FOREWORD

Freshwater aquaculture in India has witnessed significant development with an annual growth rate of over 6% during the last decade, and at present the production from freshwater aquaculture has reached 2.4 million tones. Based on the current population growth, the demand for fish exceeds the production. In order to satisfy the future demand of fish the country has to sustain a similar growth in years to come. The most basic and important component of aquaculture is quality fish seed. To accomplish this, hatcheries have undergone a number of modifications for production of better seed. AICRP on APA center at CIFA has developed Fiberglass Reinforced Plastic (FRP) hatchery, which can be transported from one place to another for easy accessibility and timely production of quality fish seed. This FRP hatchery technology has been released as a technology package by CIFA in 2006 and suitable for producing 1.0-1.2 million carp spawn in one successful operation. This FRP hatchery has got wide adoption among the users and several hatchery units are being installed at different parts of the country. At present technology is being managed through CIFA, and sometimes scientist and engineer from the institute need to go to install and operate it on site. Being the demand is increasing day by day, it becomes very difficult to go every place for the purpose. To help the users to install and operate hatchery themselves, a User's Manual on “Portable FRP Carp Hatchery” is being brought out. This manual is self-explanatory and showing the whole procedures of hatchery unit installation and assembly through pictorial as well as text presentations. It also depicts the hatchery operation procedures through various steps and. Provides the minor repairing procedures, which would be helpful to users.

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Kausalyaganga
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**Introduction**

Earlier part of 20th century has witnessed the carp seed collection from bundhs and riverine resources by different devices and collection methods. In India for the first time in 1957 carps were induced bred in captivity by administering carp (fish) pituitary extract. The breeding of carps, hatching of eggs and rearing of hatchlings up to spawn stage were carried out in different rectangular hapa. They were fixed in the pond for clear oxygenated water. In hapa system, the entire operations were weather dependent and subjected to various environmental hazards. During seventies, glass jar hatching units of various capacities were designed and made to use successfully for hatching purposes. The system had its own demerits for commercial seed production. During eighties, the Chinese carp hatchery technology got familiar in India. During nineties, different models of hatcheries with different materials (HDPE, PVC, LDPE liner, Ferro-cement, etc. in various shapes and sizes) came to the existence with certain degrees of success at research level, but, they could not be used for commercial seed production. Keeping in mind the needs of seed production in farmers field, the Co-operating Centre of ICAR-AICRP on Application of Plastics in Agriculture at CIFA, Bhubaneswar has designed and developed the complete unit of hatchery system in FRP for carp fish breeding and hatchery rearing of seed. The FRP carp hatchery technology got commercialized and released to the nation during 2006. Then after several hatchery units are commissioned for operation in different locations of the country. Constant demand exists for supply of hatcheries to different fish seed producers. To make aware the users of the technology, for easy installation, dismantling, operation and precautions to be taken have been described in brief with simple words and figures.

**Why FRP**

Glass Fibre Reinforced Plastic (GRP), which is popularly known as FRP has emerged as an important class of construction material for making load bearing structures and products. The Glass Reinforced Plastic (GRP) composites have several properties and characteristic
features that make them to stand above all other conventional materials both in their performance efficiency and manufacturing adaptability. Some of these attributes are as follows:

- Fibrous composites have generally high specific strength and specific modulus
- Composites are multifunctional materials
- Composites are generally energy efficient
- Composites generally can be made corrosion and weather resistant
- Composites can be designed to give properties for specific design conditions
- Proper orientation of fibres and directional properties can be obtained
- Products of complex shapes can be easily molded without any material wastage

**Hatchery Components**

The FRP carp hatchery unit consists the following:

1. Breeding/ spawning pool
2. Hatching/ incubation pool
3. Egg/ spawn collection tank, and
4. Overhead storage tank/ water supply system

**Breeding/ Spawning Pool**

Shape: Cylindro-vertical
Diameter: 2150 mm
Height: 900 mm
Total volume: 3409 l
Operational volume: 2950 l
Bottom slope at the centre: 1: 22
Wall thickness: 6.0 ± 0.5 mm
Duck mouth: Five numbers (15 mm diameter - Rigid PVC) fixed inner side at bottom of the pool in clockwise direction
Main water inlet: 25 mm diameter of GI/ PVC pipe
Water sprinkler: One stainless steel/ plastic shower (Std. size)
Breeding capacity: 10 - 12 kg of carps in normal conditions
Water flow rate: 1-1.5 l/ sec. depending on species & weight
Fittings: All the pipes and fittings as per ISI standard
Hatching/Incubation Pool

Outer Chamber
Shape: Cylindro-vertical
Diameter: 1400 mm
Height: 980 mm
Total volume: 1400 l
Net egg incubation volume: 1200 l (Space between outer and inner chamber)
Side slope at the wall: 1:12
Wall thickness: 5.5 ± 0.5 mm
Duck mouth: Five 15 mm diameter - rigid PVC at the bottom of the pool in clockwise direction placed/ fixed in between inner and outer chamber
Main water inlet: 25 mm diameter of GI/ PVC pipe connected to all duck mouths at outer bottom wall of the pool
Water sprinkler: One stainless steel/ plastic shower (Std. size)
Hatching capacity: 1.0 - 1.2 million eggs per operation
Water flow rate: 0.3 - 0.4 l/sec. depending on egg quantity/ volume
Hatching time: 14 - 18 h and remain in the pool for 72 h.

Inner Chamber
Socket diameter: 400 mm
Height: 890 mm
Chamber cover: Nylon bolting cloth of 0.25 mm mesh

Egg/Spawn Collection Tank
Shape: Rectangular
Size: 1000 x 500 x 500 mm
Total volume: 250 l
Operational volume: 225 l
Wall thickness: 3.5 ± 0.5 mm
Reinforce: Reinforced with MS angle of 25 x 25 x 5 mm at all sides from the bottom at a height of 350 mm to avoid deflection
Level of water: 450 mm in the tank
Water outlet: Rigid PVC pipe of 63 mm diamètre and 150 mm length is fitted at a distance of 387 mm from the bottom
Overhead Tank

One tank of 2000 l or 2 tanks of 1000 l capacity each can solve the purpose. One 1.0 HP pump set is required to fill the storage tank periodically to supply water to hatchery. Based on the capacity of the hatchery and operational needs, the storage capacity is to be decided.

Fittings: All the pipes and fittings as per ISI standard

**Salient Features**

- Easy to transport
- Easy to install
- Easy to dismantle
- High abrasion resistance
- Light in weight
- Maintenance free
- Easy to repair
- Easy for operation
- Suitable for small and marginal farmers
- Durable for 10-15 years

**Hatchery Capacity**

Hatchery unit of "one million spawn production per operation" consists of one breeding pool associated with one hatching pool. In this hatchery the spawn (final product from hatchery) is harvested on 4th day during operation. Because the fertilized eggs are kept in hatching pool for incubation and it takes 14-18 hours for hatching, and then after 72 hours for transformation to spawn. Thus four days are required for spawn production from one million capacity unit. Similarly hatchery for "two million spawn capacity" means one breeding pool associated with two hatching pools and "three million capacity" includes one breeding pool with three hatching pools. In case of two million capacity hatchery, the eggs produced from two consecutive fish breeding operations can be incubated in two hatching pools, thus two times the seed can be harvested (totaling to two million seed production from two operations) i.e., on 4th and 5th days from initial hatchery operation. Once one hatching pool is free after harvest, the next breeding programme can be taken up. In case of three million capacity hatchery, three times the seed can be harvested (totaling to three million seed production from three operations) i.e., on 4th, 5th and 6th days from initiation of hatchery operation. Then after operations can continue with serial harvesting of spawn from hatching pools.
Layout diagram of FRP Carp Hatchery
(with one breeding pool and one hatching pool)

Layout diagram of FRP Carp Hatchery
(with one breeding pool and three hatching pools)
Steps of Hatchery Operation

Step-I: Clean the breeding and hatching pools by potassium permanganate (KMnO₄) solution and then by water before the hatchery operation.

Step-II: Close the outlet valve of breeding pool and then fill it with desired water level of water. Fix a clean cotton hapa inside it.

Step-III: Collect fish breeders (male to female ratio in 1:1), transport them to breeding pool, place them in hapa and run the shower(s) for conditioning.

Step-IV: After 1-2 hours of conditioning, inject the breeders with suitable inducing agents and dose, release them to the breeding pool, remove the hapa and run the shower(s).

Step-V: After 4-5 hours of injection, allow water flow/circulation in the breeding pool, open the outlet valve, allow the water to pass from breeding pool through the hapa of the egg/spawn collection tank to the outside. If eggs released from the fishes, collect them in hapa in the egg/spawn collection tank. Create water current in the breeding pool by regulating the water flow through the inlets and outlet.

Step-VI: In hatching pool fix the screen on the inner chamber FRP socket, fix the PVC drain pipe in the center of the tank to drain excess water, maintain the height of the drain pipe in the pool at 900 mm or as needed so that up to that height water level is maintained, give water circulation in the egg incubation chamber through duck-mouths (inlets).

Step-VII: Collect the released eggs from the egg/spawn collection tank by hapa time to time, measure them, release them in the egg incubation chamber of the hatching pool. The egg release generally stops within 8-10 hr from injection.
Step-VIII: Remove the breeders from breeding pool once the breeding is over, release them to the pond after dipping in 5 ppm KMnO₄ solution; clean the breeding pool by KMnO₄ solution and then by water.

Step-IX: On release of eggs maintain the flow rate in the hatching pool in such a way that the eggs float in the water (can be checked by putting light from a torch from the top of water), periodically check the eggs/spawn, clean the filtering mesh by a brush with long handle from the inner side of inner chamber to avoid water choking.

Step-X: On 4th day from egg release, collect the spawn through hapa in the egg/spawn collection tank by opening the outlet valve connected to the outer wall of the hatching pool. Provide mild water circulation in the pool during spawn collection.

Step-XI: After spawn removal clean the hatching pool and the egg/spawn collection tank by KMnO₄ solution and then by water.

**Installation and Assembly**

Proper installation of the hatchery unit in one place for a longer period requires a platform of size 6.0 x 4.0 m. Make the height of the platform in such a way that the egg/spawn collection pipes coming out of breeding and hatching pools placed on the platform can be rested on the egg/spawn collection tank which is kept at ground level. For better collection of egg/spawn, maintain the height of the platform at about 0.5 m from ground level. For stability construct the periphery walls of the platform with bricks/stones and fill it with course sand. If the hatchery needs repeated shifting, platform construction is not required. Sand filling below the breeding pool is required for providing better foundation to the pool. In case of 1:1 ratio hatchery unit (one breeding pool with one hatchery pool) the water supply to the unit may be provided with 25mm (ASTM) pipe from storage tank. In case of 1:3 unit it may be through 50mm (ASTM) pipe for getting required water flow.
Breeding Pool Assembly

Keep the breeding pool on the platform (possibly to the left side of the platform). Its bottom outlet pipe should face towards the egg/spawn collection tank.

Fix the main water inlet and all the duck mouths on the inner side wall of the pool in clockwise direction.

Fix the egg collection pipe to the socket provided at the bottom of the pool.

Fix the ball valve to the pipe line for control of water flow.

Fix the overflow pipe to the socket provided on the outer side wall of the pool.
Central water control valve
Connection to duck-mouts
Connection to 25 mm inlet

Fix the central inlet assembly (water connection lines for duck mouth, 25mm pipe line and to shower)

Connection to shower

Fix the shower on the top of the pool to the pipeline which is connected to the central inlet assembly

Hatching Pool Assembly

Kept the hatching pool on the platform at a distance of 0.5-0.6 m from, and on the right side of the breeding pool. Its outlet pipe should face towards the egg/spawn collection tank. While installing, tilt the pool slightly towards the side wall outlet pipe of the pool for easy collection of spawn.
Fix the central inlet pipeline for supplying water flow to duck mouths and shower.

Fix the central outlet pipe with the socket provided at the bottom of the pool. Fix the inner chamber wall by push fitting on the socket provided at the bottom.

Fix the duck mouths to the nipple provided on the bottom of the pool in clockwise direction.

Cover the inner chamber wall with nylon-bolting cloth during hatchery operation.
Place the tank on the ground and below the platform. The position of the tank should be in between breeding and hatching pools. The tank has to be buried to the ground as per requirement, and if the level of the platform and tank is not uniform. Fix a cotton hapa inside the tank during eggs/spawn collection time.

Place overhead tank at a height of 3.0 m from ground level. Connect the breeding and hatching pools with overhead tank for supply of water to the hatchery.

**Repairing of FRP Products**

If any portion of the product is damaged or broken or leaked, the following steps are to be adopted for repair.

**Step-I**: Cut the damaged portion of FRP with metal cutting hand tools/Jig saw and give appropriate shape. Trim the edges with course hand file.

**Step-II**: Fix required size of plywood on the inner side, where smooth finish is required. Be sure, before fixing, plywood should be wax coated (Automotive wax), and after few hours apply PVA coat, which act as a releasing agent. Then allow few hours for drying.

**Step-III**: Mix the gel resin first with color pigments (10%), add 1-2% accelerator (Cobalt naphthanate) to this mixture, then add 2% catalyst (MEK) peroxide and mix them again. Brush
the resin mixture in a thick coat. Wait at least 4-6 hours for curing.

Step-IV : Apply resin coat with accelerator (1-2%) and catalyst (2%) over the gel coat.

Step-V : Cut chopped strand mat slightly larger than the required size with scissors.

Step-VI : Apply first layer of glass fibre over the resin coat, which has just been covered with resin. Lay it down from one side to prevent air bubbles from being trapped in to it. Pull out all wrinkles from the laminates.

Step-VII : Place additional layers of material either chopped strand mat/ woven roving (300/ 450 g/m²) over the product in the same manner as the first ones.

Step-VIII : Add final coat of resin with colours (10%) after the laminate is cured. This coat is needed to get a better finish on the outer side of the product.

**Do's and Don't Do's**

- Check alignment of the pools and tank while installation
- Use mallet in stead of hammer during fittings of the joints
- Clean hatchery with KMnO₄ solution and water before and after operation
- Use water free from any tree leaves, grasses or waste materials to avoid clogging of duck mouths. Clean the clogged duck mouths with old hacksaw blade
- Be sure that the egg/ spawn collection tank is full with water before collection of egg/ spawn
- Mild water flow is required in hatching pool while collection of egg/ spawn
- Open outlet control valves slowly during the hatchery operation
- Use M-Seal to stop minor leakage in FRP structure
- While cleaning/ washing use soft cloth/ sponge
- Avoid any corrosive chemicals during cleaning/ washing
- Don't expose the hatchery unit to direct sunlight for long period
- Don't allow cattle and other animals near to the unit. They may damage the structures/ pipelines.