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Adoption of recommended farming practices by shrimp farmers in north Konkan region of Maharashtra, India

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Abstract

Adoption of scientific practices in shrimp farming is related to psychological, social, economic, physical and technical aspects of the farmers, which influence the overall development of farmers. This study was undertaken in North Konkan region of Maharashtra to find the extent of adoption of improved farming practices and constraints faced by the shrimp farmers while adopting improved farming practices. A total of 53 shrimp farms were randomly selected for this study. The data were collected by employing pre-tested interview schedule. Descriptive score sheets for each of the recommended practice was constructed and adoption of improved aquaculture practices was classified in three categories. The results revealed quite high extent of adoption for some of the practices such as farm design and construction (81.13%), pond preparation pre and post stocking management (77.36%), site selection (69.81%), etc, while medium adoption (50.94%) was found in health management category among the shrimp farmers.

Keywords: Adoption, aquaculture practices, shrimp farmers, north Konkan

Introduction

Shrimp culture is practiced in India since immemorial time. It has been practiced as *Bheries* in West Bengal, *Pokkali* in Kerala, *Gheries* in Orisa, *Kharlands* in Karnataka, and *Ghajani* in Goa (Rawool, 2005) [20]. Till 2009, shrimp culture in India was synonymous with the monoculture of tiger shrimp, *Penaeus monodon*. Coastal aquaculture in India was predominantly focussed on tiger shrimp farming (*P. monodon*) but was inflicted with disease outbreaks leading to the introduction of SPF pacific white shrimp (*Litopenaeus vannamei*) in the year 2009 (Jayraman, 2017).

India is the second largest producer of cultured shrimps in the world (Babu *et al.*, 2014). About 190,000 ha brackish water areas have been developed for shrimp culture in country. The total brackish water area available in Maharashtra is 52,001 ha, of which only 10,400 ha was reported suitable for farming. About 265 numbers of *L. vannamei* farms were registered under Coastal Aquaculture Authority in Maharashtra till the year 2016. However, total culture area developed under brackishwater aquaculture was 1,539 ha (Anon, 2016) [3].

Brackish water shrimp farming is getting more attention because of high profitability of this business, nevertheless it is necessary to adopt improved aquaculture practices so as to get eco-friendly and sustainable development of aquaculture sector. Various research institutions have developed various techniques to enhance per/ha production, but it is necessary to assess whether the existing farmers adopt these techniques or not. If not, what are the constraints which inhibit the adoption of these improved techniques? Hitherto, adoption studies on shrimp farming practices were not studied by any researcher in North Konkan Region of India. Therefore, the present study was attempted to assess the extent of adoption of improved techniques by the farmers of the North Konkan Region in order to obtain sustainable yield in shrimp farming.

Material and Methods

In North Konkan Region, a total of 191 shrimp farms were registered. Data were collected from 53 shrimp farmers by adopting random sampling method along the North Konkan Region, of which 21 were from Raigad and 32 were from Palghar district.

The pre-tested interview schedule was used to collect primary data to fulfill the objectives of the present study. The interview schedule was divided in three sections i.e. general information, technical information and constraints faced by the farmers as per Rawool (2005) [20]. The general information regarding socio-personal, situational, socio psychological and

communicational variables of farmers was studied. Under technical information, recommendations about brackish water shrimp farming given by various institutes like, Central Institute of Brackish-water Aquaculture (Kumaran, 2016) [11] and Coastal Aquaculture Authority (Anon, 2012) [1] etc. were used as baseline information. The questions were formulated on the basis of these recommended practices and were categorized into subsections *viz.* site selection, farm design and construction, pond preparation and pre-stocking management, water quality management, feed management and health management. The score was given on the basis of response of respondent for a particular practice as well as on the basis of visual observations made during farm visit. Descriptive score sheet for each of the recommended practice was constructed as per Kumaran *et al.* (2008) [8] giving zero, one and two scores for none, partial and complete answer. Scores were also given according to visual observations during interviewing and response from the farmers. Adoption quotient was calculated separately for each farmer by formula given by Sengupta (1967) [23].

$$\text{Adoption quotient} = \frac{\text{Total score obtained by farmers}}{\text{Maximum score}} \times 100$$

It is the ratio of total score obtained by farmer to maximum score multiplied by 100. Total score obtained by farmer was calculated by adding scores obtained by farmer for each of the practice, whereas, the maximum score was the score which can be obtained by a farmer if he adopts all the recommended practices.

On the basis of adoption quotient the farmers were classified into following categories as per Sengupta (1967) [23].

1. High adopters (66.67 to 100%)
2. Medium adopters (33.34 to 66.66%)
3. Low adopters (0 to 33.33%)

Constraints were analysed by using the percentage analysis (Shrinath, 1996; Nayak *et al.*, 2001) [24]. The information sources utilized by the farmers and constraints faced by them were assessed through simple percentage analysis and were ranked in order of their importance (Swathilekshmi *et al.* 2008) [26]. Constraints were tabulated as per the frequency of the farmers facing problems while adopting the recommended practices.

Results and Discussions

Personal profile of the farmers

In the present study, older age group (46-52 years) was found dominated (30.90%), while younger age group (18-24 years) farmers involvement was very poor *i.e.* 1.89%. The age distribution of all farmers was negatively skewed with a value of -0.03. Similar results were reported by Ponnusamy (2004), while studying the shrimp farming in Nagapattinam and Tiruvallur district in Tamil Nadu. Dominance of older age group in shrimp farming was also reported by Lekshmi *et al.* (2005) [14] in Nallore district of Andhra Pradesh and Nagapattinam district of Tamil Nadu. Dominance of young age group (less than 35 years) in shrimp farming was observed by Mohite (2007) and Rawool (2005) [20]. Chaudhari (2007) [4] reported that 69.44% shrimp farmers were middle aged farmers (30-50 years). The results of present study showed that old age group farmers were more involved in shrimp farming than the young age farmers and this was attributed to the fact that majority of farmers attained formal education.

It was observed that cent percent farmers had taken formal education, of which, 41.51% had secondary education, 15.09% had taken higher secondary education, 32.07% shrimp farmers were graduates, 5.66% of farmers were professional degree holders (B.F.Sc) and 1.89% each of shrimp farmers completed their primary, diploma and post-graduate education. Results recorded during the present study are in accordance with the results reported by Gawde (2006) [5], Chaudhari (2007) [4], Sathe (2008) [22], Randive (2008) [19], Sahu *et al.* (2014) [21], Srinivas and Vankatraylu (2016) [25], Kumar *et al.* (2016) [7] as well as Kumaran *et al.* (2017) [12]. It can be concluded that the quality of enterprise was related to educational status of the shrimp farmers. It could also infer that such of the educated persons who are capable of taking risk in order to achieve higher returns might have ventured into this field. It means formal education was prime necessity in shrimp farming.

In all, total 64.15% farmers were with five or less than five members in their family and about 73.58% shrimp farmers were living in nuclear family. Sahu *et al.* (2014) [21] reported that 66.67% farmers were with more than five members in Puri district. Lekshmi *et al.* (2005) [14] reported 57.50% farmers with less than five members in their family. Similarly, Kumar *et al.* (2016) [7] also reported that 60% of farmers with less than five members of family and Rawool (2005) [20] claimed 64.58% of farmers with less than five members in their family. It indicated that the family planning campaign of Indian government played a role in maintaining the smaller family.

Chaudhari (2007) [4] observed that 53.7% of shrimp farmers were belonged to nuclear type of family in some district of Konkan coast, Maharashtra. Dominance of joint type of family in shrimp farmers was observed by Sahu *et al.* (2014) [21] in Odisha. Lekshmi *et al.* (2005) [14] also reported that 47.50% farmers were living in joint type of family and 52.50% farmers were in nuclear family. Similar results were also reported by Rawool (2005) [20] in Thane district of Maharashtra wherein, 62.50% of farmers belonged to divided family. On contrast, Mohite (2007) observed that 52.63% of farmers belonged to joint family. The results of the present study that the shrimp farmers in North Konkan Region were mostly under nuclear type of family due to the fact that nuclear family has become more common and predominant in present day society.

Majority of farmers (60.38%) were having experience up to three years in shrimp farming, while 16.98% of farmers had experience of 6-9 years. About 1.89% of farmers were found to have 12-15, 15-18, 18-21 and above 21 years farming experience. Result obtained during present study are in accordance with the results reported by Randive (2008) [19], Kumar *et al.* (2016) [7], Sathe (2008) [22], Mohite (2007) and Rawool (2005) [20]. These all studies indicated that most of respondents were involved in shrimp farming with less than five years of farming experience and can be categorized as new entrants in shrimp farming activity. The profitable nature of this venture would have attracted a large number of farmers in the recent past.

A total of 71.70% farmers were sole proprietor, while 28.30% farmers were farming with the partners, which indicated majority of sole proprietorship. Similar results were reported by Ponnusamy *et al.* (2004), Sahu *et al.* (2014) [21], Rawool (2005), Gawde (2006) [5], Mohite (2007), Sathe (2008) [22], Kumar *et al.* (2016) [7] and Chaudhari (2007) [4] revealed that majority of farmers were owner by sole proprietorship. The shrimp farmers requires high investment and is risk prone

enterprise, these may be the reasons for undertaken shrimp farming as ownership enterprise instead of undertaking the venture in partnership. The maximum (43.40%) of farmers had less than 2 hectares of farms, while 20.75% of farmers were with 4-6 ha of farm size and 11.32% of farmers were with 2-4 ha of farm size. Rest of the (24.54%) of the farmers had more than 6 ha of farm size. Kumaran *et al.* (2003) [10] observed 80% farmers having less than 4 ha area, whereas Ponnusamy *et al.* (2004) found 86% of farmers having less than 5 ha area. In North Konkan region, most of the farmers were new entrants and immediate investment for big farm was not possible for them. This could be main reason for farmers opting small size farms. So, it is very clear that average farm size was much less and farmers have initiated their farming practices by opting small size farm rather than going to bigger size due to initial high investment, recurring expenditure and technical management difficulties.

Adoption level for different aquaculture practices

The results related to the level of adoption with respect to various practices followed by shrimp farming community of North Konkan region revealed that a total of 69.81% of shrimp farmers had moderately adopted, while about 15.09% each of shrimp farmers were found with low and high adoption with respect to site selection recommended parameters. The awareness of shrimp farmers regarding selection of site for shrimp farming was very less and this clearly reflected in adoption of site selection parameters (15.09%). Kumaran *et al.* (2003) [10] in Nagapattinam district of Tamil Nadu documented that 57% farmers had adopted the practices related to site selection. Mohite (2007) observed high adoption (39.49%) and medium adoption (28.94%) in site selection category. The reason for medium adoption may be unavailability of soil and water testing laboratory in nearby areas or as farmers were not in position to purchase due to high cost of soil and water parameter testing kit.

Total of 81.13% of shrimp farmers had medially adopted farm design and construction recommended parameter, 11.32% of shrimp farmers had low adoption, while only 7.55% of farmers were found in high adoption category. The practice which was medially adopted by shrimp farmer was list of bio-security measures and awareness about biosecurity measures. Gawde (2004) observed medium adoption of farm design and construction practices *viz.*, orientation of pond as per wind direction and slope of pond bottom for proper drainage of pond water. Kumaran and Kalaimani (2005) revealed that 56.67% farmers adopted the site selection and pond construction practices. Sahu *et al.* (2014) [21] observed that crab fencing (91.67%) and bird fencing (80%) in Balsore district of Odisha. The reason for low percentage of high adoption of recommended practices regarding farm design and pond construction may be due to unavailability of technical manpower for pond construction or unawareness of the technique at the time of construction of farm.

Among the pond preparation and pre-stocking management practices, crack drying of pond bottom, colour of pond water before stocking of seed, application of lime were major practices adopted by the shrimp farmers. In the present study also the pond preparation practices were followed by all farmers. A total of 20.75% of shrimp farmers had high adoption regarding pond preparation, pre and post stocking management, 77.36% of shrimp farmers had medium adoption, while only 1.89% of farmers were found with low adoption. Similar result was also documented by Kumaran *et al.* (2003) [10] in his study and reported that cent percent

farmers followed pond preparation practices. Lekshmi *et al.* (2005) [14] also observed that 90% farmers adopted the pond bottom sterilization practice with the help of lime. In contrast, Sathe (2008) [22] reported 72.34% respondents in the categories of moderately high and medium adoption level (26.60%) in pre-stocking management. The reason for medium adoption of farmers in pond preparation was due to unawareness about bloom formation and its low importance in stabilization of water quality.

Farmers have understood that the good water quality leads to good growth, better production and better benefits. This clearly reflected in adoption of water quality management practices by farmers of North Konkan Region. The results revealed that a total of 18.87% of shrimp farmers had high adoption, about 81.13% of shrimp farmers had medium adoption, while none of the farmer was found in low adoption category in water quality management. The findings were similar to Shrinath (1996) [24] and Kumaran *et al.* (2003) [10] reported 80% adoption in water quality management practices by shrimp farmers of Nagapattinam district of Tamil Nadu, Gawde (2004) and Mohite (2007) observed medium adoption in water quality management practices in South Konkan region and Raigad district of Maharashtra. In contrast to the present study, Swathilekshmi *et al.* (2011) reported that 69.0% of shrimp farmers adopted water quality management. The unavailability of water parameter testing laboratory was the main reason for high percentage of medium adoption in water quality management.

A total of 66.04% of shrimp farmers had medium adoption and 32.08% of total shrimp farmers had high adoption regarding feed management, while only 1.89% of farmer found under low adoption category in feed management. Every farmer in North Konkan region adopted the practice of monitoring feed consumption. Expected FCR for *L. vannamei* farms and maintenance of optimum feeding frequency were also the highly adopted practices. Kumaran *et al.* (2003) [10] did not find high adoption in the practice of estimation of feed quantity as per biomass. However, Lekshmi *et al.* (2005) [14], Rawool (2005) [20] and Lekshmi *et al.* (2011) found more than 80% adoption quotient in feed management practices. The reason for medium adoption regarding to feed management was due to use of feed probiotics suggested by employs and feed technicians as an alternative of antibiotics.

The major risk nowadays in shrimp farming is occurrence of white spot disease. Every farmer attempts to avoid this disease. PCR tested *i.e.* certified seed is the only option available with farmer to avoid vertical transmission of the disease. In all, total 50.94% of shrimp farmers had high adoption, 49.06% of shrimp farmers had medium adoption, while none of the farmer was observed in low adoption category in health management. Lekshmi *et al.* (2011) documented 88.0% of adoption quotient in health management category.

They estimated 90% adoption quotient for practice acclimatization and stocking of seed. Kumaran *et al.* (2008) [8] observed that 51.95% farmers adopted disease management in Tamil Nadu, India. Most of the farmers did not observe the actual acclimatisation and PCR technique due to unawareness. This is the main reason for medium adoption regarding to health management practices in North Konkan region of Maharashtra.

The results showed that the shrimp farmers of the North Konkan region had medium adoption about the shrimp farming practices (88.68%). Only six farmers were found in high adoption category (11.32%) and none of the farmer

could be categorized as having low adoption about improved shrimp farming practices. The finding were similar to Sahu *et al.* (2014) [21], where he found 70% of farmers with medium adoption level in shrimp farming. Results obtained during the present study are in accordance with the results reported by Kumaran *et al.* (2003) [10], Rawool (2005) [20], Gawde (2006) [5], Mohite (2007), Goswami *et al.* (2010) [6], Pounraj and Rathakrishnan (2011), Swathilekshmi *et al.* (2013) [27] and Kumar *et al.* (2016) [7]. The reason for medium adoption may be due to lack of cooperation among farmers.

Constraints faced by farmers

Several constraints were faced by the farmers during shrimp farming. These constraints were categorised into socio-personal, technical, financial, marketing and environmental. According to farmers, major problem faced by them was lack of disease diagnosis lab (90.57%). Nayak *et al.* (2001) have expressed the same level of severity due to lack of disease diagnosis lab in Balasore district of Orissa. Swathilekshmi *et al.* (2008) [26] observed that disease incident (81.67%) and poor quality of seed (68.33%) were major constraint faced by shrimp farmers in shrimp culture.

Srinivas and Vankatraylu (2016) [25] observed that disease problem (66.67%) as major constraint for shrimp farmers and lack of government support was the least faced problem by shrimp farmers in shrimp culture of west Godavari district of Andhra Pradesh, India. Rawool (2005) [20] and Mohite (2007) reported that lack of remedial measures for white spot disease was the major constraints faced by 97.91 and 92.11% of shrimp farmers of Thane and Raigad districts, respectively. Unawareness about new scientific techniques of shrimp farming is the main reason behind these major constraints.

Non availability of credit and insurance schemes, self-finance and lack of support price system were also the major problem to the farmers because of non-availability of finance at affordable rate of interest and lack of knowledge about financial provisions. Similar constraints were also documented by Srinath (1996) in Ernakulum district of Kerala and Nayak *et al.* (2001) in Balasore district of Orissa. It was found that farmers of North Konkan region were facing the problem of improper co-ordination among the research institute and extension department.

There should be proper co-ordination among various institutes to put extension effort in proper direction. Apart from that high rate of seed was also major problem of shrimp farmers. Swathilekshmi *et al.* (2008) [26] found that lack of technical support (28.33%), incident of cyclone (20.00%) and losses due to theft (16.67%) were not major problem for shrimp farmers. Sahu *et al.* (2014) [21] found that price fluctuation (80%), lack of electricity 76.66% and high cost of input materials were major constraints for shrimp farmers in Puri district of Odisha in shrimp farming. The reason for these constraints may be due to less communication with successful farmers, lack of technical guidance, lack of communications with fisheries institutes and less experience in shrimp farming.

Conclusion

The shrimp farmers of this region have learnt lessons from the mistakes of earlier shrimp farmers who have faced heavy losses due to outbreak of WSSV disease in North Konkan region of Maharashtra. The shrimp farmers from the North Konkan region showed medium adoption of most of the improved techniques.

If farmers adopt the technical information, then surely they will get good aquaculture production from North Konkan Region for next many years and it would help to improve socio-economic status of farmers operating along North Konkan region with increased per ha production.

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