Chapter 10 - Fisheries/Aquaculture

Technology no.1

1. **Name of the Technology:** Run-off water harvesting technology for fish based farming system
2. **Source of the Technology:** College of Fisheries, Central Agricultural University, Lembucherra, Tripura-799210
3. **Year of Release:** 2012
4. **Agro climatic Zone:** Mid-hill region in tropical/sub-temperate zone
5. **Detail Description about the Technology:**

The main objective of the system is to collect and store catchment rain water of upland and use them by synthetic lined water harvesting structures in different altitude so that the excess catchment water accumulated in the upper water harvesting structures may be accumulated in the subsequent structures of same nature in the lower altitude to utilize it for seasonal aquaculture practices of carps with moderate doses of manure and lime as well as stocking densities.

1. **1st tier system**: High altitude/Upland location used for nursery rearing of rohu (*Labeo rohita*) spawn to fry.

2. **2nd tier system**: Medium altitude used rearing of rohu (*Labeo rohita*), common carp (*Cyprinus carpio)* fry to fingerlings.

3. **3rd tier system**: Grow-out ponds in the lower ridge/valley are used for grow out

Expected Fish production:

Tier 1: Nursery: Stocking density was 12.5 lakh ha^{-1} (six day old spawn) and obtained survival at College of Fisheries 31%.

Tier 2: Rearing: Stocking density was 3 lakh ha^{-1} and obtained survival at the unit developed at College of Fisheries was 57-72% for rohu and about 95% for common carp

Tier 3: Grow-out: The Production per ha in the grow-out ponds (3rd Tier) at the lower elevation (under scientific management with application of pelleted supplementary feed): 3500-4000 kg ha^{-1} $year^{-1}$ in the initial 1st and 2nd year and it should be > 4000-5000 kg ha^{-1} $year^{-1}$ (from third year onward once the soil fertility and water retention improves)

Cost Involvement for development of this system in Tripura. For construction of ponds (nursing, rearing and grow-out) cost may vary greatly with the states. In Tripura, it would be around Rs. 4-5 lakh ha^{-1} of total area. Besides these costs, the annual expenditure to be incurred towards operation cost to undertake intensified aquaculture would be Rs. 2.5-2.8 lakh ha^{-1}. Additionally, the cost for developing horticultural crops on the slope 2-2.5 lakh ha^{-1} would be required for pine apple.

6. **Critical Inputs Required:** High density PP, Fish seed, Fish Feed, Fertilizer/Manure, turfing with grass.
7. **Observation to be recorded:** Water depth and retention period, rainfall, soil erosion and siltation.
8. **Contact Address for relevant information**

   Dean, College of Fisheries, CAU, Lembucherra, Tripura 799210

   E-mail: cofcau@rediffmail.com

Technology no.2

1. **Name of the Technology:** Floating supplementary carp feed CAU AQUA Feed (carp) using locally available ingredients
2. **Source of the Technology:** Department of Aquaculture, College of Fisheries, Central Agricultural University, Lembucherra, Tripura-799210
3. **Year of Release:** 2015
4. **Agro climatic Zone:** Tropical
5. **Detail Description about the Technology**

   The main objective of the technology is to produce floating extruded fish feed utilizing locally available ingredients using locally available ingredients namely rice bran, mustard oil cake, corn, wheat , rice starch, wheat bran, dry fish waste, taro, cassava, wolffia meal. The formulation and production conditions of the supplementary carp feed 'COF-CAU Aqua Feed' for carphas been developed and its production process has been standardized.

   Technical Description: Floating type Twin screw extruded pellet feed of dia 2-5 mm of high water stability (>1 hour) of following nutritional contents:

   Crude protein: 20-22%

   Crude lipid: 3-4 %

   Digestible carbohydrate: 45-52 %

   Crude Fiber: 14-16 %

   Ash: 10-14 %

   The manufacturing conditions for floating pellets of 3-5 mm dia have been standardized for pilot scale production of floating supplementary feed by twin screw extruder:

   Water addition: 17.5%

   Extrusion Temperature: Zone I-160°C, Zone II-175°C, Zone III-170°C,

Feeder speed: 25-28 rpm

Twin Screw speed: 29-32 rpm

Cutter speed: 20-26 rpm

Oven temperature: 115°C

Time of Drying: 18-20 minutes

The apparent feed conversion ratio (AFCR) under tank culture system and pilot scale semi-intensive carp grow-out pond culture system was found to be 1.8-2.2.

So far, about 140 metric ton of fish feed worth Rs. 42 lakh has been sold to various stake holders including farmers, NGOs, public institutions besides of meeting requirements of different ongoing programmes including village adoption programme.

6. **Critical Inputs Required:** Feed grain and grain byproducts, fish meal, tuber (taro, **tapioca or yam) starch**
7. **Observation to be recorded:** Floatability, water stability, feed acceptability, market prices of ingredients, market price of feed, capacity of mill and labour use efficiency
8. **Contact Address for relevant information:** Dean, College of Fisheries, CAU, Lembucherra, Tripura 799210 Ph: 0381 2865264 (O), 2865291 (Fax), E-mail: cofcau@rediffmail.com.

Technology no.3

1. **Name of the Technology:** Incorporation of Silver barb *Puntius gonionotus* (bleeker) in feed-based carp polyculture system with particular reference to seasonal ponds in NE region
2. **Source of the Technology:** College of Fisheries, Central Agricultural University, Lembucherra, Tripura-799210
3. **Year of Release:** 2014
4. **Agro climatic Zone:** Tropical
5. **Detail Description about the Technology:**

   The main objective of the technology is to enhance fish productivity and farmers' income,

especially from feed based fish culture in seasonal water bodies with effective culture period of 5-6 months. The technology involves replacement of Indian major carps (IMC) and/or Chinese carps with silver barb in pond culture which has remarkably higher demand and fetch higher market price compared to *Catla catla, Cirrhinus mrigala, Hypopthalmicthys molitrix* (silver carp) *and Ctenopharyngodon idella* (grass carp). Different levels of incorporations of silver barb have been found to enhance fish yield owing to higher specific growth rates viz. 2.79-3.14% d^{-1} exhibited by silver barb as compared to those of 0.7 to 1.6 % d^{-1} shown by IMC. The increase in economic return is even more pronounced owing to 15% to 20% higher market price than that of IMC.

6. **Critical Inputs Required:** Feed grain and grain byproducts, oil cake, fish meal, truber (taro, tapioca or yam) starch, wolffia meal, Twin screw extruder, Electricity
7. **Observation to be recorded:** Market prices of ingredients, floatability, water stability, acceptability, feed utilization efficiency, market price of feed, and capacity of mill
8. **Contact Address for relevant information**

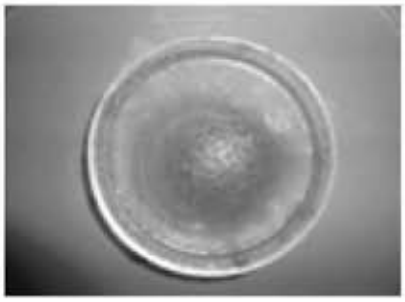
   Dean, College of Fisheries, CAU, Lembucherra, Tripura 799210 Ph: 0381 2865264 (O), 2865291 (Fax), E-mail: cofcau@rediffmail.com

Technology no.4

1. **Name of the Technology:** Seed production of zebra fish (*Danio rerio*) in aquarium condition
2. **Source of the Technology:** Department of Aquaculture, College of Fisheries, Central Agricultural University, Lembucherra, Tripura-799210
3. **Year of Release:** 2015
4. **Agro climatic Zone:** Tropical
5. **Detail Description about the Technology:**

   For the present experiment, about 400 *Danio rerio* fry were collected from the drain of the college farm facility. The fry are acclimated and stocked in two rectangular cemented tanks of 1000 l capacity for about two months. Twenty four aquaria (12 aquaria for breeding and 12 for raising fry) of 50 l capacity were used with sponge filter to supply continuous oxygen. Aquaria were divided into four treatments namely treatment 1, 2, 3 and 4 each

having three replications viz. T-1: live food (mixed zooplankton), T-2: formulated feed, T-3: commercial aquarium feed (Tokyu), T-4: mixture of all three feeds. Feeding was done twice daily. Faecal matter and leftover feed were removed by siphoning and 20% of the water volume was changed daily. Fish were housed in a photoperiod of 12: 12 h light: dark cycle and reared for 7 months. In terms growth and survival, no significant difference was found among the tested diets, but higher value was reported in the live food group. Feeding with live food (167.67±7.69) and mixed feed (formulated feed and live food) (156.5±2.5) led to improved spawning performance compared to commercial (104.5±5.5) and formulated diet (131.67±2.40).


6. **Critical Inputs Required:** Aquarium of suitable size, good source of water, filtration system with aeration, healthy broodstock, nutritionally balanced feeds, hand nets, plankton nets, spawning baskets, hand pelletizer for making feeds, live food for larval rearing.
7. **Observation to be recorded:** Water quality parameters like pH, dissolved oxygen (DO) and temperature, health of fish, growth performance, survival of fish, maturity of fish, spawning of fish and larval survival.
8. **Contact Address for relevant information:** Dean, College of Fisheries, CAU, Lembucherra, Tripura 799210 Ph: 0381 2865264 (O), 2865291 (Fax), E-mail: cofcau@rediffmail.com

Technology no.5

1. **Name of the Technology:** Low cost seed production of Pabda *Ompok bimaculatus*
2. **Source of the Technology:** Department of Aquaculture, College of Fisheries, Central Agricultural University, Lembucherra, Tripura-799210
3. **Year of Release:** 2015
4. **Agro climatic Zone:** Tropical
5. **Detail Description about the Technology:**

Ompok bimaculatus, commonly known as Pabda is a native species and recently gaining its importance as a promising aquaculture candidate owing to its good taste, excellent nutritional profile and high market value. For breeding this fish, they are induced through hormone therapy using Ovaprim, Ovatide or OvaFH. The females are given the dose of 2.0-2.5 ml / kg body weight of fish and the male are given half of the female dose. At the end of the latency period of 10 hrs stripping of the female spawners is done by gently pressing their abdomen with a thumb from the pectoral fin towards the genital papilla. The belly of the male fish is cut open and testes is taken out. The testes is then kept on a piece of cotton cloth piece and squeezed the milt content on the egg mass on a plastic tray. The eggs are

fertilized by adding few amount of water with simultaneous mixing by feather. Then water and egg mass are mixed by gently shaking of the tray.

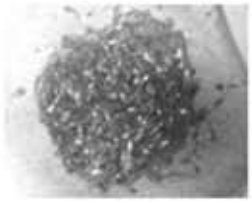
An indigenous modified micro-hatchery has been developed at College of Fisheries, Lembucherra with polythene made water holding structure and 4 nos. of 500 L glass aquariums. The settled filtered pond water can be used for hatching the eggs. For incubation the fertilized eggs are uniformly distributed in the specially made net baskets which are kept in glass aquarium. It will take 24 hours for hatching in temperature range of 27-30°C. The water level kept at a height about 14-15 cm. The system can accommodate 15000-20000 fertilized eggs in one aquarium with 60-80% hatching rate. After hatching, the larvae will come out of the net basket and settled at the bottom corner of the tanks.

The larvae are reared in the same incubation tanks. After yolk sac absorption, the larvae are fed with live plankton. Other live food such as fish flesh, earthworms, tubifex are also tried in live and freeze dried condition. It has been found that tubifex worms in live condition are most preferred by the larvae if these are given in finely chopped form. A stocking density of 10 nos./l is considered to be optimum for better growth and survival in indoor condition. The larvae grow to 15-20 mm fry during 15-21 days of rearing. After a maximum of 21 days rearing in the indoor, they should be transferred to out-door rearing tanks for fingerling production.







6. Critical Inputs Required:

i. Healthy brooders
ii. Abundant availability of natural food
iii. Continuous aeration
iv. Pollution free water
v. Water holding containers

7. Observation to be recorded:

i. Choose the hormone dose according to the ripeness of brooders.
ii. Always keep an eye on the size of food particles, particularly in larval rearing phase.
iii. Remove/replenish fully or partially the water, excreta and unconsumed food materials

from the larval and fry rearing tanks.

iv. Sort out bigger ones from the smaller one to reduce cannibalism.

v. Shed may be provided to reduce cannibalism. Maintain hygienic condition in the hatchery.

vi. Always keep ready an electric generator as stand-by arrangement.

vii. Routine checking of different rearing systems

8. Contact Address for relevant information:

Dean, College of Fisheries, CAU, Lembucherra, Tripura 799210 Ph: 0381 2865264 (O), 2865291 (Fax), E-mail: cofcau@rediffmail.com

Technology no.6

1. Name of the Technology: FLOATING PELLETED FISH FEED

2. Source of the Technology: Department of Aquaculture, College of Fisheries, Central Agricultural University, Lembucherra, Tripura

3. Year of release: 2011

4. Agro Climatic Zone: NEH Region/Eastern Himalayan Region

5. Detail description about the technology:

The feed was produced through extrusion technology utilizing ingredients namely rice bran, mustard oil cake, broken corn, broken wheat, wheat bran, and dry fish waste. The proximate composition of the feed was as follows: Crude Protein content 20-22 %, Crude lipid 3-5 %, Crude Fiber < 13-15 %, Ash ≤ 10-11 %, Digestible carbohydrate 40-45 %. Pellets floats in water for 30 to 60 minutes.

Floating pelleted fish feed and its application in culture pond

6. Critical input required:

1. Feed.
2. Seed.
3. Agrochemicals

7. **Observations to be recorded:**

   a. Survival rate of fishes. **b.** Growth of fishes. **c.** Feed Conversion Ratio.

8. **Contact Address for relevant information:**

   Department of Aquaculture,

   College of Fisheries,

   Central Agricultural University,

   Lembucherra

   Tripura

Technology 7

1. **Name of the technology**: Rice- Fish Farming under mid hill condition.
1. **Source of technology:** Division of Fisheries; ICAR Research complex for NEH Region, Umiam, Meghalaya
2. **Year of release:** 2013
3. **Agro Climatic Zone/AES:** Mid Hill altitude
4. **Description of the technologywith Critical inputs required Observation to be recorded.**

- Rice- fish farming is ideal for i.Conservation of water resources and plant nutrients,ii.Intensive production of fish protein and iii.Reduced operating costs relative to either system in isolation.
- A low lying area connected with a perennial stream was selected nder mid hill condition, Common carp in rice field (plot size: 61 X 12 m=732 Sq.mt) yielded encouraging results.

Fish growth performance in Rice-Fish Farming At ICAR –Barapani (On-station trial)

- The paddy plot is designed with Perimeter canal (size: 1 m width & 0.75 m depth) and a centre pond (size: 5m Diameter & 0.75 m Depth) for rearing only Common carp, *Cyprinuscarpio var. communis and variety Amur*
- Stocking density of 5,000 nos/ha. Common carp seeds of average size 7 cm in length and 6 g in weight are introduced after 21 days of paddy plantation .
- In a rearing period of 237 days a production of 683 kg of common carp per hectare is obtained without supplementary feeding.

Applicability of the technology in specific agro ecosystem (e.g. low land, acid soil, drought resilient etc):

A low lying area connected with a perennial stream is an ideal site for rice–fish farming

Area (appx in ha) to which it is applicable in the region or your state.

Under mid hill condition, *Common carp* in rice field (plot size: 61 X 12 m=732 Sq.mt) yielded encouraging results. However, the area can vary from 500 sq.mt to 5000 sq.mt for better management.

Contact Information:

Principal Investigator: S.K.Das. Division of Fisheries, ICAR Research complex for NEH Region, Umiam, Meghalaya)

Technology 8

1. **Name of the technology**: Simple protocol for seed production of improved variety of common carp (*Cyprinuscarpio*) - Amur variety(Hungarian strain) and Pengba (*Ostebramabelangeri*)- an endangered endemic fish species of Northeast India.
2. **Source of technology:** Division of Fisheries; ICAR Research complex for NEH Region, Umiam, Meghalaya
3. **Year of release:** 2013& 2014
4. **Agro Climatic Zone/AES:** Mid Hill altitude
5. **Description of the technology with Critical inputs required Observation to be recorded.**

Amur common carp:

Under mid hill condition maiden attempt was made to breed the genetically improved variety of Common carp on a trial basis successfully in the year 2011. Female Amur common carpa was found to mature fully at the age of 13 months under mid hill condition. Male matured earlier than the female.The first breeding trial with this new variety was conducted successfully in March'2011 when the atmospheric temperature varied between 16^{0}C to 18.3 ^{0}C. One set of genetically improved common carp comprising of fully matured one female and three males were kept in standard hapa fixed in a 0.40 ha fish pond.The fertilized eggs took about 78 to 83 hours to hatch. Water temperature ranged between 19 ^{0} C to 22.8 ^{0} C while water pH varied between 6.5 and 6.8. The best period for Amur common carp seed production was found to be March to April.The Average number of eggs per gram body weight was found to be 107.33.Under mono culture, the Amur common carp has been observed to attain an average growth of more than 400 g in 12 months rearing period at a stocking density of 5000nos/Ha under mid hill condition with regular feeding of rice polish and oil cake (1: 1 ratio) at 2-3% body weight. The best growth of Amur common carp has been recorded during April to August.

Pengba(Ostebramabelangeri)

Pengba (*Osteobramabelangeri*)was found to mature fully under mid hill condition at the age of 30 months.The weights of female and male brooders ranged from 110 to 220 g and 80 to 110 g respectively. The average weight of female brooder was 162.5 g while the male brooder was 97.1 g. The inducing agent, Gonopro-FH was administered in single dose to the brooders at different doses in the evening hours between 16.0 to 16.30hr. The injected breeding pairs (one female with two males) were released in a breeding hapa (1.5 x 2.5 x 3.0 m) fitted in an earthen pond. The brooders were removed from the hapas early in the morning and the eggs were collected manually to transfer the fertilized eggs to locally made hatching devices for incubation. A simple hatching device was designed by modifying a 17 litres capacity plastic bucket (45cm in diameter). The fertilized eggs were kept in motion by fitting a water inlet at the bottom of the bucket and an outlet pipe to drain out the overflow water. In addition, the water was continuously oxygenated through a simple air pump commonly used in aquarium. The rate of water flow in the hatching bucket varied between 267 to 625ml/minute during the incubation period.

The peak breeding season was found to be very short (First week of July to Second week of August) under mid hill condition .The month of July is the best time for induced breeding of matured Pengba.

- **Applicability of the technology in specific agro ecosystem (e.g. low land, acid soil, drought resilient etc):**

  Applicability tested successfully under mid hill climatic situation. Amur common carp is a fast growing species and thus can be best suited for short term aquaculture in seasonal ponds.

- **Area (approx in ha) to which it is applicable in the region or your state.**

  Minimum area required for seed production of both the species is 200sq,mt fish ponds for small-scale operation. However 0.5 ha to 1.0 ha fish farm is recommended for large-scale seed production of Amur common carp and Pengba.

6. **Contact Information:**

   Principal Investigator: S.K.Das. Division of Fisheries, ICAR Research complex for NEH Region, Umiam, Meghalaya)

Technology 9

1. **Name of Technology:** Fish-cum poultry cum Horticulture farming under mid altitude condition
2. **Source of technology:** Division of Fisheries; ICAR Research complex for NEH Region, Umiam, Meghalaya
3. **Year of release:** 2013
4. **Agro Climatic Zone/AES:** Mid Hill altitude
5. **Description of the technology with Critical inputs requiredObservation to be recorded.**

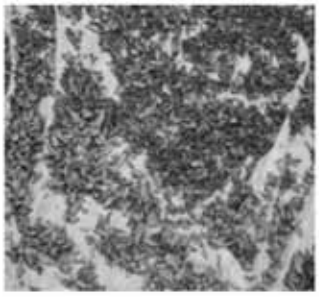
- Why this technology
  - **Effective utilization of one unit area.**
  - Recycling of organic wastes as well as production of high class protein at low cost.
  - Reduces the additional cost for supplementary feeding as well as fertilisation.
  - It is an artificial balanced ecosystem where there is no waste.
  - It provides more employment avenues.
  - It reduces the input and increases output and economic efficiency

- What is this technology
  - 0.10 to 0.2 ha size of earthen pond is easy to manage and ideal for such integration on smaller-scale. Fish in pond, birds in cage over the pond and horticultural crop (Ginger & Turmeric) planted on the embankment.
  - Low-cost Poultry house: 100 sq.ft(Bamboo & Thatched): Cost: Rs. 5,500
  - Stocking density of fish @ 8,000 nos/ha. In a rearing period of 11 months a production of 1500 kg of fish per ha could be obtained without supplementary feeding)-0-input fish production).
  - Poultry: Vanaraja layers 25 Nos.(20% mortality) in 8 months: 2384 eggs.
  - Ginger: 41.5 Kgs from (8X5.5 mt= 43.2 sq.mt).: 960gm per sq.mt
  - Turmeric: 25 Kg from (63 mX1m= 63 sq.mt): 396 gms per sq.mt.

Photos: Multiple products from one unit area.







6. Contact Information:

Principal Investigator: S.K.Das. Division of Fisheries, ICAR Research complex for NEH Region, Umiam, Meghalaya)

भाकृअनुप
ICAR

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