continued prevalence of subsistence-based farming systems (Kumar *et al.*, 2021) ^[1]. Changing climate conditions, as first constraint, are putting increasing pressure on Hill farming in Himalayan Region. Temperature rise, melting of glaciers, erratic rainfalls, and more frequent extreme weather events have disrupted water systems in the region. Rainfall events and rainy days have dropped by drastically, while intense rainfall and droughts have become more common. Consequently, not only the water availability has declined, also causing frequent crop failures, with a 25% fall in irrigation potential, a 26% drop in agricultural productivity, and a 34% loss of rural livelihoods (Tiwari and Joshi, 2015) ^[2]. Fragmented landholdings in hill regions obstruct the scope of

mechanization and reduce both land and labour productivity (Chen *et al.*, 2024) ^[10]. As average landholdings in hill districts are often less than 1 hectare, the use of farming machinery is rendered largely unviable (Salgotra, 2017; Das *et al.*, 2025) ^[3, 4], thereby narrowing the scope for both mechanization and economies of scale (Joshi & Lohani, 2023) ^[5]. In addition to this, the menace of wildlife is a considerable biotic stress causing land abandonment. Severe crop damage due to wild boars, monkeys, and other animals is forcing farmers to leave their lands fallow and give up agriculture entirely (Ogra, 2008; Rathi *et al.*, 2020) ^[6, 7]. Consequently, the animal menace has emerged as a major deterrent to farming, often pushing farmers towards alternative livelihoods. To overcome dependency on monoculture and create simultaneous sources of income, Integrated Farming Systems (IFS) offer a viable approach for marginal farmers. IFS involve the deliberate inclusion of two or more agricultural enterprises within a single farming unit, thereby shifting from conventional monoculture to a holistic, circular agricultural model. As mentioned by Yadav *et al.*, 2024 ^[11], IFS assures efficient resource recycling, long-term sustainability, and regular employment generation which are prerequisites for the sustainable livelihood of small and marginal farmers. Such system of inter-related enterprises recycles the waste of one component as input to other enterprise within the system, and thereby reducing the cost of external inputs (Kumar *et al.*, 2018) ^[12], and thus

lowers the environmental footprint along with a promise to secure income of the farmer. Moreover, single-cropping systems (i.e., monocultures) lack climate resilience and are highly susceptible to crop failure under abiotic stress. Studies support that diversifying cropping systems creates yield stability during climate extremes, such as drought (Lin 2011) ^[9]. Therefore, from an economic point of view, monocultures make farmers and producers vulnerable to market collapse (Bradshaw *et al.*, 2004) ^[8].

This paper presents a local-level case study on the successful adoption of IFS by a marginal farmer in Bageshwar District, Uttarakhand. It documents the economic feasibility and sustainability of the IFS model within the hill ecosystem of Uttarakhand.

Methodology (The Case Profile)

- **Study Area:** The present study was conducted in Village Karalagaon, Post-Kafligair, in the Bageshwar district of Uttarakhand. The respondent, Mr. Heera Singh, was selected based on his keen interest in learning and his aptitude for innovation, which distinguishes him as a progressive farmer among his peers. The study documents his shift from traditional subsistence farming to a sustainable Integrated Farming System (IFS) model.
- **Profile of the Farmer** Mr. Heera Singh (S/O Shri Dhan Singh) is a 45-year-old farmer, the family consists of 5 members dependent on the farm income. The total land holding available for cultivation is approximately 1.0 acre (marginal landholding category). Data regarding income, input costs, and yield was collected through personal interviews with farmer and records maintained by the Krishi Vigyan Kendra (KVK), Bageshwar.

Initial Agricultural Challenges (2000-2006)

Prior to becoming a full-time farmer, Mr Heera Singh was employed in a private non-farm firm. Following the company's closure, he experienced reverse migration, returning to his native village in 2000. Upon his return, he initially practiced traditional agriculture on his 1.0-acre land, which generated insufficient income to support his family's basic needs. To supplement his finances, he initiated a goat rearing venture with a herd size of 50 in 2002. However, the venture collapsed due to a lack of technical knowledge, leading to high mortality from PPR disease, while his unawareness regarding insurance coverage worsens the financial burden. In 2006, he started poultry farming as new venture, but again his attempts lead to severe losses due to lack of knowledge regarding brooding and health management of poultry. The baseline status, therefore, was characterized by financial instability, lack of technical know-how, and reliance on unscientific farming practices.

Capacity Building and Skill Development

- The primary intervention focused on capacity building through knowledge transfer, initiated by off-campus training programs organized by KVK Bageshwar in 2008. This included comprehensive scientific training on croiler and broiler production management--ranging from chick selection and brooding to vaccination and record-keeping.
- Supplemented by exposure visits to ICAR-VPKAS (Almora), GBPUA&T (Pantnagar), and progressive farms to demonstrate commercial scalability.
- To facilitate further diversification, the farmer later underwent advanced training in Mushroom production and Beekeeping under the ASCI Skill India program during 2021-22 and 2022-23 at KVK Bageshwar

Input Support and Varietal Introduction

- To mitigate initial risks, critical inputs were provided for three consecutive years (2011-2014), including improved Low-Input Technology (LIT) poultry breeds (FFG, Chabro, Vanraja) and an Azolla production unit for cost-effective feed management.
- The enterprise was diversified into an Integrated Farming System (IFS) during the COVID-19 lockdown by incorporating high-value horticultural crops and fruit plantations like Lemon and Orange, utilizing poultry manure to enhance soil fertility and thereby waste recycling and slashing down chemical fertilizer costs
- This transformation was further strengthened by value addition through shift from selling live birds to dressing broilers on-farm and selling fresh meat, which significantly increased profit margins

Marketing Innovation by establishment of a homestay in 2024, thereby integrating agri-tourism to maximize profitability.

Results and Discussion

The economic viability of the technological interventions was analysed by comparing the year-wise performance of the standalone poultry unit against the Integrated Farming System (IFS) model. The data, recorded from 2014-15 to 2024-25, highlights the impact of diversification on farm income and sustainability.

Economic Performance of the Poultry Component (Table 1)

The poultry enterprise exhibited fluctuations driven by external market factors and disease management. While initial mortality issues (2015-16) and COVID-19 market disruptions (2019-20) lowered the Benefit-Cost (B:C) ratio to 1.96 and 1.87 respectively. However, the adoption of scientific management and on-farm processing led to a robust recovery, achieving peak efficiency in 2024-25 with a net income of ₹3,73,680 and a B:C ratio of 2.16

Table 1: Economic Performance of Standalone Poultry Farming (2014-2025): This table illustrates the cost-benefit analysis of the poultry component over the last decade.

Year	Batch Size (No.)	Cost of Production (₹)	Gross Income (₹)	Net Income (₹)	B:C Ratio	Remarks / Observation
2014-15	500	2,95,500	6,03,900	3,08,400	2.04	Standard production cycle (Meat & Eggs).
2015-16	600	3,15,250	6,19,250	3,04,000	1.96	Moderate mortality affected net returns.
2016-17	600	3,15,500	6,42,650	3,27,150	2.04	Optimal flock management; high returns.
2017-18	600	3,21,900	6,26,750	3,04,850	1.95	Increase in input costs (feed/medicines).
2018-19	600	3,28,650	6,54,600	3,25,950	1.99	Stable market rates for poultry products.
2019-20	500	3,13,995	5,86,425	2,72,430	1.87	Early market disruptions due to COVID-19.
2022-23	500	3,13,795	5,96,100	2,82,305	1.9	Post-pandemic recovery phase.
2023-24	500	3,21,005	5,99,550	2,78,545	1.87	Steady recovery in demand.
2024-25	600	3,23,020	6,96,700	3,73,680	2.16	Highest efficiency achieved via on-farm processing.

Impact of Integrated Farming System (IFS) on Livelihood (Table 2)

The IFS model demonstrated superior economic stability compared to standalone poultry. During the market meltdown of 2019-20, the diversified vegetable and fruit crops compensated for the income gap, maintaining a higher

B:C ratio of 2.04 compared to 1.87 in the poultry sector alone. The collaboration between crop and livestock components peaked in 2024-25, achieving a maximum net return of ₹3,97,590 and a B:C ratio of 2.19, supporting potency and effectiveness of the multi-enterprise model.

Table 2: Year-wise Economic Impact of Integrated Farming System (IFS): This table reflects the cumulative data of Poultry combined with Vegetable and Fruit components.

Year	Total Cost of Production (₹)	Gross Income (₹)	Net Return (₹)	B:C Ratio	Developmental Milestones
2014-15	2,96,500	6,08,900	3,12,400	2.05	IFS Initiation: Establishment of fruit orchard & introduction of HYV vegetables.
2015-16	3,22,350	6,45,250	3,22,900	2	Orchard maintenance phase; income primarily from poultry & vegetables.
2016-17	3,23,380	6,77,650	3,54,270	2.1	Improved vegetable yields contributing to higher gross income.
2017-18	3,29,640	6,61,750	3,32,110	2.01	Continued maintenance of horticultural components.
2018-19	3,30,880	6,87,600	3,56,720	2.08	Fruiting Stage: Fruit crops began commercial production/sales.
2019-20	3,20,995	6,55,425	3,34,430	2.04	Market irregularity due to pandemic; diversified enterprise system compensated for income loss.
2022-23	3,21,850	6,83,100	3,61,250	2.12	Resumption of full-scale supply chain operations.
2023-24	3,29,780	7,18,550	3,88,770	2.18	Intensification of off-season vegetable cultivation.
2024-25	3,34,110	7,31,700	3,97,590	2.19	Peak Optimization: Maximum returns from fruit, vegetables, and poultry synergy.

Note: Data for years 2020-21 and 2021-22 was not recorded due to operational shutdowns/lockdowns due to COVID-19 pandemic

Conclusion

The case study of Mr. Heera Singh illustrates the potential of the Integrated Farming System (IFS) in reshaping farming of the hill ecosystem of Uttarakhand. The shift from a struggling, single cropping-based traditional farming to scientifically managed, multi-enterprise IFS has resulted in a sustainable livelihood model. The data demonstrate that while poultry farming served as the primary income source, the integration of high-value vegetables and fruit crops significantly enhanced economic stability. The achievement of a peak B:C ratio of 2.19 in 2024-25 validates that resource recycling and diversification are key to maximizing profitability on marginal landholdings. It is recommended that such IFS models may be replicated and promoted by extension agencies as a feasible strategy to combat migration of rural farmers to urban areas for better livelihood and promise economic security in the hills of Uttarakhand.

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