



INDUCED BREEDING OF INDIAN MAJOR CARPS IN FRP HATCHERY AT FARMER'S FIELD

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ABSTRACT

*The portable hatchery technology has made significant impact directly through increased availability of seed and indirectly through transfer of a range of aquaculture technology around it. Based on the need assessment one of such hatchery was installed and operated at Puranapradhan Village of Baliana Block, Khordha District, Odisha, India. During breeding season of 2015 the hatchery was used for induce breeding of Indian major carps i.e., rohu (*Labeo rohita*) and mrigal (*Cirrhinus mrigala*) 19 times (viz., rohu 11 times, and mrigal 8 times). Total 198 lakh spawn (carp seed) was produced (i.e., rohu 125 lakh and mrigal 73 lakh) from the breeding operations. Spawning fecundity was found to be 1.3-1.82 and 1.25-1.58 lakh egg/kg female body weight of rohu and mrigala, respectively. Percentage of fertilized eggs during spawning was calculated to be 90-100% for both species. Spawn production per kg female body weight was found to be 1.23-1.55 lakh/kg for rohu and 1.09-1.4 lakh/kg for mrigal and percentage of spawn survival from fertilized egg ranged 90- 97.17 % in rohu and 87.3- 94.74 % in mrigal.*

Keywords

Indian major carp, FRP carp hatchery, Induced breeding, Spawn production

Introduction

The portable FRP carp hatchery developed by the “ICAR - All India Coordinated Research Project on Plastics Engineering and Technology” Center at ICAR - CIFA, Bhubaneswar, India (Mohapatra *et al.*, 2003, 2004, 2005, 2007, 2008; CIFA, 2004; ICAR, 2005; and Sarangi *et al.*, 2008) has gained its popularity due to easy adaptability under farmers conditions. The hatchery unit has some benefits *viz.*, portable in nature, easy to install and operate, requires less quantity of water during fish breeding and spawn (fish seed) production, needs less space for installation and the product durability is about fifteen years (Mohapatra *et al.*, 2005). In lean season, the system can be used for ornamental fish rearing in which village women can take part in leisure time (Mohapatra *et al.*, 2011). This hatchery can be a tool for fish biodiversity conservation through seed production of endangered and threatened fish ((Mohapatra *et al.*, 2015a). Due to these advantages, the technology has been adopted successfully in 26 states of India (Mohapatra *et al.*, 2015a).

The unit consists of four major parts *i.e.*, breeding-cum-spawning pool, hatching-cum-incubation pool, egg-cum-spawn collection chamber and overhead water storage tank. The system is so designed that it creates an environment suitable for fish breeding in the field conditions for 10-12 kg of female carps in one operation. In one run, up to 1.0-1.2 million spawn can be produced from the system which is sufficient to stock pond area of about 30 hectares @ 5000 fingerlings/ha meter of water. One complete run of the hatchery requires minimum water quantity of 90 m³ (Mohanty *et al.*, 2009).

The actual performance of the technology under farmers’ conditions varied widely. The factor like level of skill and knowledge, availability of broodstock, soil and water quality, temperature regime, availability of farm facilities etc determine the performance which can be measured in terms of the spawn production. Several studies has been made to assess the farmer level performance. The present study, made a detailed analyses of adoption and adaptations of the technology with respect to the performance of the portable hatchery. The present case was operated by an entrepreneurs located in Puranapradhan Village, Baliana Block, Khordha District of Odisha with technical support from ICAR-CIFA. The study was conducted during 2015-16 as

a part of the DBT sponsored project on “Carp seed production in FRP hatchery and development of integrated rearing system for livelihood development of SC/ST communities in Khurda district of Odisha”.

Materials and methods

One unit of FRP carp hatchery consisting of four parts *i.e.*, one breeding pool, two hatching pools and one egg/spawn collection tank was installed at Puranapradhan Village, Baliana Block, Khordha District of Odisha. The water supply was made to the hatchery from one cemented overhead tank of capacity 35 m³. The system operates with the principle of eco-hatchery. Breeding/ spawning pool is 2.15 m diameter, 0.9 m height, 1:22 bottom slope and 3409 litre total capacity with operation capacity 2950 litre; Hatching/ incubation pool is 1.4 m diameter, 0.98 m height, 1,400 litre total volume and 1,200 litre net egg incubation volume with a FRP inner chamber of 0.4 m diameter and 90 cm height covered with nylon bolting cloth to filter the excess water to the drain) and Egg/ spawn collection chamber is 1.0 m length, 0.5 m breadth, 0.5 m height and 250 litre water holding capacity.

The carp fishes used for breeding trials were reared in the same farm. Synthetic hormone (Ovatide) was used as the inducing agent for carp breeding. The dose of Ovatide was 0.5 ml/kg body weight of female and 0.2 ml/kg body weight of male. Latency period for egg release, effective spawning period, percentage of fertilization of eggs, hatching time, percentage of spawn recovery and spawn production per kg body weight of different species were calculated.

Latency period = Time between hormone administration and initiation of spawning in carps.

Effective spawning period = Time between initiation and stoppage of spawning.

Spawn production per kg body weight = Total spawn harvested / total weight of female.

Water parameters like pH, alkalinity and hardness were analyzed by APHA 2005 method in the laboratory at ICAR-CIFA, Bhubaneswar and water temperature was measured by temperature probe.

Results and Discussion

In the monsoon of 2015, induced breeding of Indian major carps (*L. rohita* and *C. mrigala*) was conducted for 19 times at Puranapradhan Village, Baliana Block, Khordha District, Odisha. Total 198 lakh spawn was harvested, i.e., rohu 125 lakh and mrigal 73 lakh from the breeding operations. Induced breeding was conducted for 11 times for *L. rohita* and 8 times for *C. mrigala*. The results are shown in the Table – 1 and 2. In this experiment spawning fecundity of rohu and mrigala was found to be 1.3 - 1.82 lakh and 1.25 - 1.58 lakh egg/kg bodyweight of female fish respectively. Effective spawning period of rohu was 45 - 110 minutes and of mrigal 50-95 minutes. Percentage of fertilized eggs in rohu and mrigala was calculated to be 90-100%. Time for completion of egg hatching was found more or less similar trend in rohu 930 - 1060 minutes, and mrigal 950-1050 minutes. Percentage of spawn survival from fertilized egg ranged 90- 97.17 % in rohu and 87.3- 94.74 % in mrigal. Spawn production per kg female body weight (lakh) was found in similar trend for all the experimented fishes i.e., rohu 1.23-1.55 lakh/kg female body weight and mrigal 1.09-1.4 lakh/kg female body weight.

Table 1: Induced breeding of rohu (*Labeo rohita*) at Puranapradhan Village, Baliana Block, Khordha District

Parameters	No. of rohu breeding programmes										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Number of male breeders	6	6	6	5	5	8	7	4	10	5	8
Number of female breeders	6	5	6	5	5	8	6	4	9	5	7
Total weight of male breeder (kg)	7.6	7.0	8.1	6.9	6.5	10.9	8.4	4.7	12.0	6.5	8.4
Total weight of female breeder (kg)	8.4	7.3	8.7	7.2	7.0	12.0	9.3	4.9	11.0	6.7	9.1
Time of first egg released after hormone injection (minute) (latency period) (A)	390	390	375	360	340	370	330	375	345	350	380
Completion time of egg release from time of injection given (minute) (B)	460	470	450	410	420	480	430	420	440	400	450
Effective spawning period (B-A) (minute)	70	80	75	50	80	110	100	45	95	50	70
Egg released (lakh)	13	9.5	12.5	10	11	20	14	7.5	20	10	14

Spawning fecundity per kg female body weight (lakh)	1.55	1.30	1.44	1.39	1.57	1.67	1.51	1.53	1.82	1.49	1.54
Egg fertilization rate (%)	95	100	95	95	95	100	90	100	90	95	90
Fertilized egg (lakh)	12.35	9.5	11.875	9.5	9.9	20	12.6	7.5	18	9.5	12.6
Time of first hatchling observed (minutes)	730	815	740	720	820	760	780	740	750	760	830
Time of completion of hatching (minutes)	930	960	940	950	1050	1060	990	1010	1030	1020	1060
Spawn recovered (lakh)	12	9	11	9	9	18	12	7	17	9	12
Spawn survival (%)	97.17	94.74	92.63	94.74	90.9	90.0	95.24	93.33	94.44	94.74	95.24
Spawn production (lakh/kg body weight)	1.43	1.23	1.26	1.25	1.29	1.5	1.29	1.43	1.55	1.34	1.32

Table 2: Induced breeding of mrigal (*Cirrhinus mrigala*) at Puranapradhan Village, Baliana Block, Khordha District

Parameters	No. of mrigal breeding programmes							
	I	II	III	IV	V	VI	VII	VIII
Number of male breeders	4	4	8	6	6	7	7	5
Number of female breeders	4	4	7	6	6	7	6	5
Total weight of male breeder (kg)	5.8	6.2	9.0	6.9	7.6	8.5	7.3	6.0
Total weight of female breeder (kg)	7.0	6.5	9.6	6.8	8.2	8.7	7.1	6.4
Time of first egg released after hormone injection (min) (latency period) (A)	375	360	350	380	375	345	360	350
Completion time of egg release from time of injection given (min) (B)	440	420	430	450	430	440	430	400
Effective spawning period (B-A) (min)	65	60	80	70	55	95	70	50
Egg released (lakh)	10	8.5	14	9	13	12	10	8
Spawning fecundity per kg female body weight (lakh)	1.43	1.31	1.46	1.32	1.58	1.38	1.41	1.25
Egg fertilization rate (%)	95	100	90	100	95	95	90	95

Fertilized egg (lakh)	9.5	8.5	12.6	9	12.35	11.4	9	7.6
Time of first hatchling observed (minutes)	810	780	770	810	750	870	830	850
Time of completion of hatchling (minutes)	980	950	990	1040	1000	1100	1050	1040
Spawn recovered (lakh)	9	8.0	11	8	11.5	10.5	8	7
Spawn survival (%)	94.74	94.12	87.3	88.89	93.12	92.11	88.89	92.11
Spawn production (lakh/kg body weight)	1.29	1.23	1.15	1.18	1.4	1.21	1.13	1.09

Water parameters were found within suitable range for induced breeding of carps (Table - 3). Water temperature during breeding operations ranged 26.3 - 33.8 °C. Total alkalinity and total hardness of hatchery water were found in ideal range for carp breeding *i.e.*, 60 - 70 mg/l and 50 - 60 mg/l respectively.

Table 3: Physico-chemical parameters of intake water for hatchery operation at Puranapradhan Village

Sl. No.	Species	Water temperature °C	pH	Total alkalinity (mg/l)	Total hardness (mg/l)
I	<i>L. rohita</i>	28.4- 33.6	7.3-7.7	70	60
II	<i>L. rohita</i>	27.9- 33.8	7.4-7.9	70	60
III	<i>L. rohita</i>	28.6-33.4	7.4-8.0	70	60
IV	<i>L. rohita</i>	28.1-33.4	7.3-7.8	70	60
V	<i>L. rohita</i>	27.1-33.1	7.2-7.9	70	50
VI	<i>L. rohita</i>	26.4-32.6	7.1-7.6	70	60
VII	<i>L. rohita</i>	27.1-32.9	7.2-7.8	60	60
VIII	<i>L. rohita</i>	26.8-33.2	7.2-7.7	60	50
IX	<i>L. rohita</i>	26.3-32.7	7.3-7.4	60	50
X	<i>L. rohita</i>	26.5-32.3	7.1-7.5	60	50
XI	<i>L. rohita</i>	26.7-32.5	7.1-7.4	60	50
I	<i>C. mrigala</i>	27.8- 34.1	7.3-8.0	70	60
II	<i>C. mrigala</i>	28.2- 33.6	7.4-7.8	70	60
III	<i>C. mrigala</i>	27.7-33.5	7.5-7.8	70	60
IV	<i>C. mrigala</i>	27.9-32.8	7.2-7.5	70	60
V	<i>C. mrigala</i>	26.8-32.6	7.3-7.8	60	50
VI	<i>C. mrigala</i>	26.6-33.2	7.1-7.7	60	50
VII	<i>C. mrigala</i>	27.4-32.9	7.0-7.6	60	50
VIII	<i>C. mrigala</i>	26.5-32.6	7.2-7.5	60	50

Odisha Watershed Development Mission (OWDM) conducted fish breeding operations in FRP carp hatcheries under the project “Western Odisha Rural Livelihood Project (WORLP)” at Nuapada and Bargarh Districts (Sudhin, 2007; Alan Casebow, 2008). In its first year of operation

in 2005, the hatchery supported to nurse 5.5 million fish seeds, which in turn led to take up grow out culture of fish in 530 ha of pond area in Western Odisha. The water quality and temperature regime were within the limits of hatchery operation in field condition. At Nuagaon, Nayagarh District of Odisha, the rohu breeder was transport from a reservoir 22 km away from the hatchery, reared in a less deep pond prior to breeding produced 0.8 - 0.925 lakh eggs/ kg of female, 75- 95% fertilization of eggs and 0.46 - 0.65 lakh spawn/ kg of female (Mohapatra *et al.*, 2011). In the present experiment the breeders of rohu and mrigala were maintained in the same farm one month before the breeding. The stress of transportation of breeders from far off places was not there at Puranapradhan, hence, the production of egg and spawn was higher than the FRP carp hatchery established at Nuagaon. According to Sarangi *et al.* (2008) the FRP hatchery produced similar results in rohu seed production at Tanar village, Kendrapada District, Odisha. Ten trials of induced breeding of three Indian major carps, *L. rohita* (4 times), *C. catla* (4 times) and *C. mrigala* (2 times) were conducted at Subarnapur Village of Gop Block, Puri District, Odisha, India during monsoon months of 2014 (Mohapatra *et al.*, 2015b). A total of 92.0 lakh spawn (carp seed) was produced (rohu 42 lakh, catla 30 lakh and mrigal 20 lakh). Spawning fecundity of rohu, mrigala and catla was found to be 1.43-1.72; 1.41-1.54 and 1.15-1.23 lakh egg/kg female body weight respectively. Percentage of fertilized eggs during spawning was found to be 90-95%. Spawn production per kg female body weight was found to be 1.07 - 1.36 lakh/kg of rohu, 1.17 - 1.36 lakh/kg of mrigal and 0.9 - 0.95 lakh/kg of catla.

Conclusion

The portable hatchery has been widely adopted across the country and the gadget has been used for diverse purposes across the country. In the present case, the entrepreneurs located in Puranapradhan of Odisha is able to produce 204 lakh spawn with the survival of 90- 97.17 % in rohu and 87.3- 94.74 % in mrigal during the year 2015-16. With the present level of technical support and training made available by ICAR- CIFA, the technology has performed well and would be able to improve further in future. The conditions like availability of brood-stock, suitable climatic conditions would enable the farmers to reach to the potential level of performance of the technology.

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