Farm-Scale Production Performance of An Integrated Poultry–Fish Farming System Using Murrel (*Channa Striatus*) And Sonali Poultry: A Six-Month Case Study from Kothapally (V), Mupkal (M), Nizamabad District, Telangana, India

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Abstract

Integrated farming systems provide opportunities to combine multiple agricultural enterprises within a single production unit to improve resource utilization, diversify income sources, and enhance farm sustainability. This study describes the operational performance of a farm-scale integrated poultry–fish farming system involving murrel (Channa striatus) culture and Sonali poultry production at Kothapally Village, Mupkal Mandal, Nizamabad District, Telangana, India. The study evaluated farm configuration, fish production performance, poultry management practices, infrastructure development, water quality management, and economic outcomes during a six-month production cycle. The integrated farm was established on approximately 2 acres of leased land and consisted of one fish culture pond and two poultry sheds. The fish pond measured approximately 15 ft width × 50 ft length and was divided into four separate blocks for size-based management. The first two blocks consisted of fish with an average body weight of approximately 250 g, while the remaining two blocks consisted of larger fish weighing approximately 800 g to 1 kg. A total of 4000 murrel (Channa striatus) fish were stocked and managed using block-wise feeding practices. Fish were supplied with Stella commercial feed containing approximately 40% crude protein, with 4 mm pellets provided to 250 g fish and 6 mm pellets supplied to larger fish groups. During the six-month culture period, 3650 fish survived, while 350 fish were lost, resulting in a survival rate of 91.25%. The harvested fish achieved an average body weight of approximately 1 kg per fish, producing approximately 3650 kg of fish biomass. Water quality parameters including temperature, pH, dissolved oxygen, and ammonia were maintained within suitable operational ranges for murrel culture. The poultry component consisted of two sheds, each with a capacity of approximately 5000 Sonali breed chicks. Ten-day-old chicks were purchased at approximately ₹28 per bird and reared using Bhavani commercial poultry feed. The birds achieved an average final body weight of approximately 1–1.2 kg per bird under farm management conditions. The poultry sheds were equipped with essential facilities including water supply, overhead tanks, lighting, feeders, drinkers, rice bran flooring, mats, side walls, and green shade materials. The integrated farming system generated an estimated net return of ₹320,000, considering combined production outputs and operational expenses. The results indicate that integrated murrel–poultry farming can serve as a practical approach for improving resource utilization, reducing production risks, and generating diversified income opportunities for small and medium-scale farmers under Telangana farming conditions.

Keywords; Integrated farming system; poultry–fish farming; murrel; Channa striatus; Sonali poultry; aquaculture; survival rate; farm-scale production; Telangana

INTRODUCTION

Agricultural production systems are increasingly challenged by rising input costs, limited availability of land resources, environmental constraints, and the requirement for sustainable food production. Integrated farming systems have emerged as an effective approach to address these challenges by combining complementary agricultural activities within the same production unit. These systems promote efficient utilization of resources by recycling biological materials, reducing waste generation, and providing multiple sources of farm income. Among different integrated farming approaches, poultry–fish farming represents one of the most widely adopted livestock–aquaculture systems.

In this model, poultry production and fish culture are maintained together, allowing nutrients generated from poultry waste to contribute to pond productivity. Poultry manure contains organic nitrogen and phosphorus compounds that can stimulate natural productivity in aquatic systems, supporting the growth of microorganisms and natural food organisms.

Fish production provides an important source of high-quality animal protein and contributes significantly to rural livelihoods. At the same time, poultry farming provides rapid economic returns through meat production. Combining these two enterprises within a single farming system allows farmers to diversify production and reduce dependency on a single agricultural activity.

Murrel (*Channa striatus*) is a commercially valuable freshwater fish species distributed throughout South and Southeast Asia. The species has high consumer demand because of its taste, nutritional value, and market price. Murrel possesses several characteristics favorable for culture, including tolerance to variable environmental conditions and ability to utilize formulated feeds. However, successful production requires appropriate management of stocking density, feeding practices, size variation, and water quality.

Feed management is a critical factor in aquaculture production because feed represents one of the major operational inputs. Proper adjustment of feed pellet size according to fish body weight improves feed acceptance and reduces feed wastage. Similarly, maintaining suitable water quality parameters is essential for maintaining fish health and survival.

Poultry production also requires proper housing, feeding, and environmental management. Sonali chickens are widely reared in South Asia because of their adaptability, consumer acceptance, and moderate production performance. Proper housing facilities, feed management, and disease prevention practices contribute to successful poultry production.

Although integrated poultry–fish farming has been practiced in different regions, detailed documentation of farm-scale production systems remains limited. Field-based case studies provide valuable information regarding practical farm design, management approaches, production outcomes, and economic feasibility.

MATERIALS AND METHODS

Study design and location

A farm-scale field case study was conducted at an integrated poultry–fish farming unit located at Kothapally Village, Mupkal Mandal, Nizamabad District, Telangana, India. The farm occupied approximately 2 acres of leased land and integrated murrel culture with Sonali poultry production. The analysed production cycle lasted approximately six months.

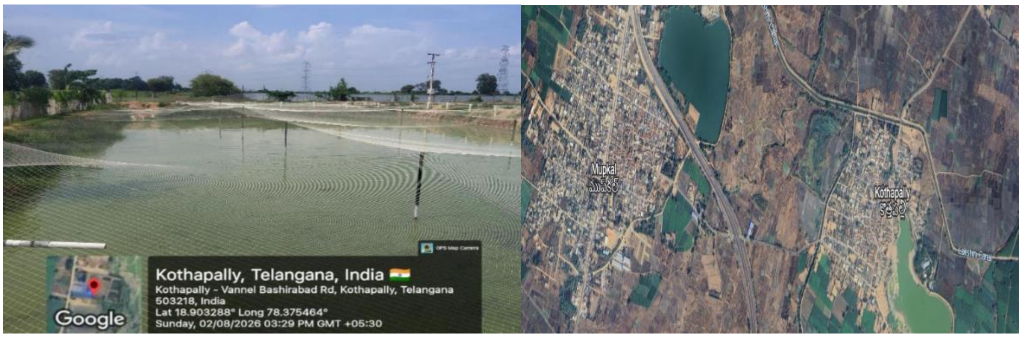


Figure 1. Location of the site

- **Kingdom:** Animalia
- **Phylum:** Chordata
- **Class:** Actinopterygii
- **Order:** Anabantiformes
- **Family:** Channidae (snakeheads)
- **Genus:** *Channa*
- **Species:** *striata*

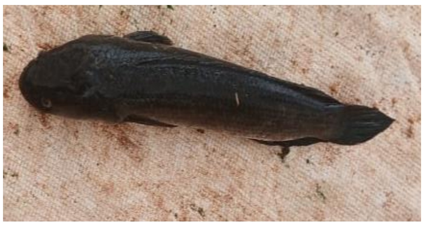


Figure 2 *Channa striata*

Integrated farming system configuration

The production unit consisted of two principal components:

1. a pond-based murrel culture unit; and
2. a Sonali poultry production unit.

The two components were operated within the same farm boundary and shared infrastructure such as water facilities, electricity supply, security monitoring, and general farm management.

Fish pond layout and stocking management

The fish culture unit consisted of one pond measuring approximately 15 ft in width and 50 ft in length. The pond was divided into four physically separated blocks to permit size-based husbandry and feeding.

A total of 4,000 murrel (*Channa striata*) were stocked in the culture system. During field observation, fish in Blocks 1 and 2 were approximately 250 g, whereas Blocks 3 and 4 contained larger fish ranging from approximately 800 g to 1 kg.

Table 1. Block-wise fish management

Block	Fish size observed	Feed pellet size
Block 1	~250 g	4 mm
Block 2	~250 g	4 mm
Block 3	~800 g–1 kg	6 mm
Block 4	~800 g–1 kg	6 mm

The block arrangement was used as a practical farm-management strategy to handle fish of different body sizes separately.

Feed and feeding management

Fish were supplied with Stella commercial feed containing approximately 40% crude protein. Feed pellet size was matched to the observed body size of the fish. Fish of approximately 250 g received 4 mm pellets, whereas the larger 800 g–1 kg fish were provided 6 mm pellets.

Table 2. Fish feeding protocol

Fish category	Approximate body weight	Feed	Crude protein	Pellet size
Smaller group	~250 g	Stella	~40%	4 mm
Larger group	~800 g–1 kg	Stella	~40%	6 mm

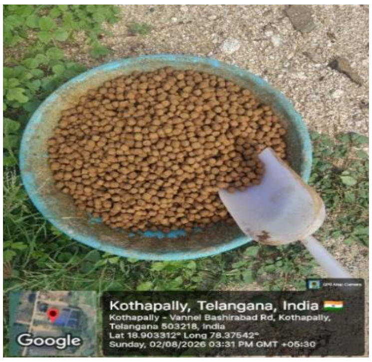
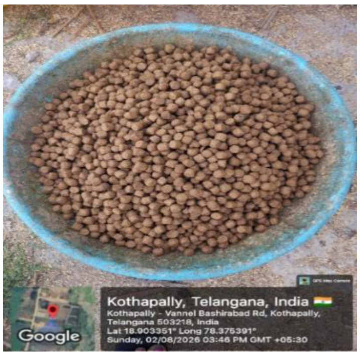


Figure 3 (a) 4mm fish feed



(b) 6mm fish feed

Water-quality management

Water quality was managed to maintain conditions suitable for murrel culture.

Table 3. Water-quality operating targets used for farm management

Parameter	Operational target
Dissolved oxygen	>4.5 mg L^{-1}
pH	6.8–8.0
Temperature	28–30°C
Total ammonia nitrogen	<1.0 mg L^{-1}
Nitrite	<1.0 mg L^{-1}
Total alkalinity	>150 mg L^{-1} as $CaCO_3$

Poultry production unit

The poultry component consisted of two sheds, each with an approximate capacity of 5,000 Sonali chicks, giving a combined housing capacity of approximately 10,000 birds.

Ten-day-old chicks were purchased for approximately ₹28 per chick. Birds were fed Bhavani commercial poultry feed. The poultry sheds were equipped with basic husbandry and environmental-management facilities, including feeders, drinkers, lighting, an overhead water tank, mats, rice-bran bedding, side-wall protection, and green shade mats.

Under the reported farm management conditions, birds reached approximately 1.0–1.2 kg body weight.

Figure 4 (a) Poultry farm (b) 10 days chicks (c) Feeder

Farm infrastructure and reported costs

Infrastructure and construction information was obtained from farm records and farmer-reported estimates.

Table 4. Infrastructure and investment values

Item	Details	Reported cost (₹)
Labour	Labour charges	5,000
Initial construction	Farm construction	250,000
Water facility	Water arrangement	50,000
Micro-irrigation	Drip system	25,000
Total farm investment	Overall setup	400,000
Power connection	Electricity/transformer	150,000
Electric poles	10 poles	10,000
Land	2 acres, leased	50,000
Medicines and sanitizer	Health and sanitation	20,000
Poultry shed	1,000 sq ft	650,000
Government subsidy	Reported/expected support	200,000
CCTV cameras	2 units	10,000

Production and economic calculations

Fish production performance was calculated from stocking number, surviving fish, mortality, and reported harvest weight.

Survival rate was calculated as:

Survival Rate (%)

The survival rate of fish was calculated using the following formula:

$$\text{Survival (\%)} = \frac{\text{Number of fish stocked}}{\text{Number of fish harvested}} \times 100$$

Mortality Rate (%)

The mortality rate was determined using the following formula:

$$\text{Mortality (\%)} = \frac{\text{Number of fish stocked}}{\text{Number of fish lost}} \times 100$$

Estimated Harvest Biomass

The estimated harvest biomass was calculated based on the number of surviving fish and their average harvest weight:

Harvest Biomass = Number of surviving fish X Average harvest weight

The farm reported a combined net return of approximately ₹320,000 from all farm production components. Because itemized revenue and recurring-cost records for fish and poultry were not separately available, the reported net return was treated as a farm-level economic observation rather than independently reconstructed.

RESULTS

Murrel survival and harvest production

A total of 4,000 murrel were stocked during the six-month production cycle. At harvest, 3,650 fish survived, while 350 fish had died.

The calculated survival rate was:

The survival rate was calculated as follows:

Survival (%)= $\frac{3650}{4000} \times 100 = 91.25\%$

The corresponding mortality rate was calculated as:

Mortality (%)= $\frac{350}{4000} \times 100 = 8.75\%$

The reported average harvest weight was approximately **1 kg fish⁻¹**. Based on the surviving fish population, the estimated marketable harvest biomass was calculated as:

Harvest Biomass = 3650 X 1.0 = 3650 kg or **3.65 tonnes**.

Table 5. Murrel production performance during the six-month cycle

Production indicator	Value
Species	*Channa striata*
Culture duration	~6 months
Fish stocked	4,000
Fish surviving	3,650
Mortality	350
Survival rate	91.25%
Mortality rate	8.75%
Reported harvest weight	~1 kg fish^{-1}
Estimated harvest biomass	~3,650 kg
Estimated biomass	~3.65 t

The results indicated that more than nine-tenths of the initially stocked population survived to harvest.

Block-wise fish management

The four-block arrangement allowed fish of distinctly different sizes to be maintained separately. Blocks 1 and 2 contained fish of approximately 250 g, whereas Blocks 3 and 4 accommodated larger individuals in the approximately 800 g–1 kg range.

Corresponding pellet sizes were used for the two fish-size classes. The approximately 250 g fish received 4 mm Stella pellets, while the larger fish received 6 mm pellets.

This block-wise arrangement was an observed management feature of the farm. Because block-specific stocking numbers, mortalities, and harvest weights were not recorded separately, statistical comparisons among blocks could not be performed.

Feed management

Stella feed containing approximately 40% crude protein was used throughout the reported fish production system. Feed size was adjusted according to fish body size.

The farm records supported description of feed brand, crude-protein content, and pellet size, but did not contain a complete quantitative feed ledger. Therefore, total feed consumed, apparent FCR, feed cost per kilogram of fish, and feed-conversion efficiency could not be calculated reliably.

Poultry production observations

The poultry component consisted of Sonali birds maintained in two sheds, each capable of accommodating approximately 5,000 chicks.

Chicks were purchased at approximately 10 days of age for ₹28 per bird. The poultry unit used Bhavani commercial feed and was equipped with feeders, drinkers, lighting, water storage, bedding, mats, side-wall protection, and green shade material.

Birds reportedly reached approximately 1.0–1.2 kg live body weight under the farm-management system. However, the number of birds actually placed, final bird count, poultry mortality, total poultry biomass, feed intake, and FCR were not available. Consequently, poultry survival and total poultry production were not calculated.

Water-quality management

Water quality was maintained according to routine farm-management targets suitable for murrel production. No major water-quality failure was reported during the study period.

Nevertheless, because repeated measured values were unavailable, the study does not claim statistically demonstrated stability of pH, dissolved oxygen, temperature, ammonia, nitrite, or alkalinity across the six-month cycle. This distinction is relevant and follows the conservative reporting style of the attached model, which also separates farm operating targets from measured time-series observations.

Infrastructure and integrated farm operation

The farm contained infrastructure supporting both aquaculture and poultry production, including a water-supply arrangement, micro-irrigation system, electricity transformer, electric poles, poultry housing, medicines and sanitizers, and CCTV monitoring.

The availability of shared infrastructure allowed the fish and poultry enterprises to operate within a common farm environment. This represented an useful practical feature of the integrated production model.

Economic outcome

The farmer-reported net return from all production components was approximately ₹320,000 for the relevant production period.

Derived production indicators

The recorded data allowed several additional descriptive indicators to be calculated without introducing unobserved values.

Table 6. Derived indicators from the murrel production cycle

Indicator	Value	Calculation
Survival	91.25%	3,650/4,000 × 100
Mortality	8.75%	350/4,000 × 100
Harvest biomass per fish initially stocked	0.913 kg	3,650 kg/4,000
Approximate surviving biomass	3.65 t	3,650 × 1 kg
Net return per initially stocked fish*	₹80	₹320,000/4,000
Net return per surviving fish*	₹87.67	₹320,000/3,650

These last two values are only farm-level descriptive ratios because the ₹320,000 net return includes all farm production components, not fish alone. They should therefore not be interpreted as fish-specific profitability.

DISCUSSION

Farm-scale production performance of murrel

A six-month production cycle of murrel (*Channa striata*) within an integrated poultry–fish farming system at Kothapally Village, Mupkal Mandal, Nizamabad District, Telangana. Of the 4,000 fish stocked, 3,650 survived to harvest, corresponding to a survival rate of 91.25% and a mortality rate of 8.75%. With a reported harvest weight of approximately 1 kg fish^{-1}, estimated marketable fish production was approximately 3,650 kg or 3.65 t.

The observed survival indicates that murrel could be maintained successfully under the reported farm-management conditions. *Channa striata* is a commercially important freshwater species, but culture performance depends strongly on feed management, stocking conditions, size variation, water quality, and husbandry practices. Previous research particularly emphasizes that size variation and cannibalism are important issues in murrel culture and should be considered during grow-out management.

Vikas et al. (2024), as discussed in the model paper, reported high-density murrel production in artificial tanks with approximately 97% survival. However, direct numerical comparison with the present study would be inappropriate because differences in culture environment, stocking strategy, fish size, feed, water management, and production duration can strongly influence performance. Previous studies also cautions against direct ranking of production systems that differ substantially in configuration and management.

The farm can therefore be considered primarily as a field implementation case showing that relatively high survival and marketable production were achievable under the farm management conditions described.

Size-based pond management

One of the notable operational characteristics of the farm was the division of the fish pond into four separate blocks. Blocks 1 and 2 contained fish weighing approximately 250 g, whereas Blocks 3 and 4 accommodated larger individuals of approximately 800 g to 1 kg.

This arrangement permitted different-sized fish to be managed separately and allowed feed pellet size to be adjusted according to body size. Such management is particularly relevant for murrel because size heterogeneity can increase competition and aggressive interactions. Reviews of *Channa striata* culture have identified size variation and cannibalism as important management concerns, particularly during juvenile and grow-out stages (Raizada et al., 2022). Previous studies similarly identifies grading and size management as important aspects requiring attention in murrel culture.

The four-block system therefore represents a practical management feature of the present farm. Nevertheless, the study did not maintain independent block-wise records of stocking number, mortality, biomass, or harvest weight. Consequently, it is not possible to determine statistically whether any particular block performed better than another.

Future production cycles should maintain separate records for each block. Such data would allow comparison of survival, growth, feed consumption, and biomass production between the smaller and larger fish groups.

Feed management and nutritional considerations

Fish were fed Stella commercial pellets containing approximately 40% crude protein. Fish of approximately 250 g received 4 mm pellets, while larger fish weighing approximately 800 g to 1 kg received 6 mm pellets. The use of different pellet sizes represented a simple but important management strategy. Pellet size should be appropriate for the mouth size and feeding capability of the fish to encourage efficient consumption and minimize physical feed loss.

Protein is particularly important in formulated diets for carnivorous fish such as murrel. Mohanty and Samantaray (1996) demonstrated that dietary protein concentration influences growth and feed conversion in *Channa striata* fry. More recent work has also shown that growth and nutrient utilization in murrel depend on the balance of dietary protein and energy rather than protein concentration alone. The reference model similarly discusses the importance of dietary protein and stage-specific feed management for *C. striata*.

The approximately 40% crude-protein Stella diet used in the present farm can therefore be described as the commercial feed used successfully during the reported production cycle. However, the present study does not establish 40% crude protein as the optimum dietary concentration because there was no experimental comparison among diets or protein levels.

An important limitation was the absence of a complete feed ledger. Total feed supplied throughout the six-month cycle was not independently recorded. Consequently, feed conversion ratio, feed cost per kilogram of harvested fish, protein efficiency ratio, and daily feeding rate could not be calculated.

Future farm records should include daily feed issued to each block, feed remaining or wasted, fish biomass estimates, and mortalities. These data would make it possible to calculate FCR and determine the economic contribution of feeding management.

Water-quality management

Water-quality management is central to successful aquaculture because feeding, metabolism, organic waste decomposition, stocking biomass, and environmental temperature can influence dissolved oxygen and nitrogenous waste accumulation.

The present farm used operational target ranges considered suitable for murrel culture, including approximately:

- dissolved oxygen >4.5 mg L^{-1};
- pH 6.8–8.0;
- temperature 28–30°C;
- total ammonia nitrogen <1.0 mg L^{-1};
- nitrite <1.0 mg L^{-1}; and
- alkalinity >150 mg L^{-1} as $CaCO_3$.

These values should be interpreted as farm-management targets rather than measured seasonal averages. The reference model uses the same conservative approach by distinguishing management targets from actual measured time-series water-quality data.

The relatively high fish survival observed during the cycle suggests that severe persistent water-quality failure was unlikely, but this cannot substitute for direct analytical monitoring. A high survival rate alone does not establish that all water-quality parameters remained continuously within optimal ranges.

This distinction is particularly important in an integrated poultry–fish system because organic matter from poultry production can potentially contribute nutrients to pond productivity but, if excessive, may also increase oxygen demand and ammonia accumulation. Integrated livestock–fish farming therefore requires appropriate balance between nutrient recycling and pond carrying capacity.

Future studies should record at least temperature, pH, dissolved oxygen, total ammonia nitrogen, nitrite, and transparency at fixed intervals. This would permit analysis of seasonal variations and their relationship with fish growth and mortality.

Poultry production performance

The poultry component consisted of Sonali chickens maintained in two sheds with an approximate capacity of 5,000 birds per shed. Ten-day-old chicks were purchased at approximately ₹28 per chick and were fed Bhavani commercial poultry feed.

The reported body weight of approximately 1.0–1.2 kg $bird^{-1}$ demonstrates that birds attained a marketable size under the farm-management conditions. The poultry sheds were equipped with essential facilities, including feeders, drinkers, an overhead water tank, lighting, rice-bran bedding, floor mats, side-wall protection, and green shade mats.

Maintaining appropriate housing and access to feed and clean water is necessary for successful poultry production. The integrated design also allowed certain infrastructure, such as electricity, water supply, surveillance, and general farm labour, to serve multiple production components.

However, the poultry performance data were less complete than the fish records. The exact number of chicks placed, number sold, mortality, total final poultry biomass, feed consumption, age at marketing, and poultry FCR were unavailable. Therefore, the reported weight range should be interpreted as a farm observation rather than a complete production-performance assessment.

Integration and resource-use implications

The central feature of the studied farm was the combination of fish and poultry production within the same farming unit. Integrated livestock–aquaculture systems are designed to improve overall resource utilization through complementary use of land, water, nutrients, labour, and infrastructure.

Little and Edwards (2003) describe integrated livestock–fish production as a system in which the outputs or wastes of one enterprise can become resources for another. Prein (2002) likewise emphasized the value of integrating aquaculture into crop–animal systems in Asia, while Nhan et al. (2007) demonstrated that integration can have economic significance at the farm level. These sources were also included in the integrated farming manuscript supplied previously.

In the present farm, the fish and poultry enterprises shared the overall farm area and several infrastructure components. These included water arrangements, electricity, monitoring facilities, and general management resources.

Poultry waste also provides a potential source of organic nutrients for pond systems. However, the present study did not quantify the amount of poultry manure entering the pond, its nutrient composition, plankton response, or reduction in fertilizer requirement. Therefore, nutrient-recycling benefits should be described as a potential and operational feature of the integrated system rather than a quantitatively demonstrated effect.

Future research could strengthen this aspect by measuring poultry-manure production, nitrogen and phosphorus inputs, pond chlorophyll or plankton productivity, dissolved nutrients, and external fertilizer use.

Infrastructure and capital requirements

The studied farm required several major infrastructure investments, including poultry sheds, water facilities, electricity connection, transformer installation, electric poles, irrigation equipment, farm construction, health-management supplies, and surveillance equipment. The poultry shed represented the largest reported individual infrastructure item at ₹650,000, followed by initial farm construction at ₹250,000 and electricity/transformer connection at ₹150,000.

However, the reported line-item costs do not reconcile directly with the stated ₹400,000 overall farm-investment figure. This may indicate that the individual values represent different construction phases, separate investment categories, partially pre-existing infrastructure, or costs recorded at different times.

Economic outcome

The farmer reported a combined net return of approximately ₹320,000 from the farm production components during the relevant production period.

This result suggests that the integrated enterprise generated a positive financial return under the reported conditions. Diversifying production between fish and poultry may also reduce dependence on a single commodity.

Nevertheless, the reported ₹320,000 should be interpreted carefully. It represents a combined farm-level net return, not an independently reconstructed profit based on audited expenditure and revenue records. Component-wise revenues from murrel and poultry were unavailable, and therefore the relative contribution of each enterprise cannot be determined.

Gross revenue is also not equivalent to net profit. Previous studies similarly emphasizes that economic conclusions require itemized information on feed, seed, labour, electricity, maintenance, depreciation, transport, and marketing expenses.

Consequently, the present economic result supports the practical income-generating potential of the integrated farm but should not be interpreted as a general profitability benchmark for all poultry–murrel farms in Telangana.

CONCLUSIONS

This study described a six-month farm-scale integrated poultry–fish farming system involving murrel (*Channa striata*) and Sonali poultry at Kothapally Village, Mupkal Mandal, Nizamabad District, Telangana, India.

A total of 4,000 murrel were stocked, of which 3,650 survived, giving a survival rate of 91.25% and mortality of 8.75%. At a reported harvest weight of approximately 1 kg fish^{-1}, estimated marketable fish production was approximately 3,650 kg (3.65 t).

The division of the pond into four blocks enabled fish of different sizes to be managed separately. Smaller fish of approximately 250 g received 4 mm Stella pellets, whereas larger fish of approximately 800 g–1 kg received 6 mm pellets. Stella feed containing approximately 40% crude protein was used during the culture period.

The poultry component consisted of Sonali birds housed in two sheds with an approximate capacity of 5,000 birds per shed. Chicks were procured at 10 days of age for approximately ₹28 per bird, fed Bhavani commercial feed, and reportedly reached approximately 1.0–1.2 kg body weight.

The combined production system generated a farmer-reported net return of approximately ₹320,000. These observations indicate that integration of murrel and poultry production can provide a practical means of diversifying farm output and sharing infrastructure under local farm conditions.

The study provides a practical farm-level example of integrated murrel–Sonali poultry production in Telangana and identifies both the production potential and the data requirements necessary for a more rigorous assessment of this farming model.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

Declaration of generative AI and AI-assisted technologies

AI-assisted language and formatting support was used to improve organisation and presentation. The authors must verify all project observations, calculations and references and remain fully responsible for the final manuscript. This declaration should be modified to comply with the selected journal's policy.

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