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Impact of Probiotics on Shrimp Culture Practices: A Case Study

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ABSTRACT

The present study was designed to evaluate the impacts of the different types of probiotics used by the shrimp growers who are holding 0-2 ha culture area. A case study was carried out during the first crop of 2011, at three mandals (taluka's) *viz* Pitlavani Palem, Nizampatnam, Karlapalem of Guntur district of Andhra Pradesh. The study area was selected purposively and the respondents were identified using simple random technique. The interview schedule was conducted with the aid of well structured and pre-tested questionnaire containing 32 items including both open and closed ended questions. The results showed that all (100%) of the shrimp farmers were using commercial probiotics such as *Pro-B Active A, Biocult, Avant prow, Avant Bact, Black solve, Prob solve, Soil pro BR, MicroPS and EnvironAC, etc.* comprising of water, feed and soil probiotics. Out of the total farmers surveyed 44 percent were using water probiotics, 44 percent were using feed probiotics and 12 percent of the farmers using soil probiotics. The results indicated that the usage of probiotics recorded increased benefits in all aspects that include shrimp survivability, reduction in total cost of average production, reduction of disease prevalence, improved water quality and pond bottom conditions, etc. The results also showed the correlation between usage of probiotics and shrimp growth. The present study concluded that the usage of different types of commercial probiotics showed positive impacts on shrimp grow- out production.

Key words: Probiotics, Shrimp culture, Impact study

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Introduction

India is the 5th top most cultured shrimp producer and farmed shrimp contributes about 60 percent by volume and 82 percent value of total export (Kunda, 2009). Shrimp farming became an important component of the Indian aquaculture industry and about 75 percent of the farming area is culturing the species of *Penaeus monodon*. Shrimp aquaculture production plays a pivotal role in developing the economy of India. Shrimp accounted for around 50 percent of the value of seafood exports, an all time high of $ 1740 million foreign exchange earnings (Narshimhan, 2013).It provides employment directly to about 0.3 million people and indirectly to 0.6 to 0.7 million people mainly in the states bordering the east coast states of Andhra Pradesh, West Bengal, Tamil Nadu and Orissa since a decade (Vasudevappa and Seenappa, 2002). The potential area available for brackish water aquaculture in AP is about 150,000 ha with a network of 172 brackish water bodies in 9 coastal districts. This accounts for 12.6% of the total potential area in the country (1.2 million ha). Out of total potential area in Andhra Pradesh, 84,951 ha (56.6%) has been developed for shrimp farming (Nagothu *et al.,* 2012). According to Ayyppan (2012), the production of shrimp has recorded over five fold increase in last one and half decades *i.e.* from 28,000 tonnes in 1988-89 to 14,000 tonnes in 2009-10.At present, 70 percent of the shrimp production of the country was from farms in Andhra Pradesh, contributing 1.6 lakh tones out of two lakh tones of the country shrimp production (Anon,2013). The yield from shrimp production started declining since 1992 due to disease outbreak, water quality problems etc. The indiscriminate usage of antibiotics and therapy agents by shrimp farmers, were unable to control these problems and posed another serious threat to environment such as antibiotic residues (Karunasagar *et al.,* 1994).

The probiotic approach came as an alternative to these problems with an immense potential in aquaculture (Gatesoup, 1999; Mishra *et al* 2001). According to Boyd (1998), Probiotics are culture product or live microbial feed supplement which beneficially affectes the host by improving its intestinal balance and health of the host. *Lactobacillus* was first discovered probiotic species. The exact definition of the probiotic is microbial 'Water additives'. These probiotic preparations include single species of bacteria or yeast or a combination of several species of both these components (Moriarity, 1998). Water quality parameters will become lethal mainly due to utilization of O_2, vegetation of inorganic nutrients and production of toxic metabolites like ammonia, nitrite and sulphide by their microbial process (Moriarity, 1996). Suhendra *et al.,* (1997) reported that commonly use of commercial probiotics, resulted in reduced incidence of *Vibrio spp* and viral outbreaks and environmental condition in the pond, reduced organic matter accumulation, improved water quality, increased growth of shrimp and production. Andhra Pradesh is the leading state in India for aquaculture activitives, where most of the farmers adapted to using both water and feed probiotics. Panigrahi and Azad (2007), reported that *Vibrio alginolyncus* introduced in larval rearing tanks caused a reduction in the incidence and severity of luminous vibriosis caused by *Vibrio harveyi* and improvement in growth of shrimp larvae.

Keeping in view of this background, the present study was designed to evaluate the impact of different types of probiotics used by the shrimp farmers in Andhra Pradesh state.

Materials and Methods

The present study was conducted to evaluate the impacts of different types of probiotics used by small-scale shrimp growers holding 0-2 ha culture area. A case study was carried out at Andhra Pradesh state during the first crop of 2011, at three Mandals (Taluka's) *viz* Pitlavani Palem, Nizampatnam and Karlapalem, of Guntur district, a southern coastal district, based on the data available with Fishery Development Office, superiority (at the time of study) in area of cultivation, production, intensity of constraints reported to Fisheries Department, intensity of consumption of probiotics reported by the probiotic distributors of specified locality.

The total extent of brackish water area developed in to shrimp ponds was 1578.46 ha (FDO, Guntur,A.P, 2011). For the present study, the information available with the Fishery Development Office, Guntur, A.P, was used for selection of manadals, villages and respondents. The selection of study area and respondents were based on purposive and simple random sampling techniques (Tab.1). The selected respondents were the leading shrimp growers in terms of economical returns and adapted the usage of probiotics for several years. The interview schedule was conducted with the aid of well structured and pre-tested questionnaire containing 32 items (Tab.2) including both open and closed ended questions. The collected data was subjected to SPSS.17.0 version and analyzed using standard statistical methods such as frequency and percentage, correlation etc.

Table 1. Selection of Mandals in Guntur District

S.No	Name of the Mandal	Total No. of shrimp farmers and Area (ha)	No. of shrimp farmer Selected (based on intensity and usage of Probiotics in large scale)
1.	Pittalavani palem	242 ; 300 ha	8
2.	Nizampatnam	226; 200 ha	7
3.	Karla palem	249; 323 ha	10

Table 2. Variables used for data collection on impact of probiotic usage in shrimp farming

S.No	General Information	S.No	Information on Grow- out pond	S.No	Information about Probiotics
1	Farmer's Name	11	Total culture area (ha)	20	Are you using probiotics
2	Address	12	Tenure status	21	Type of probiotics

	i)Father Name	13	Soil type	22	Source of probiotics
	ii)Village	14	Water source	23	Probiotic company (brand) Name
	iii)Mandal,				
	iv)District				
				24	Cost of probiotics (/kg)
3	Age	15	Type of culture	25	Total expenditure on probiotics per crop (Rs/kg)
4	Sex	16	Stocking density (/m^2)		
5	Education Qualification	17	Total period of culture	26	What are the benefits probiotics?
6	Family size	18	Source of seed	27	What are the chemicals are you using?
7	Major Occupation	19	Source of Technical advice	28	Method of application of probiotics?
8	Aquaculture Experience			29	How long will you store probiotics?
9	Annual Income			30	Are you satisfied with the benefits of the probiotics? If yes, list out the benefits such as controlling diseases,/increase the immunity/increase of production/improvement in all aspects prior to adoption of probiotics
10	Social Status			31	How much income are you spending/ crop (Rs)?
				32	How frequently will you use probiotics?

Results

The surveyed respondents were practicing modified semi intensive shrimp culture and *Penaeus monodon* was the only species (mono species) cultured. The seed was procured from a near by private hatcheries. The stocking density varied from 8-10/m^2. Majority of the respondents were using water intake from near by creek and few of them were using ground water. All (100%) the farmers were using grower feeds available in the market and using commericial probiotics. Out of the total 25 farms surveyed 44 percent were using water probiotics and 44 percent were using feed probiotics and 12 percent were using soil probiotics (Fig.1). Water probiotics were applied either directly or after fermentation with joggery and were using from the beginning of culture and feed probiotics were applied along with the feed using a

binder (either egg or cod liver oil). Soil probiotics were applied along with sand and/or fermentation with joggery from 15 days of culture. The results pertained to shrimp growers (35%) of the surveyed farms showed that they were adopted to applying the different types of probiotics (such as water, feed and soil) in the cultured water, after fermentation with joggery and applying once in 15 days, whereas 65 percent of the respondents were applying the probiotics directly in the water without fermentation.This may be as per the instruction manual of the manufacturer of the particular probiotics. The results pertained to economical benefits showed that cost of cultivation increased to 20-40 percent and farmers (100%) attributed the increase to the usage of probiotics in their shrimp culture practices. All the respondents were yielding 1.5 ton of shrimp per hectare. Details of different types of probiotic and their product name, ingredients and cost of probiotics were depicted in Tab. 2.

The results showed that there were about eight types of probiotics had been in practice of shrimp culture in the study area. Majority of the shrimp grower were adapted to using feed probiotics (44%), water probiotics (44%), and only 12 percent of the shrimp growers were uusing soil probiotics. The correlation analysis between the yield and type of probiotics revealed that water probiotics had contributed major share in the shrimp production, followed by feed and soil probiotics (Tab.3). The cost-benefit analysis showed that water probiotics had contributed to increment of cost of production as well as yield followed by feed and soil probiotics. Majority (100%) of the respondents had opined that usage of probiotics during the early stage of grow-out culture (during initial 50 days of stocking in grow-out pond) had contributed remarkable growth of shrimp.

Table.2. List of probiotic (with their active ingredients labeled) products being used by shrimp farmers in Guntur district, Andhra Pradesh

Probiotic brand name	**Active ingredients / Organisms (as per label)**	**Cost (Rs /Kg)**	**Type of Probiotic**
Pro-B Active A	Culture /viable spores comprising of *Cellulomonas Spp., Bacillus spp., Nitrasomonas spp., Nitrobacter spp., and Yeast, Xanthophyllomycease spp.,* Enzymes (Protease,cellulose,Pectinase, Hemicellulose)	2300/Kg	Water
Avant-Bact	MOS (Mannan Oligo Saccharides), *Pediococcus acidilactici* MA 18/5m	1090/Kg	Feed
Avant-proW	*Bacillus subtilis* Rosell-179 & *Pediococcus acidilactici* MA 18/5m	2790/Kg	Water
Black solve	*Bacillus spp., Nitrasomonas spp., Nitrobacter spp., Rhodococcus spp., Cellulomonas spp., Psedomonas spp., Lactobacillus spp., Aerobacter,Aspergillus niger, Aspergillus oryazea.*	729/kg	Water
Bio cult	----	120/kg	Soil
Prob	*Bacillus spp., Nitrasomonas spp., Nitrobacter spp.,*	1458/kg	Feed

solve	*Rhodococcus spp., Cellulomonas spp., Psedomonas spp., Lactobacillus spp., Aerobacter,Aspergillus niger,Aspergillus oryazea.*		
Pond solve	*Nitrasomonas spp., Nitrobacter spp., Rhodobacter* Enzymes (protease, lipase, amylase, and surfactants).	1458/kg	Water
Micro - PS	*Rhodococcus,Rhodobacter,Nitrasomonas,Nitrobacter & Thiobacillus*	165/ lit	Water

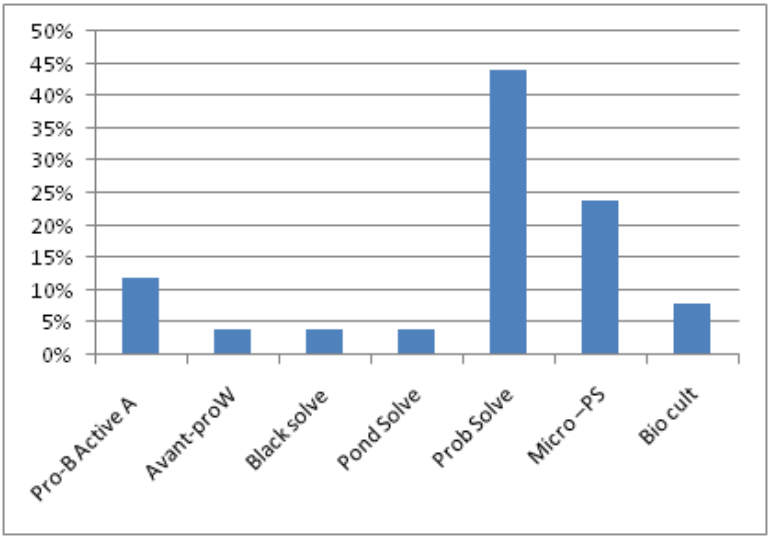

Fig.1. Percentage usage of different commercial Probiotics

Table 3. Expenditure pattern- percentage share of probiotics in shrimp farming

Total Expenditure/ crop (Rs)	Percentage of Farmers	Percentage share of Probiotics
<100000	16	10
100000-300000	16	6.6
300000-500000	36	6.25
>500000	32	4

Table 4. Details of benefits of probiotic usage

S.No	Reduction of chemicals usage	Improvement aspects
1	Disinfectants	Survivability
2	Sanitizers	Optimal growth
3	Antibiotics	Cost of average production
4	Reduction of water exchange	Good water quality
5	Others	Disease resistant's

The shrimp growers witnessed the benefits of usage of probiotics in terms of reduction of water exchange, maintenance of optimal water quality parameters and better survivability (Tab.4). All (100%) the surveyed respondents were ignorant about the information pertained to the bacterial strain present in the probiotic which they were practicing. All (100%) of the surveyed respondents were experiencing the constraints related to increment of inputs costs, lower production rates etc.

Discussion

The usage of probiotics of any kind had significant positive impact on shrimp culture practices. The present study also confirmed the beneficial aspects of probiotic application. The results are agreeing with the studies of Li Zhoujia. *et al.*,(1997), Ruangpan (1991), Boyd (1998) who had conducted similar studies and reported positive results of probiotic usage irrespective of type of probiotic. It seems, the method of application of probiotic, which has been practicing more than a decade, yielded positive results. Some of the sampled respondents adapted to using the method of fermentation of 24 hours prior to application of water probiotic using joggery, as per the specific probiotic manufacturer's instructions.. This method has showed better results compared to normal method.

The usage of probiotics in the shrimp culture practices had fetched increment of cost of production. This could be due to the variation of cost amongst the different types of probiotics. From the present study, out of 8 commercial probiotics, water probiotics were offerd more price (average Rs. 1285/ kg), followed by feed (average Rs. 1274/ kg) and soil probiotic (average Rs.120/kg). The variations of probiotic prices between different commercial probiotic products resulted in increment of cost of production. It could be better to analyse the probiotic strain present on the label and the requirement of probiotic strain by the shrimp grow-out pond. The cost of cultivation could be reduced by using the scientific method of assessment of grow-out pond for the requirement of probiotic.

The present case study concludes that usage of probiotic would improve the production yield as well as reduce the usage of chemicals. But it is essential to reduce the unnecessary use of unwanted bacterial strains which could reduce the cost of cultivation.

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