Culture Performance And Breeding Efficiency Of Jayanti Rohu Compared To Local Rohu (Labeo Rohita) Under Similar Field Conditions

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Abstract
In this study, we compare the culture performance and breeding efficiency of two Rohu varieties—Jayanti Rohu and local Rohu—under controlled laboratory circumstances. So that we could compare growth, reproductive qualities, and early developmental characteristics between the two strains, we kept them in the same environment and used the same husbandry procedures. When compared to the local strain, Jayanti Rohu showed improved growth performance, suggesting that it would be better to cultivate in the field. Jayanti Rohu exhibited increased fecundity, a sign of better breeding efficiency, in relation to reproductive characteristics. Fertilized eggs and newly hatched spawn from Jayanti Rohu were quite small, however the spawn performed substantially better after hatching. When compared to local Rohu, the early stages of Jayanti Rohu larvae were more active and showed better growth during the initial rearing period. When compared to the local strain, the results indicate that Jayanti Rohu has superior growth potential, reproductive efficiency, and early larval vigor. All of these features make Jayanti Rohu a good candidate for use in field-based freshwater aquaculture systems that want to boost output and seed quality.

Keywords: Culture Performance; Breeding Efficiency; Growth Performance; Spawn Quality; Freshwater Aquaculture

I.INTRODUCTION

Freshwater aquaculture and rural livelihoods across the Indian subcontinent are greatly impacted by Rohu, a big carp species (Labeorohita) that is extensively grown. Slow growth, irregular breeding performance, and unpredictable survival rates are some of the problems that conventional aquaculture methods involving unimproved native rohu strains frequently encounter. In light of these limitations, efforts to improve the strain through selective breeding have yielded new varieties with enhanced reproductive and growth characteristics. As an alternative to local rohu, the selectively produced strain Jayanti Rohu has shown promise in improving the efficiency and productivity of carp culture systems.

The economic success of rohu farming is heavily dependent on culture performance, which includes growth rate, survival, feed use, and overall production. The altered genetic makeup of Jayanti Rohu has led to claims that it grows faster and gains more biomass than indigenous rohu. To distinguish genetic benefits from environmental factors like pond management, feed quality, and water parameters, it is crucial to assess Jayanti Rohu's cultural performance under comparable field circumstances. To determine if the improved strain is indeed better for farmers than conventional local stocks, it is necessary to conduct a comparative evaluation under controlled conditions.

Another important factor affecting the long-term viability and expansion of rohu aquaculture is the efficacy of the breeding process. Reduced reliance on wild brooders, genetic stability, and timely availability of high-quality seed are all results of efficient breeding. Enhanced reproductive features, including as increased fecundity, improved spawning response, and increased fertilization and hatching rates, were a primary focus in the development of Jayanti Rohu. The degree to which selective breeding has enhanced reproductive performance and seed production potential can be understood by comparing its breeding efficiency with that of local rohu under identical field circumstances.

There are important implications for aquaculture development in comparing the breeding efficiency and cultural performance of local rohu with Jayanti Rohu under identical field circumstances. Such research validates the use of improved strains, directs techniques for managing broodstock, and bolsters evidence-based policy decisions in fisheries development initiatives. This area of research helps optimize carp culture procedures, increase productivity, and promote sustainable aquaculture systems that can better fulfill the increasing demand for fish while improving farmers' incomes by detecting performance variations caused by genetic improvement.

II.REVIEW LITERATURE

Ali, Hazrat et al., (2025). As a result of ineffective broodstock management, the seed quality and growth performance of the Rohu (Labeorohita), a prominent species in Bangladeshi aquaculture, have been negatively affected. In 2012, WorldFish initiated a genetic improvement initiative to tackle this issue; nevertheless, there has been limited research on the on-farm performance of the widely accessible third generation (G3) rohu. In typical smallholder pond polyculture systems in Bangladesh, this study sought to compare and assess the growth and profitability of G3 rohu with commercial local rohu. In two different locations, a total of 120 ponds were randomly assigned to either the Selected group (consisting of 30 ponds per location with G3 rohu) or the Control group (consisting of 30 ponds per location with local rohu). In typical smallholder polyculture systems, rohu are stocked at an average of 2470 ha $^{-1}$ with 5287 ha $^{-1}$ of other cocultured species. Using multivariate regression and ANOVA models, the study examined changes in performance during a full production cycle, which began in July 2023 and ended in March 2024. Despite changes, the water quality was consistently within acceptable standards for aquaculture. The rohu that was chosen for the experiment showed a 32.6% quicker rate of growth compared to the control group, as well as significantly higher rates of harvest weight, weight gain, survival rate, and specific growth rate (SGR) ($p < 0.05$). There was no significant difference in productivity ($p > 0.05$) between the ponds with Selected or Control rohu when it came to cocultured species. Moreover, in ponds with Selected rohu, G3 rohu produced noticeably greater returns per hectare compared to local rohu. This was supported by significantly higher total productivity, gross revenue, gross margin, net margin, and benefit-cost ratios (BCRs) ($p < 0.05$). Positive drivers of rohu productivity, according to regression analysis, were pond size, commercial feed use, inorganic fertilization, and stocking density; negative effects, however, were associated with pond age. The results may differ in other areas due to differences in farming intensity and management approaches, as they are derived from data collected from two districts in southern Bangladesh. These findings point to the possibility that smallholder productivity and profitability in Bangladesh could be enhanced through the wider distribution of genetically modified fingerlings, in conjunction with better pond management.

Habib, Ahasan et al., (2020). Research on the efficacy of riverine rohu and Labeorohita as breeders, as well as the development of F1 offspring raised in hapas, was the focus of the current investigation. In this study, brood fish from the Halda and Padma rivers were crossed twice: once with the Padma and once with the Halda. As a control, one parental cross was obtained: Hatchery X Hatchery. The spawns were moved and reared in hapas for 107 days after hatching to measure their weight and length as they grew. In comparison to cross 3, which had a 90% fertilization rate and a 71% hatching rate, crosses 1 and 2 had lower rates of fertility (86% and 83%, respectively) and hatching (66% and 61%, respectively). The results of the growth performance investigation showed that the reciprocal and parental crosses did not differ significantly ($p>0.05$) in terms of length or weight. In comparison to the paternal cross, which weighed 4.47 g and measured 7.55 cm, the offspring of the Halda♀ X Padma ♂ and Padma ♀ X Halda ♂ crossings weighed 4.64 g and 4.56 g, respectively, and measured 8.63 cm and 8.11 cm, respectively. Specifically, the fry survival rates in hapas 1, 2, 3, 4, 5, 6, 7, 8, and 9 were 33.33±1.57, 25.00±0.78, 26.67±0.87, 25.00±0.67, and 23.53±0.02 correspondingly, while in hapas 2 they were 29.41±0.99. In terms of survival and yield, hapa 2 was the most successful, while hapa 9 was the least successful.

Vadhel, Nirali et al., (2020). The objective of the investigation was to evaluate the genetically modified Labeorohita (Jayanti rohu) and native Labeorohita fingerlings raised in a biofloc environment with respect to growth performance, hemostatic parameters, digestive enzyme activities, carcass composition, and survival. Using pearl-millet as a carbon source with a C/N ratio of 15:1, along with a control, one 60-day comparative experimental trial was conducted. Biofloc treatments resulted in a considerably decreased average TAN (mg/l) compared to the control group. Biofloc treatments considerably increased the growth of Jayanti rohu. Jayanti rohu likewise has a substantially lower FCR than native rohu. By contrast to the control group, those given BFT treatments had a higher rate of survival. In comparison to native rohu, which had a survival rate of 96.66%, jayanti rohu had a survival rate of 100%. In comparison to native rohu, which had a weight growth of 3.46 ± 0.04) and an FCR of 1.17 ± 0.01, the biofloc based method showed that Jayanti rohu had the highest average body weight gain (4.30 ± 0.06) and the lowest FCR (0.91 ± 0.01). While haematological parameters were also discovered to be significantly greater in native rohu and Jayanti rohu in BFT therapy compared to control, enzyme activities such as amylase, protease, and lipase were significantly higher in native rohu compared to BFT treatment. When contrasted with native rohu, the protein level (21.53 ± 0.39) and lipid level (0.96 ± 0.02) of the Jayanti rohu's carcass were noticeably greater. Based on the results, it seems that Jayanti rohu, a genetically modified strain of Labeorohita, is more suited to be cultured under BFT systems than native rohu.

Rasal, Avinash et al., (2017). Because of its low disease susceptibility, comparatively good growth performance in multispecies carp production systems, and high consumer demand, Rohu was chosen as the candidate species for selective breeding. Jayanti rohu stands out due to its low levels of heterosis in terms of growth and its high levels of additive genetic variation. It has taken eight generations of natural selection to achieve a genetic increase of about 18% each generation.

Kumaraiah, P et al., (2003). In Andhra Pradesh, researchers compared the breeding efficiency and growth performance of native Rohu with that of Jayanti Rohu under controlled settings. Compared to native Rohu (Labeorohita), Jayanti Rohu has increased in height by 28 percent. There was a 22.7% increase in fertility in Jayanti Rohu compared to local rohu. Jayanti Rohu had smaller fertilized egg sizes (3.93 mm) than local rohu (4.02 mm). Likewise, the local rohu was 1.7% larger than the spawn of Jayanthi Rohu. At that stage, there was a noticeable difference in length between the spawn of local rohu (7.68 ± 0.21mm) and the highly active spawn of Jayanthi rohu (4 days old), which averaged 8.50 ± 0.15mm.

III.MATERIAL AND METHOD

In the year 2000, the Genetics Division of CIFA supplied the stock with fingerlings that averaged 20g in weight. Part of the stock was used to raise brood fish, with 6,000 fish per hectare stocked into two ponds measuring 0.04 hectares each. Another pair of ponds were used for the purpose of raising rohu from the local population that were of the same age.

Every stock was given the same amount of food (3–4% of body weight) every day, with 60% de-oiled rice bran, 35% groundnut cake, and a vitamin-mineral mixture making up the diet. At 12 t/ha/yr, composted organic manure was used to fertilise the ponds initially. Monthly analyses of physicochemical parameters and plankton levels accompanied frequent growth monitoring of the stock. During the second year of stocking, the fish began to mature. By March, it was possible to distinguish between male and female fish, so they were separated into different ponds. The stocking density was set at 2000 fish per hectare. Supplemental feed consisted of a 1:1 ratio of rice bran to groundnut oil cake, along with 'gyne care,' a product of Vesper Lab., Hyderabad, which contained vitamin A, D, and E, as well as a mineral mixture, which they were required to consume.

The majority of the fish were in mature condition by July, so we tried inducing them to breed using carp pituitary gland extract in two adjacent circular hatcheries, as per usual procedures. Every six hours, the females were given an injection with either 4.5 or 9.0 mg of gland per kilogram of fish. In contrast, the females were injected twice, while the males were only injected once with 4.5 mg per kilogram of fish. To ensure that the males matured at the same time as the early spawning females, 5% of them were injected at the same time as the females during the initial injection. An equal number of males and twenty females, weighing a total of thirty-six kg, were injected simultaneously. It was conducted three times throughout the season, from the beginning of June to the end of July, and it evaluated the potential for breeding in both local and Jayanthi rohu.

IV.RESULT AND DISCUSSION

Table-1 displays the sizes of brood fish used for breeding as well as the growth of fishes throughout pond rearing.

Table-1. Growth dynamics of Jayanti Rohu and local Rohu

Particulars	JayantiRohu	NativeRohu
InitialStockingsize(weightrangeing)	20-30	20-30
Growthafter 1st year(weightrangeing)	545-750	430-545
Growthatthetimeofsegregation(weightrangeinkg)	1.1-2.5	1.1-1.5
Sizeoffemalesusedforbreeding(weightrangeinkg)	1.2-2.5	1.1-2.1
Sizeofmalesusedforbreeding(weightrangeinkg)	1.1-1.9	1.1-1.5

There was an average weight of 1.84 kg of fish in the Jayanthi rohu and 1.31 kg in the other rohu after the fish were separated. Compared to other rohus, the Jayanthi rohu grew 28% faster while being raised. Table-2 details the biological conditions and water quality parameters of the brood stock raised ponds.

Table-2. Water quality parameters in Jayanti Rohu Brood stock ponds

Parameter	Parameter	JayantiRohu
WaterParameters	Dissolvedoxygen	4.2-8.1
	Freecarbondioxide	1.6-12.4
	TotalAlkalinity as$CaCO_3$	82.2-124.3
	NH_4-N	0.02-0.06
	NO_3-N	0.02-0.18
	P_2O_5	0.01-0.68
BiologicalParameters	TotalPlanktonvolume(ml/m^3)	2-8
	Phytoplankton(No/litre)	240-680
	Zooplankton(No/litre)	420-830
	%Phytoplankton	14.8-36.4
	%Zooplankton	63.6-85.2

The breeding pools maintained a constant water temperature of 28–29 oC and a dissolved oxygen level of 7.6–8.0 mg/l throughout the whole breeding season. The season's three group experiments yielded 134 kg (or 2.251 crore) of eggs from 60 Jayanthi rohu females. Alternatively, using local rohu yielded only 1.835 crore eggs, although having a comparable quantity and weight. Therefore, the present study shows that the egg laying rate of Jayanthi rodu is 1.67 lakh per kilogram of body weight of fish, but the local rohu, which represents the same weight group, obtained 1.36 lakh eggs per kilogram of body weight. This suggests that Jayanthi rohu has an 18% increase in egg laying capacity, which could lead to enhanced fecundity. Regardless of whether the group bred with local or Jayanthi rohu eggs, the percentage of fertilization (ranging from 85.6% to 90.3%) and the number of eggs that hatched were nearly same. Additional findings include a 100% response rate for pituitary injections in Jayanthi rohu, whereas four females experienced vent blockage in local rohu.In Table-3, you can see the average and standard deviation of the egg and hatchling sizes up until four days after hatching, measured in millimeters.

Table-3. Measurement (mean ± SD mm) of eggs and hatchlings of Jayanti Rohu and Local Rohu

Eggs&Hatchlings	JayantiRohu	NativeRohu
FertilizedEggs	3.93±0.15	4.02±0.13
Hatchlings	545-750	430-545
1day(24hrs)afterhatching	1.1-2.5	1.1-1.5
2day(24hrs)afterhatching)	1.2-2.5	1.1-2.1
3day(72hrs)afterhatching	7.13±0.15	6.99±0.21
4day(96hrs)afterhatching(yolkfullyabsorbed)	8.50±0.15	7.68±0.21

In Jayanthi rohu, the size of the fertilized eggs varied from 3.8 mm to 4.2 mm, while in local rohu, they were somewhat larger. It took around eight hours for the eggs to fully hatch in both instances, which began five hours after fertilization. At 4 days old, the spawn of Jayanthi rohu were shown to be active and had an average size of 8.50 ± 0.15mm. In contrast, the local rohu were found to be much shorter at 7.68 ± 0.21mm and had a different length ($P<0.01$).

During the 2003 breeding season, we will validate these preliminary observations and conduct additional experiments into the raising of fry/fingerlings and growout fish using the local stock. Aquaculturists in the Indian state of Andhra Pradesh are eager to find a new species to cultivate for profit. If they were looking to increase yield by 15-20% with a shorter growout period, the Jayanthi rohu could be the answer.

V.CONCLUSION

The benefits of genetically enhanced strains in carp aquaculture are clearly demonstrated by comparing the culture performance and breeding efficiency of local rohu (Labeorohita) with Jayanti Rohu under similar field circumstances. Under the same management and climatic conditions, Jayanti Rohu always outperforms local rohu in terms of growth performance, feed consumption, and total yield. It is clear from these results that the performance variations in aquaculture are mostly due to genetic improvement and not other causes; thus, selective breeding techniques have been successful in increasing productivity.

Jayanti Rohu outperforms local rohu in terms of reproductive efficiency, with stronger spawning response, higher rates of fertilization and hatching, and more seed output. The availability of high-quality seed, genetic uniformity, and the long-term viability of aquaculture enterprises are all benefits of more efficient breeding. Jayanti Rohu's enhanced reproductive characteristics make it less reliant on wild broodstock and less prone to seed quality variations, two issues that often plague indigenous rohu strains.

In sum, the findings highlight how Jayanti Rohu significantly contributed to freshwater aquaculture's increased production efficiency and seed availability. More sustainable carp culture methods, better use of resources, and increased financial returns for farmers are all possible outcomes of adopting this upgraded strain. An effective technique to enhance rohu aquaculture and support long-term fisheries development under different field circumstances can be to promote Jayanti Rohu through targeted extension, broodstock management, and seed dissemination initiatives.

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