

# The essentials to minimise costs of vannamei shrimp production

With shrimp prices on the downward trend, being able to control cost of production is fundamental to stay ahead, says Ravikumar Bangarusamy in India.



India has reached the pinnacle as the largest producer of farmed shrimp in 2019 and will continue to do so in 2020. However, with the current fluid situation on international demand for its shrimp and lower prices than in 2019, the concern among farmers, not only limited to those in India, is how to be more cost efficient along the production chain.

“The producer cannot really control the market price; therefore, controlling the cost of production is an urgent need,” said **Ravikumar Bangarusamy**, General Manager, Technical of Growel Feeds, India. “In 2019, the average cost of production was reported at INR170/kg (USD 2.42/kg) for size 70/kg. As ex farm prices for size 70/kg shrimp (April to September 2019) was INR248/kg (USD3.5/kg), farmers could secure good profits. However, as the ex-farm prices drop below that in 2019 with lower demand and now to INR225/kg (USD3.21/kg), it is imperative that farmers seek ways to increase profit margins.”

At Growel Feeds, under the guidance of the Technical Director, Dr Arul Victor Suresh, Ravikumar conducts R&D in shrimp farms throughout India and uses the findings to advise farmers on best practices. At a recent Infofish Webinar, Ravikumar discussed ways to minimise production cost for sustainable shrimp farming. At TARS 2019, he discussed the role of feed producers in finding solutions for farmers in farm management, from control of diseases with functional feeds to the use of sensors in feed management.

Over the last few years, Ravikumar’s target is to find the right balance in production. Acknowledging that lower costs of production comes with managing diseases and improving survival rates, he has been combining his expertise in farm and feed management with the findings of Dr Loc Tran, ShrimpVet Laboratory, Vietnam, to develop standard operation procedures (SOP) to manage shrimp diseases.

In this Q&A article, Ravikumar addresses several important areas of concern for farmers and offers ways to manage them.



*Ravikumar Bangarusamy's expertise in the aquaculture industry goes back to over 21 years, having worked around the world. Part of his role in Growel, is to conduct R&D in shrimp farms throughout India and use the findings to advise farmers on best practices. The target is to find the right balance in production.*

## What are the strategies to minimise cost of production and maximise profits?

Based on the trials conducted, we have shown the possibility of lowering the costs of production. In the production of size 70/kg shrimp, we have achieved a production cost of INR214/kg (USD3.05/kg) at a stocking density of 25 post larvae (PL)/m<sup>2</sup> and feed conversion ratio (FCR) of 1.0 to as low as INR175/kg (USD2.5/kg) at a stocking density of 60 PL/m<sup>2</sup> and FCR of 1.2. Cost was INR181/kg (USD2.6/kg) at a stocking density of 45 PL/m<sup>2</sup> and FCR of 1.1. Consistent results are achieved through a combination of best management practices, use of functional feed and probiotics and using SOPs advocated by Growel.



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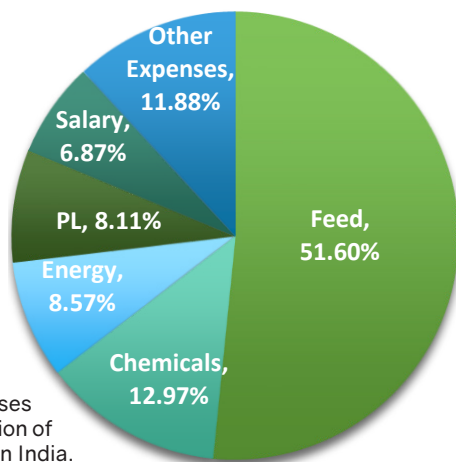
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For the past 3 years, we have been using the same fermentation technology, functional feed and auto feeder for more than seven crops at our demonstration and corporate customers' farms. The stocking density ranged between 35-50 PL/m<sup>2</sup> and the days of culture (DOC) was between DOC 59 and 156. Most of the ponds had a survival rate of about 80% and at very few ponds, shrimp survival was lower than 80%. The FCR was 1.1 because the average body weight was high at 46.28g; even small-sized shrimp had an FCR of just below 1.0.

Based on the typical production cost assessment, feed accounts for almost 50-60% (Figure 1). In 2019, as offer prices declined, farmers reduced stocking densities; the average is now 30-35 PL/m<sup>2</sup> as compared to 40-60 PL/m<sup>2</sup>.



**Figure 1.** A typical example of expenses (%) in the production of vannamei shrimp in India.

A way to minimise production costs and maximise profits is by strictly implementing best management practices (BMPs) at various stages of farming and develop farm-specific SOPs. It is essential that the farmer selects good quality inputs and validate chemicals and other inputs before use. At TARS 2019, I said that the feed industry can offer shrimp health solutions, but it cannot substitute good farm management.

At the beginning of the cycle, stocking the best quality post larvae will have a significant effect on the production and profitability of a shrimp farm. However, there is the dilemma of hatcheries providing perhaps up to 20-30% more post larvae than the amount purchased. Usually all post larvae are stocked into ponds. Henceforth, how do we estimate numbers in calculating feed amounts and the final survival to derive the actual costs of production? We know that the best feed efficiency comes with knowing the stock in the pond. I recommend estimating and measuring the post-stocking survival rate by installing hapas in the pond.

In India, most farmers are small-scale and we developed SOPs to promote sustainable shrimp farming by having an on-farm nursery phase, either using the earthen pond or lined pond with good biosecurity, to produce better quality juveniles as well as to reduce the cost and culture duration in the grow-out phase. An advantage of having a nursery phase is the elimination of weak animals before transfer to the grow-out phase. For example, in one farm, we stock juveniles of 0.5 to 1.2g each and the grow-out was only over 59 days. The production achieved was 2.7 tonnes at average body weight of 18.9g and survival was 83.5%. FCR was 1.03. There were no disease outbreaks.

Feed and disease management are key factors in the production economics and have an influence on water quality and survival, respectively. Overfeeding can cause farmers to spend more money on water quality management and treatment. For disease management, bacteria loads should be checked, and it is better to understand the balance between the *Vibrios* and probiotic bacteria. The early detection of diseases can be done by training farm staff. The current practice that most farmers adopt are tests for *Vibrios*, viruses, post larvae microscopy and the stress test.

Loc Tran showed that *Vibrios* are the primary agent of white faeces disease (WFD) in laboratory challenge trials. Pre-infection with *Enterocytozoon hepatopenaei* (EHP) may increase the severity of WFD. There are two types of WFD; a treatable one caused by *Vibrios* only and the other untreatable caused by vibriosis and EHP. Therefore, we can manage WFD if we have clean ponds, water and post larvae and microbiota maturation to control *Vibrio* load throughout the crop cycle, waste management, on-farm nursery and use of functional feed. For *Vibrio* loads, we recommend that the green colony should be less than 10<sup>2</sup> CFU/g of post larvae and yellow colony should be 10<sup>3</sup> CFU/g of post larvae before stocking.

**“ Every 0.1 improvement in FCR can increase the crop profitability by USD100/tonne of shrimp harvested and that every 0.1 increase in FCR will produce 90kg more organic waste/tonne of shrimp production.”**

**- Ravikumar**

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### With feed accounting for 50-60% of production costs, what are your thoughts on feed management?

It is important to remember that best practices for feed efficiency start at stocking. One way to look at its importance is that for every 0.1 improvement in FCR the crop profitability can increase by USD100/tonne of shrimp harvested and that every 0.1 increase in FCR will produce 90kg more organic waste/tonne of shrimp production.

There are many high (40% CP) and low protein feeds (25% CP) available in the market. But when using a high CP feed, it is important to have a stringent feed management protocol. An economical feed conversion is essential or else the production cost will go up. I have presented data from our R&D work comparing pelleted feeds versus extruded functional feeds in about 1,000 ponds across India for the past 3 years at various locations, at different salinities and over winter and summer. The results showed better survival rates by 24%, better average daily growth rate by 30% and improved FCR by 21% with extruded functional feeds. Functional feeds increased shrimp growth and profit per unit of feed intake (Figure 2).

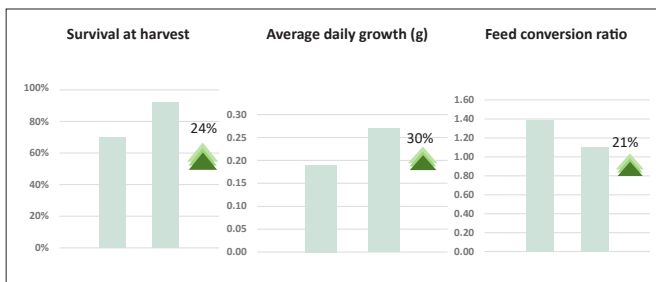


Figure 2. Performance results of shrimp fed Growel extruded functional feed (Nutriva15) as compared to pelleted feed at its demonstration farms over seven crop cycles.

### What are your observations on feeding rate and frequency?

I recommend using high-quality feed or functional feed with 6-8 feedings per day during the nursery phase. Feed particle size is important. Shrimp of about 4g size consumes on average six pellets a meal (4.2% of body weight/day). When the feeding frequency increases, the animal's overall growth is much better. Overfeeding at the farm occurs when more than 10% of shrimp gut contains feed an hour before feeding. As for underfeeding, about 40% of shrimp will have natural food in the gut an hour after feeding. We know that feeding should be based on temperature and observing the gut is important for feed management. The feeding rate is temperature dependent. When the temperature increases, the gut transit time is only 45 minutes. Any undigested feed will add to the organic load at the pond bottom, affecting water quality.

Therefore, the daily feeding rate is farm specific. We develop these based on observations and data, using check trays and feeding tables and adjusting daily within the lower and upper limits based on the pond's biomass and carrying capacity. Ideally, we should practise a combination of feeding table, check trays observation and checks on gut colour to adjust the daily feeding rate, control FCR and reduce the cost of production.

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### SOME TIPS ON BEST FEED MANAGEMENT

ABW (g)	Feed	Pellets/shrimp/meal
4-10	Pre-grower	12
10-13	Grower 1	11
13-17	Grower 1	13
17-20	Grower 2	11
20-25	Grower 2	14
25-33	Grower 2	15

A 4g shrimp eats an average six pellets/ meal  
=(4.2% of body weight/day)

vs normal feeding rate

<26°C –reduce to 25%  
28°C - 32°C –normal  
> 34°C – reduce to 20%

Light brown = shrimp consumed feed

Black = shrimp consumed natural food

Suspected Problem

overfeeding
underfeeding

Sample

1h before feeding
1h after feeding

Confirmation & Action

>10% of shrimp with feed in gut
>40% of shrimp with natural food in gut

FEEDING

### How effective are autofeeders in improving feed management?

In my opinion, the use of manual labour requires close supervision and the chances of errors are high. Automatic feeders are much better than manual feeding and there are two types of automatic feeders: one has the ration set by the farmer and delivered using a timer; the other is an acoustic feeder where the ration is driven by the shrimp's feeding activity, transmitted to the feeder as sound signals. They can also provide real-time information on water quality parameters (dissolved oxygen, pH, temperature, etc.)

When we started the crop with the acoustic feeder, the farm's FCR was 1.1. In 2 years, the overall farm FCR reached less than 0.9. Farmers will need to depend on automation in the future. But remember one advantage of using autofeeders is that your pond operator will not need

to go into the pond. Furthermore, we can say that waste is accumulated only 6-10m away from the autofeeder and as such is easy to remove in between crops.

### In your opinion, what are the major disease threats and how can we manage them?

If we look at issues in production in 2019, we had diseases caused by white spot syndrome virus (WSSV), then EHP, vibriosis, WFD and running mortality syndrome (RMS). We had reports on slow growth from most regions because of EHP and WFD. EHP does not directly cause mortality, but the microsporidian can cause severe growth retardation affecting farm production. To be effectively managed, the severity of infection needs to be correlated with growth performance and FCR.



Preliminary tests must be conducted at the farm level to determine the severity of the EHP infection and be classified as Grade 1, 2 and 3. In most cases, Grade 1 infection is reversible after treatment; however, when the infection reaches Grade 3, I recommend to harvest the shrimp crop. A weekly growth rate of 0.7g/week is acceptable. I have advised farmers to calculate growth performance (not to be less than 0.7g/week) and to control FCR to below 1.3 or 1.2. I explained how to sample the hepatopancreas and categorise the severity of EHP infections into grades. If FCR is very high at the end of the cycle, the crop can either be just at break even or incur a loss.



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Farm	Pond	Stocking density PL/m <sup>2</sup>	DOC	Average body weight (g)	Biomass (tonnes)	Survival (%)	FCR
R&D	G3	40	59	18.86	4.8	90	0.95
R&D	G7	35	82	24.40	7.4	87	1.00
R&D	F3	35	67	20.83	8.1	80	0.92
R&D	F4	40	70	21.73	7.1	81	0.87
Demo Farm-1	T1	38	68	26.30	12.1	77	1.05
Demo Farm-2	T1	50	156	38.46	25.2	93	1.13
Demo Farm-2	T2	36	156	45.50	56.9	73	1.09
Demo Farm-3	T2	40	126	31.00	31.4	97	1.03
Demo Farm-4	T1	37	159	26.32	62.3	96	1.07
Demo Farm-5	T2	50	178	46.28	23.4	94	1.21

**Table 1.** Crop results at Growel's R&D farms and demonstration farms using the combination of fermentation technology, functional feed and auto feeding.

Biosecurity is highly effective in disease management but is also challenging to apply in most practical farming systems. Here in India, 80% of farmers are small-scale with perhaps 2-3 ponds, and it is extremely difficult to implement good biosecurity systems.

### What are your approaches on water quality management?

*Vibrios* multiply rapidly every 12 minutes after disinfection and farmers stock the ponds when the *Vibrio* load is at its peak. Normally, the farmers then apply probiotics once in a month or once in 2 weeks. They need to apply a good quality probiotic at 3-day intervals and use only 100 to 200g after fermentation.

To control diseases, we recommend fermentation to encourage probiotics to multiply and utilise organic matter. But for this to work, we need sterile freshwater, carbon sources, minerals, probiotics and aeration. We use various carbon sources and all these inputs should be cooked before fermentation. Water is treated by reverse osmosis or chlorinated and then dechlorinated. It is then checked for *Vibrio* loads. In our R&D and the demonstration ponds, we do not have problems with WFD or WSSV; however, we do have issues with RMS when the organic load increases at the end of the crop cycle. My advice is that if the probiotics application is delayed, the *Vibrio* load will increase, and the probiotics becomes ineffective. At an application period of 110 days (100 days growth period + 10 days pond preparation), the product input cost of probiotics is less than USD0.1/crop/ha.

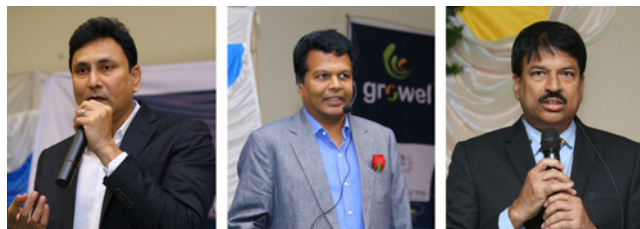
Growel Feeds has invested in a full-fledged R&D Innovation Centre which has been recognised by Government of India's Department of Science & Technology in July.



### In summary, walk us through your recommendations to lower production costs.

We need to start with pathogen-free post larvae, count the number and conduct *Vibrio* checks. TCBS plate counts tell a lot about the post larvae quality before going for PCR analysis. Use only the best quality post larvae for stocking and it will have a profound effect on the production and profitability of a shrimp farm.

When it comes to feed, manage it aggressively, avoid overfeeding and use immune-enhancing functional feeds. For pond management, address the problem of EHP during pond preparation and keep a healthy microbiota balance with aerobic and anaerobic fermentation. In the case of probiotics, use the right ones and get validation of products before using them to get the best results and control the cost of production. Finally, the removal of sludge and controlling the organic load in the pond are essential to have a successful crop. Growel is developing a mobile data application that will synchronise farm operations dashboard and provide online solutions for pond problems and predictive analysis. We expect to release this app by the end of this year.



Growel Feeds is unique in India's aquafeed industry. It has been exporting shrimp and fish feed to 11 different countries in the Middle East, Africa, South and Southeast Asia over the last four years. The leadership team, from left, P.S. Narendra (Executive Director), Dr Arul Victor Suresh (Technical Director) and Sandip Ahirrao (Vice President – Sales & Marketing).