

- Catla attained an average weight of 616 ± 54 g, 590 ± 48 g and 524 ± 38 g in T_1 , T_2 and T_3 , respectively, that of rohu was 412 ± 22 , 388 ± 31 and 334 ± 41 g; and mrigal was 390 ± 46 g, 310 ± 30 g and 274 ± 29 g, in T_1 , T_2 and T_3 , respectively.
- Grass carp showed similar growth patterns in all the treatments, there is no significant difference ($p > 0.05$) in average weight (806-876 g) as recorded from different treatments.
- Fish production of $2,466 \pm 78$, $2,395 \pm 88$ and $2,074 \pm 71$ kg/ha was obtained from T_1 , T_2 and T_3 , respectively, after six months.
- In treatment-1, the contribution of bata to total fish production was 10.31%, 13.36% and 14.38% in T_1 , T_2 and T_3 , respectively.

Policy implications

- Policy decision should be taken to develop technical packages for polyculture of indigenous and exotic carps with SIS to ensure higher economic return and benefit of the rural fish farmers.
- Efforts should be undertaken to motivate rural fish farmers to incorporate SIS in carp polyculture system.
- Policy decision should be taken to develop and disseminate technology for seed production of important SIS.
- Department of Fisheries (DoF) might take a policy to produce SIS seeds in their Fish Seed Multiplication Farms for the rural farmers.

Livelihood implications

Until early 90s, small indigenous fish species (SIS) were abundantly available in rivers, beels ditches and flood plain in Bangladesh and rural people used to catch SIS from the natural waters at a little or no cost for their livelihoods. Gradual declining of SIS in the open waters is making the livelihood of poor fishers vulnerable. Popularising SIS culture and conserving SIS in open water system could increase the production of SIS, which could improve the livelihood of the rural poor fishers. Availability of SIS seed in the Fish Seed Multiplication Farm will encourage fish farmers to culture SIS with larger indigenous carps as a result the total fish production will be increased in the country, which would improve the livelihood of the rural poor.

On farm trial of Bangladesh Fisheries Research Institute (BFRI) evolved two aquaculture technologies

A.H.M. Kohinoor*, M.S. Uddin and M.G. Hussain

Freshwater Station, Bangladesh Fisheries Research Institute
Mymensingh 2201, Bangladesh

*Corresponding author

E-mail address: fsbfri@bdonline.com (M.G. Hussain)

Abstract

Two BFRI evolved aquaculture technologies - integrated rice fish farming and carp polyculture with over-wintered fingerlings under different stocking densities were tested during 2003-04. The study was coordinated with two local NGOs namely NICHAITA and JNDP, Muktagacha, Mymensingh. Integrated rice fish farming technology was demonstrated in 9 plots each having an area between 60-100 dec. during boro season. Fifteen days after transplantation of rice seedlings, fingerlings of rajpunti (*Barbodes gonionotus*) of 7-10 g of individual weight were stocked in the rice fields at the density of 3,000 (T_1), 3,750 (T_2) and 4,500/ha (T_3). The corresponding final weight of fish after three and half months in treatments 1, 2 and 3 were 110 ± 14.21 , 101 ± 16.55 and 86 ± 22.28 g, respectively. The mean weight of fish in treatments 1 and 2 was significantly higher than treatment 3. Fish production obtained from treatments 1, 2 and 3 were 218.16 ± 18.29 , 239.70 ± 25.11 and 236 ± 24.66 kg/ha, respectively. On-farm demonstrations of carp polyculture using over-wintered fingerlings rohu (25-28 g), catla (24-26 g), mrigal (21-26 g) and grass carp (20-24 g) under different stocking densities were undertaken in nine earthen ponds (1,200-1,600 m²) for a period of six months at three different stocking densities. The stocking densities of treatment 1 (T_1), treatment 2 (T_2) and treatment 3 (T_3) were 2,000, 3,000 and 4,000/ha, respectively. Fish were fed with rice bran and mustard oil cake (3:1). Soft green grass and banana leaves were provided mainly for grass carp. At harvest, the production obtained in treatments 1, 2 and 3 were $2,325 \pm 74.75$, $2,620 \pm 49.66$ and $2,982 \pm 171.52$ kg/ha, respectively. The results demonstrated higher growth of fish in treatment 1 than those of treatments 2 and 3. However, treatment 3 contributed relatively higher production than those of treatments 1 and 2, whereas, highest net benefit was received from treatment 2.

Key words: On-farm trial, Aquaculture technology, NGO

Research findings

Integrated rice-fish farming

- The mean weight of fish in treatments 1 and 2 were significantly higher ($p < 0.05$) than treatment 3, however, treatments 1 and 2 did not show any significant difference ($p > 0.05$).

- Stocking density of 3,000-3,750/ha was suitable for better production and as well as economic return.
- Rice-fish farming is an ideal way of integrating aquaculture-agriculture which can offer the best opportunities to make rural farmers involve in generating additional work, improving their income and nutritional status.

Polyculture of carps using over-wintered fingerlings

- Among the four species under the three treatments, the highest average weight ($1,589 \pm 130$ g) was attained by catla in treatment-1. Catla reached an average weight of $1,100 \pm 122$ g in treatment 2, and 856.00 ± 76.65 g in treatment 3.
- The mean harvesting weight of rohu was 746.15 ± 52.99 , 633.14 ± 55.08 , 614.40 ± 97.61 g; mrigal- 789.24 ± 75.33 , 726.53 ± 100.29 and 652 ± 69.20 g; and grass carp- $1,280 \pm 141.65$, $1,218 \pm 193.45$ and $1,240 \pm 189.59$ g in treatments 1, 2, and 3, respectively.
- Survival rates in different treatments were fairly high and ranged between 90 to 94%.
- The highest production was obtained from treatment 3, where carp were stocked with higher stocking density i.e. 4,250/ha. The lowest production of 2,264 kg/ha was obtained in treatment 1 where carp were stocked at 2,250/ha.
- In cost-benefit analysis, highest net benefit of Tk. 103,983 was obtained from treatment 2, followed by Tk. 96,621 and 93,277 from treatments 3 and 1, respectively.
- Although the level of fish production in the present study can not be considered very high but the production obtained in this experiment within six months culture period was very encouraging in terms of maximum individual weight.

Policy implications

- Policy decision should be taken to disseminate these technologies through GOs and NGOs for increasing fish production as well as to improve the socio-economic condition of rural farmers.
- DOF and BFRI should provide regular training to fish farmers to disseminate these refined technologies.
- The GOs and NGOs involved in the fisheries sector should take initiative to popularise these technologies among the rural farmers.

Livelihood implications

Farmers' livelihood can be improved by adopting modern and refined aquaculture technologies in their water bodies and rice fields with the application of proper input in a sustainable way. Only the proper use of sustainable technology by rural fish farmers can ensure increased fish production, nutritional upliftment and sustainable livelihood.

Euglenophytes in aquaculture ponds- their ecology and role in fish production

S. Khan

Department of Fisheries Management, Bangladesh Agricultural University
Mymensingh 2202, Bangladesh
E-mail address: salehamk@bdcom.com (S. Khan)

Abstract

The ecology of euglenophytes and their role in fish production were studied in 12 small earthen ponds beside the Faculty of Fisheries, BAU from July to November 2001. Four experiments each with three replications were conducted and those were as follows: pond treated with both poultry droppings and cowdung (T₁); pond treated with only poultry droppings (T₂), and pond treated with only poultry droppings (T₃), while the control (T₄) where no organic manure was applied. Fishes comprising of rohu (*Labeo rohita*), catla (*Catla catla*), mrigal (*Cirrhinus cirrhosus*), silver carp (*Hypophthalmichthys molitrix*) and silver barb (*Barbonymus gonionotus*) were stocked at the same stocking density of (10,621 fish/ha) and species ratio (1:1:1:2:2). The stocked fishes were fed with a common supplemental diet comprising of mustard oil cake and rice polish (1:1) at the rate of 4% of body weight per day. The highest cell density of euglenophytes was found in the ponds of T₂, where poultry droppings were applied and was followed by T₁, where both poultry droppings and cow dung were applied. Higher temperature, nitrate-nitrogen, phosphate-phosphorous and acidic pH were found to be conducive for the bloom of noxious euglenophytes. The bloom was found to use up most of the nutrients resulting in reduction in the growth of beneficial plankters and planktivorous fishes. The SGR (%/day) of catla, rohu and mrigal was lower during heavy bloom period while that of silver carp and silver barb were comparatively higher. The mortality of fishes in a pond of T₂ during the bloom period was possibly due to formation of anoxic situation (dissolved oxygen level as low as 0.34 mg/l) in the early mornings through bacterial decomposition of the settled dead individuals or due to the combined effect of anoxic situation and toxic metabolite secretion by the euglenophytes.

Key words: Euglenophytes, Aquaculture ponds, Ecology, Fish production

Research findings

- Peak euglenophytes bloom was found in August which was initiated and exacerbated by a set of factors such as comparatively higher water temperature, acidic pH and high nutrient concentration.

- Thick scum of euglenophytes was found to use up nutrients of the water bodies for their growth and inhibited light penetration that markedly hampered the growth of beneficial plankton (Chlorophyceae and Bacillariophyceae) resulting in growth reduction of planktivorous fish.
- The growth rate of catla, rohu and mrigal was found to be significantly ($P > 0.05$) lower in comparison to that of silver carp and silver barb in the ponds having euglenophytes bloom.
- Results of gut content analyses indicated that silver carp and silver barb consumed euglenophytes though their digestibility is questionable. However, euglenophytes were not found in the gut contents of catla, rohu and mrigal.

Policy implications

- Policy makers should consider euglenophytes bloom as a potential threat to pond aquaculture development as they use up nutrients of the water bodies for their growth and seriously inhibit the growth of beneficial plankton (Chlorophyceae and Bacillariophyceae) that are the preferred food of the planktivorous fishes.
- Farmers should be suggested not to use excess fertilizers either organic or inorganic in their fish ponds.
- As euglenophytes were found in the gut contents of silver carp and silver barb, farmers may be suggested to stock silver carp and silver barb along with other carps in their ponds, having euglenophytes problems.

Livelihood implications

The euglenophytes bloom is a serious threat to the development of rural aquaculture in Bangladesh. It was found to deteriorate water quality, reduce growth and survival rate of fishes causing serious economic loss to the poor farmers. The present study indicated that it is possible to predict the period of euglenophytes bloom and the physico-chemical factors that are conducive for bloom formation as well to develop measures to control the bloom. The ecological knowledge gained will help to manage the aquaculture ponds in a more effective and economic way which will ultimately help the poor farmers' livelihood through better fish production.

Management of euglenophytes in aquaculture ponds for improvement of fish production

S. Khan

Department of Fisheries Management, Bangladesh Agricultural University

Mymensingh 2202, Bangladesh

Email address: salehamk@bdcom.com (S. Khan)

Abstract

Four experiments each with three replications were conducted in 12 experimental ponds to control the euglenophytes bloom viz. treatment 1 (T_1), covering of one third of the water surface by duckweed (*Lemna minor*); treatment 2 (T_2), application of 123.5 kg lime/ha/month; treatment 3 (T_3), use of both duckweed as in T_1 and lime as in T_2 ; treatment 4 (T_4) was considered as control where neither duckweed nor lime was applied. Fishes comprising of rohu (*Labeo rohita*), catla (*Catla catla*), mrigal (*Cirrhinus cirrhosus*), silver carp (*Hypophthalmichthys molitrix*) and silver barb (*Barbonymus gonionotus*) were stocked at the rate of 1080 fishes/ha with the species ratio of 8:4:6:9:13, respectively. The lowest cell density of euglenophytes was found in the ponds of T_3 followed by T_2 , and T_1 . In the ponds of T_3 , euglenophytes bloom did not occur possibly due to alkaline pH, shade and nutrient absorption by duckweed. Thin bloom was observed in the ponds of T_1 where pH was neutral or slightly alkaline. The grazing on euglenophytes by the silver carp and silver barb also had some contribution in controlling the bloom. Growth of fishes was comparatively higher in the ponds of T_3 and T_1 , which might be due to better water quality and availability of adequate food while the lower fish growth as recorded from the ponds of T_4 might be due to euglenophytes bloom. Thick bloom inhibited light penetration which hampered photosynthesis and growth of other phytoplankton that are the preferred food of planktivorous fishes. Mortality of fishes in ponds having euglenophytes bloom was possibly due to formation of anoxic situation in the early morning or due to the combined effect of anoxic situation and toxic metabolites secretion by the euglenophytes.

Key words: Euglenophytes management, Carp aquaculture, Fish production

Research findings

- Alkaline pH associated with shade formation and nutrient absorption by duckweed did not allow euglenophytes to form bloom in the experimental ponds. Neutral to slightly alkaline pH in ponds of T_1 allowed only thin bloom formation.
- Better water quality parameters and optimum availability of fish food items in ponds belonging to T_1 (duckweed treated) and T_2 (duckweed + lime treated) provided better growth of fishes.

- Periodic application of lime at the rate of 120-125 kg/ha and allowing duck weeds to cover one third of pond water surface prevented euglenophytes to form bloom, maintained better water quality and allowed better fish production.
- The grazing on euglenophytes by silver carp and silver barb also had some contribution in controlling the bloom.

Policy implications

- Policy makers should consider euglenophytes bloom as a potential threat to pond aquaculture development.
- The present observation “combined use of duckweed and lime was found to be effective in controlling euglenophytes bloom and maintenance of water quality as well as good fish production” needs further refining for the development of a package for dissemination among the farmers.
- If the package is available, arrangement should be made to train all the fisheries extension workers of GOs and NGOs with the help of researchers for dissemination of the technology.

Livelihood implications

Euglenophytes bloom has serious implications on the livelihoods of poor farmers. The farmers are facing increasing problem with water quality deterioration, reduced growth and even mortality of fishes due to euglenophytes bloom. The euglenophytes bloom as well as the cost of fertilizers and feeds could be reduced considerably by using duckweed which is easily available to the poor farmers. The duck weed could be used for dual purposes: i) for reducing euglenophytes bloom in hypernutrified ponds and ii) as a food for herbivorous fishes. In the present culture system the contribution of silver carp and silver barb to total fish production is high, so poor farmers who can not afford to buy expensive fish will be able to fulfill their protein demand by eating these cheap fishes.

On farm trial of freshwater pearl culture

N. Sultana*, M.A. Hossain, K.M.A. Uddin, M.G. Hussain and M.A. Mazid

Freshwater Station, Bangladesh Fisheries Research Institute
Mymensingh 2201, Bangladesh

*Corresponding author

Email address: mghussain054@yahoo.com (M.G. Hussain)

Abstract

On farm preliminary trial of freshwater pearl culture was done through 20 entrepreneurs in Boilor and Sutiakhali villages of Mymensingh district during 2004. A group of 20 enthusiastic women were selected and trained on the art of mantle tissue dissection, operation for mantle tissue implantation and preparation of ponds for pearl culture. A total of 200 juvenile freshwater mussel, *Lamellidens marginalis*, were collected from the wild and were used for mantle issue operation. The operated mussels were then transferred to farmer's pond and were subjected to observational trial. Length and weight of each of the test mussels were recorded before hanging them at a depth of 40 cm in net bags (3 mussels/net bag) in ponds at the rate of 24,700 mussels/ha of pond area. Ponds were routinely fertilized with organic and inorganic fertilizers thorough out the mussel rearing period. Water temperature, pH, plankton density and soil organic matter were monitored fortnightly. Growth of pearl is yet to be monitored through sacrifice of the mussels but X-ray photography of a few mussels indicated the initiation of pearl formation in most of them.

Key words: Pearl culture, Freshwater mussel, On-farm trial, Women

Research findings

- The posterior region of the mantle tissue was the best place for mantle slice insertion.
- Juvenile stage was the best age of mussel for the production of pearl.
- Plankton concentration was directly related to application of fertilizers in the ponds.
- Pearl growth was apparently related to Ca^{++} concentration in the pond water.
- Growth of mussels was better in pond bottom condition than in hanging conditions.

Policy implications

- Policy decision may be taken to develop the pearl culture technology package and also disseminate the same throughout the country in near future.

- If pearl culture technology package is available, arrangement should be made to train all the fisheries extension workers of GOs and NGOs with the help of researchers for dissemination of the technology.
- Policy decision may be taken to encourage pearl culturists to culture pearl with other fish species in the same pond or in the same water body.

Livelihood implications

Freshwater mussels are induced to develop pearl, a valuable gem in them. Development of pearls in mussels will not only enhances the value of mussels but also contribute significantly towards poverty alleviation and livelihood improvement of the rural poor. There is no need to use a separate pond or other water bodies for pearl culture; it can be cultured with the fish polyculture system in the same water body. Therefore, rural people particularly, the poor and landless women can improve their livelihood through freshwater pearl culture.

Nursery management system of stinging catfish, *Heteropneustes fossilis* and walking catfish, *Clarias batrachus* in Bangladesh

N. Sultana*, K.M.A. Uddin, C.T. Ahasan and M.G. Hussain

Freshwater Station, Bangladesh Fisheries Research Institute

Mymensingh 2201, Bangladesh

*Corresponding author

E-mail address: fsbfri@bdonline.com (M.G. Hussain)

Abstract

A total of four experiments were conducted to develop nursery management system for the two important native catfishes viz. stinging catfish, *Heteropneustes fossilis* and walking catfish, *Clarias batrachus* during 2003 and 2004. Two experiments were conducted in on-station condition to determine stocking density efficacy in hapa and in earthen mini ponds for *H. fossilis*. This was followed by on-farm trial on stocking density in earthen mini ponds. In hapa, the highest survival rate was 60% for *H. fossilis* at stocking density of 100/m²; followed by 54.5 and 50% at stocking densities of 150 and 200/m², respectively. Similarly, gain in weight and length was also better in lower stocking densities. Similar survival rate (45 to 55%) was observed in three densities in earthen mini ponds. However, gain in weight and length showed no significant ($p < 0.05$) differences. *H. fossilis*, *C. batrachus* showed almost similar survival rates (57.5-59.0%) in all the three stocking densities (100, 150 and 200/m²) in earthen mini ponds in on-station condition. In terms of gain in weight and length showed no significant ($p < 0.05$) differences in pond conditions. Almost similar result was obtained in terms of growth and survival in on-farm condition.

Key words: Nursery management, *Heteropneustes fossilis*, *Clarias batrachus*

Research findings

- In hapa the highest survival rate was found to be 60% for *H. fossilis* fry at stocking density of 100/m², followed by survival of 54.5% and 50% with stocking densities of 150 and 200/m², respectively.
- In earthen ponds survival rate for *H. fossilis* fry varied from 45 to 55% in three stocking densities (100, 150 and 200/m²).
- In on-station earthen mini ponds both *C. batrachus* and *H. fossilis* gave almost similar survival rate (57.5 to 59.00%).
- In farmers' pond no significant ($p < 0.05$) difference was found between these two species in terms of survival, gain in weight and length.

Policy implications

- More research for development of culture techniques for native catfishes is required, so government should allocate more fund to carry out adaptive research on catfishes.
- Private entrepreneurs and NGOs should come forward to disseminate the nursing technique of native catfishes.
- BFRI, DoF and NGOs can jointly organize training programme on nursery management of native catfishes.

Livelihood implications

Stinging catfishes and walking catfishes are highly valued local catfishes in Bangladesh. Culture and rearing of these catfishes will obviously play an important role for the livelihood upliftment of the poor fish farmers. The poor people can improve their livelihood by culturing these catfishes in their homestead ponds.

Effect of low cost feed on the production of walking catfish, *Clarias batrachus* in farmer's ponds

M.K.I. Haque* and M.A. Mazid

Freshwater Station, Bangladesh Fisheries Research Institute
Mymensingh 2201, Bangladesh

*Corresponding author

Email address: fsbfri@bdonline.com (M.K.I. Haque)

Abstract

A feeding trial was conducted for six months in farmer's ponds to assess the performance of BFRI formulated catfish feed on the growth and survival of *Clarias batrachus* (L.). Nine interested farmers and their ponds (size range: 10-15 dec) in the Barera union of Mymensingh Sadar were selected. The ponds were divided into 3 treatments each with 3 replications. Among the three treatment diets, two diets- traditional (F₁) and BFRI formulated (F₃) were prepared by using low cost agro-based locally available ingredients and the commercial diets was Saudi-Bangla Grower-1 (F₂). The diets were designed as F₁, F₂ and F₃ for traditional (20.40% protein), Commercial (31% protein) and BFRI formulated (30.44% protein) diets respectively. The fingerlings of catfish (7.3 g) were collected from local fish vendors and stocked at the rate of 100/dec. Feeding rates were adjusted by weight after fortnightly sampling of fish. Feeding rate were 10 and 8% of the total body weight respectively for 1st, 2nd month and 5% for the rest of the experimental period. The range of some selected water quality parameters were as follows: dissolved oxygen 4.0 - 7.4 mg/l, temperature 24.0^o - 33.9^oC, pH 6.8 - 8.00, and transparency 17.0 - 32.00 cm. Which showed suitability of the ponds for rearing fish. At the end of the experiment, significantly highest gain (p<0.05) in weight (1210.96%±87) and lowest gain in weight (865.25%±90) were observed in the group of fish fed on diets F₃ and F₁ respectively. However, no significant differences in growth (p>0.05) was observed in fish fed on commercial diet (F₂) and BFRI formulated diet (F₃). The FCR value ranged between 2.00 and 2.80 with the traditional diet (F₁) showing significantly lower FCR. The total production of fish ranged between 1398.08 and 2145.34 kg/ha with F₃ diet resulting in the highest production and net profit. A simple economic analysis showed that fish fed with BFRI formulated (F₃) diet resulted in the highest net profit in farmer's pond.

Key word: Low cost feed, Walking catfish, Farmers' ponds

Research findings

- The result of the study illustrate that it is economically beneficial and biologically more productive to provide the fish with diet prepared from on farm agro-based locally available ingredients besides using high priced commercial diet.
- Low-cost BFRI fish feed formulation could significantly increase the total fish production.
- To generate more profit from small-scale local catfish farms, BFRI formulated diet should be used.
- The application of low-cost on farm fish feed have much potential for reducing feed cost (Table 2) without affecting growth rate and yields

Table 1. Proximate composition of the diets

Proximate composition (%)	Traditional (F ₁)	Saudi-Bangla Grower-1 (F ₂)	BFRI formula (F ₃)
Dry matter	89.00	92.00	90.48
Crude protein	20.40	31.00	30.44
Lipid	9.20	11.42	10.62
Ash	15.53	15.10	16.10
Crude fibre	7.78	7.58	7.08
NFE	54.86	34.90	35.76
Price (Tk/Kg)	8.00	18.00	14.50

Table 2. Cost and return analysis (Taka/per hectare)

Component	Traditional (F ₁)	Saudi-Bangla Grower-1 (F ₂)	BFRI formula (F ₃)
Fingerlings	125,000	125,000	125,000
Feed cost	31,203	76,652	63,072
Misc. (labour, fencing, fencing, fertilizer etc.)	77,000	77,000	77,000
Total cosy	233,203	278,652	265,072
Total return	348,250	532,250	536,250
Net profit	115,047	253,598	271,178

Policy implications

- Since the BFRI formulated catfish diet found to be more economical and suitable for small scale farmers, the government and non-government agencies, and private entrepreneurs involved in the fisheries sector should take initiatives to popularise this catfish feed among the rural farmers.

- Country like Bangladesh where catfish is costly thus initiative should be taken to train poor households for culture catfish in their adjacent small ponds by using low-cost on farm BFRI feed technology.

Livelihood implication

A large investment is needed to culture carnivore fishes like walking catfish, *C. batrachus* in farming system. Low cost BFRI formulated farm-based fish feed tested in this study will open up an avenue to the poor rural farmers to grow the fish in their homestead ponds. This will ultimately provide the farmers nutritional and financial security.

Seed production and culture techniques of climbing perch, *Anabas testudineus*

A.H.M. Kohinoor*, M.S. Islam, M. Zaher and M.G. Hussain

Freshwater Station, Bangladesh Fisheries Research Institute

Mymensingh 2201, Bangladesh

*Corresponding author

E-mail address: fsbfri@bdonline.com (M.G. Hussain)

Abstract

Six treatments each with 12 replications designed to optimize the dose of inducing agent PG to achieve fertilization and hatching success of climbing perch, *Anabas testudineus* were tested. The females were given single injection of 7-12 mg PG/kg body weight and the males were given 4 mg PG/kg body weight. Fertilization and hatching rate varied from $67\pm 4.55\%$ to $66\pm 3.0\%$ and $59\pm 4.88\%$ to $57\pm 6.21\%$ for the doses of 10, 11 and 12 mg PG/kg of body weight, respectively. The hormone dose had significant ($P < 0.05$) effect on fertilization and hatching. Six mini shallow cisterns (570 cm x 105 cm) were used to investigate the efficacy of zooplankton and *Artemia* nauplii as feed for spawn rearing. Three-day old spawns were stocked in six mini shallow cisterns at a stocking density of 100 individuals/L of water. Two treatments each with three replications were used to develop culture technique of the climbing perch. In case of treatment-1, the spawns were fed with *Artemia* nauplii three times daily, while in treatment-2, zooplankton were used as feed in the same manner as in treatment-1. After 14 days of rearing, mean final weight of the fry of treatments-1 and 2 were 95.55 ± 6.71 and 57.69 ± 5.40 mg, respectively. In treatment-1, spawn fed with *Artemia* nauplii showed significantly ($P < 0.05$) higher mean weight than the spawn fed with zooplankton (treatment 2).

Key words: Seed production, Culture techniques, Climbing perch

Research findings

- PG doses ranging from 7 to 12 mg/kg body weight (bw) of females responded equally in all the treatments.
- Fertilization and hatching successes of 67% and 59% were obtained for PG dose of 10.0 mg/kg of bw while it was 66% and 57% for the PG dose of 12.0 mg/kg of bw.
- Fry gained a mean weight of 95.55 ± 6.71 mg in treatment-1 (*Artemia* nauplii) and 57.69 ± 5.40 mg in treatment-2 (zooplankton) after 14 days of rearing.
- Spawn fed with *Artemia* nauplii showed significantly ($p < 0.05$) higher growth in weight than spawn fed with zooplankton.
- Mean survival rate was higher in treatment-1 (56%) than in treatment-2 (42%).

- For better survival and growth, *Artemia* nauplii was found to be a suitable feed for the spawn of *A. testudineus* than zooplankton in cistern condition.

Policy implications

- Department of Fisheries (DoF) and NGO's can take initiative to disseminate the techniques of breeding and rearing of climbing perch to the Government and private hatchery operators for mass seed production.
- Bangladesh Fisheries Research Institute (BFRI) may organise regular training programme on climbing perch breeding and rearing technology for interested fish farmers, hatchery managers and graduate student of different universities.
- BFRI should continue the research programme of climbing perch to develop a low-cost culture system of this high valued species in collaboration with private fish farms and NGOs

Livelihood implications

Climbing perch is an important and endangered fish species having high market value, which will obviously play an important role for livelihood upliftment of the rural fish farmers. The farmers may come forward for adopting climbing perch rearing techniques from which they will be able to make more profit than carps and other species. The unutilised small ditches and ponds in different areas of Bangladesh can be used for culturing this species, which will ultimately change the livelihood of the rural poor.

Production of freshwater giant prawn using over-wintered juveniles for enhancement of farm income and reduction of rural poverty in Bangladesh

M. Karim

Bangladesh Shrimp Foundation
House # 47, Road # 23, Block-B, Banani
Dhaka, Bangladesh

E-mail address: karim@shrimpfoundation.org (M. Karim)

Abstract

Freshwater giant prawn, *Macrobrachium rosenbergii* fry produced during late season can not withstand low temperature thus the prawn culture programme during winter is hampered. To overcome this problem, late season (August-September) prawn juveniles (0.9-6.8 g) were stocked at a density of 1.43 to 3.57/m² in 350-476 m² ponds in Pabna and Mymensingh districts during October 2000 and cultured till May 2001. Monthly average water temperature during the winter months (December-February) varied from 16 to 22 °C and gradually increased to 32 °C in May. The prawn fry showed fast growth rate and attained an average weight of 60-70 g within eight months including three winter months. Growth compensation was observed during summer months. Survival rate was 60-79%. After extrapolation of the present growth rate more than 1,600 kg/ha production can be achieved in better-managed ponds. Extrapolated cost of production was Tk. 268,000 and 200,000Tk./ha in two best ponds, sale value was Tk. 644,9146 and 528,466 and gross profit was Tk. 376,000-410,000, suggesting a higher economic feasibility of farming freshwater prawn with over-wintered juveniles.

Key words: Freshwater giant prawn, Over-wintered juveniles, Poverty reduction

Research findings

- Techniques were developed for raising an early crop of prawn during the first half of the year by utilizing over-wintered (the previous year's late season) juveniles and use them for farming.
- Pond water temperature ranged between 16 and 22 °C during the winter months (December to February) and gradually increased to 30 °C during the summer in May.
- Freshwater giant prawn attained an average weight of 60-70 g within eight months of culture period. extrapolated production was more than 1,600 kg/ha in better-managed ponds, as against the national average of around 300 kg/ha.

- Gross profits of Tk. 376,200-339,664 (US\$ 6,400-5,800)/ha was obtained from prawn farming as against only about US\$ 370 from paddy farming, suggesting high economic feasibility and relative advantage of prawn farming. Production of herbivorous fin-fish (about 1,000 kg/ha) fetching an additional income of Tk. 40,000 –provided an additional benefit to the farmer.

Policy implications

- DoF, BFRI and NGOs can take programmes to develop techniques for nursery rearing of late season prawn fry and over-winter them with good survival.
- Demonstrations of the benefits of raising an early crop of prawn with over-wintered juveniles, preferably male prawn, at various strategic points in major Freshwater prawn farming districts (Khulna, Bagerhat, Jessore, Narail, Pirojpur, Noakhali, Patuakhali, Gopalganj, Mymensingh and Sirajganj) may be organized by the DoF and NGOs.
- Hatchery operators should be encouraged to involve in the above demonstrations and persuade them to extend hatchery operation until October or November.
- BFRI/DoF/NGOs should publish suitable extension booklets on nursery rearing of late season prawn fry on a commercial scale and on raising an early crop of prawn with over-wintered juveniles.

Livelihood implications

Early farming technology may create a good demand for over-wintered juveniles, thereby greatly trigger hatchery, nursery and farm operation periods and their productivity and profitability. Using the late season fry for producing an early crop of prawn in addition to the traditional shrimp crop in the second half of the year can significantly increase farmers' total income from their scarce land. The technology may be very conducive in supporting various types of shrimp-based businesses, all leading to poverty reduction in rural areas.

Effects of black Bengal goat manure on growth and production of Genetically Improved Farmed Tilapia (GIFT) starin, *Oreochromis niloticus*

M.W.A. Pramanik*, M.A. Razzak, M.G. Hussain and M.A. Mazid

Freshwater Sub-station, Bangladesh Fisheries Research Institute

Shantahar, Bogra, Bangladesh

*Corresponding author

Abstract

In a goat-tilapia integrated farming system, the effect of Black Bengal goat manure on the growth and production of *Oreochromis niloticus* was studied at the Freshwater Sub-station, Shantahar, Bogra for 4.5 months. The stocking density used in three treatments were, 200 goats and 15,000 GIFT strain/ha (T_1); 300 goats and 15,000 GIFT strain/ha (T_2); and only 15,000 GIFT strain/ha (T_3). The initial individual total length and weight of stocked tilapia were 7.6 cm and 11.34 g, respectively. Twelve ponds each having an area of 40 m² were used for this trail. On one side of each pond goat shed was constructed and the space allocated for each goat was 0.75 m x 1.5 m. Newly weaned black Bengal goats of average weight 8.45 kg was used in the trial. Every morning the goats manure was swiped out in ponds through the fixed opening of bamboo made floor of goat shed. Water depth of the ponds was maintained at 0.75 m. The highest fish production was in treatment 1 (1,750 kg/ha) followed by treatment 2 (1,455 kg/ha) and treatment 3 (621 kg/ha). The difference in individual goat weight was not significant ($P > 0.05$) among treatments 1 and 2.

Key words: Black Bengal goat, GIFT strain, Integrated farming

Research findings

- The final individual length of tilapia in three treatments was 17.95 cm (T_1), 15.18 cm (T_2) and 11.10 cm (T_3) while the highest final individual weight was 130 g in T_1 followed by T_2 and T_3 .
- The survival rate of tilapia as obtained from the three treatments was 98% in (T_1), 97% in (T_2) and 90% in (T_3). The survival rate of goat was 95% in (T_1) and 97% in (T_2).
- The highest fish yield of 1,750 kg/ha was obtained from T_1 where 200 goats/ha was stocked while the lowest fish production of 621 kg/ha was obtained from T_3 where no goat was stocked.

Policy implications

- Bangladesh is one of the most densely populated countries in the world and land is very scarce. To ensure the maximum use of space integrated farming will be an alternative and diversified technology for wider dissemination among the stakeholders.
- As this study revealed that integration of goat and tilapia ensure more fish production than tilapia monoculture, the technology can be packaged after repeated trials involving GOs and NGOs in different parts of the country for dissemination.

Livelihood implications

Integrated farming system has a great potential in Bangladesh. Integrated tilapia and goat farming would not only supply more fish but also would be a good source of nutritious animal meat and milk in the rural poor households. The practice of this type of integrated farming would have definite impact on socioeconomic status and sustainable livelihoods in the rural households.

Monoculture of three native air breathing fishes in homestead ditches and plastic barrels

M.S. Azam

SATU, Main Road, Tangail 1900, Bangladesh

Email address: satu@bol-online.com (M.S. Azam)

Abstract

Six on-farm trials were conducted from 1 August to 23 November 2004 in two different environments such as homestead ditches (10 to 17 m²) and plastic barrels (240 liters) to develop techniques for monoculture of climbing perch, *Anabas testudineus*, stinging catfish, *Heteropneustes fossilis* and walking catfish, *Clarias batrachus* for poor and landless people who have no access to pond. Stocking density for ditch was 10 fry/m² while that for barrel was 20 fry/m³. The fishes were fed with 3-test diets viz. low-cost formulated feed (rice bran 20%, wheat meal 10%, mustered oil cake 35%, poultry offal 35%), live foods (chopped snails and clams), and a commercial feed (Saudi-Bangla feed, starter 3: first month and grower-1: subsequent two months) and designated as T₁, T₂ and T₃, respectively. Feeding rate was the same in all the treatments viz. 10% of body weight (first two months), 8% (third month) and 6% (fourth month). T₁ and T₂ had three replications while T₃ had two replications. Water temperature was recorded weekly while fish growth was monitored monthly. After 4 months' rearing, *H. fossilis* and *C. batrachus* in ditches and barrels attained higher average weight in T₂ followed by T₃ and T₁ while *A. testudineus* in barrels also attained higher average weight in T₂. The variation in net weight gain by *A. testudineus* in ditch fed test diets T₂ and T₃ was not significantly different ($P > 0.05$) though the net gain in both T₂ and T₃ was significantly ($P < 0.05$) higher than that of T₁. The yield of climbing perch as obtained from T₁, T₂ and T₃ was 988, 1136 and 1185 kg/ha, respectively while that stinging catfish was 395, 242 and 444 kg/ha and walking catfish was 1605, 2,099 and 1,654 kg/ha respectively. All the three species showed significantly lower growth rate in barrels than in ditches.

Key words: Air breathing fishes, Monoculture, Homestead ditches, Plastic barrels

Research findings

Culture in homestead ditches

- The variation in net weight gain by *A. testudineus* fed test diets T₂ and T₃ was not significantly ($p > 0.05$) different though the net gain in both T₂ and T₃ was significantly ($p < 0.05$) higher than T₁.
- *H. fossilis* and *C. batrachus* in ditches and barrels attained higher average weight in T₂ followed by T₃ and T₁.

Culture in plastic barrels

- The growth response of *A. testudineus* in T₂ was the highest followed by T₃ and T₁. However, the variation between T₃ and T₁ is not significant ($p > 0.05$).
- Net weight gain by *C. batrachus* in T₂ was higher than that of T₃ and T₁.
- Variation in survival rate of all the three air breathing fishes in different treatments were not significant ($p < 0.05$).

Policy implications

- Culture of air breathing fishes in homestead ditches was found to be economically potential for the landless poor. GOs and NGOs should take initiative to update and disseminate the technology to the poor.
- Snails and bivalves were found to be preferred by the experimental air breathing fishes, however to save the shellfish diversity molluscs should not be used as feed.
- All the three high valued air-breathing fishes are threatened, homestead culture of these species not only help the poor but also will ensure its protection.
- GOs and NGOs should take initiatives for mass production of fingerlings of air breathing fishes, so that poor farmers can easily get the fingerlings for their homestead culture purpose. By culturing the high priced air breathing fish livelihood of the rural people can be improved.

Livelihood implications

Culture of short cycle air breathing fishes has considerable positive implication on the livelihood of the poor and landless people through ensuring better utilization of their limited resources. Homestead culture of air breathing fishes (climbing perch, stinging catfish and walking catfish) might uplift the nutritional status of rural people. Until hatchery produced fry are available poor farmers can continue culture of these fishes by collecting naturally produced fingerlings from different ditches and water pools. Through homestead culture of costly air breathing fishes in earthen ditches in rural areas the poor and landless can improve their livelihood. Culture of air-breathing native species in homestead ditches would ensure aquaculture diversification and benefit of the resource poor rural people.

Demonstration of some selected aquaculture technologies under farming system research in Jessore and Santahar, Bangladesh

M.W.A. Pramanik, M.A. Razzak, M.G. Hussain* and M.A. Mazid

Bangladesh Fisheries Research Institute

Mymensingh 2201, Bangladesh

*Corresponding author

Email address: fsbfri@bdonline.com (M.G. Hussain)

Abstract

BFRI evolved some selected aquaculture technologies viz. polyculture of carps in perennial ponds, monoculture of short cycled fish species (BFRI super strain) in seasonal ponds and prawn seed production through backyard hatchery system have been demonstrated under Farming System Research (FSR) component in Jessore and Santahar regions. Both polyculture of carps and monoculture of short cycled fish species technologies were tested in farmer's ponds in Kaium Kula village near Jessore town. In polyculture trials, seven species comprising of silver carp (*Hypophthalmichthys molitrix*), catla (*Catla catla*), rohu (*Labeo rohita*), grass carp (*Ctenopharyngodon idellus*), common carp (*Cyprinus carpio*), mrigal (*Cirrhinus cirrhosus*) and silver barb (*Barbonymus gonionotus*) were stocked @ 9,500 (ratio 6:2:4:2:1:5:5); 10,750 (ratio 6:2:4:2:1:5:5) and 12,000 (ratio 6:2:4:2:1:5:4) fish/ha respectively in ponds of T₁, T₂ and T₃ having three replications of each. The mean highest fish production was 3,148 kg/ha in T₃, followed by 2,899 kg/ha in T₁ and 2,875 kg/ha in T₂. Production of T₃ was significantly different (P<0.05) than both T₁ and T₂, while there was no significant differences (P>0.05) between the production of T₁ and T₂. In case of trial of short cycled fish species, two treatments were tested: T₁ (comprising of BFRI super strain of Niletilapia, silver carp, common carp and silver barb; ratio 3:5:1:1) and T₂ (having only BFRI super strain of Nile tilapia). Stocking density in both the treatments were same (20,000 fish/ha). In this trial average production was higher in T₁ (2,743 kg/ha) than that of T₂ (2,369 kg/ha) but the production figure in these two treatments was not significantly different (P>0.05). Demonstration of backyard prawn hatchery technology was tested at Santahar region of Bogra district, North-west part of Bangladesh. This hatchery consisted of three main components i) bio-filter, ii) rearing tank unit (*chari*) and iii) air blower/air pump unit. Plastic drum of 200 – 250 l capacity and cemented *chari* of 200-250 l capacity were used as bio-filter and larval rearing containers respectively. A 0.5 hp air blower with 6 aquarium air pump were used to operate the aeration system in the hatchery. Diluted sea water (10-12 ppt) made from brine solution (200-250 ppt) collected from salt-bed was used in the backyard hatchery system of hatching of eggs and rearing of larvae. Rearing of first stage zoea-larvae was reared in three rearing tanks following the stocking densities of 40, 50 and 60/l of water respectively. Production of post-larvae were 20±0.82, 22±1.12 and 28±1.63/liter of water in treatments I, II and III respectively in 38, 40 and 39 days rearing period.

Key words: Farming System Research, Backward prawn hatchery

Research findings

- In polyculture trials, the mean highest fish production was 3,148 kg/ha in T₃, followed by 2,899 kg/ha in T₁ and 2,875 kg/ha in T₂. Production of T₃ was significantly different ($p < 0.05$) than both T₁ and T₂, while there was no significant differences ($p > 0.05$) between the production of T₁ and T₂.
- In case of trial of short cycled fish species, two treatments were tested: T₁ (comprising of BFRI super strain of Nile tilapia, silver carp, common carp and silver barb; ratio 3:5:1:1) and T₂ (having only BFRI super strain of Nile tilapia). Stocking density in both the treatments were same (20,000 fish/ha). In this trial average production was higher in T₁ (2,743 kg/ha) than that of T₂ (2,369 kg/ha) but the production figure in these two treatments was not significantly different ($p > 0.05$).
- Post larvae production in treatment I was 20 ± 0.82 in 38 days rearing period out of 40 larvae stocking per liter
- Post larvae production in treatment II was 22 ± 1.12 in 40 days rearing period out of 50 larvae stocking per liter
- Post larvae production in treatment III was 28 ± 1.63 in 39 days rearing period, where stocking density were 60 larvae/liter

Policy implications

- Polyculture of carps in perennial ponds and culture of short cycled fish species in seasonal ponds are the most popular and useful technologies, which can be disseminated for wide scale adoption all over the country through GOs and NGOs.
- For introducing different cultural practices supply of desired number of prawn juvenile to the farmers in time, the backyard prawn hatchery technology should also be disseminated by DoF, NGOs and private entrepreneurs.

Livelihood implications

Adoption of carp polyculture and culture of short cycled species technologies in the suitable water bodies have, meanwhile, shown a tremendous impact on the livelihood of rural farmers. The relevant stakeholders such as, hatchery owners, technicians, farmers, processors and importers etc. will also be benefited by implementing prawn hatcheries and seed production systems in some important areas of the country for enhance exporting of prawn/shrimp products, which will create enormous opportunities for the large group of unemployed youth, women and poor people.

Health and disease status of Thai pangas, *Pangasius hypophthalmus* cultured in rural ponds of Mymensingh, Bangladesh

M.A.R. Faruk

Department of Aquaculture, Bangladesh Agricultural University

Mymensingh 2202, Bangladesh

Email address: hasin96@yahoo.com (M.A.R. Faruk)

Abstract

Thai pangas, *Pangasius hypophthalmus* is one of the important aquaculture species in Bangladesh. Over the last few years spectacular development has been taking place in Thai pangas farming in Mymensingh district. Due to availability of easy breeding and culture techniques as well as quick return, more and more people are converting their rice fields into pangas farms overnight. The present study was carried out to examine health and disease status of Thai pangas mainly through clinical, histopathological and bacteriological techniques. In addition, for collecting primary data on disease and health status of Thai pangas and the resultant socioeconomic impacts on rural households, questionnaire interview and participatory rural appraisal tools were used with selected farming households in three upazilas of Mymensingh district. The most prevalent diseases as reported by the farmers were red spot, followed by anal protrusion, tail and fin rot, pop eye, dropsy and gill rot. Other conditions like cotton wool type lesion, ulceration and white spot were reported but with lower incidence. Four isolates of *Aeromonas hydrophila* were recovered from kidney and lesion of diseased fish. Hemorrhage over the body especially near mouth and caudal region was noticed in the fishes associated with aeromonad infection. Internally, kidney, liver and spleen became swollen and enlarged. The isolates varied with their pathogenicity. All the four isolates were sensitive to Nitrofurantoin, Cotrimoxazole and Tetracycline but were resistant to Amoxicilline. An attempt was made to treat diseased fish with extracts from neem leaf, garlic and turmeric. Recovery of infection was monitored through mortality and histopathology. General histopathological changes of different organs were also studied. Extract from neem (*Azadirachta indica*) leaf gave better result. Telangiectasis, lamellar hypertrophy and hyperplasia hemorrhage, lamellar fusion, necrosis of lamellar epithelial cells, presence of parasites and their cysts were the major pathology of gills. Hemorrhagic lesion, pyknotic nuclei and melanomacrophage centers (MMC) were found in the liver of fish. Major pathologies in kidney of fish included presence of MMC, necrotic and ruptured kidney tubules, severe haemopoietic necrosis, and hemorrhage. The economic loss due to disease in Thai pangas farming was estimated from the difference between expected production and actual production. On an average, Thai pangas farmers of Mymensingh incur a loss of Tk. 23,104/ha/cycle due to fish disease (3.6% of expected total production). The loss, however, varied with location and size of farms, type of farmers and management practices. The study also highlighted fish health management related problems and

recommended further work for the development of user-friendly farmer-oriented fish health management packages.

Key words: Disease, Thai pangas, Pathogen, Treatments, Economic loss

Research findings

- Prevalence of various types of diseases in Thai pangas farming had negative impacts on its production.
- Economic losses due to fish diseases could be as high as Tk 23,104/ha/cycle.
- The rate of prevalence was found to vary according to farm categories and it was highest in small-scale farms.
- The most common diseases identified were the hemorrhage or red spot, anal protrusion, pop eye, tail and fin rot, ulceration and white spot (Fig. 1).
- Average disease control cost was Tk.4,285 ha/cycle.
- The diseases were more prevalent in winter season.
- A gram-negative motile bacterium, *A. hydrophila* was found to be the major causative agent of pangas disease. The bacterium could be recovered from kidney and lesion of diseased fish.
- The isolates of *A. hydrophila* was found to be pathogenic to susceptible fish when injected intramuscularly with 1.2×10^7 cfu/fish.
- Nitrofurantoin and cortimoxazole could be used as antibacterial therapy against *A. hydrophila* infection.
- Extracts from neem leaf could have some therapeutic value in recovering diseased fish.
- The study also highlighted fish health management related problems and recommended further work for the development of farmer-oriented fish health management.

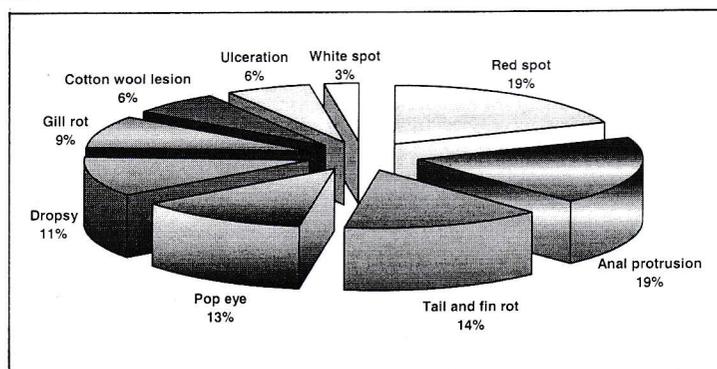


Fig. 1. The diseases identified in Thai pangas in Mymensingh.

Policy implications

- GOs and NGOs should come forward to create awareness among pangas farmers on primary fish health management techniques.
- More effort should be directed towards the characterization of pathogens.
- The farmers and the extension agents should be trained up on simple diagnostic procedure and effective therapy.
- There should be legislation on the safe use of chemotherapeutic agents used for fish health management
- Establishment of mobile diagnostic centers and support service for pangas farmers.
- Herbal therapy especially neem leaf extracts could be a low-cost and environment friendly alternative of chemical treatment but more research is needed in this particular area.
- Regular fish health monitoring protocol should be established.

Livelihood implications

The livelihood of people associated with pangas industry like fish famers, traders, feed manufacturers, hatchery operator etc. are in danger due to outbreak of diseases. This is negetavely affecting their livelihoods through loss of production, income and asset. To secure the livelihood of the huge number of people involved in pangas industry, it is important to follow improved fish health management strategies to avoid disease outbreak.