



## Constraints Analysis of *Litopenaeus vannamei* Culture in Prakasam District, Andhra Pradesh, India

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**Abstract:** *Litopenaeus vannamei* (shrimp) farming is playing a pivotal role in the socio-economic development of India. India is exporting 4.4 lakh tonnes of shrimp products (2016-17) of which vannamei share is 3.30 lakh tonnes. The Andhra Pradesh state is the largest vannamei producer amongst the shrimp farming states of India contributing 2.31 lakh tonnes (70% of total Indian exports). A study was undertaken during 2014-15 in Prakasam district of Andhra Pradesh, to analyze the constraints prevailed in *L.vannamei* culture. The Prakasam district has 3 revenue divisions and 56 Mandals (Taluka's) with 2,273.39 ha brackish water area is under shrimp culture. The study area was selected purposively and the respondents were identified using simple random technique. The sample size for the current investigation was 60. The study was conducted based on personal interview schedule aided with well structured and pre-tested questionnaire consisting of 11 items of constraints such as seed, feed, diseases, management aspects, inputs, harvest, labour related, extension activities, infrastructure, marketing and miscellaneous constraints. Garrett's ranking technique was employed for allotment of ranking to the various constraints. The data was analyzed using frequency and percentages. The results showed that out of the total farmer's surveyed, input constraint (rank-1) was opted as the major constraint, followed by other constraints such as lack of marketing (rank-2), infrastructure constraint (rank-3), Seed constraint (rank-4), management constraint (rank-5), Miscellaneous constraint (rank-6), disease constraint (rank-7), Feed constraint (rank-8), harvest constraints (rank-9), extension constraint (rank-10) and labour constraint (rank-11). The results were reflecting the existing scenario of *L.vannamei* culture in the study area. Irrespective of the ranking of the various constraints, majority of the constraints were the reasons behind the setback of vannamei crop failure. The study conclude that the regulating agencies such as MPEDA of GOI to take appropriate remedial measures to combat the identified constraints of the present study.

**Keywords:** *Litopenaeus vannamei*, Garrett ranking, Better Management Practices (BMP's) and Constraints.

### 1. INTRODUCTION

Aquaculture is the fastest- growing form of food production in the world and shrimp dominates the aquaculture production by value. Shrimp aquaculture is the fastest growing food area and its economic importance is increasing concurrently. It is an important sector in the majority of the countries of the world from the viewpoint of income and employment generation. From the year 2010 to 2015, shrimp export volume increased at a compound annual growth rate of 15.8 %. Since 2009-10, vannamei (*Litopenaeus vannamei*) production has shown consistent growth and reached 4.06 lakh MT (metric tonnes) during 2015-16, increasing the overall shrimp production to about 5 lakh MT. In India, the state of Andhra Pradesh stands first both in coastal and inland aquaculture production.

The Andhra Pradesh state is contributing half of the total shrimp production of India. It has a coast line of 974 KM and about 175,000 Ha of area is under shrimp culture. *Penaeus monodon* was the leading shrimp culture during 1990's. Due to the outbreak of WSSV and other associated problems, the *Litopenaeus vannamei* (Pacific white legged shrimp), an exotic species was introduced during 2009 as an alternative species to *P.monodon*. *Litopenaeus vannamei* (shrimp) farming playing an vital role in the socio-economic development of India. Aquaculture technology is continuously getting improved to cope up with the emerging scenario. Better Management Practices (BMP's) is one such technology adopted by organized farming community for better yields and sustainable environment. In short, the implementation of the BMPs has provided benefits to the farmers, environment, and society (Mohan *et al.* 2008). The culture vannamei had increased rapidly in all the maritime states of

India. The Andhra Pradesh state has become hub of shrimp aquaculture and it has been cultured on commercial scale in 9 coastal districts. India is exporting 4.4 lakh tones of shrimp products (2016-17) of which vannamei share is 3.30 lakh tonnes. The Andhra Pradesh state is the largest vannamei producer amongst the shrimp farming states of India contributing 2.31 lakh tonnes (70% of total Indian exports). In recent times, the vannamei culture also receiving severe setback due to several reasons and lead to crop losses.

In view of this background, the present study was aimed to analyse various constraints of shrimp aquaculture in Prakasam district of Andhra Pradesh state and an attempt was made to find necessary site-specific remedial measures to the identified constraints.

## 2. MATERIALS AND METHODS

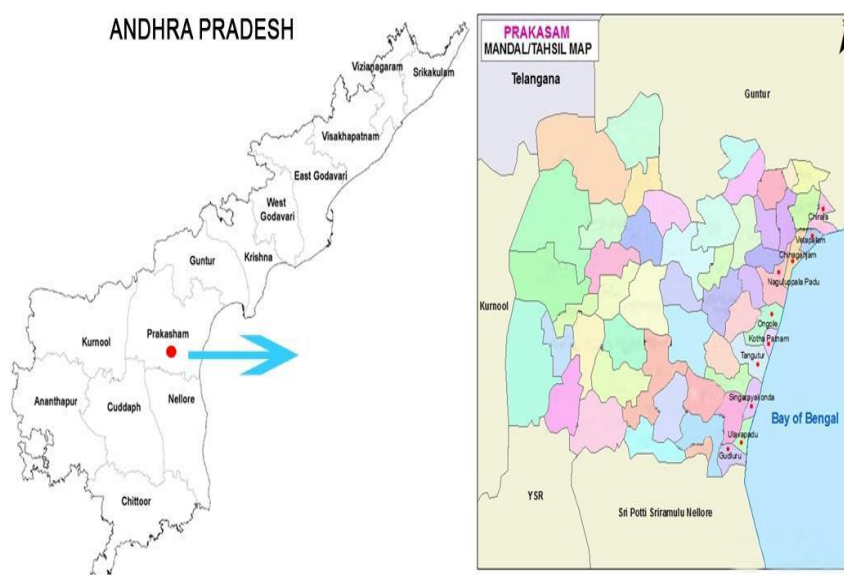
The present study was conducted in Prakasam district of Andhra Pradesh during the second crop (September / October) of 2014-15. It was selected purposively so as to get hands-on information about diversification of various existing problems of vannamei growers.

### 2.1. Locale of the Study

The Prakasam district (Fig.1) lies between 15°-30' of the Northern latitude and 80°-60' of the Eastern longitude, average rainfall is 1753 mm. It is located on the west coast of Bay of Bengal and is bounded by Guntur district on the north, Kurnool district on the west, Kadapa and Nellore districts on the south. It is the 3<sup>rd</sup> largest district in the state with an area of 17,626 km<sup>2</sup> (6,805 sq mi) and had a population of 3,392,764 as per 2011 census of India (Anon, 2017). It has 3 revenue divisions with 56 mandals/talukas. The district has 102 km long coastline and 3859 sq. km area of continental shelf. The 102 km long coastline offers very good scope for brackish water shrimp culture and the district had attracted major corporate bodies besides many small farmers towards this activity. Brackish water shrimp farming was taken up in 9 mandals (talukas) involving 1293 farmers from 35 villages in the district covering 2273.39 ha at present. All farmers have got the licenses from the Coastal Aquaculture Authority, Govt.of India.

### 2.2. Research Design

The present study was conducted during the year 2014-15 in the district of Prakasam district of Andhra Pradesh State, India. *Ex-post-facto* research design was used in the present investigation. According to Robinson (1976), *ex-post-facto* design is any systematic empirical inquiry in which the independent variables have not been directly manipulated because they have already occurred or because they are not inherently manipulable Both purposive and simple sampling technique were employed for the present study.



**Fig1.** Location of Prakasam District of Andhra Pradesh state, India (Source: Anon, 2017)

### 2.3. Population and Sample

The population for the study covers the small-scale (<2 ha area ) farmers of *L.vannamei* culture, where majority of the shrimp cultivators are depending on shrimp aquaculture as their main livelihood, *L.vannamei* farming activity was large and reported high production in the Prakasam district. The sampling district was selected purposively and revenue based on the number of shrimp farmers, farming area, production and diversity of problems. Interview schedule with a well structured questionnaire was used as a tool for the present study. A set of 11 items out of 50 was incorporated in the questionnaire. A pilot study was also conducted prior to the present study.

### 2.4. Selection of Revenue Division - First stage selection

The Prakasham district has a total of 3 revenue divisions viz. Kandukur, Markapur and Ongole. As the Ongole division has coastline with abundant brackish water area is under shrimp culture and a majority of small –scale growers are prevalent, it was identified as the sampling division for the present study.

### 2.5. Identification of Mandals (taluks) - Second Stage of Selection

The Ongole division has 20 Mandals (taluks) and information about authorized (obtained approval for farming from CAA, Govt.of India) *vannamei* farmers in each Mandal was obtained from the Department of Fisheries, A.P. Accordingly Mandals were identified based on the availability of number of farmers. For the present study, 3 Mandals viz. Tangutur, Kothapatnam and China Ganjam were selected purposively based on the history of problems and crop failures.

### 2.6. Selection of Respondents - Third Stage of Selection

The technique of proportionate and simple random sampling was adopted to select the required number of respondents for *vannamei* farming practices in each mandal. A sample size of 60 respondents was selected out of 3 Mandals and 20 respondents were selected from each Mandal (Table.1).

**Table1.** Selections of Respondents (n =60)

Name of the Mandal	Total No of identified respondents	No.of respondents selected	No. of respondents in each selected village	
Tangutur	473	20	Ananthavaram	10
			Velagapudi	5
			Tallapalem	5
Kothapatnam	265	20	Mandanur	8
			Ethamukkala	7
			Kothapatnam	5
Chinnaganjam	405	20	Peddaganjam	9
			Chinnaganjam	6
			Munnamvaripalem	5

### 2.7. Statistical Tools Used in the Study

The collected data was tabulated, scored, and analyzed using frequency, percentage and Garrett (1969) ranking technique using the following formula.

Garrett’s ranking technique was used. As per this method, respondents have been asked to assign the rank for all factors and the outcome of such ranking has been converted into score value with the help of the following formula:

$$\text{Percent position} = \frac{100 (R_{ij} - 0.5)}{N_j}$$

Where

$R_{ij}$  = Rank given for the  $i$ th variable by  $j$ th respondents

$N_j$  = Number of variable ranked by  $j$ th respondents

With the help of Garrett's Table, the percent position estimated is converted into scores. Then for each factor, the scores of each individual are added and then total value of scores and mean values of score is calculated. The factors having highest mean value is considered to be the most important factor.

### 3. RESULTS AND DISCUSSION

The results (Tab.2) showed that 11 constraints are the major constraints which are playing significant role in the success of vannamei culture. All the identified 11 constraints had been influenced by another sub-component of the farming practices. All these constraints were analysed using frequency and percentage and ranking was given accordingly.

**Table2.** Constraints of vannamei shrimp farmers in Prakasham district (n=60)

Constraint	Frequency	Percentage
<b>I. Seed constraints</b>		
Non availability of quality seed	18	30.00
High cost of the seed	39	65.00
Inadequate supply of hatchery seeds in the required time	36	60.00
Mixed seed or differential size of the seed from hatcheries	25	41.66
Heavy mortality of hatchery seeds due to poor quality	22	36.66
Lack of adequate No.of near by hatchery units	14	23.00
<b>II. Feed Constraints</b>		
High cost of feed	55	91.66
Low quality of feed	48	80.00
Lack of feed processing units ( Feed mills)	51	85.00
Aflotoxins in feed	03	05.00
<b>III. Disease Constraints</b>		
WSSV	20	33.33
Any other	24	40.00
<b>IV. Management Constraints</b>		
Non-availability of land near to sea shore	04	06.66
Water management	04	06.66
Absence of proper inlet (Feeding) and outlet (Drainage) canals		
Problem of bad count	30	50.00
Problem of theft	04	06.66
Problem of birds	06	10.00
Quarantine standards	35	58.33
Knowledge about services of MPEDA/CAA	34	56.66
Information on export oriented standards	08	13.00
<b>V Input constraints</b>		
Quality manure not available	06	10.00
Lack of Prophylactic treatment	02	03.33
Problems related to Medicines		
Manure and fertilizers not available in local markets	34	56.66
Problems related to fuel	48	80.00
<b>VI Labour Constraints</b>		
Inadequacy of the family labour	41	68.33
Scarcity of the hired labour	26	43.33
Demand of higher wages during peak season	30	50.00
Employment of unskilled and untrained labour	22	36.66
<b>VII Harvest constraints</b>		
Time of harvest	05	08.33
Lack of labour	30	50.00
<b>VIII. Extension Constraints</b>		
Lack of proper extension network	05	08.33
Lack of regular training programmes	05	08.33
Lack of information on technology	16	26.66
Lack of private consultants	05	08.33
Approach to extension agency / Distance		
Demonstrations Published literature Subsidies (Inputs)	03	05.00

<b>IX Infrastructure Constraints</b>		
Lack of roads	05	08.33
Lack of good transport	07	11.66
Lack of communication facilities	02	03.33
Lack of power	52	86.66
Lack of drinking water supply	11	18.33
Salination of drinking water wells due to heavy withdrawal		
Deterioration of soil quality of pond	05	08.33
<b>X. Marketing Constraints</b>		
Price fluctuations of inputs	42	70.00
Lack of storage facilities	51	85.00
Selling at pond site	11	18.33
Distance from the market	06	10.00
Lack of ice factories and plastic factories for proper storage of produce	45	75.00
Lack of information on price	48	80.00
High commission charges	14	23.33
Lack of Govt. support	51	85.00
Constraints faced due to Govt. policies	47	78.00
<b>XI Miscellaneous Constraints</b>		
Lack of facilities to test the soil quality	09	15.00
Lack of facilities to test the salinity of the water	10	16.66
Lack of knowledge on tidal fluctuations	28	47.00
Lack of availability of experienced engineers	18	30.00
Lack of insurance policy	38	63.33
Lack of Post harvest knowledge	07	11.66
Weed fishes	06	10.00
Floods & Drought	03	05.00
Pouching	01	01.66

### 3.1. Seed Constraints

The constraint analysis (Tab.2) of seed showed that majority (65 %) of the respondents facing the constraints of high cost of seed data followed by inadequate supply of required number of hatchery seed (60 %) within stipulated time. It is also interesting to note that 41.66 % of respondents reported mixed seed or differential size of the seed and few others (36.66 %) informed that, high mortality of hatchery seed due to poor quality. It is clear that seed is playing success of any culture and stocking of a quality seed will improve the survival rate and also reduce the cost of shrimp production. It is necessary to establish good number hatchery units to the nearby shrimp farming sites. The results are agreeing with the studies of Mohamed et al. (2013), koteswari et al. (2014) and Tejavath Jagadeesh (2015). Srinivas D. and Ch. Venkatrayalu (2016) revealed that Shrimp farming is highly resilient in West Godavari. The lack of availability of quality seed is the major problem for sustainability of the shrimp farming. Disease outbreaks also appeared to be the major threat to shrimp farming.

### 3.2. Feed Constraints

Vannamei feed is the important constraint of shrimp growers of the present study area. Majority (91.66 %) of respondents reported high cost of feed followed by lack of local feed processing units/Feed mills (85 %) It was also observed that 80 % of respondents reported poor quality of feed and a very few (5 %) reported problems of aflotoxins in preserved feed. The present study emphasizes the importance of supply of low priced high quality shrimp feed with long shelf life. It is also necessary to improve the feed storage facilities at shrimp farms such as erecting cold storages at shrimp farms. The results are agreeing with the studies of Mohamed et al. (2013), koteswari et al. (2014) and Tejavath Jagadeesh (2015).

### 3.3. Management Constraints

The results pertaining to the management constraints showed that 58.33 % of respondents attributed to hygienic/bio-secure/ quarantine standards and another 56.66 % of respondents reported ignorance of services of govt. organizations of MPEDA/CAA. The study also found that problems of harvesting marketable count size (50 %), non-availability of latest information on export standards (13 %), and few (10%) reported menace of birds and 6.66 % of respondents reported non-availability of land near

to sea shore and lack of prophylactic treatment (03.33 %) was also another reason for the disease prevalence. It is clear evidence that Good Management Practices (GMP's/BMP's) are important in order to yield more amount of marketable size counts as well good quality final product. The study also found the importance of outreach programmes to enable the shrimp grower informed about the advanced methods of vannamei farming. The results are agreeing with the studies of Mohamed et al. (2013), koteswari et al. (2014) and Tejavath Jagadeesh (2015).

### **3.4. Disease Constraints**

Prevalence of disease outbreaks in vannamei culture is receiving serious attention in recent times and resulting in crop failures. Majority of the respondents (40%) of the surveyed experiencing other than WSSV diseases (33.33%) such as *Vibrio* sp., white gut, white fecal matter, loose shell etc. The reasons behind the prevalence of diseases other than viral might be poor water quality management, high stocking densities and poor maintenance of BMP's at Shrimp farming facilities. The results are agreeing with the studies of Mohamed et al. (2013), koteswari et al. (2014) and Tejavath Jagadeesh (2015). Jitendrakumar *et al.* (2016) reported that Disease is the major limiting factor faced by the shrimp farmers and it has become the most burning and threatening issue for shrimp farming communities.

### **3.5. Input Constraints**

The vannamei culture is facing serious concern over the increase of input cost/operating cost. The present study had found that increment of fuel cost was the major concern (80 %) and 56.66 % of respondents reported the scarcity of manure and fertilizers in local markets. Other input related constraints include non-availability of quality manure (10.00 %) and. During the study it was observed (66.66%) that inorganic fertilizers were not playing any role in supplying adequate amounts of N, P& K. It might be due to the companies that they were supplying the inorganic fertilizers. The Govt. of A.P has to make stringent vigilance to verify the labeling of the products of particular companies and verify the actual availability. The results are agreeing with the studies of Mohamed et al. (2013), koteswari et al. (2014) and Tejavath Jagadeesh (2015).

### **3.6. Labour Constraints**

The vannamei culture in the present study area had been facing sever constraint about the non-availability of skilled man power (36.66%) and scarcity of required number of hired labour (43.33 %) during important operations such as stocking, harvesting, manuring etc.. The biggest constraint (50%) of the vannamei culture is demand of higher wages during peak season. The existing shrimp growers were also suffering from inadequacy of the family labour (68.33%) for their day today activities. The present study had reconfirmed the earlier studies of demand of higher wages and non-availability of skilled man power. These problems have to be checked by fixing standard prices to the skilled workers/certified workers and appropriate policy has to be prepared by the Govt. Agencies for hiring and wage fixation for the labour in order utilize their services in the vannamei culture facilities. The results are agreeing with the studies of Mohamed et al. (2013), koteswari et al. (2014) and Tejavath Jagadeesh (2015).

### **3.7. Marketing Constraints**

In recent times shrimp culture is facing setback due to fluctuation of market prices even though good market is available for good count at global level. The present study also revealed that majority (85 %) reported lack of Govt. support, lack of ice factories & storage facilities (75%) and 80.00 % of respondents reported lack of information on actual market price where as 78 % respondents attributed to Govt. policies for these constraints. 70 % of respondents reported fluctuations of prices. The fluctuations of shrimp prices and supply of adequate information to shrimp growers at regular intervals by the Govt., is the need of the hour so as to minimize the crop losses. The results are agreeing with the studies of Mohamed et al. (2013), koteswari et al. (2014) and Tejavath Jagadeesh (2015). Koteswari N.*et al.*, (2014) reported that all farmers were producing tonnes of shrimp but there is price fluctuation in the market for the produce which affects their income.

### **3.8. Infrastructure Constraints**

The present study analysed the constraints of infrastructure an allied facilities. The results showed that lack of power (86.66%), lack of roads (8.33%), lack of transport (11.66%), lack of adequate drinking

water facilities (18.33%) and communication of facilities (3.33%). The intensity and seriousness of these constraints varied from system to system. These constraint analyses emphasize the importance of site selection criteria to be implemented prior to design of shrimp culture system. Appropriate facilities as mentioned above to be incorporated at reasonable price. Care to be taken in order to minimize the operational cost of production of vannamei culture. The results are agreeing with the studies of Mohamed et al. (2013), koteswari et al. (2014) and Tejavath Jagadeesh (2015).

### 3.9. Miscellaneous & Others

The present study had shown that lack of crop insurance was the major constraint for majority (63.33%) growers and lack of updated scientific information on vannamei culture (26.66%) was also another constraint reported by the shrimp growers. The Govt. has to make appropriate crop insurance policies to vannamei culture in the similar lines of agriculture and allied sectors. The results are agreeing with the studies of Mohamed et al. (2013), koteswari et al. (2014) and Tejavath Jagadeesh (2015). Kumaran *et al.* (2003), and Vadher *et al.* (2014), shrimp farming was successfully practiced in Andhra Pradesh and Gujarat, although with some constraints. Shrimp aquaculture has contributed significantly in employment generation and infrastructure development of the coastal community and overall development of coastal areas.

### 3.10. Ranking of Constraints in *L.vannamei* Culture

The data were analyzed using ‘Garrett (1969) method of ranking’ for all the listed constraints and depicted in Table and depicted in Table 3. The results showed that out of the total farmer’s surveyed, input constraint (rank-1) was opted as the major constraint, followed by other constraints such as lack of marketing (rank-2), infrastructure constraint (rank-3), constraint (rank-4), management constraint (rank-5), Miscellaneous constraint (rank-6), disease constraint (rank-7), feed constraint (rank-8), harvest constraints (ranking-9), extension constraint (rank-10) and labour constraint (rank-11).

The ranking of constraints could be utilized for prioritization of constraints in order to make immediate steps on priority basis to address the specific constraint. Even though 11 ranks were opted for each constraints, but all the constraints were playing equal importance in most of the vannamei farms in the study area as the majority of the farmers were experiencing the either of these constraints irrespective of their rank. The results clearly indicated that shrimp farmers are still experiencing the problems of diseases which fetched them severe economic losses. The increase of wages of labour used in the shrimp farming operations and fluctuations of shrimp prices were also the major hurdles perceived by the shrimp growers in the study area. It might be the similar situation prevailed in all the shrimp growing places of rest of the state of Andhra Pradesh.

**Table3.** Garret’s ranks and scores on Constraints encountered by shrimp farmers in BMP’s of *L.vannamei* practices

S.NO	Constraints	Score	Rank
1	Input constraint	59.31	I
2	Marketing constraint	56.66	II
3	Infrastructure constraint	55.81	III
4	Seed constraint	52.33	IV
5	Management constraint	52.26	V
6	Miscellaneous constraint	51.11	VI
7	Diseases constraint	48.64	VII
8	Feed constraint	46.74	VIII
9	Harvest constraint	44.21	IX
10	Extension constraint	43.93	X
11	Labour constraint	40.01	XI

## 4. CONCLUSION

The present study conclude that vannamei culture even though it was stated with high expectations compared to tiger shrimp, but in recent time it is also receiving severe setbacks due to several constraints and fetching heavier economic losses. The need of the hour is to address all the identified/analyzed constraints with more pragmatic approach and immediate preventive measures to be taken to sustain the vannamei culture in all shrimp farming states in general and Andhra Pradesh state in particular as the later is contributing 70 % of the total Indian shrimp production. The

constraints such as non-availability of quality seed and feed, high cost of seed and feed, very low support price fixed by the Govt., lack of market facilities, lack of labour, high cost of labor, & higher input cost are to be addressed with appropriate existing measures which includes adoption Better Management Practices (BMP's) and HACCP principles at vannamei culture facilities in order to produce zero defect shrimp products.

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