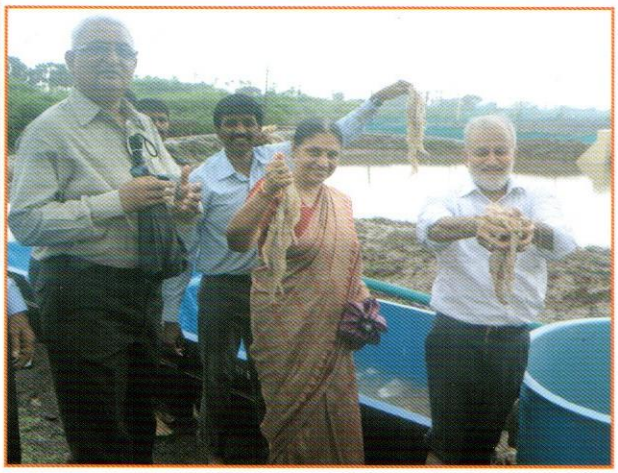
CIBA Technology Series No.12

CULTURE TECHNOLOGY FOR BANANA SHRIMP, *Fenneropenaeus merguiensis*



केन्द्रीय खारा जलजीव पालन अनुसंधान संस्थान
(भारतीय कृषि अनुसंधान परिषद्)
75, सन्थोम हाई रोड, राजा अण्णामलैपुरम्, चेन्नई - 600 028.

CENTRAL INSTITUTE OF BRACKISHWATER AQUACULTURE
(Indian Council of Agricultural Research)
75, Santhome High Road, R.A.Puram, Chennai - 600 028.

July 2014

CULTURE TECHNOLOGY FOR BANANA SHRIMP, *Fenneropenaeus merguiensis*

S.M.Pillai, C.Gopal, H.G.Solanki,

M.Muralidhar, A. Panigrahi, P.K.Patil, J.G.Vanza,

R.G.Patil and A.G.Ponniah

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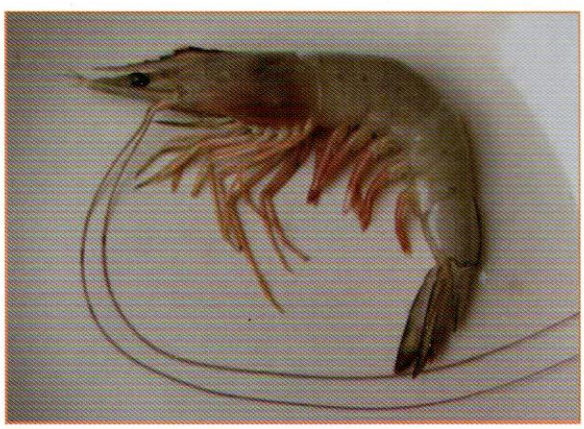
CENTRAL INSTITUTE OF BRACKISHWATER AQUACULTURE
(Indian Council of Agricultural Research)
75, Santhome High Road, R.A.Puram, Chennai - 600 028.
Phone :91 - 44 - 2461 7523 (Direct) 2461 6948, 2461 0565, 2461 0311
Fax:91 - 44 - 2461 0311 E-mail:director@ciba.res.in

Published by : **Dr. C. Gopal**
Director, CIBA

Edited by : **Dr. G. Gopikrishna**

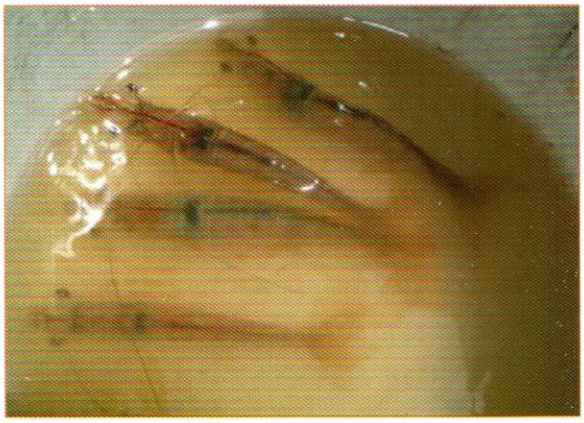
Background

Globally there is a paradigm shift in the choice of species in shrimp culture and this is true in India also. Aquafarmers are receptive to the changes needed to circumvent the repeated losses with tiger shrimp farming due to white spot syndrome virus (WSSV). The introduction of specific pathogen free *Litopenaeus vannamei* has been well accepted by the farmers and this species can be cultured in high stocking density for short duration with low protein feed resulting in high production. Apart from quality seed, feed, water, chemicals and skilled manpower, technological support is also equally important for harnessing the full potential of aquaculture. Hence, there is an urgent need to develop sustainable alternative shrimp farming systems using endemic, location specific shrimp species for improving the economy of marginal farmer. In this context the Central Institute of Brackishwater Aquaculture (CIBA) focused its research efforts to identify potential native species for developing location specific farming systems and developed the technology package for hatchery seed production and farming of banana shrimp *Fenneropenaeus merguiensis*.

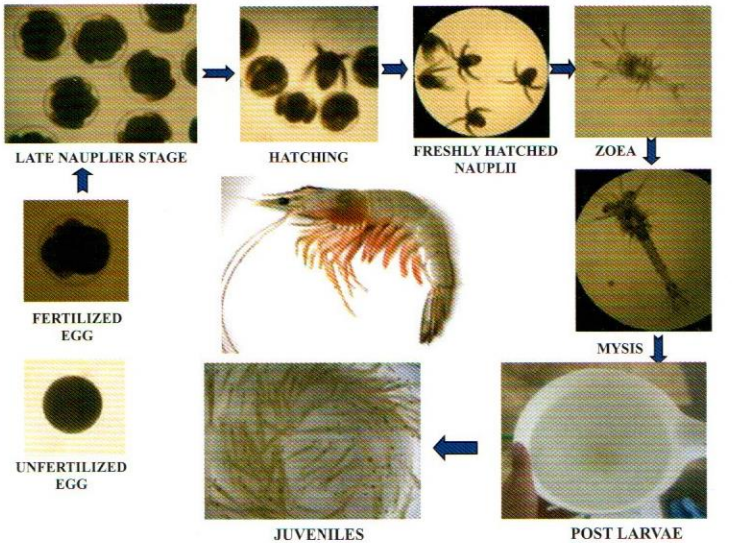


Tiger shrimp *Penaeus monodon* which dominated the culture till 2011 has been replaced by Pacific white shrimp *Litopenaeus vannamei* making it the major cultured shrimp species. Though productivity of shrimp in the state of Gujarat is higher than the national average, extremely low temperatures prevailing during winter months prevent farmers from taking up the winter crop. In search of suitable shrimp species for culturing during winter season, CIBA, Chennai in collaboration with Navsari Agricultural University (NAU), Navsari, Gujarat initiated studies to evaluate the potential of banana shrimp which is known to adapt to low temperatures and high salinities. Trials and yard experiments on the culture potential of this species were initiated in 2009 at the Danti Experimental Station of NAU, Navsari and the present technology has been developed based on the on- farm studies conducted till 2013.

Broodstock collection



Banana shrimp occurs from the northwest Indian coast starting from Gujarat extending up to Karnataka and then in the northeast coast from Odisha to West Bengal. Banana shrimp also constitute a major fishery in certain localized areas in southern Tamil Nadu at Adirampattinam coast. Broodstock of this species is available at this coast throughout the year. Broodstock (50-60g) were collected from this area and brought to CIBA Shrimp Hatchery at Muttukadu, Chennai.Transportation entailed 8-10 h by road and it was observed that 40-50% of the brooders spawned in transit with fecundity of 1.5 to 3.5 lakhs. The water parameters such as salinity (30 ppt), temperature (29°C) and pH (7.9–8.2)were found to be conducive for successful spawning. The breeding, larval rearing and seed production were managed as per conventionally followed procedures for rearing tiger shrimp.. The larvae were fed with *Skeletonema costatum* from late Nauplii (N_6) stage till Postlarvae (PL_2) and thereafter with freshly hatched *Artemia* nauplii (5 times/day).



Yard trials for salinity tolerance

To evaluate the optimal salinity for growth, juvenile shrimp (5.0 g) from the same mother were stocked in 200 l tank @ 20 nos./tank. Animals were reared in varying salinities of 15, 20, 25, 30, 35, 40, 45 ppt for 60 days. Fortnightly sampling of length/weight analysis revealed that salinity in the range of 30 to 40 ppt is suitable for the optimal growth of banana shrimp.

Grow-out culture trials

To evaluate the effect of temperature on the growth and survival, culture demonstrations were carried out in different seasons *viz.* summer (March to June), monsoon (July to November) and winter (December to March) at different stocking densities.

Flow diagram showing the sequence of pond preparation and management practices

Drying of pond

↓

Scrapping of subsurface soil

↓

Liming of pond soil (Agrilime @ 1 ton/ha)

↓

Pond filling with sea water following four stage filteration system (20, 40, 60, 80 mesh)

↓

Settling (2-3 days)

↓

Bleaching of water with Bleaching powder (Calcium hypochlorite) @ 300 kg/ha

↓

Liming of pond water (Agrilime @ 100 kg/ha) after 3 days

↓

Fertilization of pond water with ferment every 3rd day (100 kg rice bran+ 10 kg jaggery+ 100 g yeast) / ha (3 doses)

↓

Addition of Microbial products

↓

(Soil probiotics @ 2 kg/ha and Water probiotics @ 1kg/ha)

↓

Stocking of shrimp Postlarvae

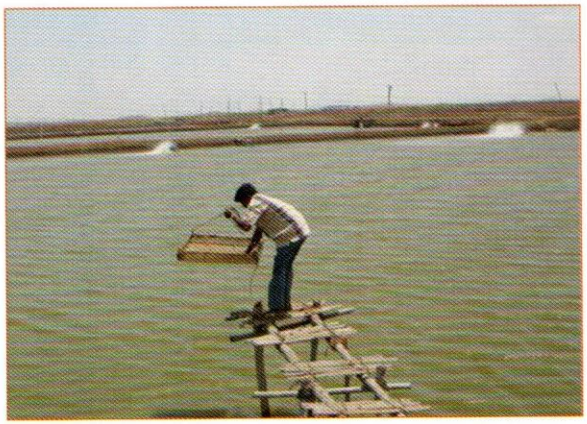
Seed transportation and stocking

After acclimation to the salinity of the stocking ponds, seeds (PL_{13-14})were packed @ 2500-3000 nos./ bag with freshly hatched *Artemia* nauplii @ 45-50 nos./PL in polyethylene bags filled with ozonated cool seawater at 18^{0}C. Boxes with shrimp seed were airlifted to Mumbai and then transported by road to Danti, Navsari in 12-18 h. On reaching the farm site, the packets were acclimatized by allowing them to float in the pond for 3-4 h before releasing the seed. Samples of 100 postlarve were stocked in a hapa (2m x1mx1m) fixed in deeper areas of the pond. In all the experimental trials, hapa survival of 98-100 % after 48 h was recorded, suggesting sturdiness of the larvae and the optimal packing and transportation conditions.

Biosecurity measures

As a part of basic biosecurity measures, bird netting and crab and dog fencing were provided all along the farm. The farm implements (cast net, tubs, others) were disinfected with bleaching powder and sun dried before every use. Additionally, personnel working in the ponds were trained to follow maximum hygienic conditions.

Feed management



During different culture trials, shrimp were fed with commercial tiger shrimp feed (40 % crude protein) or vannamei feed (35 % crude protein). Initially up to three days feeding was done @ 1.0 kg/ha/day by broadcasting twice at 6.00 AM and 6.00 PM. From 4th to 8th day, Cr1 was fed @ 1.0 kg/day/lakh PL with daily increase of 100 g. From 9th day onwards, Crumble 2 feed was started @ 2.0 kg/day with daily addition of 200 g. Feed Crumble 3 was introduced on 24th day @ 5.0 kg/day with daily increase of 300 g. Pelleted feed (P1) was initiated on 42nd day @ 13 kg/day, three times with daily increment of 1.0 kg. Subsequently the feed was given based on average body weight (ABW) and check tray observations. When the ABW is around 8-10 g, the pelleted feed (P2) was introduced @ 3% of biomass and continued till harvest.

Pond management

During pond preparation and culture, agricultural lime and dolomite were used to improve low pH conditions. To reduce pH, NH_3 and H_2S concentrations,fermented rice juice and zeolite were applied whenever needed. Commercial water and soil probiotics were used as per the schedule shown in Table 1 to maintain optimal water and soil conditions. Water probiotics were inoculated in rice juice prior to application whereas the soil probiotics were mixed with sand + zeolite and broadcasted in the ponds. Two aerators were provided diagonally in each pond and operated 2, 4, 6 and 8 h from 1st, 2nd, 3rd and 4th month, respectively for maintaining dissolved oxygen above 3 ppm. Seepage loss and evaporation were compensated by pumping pre-treated water from reservoirs.

Table 1.Schedule of probiotic and chemical application during the culture

Farm inputs	Dose and schedule
Water probiotics *Bacillus subtilis* *B. licheniformes*	@ 200 g/ha every 15 days (3 days prior stocking to harvest)
Soil probiotics *Bacillus pumilus* *B.megaterum* *Thiobacillus denitrificans*	@ 1.5 kg/ha every 15 days (60 to 90 DOC) @ 2.0 kg/ha every 15 days (90 DOC to harvest)
Fermented juice	@ 100 l/ha in every 15 days throughout culture
Agricultural lime and Dolomite	@100 kg/ha as and when required
Zeolite	@ 20 kg/ha as a base to soil probiotics

Monitoring pond environment

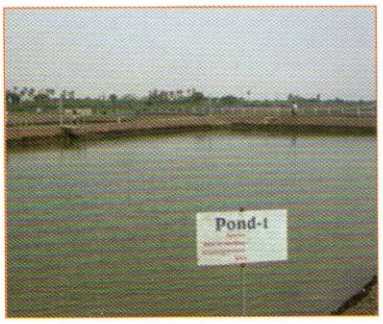
During the culture period, water samples were analysed for pH, EC, CO_3, HCO_3, Ca^{++} Mg^{++}, alkalinity, salinity, TAN, NO_2 , NO_3, total and available N and P and were found in optimum range. Bacterial counts like, total heterotrophic counts, total vibrio counts and pathogenic vibrio counts were monitored and found to be within permissible limits.

Growth and health monitoring

Regular samplings by cast netting were carried out to assess the growth and health status. Length, weight, sex ratio and ABW were recorded. The shrimp in check trays were also examined for any deformities, disease symptoms, moulting stage and faecal colour etc.

Culture Trials

Culture trials were carried out in different seasons at variable stocking densities in the Danti farm ponds of NAU.

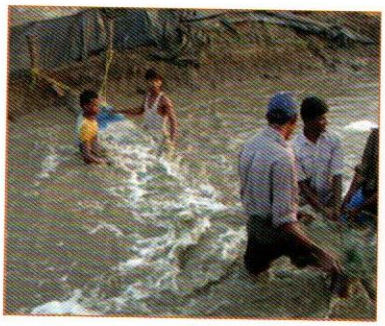
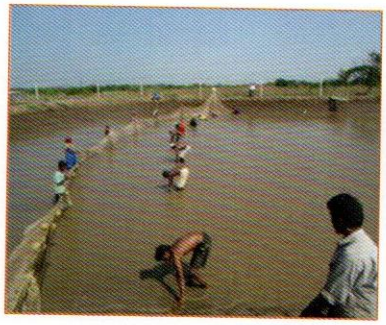
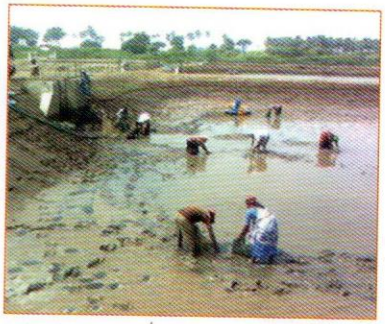


Monsoon crop

Culture was done in four ponds prepared as per the standard protocols explained earlier. In two ponds the shrimp were stocked @ 20 nos./m^2 and in another two ponds @ 10 nos./m^2. Details of the culture are given in Table 2.

Table 2: Details of monsoon culture of banana shrimp at Danti farm

S. No.	Particulars	Pond 1	Pond 2	Pond 3	Pond 4
1	Area (m^2)	1500	1500	1500	1500
2	Stocking density (nos./m^2)	20	20	10	10
3	DOC	165	165	130	130
4	ABW (g)	13.89	14.49	15.87	14.71
5	Count (nos./kg)	72	69	63	68
6	ADG (g)	0.084	0.088	0.12	0.11
7	Biomass harvested (kg)	284.5	293.5	153	163
9	FCR	2.45	2.73	2.28	2.12
10	Survival (%)	68.28	70.44	64.26	73.89
11	Production (kg/ ha)	1897	1957	1020	1087

Grading of material

The average production obtained was 1927 kg/ha (20 nos./m^2) and 1053.50 kg/ha (10 nos./m^2) in 165 and 130 DOC, respectively. The comparative growth of banana shrimp under the two densities is shown in Fig.1.

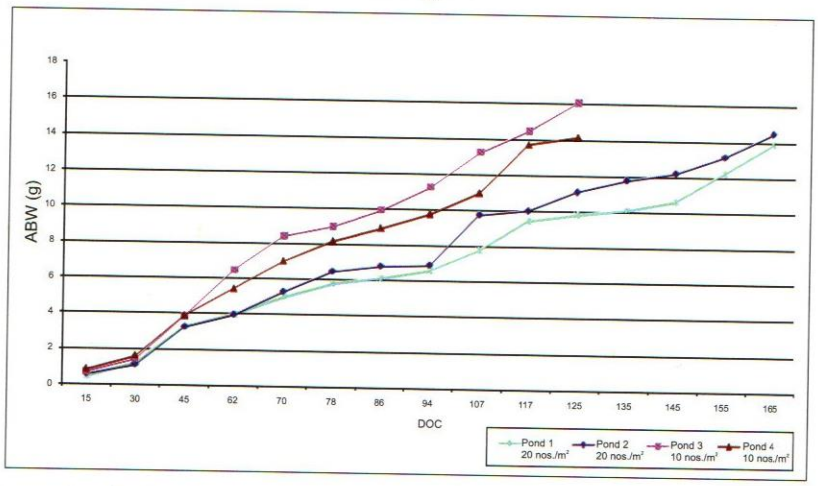


Fig. 1.Growth of *F. merguiensis* at two stocking densities (10 and 20 nos./m^2)

Winter crop

The winter crop was taken up in all the four ponds at a stocking density of 10 nos./m^2 following similar pond and feed management practices as done in monsoon crop. In 136 DOC, the shrimp attained an average body weight of 18.0 g with average survival of 70%, FCR of 2.31 and production of 1.26 t/ha.

Summer crop

The summer crop was raised @ 15 nos./m^2 in two ponds following similar pond and feed management practices as in the earlier crop. In 120 days of culture, the shrimp weighed 21.0 g with average survival of 75%, FCR of 1.60 and production of 2.36 t/ha.



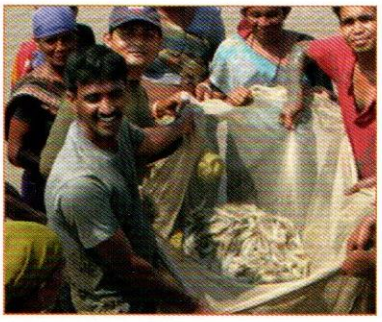
Popularization of technology

The culture technology was popularized through farmers-scientist interaction meets, harvest melas, farmers day, farmers awareness programs and training programs to farmers and officials of Fisheries Department of Gujarat state.

Economics of banana shrimp culture

Based on the three crops, banana shrimp culture can be summarized as:

- Marketable size: 90-110 days
- Average survival: 70-80 %
- Average body weight: 18-22 g
- FCR of 1.4-1.6 under optimal conditions
- Production of more than 2 ton/ha @ 20 nos./m^2
- Farm gate price of Rs 210-220/kg for 55-60 count
- Cost of production : Rs130-160/kg
- Cost : benefit ratio is about 1 to 1.3


Operational cost of banana shrimp culture

Sl. No.	Particulars	Rs. Lakh
1.	Pond Preparation @ Rs 20,000/ha	0.20
2.	Seed 2,00,000 /ha @ Rs 0.35/seed	0.70
3.	Feed (FCR @ 1.5) 3780 kg @ Rs 72/kg	2.72
4.	Chemicals/Drugs	0.20
5.	Electricity/Diesel @ Rs 30,000/ha	0.30
6.	Analytical charges (PCR and soil & water) @ Rs 5000/ha	0.05
7.	Farm labour (1 skilled and 1 unskilled) @ Rs 10,000/month for 4 months	0.40
8.	Harvest charges (including labour and ice) @ Rs 8,000/ha	0.08
9.	Miscellaneous expenditure @ Rs 10,000/ha	0.10
	TOTAL	4.75

Revenue

1.	Shrimp harvested (55 count) (kg/ha)	2520
2.	Farm gate price of shrimp (Rs/kg)	220
3.	Total cost/crop (Rs in lakhs)	4.75
4.	Production cost (Rs/kg)	188.5
5.	Gross return from sales (Rs lakhs/ha)	5.54
6.	Net return or profit (Rs in lakhs/ha)	0.79
7.	Return over operational cost (%)	16.71

For details please contact

THE DIRECTOR
CENTRAL INSTITUTE OF BRACKISHWATER AQUACULTURE
75, Santhome High Road, R.A.Puram, Chennai - 600 028
Phone: (044) 2461 8817, 2461 6948, 2461 0565 Fax: 91-44-2461 0311
Email :director@ciba.res.in

HEAD QUARTERS

CENTRAL INSTITUTE OF BRACKISHWATER AQUACULTURE
75, Santhome High Road, R.A.Puram, Chennai - 600 028
Telephone : 91-44-24617523 (Director)
: 91-44-24616948, 24618817, 24610565
Telegram : Monodon
Fax : 91-44-24610311
Email : director@ciba.res.in
Website : www.ciba.tn.nic.in

RESEARCH CENTRES

KAKDWIP
Kakdwip Research Centre of CIBA,
Kakdwip, West Bengal-743347
Telephone : 03210-255072

MUTTUKADU
Muttukadu Experimental Station of CIBA,
Kovalam Post, Muttukadu - 603 112, Tamil Nadu
Telephone : 91-44-27472425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