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Training Needs of Extension Personnel in Pacific White Shrimp *(Litopenaeus vannamei)* Farming

Mariappan Kumaran*, Jangam Ashok Kumar, Periyakaruppan Anand and Johnson Paul
ICAR-Central Institute of Brackishwater Aquaculture, 75, Santhome High Road, Chennai - 600 028, India

Abstract

Assessment of training needs and subsequent capacity enhancement are important for the efficient performance of extension workers. An investigation was conducted among the field level extension workers to identify the gaps in their technical skills pertaining to farming of *Litopenaeus vannamei* shrimp. The study indicated that extension personnel lacked skills in on-farm disease diagnosis and management, water quality management, shrimp seed selection, pre-stocking water culture and biofloc technology concerned with *L. vannamei* shrimp farming. Study also indicated that differences in the socio-personal attributes of the respondents did not influence the training requirements. It was suggested that an on-farm experiential training programme using 'group learning mode' with appropriate training curriculum needs to be arranged at different locations covering the coastal states. Further, in the absence of strong research-extension linkage, ICT aided tools like expert system, mobile application and a knowledge portal on *L. vannamei* farming need to be developed, validated and uploaded by ICAR-CIBA for the capacity enhancement of field level extension workers.

Keywords: Training needs assessment, *L. vannamei* shrimp aquaculture, extension workers, experiential learning, training strategy

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* *E-mail: mkumaran@ciba.res.in*

Introduction

Pacific white shrimp (*L. vannamei)* is a extensively farmed penaeid shrimp species globally due to the availability of Specific Pathogen Free (SPF) seed, amenable for different salinity regimes and high stocking densities. Government of India has introduced *L. vannamei* after conducting a detailed risk assessment inquiry to revive the shrimp farming in the country which was in the doldrums due to crop failures and abandonments caused by diseases. Shrimp farmers have been showing keen interest in *L. vannamei* farming and it is being farmed in wide range of salinities and at different densities. The *L. vannamei* farming area has increased from 283 ha in 2009-10 to 50 241 ha and the production has also grown from 1 731 to 353 413 metric t in 2014-15 (MPEDA, 2015). Andhra Pradesh (AP) topped the list with 87% of the total area and 84% of the total farmed shrimp production in the country (Fig. 1). Tamil Nadu (TN) state with an area of 5 087 ha (9%) and a production of 26 281 t (10%) ranked second. The national average productivity is 4.4 t ha^{-1}. However, Gujarat state ranked first in case of the productivity per ha with an average production of 9 t ha^{-1} due to their superior infrastructure, biosecurity and adoption of better management practices. The productivity in AP was 4.2 t ha^{-1} and in TN was 5.2 t ha^{-1}.

Introduction of *L. vannamei* has revived shrimp aquaculture and many abandoned farms were reclaimed and new farmers entered into farming. However, it is learned from field experiences that *L. vannamei* farming too has several risks due to either greediness of the hatchery operators and farmers and poor farm management. Therefore, unless the production risks are identified, ably prevented and managed efficiently at the initial stages, the sustainability of *L. vannamei* farming will be at stake. This requires creating awareness and capacity building among farmers. Shrimp farmers mostly depend on field technicians of feed companies and independent consultants for technical support and management counselling (Kumaran et al., 2007; 2012). The Department of Fisheries, the nodal agency to provide extension service, is

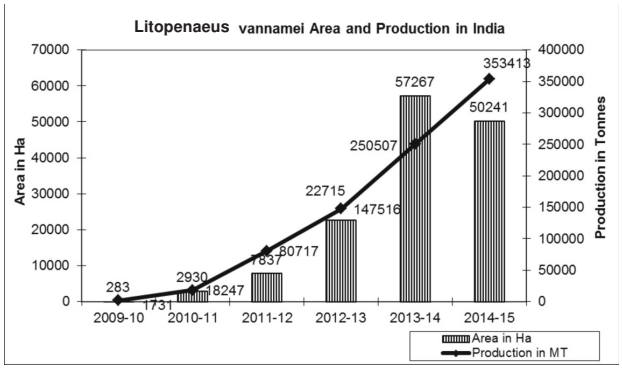

Fig. 1. *L. vannamei* shrimp area and production in India (2009-15)

constrained with limited staff, lack of extension orientation and limited budget which confined their role to regulation and welfare works. Hence, the extension service has been largely provided by the private sector as far as shrimp farming is concerned.

Success in extension services largely depends on skills of extension workers (Kashem et al., 2001; Ahamad, 2002). Continuous updation of scientific and extension skills are necessary and an opportunity for the same is absolutely essential. However, due to limited research-extension linkage mechanism in the fisheries sector, routine capacity building of extension workers by the subject matter specialists and getting feedback from the field is lacking. Therefore, identification of gaps in skills in the form of training needs and subsequent capacity building is the best option to bridge this gap. Yondeowei & Kwarteng (2006) defined training need as the difference between the required level of individual competence and the present level of competence. Allo (2001) pointed out that one of the main factors limiting the development of effective training programmes for agricultural professionals in developing countries is the inadequacy of information on their training needs. Therefore, if extension workers are to improve their on-the-job effectiveness, they must receive continuous in-service training relevant to their training needs (Tladi, 2004; Chizari et al., 2006). Deficient competencies can be expected when the in-service or on-the-job training is not given or when it is weak (Olajide-Taiwo & Akinsorotan, 2006). In this context, the present study was undertaken to identify the training needs of field level extension workers and to suggest a training strategy to undertake suitable capacity building programmes to bridge the gaps in skills.

Materials and Methods

The present study adopted the Borich Need Assessment Model (Borich, 1980) which relies on the extension agents' judgments about their own performances. To identify the skill gaps of extension workers in the *L. vannamei* shrimp farming, the subject matter was divided into 10 components *viz.*, pond preparation, primary productivity development, shrimp seed production, seed selection and stocking, feeding and feed management, water quality management, disease diagnosis and management, *L. vannamei* farming with periphyton and biofloc, principles of better management practices and regulatory guidelines. A dichotomous importance vs. competency three point continuum, from least important to most important and least proficient to most proficient was developed. A score of 1 on the scale signified the least important competency/least proficient and number 3 denoted the most important competency/most proficient. The field technicians of input companies and independent aqua farm consultants were the respondents of the study. A random sample of 60 field technicians working in the states of Andhra Pradesh and Tamil Nadu states were selected for primary data collection. Field extension workers were asked to give their self perceived responses on the identified 10 competencies for both importance and competency categories.

A Mean Weighted Discrepancy Score (MWDS) was calculated to describe the overall rankings for each competency. A discrepancy score was calculated for each individual on each competency by taking the importance rating minus the competency rating. A weighted discrepancy score was then calculated for each individual for each of the professional competency by multiplying the discrepancy score with the mean importance rating. A MWDS for each of the competencies was calculated by taking the sum of the weighted discrepancy scores and dividing by the number of observations. Using the MWDSs, all the 10 competencies were then ranked as suggested by Alibaygi & Zarafshani (2008). Data were collected by means of personal interview with respondents using a structured questionnaire. The data collected were analysed using the Statistical Package for the Social Sciences (version 17.0).

Results and Discussion

The personal attributes of the private extension personnel were studied to know their general

background and explore their probable influence on the subject under study. The results shown in Table 1 indicate that majority of the respondents (68%) were below 40 years of age and post graduates (65%) with Master's Degree in Zoology or Aquaculture. More than half of the respondents (57%) had 8 to 10 years of field experience in shrimp aquaculture. About 43% of the respondents had more than 10 years of field experience and were working with farmers providing day-to-day technical counselling to their client farmers. Majority of them had not attended any formal training on *L. vannamei* farming per se, however, they had attended seminars organized by their own company and other research and development institutions. The respondents had personal contact with client farms and 58% of the respondents visited their clients twice a week (58%) and 43% did it on a weekly basis. The respondents provided the farmers with the total package of practices of shrimp farming. The technicians gave their advice in writing based on their observation and assessment of pond water quality, animal behaviour, growth and duration of the culture. Besides regular farm visits, 57% of the respondents conducted group meetings for farmers by inviting researchers to educate the farmers on the do's and don'ts preferably before starting of the first crop. Other than these, 35% of respondents had conducted demonstrations on the new inputs or practice to convince the farming community. The respondents consulted aquaculture websites (77%), research teams of their company and research institutions (63%), fellow technicians (58%) and printed literature of the research institutions, development departments and popular magazines (40%) for their knowledge updation. The respondents revealed that they were constantly in touch with each other to clarify their doubts and sought the experience of the fellow technicians in dealing with particular pond management problem or availability of quality inputs. Majority of the respondents (63%) managed 20 to 40 farms with 120 – 300 ha of shrimp farming. More than 77% respondents had regular access to the internet and this finding indicates that these extension workers could be contacted online to communicate any technical information. Similarly 70% of them opined that mobile telephones were the better medium to convey information about farming and stated that the farmers regularly contact them through mobile phones. The respondents felt that mobile application (Mobile Apps) for various aspects of shrimp farming including disease diagnosis, application of inputs and calculations for feeding, biomass and other inputs need to be developed and made available for downloads through the Internet.

The training needs in the form of gaps in skills of field extension workers are presented in Fig. 2 and the order of their preference is given in Table 2.

Table 1. Personal attributes of extension workers

S.No	Attribute	Multiple responses (N=60)
1	Age	
	Below 40 years	68.00
	Above 40 years	32.00
2	Education	
	Post Graduation	65.00
	Graduation/Diploma	35.00
3	Experience	
	Up to 10 years	56.67
	Above 11 years	43.33
4	Training on *L. vannamei*	
	Attended	32.00
	Not attended	68.00
5	Frequency of contact	
	Weekly twice	58.33
	Once a week	42.67
6	Extension methodology	
	Farm visits	100.00
	Farmers group meetings	56.67
	Demonstration	35.00
7	Information source	
	Online websites	76.67
	Company R & D	63.33
	Fellow technicians	58.33
	Printed literature	40.00
8	Farms covered	
	Up to 20 farms	20.00
	21-40 farms	63.33
	Above 41 farms	16.67
9	Access to Internet	
	Frequency of access-daily	76.67
	Frequency of access-weekly	24.33
10	Preferred mode of contact	
	Mobile	70.00
	Group meeting/seminar	55.55
	e-mail	33.33

Among the 10 main practices of *L. vannamei* shrimp farming, the extension workers perceived that they had more gaps in skills related to disease diagnostics and water quality management. Disease is the major risk in *L. vannamei* farming and it needs to be prevented and managed efficiently (Arthur et al., 2009). There were disease outbreaks in *L. vannamei* at various stages and emerging diseases like slow growth, white gut disease were also reported with low survival and poor growth eventhough SPF shrimps was used for culture. Therefore, the respondents were interested to know more about disease diagnosis and management. The second important training need was water quality management. The CAA has permitted a maximum stocking density 60 PL m^{-2} with adequate infrastructure and biosecurity. However, due to the high market price, farmers stocked *L. vannamei* shrimp seeds in higher densities with or without adequate infrastructure and biosecurity measures. Optimum water quality parameters like Dissolved Oxygen, pH and pond bottom metabolites were difficult to maintain and manage which lead to mortalities and disease outbreaks. Further, due to huge densities and heavy dumping of inputs, aeration in tune with the pond biomass was very much essential. Knowledge about aeration requirement at different stages, aerator positioning and combination of aerators to be used was very essential for the field level extension workers. Further, *L. vannamei* was cultured in different salinities with water from different sources and each system required a different system of water quality management. Moreover, mineralization of rearing water especially in low saline waters for maintenance of osmo-ionic equilibrium of the *L. vannamei* shrimp which is a new requirement needs specific education.

L. vannamei seed selection protocols were the next important training need. *L. vannamei* shrimp was introduced because of its SPF seed. However, many farmers who had procured seed from the registered hatcheries got affected with disease outbreaks. *L. vannamei* seed was stocked at PL 10-12 size and it was not possible to differentiate SPF and non-SPF seed. Since the seed was SPF, neither the hatchery allowed the farmers to screen the seed for pathogens nor the farmers strongly demanded it due to the huge demand for the seed. The respondents wanted to know how to differentiate between the SPF and non-SPF seed. It was also informed that hatchery operators tend to mix the seeds of several spawning processes, and which later lead to size variations

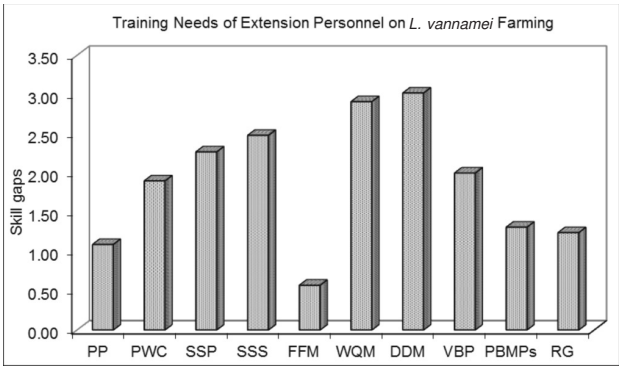

Fig. 2. Skill Gaps of Field Extension Personnel on *Litopenaeus vannamei* farming

PP: Pond preparation	WQM: Water quality management
PWC: Pre-stocking water culture	DDM: Disease diagnosis and management
SSP: Shrimp seed production	VBP: Vannamei with bio-floc
SSS: Shrimp seed selection and stocking	PBMPs: Principles of BMPs
FFM: Feeds and feed management	RG: Regulatory guidelines

and poor survival. Many farmers and extension workers were of the view that the seed quality was poor. Most of the diseases reported were mainly due to white spot syndrome virus and hence screening of the seed for presence of pathogens needs to be ensured. Seed selection is very critical and quality seed minimises the production risk by 40-50%, hence, it was felt as a major training need.

L. vannamei farming with biofloc technology was the other important training need expressed by the respondents. Since *L. vannamei* was farmed at high densities, use of biofloc technology may help in not only reducing the cost but also improves pond hygiene. Hence, the respondents were interested to know about biofloc technology, as well as its protocols and management. Pre-stocking water culture was the next important training need of the extension workers. The water culture practices need to produce adequate phytoplankton as natural feed for the shrimp larvae before seed stocking. Proper water culture with beneficial bacteria enhances the survival of the shrimp seed initially. Better Management Practices (BMPs) were the risk management practices advocated to prevent and manage the entry and spread of pathogens into the *L. vannamei* culture systems. These practices were developed to prevent the risk factors identified at various stages of farming from pond preparation to harvest. All the BMPs were scientific practices and the extension workers wanted to understand the science behind

Table 2. Skill gaps and training preference of private extension workers

Sl. No.	Subject Matter	Perception of the field extension workers		Training need - Rank
		Mean Importance	Mean Competency	
1.	Pond preparation	2.97	2.60	IX
2.	Pre-stocking water culture	3.00	2.37	VI
3.	Shrimp seed production	2.78	1.97	IV
4.	Seed selection and stocking	2.75	1.85	III
5.	Feeding management	2.83	2.63	X
6.	Water quality management	2.87	1.87	II
7.	Disease diagnosis and management	2.83	1.75	I
8.	*L. vannamei* farming with bio-floc	2.18	1.53	V
9.	Principles of better management practices	2.45	1.92	VII
10.	Regulatory guidelines	2.57	2.08	VIII

those BMPs so that they could explain the farmers clearly.

The CAA has framed strict regulatory guidelines for the seed production and farming of *L. vannamei*. It included exclusive registration for *L. vannamei* farming, periodical reporting of culture details, farming protocols and infrastructure requirements, waste water treatment pond and standards for waste water. Presently, it is mandatory that shrimp farms be registered either with the CAA or with the State Departments. Therefore, the respondents felt that they should be sensitized with regulatory guidelines. Feed management, rationing and application strategies and pond preparation protocols were the other training needs expressed by the respondents. Feed was the major input and accounted for 50-60% of the production cost. Efficient feed management helps in proper pond management and reduces cost of production. Therefore, feed management was an important training need for them.

Personal attributes of an individual influences his/her behaviour and performance. It is important to know the influence of selected personal attributes such as educational background, experience, frequency of contact with client farmers, previous trainings and access to online vis-à-vis their skill gaps. Separate training strategies, training material and audience segmentation need to be done if significant differences are found in personal attributes vis-à-vis the subject matter of study. Non-parametric statistics such as Kruskal-Wallis and Wilcoxon tests were attempted to explain the relationship between the personal attributes and training needs and it was found that differences in the personal attributes of the respondents do not influence their training requirements significantly (Table 3).

A training module incorporating the training requirements identified need to be formulated and it should be *"on-field"* and "*experiential learning by doing*" mode involving the CAA. The training may be conducted either in July or December month for a duration of 3-4 days. Further, an *expert system* on *L. vannamei* shrimp aquaculture need to be developed and hosted in the website of the nodal research institution to keep it as a reference module and it should be updated periodically. Research institutes like CIBA should take efforts to develop a freely downloadable mobile phone app on *L. vannamei* including modules for calculations and disease diagnosis that would serve as a capacity building tool for the field level extension workers. In addition, research institutions may also develop a *L. vannamei* knowledge portal similar to Rice Knowledge Portal as a single window platform for exchange of field experiences, scientific advancements, price forecast and feedback on policies and programmes. Thus, the portal will also serve as a platform for facilitating interaction among researchers extension workers and other stakeholders.

Extension workers are basically aiming for bringing out desirable changes in the adoption behaviour of

Table 3. Influence of personal attributes on the training needs

Kruskal-Wallis test	Chi-square	Probability (Chi-square)	Significance
Education (3 groups)	1.4727	0.4789	p> 0.05
Frequency of contact (4 groups)	1.1994	0.5490	p> 0.05
Area coverage (4 groups)	1.0382	0.5951	p> 0.05
Wilcoxon two sample test	Z score	Probability (z)	
Experience	0.4078	0.6834	p> 0.05
Training attended	0.6997	0.4841	p> 0.05
Online access	0.0662	0.7970	p> 0.05

farmers by providing knowledge and skill development. *L. vannamei* farming being an investment intensive enterprise, the farmers require constant technical and backward and forward supports from the field extension workers. In order to be efficient, the extension workers need to be well informed and supported with appropriate capacity enhancement. Hence, periodical assessment of training needs, developing an appropriate training content with experiential learning modules, conduction of on-field training and obtaining feedback should be a continuous process. In the absence of a formal research-extension linkage mechanism to facilitate the above link, electronic extension programmes in the form of expert systems, mobile apps and knowledge portals should be developed and disseminated for capacity strengthening of field extension workers.

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