



An Analysis of Shrimp Culture Business in Nellore District, Andhra Pradesh, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study was taken to analyse the Shrimp Culture Business in Nellore district, Andhra Pradesh. The performance of the shrimp (*Litopenaeus vannamei*) culture business in terms of production, marketing, finance and also constraints faced by shrimp culture farmers was analysed. Aquaculture farmers were classified into small (1-2 ha), semi-medium (2-4 ha), medium (4-10 ha) and large farmers (>10 ha). The results revealed that the average gross income earned was Rs.31.91 lakh/ha/crop, Rs. 31.73 lakh/ha/crop, Rs. 31.79 lakh/ha/crop and Rs.32.57 lakh/ha/crop by small, semi-medium, medium and large farmers respectively. The net income per hectare per crop for large farmers (Rs.13.07 lakh) was highest followed by medium (Rs. 11.8 lakh), semi medium (Rs. 11.1 lakh) and small (Rs.10.42 lakh) shrimp culture farmers. Break-even prices revealed that small, semi-medium, medium and large farmers can choose to price one kg of shrimp above Rs. 256, Rs. 247, Rs. 239, and Rs. 228 respectively. The profitability ratio showed that Gross profit margin and net profit margin for large farmers were high when compared to small, semi-medium, medium and

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large farmers. Non-availability of good quality seeds and the high cost of feed were the major problems faced by the farmers in production. Fluctuations in shrimp price and insufficient market information were major marketing constraints faced by the farmers in marketing of shrimp.

Keywords: Shrimp culture; aquaculture; gross income; net income; break-even price; quality seeds.

1. INTRODUCTION

Aquaculture has emerged as one of the fastest growing food farming systems at the global level with enormous potential for further development [1]. The significant expansion of the fisheries and aquaculture production came with many transformations. Globally in the last three decades, aquaculture has been the main driver of the increase in fisheries and aquaculture production, with an average growth of 5.2 percent per year in the period 2000–2019, reaching a record 85.3 million tonnes in 2019. Total aquaculture production of aquatic animals reached its peak at 88 million tonnes in 2020, despite the related impacts of COVID-19 (FAO Statistics, 2021).

India is the second largest producer and exporter of shrimp. The total shrimp production in India was 8.5 lakh MT in the year 2020-21 [2]. The share of *Litopenaeus vannamei* was high when compared to tiger shrimp and scampi with 3.24 percent and 0.97 percent respectively. In India, Andhra Pradesh accounted for a major share of shrimp (*Litopenaeus vannamei*) production by 77.80 percent, followed by Gujarat and Tamil Nadu with 6.18 percent and 5.48 percent respectively (MPEDA, 2020). Shrimp farming for commercial purposes began in the years 2009–2010. Brackish water aquaculture in Andhra Pradesh is almost synonymous with shrimp culture [3].

2. REVIEW OF LITERATURE

Sathiadhas et al. [3] determined that white shrimp cultivation is less risky, with a break-even price of Rs.166/kg in semi-intensive culture and Rs.88/kg in enhanced extensive culture and there is sufficient possibility and feasibility for implementing an integrated strategy in aquaculture techniques in India.

Lekshmi et al. (2011) concluded that disease incidence, low seed quality, and lack of quality control agencies were the constraints faced by farmers in shrimp cultivation.

Navghan et al. [4] reported that farmers of black tiger shrimp and white legged shrimp made a net

profit of Rs.19.63 Lakh/ha/crop and Rs.5.57 Lakh/ha/crop respectively and compared to white legged shrimp, black tiger shrimp was less profitable.

Srinivas and Venkatrayalu [3] reported that shrimp aquaculture in Andhra Pradesh is very resilient. Each district's farming system is distinct in several ways. Some districts perform shrimp farming in low salinity waters, while others perform in medium and high salinity waters.

Venkateswarlu and Chenji [5] reported that culture ponds of 40 percent in West Godavari, 50 percent in East Godavari, 65 percent in Guntur, 70 percent in Nellore, 69 percent in Krishna were disease affected. More disease-related difficulties were noted throughout the summer crop in all sites. Farms that applied biosecurity measures and those that were free of Dissolved Oxygen (DO) issues had fewer illnesses.

According to Srinivas et al. (2019) understanding disease concerns, water quality factors, socio-economic difficulties of shrimp producers, farming techniques, issues, and restrictions in shrimp culture were necessary for the sustainability of *L. vannamei* culture.

Durai and Alagappan [6] carried out the techno-economic analysis of shrimp farming practices in the coastal districts of Tamil Nadu. According to the findings, the key expenditure in shrimp farming activities was feed (42.94 percent) followed by power (10.10 percent), medicines (8.97 percent), and seed (8.26 percent). With a BCR of 1.85, shrimp growers generated a net profit of Rs.11.47 lakh/ha.

According to Patil and Sharma [7] shrimp price variations were the biggest marketing constraint while the lack of hatchery facilities was the main infrastructural limitation encountered by shrimp farmers.

Narkis et al. [8] conducted economic studies of shrimp production and the restrictions encountered by shrimp producers in Nagapattinam district of Tamil Nadu. According to the study, shrimp producers earned an average gross return of Rs. 24.4 lakh per hectare

and a net return of Rs. 8.7 lakh per hectare. Farmers' biggest restraint in shrimp production was disease problems and high feed costs.

3. MATERIALS AND METHODS

This study was carried out from May 2022 to June 2022 and was confined to Nellore District, Andhra Pradesh. Nellore district consists of 46 mandals. Three mandals namely Kota, Chillakur, and Chittamur were selected purposively to analyse the performance of the shrimp (*Litopenaeus vannamei*) culture business in terms of production, marketing, finance and constraints encountered by the shrimp culture farmers. From each mandal two villages were selected and from each village 10 shrimp culture farmers were selected by simple random sampling procedure. Thus the total sample size was 60 shrimp culture farmers. The primary data was collected by personal interviews with the help of well-structured interview schedule from 60 shrimp culture farmers, 10 market commission agents, seven retailers and three processing units. The cost of cultivation was estimated to analyse costs and returns. To analyse the marketing efficiency Shepherd's [9]

method of estimation was analysed. Financial ratios were estimated to analyse the performance of shrimp culture farms. Garrett ranking technique was used to identify the constraints encountered by the shrimp culture farmers.

4. RESULTS AND DISCUSSION

4.1 Socio-economic Profile of the Shrimp Culture Farmers

Most of the farmers were middle aged. In the study reported by Narkis et al. [8] middle age group people were predominantly engaged in shrimp farming in Nagapattinam district of Tamil Nadu. Majority of the farmers had nuclear type families with higher secondary and graduate level education. Among the farmers 28.33 percent of farmers had shrimp culture alone as an occupation. In terms of experience 45 percent of the shrimp culture farmers had 6-10 years followed by more than 10 years (30 percent). A brief socio-economic profile of the sample shrimp culture farmers of Nellore District is presented in the Table 1.

Table 1. Socio-economic profile of the shrimp culture farmers

Sl. No.	Category	Frequency (N = 60)	Percentage
I	Age (in years)		
1	Young Adults (18-35)	18	30.00
2	Middle age Adults(36-55)	40	66.67
3	Older Adults(>55)	2	3.33
II	Family type		
1	Nuclear	52	86.67
2	Joint	8	13.33
III	Education status		
1	Illiterate	10	16.67
2	Primary	2	3.33
3	Secondary	13	21.67
4	Higher Secondary	18	30.00
5	Graduate	14	23.33
6	Post Graduate	3	5.00
IV	Occupational status		
1	Shrimp culture alone	17	28.33
2	Shrimp culture + Agriculture	25	41.67
3	Shrimp culture + Business	18	30.00
V	Farming experience		
1	< 5 years	15	25.00
2	6-10 years	27	45.00
3	Above 10 years	18	30.00

Table 2. Shrimp farm details

S. No	Category	Frequency (N = 60)	Percentage
I	Farm size		
1	Small Farmers (1-2 ha)	23	38.33
2	Semi-Medium Farmers (2-4 ha)	19	31.67
3	Medium farmers (4 -10 ha)	12	20.00
4	Large farmers (> 10)	6	10.00
II	Ownership details		
1	Owned	36	60.00
2	Owned +Leased	24	40.00

Table 3. Cost and return of shrimp culture (per hectare/crop)

Sl. No	Particulars	Amount (in Rs)			
		Small Farmers	Semi-medium Farmers	Medium Farmers	Large Farmers
I	Fixed Cost				
1	Depreciation	88821.30 (4.14)	68304.92 (3.31)	81940.93 (4.10)	86942.20 (4.46)
2	Salaries to permanent labour	27544.91 (1.28)	18855.22 (0.91)	13404.83 (0.67)	9375.00 (0.48)
3	Interest on Capital Investment	93420.79 (4.35)	89659.20 (4.35)	86892.20 (4.35)	64064.05 (3.29)
4	Lease Value/rental value for own land	119386.23 (5.56)	106481.48 (5.16)	91052.28 (4.56)	94531.25 (4.85)
5	Rent (generator)	49700.60 (2.31)	30639.73 (1.48)	20643.43 (1.03)	6250.00 (0.32)
6	Total fixed cost	378873.83 (17.64)	313940.55 (15.21)	293933.67 (14.71)	261162.50 (13.40)
II	Variable cost				
1	Pond preparation	25556.60 (1.19)	22659.80 (1.10)	22136.60 (1.11)	20856.40 (1.07)
2	Cost of seed	152514.97 (7.10)	154545.45 (7.49)	150804.29 (7.55)	150000.00 (7.69)
3	Cost of feed	776766.47 (36.16)	789898.99 (38.28)	770777.48 (38.58)	766666.67 (39.33)
4	Fertilizers & Manures	20750.52 (0.97)	20559.30 (1.00)	20226.22 (1.01)	20000.50 (1.03)
5	Medicines/probiotics	426727.54 (19.87)	410236.53 (19.88)	400607.91 (20.05)	398916.67 (20.46)
6	Lab test (water quality)	3089.82 (0.14)	3151.52 (0.15)	2895.44 (0.14)	2875.00 (0.15)
7	Electricity	112500.65 (5.24)	112387.50 (5.45)	112254.90 (5.62)	112456.65 (5.77)
8	Fuel cost	1550.00 (0.07)	1542.50 (0.07)	1523.40 (0.08)	1500.00 (0.08)
9	Labour charges (pond construction)	6631.74 (0.31)	6338.38 (0.31)	6253.35 (0.31)	6250.00 (0.32)

SI. No	Particulars	Amount (in Rs)			
10	Labour charges (intercultural)	27544.91 (1.28)	18855.22 (0.91)	13404.83 (0.67)	9375.00 (0.48)
11	Labour charges (Harvesting)	8233.53 (0.38)	7138.05 (0.35)	6655.50 (0.33)	6445.31 (0.33)
12	Labour charges (postharvest)	2544.91 (0.12)	2533.67 (0.12)	2500.00 (0.13)	2500.00 (0.13)
13	Miscellaneous expenses	15025.50 (0.70)	12254.90 (0.59)	11546.50 (0.58)	9653.90 (0.50)
14	Interest on working capital	189532.46 (8.82)	187452.22 (9.08)	182590.37 (9.14)	180899.53 (9.28)
	Total variable cost	1768969.62 (82.36)	1749554.03 (84.79)	1704176.78 (85.29)	1688395.63 (86.60)
	Total Cost	2147843.45 (100)	2063494.58 (100)	1998110.45 (100)	1949558.13 (100)
	Per crop/Season Returns				
1	Yield of shrimp/crop (in kg)	8396.54	8361.39	8367.59	8572.05
2	Average Price (Rs/kg)	380.00	380.00	380.00	380.00
3	Gross Income	3190685.30	3177328.84	3179684.24	3257378.47
4	Net income	1042841.84	1113834.26	1181573.79	1307820.34
5	BCR	1.49	1.55	1.59	1.67
6	Production cost (Rs/kg)	255.80	245.67	238.79	227.43

(Values in parenthesis indicates percent contribution to total cost)

4.2 Shrimp Farm Details

Based on farm size, majority of farmers were small farmers (38.33 percent) followed by semi-medium (31.67 percent), medium (20 percent), and large farmers (10 percent). Among the farmers 60 percent of farmers had own ponds and 40 percent of the farmers had their own and leased ponds. Shrimp farm details of sample farmers are presented in Table 2.

4.3 Cost and Returns of Shrimp Culture (Rs/ha/crop)

The total cost of shrimp culture was highest for small farmers (Rs.21.47 lakh/ ha) followed by semi-medium (Rs.20.63 lakh/ ha), medium (Rs.19.98 lakh/ ha) and large farmers (Rs.19.49 lakh/ ha). For all the categories of farmers, the major factors of the total cost were cost of feed followed by medicines/ probiotics and interest on working capital. The results revealed that the average gross income earned by large farmers (Rs.32.57 lakh/ha/crop) was highest followed by small (Rs.31.91 lakh/ha/crop), semi-medium (Rs.31.73 lakh/ha/crop) and medium (Rs.31.79 lakh/ha/crop). These values are higher than the values reported by Narkis et al (2021) because the yield of shrimp in Nellore district is more than Nagapattinam district. The net income per hectare per crop for large farmers (Rs.13.07 lakh) was highest followed by medium (Rs.11.8 lakh), semi medium (Rs.11.1 lakh) and small (Rs.10.42 lakh) shrimp culture farmers. Shrimp culture in Nellore district of Andhra Pradesh was found to be economically profitable as the Benefit Cost Ratio (BCR) was 1.49, 1.55, 1.59, and 1.67 for small, semi-medium, medium and large farmers respectively. The cost and returns of shrimp culture per hectare per crop of small, semi- medium, medium and large farmers were analysed and the results were given in Table 3.

4.4 Marketing of Shrimp

4.4.1 Marketing channels

The following channels were identified in the study area:

Channel I:

Farmer — Commission Agent — Processor cum Exporter — Consumer

Channel II:

Farmer — Commission Agent — Retailer — Consumer

The majority of farmers engage in channel I because farmer get a better price in channel I than in channel II. The processing unit exports the majority of shrimp to countries like The United States, United Kingdom, Netherlands, Vietnam, Canada and South Africa.

4.4.2 Price spread, farmer's share in consumer rupee and marketing efficiency

Channel II was found to be more cost effective since it has the lowest price spread. The Price paid by consumer was less in channel II as the shrimp was consumed without any processing. Among the two channels, farmers share in consumer rupee was relatively high in channel II. Channel II was found to be more efficient in marketing efficiency since processing charges are not there in channel II and transportation cost is less when compared to channel I. The Price Spread and Farmer's share in consumer rupee for small, semi-medium, medium and large farmers were calculated and the results are presented in Table 4. And marketing efficiency analysis using Shepherd's method was calculated and the results are furnished in Table 5.

4.5 Financial Analysis of Shrimp Culture

4.5.1 Break even analysis of shrimp culture

Break-even prices revealed that small, semi-medium, medium and large farmers can choose to price one kg of shrimp above Rs.256, Rs.247, Rs.239, and Rs.228 respectively. Break-even production results indicated that small, semi-medium, medium and large farmers have to sell 2238 kg, 1839 kg, 1667 kg, and 1427 kg of shrimp in one crop period (four months) to reach breakeven production. The break even analysis of shrimp culture was analysed and furnished in Table 6.

4.5.2 Profitability ratio

The Gross profit margin and net profit margin for large farmers were more when compared to small, semi-medium, and medium farmers. The results indicated that large farmers managed well in production cost and labour cost to earn profit. The profitability ratios were calculated and furnished in Table 7.

Table 4. Price spread (Rs/kg) and farmer's share in consumer rupee

Sl. No	Marketing Channel	Average Price received by all categories of farmer	Price paid by the consumer	Price Spread	Farmers share (%)
1	Channel I	380	750	370	50.6
2	Channel II	360	480	120	75.0

Table 5. Marketing efficiency analysis using Shepherd's method (Rs/kg)

S. No	Particulars	Channel I	Channel II
1	Consumer price(V)	750	480
2	Total Marketing Cost(I)	83.56	29.8
3	Marketing Efficiency (ME)= (V/I)-1	7.98	15.11

Table 6. Break even analysis of shrimp culture

Sl. No	Particulars	Small Farmers	Semi-medium Farmers	Medium Farmers	Large Farmers
1	Break-even production (kg)	2238	1839	1667	1427
2	Break-even point of sales (Rs)	850440	6987820	633460	542260
3	Break-even price (Rs/kg)	256	247	239	228

Table 7. Profitability ratio of shrimp culture (in percent)

S. No	Particulars	Small Farmers	Semi-medium Farmers	Medium Farmers	Large Farmers
1	Gross Profit Margin	48	49	50	52
2	Net Profit Margin	33	36	38	41

Table 8. Constraints in production of shrimp (n=60)

Sl. No	Particulars	Garrett score	Ranking
1	Non Availability of good quality seed	83	I
2	High cost of Feed	72	II
3	Disease outbreak	65	III
4	Plankton Problems	59	IV
5	Low dissolved Oxygen	55	V
6	Acidity	50	VI
7	Sedimentation	45	VII
8	Seepage	41	VIII
9	Low productive soil	35	IX
10	Poaching	28	X
11	Lack of laboratories	17	XI

Table 9. Constraints in marketing of shrimp (n=60)

S. No	Particulars	Garrett score	Ranking
1	Fluctuations in shrimp price	75	I
2	Insufficient market information	60	II
3	Fluctuations in Demand and Supply of shrimp	50	III
4	Lack of Common Cold storage	40	IV
5	Distance of market	24	V

4.6 Constraints Faced by Shrimp Farmers

Using the Garrett ranking method the constraints encountered by the shrimp culture farmers in shrimp production and marketing were ranked and the results are presented in Tables 8 and 9. From Table 8 it could be inferred that non availability of good quality seed and the high cost of the feed were major constraints faced by the farmers in production and the similar result was reported by Srinivas et al. [10]. In the study area, majority of farmers purchased seed from hatcheries of Pondicherry and local hatcheries of Nellore district. Lack of knowledge in seed selection is the major reason for the first constraint faced by farmers. From Table 9 it was inferred that fluctuations in shrimp price were the first and most important constraint for shrimp farmers and Patil and Sharma [7] also reported price fluctuation as the most important constraint. During the study it was revealed that the price of the shrimp was fixed based on the demand of exporters. Insufficient market information is the second major constraint faced by the farmers in marketing of shrimp [11].

5. CONCLUSION AND RECOMMENDATION

Economies of scale are operating in shrimp culture farms in Nellore District, Andhra Pradesh. The net income per hectare per crop for large farmers (Rs.13.07 lakh) was highest followed by medium (Rs.11.8 lakh), semi medium (Rs.11.1 lakh) and small (Rs.10.42 lakh) shrimp culture farmers. Channel II (Domestic channel) was found to be more cost effective since it has the lowest price spread (Rs.120/kg). Among the two channels, farmer's share in consumer rupee was relatively high in channel II (Domestic channel). The profitability ratio showed that Gross profit margin and net profit margin for large farmers were high when compared to small, semi-medium, and medium farmers. Non availability of good quality seeds and high cost of feed were the major problems faced by the farmers in production. Fluctuations in shrimp price and insufficient market information were major marketing constraints faced by the farmers in marketing of shrimp.

Government should promote production of quality seeds and it should also provide training on seed selection to farmers so that farmer can choose high quality seed and could solve the problem of disease outbreaks and ensure high

survival rate. Dissemination of price information through mass media such as newspapers, television and through mobile local applications would assist farmers in securing good price for shrimp. Research should undertake in reducing feed cost without compromising the productivity of shrimp. New technology should be disseminated to increase the production of shrimp.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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