

Cost optimization for sustainable shrimp farming: Practical strategies for improving farm profitability

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Note from the Chief Editor:

Cost optimization for sustainable shrimp farming: Practical strategies for improving farm profitability was the topic of FIFP webinar conducted on 6th September 2022. Shrimp farming generates significant livelihood opportunities and export earnings for India. However, of late, this sector faces several challenges, the main one being increasing operational expenses among others. Under these circumstances, shrimp farmers can no longer depend solely on market price improvements for better returns. Instead, the focus must shift towards optimizing production costs without compromising shrimp health, growth performance, or survival. The most critical factor influencing profitability is feed that accounts for nearly 50–60% of the total cost of shrimp production. Mr. Praveen Ravi discussed practical and professional strategies that shrimp farmers can adopt to improve cost efficiency and ensure sustainable shrimp farming. He highlighted the importance of feed management to reduce production cost. He stressed the need for pond preparation and biosecurity. Mr. Praveen Ravi explained in detail major factors affecting shrimp farm profitability. He discussed the importance of selection of quality Post Larvae (PL) and post larvae quality assessment. Other aspects covered in his presentation include transportation, acclimatization, and nursery systems; disease prevention and sustainable farm health. The future of sustainable shrimp farming lies in combining traditional farm knowledge with scientific management and adoption of automation and Artificial Intelligence (AI).

Introduction

Shrimp farming has become one of the most promising sectors in aquaculture, generating significant livelihood opportunities and export earnings across many countries, particularly in India. However, shrimp farming has also become increasingly challenging due to fluctuating market prices, disease outbreaks, rising feed costs, labour shortages, and increasing operational expenses. In recent years, while shrimp selling prices have often shown instability, the cost of production has continued to rise steadily, creating pressure on farm profitability. Sustainable shrimp farming is not merely about achieving higher production but producing shrimp economically while maintaining pond health and long-term farm sustainability. Based on practical farm experience and field observations, cost optimization in shrimp farming begins with prevention, planning, and management. From selecting quality post larvae (PL) to efficient feed utilization, disease prevention, water quality management, and nursery practices, every stage of farming plays an important role in reducing production costs and increasing profitability.

Understanding the cost of production in shrimp farming

Before discussing cost optimization, it is important to understand where production expenses arise in shrimp farming. A standard cost evaluation of commercial shrimp farming shows that feed contributes the highest proportion of the total production cost. Typically, feed accounts for nearly 50–60% of the total cost of shrimp production, making it the most critical factor influencing profitability. Based on field-level observations and operational data, the approximate production cost distribution includes feed (52.62%), chemicals and minerals (12.78%), shrimp seed (10.21%), electricity and diesel (9.88%), salaries and manpower (6.70%), and miscellaneous expenses such as land lease, maintenance, and repairs (7.81%). Since farmers have very little control over market prices, the most practical and sustainable approach is to optimize internal production costs. Even small improvements in feed conversion ratio (FCR), disease prevention, survival percentage, or pond management can substantially improve farm profitability.

Major factors affecting shrimp farm profitability

Shrimp farming profitability is highly influenced by biological and environmental risks, with diseases being the most serious challenge. Shrimp diseases not only affect production but significantly increase operational costs through additional feed consumption, medicine usage, electricity requirements, and prolonged culture periods.

Among diseases, White Spot Syndrome Virus (WSSV) remains one of the most devastating viral diseases due to its rapid spread and ability to cause mass mortality within a short period. Farmers are often forced to perform distress harvesting, resulting in severe financial losses. Similarly, *Enterocytozoon hepatopenaei* (EHP) primarily affects shrimp growth performance. Though EHP may not directly cause mortality, it significantly reduces growth rates and creates size variation within the population, ultimately reducing harvest efficiency and market value. Poor growth also increases the culture duration, leading to higher electricity, feed, and pond management cost. White Faecal Disease (WFD), frequently associated with *Vibrio* infection and poor pond conditions, further affects feed intake, gut health, and survival. Such diseases often result in poor feed conversion ratio, low average body weight (ABW), and increased production cost. Therefore, disease prevention and proper farm management should be viewed not as expense but as investment in profitability.

Selection of quality post larvae (PL): The foundation of success

Successful shrimp farming begins with stocking high-quality post larvae. Poor-quality seed can negatively affect survival, growth, FCR, disease resistance, and ultimately profitability. In practical shrimp farming, post larvae quality assessment should involve the following six major components.

1. Gross examination
2. Microscopic examination
3. Stress testing

4. Physical measurement
5. Vibrio testing
6. PCR screening

While many farmers primarily focus on PCR testing, field experience suggests that Vibrio testing should receive equal importance before final seed selection. A healthy PL with low bacterial load generally performs better under farm conditions. TCBS plate count analysis provides valuable information regarding bacterial contamination. Ideally, green Vibrio colonies should remain below 1×10^2 CFU/g, while yellow colonies should remain below 1×10^3 CFU/g. Once Vibrio status is confirmed, PCR screening for diseases such as WSSV and EHP can be performed, followed by microscopy and stress testing.

Investing slightly more time during PL selection often saves farmers from significant losses later in the crop cycle. Poor seed quality almost always results in higher hidden costs through mortality, weak growth, or disease vulnerability.

Importance of transportation, acclimatization and nursery systems

Even good-quality post larvae can fail if transportation and acclimatization are poorly managed. Excessive stress during transport or improper temperature, salinity, and pH adjustment during stocking can significantly increase initial mortality. It is advisable to establish survival cages or hapa systems immediately after stocking to estimate post-stocking survival. Monitoring survival within the first 24–48 hours allow farmers to assess stocking success and make necessary management decisions.

An on-farm nursery system is another highly effective strategy for cost optimization. Nursery systems reduce biological risk, improve survival, shorten grow-out periods, and help farmers identify weak animals early. Both earthen and lined nurseries can be effectively used with proper aeration and biosecurity. Generally, shrimp are retained in nursery systems for 25–35 days, allowing stronger animals to enter grow-out ponds. For example, if a farmer stocks 3 million shrimp in a nursery and only transfers 2.5 million stronger shrimp to grow-out ponds, the removal of weaker animals can significantly reduce later-stage complications and unnecessary feed expenses.

Pond preparation and biosecurity: Prevention is more economical than cure

Farm success does not depend solely on quality seed or feed. Even the best inputs will fail if pond conditions are unsuitable. Proper pond preparation acts as the first line of disease prevention. Pond bottoms should be cleaned, sludge removed, and pond conditions stabilized before stocking. For earthen ponds, the use of burnt lime (CaO) and proper drying can improve soil pH and reduce pathogen load. In some cases, increasing pond bottom pH above 12 helps reduce disease-causing organisms. Similarly, pond water should be filtered carefully to reduce vector entry. Finer filtration systems reduce the entry of carriers such as copepods and disease vectors. Controlled chlorination, followed by an

adequate waiting period before stocking, helps ensure safer water conditions. Strong biosecurity practices, including bird fencing, crab fencing, restricted pond entry, and proper sanitation, are essential for sustainable shrimp farming.

Feed management: The greatest opportunity for cost optimization

Feed management represents the most important area for production cost reduction because feed contributes more than half of total production expenses. In shrimp farming, profitability can significantly improve through better feed conversion ratio (FCR). Even a 0.1 reduction in FCR can substantially lower production costs per kilogram of shrimp produced. At the same time, poor feed management increases organic waste accumulation, pond deterioration, and water quality problems. Efficient feeding starts immediately after stocking. Farmers should estimate survival accurately, conduct early sampling, and continuously estimate biomass. Check trays remain useful tools for monitoring feed consumption, but they should not be used as the sole decision-making method. Farmers must also evaluate shrimp gut condition, feeding activity, temperature, moulting patterns, and pond carrying capacity.

Temperature-based feed adjustment is particularly important. Under low temperatures, feed intake reduces naturally, while excessive feeding during very high temperatures often results in undigested feed and increased organic load. Good feed management requires a balance between feeding tables, check tray observations, and shrimp gut condition and field observations. In practical farming, no fixed feed chart works for every pond. Feeding strategies must be farm-specific and adjusted daily.

Water quality management and the role of probiotics

Maintaining stable water quality is another major pillar of sustainable shrimp farming. Water quality management should begin immediately after pond preparation and bleaching. The increasing use of probiotics, fermented carbon sources, and microbial management has proven highly beneficial in improving pond health while reducing chemical dependency.

Probiotics help improve organic matter decomposition, microbial balance, nutrient recycling, and phytoplankton growth. Carbon sources such as molasses or rice bran support beneficial bacterial growth while reducing pathogenic pressure inside ponds. Rather than depending heavily on chemicals, farmers should focus on biological pond stabilization through better microbial management and aeration.

Disease prevention and sustainable farm health

Disease management in shrimp farming should always focus on prevention rather than treatment. Among major threats, EHP and White Faecal Disease continue to affect farm profitability significantly. Unfortunately, there is currently no direct treatment for EHP, making prevention through best management practices

(BMP) essential. Proper pond disinfection, EHP-free PL stocking, and strong biosecurity remain the most effective approaches.

White Faecal Disease management requires a holistic approach that considers clean post larvae; clean water; effective waste removal; proper nursery systems; nutritionally balanced feed; and mature microbiota balance. In many farm situations, poor pond hygiene and microbial imbalance are the root causes of disease outbreaks.

Automation and Artificial Intelligence: The future of shrimp farming

Modern shrimp farming is increasingly adopting automation and artificial intelligence (AI) to improve operational efficiency. Automatic feeders, water quality sensors, and AI-driven analytics now help farmers make better feeding decisions and reduce wastage. Acoustic feeders, for example, adjust feed based on shrimp feeding activity, improving feed utilization. AI also helps monitor shrimp growth, feeding behaviour, biomass estimation, and pond performance through machine learning and camera-based systems. These technologies are expected to become increasingly important in achieving precision aquaculture and sustainable shrimp farming in the future.

Conclusion

There are no shortcuts or magical solutions for reducing production costs in shrimp farming. Sustainable profitability comes from disciplined farm management, practical decision-making, and continuous optimization. Farmers cannot control shrimp market prices, but they can certainly control production efficiency. Quality PL selection, strong biosecurity, nursery systems, efficient feed management, pond preparation, water quality control, and early disease prevention collectively contribute to better profitability. In practical shrimp farming, small improvements made consistently often create major financial benefits over time. Improving FCR, reducing unnecessary chemical usage, minimizing mortality, and strengthening pond ecology are not only methods of reducing cost but are essential foundations for sustainable shrimp farming.

The future of shrimp farming lies in combining traditional farm knowledge with scientific management and emerging technologies. Farmers who focus on prevention, precision, and efficiency will be better positioned to remain profitable and sustainable in an increasingly challenging aquaculture environment.

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