J. Aqua. **22** (2014)

DEMONSTRATION OF CARP SEED PRODUCTION AND REARING IN REMOTE AREA : A CASE OF A FARMER OF BADABISHOLA, MAYURBHANJ DISTRICT, ODISHA

B. C. Mohapatra*, N. K. Barik, D. Majhi, S. K. Mahanta and H. Sahu

ICAR-Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar-751002, Odisha. India
**Corresponding author: bcmohapatra65@gmail.com*

Availability of good quality and quantity fish seed was the main constraint for aquaculture development of a remote village at Badabishola, Mayurbhanj District, Odisha State. This issue was addressed by the ICAR-CIFA through technology transfer under a project funded by the Department of Biotechnology, Government of India. In the village one farmer having brood rearing facility and overhead water supply system, adopted for FRP carp hatchery operation through a cooperative society. With the help of the technology eight carp breeding programmes were undertaken producing 56 lakh spawn (47 lakh rohu, 6 lakh grass carp and 3 lakh common carp spawn) in the year 2011-2012. A portion of spawn was reared for 15-20 days in nursery ponds for fry production, which had produced 5.6, 0.96 and 0.63 lakh fry of rohu, grass carp and common carp respectively. These fry were once again reared for 3-4 months in rearing ponds which had produced fingerlings of 3.15, 0.38 and 0.3 lakhs of rohu, grass carp and common carp respectively. Through these activities the farmer could add Rs. 11,044 from hatchery operation and Rs. 2,55,241 from seed rearing to his annual income in 2011-12.

INTRODUCTION

Over last few decades the country has noticed a sizable expansion of freshwater aquaculture, but, these developments are concentrated in few states and few regions within the states. The remote, inaccessible and backward regions are often lagged behind in aquaculture development due to lack of access to aquaculture technologies. The Mayurbhanj District of Odisha located in the northern part of Odisha is one of such district in which available water resources are not been used adequately for aquaculture purposes. The aquaculture has the potential to produce quality protein at a cheaper price with simultaneous improvement in the income and livelihood of the poor. Availability of quality seed is the prime requisite for aquaculture development. The remote and inaccessible localities often lack timely access to quality seed. Therefore, producing seed in these regions is a feasible alternative, which can be made into reality by establishment of portable FRP hatcheries (Das *et al*., 2011; Mohapatra *et al.,* 2011*,* 2012 & 2013) and transfer of seed production technologies.

To initiate the aquaculture development process in the Mayurbhanj District of Odisha, a seed production center was established in *Sagunibasa* by installing portable hatchery in June 2011. The center was developed with an objective of making seed, inputs and information available to the

other aquaculture farmers in the localities. The gamut of aquaculture technologies *i.e*., hatchery operations, seed rearing, table fish production has been transferred to the center with a percolating effect on nearby areas as it has given a boost to the aquaculture development in the nearby localities.

The work was carried out by a project, which was undertaken by ICAR-CIFA with funding support from Department of Biotechnology, Govt. of India. Under this project as many as 10 locations were chosen for the establishment of the FRP hatcheries among the poor households in Nayagarh and Mayurbhanj Districts of Odisha. Out of which one extremely resource poor and remote village *viz*., Badabisola was selected in Mayurbhanj.

The present case study was undertaken to evaluate the performance of the technology and its impact in the farmer's field. The field work was carried out during July 2011 to June 2012.

MATERIALS AND METHODS

The Mayurbhanj District is located between 21^{o} and 22^{o} North latitude and 85^{o} and 87^{o} East longitude. The Soil is generally acidic in reaction with sandy loam and lateritic; light textured having low water retentive capacity. Generally, the tanks and ponds are owned by Gram Panchayats, Revenue Department and private persons. The total water area covered under pisciculture is 5338.85 hectares excluding 5525 hectares under reservoir and minor irrigation projects (CGWB, 2013). The present level of fish production in the district is about 9600 M.T. and the per capita consumption of fish is about 5.28 kg per annum (NFFWP), which is below the recommended level of 11.0 kg per head per annum. In order to utilize the available water resource, around 400 lakh of seed (fingerlings) is required. The district produces about 120 lakh in addition to 100 lakh seed is available through the hatcheries of the Odisha Pisciculture Development Corporation Ltd during 2010-11 (F&ARD, 2011). Thus, there is a sizeable gap of 180 lakh carp seed, which has to be met through private producers and traders. The establishment of hatchery unit is the better alternative available which can be operated by an individual or self-help-group. Keeping this in view, the SHG in the Badabishola village was supported for producing quality fish seed to the need of local aqua-farmers.

The FRP carp hatchery is a plastic gadget in which up to 30 million seeds can be produced in a year. Till today, approximately 250 numbers of such gadgets are being operated across the country. It has been tested widely across the geographical regions, which has positive impact of the overall development of the aquaculture in the region (Sudhin, 2007, Alan Casebow, 2008, Sarangi *et al.,* 2008; Das *et al*., 2011 and Mohapatra *et al.,* 2011, 2012, 2013).

Badabishola Village is situated 6 km away from Kaptipada Block of Mayurbhanj District. The hatchery was installed and operated in the farm of Mr. Lalit Krusna Sahu. He is a member of *Salukkumari Prathamik Matsyajibi Sangha*, Sagunibasa, a society with 53 members (4 OBC and 49

Scheduled tribes). The farm has 8 ponds covering water area 2 ha. Mr Sahu has the prior experience of the fish seed trade and traditional way of fish seed production in hapa. He discontinued the enterprise since 2010 due to lack of technical support. To fill up the gap, ICAR-CIFA has provided the hatchery and technical support to re-establish the seed production system in the scientific manner. The arrangements were made in which Mr Sahu shall produce spawn from hatcheries, while other members would be involved in seed rearing from spawn. The technology of hatchery management and seed rearing was transferred to all the members of the society to sustain activities in future.

RESULTS AND DISCUSSION

Physico- chemical properties of pond water

Physico-chemical parameters of the hatchery water at Badabisola Village during breeding programmes were pH 6.7 to 7.9; dissolved oxygen 2.4 to 6.4; total alkalinity 50-120 mg/liter and total hardness 60-120 mg/liter (Table 1). The water of the adopted ponds was analyzed every month and it was found to be suitable for fish rearing with some BMP (Better Management Practice) advices. In the nursery and rearing ponds, the pH ranged between 7.0 and 7.6; total alkalinity 80-120 mg/liter and total hardness 60-110 mg/liter.

Table 1. Physico-chemical parameters of hatchery water at Badabisola Village during carp breeding operation

Date of breeding operation	Temperature (°C)	pH	Conductivity (milli m ho/cm)	Dissolved Oxygen (ppm)	Alkalinity (mg/l)	Hardness (mg/l)
30.06.11*	29.1 - 31.0	6.8 - 7.31	0.38 - 0.53	4.2 – 5.4	70 - 80	60 - 70
30.06.11+	28.4 - 32.7	7.01 - 7.23	0.267 - 0.31	5.4 - 6.1	80 - 120	60 - 70
21.07.11	30.6 - 31.9	6.78 - 7.03	0.31 - 0.43	3.2 – 5.9	50 - 80	60 - 80
23.07.11	27.5 - 33.2	6.80 - 7.4	0.26 - 0.46	5.4 – 5.8	60 - 90	70 - 90
01.08.11	27.9 - 31.8	6.7 - 7.02	0.47 - 0.53	3.9 - 6.4	80 - 100	70 - 80
06.08.11	27.5 - 28.6	7.34 - 7.96	0.41 - 0.59	4.5 - 6.8	70 - 100	80 - 80
07.08.11	29.1 - 32.3	7.21 –7.41	0.26 - 0.38	2.4 – 4.6	70 - 90	70 - 90
13.08.11	27.6 - 32.9	6.8 - 7.33	0.24 - 0.27	3.7 - 4.9	60 - 100	90 - 120

* morning, + Evening

Spawn Production

In Badabishola Village, 3 ponds of 1.0 hectare total area were selected for carp brood stock rearing. The size of the ponds ranged between 0.3 and 0.5 ha. The water depth varied between 0.9 - 1.5 m. The water depth was maintained by filling the ponds from the borewell of the farm. These ponds were kept free from aquatic weeds and standard management practices were followed for broodstock rearing. Initially the breeders were collected from nearby reservoir

and ponds, and were kept @ 1500 - 2500 kg/ha. Floating feed of 3-4 mm diameter was supplied @ 2-3 % of body weight of the fish stock in the ponds.

Induced breeding operations were conducted for three carp species *i.e.,* Rohu, *Labeo rohita*; Grass carp, *Ctenopharyngodon idella* and Common carp, *Cyprinus carpio* in the village. The first induced breeding in FRP carp hatchery was conducted on 30 July 2011 and continued till 13 August 2011. Male and female fishes were selected in 1:1 ratio for *L. rohita* and 2:1 for other species in induced breeding operations. Ovaprim, a marketed inducing agent was used @ 0.5 ml/kg of female and 0.2 ml/kg of male body weight. Injection was given at intraperitoneal region of the fish. Eggs were collected by fixing cotton hapa in the pond adjacent to FRP carp hatchery unit. The eggs were incubated for 4 days in the FRP hatching pools for spawn production. Spawn were harvested after 72 hours from hatching from the hatchery and reared for fry and fingerlings. Total 8 breeding programmes were conducted, five for *L. rohita,* two for *C. idella* and one for *C. carpio*.

Total eight carp breeding operations were conducted in the FRP carp hatchery in 2011-12 and 56 lakh spawn were harvested (Table 2). From eight breeding trials, 47 lakh rohu spawn were harvested. Survivability rate of rohu spawn was found to be 85.9 –92.1 per cent . Grass carp was bred in two operations and 6 lakh spawn were harvested. Common carp was bred once in 2012 and 3 lakh spawn were recovered. The survivability rate of grass carp spawn was recoded 62.5 and 70 per cent in two breeding operations. In common carp survivability rate was low, *i.e.*, 56.6 per cent. After harvest, 31 lakh rohu spawn were sold @ Rs 500/lakh spawn.

Table 2. Carp breeding operations and seed production at Badabishola Village

Sl. No	Date of Operation	Species	Total Wt. of breeder (kg)		Spawn			Fry			Fingerlings
			Male	Female	Recovery (lakh)	Sold	Reared	Produced (lakh)	Sold	Reared	Harvested (lakh)
1	30.06.11*	*L. rohita*	7.5	9.6	11.0	No	11.0	4	--	4	2.15
2	30.06.11+	*L. rohita*	8.6	8.9	13.0	13.0	--	--			
3	21.07.11	*L. rohita*	2.5	3.2	05.0	No	05.0	1.6	--	1.6	1.0
4	23.07.11	*L. rohita*	4.4	5.9	08.0	08.0	--	No			
5	01.08.11	*L. rohita*	6.0	7.8	10.0	10.0	--	No			
6	06.08.11	*C. idella*	6.15	4.8	02.5	--	06.0	0.96	--	0.96	0.38
7	07.08.11	*C. idella*	6.1	4.7	03.5						
8	13.08.11	*C. carpio*	6.3	7.0	03.0	No	03.0	0.63	--	0.63	0.3

* morning, + Evening

In rohu 1.33-1.58 lakh eggs/kg of female, 85.9 –92.1% fertilization of eggs and 1.14-1.46 lakh spawn/kg of female were found during the FRP carp hatchery operation. In case of grass carp 0.83-1.06 lakh eggs/kg of female, 62.5-70 per cent fertilization of eggs and 0.52-0.74 lakh spawn/kg of female were reported. In common carp 0.75 lakh eggs/kg of female, 56 per cent fertilization of eggs and 0.42 lakh spawn/kg of female were reported during the hatchery operation (Table 3).

Table No. 3. Carp breeding efficiency in FRP hatchery at Badabisola Village

Sl. No	Species	Egg produced/kg female body weight	Rate of fertilization	Total spawn produced (in lakh)	Spawn produced / kg female body weight
1	*Labeo rohita*	1.33-1.58	85.9-92.1	47	1.14-1.46
2	*Ctenopharyngodon idella*	0.83-1.06	62.5-70 %	6	0.52-0.74
3	*Cyprinus carpio*	0.75	56%	3	0.42 lakh

Fry Production

Seed rearing was undertaken in two phases comprising of rearing spawn to fry in nursery and fry to fingerling in rearing ponds. Out of 47 lakh, 16 lakh rohu spawn were reared in nursery pond and 5.6 lakh fry were harvested after 15-20 days of rearing. Likewise 0.96 lakh grass carp and 0.63 lakh common carp fry were harvested from 6 lakh and 3 lakh spawn of respected species. The harvested fry of all species were reared for fingerling production.

Environment in which carp seeds live influences their growth and survival. The survival rate of carp seed depend on the aquatic weeds; aquatic insects; predatory and weed fishes; soil and water quality; availability of natural food; stocking density; artificial supplementary feed and rearing period in pond. At Badabishola Village earthen ponds of size 0.15 to 0.20 ha each with water depth 0.9-1.3 m were used for nursery phase of rearing. Spawn stocked for 15-20 days for fry production. To maintain proper nutrients to the fish ponds, organic and inorganic fertilizers were used. Phase manuring was done with a mixture of 750 kg/ha groundnut oil cake (GNOC), 200 kg/ha raw cow dung and 50 kg/ha single super phosphate. Half of the dose was made in to thick paste by addition of water and was applied as basal dose 3-4 days prior to stocking of spawn, and the remaining dose were applied in 2-3 splits, depending on the plankton population of the pond. The population of aquatic insects was increased in the ponds just after fertilization. Insects were controlled by application of cheap oil and detergent powder in the ponds and repeated netting. The combination of GNOC and rice-bran at 1:1 (w/w) was used as supplementary feed. The dry feed mixture was applied @ 400% of initial spawn biomass for the first 5 days and 800% of the initial spawn biomass for the subsequent days. The daily ration was supplied two equal splits, *i.e.,* during morning and evening.

Fingerling Production

Fry of rohu, common carp and grass carp measuring 18-30 mm were raised further for 3 months fingerlings produced and then after to yearling. Fry stocked in the same nursery ponds and in two extra ponds covering water area of 1.5 ha. GNOC and rice-bran at 1:1 (w/w) was used as supplementary feed @ 8-10; 6-8 and 4-6 per cent of initial biomass of fry/day during the first, second and third months of rearing, respectively

After 3 months of rearing of fry, 3.15 lakh rohu, 0.38 lakh grass carp and 0.3 lakh common carp fingerlings were harvested. Out of total rohu fingerlings, 0.5 lakh were sold and the rest were kept for yearling production.

Economic analysis

Through the hatchery operation for 8 times and carp seed production, the farmer could add Rs. 11,044 and Rs.2,55,241 respectively to his annual income in 2011-12. The economics of hatchery operation and seed rearing are given in Tables 4 & 5.

Table 4. Economics of FRP carp hatchery operation at Badabisola

Sl. No	Items	Unit	Price/ unit in Rs.	Cost in Rs. (A)	life (in years) (C)	Scrap value in Rs. (B)	Depreciation per year in Rs. (A-B)÷C
	Fixed Cost						
1	FRP hatchery set	1	1,00,000	1,00,000	15	0	6,667
2	Over-Head tank	1	5,000	5,000	15	0	333
3	Platform and shed	1	6,000	6,000	10	600	520
4	Electric pump	1	5,000	5,000	5	500	900
5	Miscellaneous (fittings)			1000	10	0	100
	Recurring cost						
6	Brood Fish	99.5	120	11,940			11,940
7	Electric or fuel (per operation)	8	200	1,600			1,600
8	Ovaprim (ml)	40	38.40	1,536			1,536
	Sub total of depreciation and recurring cost						22,596
	10% Interest on depreciation and recurring cost						2,260
I	**Total Expenditure**						**24,856**
	Gross Income						
10	Spent fish (kg)	90	120	10,800			10,800
11	Spawn (lakh) Rohu & Mrigala	47	400	18,800			18,800
	Grass Carp	6	800	4,800			4,800
	Common Carp	3	500	1,500			1,500
II	**Total Income**						**35,900**
	Net income (II-I)						**11,044**

Table 5. Economics of carp seed rearing at Badabishola Village in 2011-12
(1.0 ha pond area)

Sl. No.	Items	Unit	Price/unit (Rs)	Cost (Rs)
	Recurring cost			
1	Rohu spawn	16 (lakh)	400	6400
2	Grass carp spawn	6 (lakh)	800	4800
3	Common carp spawn	3 (lakh)	500	1500
4	Kerosene	135 (lit)	25	3375
5	Feed	5200 (kg)	17	88,400
6	GOC	2400 (kg)	24	57,600
7	SSP	125 (kg)	11	1375
8	Urea	90 (kg)	14	1260
9	Lime	540 (kg)	10	5400
10	Cow dung	3600 (kg)	0.50	1800
11	Wages	165 (Labor/day)	100	16,500
12	Miscellaneous			2000
A	Total recurring cost			1,90,410
B	12% Interest on recurring cost			22,849
I	**Total expenditure (A+B)**			**2,13,259**
	Gross Income			
13	Rohu fingerlings sold	3,00,000 (nos)	1.00	3,00,000
14	Grass carp fingerling sold	20,000 (nos)	2.25	45,000
15	Common carp fingerling sold	20,000 (nos)	1.10	22000
16	Rohu fingerlings stocked	50,000 (nos)	1.00	50,000
17	Grass carp fingerling stocked	18,000 (nos)	2.25	40,500
18	Common carp fingerlings stocked	10,000 (nos)	1.10	11,000
II	**Total income**			**4,68,500**
	Net income (II-I)			**2,55,241**

Note: No fixed cost involved

CONCLUSIONS

A case study was undertaken in *Sagunibasa,* Badabisola village in Mayurbhanj district in which a FRP hatchery was established. Under the DBT sponsored project, the *Salukkumari Prathamik Matsyajibi Sangha*, cooperative the society was adopted to develop a seed production system by imparting training and capacity building of members in the seed rearing of carps. The demonstration achieved objectives of seed production and supplied to the large number of farmers to meet the gap in the fish seed availability in the locality. The technology used for the seed production of all three species of Indian Major carps and significant economic benefits were generated. The system developed as a model for carp seed production in the remote areas of Odisha.

ACKNOWLEDGEMENTS

The authors acknowledge the financial assistance of the Department of Biotechnology, Govt. of India and the facilities provided by ICAR-CIFA, Bhubaneswar for carrying out the present programme at Badabishola Village, Mayurbhanj District, Odisha.

REFERENCES

Alan Casebow, 2008. A new fish hatchery in Diptipur. *Operation Agri: Outreach Abroad*, Edinburg, January 2008.

CGWB, 2013. Ground water information booklet- Mayunbhanj district. Central Ground Water Board, Ministry of Water Resources, SER Bhubaneswar

Das, B. K., B. C. Mohapatra, H. K. De, D. N. Chattopadhay, N. Sarangi, A. E. Eknath, S. Chandra, P. Pattnaik, A. Mallick, D. K. Swain and S. Ghosh, 2011. Women Self Help Group in aquaculture at Tanar, Kendrapada Sadar, Odisha: A case study. In: Radheyshyam *et al.* (ed.) *Aquaculture Innovators*. Published by Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha, pp 78-86.

F&ARD, 2011. Annual Report: 2010-11. Department of Fisheries and Animal Resource Development, Government of Odisha.

Mohapatra, B. C., N. K. Barik, Bikash Sarkar, D. Majhi, S. K. Mahanta and H. Sahu, 2013. Carp Seed Production in FRP Carp Hatchery by Women Self-Help-Group in Odisha. In: *Plasticulture in Field: Success Stories of All India Coordinated Research Project on Application of Plastics in Agriculture*. AICRP Cooperating Unit, CIPHET, Ludhiana: pp 8-10.

Mohapatra, B. C., S. K. Mahanta, D. Majhi and A. E. Eknath, 2012. Seed production of Rohu (*Labeo rohita* H.) in FRP hatchery in Nuagaon block, Nayagarh district of Orissa: *e-Planet*, **9**(1): 35-39.

Mohapatra, B. C., S. K. Sahoo, D. Majhi, S. S. Ikmal, S. Parida, B. Patro, J. K. Jena and S.K. Swain, 2011. Successful venture of carp seed production by a farmer at Purunia Village,

Patna Block, Keonjhar District, Odisha: A case study. In: Radheyshyam *et al.* (ed.) *Aquaculture Innovators*. Published by Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha*.,* pp 44-49.

Sarangi, N, B. K. Das, B. C. Mohapatra, P. Patnaik, S. Ghosh, D. K. Swain and A. Mallick, 2008. Carp seed production under extreme temperatures: An experience at Tanar Village, Odisha, India; *Fishing Chimes*, 28 (3): 42-44 and 49.

Sudin, K., 2007. Pisciculture as a viable livelihood option for poor: issues, experiences and lessons from Western Orissa Rural Livelihoods Project (WORLP). *Workshop on Portable hatchery for better carp seed production. 31 August-1 September, 2007*, Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha, India, pp : 4-10