

Hatchery and Broodstock Management

to produce quality seed in carps

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The fish production is needs to be enhanced from 13.75 million metric tonnes (2018-19) to 22 million metric tonnes by 2024-25. To achieve this target aquaculture productivity should be augmented from the present 3 tonnes to about 5 tonnes per ha. The contribution of fish seed in total production cost is 5-10% and stocking of better quality seed is crucial to the expansion and progress of aquaculture sector. Inbreeding depression is observed in many of the carp hatcheries because of repeated usage of the same brood fishes without following intermittent replenishment of broodstock. There is lack of genetic norms in most of the hatcheries in India, which account to nearly 30% loss in production due to bad quality fish seed. Thus, using genetically improved seed following proper broodstock management and genetic norms in the carp hatcheries can serve as a suitable alternative to solve the problem of poor quality fish seed.

Keywords: Broodstock, Carps, Fish seed, Hatchery management

WITH the shift from wild harvest of a product to agricultural or aquaculture production, genetic improvement has always been an important developmental strategy. The first stage is usually the process of domestication. Further genetic improvement in agriculture or aquaculture typically has a focus to enhanced production, although the process of domestication for aquatic organisms is at an infant phase than their terrestrial counterparts.

The growing importance of aquaculture has propelled improvements in the technologies required for securing the initial and basic needs for higher productive aquaculture. Aquaculture presently is difficult without induced breeding of commercially cultivable fish species. The fish seed demand has increased steadily for stocking in aquaculture pond and natural water bodies such as reservoirs and rivers. The per capita fish consumption will increase largely in the developing countries in near future.

Seed is the important component for development of aquaculture sector. The rapid growth of aquaculture has been dependent on the availability of desired fish seed in required quantity to the fish farmers. Broodstock or brood fish are the base materials on which the growth of aquaculture industry depends. The availability of quality fish seed throughout the year is crucial for adoption of sustainable aquaculture by farmer. Although large quantities of seed of major cultured species is now produced in hatcheries, seed quality has remained as a major constraint for the success of aquaculture. Poor quality of seed can have a variety of causes related to both genetics and management. The quality and management of brood fish and hatchery practices that lead to inbreeding or contamination have been implicated, as has been poor husbandry during nursing, culture and transportation. Infection with pathogens to the seed may be cause for poor performance.

Issues and importance of breed improvement

Selective breeding is a novel approach to improvise the fish production. The major issues are:

- Non adoption of genetic norms in commercial carp hatcheries resulting in inbreeding depression leading to genetic erosion, loss of important alleles in the population and seed quality deterioration.
- Inadvertent hybridization of Indian Major Carps because of mixed breeding resulting to the genetic pollution in the hatcheries leading to non-availability of the pure strains of the carps.
- Genetically improved breed for desirable traits.

Broodstock is the principal and primary input of an effective and productive hatchery, while, management of broodstock is also vital for quality seed production. Success of induced breeding depends on the availability of adequate number of brood fish. Brood fish should be reared scientifically to get the matured broods during breeding season.



Fig. 1. Spawning and hatching pool for breeding

Hatchery management

For hatchery manager/owners two types of managements are required: Management of broodstock and hatchery while spawning, and Stock management through genetic norms (Fig. 1 and 2).

Management of broodstock and hatchery

To raise good quality brood fish, it is better to collect fast growing healthy yearlings from known source (genetic background) of parent fishes and keep in quarantine for 1-2 months. Stocking density is one of the important measures for assuring good and healthy brooders. The stocking density for brood carps should be at 1,500-2,000 kg/ha in polyculture system.

The prospective brood fishes are to be reared in separate ponds with rich plankton source. They should be checked for secondary infection during netting and if found they should be given prophylaxis with potassium permanganate solution (5 ppm). Two or three months prior the spawning period, water exchange should be done in the brood fish ponds. The periodic examination should be done to check the maturity status of brooders. Due care should

be taken to avoid any parasitic infection or any other diseases. The surfacing of brood fish during cloudy weather is usually observed which is mainly due to depletion in level of oxygen. To overcome this it is advised to aerate the water surface.

Feed management is equally important for getting healthy brood fish. In spite of the natural food like plankton, the brood fishes required to be fed adequately with supplementary feed, @ 1-2% of the body weight. CIFABROOD™ a carp broodstock diet having 30-31% protein proved to be very good as brood fish diet for carp. Otherwise, also traditional feed or commercial pelleted feed may be given to the brood fishes. Over feeding may lead to fat deposition in the body affecting maturity adversely. With good scientific husbandry practices fishes attain maturity before onset of monsoon, which can be checked physically by free oozing of milt in male with gentle pressure and bulging belly in case of female.

Hatchery management during spawning/ fish breeding

Brood fishes transportation from the broodstock pond to hatchery is very important. They should be

transported in a stress free condition. Canvass carry bags with water may be used for this purpose. After reaching the hatchery, fishes should be allowed to acclimatize in the spawning pool for 15-20 min in a showering condition. As per their body weight and species hormone injection may be applies preferably by intra-peritoneal route (Fig. 2). Over dose may lead to plugging of the female brooder.

Critical water quality parameters that hatchery managers should look for on regular basis in his hatchery are as below:

Water source

Water source should be pollution free. Water should be filtered before entering the hatching pools.

Temperature

Ideal temperature for carp breeding is 28-32°C. Beyond 35°C may affect breeding response.

Oxygen

Dissolved oxygen level in the hatchery pond water should be more than 4.0 ppm. Oxygen level below 2 ppm may lead to mass mortality of hatchlings.

Total alkalinity

Total Alkalinity should be less than 100. Alkalinity above 100 ppm affects the hatching process negatively. Ideal alkalinity range is 60-80.

Further following technical operations in the hatchery may be taken care by the hatchery managers for improving survival of seed.

- Egg collection should be done on a water cushion in the collection



Fig. 2. Broodstock of Jayanti rohu



Fig. 3. Indian Major Carp Seed

chamber.

- Direction of the duck mouths and speed of the water are maintained in such a way that they keep developing eggs away from both inner screen and wall of the incubation chamber.
- The water speed should be maintained at 0.4-0.5 m/sec for the first 12 h, 0.1 m – 0.2 m/sec for the next 6 h and 0.3 – 0.4 m/sec for rest of the operation.
- Reducing speed after 12 h of the operation avoids premature hatching and prolongs hatching of the developing eggs.

Stock management using genetic norms

Fish stock improvement through selective breeding is a novel approach and in the present context it is the need of hour to produce quality carp seed (Fig. 3). The primary goal of aquaculture genetics is to produce quality fish/shellfish seed. In genetic term, 'quality seed' may be defined as those having better food conversion efficiency, high growth potential, better ability for adapting to changing environmental conditions and to resist diseases. It is expected that culture of quality seed will improve over all aquaculture production of the country. The focus of hatchery operator should be to maximize the effective population

size to reduce adverse effects of inbreeding depression. Production of pure breed is equally important so following suggestions may be considered to improve brood fishes with genetic norms:

- Avoid spawning of all Indian major carps in single spawning pool to protect the genetic purity of carps' gene pools. Spawning should be done separately for each species to avoid unintended hybridization between these species.
- To increase the heterozygosity different lines of fishes may be crossed. Separate lines of fish can be maintained by keeping the record of the families of different strains bred in the hatchery.
- Improved varieties of fish like Jayanti rohu and improved catla may be taken for broodstock development in the hatchery for producing quality seed for the farmers.
- Significance should be given to own broodstock production in the hatchery. Seed from different times of breeding may be taken for own stocking rather than from same day spawn for own broodstock production.
- Equal sex ratio for male and female (1:1) may be maintained and same ratio may be used for breeding purpose.

- Female breeder of 3-5 years of age and male of 2-5 years may be used in the breeding program. Broodstocks of different age groups should be bred together. This helps in reducing the chance of loss of some valuable alleles due to genetic drift.
- Replacement of broodstock from different sources i.e. rivers, hatcheries and crossing between them may be done for seed production. Natural stocks may be included in the breeding nucleus to increase the heterozygosity level of the domesticated hatchery stock. Networking of hatcheries can be made for exchange of brooders between hatcheries to improve the quality by crossing between the stocks.
- The mating between same year class, parent offspring, sibs and repeated use of same breeder may be avoided.
- To improve the quality of carp seed cohort breeding protocol may be practiced.
- To reduce pond space required for the male broodstock raising in the hatchery cryopreserved milt may be used.
- Hatchery operator should maintain the pedigree record by various means (tagging, fin clipping, dye marking) to avoid the inbreeding in the hatchery.
- Other aquaculture management practices such as water, feed and disease management are also crucial for quality seed production.

Conclusions

Genetic basis of broodstock management and use of genetic norms in hatcheries are highly essential in the present context. Increase in production as well as purity of stock is also equally important. From all states effort should be made to implement the genetic norms in their hatcheries for quality seed production.

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