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Impact of probiotics on shrimp culture practices : A case study

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ABSTRACT

A study was conducted to evaluate the impact of use of probiotics in shrimp farming. The study was carried out during 2011 in three mandals (talukas) viz., Pitlavani Palem, Nizampatnam and Karlapalem of Guntur District in Andhra Pradesh. The results of the study revealed that all the shrimp farmers used a variety of commercial probiotics comprising water, feed and soil probiotics. Out of the total farmers surveyed, 44% each used water probiotics while and feed probiotics while 12% of the farmers used soil probiotics. The results showed correlation between use of probiotics and shrimp growth and also indicated that the use of probiotics increased benefits in terms of shrimp survival, reduction in total cost of production, reduction of disease prevalence and improved water quality as well as pond bottom conditions.

Keywords: Impact study, Probiotics, Shrimp farming

Shrimp aquaculture plays a pivotal role in the Indian economy. The potential area available for brackishwater aquaculture in Andhra Pradesh accounts for 12.6% of the total potential area available in the country (1.2 million ha), out of which 56.6% has been developed for shrimp farming (Nagothu *et al.*, 2012). Currently, 70% of shrimp production in the country is from Andhra Pradesh (Anon., 2013). The yield from shrimp production started declining since 1992 due to disease outbreak and this has led to indiscriminate use of antibiotics and therapeutic agents by shrimp farmers which subsequently created serious threats to the environment (Karunasagar *et al.*, 1994). The probiotic approach came as an alternative to these problems with immense potential in aquaculture (Gatesoup, 1999; Mishra *et al.*, 2001). These probiotic preparations include single species of bacteria or yeast or a combination of several species of both these components (Moriarity, 1998). Suhendra *et al.* (1997) reported that the commercial probiotics resulted in reduced incidence of *Vibrio* spp. as well as viral outbreaks

and helped to improve environmental conditions in the pond with increased growth and production of shrimp. Andhra Pradesh is the leading state in India for aquaculture activities, where most of the farmers use both water and feed probiotics. 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.

The study was conducted during the first crop of 2011, in three Mandals (Taluka's) viz., Pitlavani Palem, Nizampatnam and Karlapalem of Guntur District in Andhra Pradesh. For the study, the information available with the Fishery Development Office, Guntur was used for selection of manadals, villages and respondents. The selection of study area and respondents was based on purposive and simple random sampling techniques (Table 1). The selected respondents were the leading shrimp growers in terms of economic returns and who adopted use of probiotics for several years. The interview was conducted with the aid of well structured

Table 1. Selection of Mandals in Guntur District

Name of the Mandal	Total no. of shrimp farmers and area	No. of shrimp farmers selected (based on intensity and use of probiotics in large scale)
Pittalavani palem	242 ; 300 ha	8
Nizampatnam	226; 200 ha	7
Karlapalem	249; 323 ha	10

and pre-tested questionnaire containing 32 items (Table 2). The collected data was statistically analysed using SPSS.17.0 version.

All the respondents practised modified semi-intensive shrimp culture and *Penaeus monodon* was the only species cultured during the study period. The seed was procured from a nearby private hatchery. The stocking density varied from 8 - 10 m². Majority of the respondents were using water from a nearby creek and few of them used ground water. All the farmers used grower feeds and commercial probiotics available in the market. Out of the total 25 farms surveyed, 44% each used water and feed probiotics and the rest 12% used soil probiotics (Fig.1). Water probiotics were applied from the beginning of culture, either directly or after fermentation with jaggery. Feed probiotics were applied along with the feed using a binder (either egg or cod liver oil). Soil probiotics were used along with sand and/or after fermentation with jaggery from 15 days of culture. Thirty five percentage of the farmers of the surveyed farms applied the different types of probiotics (such as water, feed and soil) once in 15 days, after fermentation with jaggery, while 65% of the respondents applied probiotics directly in water without fermentation, as per the instruction manual of the manufacturer of the particular probiotics. Details of different types of probiotics and their product name, ingredients and cost are summarised in Table 3.

The results showed that there were about eight types of probiotics being used in shrimp culture in the study area. The correlation analysis between the yield and type of probiotics revealed that water probiotics had contributed

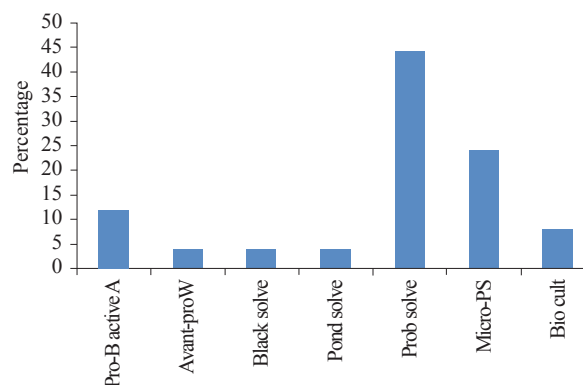


Fig. 1. Percentage use of different commercial probiotics by shrimp farmers during the study period

major share in the shrimp production, followed by feed and soil probiotics (Table 3). The results pertaining to economic benefits showed that cost of cultivation increased to 20-40% and all the farmers attributed this increase in the use of probiotics. All the respondents got a minimum of 1.5 t of shrimp per hectare. The cost-benefit analysis showed that among the three types of probiotics used, water probiotics contributed the highest towards increase in cost of production as well as yield, followed by feed and soil probiotics. Majority of the respondents opined that the use of probiotics during the early stages of grow-out culture (during initial 50 days of stocking in grow-out pond) contributed to remarkable growth of shrimps. The shrimp growers witnessed the benefits of use of probiotics in terms of reduction of water exchange, maintenance of optimal water quality parameters and better survival (Table 4).

Table 2. Variables used for data collection on impact of probiotic use 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	Using/not using probiotics
2	Address	12	Tenure status	21	Type
	i) Father's name	13	Soil type	22	Source
	ii) Village	14	Water source	23	Brand name
	iii) Mandal	15	Type of culture	24	Cost (₹ per kg)
	iv) District	16	Stocking density (per m ²)	25	Total expenditure on probiotics per crop (₹ per kg)
3	Age	17	Total period of culture	26	Benefits of using probiotics
4	Sex	18	Source of seed	27	Chemicals used
5	Educational qualification	19	Source of technical advice	28	Method of application
6	Family size			29	Storage period of probiotics
7	Major occupation			30	Whether satisfied with the benefits of probiotics? If yes, list out benefits such as controlling diseases, /increase immunity/increase of production /improvement in all aspects
8	Aquaculture experience			31	Total expenditure per crop (₹)
9	Annual income			32	Frequency of use of probiotics
10	Social status				

Table 3. List of probiotic products used by shrimp farmers in Guntur District, Andhra Pradesh

Probiotic brand name	Active ingredients/Organisms (as per label)	Cost (₹ per kg)	Type of probiotic
Pro-B Active A	Culture/viable spores comprising of <i>Cellulomonas</i> spp., <i>Bacillus</i> spp., <i>Nitrasomonas</i> spp., <i>Nitrobacter</i> spp., and Yeast, <i>Xanthophyllomyces</i> spp., Enzymes (protease, cellulase, Pectinase, Hemicellulase)	2300/-	Water
Avant-Bact	MOS (Mannan oligo saccharides), <i>Pediococcus acidilactici</i> MA 18/5 m	1090/-	Feed
Avant-proW	<i>Bacillus subtilis</i> Rosell-179 and <i>Pediococcus acidilactici</i> MA 18/5m	2790/-	Water
Black solve	<i>Bacillus</i> spp., <i>Nitrasomonas</i> spp., <i>Nitrobacter</i> spp., <i>Rhodococcus</i> spp., <i>Cellulomonas</i> spp., <i>Pseudomonas</i> spp., <i>Lactobacillus</i> spp., <i>Aerobacter</i> , <i>Aspergillus niger</i> , <i>Aspergillus oryzae</i>	729/-	Water
Bio cult	-	120	Soil
Prob solve	<i>Bacillus</i> spp., <i>Nitrasomonas</i> spp., <i>Nitrobacter</i> spp., <i>Rhodococcus</i> spp., <i>Cellulomonas</i> spp., <i>Pseudomonas</i> spp., <i>Lactobacillus</i> spp., <i>Aerobacter</i> , <i>Aspergillus niger</i> , <i>Aspergillus oryzae</i>	1458/-	Feed
Pond solve	<i>Nitrasomonas</i> spp., <i>Nitrobacter</i> spp., <i>Rhodobacter</i> , Enzymes (protease, lipase, amylase) and surfactants	1458/-	Water
Micro -PS	<i>Rhodococcus</i> , <i>Rhodobacter</i> , <i>Nitrasomonas</i> , <i>Nitrobacter</i> and <i>Thiobacillus</i>	165/- per litre	Water

The present study confirmed the beneficial aspects of probiotic application with the use of probiotics of any kind leading to significant positive impact on shrimp culture. The results are in agreement with the studies of Li Zhoujia. *et al.* (1997), Ruangpan (1991) and Boyd (1998) who conducted similar studies and reported positive results of probiotic usage, irrespective of the type of probiotic. Some of the shrimp growers (respondents) were adapted to use the method of fermentation for 24 h using jaggery prior to application of water probiotics, as per the specific manufacturer's instructions, which showed better results. In the present study, out of the 8 commercial probiotics, cost of water probiotics was the highest (average ₹1,285/- per kg), followed by feed (average ₹1,274/- per kg) and soil probiotic (average ₹120/- per kg). However, the cost of cultivation was brought down by adopting the scientific method of farming with the use of probiotics. The results of the present study concluded that the use of probiotics can help to improve the yield as well as to reduce the usage of chemicals in shrimp farming.

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Table 4. Expenditure pattern - percentage share of probiotics in shrimp farming

Total expenditure per crop (₹)	Percentage of farmers	Percentage share of probiotics
<100000	16	10
100000-300000	16	6.6
300000-500000	36	6.25
>500000	32	4

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