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## **Integrated Poultry-Fish Farming Systems for Sustainable Rural Livelihood Security in Kumaon Hills of Uttarakhand**

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### **Abstract**

The study has analyzed socio-economic impact of poultry based farming system on farmers for their livelihood security and women empowerment. The analysis is based on the data collected from 95 poultry farmers selected from three hill districts of Kumaon region for two production years, 2011-12 and 2012-13. It has been observed that the farmers' access to day-old chicks (DOCs)/fish seed/fingerlings plays the key role in popularization of integrated poultry-fish farming. The economics of prevailing poultry production systems has been worked out and it has been found that cost on rearing of chicks up to 3-5 weeks is nearly ₹ 46 per chick and a small unit of 10-15 birds in backyard poultry gives a net income of ₹ 11470/ annum. The chicken broilers could be reared successfully by farmers in the remote hills villages. The feed cost has a lion's share (72%), followed by DOCs cost in the total cost. The study has revealed that poultry could be successfully reared in backyard as well as intensive broiler farming. The adoption of integrated poultry-fish farming provides fetch additional income of ₹ 4000-5000 and employment opportunities for 45-50 human days. Additionally, the consumption of eggs/fish and meat adds to food quality and livelihood security of the resource-poor family. High costs of feed and chicks have been identified as the major constraints of integrated poultry farming. The study has concluded that the integrated poultry-fish system could address issues of sustainability, women empowerment and livelihood security effectively. The government should offer subsidy on feed and other inputs as incentives to the BPL families for adoption of integrated poultry-cum-fish farming which would lead to women empowerment and livelihood security in the region.

**Key words:** Poultry-fish integrated farming, livelihood security, women empowerment, Uttarakhand

**JEL Classification:** C 42,I 11 and I 12

### **Introduction**

Poultry is the foremost developing segment of the agricultural sector in India. Globally, India ranked 3<sup>rd</sup> in egg production (66.45 billions) and 5<sup>th</sup> in chicken production (3.6 Mt) in the year 2011-12. This increase in poultry production has enhanced the per capita availability to 55 eggs and 2.4 kg poultry meat per annum (Economic Survey, 2012-13). In spite of having huge potential for backyard poultry production,

Uttarakhand hills have wide gaps in demand and supply of poultry products. Its annual egg production of 261 million numbers is less than 0.4 per cent of the total egg production in India in 2011-12. The average per capita availability of 26 eggs and 0.1 kg poultry meat is far below their national levels (BAHS, 2012). The integrated poultry-based farming provides enormous opportunities for supplementary income, women empowerment and livelihood security to rural families in hills, where crop production has limited scope of ensuring food and nutritional security of more than 7 lakh rural families, most of which are in the BPL

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category. The integrated poultry-fish farming offers opportunities to these resource-poor families at meagre financial investments and addresses the issues of women empowerment and livelihood security at the gross root level. To encourage poultry entrepreneurship among women SHG-members/rural households, a centrally sponsored scheme 'Poultry Venture Capital Fund' has been implemented in capital subsidy mode to support backyard or intensive broiler production and hatchery/ small poultry feed mills in the Kumaon hills.

The basic reasons behind poor growth of poultry production in the Kumaon hill are extreme cold climate, scarcity of poultry houses, weak economic status and inefficient disease management, especially during the winters. The most challenging job in poultry production is maintenance of optimum temperature in the poultry houses during the winter season (Biswas *et al.*, 2010). Singh *et al.* (2009) have assessed the economic potential of rearing of free-range indigenous fowls by the rural women in Uttarakhand and have reported that the average annual income from the sale of eggs and poultry birds was in the range of ₹ 7450 to ₹ 35600, depending on farm/unit size. The Uttarakhand hills have enormous potential for high-value crops, livestock and poultry, but need a strategy to manage the challenges of food and livelihood security and check the migration of rural youth to metro cities (Mittal *et al.*, 2008). It should include creation of brand loyalty for organic/fresh/green poultry products to reap price advantage of urban/metro markets. The adoption of integrated poultry-fish farming can offer opportunities for livelihood and food security to the households of the Uttarakhand. Keeping this in view, the present study has been conducted to assess the economics of prevailing poultry production systems and their role in ensuring rural livelihood security and sustainability in the Kumaon hills of Uttarakhand.

### Data and Methodology

The study is based on the primary data collected from poultry farmers selected randomly from three districts (Nainital, Champawat and Pithuragarh) of Kumaon region. From each selected districts, two blocks and from each block, 6 villages were selected for identification of broiler farms and rural poultry farmers. In total, 37 commercial broiler farms, 40 rural poultry farmers, 18 contract chick-rearers from SHGs were selected, making the total sample of 95 farmers.

The primary data were collected on different aspects of poultry production through survey conducted during the years 2011-12 and 2012-13. The simple tabular analysis and appropriate statistical tools were applied for estimation of economic benefits of popular poultry production systems. The respondents were also asked to rank the problems/ constraints being faced by them in adoption of poultry rearing and its possible impact on their livelihood security. The Garrett's Rank Based Quotients (RBQs) methodology was applied to rank these constraints using the followings formula:

$$RBQ = \frac{\sum f_i (n+1-i)}{N.n} \times 100$$

where,  $f_i$  is the frequency of the  $i^{\text{th}}$  rank,  $n$  is the number of ranks,  $i$  is the rank position (1 to  $n$ ), and  $N$  is the number of poultry farmers selected as respondents.

### Results and Discussion

The genetic material in the form of poultry day-old chicks (DOCs) and fish seeds/fingerlings was supplied to the farmers by various organisations such as the ICAR institutes, Directorate of Animal Husbandry, State Agricultural University, KVKs, non-governmental organisations (NGOs), self-help groups (SHGs), village level societies, private fishery/poultry hatcheries and agricultural inputs shops-owners. The adoption of integrated poultry-fish-duck farming in different forms such as intensive broiler production, backyard poultry rearing, etc. leads to conservation of natural resources and provision of additional income/employment opportunities, especially to the youths and women workers in the villages. Based on the secondary information compiled from various sources and respondents, the inputs supply network system for promotion of integrated poultry-fish-duck rearing has been presented in Figure 1.

The elite poultry and fish germplasm/parent stock suitable for cold water region/colour birds suitable for backyard farming were maintained and supplied by the institute of National Agricultural Research System (NARS) to Central Poultry Development Organizations (CPDOs), public/private mother hatcheries, KVKs' farmer clients and other stakeholders. The mother hatcheries produced fish fingerlings/ fertile eggs; maintained hatcheries and supplied day old chicks (DOCs)/fish seedlings. The production capacity of mother hatcheries varied from 10000-25000 DOCs per batch. The DOCs and fish seedlings were supplied to

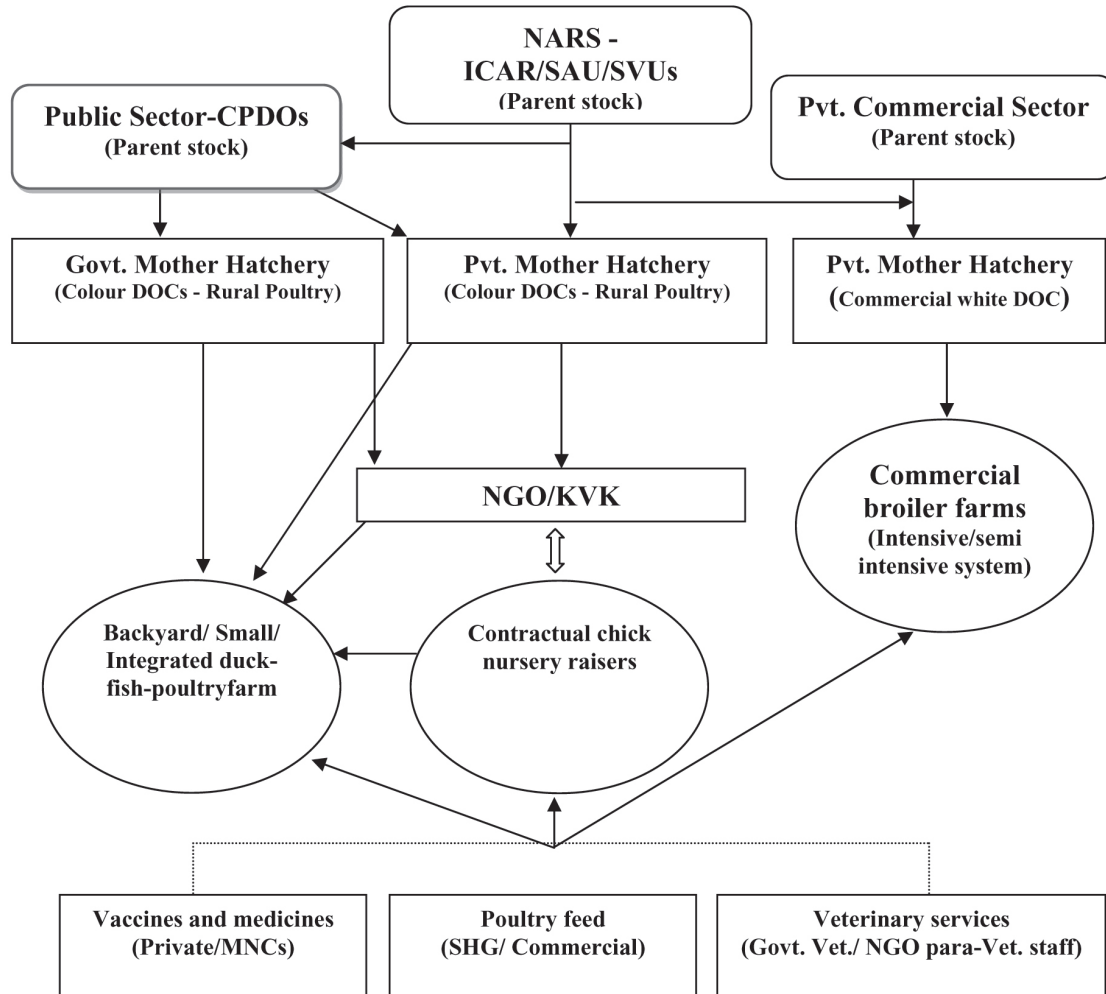


Figure 1. Input supply model for integrated poultry-fish farming in Kumaon hills

the NGOs, KVKs, SHG members and fish/ poultry farmers at the prevailing market prices. The DOCs were reared by the contractual chick-raisers based on the requirement of SHG women members of village in batches of 250-350 birds per batch. They had identified some women farmers from SHG-members and trained them for fish-cum-poultry keeping and disease management to reduce mortification during early growing period. These women SHG-members were equipped by the NGO/KVK for brooding, feed manufacturing, housing, disease management and to vaccination of birds. They used indigenous traditional knowledge (ITK) for poultry health care and purchase of vaccine and medicines from the local market. The small poultry feed mills operated by the *Parvatiya Pasupalak Mahila Sangh*, the cooperative society run by the women members of SHGs, procured various feed ingredients (including per-mixes), available in the

villages/local market or supplied by the NGO. They were selling the compound poultry feed to the contractual chicks' nursery growers and poultry farmers. The economic analysis of various activities performed by the NGOs/SHGs as well as poultry farmers at the grass root level was carried out.

### Economics of Contract Chick-rearing during Early Brooding

The government/private agencies promoting rural family poultry for women empowerment and poverty alleviation in the Kumaon hills, emphasized on chicks brooding and trained a few SHG-members to minimize chicks mortality during the early brooding phase by contract chicks-rearing. The DOCs purchased from the mother hatcheries were reared by the trained SHG members turned chick nursery operators till 3-5 weeks.

**Table 1. Contract chicks-rearing for promotion of rural poultry in Kumaon hills**

Particulars/parameters	Average per contract farm	
Average farm capacity/batch (No.)	250-350	
Chicks reared by SHG /batch (No.)	305	
Preferences for chicken variety	Krioler>CARI Nirbheek>Vanraja	
Cost components (in ₹)	Total cost	Unit cost/ chick
Cost of chicks	5065 (35.93)	16.60
Transport cost	664 (4.71)	2.20
Brooding rent	512 (3.63)	1.68
Expenses (electricity & water)	239(1.70)	0.78
Vaccines and medicines	647 (4.59)	2.12
Labour	2025 (14.36)	6.64
Feed cost	4945 (35.08)	16.21
Total cost	14097 (100.00)	46.23
Mortality during 3-5 weeks	5% (adjusted for free chicks)	
Average chick-rearing cost (3-5 weeks) (₹)	46.23	
Total margin shared NGO/SHG (75:25) (₹)	3.17	
Incentive to the farmer	0.60	
Sale price of chicks (3-5weeks) (₹)	50.0	

Note: Figures within parentheses indicate the percentage of the total cost of rearing

The economic analysis of chick brooding has revealed that the average cost of rearing chicks till 3-5 weeks old was ₹ 46.23 per chick with 5 per cent mortality (Table 1). The grown-up chicks were sold to the fellow members of the SHGs @ ₹ 50/- per bird for onward rearing. The net margin of ₹ 3.77 was shared between NGO and the chick nursery operator in the ratio of 75:25. The chick nursery operator was also provided some additional incentives if the mortality remained below 10 per cent.

### Economics of Integrated Poultry-Fish-Duck Farming

Integrated poultry-fish farming has become popular for household nutritional security and women empowerment in the remote villages of Kumaon hills. Besides production of eggs and meat, poultry also provides faecal waste material, which could be used as manure or feed for aquaculture fish. It was observed that the farmers had constructed house covering the fish pond partially and recycling poultry droppings in the pond. The others had constructed the fish pond nearby the poultry house. The average size of fish pond varied from 30 sqm to 60 sqm and some had more than one fish pond.

The economics of integrated poultry-fish-duck farming revealed that the cost of feed and chicks together accounted for 88 per cent of the total cost (Table 2). The rearing cost in backyard poultry was ₹ 163 per bird. The farmers reared at least two batches of poultry birds per year and the average income generation was ₹ 5735 per batch with B-C ratio of 2.70. The scarcity of financial resources, improper housing, cold climate and damaging of grain crops by poultry birds were the major constraints in promotion of backyard poultry. Heavy mortality during the first 3-4 weeks of rearing of DOCs due to lack of technical knowhow about brooding was yet another major constraint reported by the backyard poultry farmers which was forcing them to purchase grown-up chicks, instead of DOCs, directly from the hatcheries. The study has revealed that poultry provided additional income and employment, improved food and nutritional quality for the rural families living in the remote hill villages.

The fish harvesting and supply to local markets depend on the consumers' demand and market prices. The fish farmers prefer partial fish harvest and sell it in the market. They add fingerlings of the same fish



**Table 2. Economics of integrated poultry-fish farming system in Kumaon hills**

Particulars/parameters	Average per farm family (in ₹)
Poultry rearing capacity (range) (No.)	5-20 hens/5-10 ducks
Poultry variety preference-wise	Krioler > CARI Nirbhik > Vanaraja
Pond size and fish breeds	30-60 sqm, Catla, rohu, mangur, carp, etc.
Price of a chicks (3-5 weeks) (₹/bird)	50-60
Cost of chicks	650 (30.63)
Mortality (%)	15-35
Feed cost (for 5-6 months) (₹)	1224 (57.68)
Depreciation value of cage/house (₹)	248 (11.69)
Total cost (₹)	2122( 100.0)
Cost of rearing/bird (₹)	163
Number of poultry sold (₹)	9
Income earned from poultry (₹)	3840
Value of poultry consumed (meat) (₹)	1525
Value of poultry eggs consumed (₹)	370
Total gross income (poultry) (₹)	5735
Net income (₹)	3613
B-C ratio based on poultry sold	1.81
B-C ratio	2.70
Additional income earned from fish sale (₹/year)	5340
Value of fish consumed (₹)	650
Additional employment generation (human-days/year)	45-70

Note: Figures within parentheses indicate percentages to the total cost of rearing

species after phased fishing to maintain fish population in the pond. The final fishing is done after one year. The average fish yield from a small pond was 35-50 kg/year. The integrated poultry-fish-duck farming provides employment for 45-70 human days and additional economic benefits of ₹ 4000-5500 per annum to a family. Additionally, the consumption of eggs and meat improves the livelihood, food and nutritional security of the BPL families.

### Economics of Commercial Broiler Farming

There was wide a gap in demand and supply of poultry products especially during the tourist season. The local production of broiler was insufficient to fulfil the demand. Therefore, the poultry products were being supplied from plains of Uttarakhand and NCR Delhi.

The high transportation cost and profit margin inflate the prices of eggs and meat. Keeping in view the high demand and escalating prices of poultry, farmers have initiated commercial production of broilers in the hill villages adjacent to towns/cities. They have started rearing broilers "*Vencobb white*" with farm production capacity of 500-4000 birds per batch. The economics of broilers production was computed and is presented in Table 3.

The average mortality of day-old chicks during brooding was 7.75 per cent. The feed cost had a lion's share of nearly 72.2 per cent, followed by of DOCs cost (21.5 %). The gross return, total cost and net returns were ₹ 110, ₹ 99 and ₹ 11/broiler, respectively. The study has concluded that the commercial production of broilers has very thin margin as is evident

**Table 3. Economics of broilers production in Kumaon hills**

Particulars/parameters	Average per broiler farm	
No. of DOCs purchased /farm/year	8964	
Chicken broiler breed	Vencobb (white)	
Cost components (in ₹)	Total cost	Unit cost/broiler
Cost of chicks	190342 (21.52)	21.23
Transport cost	5008 (0.57)	0.56
Expenses (electricity & water)	17114 (1.93)	1.91
Vaccines and medicines	9401 (1.06)	1.05
Labour	9141 (1.03)	1.02
Feed cost	638539 (72.18)	71.24
Depreciation	5200 (0.59)	0.58
Maintenance of broiler shed	4730(0.58)	0.52
Interest on working capital	5124 (0.58)	0.57
Total cost	8,84,598 (100.0)	99
Mortality (%)	7.55	
Sale of broilers (₹)	9,48,224 (96.10)	106
Sale of poultry manure (₹)	28344 ( 3.22)	3
Sale of gunny bags (₹)	6005 (0.68)	1
Gross return (₹)	9,82,574 (100.0)	110
Net profit per broiler (₹)		11
Benefit-cost ratio (B-C ratio)	1.11	-

Note: Figures within parentheses indicate the percentages of the total cost of rearing

from the B-C ratio. The farmers were unable to reap economic returns from broilers production because of wide fluctuations in prices of poultry feed and DOCs. The respondent-farmers suggested that the government should provide subsidy on poultry feed, ensure regular supply of good quality DOCs and develop infrastructural facilities to boost poultry entrepreneurship and broiler production in this region.

#### **Constraints in Adoption of Integrated Poultry-Fish Farming System in Kumaon hills**

The constraints being faced by the respondents, presented in Table 4, reveal that the high cost of DOCs and poultry feed was the main constraint in promotion of integrated poultry-fish farming in the hill region (RBQ value 70.13), followed by the poor quality DOCs which causes high mortality during early brooding under hill villages (RBQ value 69.48). The management of small poultry feed-making

units by SHG women-members shows concerns for inferior feed ingredients and non-availability of mineral mixture. The distance of veterinary hospital from villages and high consultation fee, unwillingness of para-vet staff to vaccination and delivery of poultry medicines at farmers door step were ranked 4<sup>th</sup> and 5<sup>th</sup>, respectively. Lack government subsidy and paucity of funds for construction of suitable poultry houses was another constraint in adoption of integrated poultry-fish farming system in the Kumaon region. Keeping in view, the weak financial status of farmers, there is the need for special government subsidy for sustainable development of integrated poultry-fish farming in the Kumaon hills. The study has concluded that government may address the issues of income and employment generation, malnutrition, poverty, hunger and women empowerment for livelihood security of rural poor in the Kumaon hills of Uttarakhand.

**Table 4. Constraints in adoption of integrated poultry-fish-duck farming system in Kumaon hills**

Problem/Constraint	Rank frequency							RBQ value	Overall rank
	I	II	III	IV	V	VI	VII		
Poor quality of DOCs supplied in villages	22	14	4	8	4	5	9	69.48	2
High cost of DOCs, poultry feed and veterinary medicines	13	21	9	7	5	8	3	70.13	1
Distance of veterinary hospital from villages	10	6	11	14	9	9	7	58.23	4
High consultation fee of vet. staff	6	7	9	8	17	15	4	53.25	5
Improper marketing due to small produce	3	5	7	6	10	11	24	40.26	7
Lack of resources for construction of ponds/poultry sheds	3	7	9	14	12	8	13	49.57	6
Inferior quality of feed ingredients and vitamins/mineral mixture	9	6	17	9	9	10	6	59.09	3

## Conclusions

The study has revealed that integrated poultry-fish farming could be an economical viable avenue for the resource-poor hill farmers for their livelihood security and women empowerment. The study has revealed that the supply of day-old chicks (DOCs)/fish fingerlings is the key input for the spread of integrated poultry-fish farming. The efficient input supply system has a positive impact on the promotion of poultry-based farming activities, food and nutritional security and women empowerment in the study area. The contractual arrangements for DOCs-rearing have been found successful in minimizing mortality up to 5 per cent during the early phase of brooding. The grown-up chicks are sold to women-farmers who rear them in small flocks of 5-20, depending upon space availability and financial capacity.

The economics of prevailing poultry production systems have revealed that the poultry could be successfully reared both as backyard and intensive forms. The integrated poultry-cum-fish farming provides additional employment opportunities at least for 45 human-days and livelihood security to BPL families. The economic analysis has indicated that the backyard poultry could add on average an income of ₹ 11470 per annum from two batches. The average fish production from a small pond of 30-50 sqm size is 40-50 kg/year. This farming system gives net additional profit of ₹ 5000-6000 per annum.

The farmers could undertake commercial production of broilers successfully in the remote hills.

The broilers farm capacity ranges from 500 to 5000 per batch with 7.55 per cent mortality. In the total cost, the feed cost has a lion's share (72.0%), followed by the cost of DOC (21.5%). The average rearing cost has been found to be ₹ 99/broiler. The gross returns are ₹ 110/broiler with net profit of ₹ 11/broiler. The intensive broilers production has been found to provide very thin profit margins as the B-C ratio is only 1.11. High cost of DOCs and feed has been identified as the major constraint in adoption of integrated poultry farming. This system has been successful in addressing women empowerment, equity and livelihood security.

The study has suggested that efforts should be made to supply superior fish fingerlings/chicks, poultry feed, technical knowledge for fish ponds/poultry house designing, disease management and to diversify backyard poultry to mitigate production risks. The study has concluded that the government should provide special subsidy for the promotion of integrated poultry-fish farming for sustainable development of the Kumaon region. It should be linked with other rural development schemes/activities sponsored by various agencies.

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