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Constraints perceived by the *Litopenaeus vannamei* farmers with implementation of Better management practices (BMP's) in Andhra Pradesh, India

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Abstract
Shrimp aquaculture especially *Litopenaeus vannamei* farming in India is reporting promising growth rate for the past decade and more than 14 million people were depending on this sector. The present study was conducted at *L. vannamei* cultured ponds, located at various coastal districts of Andhra Pradesh state, India, where *vannamei* farming was practicing at commercial level in semi intensive systems of aquaculture. 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). The present study was conducted to evaluate constraints faced by the *vannamei* shrimp farmers in Andhra Pradesh. This study was conducted during the year 2014-15, in various districts of reorganized Andhra Pradesh state. A total of 3 districts were selected out of 13 districts of newly formed Andhra Pradesh state for the present study and a total of 180 *vannamei* farmers were selected both randomly and purposively and 60 *vannamei* farmers were selected from each district. 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, seed constraint (rank-1) was opted as the major constraint, followed by other constraints such as labour constraint (rank-2), disease constraint (rank-3), feed constraint (rank-4), marketing constraint (rank-5), harvest constraint (rank-6), infrastructure constraint (rank-7), management constraint (rank-8), Miscellaneous constraints (ranking-9), extension constraint (rank-10) and input 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)

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 tones) 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.
Indian fisheries and aquaculture is an important sector of food production, providing nutritional security to the food basket, contributing to the agricultural exports besides engaging more than 14 million people in different activities. Constituting about 6.3% of the global fish production, the sector contributes to 1.1% of the GDP and 5.15% of the agricultural GDP. In India, shrimp farming areas are mostly located in the coastal states of Gujarat, Maharashtra, Karnataka, Goa, Kerala, Tamil Nadu, Andhra Pradesh, Orissa and West Bengal. *Litopenaues vannamei* is the most commonly cultured shrimp in south east Asia and India is the second

shrimp producer is the world. The Andhra Pradesh state is the largest *vannamei* farming area amongst the shrimp farming stats of India. *Litopenaues vannamei* was introduced is 2009, since then its production and culture area has gradually increased replacing *penaues monodan* culture, was the mainstay of Indian aquaculture during 1995-2008. Andhra Pradesh produces more than half of the country's farmed shrimp and has a lot of potential to export unutilized waste lands. Andhra Pradesh is the fifth biggest state of India. Andhra Pradesh is considered to be important states in the consumption and production of shrimp. Due to the high cost involved in cultivation and agriculture practices and due to commercialism, consumption strategies the farmers of Andhra Pradesh are shifting to the new type of practices to solve the problem of food production *i.*e the aqua culture ponds.

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) [18]. 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.

2. Materials and Methods

2.1 Locale of the study

The present study was conducted during the year 2014-15 in the districts of Krishna, Guntur and Prakasam, which falls under Southern Andhra Pradesh state, represent the different agro-climatic zones (Fig 1). The study was conducted in *Litopeneaus vannamei* farmers (licensed and permitted by the Department of Fisheries, Govt. of Andhra Pradesh) which were practicing BMP's in a phased manner.

The newly established Andhra Pradesh state has 13 districts, of which 9 are coastal districts covering 974 KM of coastline from Srikakulam to Nellore. Amongst the Bay of Bengal states of India, the Andhra Pradesh state occupies the first position in respect of number of fishing vessels, freezing plants and peeling sheds. The Andhra Pradesh state is contributing half of the total shrimp production of India. The total number of farmers in brackish water farming is 34,542 and total area under brackish water shrimp culture is 35,925.9 Ha as on 2015.

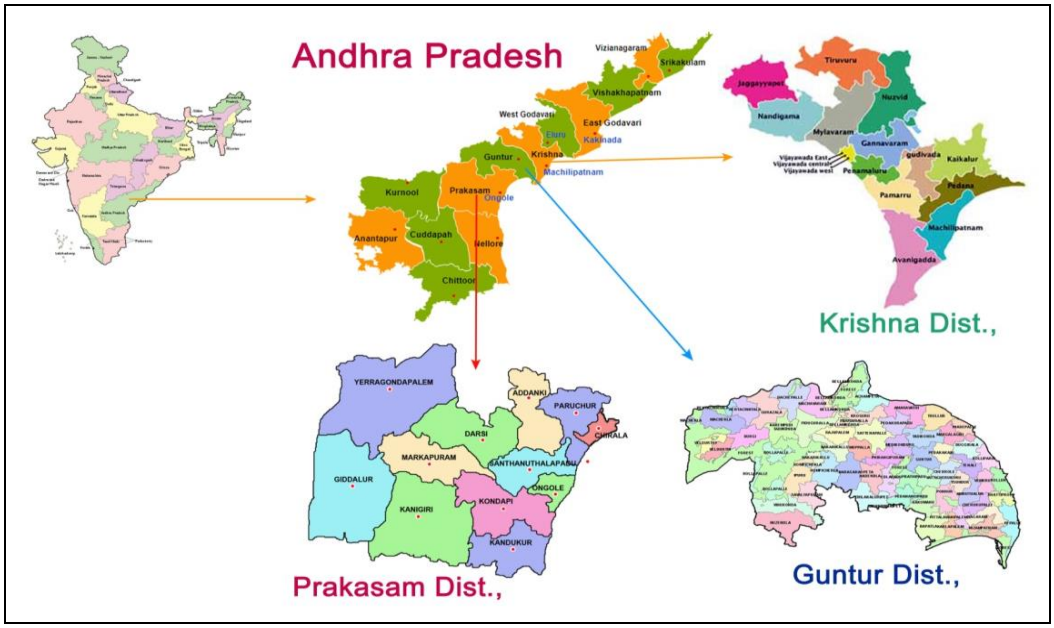

Fig 1: Map showing the study area

2.2 Research design

Ex-post-facto research design was used in the present investigation. According to Robinson (1976) [31], *ex-post-facto* designs as 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. A pilot study was conducted prior to main investigation to obtain insights and familiarity to the problem.

2.3 Development of interview schedule

Taking into consideration of the scope and objectives of the study, interview schedule is prepared after perusal of the available literature on extension education as well as in consultation with experts in the field of fisheries extension and allied areas. The suggestions given were considered in finalizing the interview schedule. Thus, the final interview schedule consists of all relevant schedule items for measuring the variables was included in the study. After pre-testing, necessary changes were incorporated in the schedule. The final version of the interview schedule is appended.

2.4 Population and Sample

The population for the study covers the small–scale farmers (holding < 2 ha of area) 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 Andhra Pradesh State. The population for the study covers the *L. vannamei* farming farmers of the entire three districts *viz.* Guntur, Krishna and Prakasam of Andhra Pradesh state. The sampling districts were selected purposively and based on the information on number of shrimp farmers, farming area, production and diversity of problems.

2.4.1 First stage selection - Identification of districts

For the present study, coastal districts of Andhra Pradesh *viz.* Guntur, Krishna and Prakasam were identified as first stage selection, where the *L. vannamei* farming activity was large and reported high in production. The intensity of *L. vannamei* farming is prevalent in small scale (<2 ha) areas of these identified districts, where majority of the shrimp cultivators are depending on shrimp aquaculture as their main livelihood. Out of nine districts of coastal Andhra Pradesh state, three districts *viz.* Prakasam, Guntur and Krishna were purposively selected for the sample collection.

2.4.2 Second stage of selection- Identification of mandals

From the identified districts, the details of information on number of *vannamei* farmers in each mandal were obtained from the officials of Department of Fisheries, Govt. of A.P. Based on the information on availability of more number of farming area/farmers, the mandals were identified and selected purposively for the present study. Three mandals from each district of Prakasam, Guntur and Krishna were purposively selected for the study (Tab.1).

2.4.3 Third stage of selection-Selection of respondents

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 180 respondents was selected from the identified mandals of the three districts *i.e.* Prakasam, Guntur and Krishna. Consequently, out of 180 respondents, 60 respondents from the identified mandals of each district were selected proportionately.

2.5 Statistical tools used in the study

The quantification of qualitative data was done in accordance with the standards laid down and tabulated to draw meaningful inferences. The collected data was scored, tabulated and analyzed using the statistical tools and techniques Frequency and percentage, Arithmetic mean ($\overline{X}$), Standard deviation (S.D) and Garrett's ranking technique**.**

Table 1: Selection of Mandals

District	Total No. of Mandals in the district	Total No. of mandals identified & selected	Name of the Mandal Selected
Prakasam	56	3	Tangutur, Kothapatnam & Chinnaganjam
Guntur	57	3	Bapatla, Karlapalem & Pittalavari Palem
Krishna	50	3	Machilipatnam, Bantumalli & Koduru

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 constrains 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.

3.1 Seed constraints

The constraint analysis (Tab.2) of seed showed that majority (81.66%) of the respondents had reported the constraints of non-available of quality seed as main constraint in seed. Majority (62.22%) of the respondents facing the constraints of high cost of seed, followed by inadequate supply of required number of hatchery seed (66.66%) within stipulated time. It is also interesting to note that 45 percent of respondents reported mixed seed or differential size of the seed and few others (31.66%) informed that, high mortality of hatchery seed due to poor quality.

Table 2: Constraints of *vannamei* shrimp farmers in Andhra Pradesh (n=180)

Constraint/Problem	Frequency	Percentage	Rank
I. Seed constraints			
Non availability of quality seed	147	81.66	I
High cost of the seed	112	62.22	II
Inadequate supply of hatchery seeds in the required time	120	66.66	IV
Mixed seed or differential size of the seed from hatcheries	81	45.00	III
Heavy mortality of hatchery seeds due to poor quality	57	31.66	V
Lack of adequate No. of near by hatchery units	36	20.00	VI
II. Feed Constraints			
High cost of feed	172	95.55	I
Low quality of feed	120	66.66	III
Lack of feed processing units (Feed mills)	152	84.44	II
Aflotoxins in feed	06	03.33	IV
III. Disease Constraints			
WSSV	67	37.22	II
Any other	129	71.66	I
IV. Management Constraints			
Non-availability of land near to sea shore	13	07.22	V
Water management Absence of proper inlet (Feeding) and outlet (Drainage) canals	09	05.00	VII
Problem of bad count	120	66.66	III
Problem of theft	04	02.22	VIII
Problem of birds	10	05.55	VI
Quarantine standards	124	68.88	I
Knowledge about services of MPEDA/CAA	123	68.33	II
Information on export oriented standards	27	15.00	IV
V Input constraints			
Quality manure not available	18	10.00	III

Lack of Prophylactic treatment Problems related to Medicines	06	03.33	IV
Manure and fertilizers not available in local markets	120	66.66	II
Problems related to fuel	150	83.33	I
VI Harvest constraints			
Time of harvest	18	10.00	II
Lack of labour	123	68.33	I
VII Labour Constraints			
Inadequacy of the family labour	125	69.44	II
Scarcity of the hired labour	98	54.44	IV
Demand of higher wages during peak season	135	75.00	I
Employment of unskilled and untrained labour	112	62.22	III
VIII. Extension Constraints			
Lack of proper extension network	13	07.22	V
Lack of regular training programmes	61	33.88	II
Lack of information on technology	88	48.88	I
Lack of private consultants Approach to extension agency / Distance	14	07.77	IV
Demonstrations Published literature Subsidies (Inputs)	15	08.33	III
IX Infrastructure Constraints			
Lack of roads	20	11.11	IV
Lack of good transport	23	12.77	II
Lack of communication facilities	06	03.33	V
Lack of power	169	93.89	I
Lack of drinking water supply Salination of drinking water wells due to heavy withdrawal	20	11.11	IV
Deterioration of soil quality of pond	21	11.66	III
X. Marketing Constraints			
Price fluctuations of inputs	138	76.66	IV
Lack of storage facilities	141	78.33	III
Selling at pond site	31	17.22	VIII
Distance from the market	25	13.88	IX
Lack of ice factories and plastic factories for proper storage of produce	120	66.66	VI
Lack of information on price	144	80.00	II
High commission charges	32	17.77	VII
Lack of Govt. support	146	81.11	I
Constraints faced due to Govt. policies	135	75.00	V
XI Miscellaneous Constraints			
Lack of facilities to test the soil quality	23	12.77	V
Lack of facilities to test the salinity of the water	26	14.44	IV
Lack of knowledge on tidal fluctuations	63	35.00	II
Lack of availability of experienced engineers	37	20.55	III
Lack of insurance policy	136	75.55	I
Lack of Post harvest knowledge	23	12.77	V
Weed fishes	12	06.66	VI
Floods &Drought	07	03.88	VII
Pouching	02	01.11	VIII

It is clear that seed is playing success of any culture and stocking of a quality seed would 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 were agreeing with the studies of Umamaheswari *et al.,* (2016) [40], Tejavath Jagadeesh (2015) [39], Koteswari *et al.* (2014) [11], Rahaman *et al.,* (2013) [29], Mohamed *et al.* (2013) [17], Baruwa, *et al.,* (2012) [2], and Pandey & Ritu Dewan. (2006) [25]. According to Srinivas and Venkatrayalu (2016) [33] shrimp farming is highly resilient in West Godavari district of A.P. state. The lack of availability of quality seed is the major problem for sustainability of the shrimp farming.

Adequate availability and timely supply of fingerlings of recommended shrimp species to shrimp farmers is very important aspect. Non availability of desired shrimp seed at required time was felt as a limiting factor by almost 1/3rd of respondents. The present findings are in line with the findings of earlier workers (Alam, 1997 and Talkudar, 2000) [1, 37]. The most important constraint from the farmers' perspective was lack of good quality seed and the same was reported by Das *et al.* (2014) [6]. Majority of shrimp farmers reported at the time peak season high demand and high cost of seed particular species like as major constraint. Similar findings agree with Meeran and Jayaseelan (1996) [15] and Ponnusamy *et al.,* (2001) [28].

Nearly 31.66 per cent of the shrimp farmers express high mortality of shrimp seed stocked as one of the constraint. Mortality of shrimp seed occurs due to bad handing during transport, duration of transport, poor quality of seed. More or less similar findings were reported by Wayal and ingle (1994) [41]. Nearly ¼ of the fish farmers express high mortality of fish seed stocked as one of the constraint by Nagarajaiah C.S. (2002) [22].

3.2 Feed constraints

The problems related to *vannamei* feed were another important constraint of shrimp growers of the present study

area. Majority (95.55%) of respondents reported high cost of feed followed by lack of local feed processing units/Feed mills (84.44%). It was also observed that 66.66% of respondents reported poor quality of feed and a very few (03.33%) 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) [17], Pandey and Ritu Dewan. (2006) [25], Sanusi *et al.* (2016), Pandey *et al*, (2014) [24], Koteswari *et al.* (2014) [11] and Tejavath Jagadeesh (2015) [39]**.**

Nearly 95.55 percent of shrimp farmers expressed high cost of feed items as a constraint. Feeding and manuring practices demand more investment. Similar findings were reported by Umamaheswari *et al.,* (2016) [40], Rahaman *et al.,* (2013) [29], Baruwa *et al.,* (2012) [2], Daisy *et al.,* (2009), Nagarajaiah (2002) [22], Ponnusamy *et al.,* (2001) [28], Nagaraj (1999) [21], Chandrakala (1999) [4], Krishnamurthy (1997) [12], Meeran and Jayaseelan. (1996) [15], Suresh *et al.,* (1990) [36], and Ponnaiah (1982) [27].

Supplementary feeds were the main source of energy for the commercial practices of *vannamei* culture. Majority of shrimp ponds are located at rural areas, and feed processing units were located in small towns. The availability of feed processing units in comparison to number *vannamei* farms, are very less in numbers. At the time of peak stage of shrimp culture high quantity of feed is required for shrimp. In order to overcome the constraint of feed requirements as per the demand, it is essential to establish required feed processing units which would also help in control of feed prices. Lack of adequate number of feed plants was one of the feed constraints as majority (84.44%) of surveyed respondents informed. Devaki and Senthil kumar (2011) [7] reported that the high cost of feed and marketability were the 3rd and 4th ranked constraints respectively, whereas Das *et al.* (2014) [6] reported that high cost of feed was the 5th important constraint.

3.3 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 (71.66%) of the surveyed experiencing the diseases such as *Vibrio sp*., white gut, white fecal matter, loose shell etc. whereas 37.22 percent indicated the problems of WSSV disease. The reasons behind the prevalence of diseases other than viral might be due to 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) [17], Koteswari *et al.* (2014) [11] and Baruwa, *et al.,* (2012) [2], Rahaman *et al.,* (2013) [29], Pandey *et al.,* (2014) [24], Umamaheswari *et al.,* (2016) [40], Pandey and Ritu Dewan (2006) [25], Tejavath Jagadeesh (2015) [39]**.** According to Jitendrakumar *et al.* (2016), 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. Srinivas and Venkatrayalu (2016) [33] reported that the most of the viral and bacterial disease outbreaks were considered as the major constraint by 66.67 percent of the farmers. In their study most of the common diseases observed were Black gill disease, IHHNV (Infectious Hypodermal and Hematopoietic necrosis Virus), White muscle disease, White gut disease, Running Mortality syndrome and White spot syndrome virus (WSSV). Lack of availability of quality shrimp seed from hatcheries is of great concern to 50.44 percent of the farmers.

3.4 Management Constraints

The results pertaining to the management constraints showed that 68.88 percent of respondents attributed to hygienic/bio-secure/ quarantine standards and another 68.33 percent of respondents reported ignorance of services of govt. organizations of MPEDA/CAA. The study also found that the problems of harvesting marketable count size (66.66%), non-availability of latest information on export standards (15%), and few (05.55%) reported menace of birds and 07.22 percent of respondents reported non-availability of land near to sea shore. It is clear evidence that Better Management Practices (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.

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 (83.33%) and 66.66% 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 lack of prophylactic treatment (03.33%) was also another reason for the disease prevalence.

During the study, it was observed (66.66%) that inorganic fertilizers were not playing any role in supplying adequate amounts of N, P& K as specified on labeling. It might be due to that the fake companies might be in existence and there by cheating the farmers as they were supplying at low prices. The Govt. of A.P has to make stringent vigilance to verify the labeling of the products of particular companies and to evaluate the actual availability of labeled contents. Non-availability of fertilizer in time, lack of knowledge on fertilizer application and high cost of fertilizers were the other major constraints of input constraints. The input dealers hiked the prices largely when they were needed at most, and there was no regulation on the prices of the inputs. The traders also sometimes created artificial stock deficit, which made the farmers to perceive this problem. Steps should be taken by the government to provide sufficient fertilizers on subsidized rates, and posting of sufficient technical staff needed to guide the shrimp farmers on package of practices. Sriram and Chauhan (2005) [34] were also reported similar constraints.

Presence of aquatic weeds, predators and weed fishes were perceived as problems in adoption of shrimp culture by nearly 1/5th of the shrimp farmers. Control of aquatic weeds and predators in perennial and seasonal tanks involves huge money and it is a recurring expenditure. The problem is more severe in perennial tanks, where complete eradication of aquatic weeds and predators is beyond control. Suresh *et al.,* (1988) [35] identified presence of predators and weed fishes and aquatic weeds as production constraint in shrimp culture.

3.6 Harvest Constraints

The *vannamei* culture in the present study area had been facing severe constraint of lack of labour at the time of harvest (68.33%) and 10 percent of respondents had informed

about the knowledge on procedures/time of harvest. The results are agreeing with the studies of Mohamed *et al.* (2013) [17], koteswari *et al.* (2014) [11] Pandey and Ritu Dewan. (2006) [25], Rahaman *et al.,* (2013) [29], Pandey *et al.,* (2014) [24], Umamaheswari *et al.,* (2016) [40], Tejavath Jagadeesh (2015) [39], Baruwa, *et al.,* (2012) [2].

3.7 Labour Constraints

The *vannamei* culture in the present study area had been facing sever constraint of non-availability of skilled man power (62.22%) and scarcity of required number of hired labour (54.44%) during important operations such as stocking, harvesting, mannuring etc. The biggest constraint (75%) 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 (69.44%) 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.

3.8 Extension Constraints

The present study analyzed the constraints of extension and allied facilities. The results showed that the majority of respondents reported that the lack of updated scientific information on *vannamei* culture (48.88%). 33.88% of respondents reported lack of regular training programmes. Very few (8.33%) of respondents reported about non-availability of published literature, where as 7.77 percent reported about lack of private consultants approach to extension agency and 7.22 percent reported about lack of proper extension network. Inadequate extension support for timely advice and guidance was felt as problem by *vannamei* of farmers. Similar findings were reported by Ponnaiah (1982) [27] and Ponnuswamy *et al.,* (2001) [28].

Another important constraint faced by shrimp farmers was lack of exact information on important practices for better yields. More or less similar findings were reported by Mishra and Mishra (1999) [16] and Talukdar (2000) [37]. Lack of technical expertise and performing aquaculture out of their own knowledge, was reported to be a common problems in several Asian countries (Chinabut *et al*., 2002, Hasan and Ahmed, 2002, Jeney *et al.,* 2002, Phan *et al.,* 2002, Baruwa, *et al.,* 2012, and Mondal and Das, 2005) [5, 9, 10, 26, 2, 20].

3.9 Infrastructure Constraints

The present study also analyzed the constraints of infrastructure and allied facilities. The results showed that lack of power (93.89%) was the major constraint where as lack of roads (11.11%), lack of transport (12.77%), lack of adequate drinking water faculties (11.11%) and communication of facilities (3.33%) were other infrastructure constraints. The intensity and seriousness of these constraints varied from system to system. These constraint analyses emphasize the site selection criteria to be implemented as per the procedure prior to construction of shrimp culture system. The requisite facilities to be provided at reasonable price and every care to be taken in order to minimize the operational cost of *vannamei* culture.

3.10 Marketing Constraints

In recent times, *vannamei* culture also facing severe setback due to fluctuation of market prices, even though good market is available for good *vannamei* count at global level. The present study also revealed that majority (81.11%) reported lack of Govt. support, lack of ice factories were the major marketing constraints, where as storage facilities (66.66%), lack of information on actual market price (80.00%), Govt. policies (75%), fluctuations of prices (76.66%), lack of storage facility (78.33), selling at pond site (17.22%), and distance from the market (13.88%) were the major marketing constraints of *vannamei* culture. 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.

Koteswari *et al.,* (2014) [11] reported that all farmers were producing optimal yield but price fluctuations in the market affecting the income of the *vannamei* cultivators. Market price used to be unstable in fishery and aquaculture sector. The shrimp farmers should aware of fluctuations on price during the harvesting time, better to have updated information on market price on day to day basis so as to get profit from the shrimp culture. It was observed that 80.00 per cent of *vannamei* farmers reported lack of information on market price as the major problem. Similar findings were reported by Krishnaiah. (1989) [13], Sanusi *et al.* (2016) [32], Baruwa *et al*, (2012) [2], Pandey and Ritu Dewan. (2006) [25], Taufiq Rusdi. (1995) and Rathord. *et al.,* (2011) [30].

About 75 percent of opined that state/central governments might increase taxes on shrimp ponds as well taxes on exports and reported as another major constraints. Meeran and Jayaseelan. (1996) [15] reported similar findings. Chanchal Angral *et al.,* (2017) [3] reported that the many fish farmers who are capable of becoming large scale commercial operators but because of several constraints they face in the field *viz*. lack of knowledge/awareness regarding various fisheries schemes, poor quality of seed and feed, lack of adequate marketing channels, non-availability of insurance coverage, lack of proper exposure visits, misuse of subsidy, lack of water, lack of institutional credit, allocation of ponds & compartmental approach, fish farming has remained at low ebb in A.P state.

3.11 Miscellaneous Constraints

The present study found that lack of crop insurance (75.55%) was the major constraint among the miscellaneous constraints. The results also indicated that 35 percent of respondents reported lack of knowledge on tidal fluctuations, 20.55 percent of respondents reported lack of availability of experienced engineers, 1.11 percent reported about poaching, 3.88 percent reported about floods & drought and 6.66 percent reported about weed fishes.

The results had indicated about the Govt. to make appropriate measures of implementation of crop insurance policies to *vannamei* culture in the similar lines of agriculture and allied sectors. The other constraints expressed by the respondents include loss of fingerlings due to unexpected and untimely rains, lack of adequate marketing facilities, high price of leased ponds and encroachment of tank bed. Lack of transport and storage facilities (Krishnaiah, 1989 and Alam, 1997) [13, 1], lack of marketing facilities (Le Xuan Sinh, 1996) [14] were perceived as constraints faced by shrimp farmers in varying degrees. Lack of financial assistance was ranked as the eighth constraint where as Das *et al.* (2014) [6], ranked it as the

second constraint.

Ogunmefun, and Achike, (2017) [23] reported that the lack of capital/finance (3.6), high cost of inputs (3.4), poor hatching techniques (3.4), pest and diseases (3.4) and lack of water supply (3.4) respectively topped the list of major constraints of fish farming enterprise.

Lack of information on relative performance of high yielding varieties, high cost of improved/ high yielding shrimp seed, non-availability of seed in time, non-availability of chemical/ culture for seed treatment, higher cost of field preparation, non-availability of labour at sowing time were the major constraints identified in this group. The present underlines the importance of sufficient technical staff to guide the farmers about high yielding varieties at the time of beginning of each crop season. Extension functionaries have to educate the farmers about package of practices of shrimp through training programmes and various extension activities such as group discussion, field visits etc. Mohanty *et al*. (2011) [19] also identified lack of knowledge as major constraint under pond preparation.

3.12 Garret's ranks and scores on constraints

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

Table 3: Garret ranking and scores of constraints in *L. vannamei* culture

S. No	Constraints	Score	Rank
1	Seed constraint	64.25	I
2	Feed constraint	55.67	IV
3	Diseases constraint	56.66	III
4	Management constraint	48.64	VIII
5	Input constraint	22.17	XI
6	Harvest constraint	52.26	VI
7	Labour constraint	59.31	II
8	Extension constraint	40.01	X
9	Infrastructure constraint	51.11	VII
10	Marketing constraint	54.37	V
11	Miscellaneous constraint	44.64	IX

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 were still experiencing the problems of diseases which fetched them economic losses. The increase of wages of labor 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.

4. Conclusion

The constraints related to seed, feed, disease, pond management, infrastructure faculties, and input constraints were the major constraints perceived by the *vannamei* shrimp farmers. The availability of good quality, virus free shrimp seeds is essential for the successful grow-out operations. Lack of information on relative performance of high yielding varieties, high cost of improved/ high yielding shrimp seed, non-availability of seed in time, non-availability of chemical/ culture for seed treatment, higher cost of field preparation, non-availability of labour at sowing time were the major constraints identified.

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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