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Breeding and Seed Production of *Labeo rohita* Using GONOPRO-FH Hormone at Bhosi Village, Nirmal District, Telangana, India

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Abstract

Breeding and seed production of rohu, *Labeo rohita*, were carried out at Bhosi Village, Nirmal District, Telangana, to evaluate the practical use of GONOPRO-FH under farm conditions. The breeding operation took place during the monsoon season in an eco-hatchery using healthy, sexually mature brood fish more than two years old and weighing about 3 kg each. One female and two males formed a breeding unit in a 1:2 ratio. GONOPRO-FH was administered according to body weight at 0.4 mL kg^{-1} to the female and 0.2–0.3 mL kg^{-1} to the males. The brooders responded to hormonal induction and spawned successfully in the hatchery. The spawn were collected and transferred to a nursery pond prepared in advance. To promote natural food production, the nursery pond received 40 kg cow dung and 5 kg single super phosphate. Plankton developed after about six days and was checked with a plankton net before stocking. During breeding and nursery rearing, water temperature remained at 27–29 °C, pH at 7.0–8.0, dissolved oxygen at 7.5–8.0 mg L^{-1}, free carbon dioxide at 0.40–0.50 mg L^{-1}, and total alkalinity at 83–85 mg L^{-1}. Nursery survival was approximately 40%. Under these farm conditions, GONOPRO-FH supported successful rohu breeding when combined with mature brood stock, proper eco-hatchery operation, timely nursery preparation, plankton availability, and suitable water quality.

Keywords: *Labeo rohita*, induced breeding, GONOPRO-FH, eco-hatchery, rohu seed, nursery management, Telangana

1. Introduction

Rohu, *Labeo rohita* (Hamilton, 1822) [9], is one of the most widely cultured Indian major carps and remains an important species in freshwater aquaculture across South Asia. Its popularity is linked to good market acceptance, suitability for polyculture, and the availability of established seed-production techniques (Khan & Jhingran, 1975; FAO, n.d.; Reddy *et al*., 2002) [16, 24]. As hatchery production has expanded, greater attention has also been given to broodstock quality and the genetic management of seed populations (Hamilton *et al*., 2019, 2022) [12, 13]. Hypophysation is an effective technique for inducing breeding in *Oreochromis niloticus* (*Nile tilapia*) under controlled conditions ("Study on Induced Breeding," 2025) [32].

A practical difficulty with rohu is that fully mature fish do not spawn reliably in ordinary confined ponds. Indian carp seed production therefore developed around induced breeding, first through hypophysation and later through commercial hormone preparations based on gonadotropin-releasing hormone (GnRH) analogues (Chaudhuri & Alikunhi, 1957; Jhingran & Pullin, 1985; Halder *et al*., 1991) [6, 14, 11]. Field and hatchery work has shown successful induced breeding of rohu with Ovaprim, Ovatide and related synthetic preparations (Kiran *et al*., 2006; Khan *et al*., 2006; Naeem *et al*., 2013; Ali *et al*., 2015; Thirupathi *et al*., 2023) [17, 15, 20, 1, 31]. Hypophysation also remains a useful reference method; Bhukya *et al*. (2024) [3], for example, used a rohu breeding unit consisting of one female and two males.

Commercial spawning agents are convenient in farm hatcheries because the dose can be calculated directly from brood-fish weight. GONOPRO-FH belongs to this practical group of inducing preparations and has been used in experimental work with rohu (Malik *et al*., 2023) [19]. The biological response to these products is linked to the GnRH-gonadotropin pathway that controls final maturation, ovulation and spermiation (Peter *et al*., 1988; Peter & Yu, 1997; Pradhan *et al*., 2018) [21, 22, 23]. Even so, a dose that works well in one hatchery cannot automatically be treated as a fixed recommendation for every farm. Brooder maturity, sex, water temperature, handling, and the formulation of the hormone can all influence the response (Kiran *et al*., 2006; Ali *et al*., 2015; Bagra *et al*., 2024) [17, 1, 2].

The breeding season is equally important. Rohu is a monsoon-associated breeder, and its reproductive condition changes markedly over the annual cycle (Dasgupta *et al*., 2009; Lone & Hussain, 2009; Sahu *et al*., 2013) [8, 18, 25]. Kiran *et al*. (2006) [17] conducted induced-breeding trials from May to August, while Dasgupta *et al*. (2009) [8] found clear differences between pre-monsoon and monsoon spawning responses. These observations are relevant to farm practice because hormone treatment is most useful when brooders have already reached an advanced stage of gonadal maturity.

Successful seed production also depends on what happens after spawning. Eggs and newly hatched seed are sensitive to poor water quality, crowding and rough handling, while nursery survival depends heavily on early food availability and stocking conditions. Carp hatchery manuals therefore recommend preparing the nursery before stocking and encouraging natural food production through pond fertilization (Jhingran & Pullin, 1985; Gupta & Rath, 2006; FAO, n.d.) [14, 10]. Work with rohu larvae and fry has shown that stocking density and handling stress can alter survival and growth (Sharma & Chakrabarti, 2003; Sharma *et al*., 2004; Chatterjee *et al*., 2010) [28, 29, 5]. Water-quality management remains part of the same production process rather than a separate activity (Boyd, 1982) [4].

2. Materials and Methods

2.1 Study area, season, and production unit

Breeding was carried out at Bhosi Village in Nirmal District, Telangana, India, during the monsoon season. The eco-hatchery had an operational seed-production capacity of approximately 30 lakhs. The work followed one routine farm production cycle, without a replicated comparison among hormone treatments.

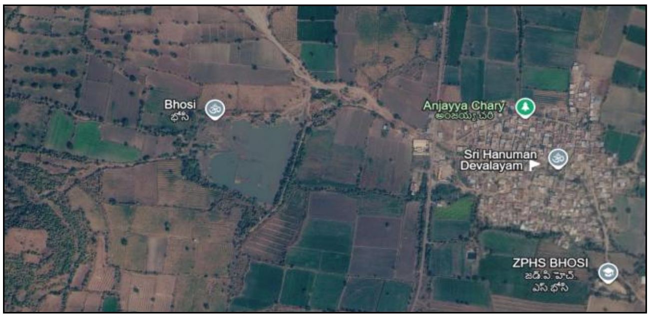

Fig 1: Showing the location

Fig 2: *Labeo rohita*

Kingdom -Animalia
Phylum -Chordata
Class -Actinopterygii
Order -Cypriniformes
Genus -*Labeo*
Species- *rohita*

2.2 Broodstock selection and feeding

One mature female and two mature males were selected for the breeding set, giving a female: male ratio of 1:2. All three fish were more than two years old and weighed approximately 3 kg each. Selection was based on apparent health and breeding condition. Bhukya *et al*. (2024) [3] also used a two-male-to-one-female unit for rohu hypophysation. No alternative sex ratio was tested at Bhosi. The brooders were fed mainly with groundnut oil cake and rice bran. These are common carp-feed ingredients, and Kiran *et al*. (2006) [17] also included groundnut oil cake and rice bran in broodstock feed during induced breeding of rohu.

Table 1: Broodstock and breeding characteristics at Bhosi Village.

Characteristic	Observation
Species	*Labeo rohita* (rohu)
Breeding season	Monsoon
Female brooders	1
Male brooders	2
Female: male ratio	1:2
Brooder age	More than 2 years
Approximate body weight	3 kg fish-1
Broodstock feed	Groundnut oil cake and rice bran
Breeding system	Eco-hatchery
Seed-production capacity	Approximately 30 lakh

2.3 Hormonal induction

GONOPRO-FH was used for hormonal induction, with the dose calculated from body weight at the time of breeding. The female received 0.4 mL kg^{-1}, whereas the males received 0.2–0.3 mL kg^{-1}. At an approximate body weight of 3 kg, the calculated volume was about 1.2 mL for the female and 0.6–0.9 mL for each male. These quantities apply to the Bhosi breeding cycle and should not be treated as a universal dose. Other commercial spawning agents are also administered according to sex and body weight, although the actual dose varies with formulation and hatchery conditions (Kiran *et al*., 2006; Naeem *et al*., 2013; Thirupathi *et al*., 2023; Malik *et al*., 2023) [17, 20, 31, 19].

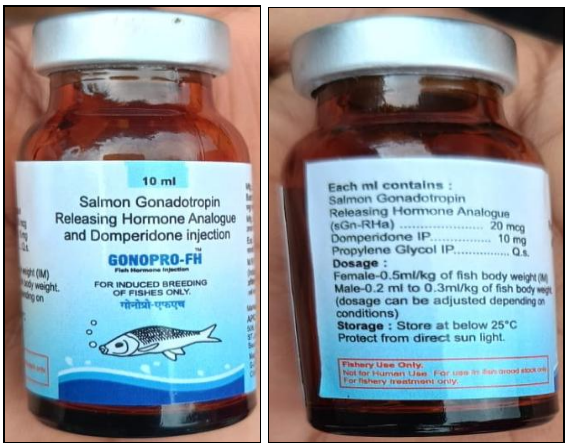

Fig 3: GONOPRO-FH

Table 2: GONOPRO-FH dosage used during the breeding operation

Brooder	Approx. weight	Dose used	Calculated volume
Female	3 kg	0.4 mL kg^{-1}	Approx. 1.2 mL
Male 1	3 kg	0.2-0.3 mL kg^{-1}	Approx. 0.6-0.9 mL
Male 2	3 kg	0.2-0.3 mL kg^{-1}	Approx. 0.6-0.9 mL

2.4 Handling and equipment

Brooders were collected with a catch net and handled with gloves and a clean cotton cloth during restraint. Sterile syringes were used to administer the hormone. A fine collecting net was used for spawn collection, and a plankton net was later used in the nursery to check the development of natural food. The equipment used in the operation is listed in Table 4.

2.5 Eco-hatchery operation and spawn collection

After injection, the breeding set was released into the eco-hatchery. Water circulation was maintained through the breeding and hatching stages, after which the spawn were collected with a fine-mesh net. Eco- and circular-hatchery systems are well established for Indian major carp seed production because they provide controlled water movement during spawning and incubation (Jhingran & Pullin, 1985; Gupta & Rath, 2006) [14, 10]. Kiran *et al.* (2006) [17] also carried out rohu induced breeding in a Chinese eco-hatchery, providing a useful comparison with the hatchery arrangement used at Bhosi.

2.6 Nursery Pond preparation and plankton development: The nursery pond was prepared before the hatchery spawn were ready for transfer. It was first filled with freshwater and then fertilized with 40 kg cow dung and 5 kg single super phosphate (SSP). These were the actual quantities used at the farm. The purpose of this treatment was to build natural pond productivity before stocking, a standard practice in carp nursery management (Jhingran & Pullin, 1985; FAO, n.d.) [14].

The fertilized nursery was left for about six days. Plankton was then collected with a plankton net and examined to confirm that natural food organisms had developed. The spawn were shifted only after plankton was visible. In farm conditions, this simple check is useful because it bases the stocking decision on the condition of the pond rather than on time alone (Gupta & Rath, 2006) [10].

2.7 Water-quality monitoring: Water quality was monitored through pH, water temperature, dissolved oxygen (DO), free carbon dioxide (CO_2), and total alkalinity. These variables are important in rohu breeding and hatchery management because they influence broodstock condition, egg development, and nursery performance (Boyd, 1982; Kiran *et al*., 2006; Thirupathi *et al*., 2023) [4, 17, 31]. The measured ranges are shown in Table 3.

Table 3: Water-quality ranges during breeding and nursery management.

S. No.	Parameter	Observed range
1	pH	7.0-8.0
2	Temperature	27-29 °C
3	Dissolved oxygen	7.5-8.0 mg L^{-1}
4	Free CO_2	0.40-0.50 mg L^{-1}
5	Total alkalinity	83-85 ppm

2.8 Nursery survival assessment

Nursery survival was approximately 40%. The original numbers of spawn stocked and fry harvested were not retained, so the survival percentage could not be recalculated from raw counts. The breeding cycle also did not include replicate ponds or replicate breeding sets. For this reason, the results are summarized descriptively and no inferential statistical test was applied.

Table 4: Equipment and materials used in the breeding and nursery operation.

S. No.	Item	Main use
1	GONOPRO-FH	Induction of spawning
2	Syringes/injection equipment	Hormone administration
3	Gloves	Hygienic and safe handling
4	Cotton cloth	Restraint and handling of brooders
5	Catch net	Collection of brood fish
6	Fine collecting net	Spawn collection
7	Plankton net	Collection and observation of plankton
8	Eco-hatchery	Breeding, incubation, and hatching
9	Groundnut oil cake	Broodstock supplementary feed
10	Rice bran	Broodstock supplementary feed
11	Cow dung (40 kg)	Organic fertilization of nursery
12	Single super phosphate (5 kg)	Inorganic fertilization of nursery
13	Freshwater	Hatchery and nursery management

3. Results

3.1 Breeding response and spawn production

The one-female, two-male breeding set spawned after GONOPRO-FH treatment during the monsoon season. The female received 0.4 mL kg^{-1} and the males 0.2–0.3 mL kg^{-1}. Spawn were obtained in the eco-hatchery and collected for transfer to the nursery, showing that the breeding cycle was completed successfully. Egg number, fertilization percentage, hatching percentage, and latency period were not measured, so numerical breeding-efficiency indices could not be calculated.

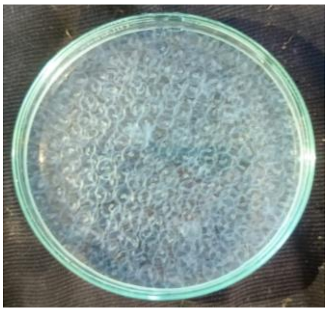

Fig 4: Observation of fertilized eggs

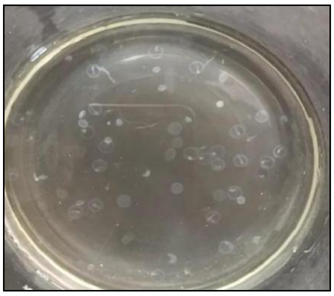

Fig 5: Hatched eggs

Fig 6: Observation of spawn

3.2 Nursery preparation and plankton availability

The nursery pond developed visible plankton after the application of 40 kg cow dung and 5 kg SSP. Plankton-net sampling at about six days confirmed the presence of natural food, after which the spawn were stocked. Preparing the nursery in advance avoided transferring newly hatched seed into a pond that had not yet developed biological productivity.

3.3 Water-quality conditions

Water quality remained within a narrow range during the production cycle: pH 7.0–8.0, temperature 27–29 °C, dissolved oxygen 7.5–8.0 mg L^{-1}, free CO_2 0.40–0.50 mg L^{-1}, and total alkalinity 83–85 ppm. These values indicate well-oxygenated water with near-neutral to mildly alkaline pH and stable alkalinity throughout the monitored period.

3.4 Nursery survival

Nursery survival reached about 40%. The exact stocking number, harvest number, nursery area, stocking density, and rearing duration were not measured in sufficient detail to examine survival in relation to pond area or stocking density.

4. Discussion

Breeding was carried out during the monsoon, which is a suitable period for rohu because brooders are naturally approaching or undergoing final maturation. Dasgupta *et al.* (2009) [8] found clear seasonal differences in induced spawning of rohu, while Kiran *et al.* (2006) [17] conducted hatchery trials from May to August. The timing used at Bhosi therefore agrees with the reproductive biology of the species and with common hatchery practice.

The breeding set contained one female and two males. This 1:2 female-to-male arrangement is commonly used in carp breeding. Bhukya *et al.* (2024) [3] likewise used two males and one female as a rohu hypophysation unit. At Bhosi, no alternative ratio was tested, so the result only shows that the 1:2 ratio worked under the farm conditions; it does not establish that this ratio is better than other combinations.

The selected brooders were older than two years and weighed about 3 kg each. Their size and age were consistent with mature brood fish rather than young grow-out stock. Kiran *et al.* (2006) [17] selected rohu brooders over a wide size range and adjusted hormone use according to body weight and maturity. Histological work by Lone and Hussain (2009) [18] also shows that reproductive readiness in rohu is closely linked with age and seasonal ovarian development. For routine hatchery work, this supports the practice of selecting fish by maturity and condition rather than by body weight alone.

Groundnut oil cake and rice bran were the main feed ingredients given to the brooders at Bhosi. Both are inexpensive and readily available in carp-farming areas. Kiran *et al.* (2006) [17] included the same ingredients in a mixed broodstock feed, and FAO guidance lists rice bran and oil cakes among common supplementary feeds in rohu culture (FAO, n.d.). Daily ration and nutrient composition were not measured, so the specific contribution of feeding to reproductive performance could not be separated from the other management factors.

The GONOPRO-FH dose used at Bhosi was 0.4 mL kg^{-1} for the female and 0.2–0.3 mL kg^{-1} for the males. This sex-based dosing pattern is broadly similar to that used with other commercial spawning agents, although the products are not identical. Kiran *et al.* (2006) [17] used Ovatide at 0.25–0.30 mL kg^{-1} for males and 0.45–0.50 mL kg^{-1} for females, while Thirupathi *et al.* (2023) [31] used 0.10–0.20 mL kg^{-1} for male rohu and 0.20–0.40 mL kg^{-1} for females. Malik *et al.* (2023) [19] also used GONOPRO-FH in experimental work on rohu. Because hormone formulations differ, the dose comparisons provide practical context rather than evidence that the preparations are interchangeable.

The eco-hatchery was important because controlled water movement and adequate oxygen supply are needed between hormone injection and spawn collection. Kiran *et al.* (2006) [17] achieved successful rohu breeding in a Chinese eco-hatchery, and carp hatchery manuals explain the same principle of circulating water through breeding and incubation units (Jhingran & Pullin, 1985) [14]. The Bhosi operation followed this established approach.

Nursery preparation was completed before stocking. The pond received 40 kg cow dung and 5 kg SSP, followed by about six days for plankton development. The use of organic and inorganic fertilizers to establish natural food is a routine feature of carp nursery management (Jhingran & Pullin, 1985; Gupta & Rath, 2006; FAO, n.d.) [14, 10]. What was useful in this farm cycle was the additional check with a plankton net: stocking was done after plankton was actually observed, rather than simply after a fixed number of days.

The water conditions at Bhosi were suitable for the breeding and nursery stages. The pH of 7.0–8.0 and temperature of 27–29 °C closely match the operating ranges used by Thirupathi *et al.* (2023) [31] for induced breeding of rohu. Their values for dissolved oxygen, free CO_2, and alkalinity were also similar. Kiran *et al.* (2006) [17] observed a broader range of pH, temperature, and alkalinity in broodstock ponds during rohu breeding trials. These comparisons place the Bhosi values within conditions already used successfully for rohu breeding, although no water-quality treatments were tested experimentally.

Nursery survival was approximately 40%. The FAO cultured-species profile gives a practical nursery-survival range of 30–50% for rohu (FAO, n.d.), placing the Bhosi result within that range. Losses at this stage can arise from stocking density, handling, food availability, and early-morning oxygen conditions. Experimental work with rohu has shown that density and handling stress can influence fry survival and performance (Sharma & Chakrabarti, 2003; Sharma *et al*., 2004; Chatterjee *et al*., 2010) [28, 29, 5]. The 40% survival therefore reflects the overall nursery outcome and should not be interpreted as a direct measure of hormone efficiency.

The Bhosi breeding cycle shows that successful seed production depends on several management decisions working together. Hormone injection initiated the breeding response, but mature brooders, monsoon timing, hatchery circulation, nursery preparation, plankton availability, and water quality were all necessary to complete the cycle. Earlier rohu breeding work reaches the same practical conclusion: hormonal induction is most effective when it is supported by sound hatchery and nursery management (Kiran *et al*., 2006; Dasgupta *et al*., 2009; Thirupathi *et al*., 2023; Malik *et al*., 2023) [17, 8, 31, 19].

5. Practical Production Protocol

The production cycle followed a straightforward sequence. Brood fish were conditioned on groundnut oil cake and rice bran, after which one mature female and two mature males were selected and weighed. GONOPRO-FH was injected according to body weight, and the breeders were released into the eco-hatchery for spawning. Eggs developed and hatched under circulating water, and the resulting spawn were collected. At the same time, the nursery pond was filled and fertilized with 40 kg cow dung and 5 kg SSP. After about six days, plankton development was checked with a plankton net. Once natural food was evident, the spawn were transferred to the nursery and reared with regular water-quality monitoring. Survival was then assessed at the end of the nursery phase. Figure 1 shows the complete production sequence used at the farm.

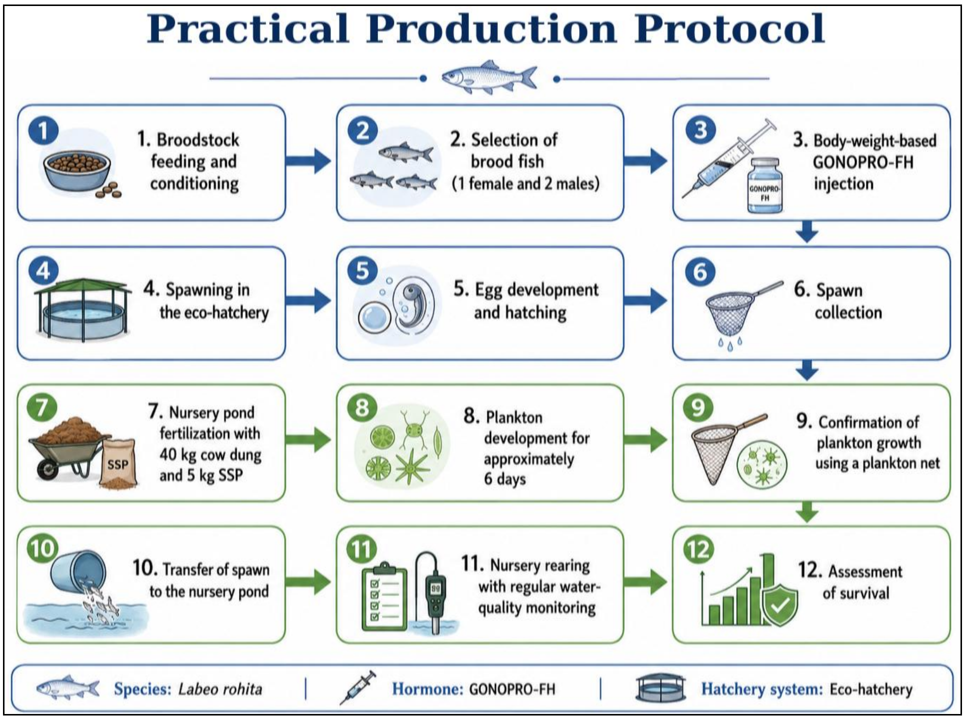

Fig 7: Practical production protocol followed for GONOPRO-FH-assisted breeding and nursery rearing of *Labeo rohita* at Bhosi Village.

6. Conclusion

Rohu breeding and seed production were completed during the monsoon season at Bhosi Village, Nirmal District, using GONOPRO-FH and an eco-hatchery. The breeding set consisted of one female and two males, all more than two years old and weighing about 3 kg. The female received 0.4 mL kg^{-1} GONOPRO-FH and the males 0.2–0.3 mL kg^{-1}. Spawn from the hatchery were transferred to a nursery pond fertilized with 40 kg cow dung and 5 kg SSP. Plankton developed after about six days and stocking was carried out after checking natural food availability with a plankton net. Water quality remained within pH 7.0–8.0, temperature 27–29 °C, dissolved oxygen 7.5–8.0 mg L^{-1}, free CO_2 0.40–0.50 mg L^{-1}, and alkalinity 83–85 ppm. Nursery survival was approximately 40%. GONOPRO-FH worked effectively within this eco-hatchery production cycle, while stronger evaluation will require repeated breeding sets together with exact egg, fertilization, hatching, stocking, and harvest measurements.

7. Acknowledgement

The author is grateful to the personnel of the fish seed-production unit at Bhosi Village, Nirmal District, Telangana, for assistance with broodstock handling, hatchery operation, nursery preparation and routine farm observations.

8. Conflict of Interest

The author declares that there is no conflict of interest related to this work.

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