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CARP SEED RAISING

PACKAGE OF PRACTICES FOR INCREASING PRODUCTION

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FOREWORD

CIFRI achieved a major breakthrough in captive breeding of Indian major carps as early as 1959 opening thus the way for scientific fish farming and intensive aquaculture for carps. This has since been followed by detailed investigations on carp fry rearing and fingerling rearing. The package of practices developed by CIFRI facilitates high survival rate of carp fry and fingerling in comparison to the traditional system where the survival rate never exceeded 5% from spawn to fry while no practices existed on fingerling raising. In the present manual an attempt has been made to synthesise all available information on carp seed raising based on experiments carried out by CIFRI from time to time and has been set forth in this manual in terms of a set of package of practices to achieve a high production rate.

Dearth of carp seed has been identified as one of the important constraints in the development of carp culture in this country. This is further compounded by limited availability of seed farms. It is hoped that the present manual would help achieve a high production rate of carp seed per unit area and would generate necessary momentum in carp seed production in this country and thus help carp culture activity. The manual has been designed for use by extension workers, entrepreneurs, bank officials and progressive fish farmers and includes economics of carp seed production.

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PACKAGES OF PRACTICES FOR INCREASING CARP SEED PRODUCTION

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1. INTRODUCTION

The Indian and Chinese major carps, *viz.* catla (*Catla catla*), rohu (*Labeo rohita*), mrigal (*Cirrhinus mrigala*), silver carp (*Hypophthalmichthys molitrix*) and grass carp (*Ctenopharyngodon idella*) generally breed in riverine conditions. Though they show gonadal maturation upto a point in captivity in ponds, yet the final phase of maturation and ovulation/spermiation do not normally take place in pond ecosystem. However, they breed in *bundth* type of tanks. The country, thus had been primarily depending on riverine carp seed resources till the Central Inland Fisheries Research Institute (CIFRI) evolved a technique of induced breeding through hypophysation for Indian major carps in 1957 and Chinese carps in 1962. The technique has since been improved, refined and standardised at the Institute.

In the traditional system the survival rate of carp fry in nursery ponds hardly exceeds 5% while fingerling rearing practice does not exist at all. Since production of fry and fingerlings are crucial inputs in modern farming, the Institute conducted experiments extended over a number of years that finally resulted in packages of practices with high survival rates of fry and fingerlings for both Indian and Chinese carps.

The detailed account of the packages of practices relating to induced breeding, hatching, nursery and rearing pond management, developed at CIFRI are presented in this bulletin in a manner that would serve as guideline for fishery extension workers.

2. INDUCED BREEDING OF CARPS

The successful development of the technique of induced breeding through hypophysation, evolved at CIFRI, ensures breeding of both Indian and Chinese major carps in captivity. The technique involves injection of fish pituitary gland ex-

tract to sexually mature fishes of prime condition under favourable water and climatic conditions during monsoon season. The conducive water temperature range is 24 - 33°C with cool and drizzling weather. Rain water is helpful in spawning and also ensures high rate of fertilization. Water temperature between 27 - 31°C results in better hatching.

The normal breeding season of carps is generally during South-West monsoon period from April to September, depending on the rainy season in different parts of the country. With the advent of monsoon, breeding generally starts in April/May in Assam and during June/July in rest of the country.

The package of practices of induced breeding of Indian and Chinese carps is described below :

2.1 Maintenance of brood stock

Raising of properly maintained brood stock of both sexes to prime mature condition is a pre-requisite for successful induced breedihg. Potential brood fishes of over 2 years age, need be stocked in ponds @ 1000-2000 kg/ha by November in Assam and January in other parts of the country and reared for a period of about 6 months. For a target production of one crore spawn (60 lakh of Indian major carps and 40 lakh of Chinese carps), during a season 750 kg of brood stock (300 kg of Indian major carps+450 kg of Chinese carps) comprising males and females in an approximate ratio of 1 : 1 by weight and 2 : 1 by number would be required. The management of the pond includes maintenance of sanitary condition in the predator free pond devoid of weeds, enriching the nutrient status by application of manures and fertilizers as in stock ponds (CIFRI Aquaculture Extension Manual, New Series No. 2) and providing supplementary feed mixture of groundnut/mustard oilcake and rice bran in 1 : 1 ratio by weight @ 1 - 2% (generally 1%) of total body weight of fish per day.

2.2 Collection of fish pituitary gland

The hormone, excercising a decisive control over maturation of gonads and breeding in fishes is secreted by the pituitary gland. In fish, the pituitary gland is situated ventrally to the brain immediately behind the optic chiasma in a concavity on the floor of the cranium (Fig. 1).

Pituitary glands are collected from fresh as well as properly preserved fishes (weighing atleast 2 kg) of both the sexes of same (homoplastic) or allied species (heteroplastic). Glands from induced bred fishes, soon after spawning, are also potent. Since mature specimens of common carp are available during most part of the year in the farms/ponds, they also serve as good source of gland material..

The glands are conveniently collected during the premonsoon months : April - June (March in Assam). The glands are preserved in absolute alcohol and preferably kept in refrigeration. The collection methods are as follows :

2.2.1 Using a sharp butcher's knife a portion of the scalp is removed and the brain is exposed. The entire brain is lifted with a pair of forceps. The pituitary gland is then seen covered by a membrane which is also removed by forceps. The gland, then, is taken out very carefully avoiding rupture.

2.2.2 In fish markets where severed heads of fish are usually separately sold, pituitary glands can be collected by adopting a simple technique. The posterior part of the brain case is cut by using a bone cutter and a bigger opening is made in the region of the foramen magnum thereby exposing the posterior region of the brain. Through the opening thus made, the gland can easily be removed.

2.3 Selection of mature fish for breeding

At the advent of monsoon brood fishes of 2 kg and above are netted out and selected for induced breeding. A male is easily distinguished by roughness on the dorsal surface of the petcoral fin. When it is ripe milt oozes out freely on gentle pressing at the belly near the vent. The females possess soft, round, bulging belly and swollen, pinkish genital opening (Fig. 2).

While the Indian major carps and males of Chinese carps are easy to select with the help of the above symptoms alone, a catheter may be useful in confirming the stage of maturity of female grass and silver carps. Inserting the catheter through the genital opening some oocytes are taken out and examined by keeping them in a petridish. Silver carp eggs of uniform size, pale blue in colour and grass carp with brownish or copper coloured eggs of uniform size indicate proper maturity. Females with such eggs are selected for induced breeding, individually weighed and kept in hapas.

2.4 Dosage of injection

The dosage of injection is calculated in terms of milligram of pituitary gland per kilogram of body weight of the recipient fish.

Indian major carp females are given two injections at an interval of 6 hours. Depending on the maturity of fish and climatic conditions etc., the two split up doses vary from 2 - 4 mg/kg body weight for the first injection and 5 - 10 mg/kg body weight for the second injection. The males are given a single injection of 2 - 4 mg/kg body weight at the time of second injection to the female.

Chinese grass and silver carp females receive @ 3 - 4 mg/kg body weight at first injection and @ 8 - 10 mg/kg body weight as the second dose. The males receive the only injection @ 3 - 4 mg/kg body weight at the time of second injection to the female.

Recent research has indicated that gonadal hydration is a prerequisite for successful spawning of carps. Pituitary extract injection induces the hydration process thereby increasing the body weight of the spawners. A 3% difference in body weight of female brood fishes between the two injections, thus, indicates better breeding success.

2.5 **Preparation of injection material**

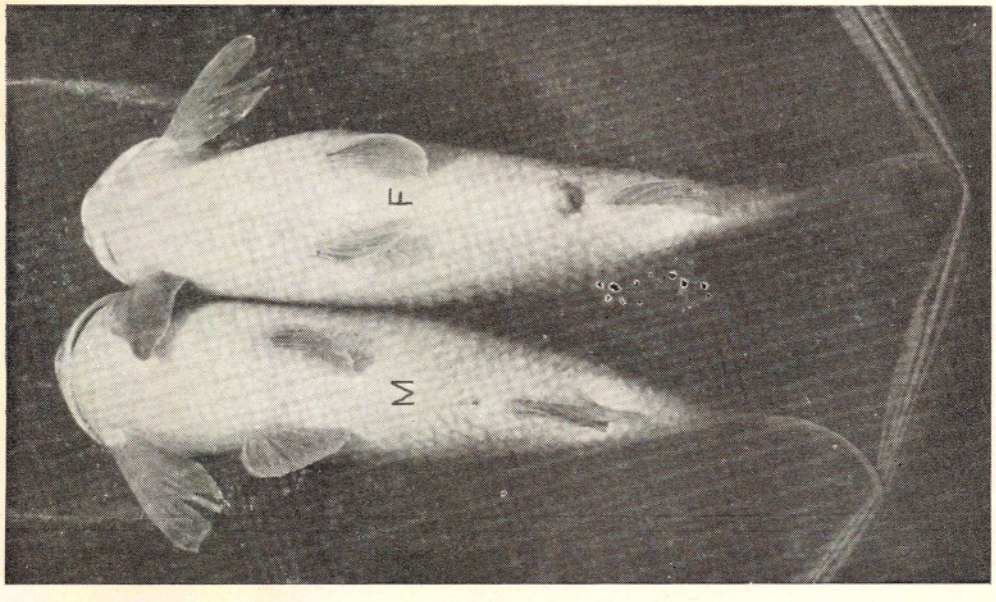
After deciding the dosage, the quantity of glands required for injecting the spawners is calculated. The required quantity of the glands is taken out, the excess alcohol is allowed to evaporate in about a minute and weighed. The glands are then macerated in a tissue homogenizer with small quantity of distilled water or 0.3% saline solution and further diluted by the same liquid to a desired volume (Section 2.6). The extract is thereafter centrifuged and only the supernatant solution is utilized for injection.

The extract can also be prepared in bulk, preserved in glycerine (1 part of extract : 2 parts of glycerine) and kept in refrigerator or ice for later use. It can even be ampouled and transported to other places.

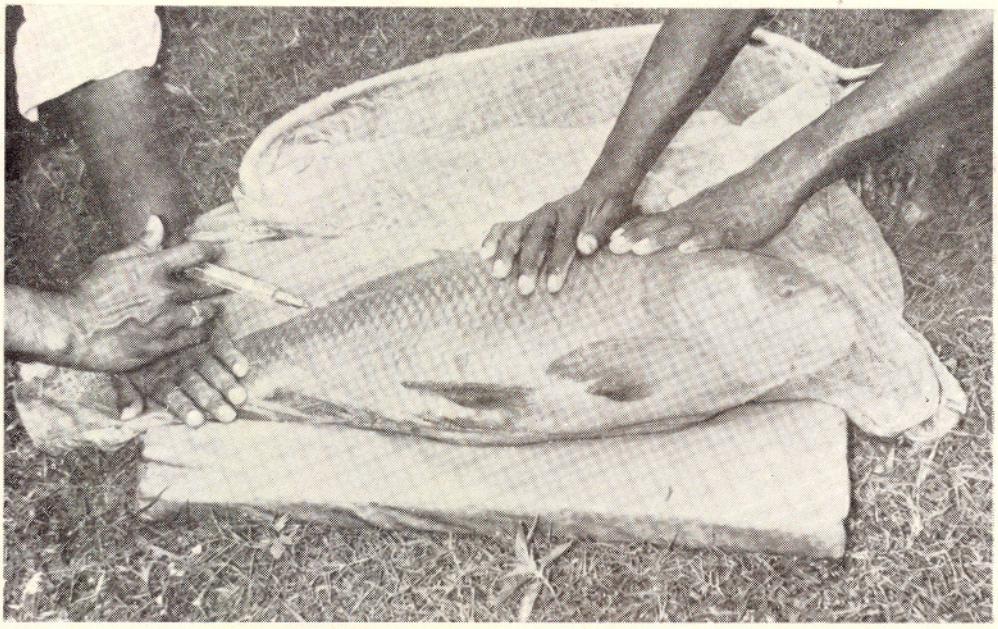
2.6 **Injection to brood fishes**

Usually a breeding set consists of one female and two males, the combined weight of males being equal to that of the female. Keeping the spawner inside a hand net and placing it on a soft cushion, intramuscular injection is given in the caudal peduncle region, avoiding the lateral line (Fig. 3). The volume of gland extract normally injected in one dose varies from 0.5 - 2.0 ml/fish depending on the size of the spawner. The first injection is preferably administered in the late afternoon hours.

Head of rohu incised to show the location of pituitary gland



Ventral view of male and female brood fishes



Pituitary extract administration to a brood fish

Eggs are being collected by stripping a silver carp

The injected brood fish sets are then released in indoor breeding tanks of metal, cement or plastic pools with cooling tower or air conditioner to control the water temperature. A feeble flow of current is preferable.

In absence of such a facility, each set of brood fishes may be released in a closed breeding hapa fixed in ponds, marginal waters of canals, lakes and reservoirs. The water sheet need be free from algal bloom, common carp, tilapia and crabs etc. A breeding hapa is a rectangular cloth container ($2.5 \times 1.25 \times 1.0$ m), stitched with close meshed cloth, having an opening on one side with tying arrangements, through which spawners are introduced and taken out.

2.7 **Spawning and hatching**

Spawning takes place generally inside the breeding tank or hapa usually within 4 - 6 hours after the second injection. While the Indian major carps generally breed naturally inside the hapa, the Chinese grass and silver carp are preferably stripped for better fertilization. Dry method of stripping is generally adopted where the females, wrapped in a towel, are stripped to collect eggs in a dry enamel/plastic basin and are fertilized by milt stripped from males (Fig. 4).

Ovulated eggs, swell up in water. Fertilized eggs are transparent while the unfertilized ones appear opaque and whitish (Fig. 5). Eggs are usually collected from the breeding tank/hapa 4 - 6 hours after spawning with a mug of known capacity and kept for hatching.

A glass jar hatchery with circulating water system, developed by CIFRI, enssures about 95% hatching success. Water hardened eggs are incubated in vertical hatchery jars. In a jar of 6.35 litres capacity 50,000 eggs can be kept for hatching. The flow of water in the jars is so regulated during incubation that the eggs are stirred without being spilt. Normally the rate of flow of water maintained is 600 - 800 ml/minute for Indian major carps and 800 - 1000 ml/minute for Chinese carps. It normally takes 12 - 15 hours for the developing eggs to hatch out in the hatchery. Various modifications of this hatchery system are now available in the country. Based on the same principle, the CIFRI has also recently developed a low cost earthen hatchery for marginal and small farmers.

In absence of modern hatching facilities, fertilised eggs can also be hatched in double-walled hatching hapas fixed in ponds free from algal bloom, common carp, tilapia and crabs. About 50,000 to 1,00,000 eggs are spread in the inner portion of the double layered hatching hapa. While outer hapa ($1.8 \times 1.0 \times 1.0$ m) is made of

thick meshed markin cloth/nylon, the inner part (1.5×0.8×0.5 m) is made of round meshed mosquito netting cloth. The eggs hatch out in 15 - 18 hours at temperature range of 26 - 31°C. The hatchlings pass through the meshes of inner hapa to the outer. After ascertaining complete hatching, the inner hapa with egg shells etc. is removed. The hatchlings are left undisturbed in the outer hapa till the third day when the spawn are ready for stocking in prepared nursery ponds.

2.8 **Expenditure and return**

The economics of producing one crore of spawn is based on a moderate assumption that 80% of the brood stock will be available in prime condition for spawning with 60% success in Indian major carps and 40% in Chinese carps. Fecundity has been taken as 1.5 lakhs and 1.0 lakh eggs/kg body weight of females for Indian major carps and Chinese carps respectively. The fertilization and hatching success have been taken as 80% and 70% respectively. It has also been presumed that cloth hapas are used for both breeding and hatching purposes. The generalised economics has been calculated on the basis of present market rates.

For producing one crore of spawn, an investment of Rs. 42,100/- brings a receipt of Rs. 62,500.00 yielding a net profit of Rs. 20,400/- with 48.4% return on variable cost, as shown in Table-1.

T A B L E - 1 : Cost and return of induced breeding

A	*Expenditure :*		
1.	Rental of three ponds for 6 months (0.2 ha each, one for stocking silver and grass carp, one for stocking Indian major carps and one for fixing hapas. Total area 0.6 ha).	Rs.	900.00
2.	Labour charges for pond clearance (10 man days @ Rs. 10/ per man day).	Rs.	100.00
3.	Cost of 200 kg of lime @ Rs. 1/kg.	Rs.	200.00
4.	Cost of 3.0 tons of Mahua oil cake @ Rs. 800/ton, for pond preparation.	Rs.	2400.00
5.	Cost of 1.2 ton of cattledung @ Rs. 50/ton (1000 kg/ha/ month for 3 months for 0.4 ha for two brood stock ponds.)	Rs.	60.00

6.	Cost of 750 kg of brood stock @ Rs. 25/kg.	Rs.	18,750.00
7.	Transport charge of brood stock	Rs.	200.00
8.	Cost of supplementary feed for 750 kg brood stock for 180 days 675.0 kg of Mustard oil cake @ Rs. 2/kg + 675.0 kg of rice bran @ Rs. 0.70/kg.	Rs	1822.50
9.	Cost of feed transport and storage	Rs.	200.00
10.	Watch & ward for 180 days (3 persons @ Rs. 10/day)	Rs.	5400.00
11.	Casual labour for 30 days for netting etc. (6 persons @ Rs. 10/ day).	Rs.	1800.00
12.	Cost of one dragnet (Rs. 3000.00 economic life 3 years, so $\frac{1}{3}$ rd of the cost taken)	Rs.	1000.00
13.	Cost of 12 breeding hapas @ Rs. 55/hapa	Rs.	660.00
14.	Cost of 100 outer hatching hapas @ Rs. 25/hapa	Rs.	2500.00
15.	Cost of 60 inner hatching hapas @ Rs. 35/hapa (economic life - 2 years, so, $\frac{1}{2}$ the cost taken).	Rs.	1050.00
16.	Cost of rope, bamboo etc.	Rs.	500.00
17.	Cost of induced breeding equipment and other miscellaneous items.	Rs.	500.00
18.	Cost of pituitary gland (5500 mg @ Rs. 2/10 mg)	Rs.	1100.00
	Total	Rs.	39,142.50
19.	Interest on working capital @ 15% for 6 months	Rs.	2,935.70
	Grand total (A)	Rs.	42,078.20
	Say	Rs.	42,100.00

B. *Income*

1.	Sale proceed of 6 million Indian major carp spawn @ Rs. 2,500 / million.	Rs.	15,000.00

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2.	Sale proceed of 4 million Chinese carp spawn @ Rs. 10,000/ million.	Rs.	40,000.00
3.	Sale proceed of 750 kg of fish @ 10/kg (increase in weight during six month rearing and loss due to breeding taken as equal).	Rs.	7,500.00
	Total (B)	Rs.	62,500.00
C.	**Net profit (B-A)**	Rs.	20,400.00
	Return on investment		48.4%
	Percentage of profit to turnover		32.6%

3. NURSERY POND MANAGEMENT

The tender spawn start external feeding after about 3 days of hatching and thus, thereafter need congenial environment with enough of feed for growth and survival. The spawn of 5 - 6 mm size (Fig. 6) are nursed in well prepared nurseries and grown to fry measuring 25 - 30 mm size in about 2 weeks period.

The package of practices, evolved at CIFRI, ensures 60 - 70% survival rate of fry against about 5% under traditional system in the country.

3.1 Selection of ponds

Nursery ponds are usually small, 0.02 - 0.05 ha in area, with water depth between 1.0 and 1.5 m. Seasonal ponds are preferable to perennial ones since seasonal exposure of the pond bed to direct sunlight helps in improving pond conditions. It is preferable also because such ponds are relatively free from weeds and unwanted fishes.

Aiming at providing the delicate young ones enough moving space and sufficient feed in an environment free of pond dwelling enemies, nurseries are especially prepared just before monsoon season. Care is taken to prevent entry of ducks in such ponds in view of their predacious habits.

3.2 Clearance of weed

A weed free nursery facilitates free movement of the growing fry and is also conducive to production of their natural food. Such ponds, being small and shallow are cleared of vegetation conveniently and economically by manual labour. This may be done during summer months, April and May.

3.3 **Eradication of unwanted fishes**

Predatory fishes directly prey upon the young ones besides competing with them for space and oxygen. The weed fishes compete with the cultured species for their demand of food, space and oxygen. In view of the harm caused by these undesirable fishes, their complete eradication from the pond before stocking is of utmost importance in scientific nursery namagement.

The commonly encountered species of predatory fishes are : *Channa* spp., *Clarias batrachus*, *Heteropneustes fossilis*, *Pangasius pangasius*, *Mystus* spp., *Ompok* spp., *Wallago attu*, *Glossogobius giuris* etc.

The common weed fishes are : *Puntius* spp., *Oxygaster* spp., *Ambassis* spp., *Amblypharyngodon mola*, *Colisa* spp., *Rasbora* spp., *Aplocheilus* spp., *Laubuca* spp., *Esomus danricus* etc.

Repeated netting of the pond is one of the methods for eradication of fishes. But many fishes escape the net, particularly in deeper waters. Another method of eradication is dewatering of the pond. But this method can only be applied in small water bodies with additional water source to refill the pond. Hence, to ensure complete removal of existing fish population use of fish toxicants is necessary. This may be economically done during premonsoon season when the water level is minimum. The date for use of fish toxicant may be adjusted about 5 weeks earlier to the anticipated time of spawn availability.

However, seasonal ponds which dry up during summer months are generally devoid of such unwanted fishes and thus, need no such treatment.

The suitability of fish toxicant is judged on its properties like effective minimum dose, its cost, consumability of the killed fish, least adverse effect on the pond biota, short duration of the toxicity, non-cumulative residual effect in the pond, commercial availability and simplicity of application etc. Out of a long list of known fish toxicants, suitable ones are : mahua oilcake, tea seed cake or any other plant derivative ; Ammonia and Bleaching powder. Depending on availability , cost and convenience, one may choose any of the following fish toxicants.

3.3.1 *Mahua oilcake* : The most extensively used fish toxicant in the country is oilcake of Mahua (*Basia latifolia*) containing 4-6% saponin, It kills fishes at 200-250 ppm in 6-10 hours. The fishes, thus killed, are fit for human consumption. While the toxicity in water lasts for 15-20 days, the oilcake serves as organic manure in the pond subsequently.

The quantity required is calculated on the basis of water volume in the pond. At the above mentioned dosage mahua oil cake required is 2000-2500 kg per hectare for every meter of average depth. The required quantity of mahua oil cake is powdered, soaked in water and broadcast uniformly over water surface. Repeated stirring of water thereafter ensures proper mixing of the oilcake. Drag netting helps removal of effected fishes besides mixing of the toxicant.

3.3.2 *Tea seed cake* : Seed cake of tea (*Camellia sinensis*) ,may prove to be a substitute for Mahua oil cake wherever commercially available. A dose of 75-100 ppm is sufficient to obtain a complete kill in the pond with toxicity lasting for 10-12 days. It also ultimately acts as fertilizer in the pond. The treated fishes are fit for human consumption. The method of application is same as in mahua oilcake.

3.3.3 *Other plant derivatives* : Other fish toxicants of plant origin like stem bark (20 ppm), seed (15 ppm) and root bark (10-15 ppm) powder of *Barringtonia acutangula*, seed powders of *Croton tiglium* (3-5 ppm) and *Milletia piscidia* (4-5 ppm), root powder of *Milletia pachycarpa* (3-6 ppm), unripe fruit powder of *Randia dumetorum* (15 ppm) and *Cassaria arevaolaus* (25-30 ppm), seed husk of *Tamarindus indica* (5-10 ppm), bark powder of *Walsura piscidia* (5 ppm) and whole plant of *Euphorbia thirucalli* have been found to be effective as fish toxicant under laboratory conditions. The method of application is same as in Section 3.3.1.

3.3.4 *Ammonia* : Anhydrous ammonia @ 20-25 ppm has been found as an effective fish toxicant. The killed fishes are safely consumable. The cost of ammonia as a fish toxicant is off-set to some extent by its fertilizer value which has been estimated to be about 36% of the cost of ammonia applied. Ammonia acts as herbicide as well. Toxicity of ammonia in water lasts for about 5-6 weeks.

Anhydrous ammonia from a cylinder is introduced into the water through a hose and a 1.2 m long G. I. pipe applicator with delivery holes. The applicator is suspended from a boat or held in position by long ropes by two persons standing on opposite bank. The cylinder is partly immersed in water near the shore to prevent excessive cooling and condensation of ice. Ammonia being lighter than water, the applicator is kept as far below the water level as necessary to effect the bottom dwellers. However, the applicator should be kept well above the bottom soil to prevent loss of gas from absorption by the soil. Its efficacy also depends on the pH of water, effect being quicker with increasing pH.

3.3.5 *Bleaching powder* : Bleaching powder, Calcium hypochlorite, as fish toxicant has been found to be effective in 3-4 hrs. at 25-30 ppm . Its toxicity lasts for about 7-8 days in the pond. It also possesses disinfecting effect besides oxidising the decomposing matter on the pond bottom. In view of limited supply of mahua oilcake, bleaching powder is an effective substitute with easy availability and lower cost.

The powder is dissolved in water and made into the form of a slurry. The solution is sprayed on the water surface immediately and the water stirred for thorough mixing. Distressed or killed fishes are removed by subsequent repeated netting and are fit for human consumption.

3.4 **Application of lime**

With a view to helping mineralisation of organic matter and for prophylactic reasons, quick lime is applied in the pond. After about two week of eradication of unwanted fishes, application of lime @ 250-300 kg/ha is generally recommended.

3.5 **Manuring of pond**

Manuring is done with the objective of encouraging growth of plankton, particularly animalcules which form the natural food of the spawn. Nurseries are, thus, manured with only cattledung (organic manure) @ 10,000 kg/ha about 15 days before the anticipated date of stocking by broadcasting all over the pond. In ponds where mahua oilcake is used as piscidice earlier, the dose of cattledung may be reduced to half.

3.6 **Aquatic insect control**

Manured nursery ponds are populated with large number of aquatic inseets particularly during monsoon months. Most of the aquatic insects, either in their larval and/or adult stages, prey upon spawn and early fry and, in addition, also compete with them for food. Hence, it is necessary to eradicate all such insects from nursery ponds before stocking with spawn. The most commonly occuring aquatic insect group are :

Coleoptera (*Beetles*) : Predaceous diving beetle (*Cybister*), water scavenger beetle (*Sternolophus*) and whirling beetle (*Gyrinus*), etc.

Hemiptera (*Bugs*) : Back swimmer (*Anisops*), Giant water bug (*Belostoma*), water scorpion (*Ranatra*), water stick insect (*Laccotrephes*), etc.

Odonata : Dragonfly nymphs, etc.

Since complete eradication of insects by means of seining is not possible, selective treatments are necessary. The commonly used methods to control insects in fishery waters are as follows. However, choice of a method depends on convenience of application, local/easy availability of the items and cost involved etc.

3.6.1 *Use of soap oil emulsion* : The generally recommended CIFRI method is to spray a soap-oil emulsion on the surface of the water for killing insects which come up to the surface for respiration. An emulsion of any cheap washing and vegetable oil at the rate of 18 kg soap : 56 kg oil per hectare is prepared by heating the mixture for a short while. The emulsion is applied 12-24 hours before stocking by uniformly broadcasting over the water surface of the nursery. Care is taken to keep the uniform film undisturbed for a couple of hours. Hence, calm dry days are chosen for the application.

Soap can be substituted by Teepol B-300 (a synthetic detergent) in the above-said emulsion. The recommended dose of Teepol is 560 ml to be emulsified with 56 kg of vegetable oil.

3.6.2 *Use of kerosene oil* : Spraying of kerosene oil over the surface of water @ 80-100 litres/ha has also been found to be useful by West Bengal State Fisheries Department in killing the aquatic insects in nursery ponds.

3.6.3 *Use of L.S.D.* : Another treatment, found useful by Maharashtra State Fisheries Department in killing aquatic insefcts, is spraying an emulsion prepared by mixing light speed Diesel oil (1 litre), emulsifier Hyoxid 1011 (0.75 ml) and water (40 ml) at the rate of 1040.75 ml per 200 square meter of water surface.

3.6.4 *Use of turpentine oil* : Turpentine oil @ 75 litres/ha when sprayed on the water surface has been reported to kill the insects completely.

3.7 **Stocking of spawn**

If piscicide is earlier used for preparation of the pond, it is essential to ascertain its complete detoxification before stocking. This may be conveniently done under field conditions by fixing a hapa in the pond and releasing some spawn in it. Comfortable behaviour of spawn for about 24 hours confirms complete detoxification. Nursery ponds are stocked with about 3-4 days old spawn usually in the morning hours after about 5 weeks of piscicide application, if done. The moderate rate of stocking may be 25-35 lakh/ha.

Fertilized eggs of carp

Carp spawn

Feed being broadcast in a nursery pond

A harvest of fry from one of the nursery ponds

3.8 **Supplementary feeding**

Since it becomes difficult, even after manuring to maintain the desired level of natural food for the growing fry in the pond, it becomes necessary to provide supplementary feed from outside. A mixture of finely powdered groundnut/mustard oilcake and rice bran/polish in equal proportion by weight is supplied to the fry. Other feed items that can alternatively be used are mixture of powdered aquatic insects, prawn and cow peas or fish meal and groundnut oilcake etc. It is recommended that cobalt chloride or manganese sulphate @ 0.01 mg/day/spawn may be added to the feed. Addition of yeast increases survival of fry. Feed may be broadcast all over the pond once daily in morning hours commencing from the day of stocking (Fig. 7). Feeding may be stopped a day earlier to harvesting. The generally recommended feeding schedule is as below :

Period	*Rate of feeding per day*	*Approximate quantity per one lakh of spawn/day*
1st to 5th day after stocking.	4 times the initial total weight of spawn stocked.	0.56 kg.
6th to 12th day after stocking.	8 times the initial total weight of spawn stocked.	1.12 kg.
13th day	No feeding	—
14th day	Harvesting	—

Feeding need be suspended in adverse ecological conditions.

3.9 **Harvesting of fry**

The fry in about 2 weeks generally grow to 25-30 mm size (Fig. 8). They are harvested with fine meshed (1.5 mm) drag net in the cool morning hours avoiding the cloudy days.

During a normal breeding season lasting about 3 months, 3-4 crops can be raised from the same nursery pond. The fry are then raised to fingerlings in rearing ponds.

3.10 Cost and returns

Table 2 concludes that fry raising is highly remunerative. Though the cost and return in the management practice depend on various factors, an investment of Rs. 2000/- in a 0.1 ha nursery pond generally yields a net profit of Rs. 3400/-per crop, showing 170 percent return on variable cost at current market prices.

TABLE-2 Cost and return of Nursery pond management for Indian major carps per 0.1 ha/crop of one fortnight.

Sl. No.	*Item*	*Quantity*	*Rate (Rs.)*	*Expenditure (Rs.)*
A.	**INPUT**			
1.	Weed clearance	—	—	50.00
2.	Mahua oil cake	250 kg.	80/100 kg.	200.00
3.	Organic manure (Cattle dung)	1000 kg.	50/1000 kg.	50.00
4.	Lime	30 kg.	1/kg.	30.00
5.	Soap & oil treatment :			
	Soap	1.8 kg.	5/kg.	9.00
	Oil	5.6 kg.	10/kg.	56.00
6.	Supplementary feed :			
	Mustard oil cake	16 kg.	2/kg.	32.00
	Rice bran	16 kg.	0.7/kg.	11.20
7.	Carp spawn	3 lakh	250/lakh	750.00
8.	Netting charges			120.00
9.	Watch & ward labour	45 man days	10/man day	450.00
10.	Depreciation, maintenance, repairs & incidentals.			100.00

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11.	Rent of water body (estimated proportionate rate for one crop).		75.00
		Total	1933.20
12.	Interest on working capital @ 15% / annum for 3 months.		72.50
		Gross total	2005.70
		Say Rs.	2000.00
B.	**RETURN**		
Sale of fry 1,80,000 @ Rs. 30/thousand		Rs.	5,400.00
C.	**Net Profit** (B — A)	Rs.	3,400.00
	Percentage of return on variable cost		170%
	Profit percentage to turn over		63%

N.B.—3-4 crops are possible in one season from the same pond.

4. REARING POND MANAGEMENT

Fry are raised to fingerling size in rearing ponds in about 3 months period. The package of practices, as developed at CIFRI, for ensuring healthy growth and better survival of fingerlings is as follows :

4.1 **Pond selection**

Rearing ponds may be 0.05 ha to 0.1 ha in area, rectangular in shape with water depth ranging from 1.5 to 2.0 m Seasonal ponds/impoundments are often preferable to perennial ones. Care should be taken to prevent entry of ducks in the rearing ponds too.

4.2 **Weed eradication**

The weeds from the shallow small ponds may be economically and easily eradicated by manual labour during summer months.

4.3 Removal of unwanted fishes

The methods for eradication of predatory and weed fishes from rearing ponds are same as given in Section 3.3.

4.4 Lime application

Liming the pond @ 250-300 kg/ha in 3 equal monthly instalments is recommended. The first dose need be applied one week earlier to stocking.

4.5 Pond fertilization

Provision of adequate natural food can be ensured to some extent in the pond through manuring and fertilization at fortnightly intervals. Organic manure (Cattledung) @ 2500 kg/ha is applied in 4 equal instalments. While the initial dose is applied about a fortnight before the stocking, the subsequent ones are used on monthly intervals. However, when the ponds are earlier treated with mahua oilcake the first instalment of cowdung can be dispensed with.

Inorganic ferlitizers like urea @100 kg/ha or ammonium suplhate @200 kg/ha and single super phosphate @ 100 kg/ha or triple superphosphate @ 35 kg/ha may be applied in 3 equal instalments during the rearing period. The first instalment of inorganic fertilizers is given on second day of stocking and thereafter at monthly intervals, alternating with organic manures. Manuring and fertilization need be suspended if algal blooms or any other adverse conditions appear in the pond.

4.6 Fry stocking

After testing for complete detoxification as given in Section 3.7, 25-30 mm fry are stocked in various combinations at densities ranging from 2 to 3 lakhs/ha in any of the following ratios.

Species	*Ratio*
Catla + Rohu + Mrigal	2 : 4 : 4
Silver carp + Grass carp	1 : 1
Silver carp + Grass Carp + Common carp	4 : 3 : 3

Silver carp + Grass carp + Common carp	5 : 1.25 : 3.75
Catla + Rohu + Mrigal + Common carp	3 : 4 : 1 : 2
Catla + Rohu + Mrigal + Grass carp	4 : 3 : 1.5 : 1.5
Catla + Rohu + Mrigal + Grass carp	3 : 3 : 3 : 1
Silver carp + Grass carp + Common carp + Rohu	3 : 1.5 : 2.5 : 3
Silver carp + Grass carp + Common carp + Rohu	4 : 2 : 2 : 2

4.7 **Supplementary feeding**

Plankton production in the pond can not be maintained at adequate level even after regular manuring and fertilization in view of the heavy stocking density maintained under modern practices. In order to meet the increasing demand, supplementary feed consisting of a mixture of groundnut/mustard oilcake and rice bran at 1 : 1 ratio by weight in powder form is broadcast every day in the pond during morning hours commencing from the first day of stocking. A generalised feeding schedule may be be as below :

PERIOD	*QUANTITY OF FEED/LAKH/DAY*
1st month	6 kg.
2nd. month	10 kg.
3rd. month	15 kg.

Feeding need be suspended if algal bloom or any other adverse conditions appear in the pond.

When the grass carp is stocked, duck weeds (small floating weeds like *Wolffia, Lemna* and *Spirodella*) need be introduced in required quantities as food. The duck weeds are preferably introduced within a bamboo enclosure in one side of the pond. The quantity of weed is regulated according to consumption by grass carp.

4.8 **Algal bloom control**

Fertilization, at times, may result in the development of excessive microscopic plants which are less desirable or may even become undesirable when they form bloom. Depending on the intensity of such blooms, Diuron @ 0.1 to 0.3 ppm

(1 to 3 kg per hectare-metre of water) may be used as control measure. The required quantity of herbicide may be mixed with water and spread uniformly over the pond surface. However, bloom in such small ponds are most conveniently controlled in about a week by thickly covering the water surface with duck weeds. The weeds may afterwards be removed from the pond. If grass carp exists in the system the same will serve as their food and thus need not be removed.

4.9 Fingerling harvesting

The growth and well being of the growing fry during the rearing period need be periodically checked. This is conveniently done by drag netting.

Healthy fingerlings of 100-150 mm size are obtained in three months rearing period (Fig. 9). Supplementary feeding is stopped a day before the date of catching. Harvesting is done during cool morning hours by repeated drag netting. Survival of about 70-90% (average 80%) is generally obtained in about 3 months rearing.

4.10 Cost and return

A net profit of Rs. 1900/- is expected in rearing pond management for a period of 3 months with an investment of Rs. 7100/- in a 0.2 ha pond. The enterprise shows a 26.8 percent return on investment at current prices as shown in Table-3.

Table - 3 : Cost and return of Rearing Pond Management of Indian major carps per 0.2 ha/crop

Sl. No.	Item	Quantity (kg.)	Rate (Rs.)	Expenditure (Rs.)
A.	INPUT			
1.	Weed clearance			100.00
2.	Mahua oilcake	500	80/100 kg.	400.00
3.	Lime	60	1/kg.	60.00
4.	Organic manure (Cow dung)	500	50/1000 kg.	25.00
5.	Inorganic fertilizer :			
	Urea	20	2.50/kg.	50.00
	Single super phosphate	20	1.00/kg.	20.00

.....Contd.

6.	Fry	50,000 nos.	30/1000	1500.00
7.	Supplementary feed :			
	Mustard oilcake	240 kg.	2/kg.	480.00
	Rice bran	240 kg.	0.7/kg.	168.00
8.	Netting charges			500.00
9.	Depreciation, Transport and contingency etc.			250.00
10.	Labour including watch & ward	270 man days	10/man day	2700.00
11.	Rent of water body (estimated proportionate rent)			300.00
			Total	Rs. 6553.00
12.	Interest @ 15% per annum for 6 months			490.00
			Grand total	Rs. 7043.00
			Say	Rs. 7100.00

B. RETURN

Sale price of 40,000 fingerlings @ 225/thousand	Rs.	9000.00
C. Net profit (B — A)	Rs.	1900.00
Percentage of return on variable cost	Rs.	26.8%
Profit percentage to turn over		21%

5. SUMMARY

INDUCED BREEDING OF CARPS

● Brood fishes need be stocked in properly prepared ponds in the month of November in Assam and January in other places @ 1000-2000 kg/ha and fed with a mixture of oilcake and rice bran (1 : 1) by weight @ 1-2% of body weight/day for about 6 months before the breeding season.

- Pituitary glands are collected from carps of over 2 kg generally during the premonsoon months, April-June (March in Assam).

- Gland extract is administered to both sexes of selected Indian major carp spawners @ 2-4 mg/kg as first dose and 5-10 mg/kg body weight of females as second dose at an interval of 6 hours. The males need only one dose @ 2-4 mg/kg body weight along with second dose to the females. The grass and silver carp males need @ 3-4 mg/kg body weight in one injection while females @ 3-4 mg/kg body weight and 8-10 mg/kg body weight as first and second doses respectively.

- The injected sets, consisting of 1 female and 2 males, the combined weight of males being nearly equal to that of the female, are placed in cement cistern/metal tank/breeding hapas fixed in ponds where they spawn in 4-6 hours after second injection.

- While Indian major carps normally breed in hapas, the Chinese carps are preferably stripped for better fertilization.

- The water hardened fertilized eggs are transferred to hatcheries or double walled hatching hapas 4-6 hours after spawning where they hatch in 12-15 hours and 15-18 hours respectively.

- With an investment of variable cost of about Rs. 42,100/- a net profit of Rs. 20,400/- is expected for a production of one crore of spawn in a season.

NURSERY POND MANAGEMENT

- The spawn are raised to fry stage in nursery ponds in about a fortnight during monsoon months.

- The preparation of ponds include deweeding by manual labour, eradication of unwanted fishes by application of mahua oilcake @ 2000-2500 kg per hectare-metre or tea seed cake @ 75-150 ppm or ammonia @ 20-25 ppm or bleaching powder @ 25-30 ppm in perennial ponds. This is done in summer months about five weeks before the anticipated date of stocking. Lime is applied @ 250-300 kg/ha about two weeks after application of piscicide, followed by manuring with cowdung @ 10,000

kg/ha about two weeks before anticipated date of stocking. Harmful aquatic insects are controlled by soap oil emulsion treatment @ 56 kg vegetable oil : 18 kg cheap washing soap/ha about 12-24 hours before stocking.

- 3-day old spawn are stocked @ 25-35 lakhs/ha after ensuring complete detoxification of the piscicide.

- Supplementary feed mixture of groundnut/mustard oilcake and rice bran (1 : 1 by weight) are fed daily @ 0.56 kg for first five days and 1.12 kg for next seven days for every one lakh of spawn. No feeding is required thereafter.

- Harvesting of fry (25-30 mm size) is done on the 14th day by fine meshed drag net (1.5 mm).

- An investment on variable cost of Rs. 2000/- in a 0.1 ha pond generally yields a net profit of Rs. 3400/- per crop of a fortnight.

- 3 to 4 such crops are possible to be obtained from the same pond during one season.

REARING POND MANAGEMENT

- The steps relating to deweeding, eradication of unwanted fishes, application of lime are same as in nursery pond management.

- Organic manuring is done with cowdung @ 2500 kg/ha in four equal monthly instalments. The initial dose is applied about 15 days earlier to stocking.

- Inorganic fertilization is done with urea @ 100 kg/ha or ammonium sulphate @ 200 kg/ha and single super phosphate @ 100 kg/ha or triple super phosphate @ 35 kg/ha in three instalments. The first instalment of inorganic fertilizers is given on second day of stocking and thereafter at monthly intervals, alternating with organic manuring.

- After ascertaining complete detoxification of piscicide, stocking of fry is done @ 2-3 lakhs/ha.

- Supplementary feeding with oilcake and rice bran mixture @ 6 kg/lakh/day for the first month, 10 kg/lakh/day for the second month and 15 kg/lakh/day for the third month may be done commencing from the day of stocking.

- Duck weeds, preferably *Lemna* and *Wolffia* need be supplied as per consumption of grass carp, if stocked.

- Fingerlings of 100-150 mm size are expected in about 3 months rearing period when they are ready for harvesting.

- A net profit of Rs. 1900/- is expected in this enterprise with an investment on variable cost of Rs. 7100/- in a 0.2 ha pond.

A harvest of carp fingerlings