Indian Farming 74 (03): 71-73; March 2024

Seed production of pearlspot (*Etroplus suratensis*)

The State Fish of Kerala

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Pearlspot (Etroplus suratensis), *known as Karimeen, holds cultural and culinary significance in Kerala and is designated the 'State Fish of Kerala'. With an annual demand of 10,000 MT for 'Kerala Karimeen' far exceeding the production of 2,000 MT, there is a growing interest in pearlspot culture. However, limited availability of seeds, with an annual requirement of 40 million, poses a critical challenge. Addressing the low fecundity and unique reproductive behaviours of pearlspot, this article introduces an innovative seed production approach in pond systems. The article emphasizes pond preparation for optimal conditions, brood fish management, facilitating breeding environments, breeding behaviours etc. are explored. Parental care, predator control, economic and marketing aspects are also discussed. The innovative pond system approach emerges as a promising solution for making quality seeds available for pearlspot aquaculture.*

Keywords: Breeding, Fecundity, Pearlspot, Pond systems, Seed production, Water quality

THE Pearlspot (Karimeen), native to the coastal waters of Peninsular India and colloquially known as Karimeen, stands as an iconic symbol of Kerala's culinary excellence. Renowned for its exquisite taste, it carries cultural significance in local celebrations and is a culinary highlight for tourists along Kerala's coastal line. Acknowledging the socio-economic importance, especially in backwater tourism, the Kerala government designated pearlspot as the 'State Fish of Kerala'. The inherent quality of pearlspot is intricately linked to Kerala's backwaters, imparting an authentic flavour. Locally sourced pearlspot is preferred over imports from neighbouring states, where the fish is reared in freshwater and often considered inferior.

Nevertheless, the current annual production of 2,000 MT falls drastically short of meeting the escalating demand of 10,000 MT per annum for 'Kerala Karimeen'. This substantial gap between supply and demand has prompted farmers to explore pearlspot culture. However, a critical constraint in this endeavour is the low availability of seeds. The annual seed requirement stands at 40 million, and the existing availability of only 8 million in Kerala highlights the pressing need to enhance pearlspot seed production.

Low fecundity

The primary challenge arises from the low fecundity of the species. The intricacies of pearlspot reproduction, characterized by monogamous behaviour and parental care, pose formidable obstacles to achieving large-scale seed production. The meticulous egg-laying and guarding behaviours, combined with the species' low fecundity, present significant challenges for traditional hatchery methods, rendering them economically unviable. One of the primary challenges in pearlspot seed production lies in its low fecundity when compared to species like Carp fish. The prolonged nursery-rearing period and the distinctive parental care behaviour exhibited by pearlspot further compound the difficulties in large-scale seed production. These factors set it apart from other fish species, presenting unique hurdles that demand innovative solutions for sustainable aquaculture. Addressing these challenges is crucial for meeting the increasing demand for pearlspot and enhancing its commercial viability in the market. In addressing these challenges, ICAR-KVK, Ernakulam has undertaken an initiative to significantly enhance seed production by utilizing pond systems instead of the commonly followed hatchery method. This innovative approach presents a promising solution to bridge the existing demand-supply gap.

Seed production in natural ponds

Producing seeds in pond systems incur significantly lower investments and operational expenses when compared to hatchery systems. However, the yield in pond systems tends to be substantially lower due to challenges such as water quality issues and attacks by predators. Natural pond conditions significantly influence successful egg production, emphasizing the importance of well-prepared ponds.

Pond preparation involves several steps, including de-watering, removal of excess humus, and eradication of weed fish using tea seed cake (at the rate of 5 g per m^2 pond area). Subsequently, the pond bottom needs to be sun-dried. Afterwards, powdered dolomite is applied (at the rate of 100 g per m^2 pond area) as a liming material to correct acidity and enhance phosphorus and carbon content, promoting higher phytoplankton production. Following this, the ponds are filled with water using a pump through a 200-micron mesh screen to prevent the entry of unwanted fish or fish eggs. Pond fertilization involves the application of dried cow dung (4 kg/cent), groundnut cake (300 g/cent), and urea (50 g/cent). To induce consistent production of phytoplankton bloom in ponds, it is essential to apply fermented liquid extract of oil Sardine and Jaggery at the rate of 1 ml/m^2 of pond area an at interval of 15 days.

Creating breeding environment

In one acre pond, 400 sufficiently mature pearlspot brood fish each approximately weighing 100-150 g and 100-200 mm length need to be deposited. Ensuring proper nutrition, a formulated feed with 40% protein and 8% fat in the form of 3 mm floating pellets is advised. The feeding regimen should be carried out during both dawn and dusk to meet the dietary needs of the brood fish. This strategic approach aims to enhance the health and reproductive capabilities of the pearlspot brood fish, contributing to a thriving aquaculture environment in the one-acre pond.

Pearlspot brooders show a preference for stationary solid objects for egg-laying, particularly those near the bunds. Therefore, the installation of mud tiles, each approximately 400 mm in length and 150 mm in width, and wooden poles measuring 1 m in length, made of materials such as bamboo and casuarina, is recommended. These structures should be erected vertically on the pond bottom in a line, maintaining a constant distance of 1 m from the sidewalls of the ponds. It is advisable to keep a pole-to-pole distance of 2 m to facilitate brooders in affixing their eggs.

Breeding and egg hatching

Pearlspots exhibit year-round breeding tendencies, with peak breeding periods observed from February to May and October to December. The pearlspot brood fishes move in pairs around the sides of the ponds approximately seven days after stocking. The brood fish's kissing behaviour and jumping movements around the bamboo poles are indications of egg-laying. Together, the pair clean the bamboo substrate using their mouths and subsequently lay eggs.

Eggs undergo a continuous colour transformation as they advance towards hatching stage. Soon after fertilization, the egg's colour will be yellow, which changes to brown, dark brown, and eventually black. Approximately 90-96 hours of incubation is necessary for the eggs to hatch. From a single batch of eggs, an average of 900 to 950 fries can hatch out, resulting in an average hatching percentage of approximately 80-85. For the first two days, no external feed is necessary for the fries, which are around 800±40 µm in size, due to the presence of a sufficient yolk sac. After the yolk sac is reabsorbed, the fries, now measuring 1500±90 µm, begin to rise to the surface for active feeding. To ensure the robust growth of pearlspot fish fry, a consistent feeding regimen is crucial. Employing a specially formulated dust feed with 40% protein and 10% fat at both dawn and dusk proves to be an effective strategy. Feeding in close proximity to dip nets plays a crucial role in conditioning the fry, encouraging them to gather near the nets. This conditioning significantly enhances the efficiency of harvesting, ensuring a seamless harvesting whenever required.

Parental care

The brood fishes create small pits in the pond bottom to provide a secure space for the tiny hatchlings, shielding them from potential predators. These brood fishes exhibit parental care by relocating the seeds from one pit to another at different intervals, demonstrating a protective behaviour. This involves keeping the fry in small pits near the egg colonies on the pond bottom for 4 to 5 days. The early separation of pearlspot fry from their parents facilitates subsequent spawning at an earlier stage.The school of fish fries adopts a spherical shape while moving during the first month after hatching, possibly as a natural defensive mechanism to deter predatory fishes. The transition from the fry stage to reaching a marketable size seed can take approximately 2 months.

Predator control

The presence of predatory weed fishes, such as *Etroplus maculatus*, frequently diminishes the seed survival percentage. Despite attempts to eradicate these weed fishes during pond preparation, certain eggs or larvae persist, grow in the ponds, and subsequently function as predators. In the event of a surge in the population of weed fishes within the breeding ponds, their elimination may need to be carried out twice a year by resetting the pond and repeating all the pond preparation procedures. As birds prey on fish larvae and fry on a massive scale in breeding ponds, the top surface of the ponds needs to be covered with 1.25 mm thick

and 60 mm mesh high-density polyethylene (HDPE) nets. Similarly, the pond-side walls are covered with 2.5 mm wide and 30 mm mesh HDPE nets to prevent otters' entry.

Pest control and water quality

The existence of the ectoparasite *Caligus minimus* poses a substantial threat to pearlspot seed production. To mitigate this risk, it is crucial to uphold optimal water quality. Additionally, careful broodstock selection is essential to ensure that the brood fish introduced to the ponds are free from external parasites. Achieving this involves stocking the brood fish in separate tanks or ponds for quarantine, typically for about a week, to meticulously confirm the absence of external parasites. This quarantine process stands as the most effective measure to prevent the entry of external parasites into the ponds.

A precautionary approach to water quality management is essential for preventing and controlling infestations in breeding ponds. Achieving optimal pond water quality involves the systematic use of probiotics to ensure the decomposition of fish faecal matter and other wastes accumulated at the pond's bottom. Regular applications of probiotics enhance water quality, creating a favourable environment for phytoplankton bloom. This proactive approach not only supports the overall health of the aquatic ecosystem but also plays a pivotal role in sustaining a thriving pearlspot population.

In some instances, even with probiotics, water quality may not improve. Water exchange can be practiced in such cases, but precautions should be taken to prevent the entry of weed fishes into the ponds. Occasionally, water exchange may not be possible due to poor water quality in the external water source. In such situations, installing an air-giving mechanism is advisable, especially in nursery-rearing happa units.

Overfeeding can contribute to water quality problems, making it advisable to adopt an on-demand feeding approach to minimize feed wastage. Feed wastage, if left unattended, has the potential to contaminate the water. In certain instances, an excessive proliferation of algae may occur. In such cases, prompt water exchange is recommended, coupled with the removal of slurry from the ponds to prevent oxygen depletion and mitigate the risk of sudden fish mortality.

Harvesting, packing and transportation

Dip nets of 4 m × 4 m size erected at four corners of the ponds help with periodic seed collection. Seed collection can commence two months after stocking. Approximately 40,000 to 60,000 seeds can be harvested from a 1-acre pond within a year, with variations depending on factors such as water quality, soil type, harvesting methods, pond management, etc. The initial step following seed collection is maintaining them in a healthy condition in ponds or tanks before marketing. Extreme care is essential during this phase to ensure the health of the fish seed. Provide ample aeration to the happa nets or tanks before packing.

Cease larval feeding 24 hr prior to packing, and transportation measures are necessary to minimize stress during transit. Packing should be carried out using polythene bags with ideal dimensions of 36 inches in height and 12 inches in width, possessing a thickness of 300 microns. It is crucial to arrange medical oxygen cylinders for filling the bags to create a healthier environment for the fish. Typically, in regular circumstances, 50 fingerling-size seeds can be stocked in a bag, packed, and kept viable for up to 8 hours. If the travel duration exceeds this, reduce the number of fish in the packet. Transport activities should be scheduled for early morning or evening, and the use of air-conditioned vehicles is imperative to prevent heat stress.

Economics and marketing

The production cost for a single fingerling in a pond system amounts to ₹3.5. Consequently, the seed should be marketed at a minimum price of ₹ 7.0 per seed and the overall cost-benefit ratio stands at 2.15. For optimal survival at the farmers' end, the minimum size for saleable seeds should exceed 5 cm.

It is imperative to disseminate information regarding the availability of these seeds to other farmers through channels such as newspapers, brochures, posters, and social media, leveraging the power of free advertisements within the farming community. Additionally, on-site delivery services can be extended if farmers acquire at least 2,000 seeds or more, particularly within the same district. Agriculture magazines can serve as effective platforms for promoting this news, and farmers are encouraged to explore innovative methods for marketing their produce at a premium price, bypassing intermediaries. The successful buy-back arrangements and marketing models demonstrated by ICAR-KVK Ernakulam in the Ernakulam region are viable examples supporting agencies can adopt.

SUMMARY

The innovative pond system approach for pearlspot seed production, introduced by ICAR-KVK, Ernakulam, emerges as a promising solution to bridge the gap between demand and supply. Overcoming challenges like low fecundity and intricate breeding behaviours, this method offers a cost-effective alternative to traditional hatchery systems. The emphasis on water quality management, predator control, and efficient harvesting techniques contributes to the success of sustainable pearlspot aquaculture. The economic feasibility and marketing strategies presented provide valuable insights for farmers, ensuring optimal seed production and dissemination in the market.

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