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Some Innovative Techniques Practiced by Fish Farmers of Northeastern India

Simanku Borah, B.K. Bhattacharjya, K.K. Sarma, Dharmendra Kumar Meena and Utpal Kumar Das

Some of the innovative, cost-effective and easily implemented techniques practiced by fish farmers in Assam, India is the focus of this article. These techniques are used for controlling diseases, controlling predators, maintaining pond water quality, transporting fish seed and utilizing weed-infested water bodies. Such techniques can benefit fish farmers, especially those with small land holdings and limited financial capabilities.

FIGURE 1. *Preparing a 10:1 mixture of lime and turmeric powder (a). Applying the mixture to a fish pond can help control Epizootic Ulcerative Syndrome.*

India is the second largest fish-producing nation in the world, contributing about 5.7 percent of global fish production. India is also a major producer of fish through aquaculture and ranks second in the world after China (Anonymous 2015a). The total fish production in the country stands at 10.07 million t, with inland sector contributing 6.57 million t and the marine sector 3.49 million t (Anonymous 2015b). A significant portion of the total inland fish production comes from aquaculture.

The state of Assam, in northeastern India, is endowed with 0.28 million ha of fisheries resources and fish occupies a central place in the lives of its people. With 95 percent of the population consuming fish regularly and high export potential to neighboring states, fish farming is an important socio-economic activity, particularly in rural areas (Gogoi *et al*. 2015). Total fish production in the state was approximately 270 thousand t during 2013-14 (Anonymous 2015a).

Innovation can be defined as the implementation of a new or significantly improved product (good or service) or process or a new organizational method in business practices, workplace organization or external relation (OCED 2005). Farmers have developed many innovative techniques over the years that can improve their fish production. The evolution of innovative techniques is a result of field experiences of farmers or application of certain indigenous technical knowledge to tackle practical problems faced by fish farmers. What is common to these innovative techniques is that they are simple, cost-effective and easy to implement. Such methods are a boon to marginal and small-scale fish farmers with limited financial capabilities. A brief account of a few innovative techniques practiced by fish farmers in the state of Assam, India is given here.

Application of Lime and Turmeric Powder to Control Epizootic Ulcerative Syndrome

Epizootic Ulcerative Syndrome (EUS) is an OIE-listed disease of fungal origin and occurs in freshwater fishes usually during periods of low temperature and after heavy rainfall. The disease is characterized by red spots over the body and subsequent ulcers. High mortality occurs in most cultured fishes, particularly among juveniles in EUS-infected fishponds, causing economic losses to fish farmers.

A technique to treat EUS-infected fish in ponds was developed by Monoranjan Dey, a fish farmer from Dighaliati village, Nagaon district, Assam. Lime and turmeric *Curcuma longa* powder were applied at a 10:1 ratio to fish ponds early in the morning (Figs. 1a and 1b). This prevented EUS incidence and fish mortality with a high success rate when applied prior to the onset of winter. The development of this technique was based on the farmer's knowledge that turmeric is used as an antiseptic for wound healing in humans and animals. Initially the farmer applied turmeric only at 1 kg/ha with good results. Later, he experimented by applying a mixture of lime and turmeric powder and got better results.

Kalita *et al*. (2004) reported the use of turmeric powder during winter in fishponds to control EUS in Assam. They also reported that ashes of hay or bamboo and branches of neem plant *Azadirachta indica* were also applied to fishponds by farmers in hilly districts of Assam to control EUS. In Tripura, farmers use a mixture of raw turmeric paste at 625 g/ha and banana stem juice at 12.5 L/ha area to control EUS (Das *et al*. (2013). These treatments were reported to be effective in controlling the disease within 15 days.

Use of Bamboo Cages to Scare Predatory Birds

Aquatic birds are well-known as predators of cultured fish and can cause considerable fish losses on aquaculture farms. Barriers and different frightening techniques, including mirror-like materials, are commonly used to scare away birds from fishponds. Complete enclosure of fishponds with screens or nets or partially covered

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FIGURE 2. *A visual deterrent against birds constructed of bamboo.*

FIGURE 3. *Pieces of banana stem to control turbidity.*

systems offer good protection to reared fish stocks but increase the cost of aquaculture operations. Noise, visual scare devices, light, scarecrows and predator models are some of the common frightening techniques used to control predatory birds in aquaculture facilities.

Mohammed Ali Hussain, a progressive fish farmer of Dalapani village, Koliabar, Nagaon district, Assam, devised a useful technique to control predatory birds, particularly egrets, on his aquaculture farm. This bamboo cage was a visual scare device and was a slight modification of the indigenous traps used to hunt egrets in the locality (Fig. 2). This trapezoid shaped structure was wider at the base and tapered toward the top. Split bamboo strips were fixed longitudinally to the main frame and made with stronger split bamboo strips. Four curved arches (inverted U shape) were prepared with split bamboo strips and were attached on four sides of the top opening. Nylon threads were also fitted diagonally at the top. The height of these cages should be such that nearly half of it is above the water level. A total of 3-4 such structures were placed in the swallow peripheral regions (<0.5 m depth) of an aquaculture pond of 0.14-0.16 ha area. The farmer reported that these devices frighten predatory birds away from his aquaculture ponds.

Application of Banana Stems and Leaves to Maintain Water Quality

Ajit Barun Das, a fish farmer of Dighorshrikona village, Tatang, Cachar district, Assam, used split strips of banana stem and leaves to improve water quality in his aquaculture pond. The use of banana stem strips and leaves improved pH, reduced turbidity and controlled humus gas in fishponds. Turbidity caused by suspended solids and phytoplankton bloom often led to deterioration of water quality in fishponds. Formation of gas bubbles on the surface water indicated humus gas formation related to an excess sediment load in the pond bottom, thereby causing stressful conditions for the fish. The farmer applied split banana stem strips and leaves, which floated over the pond water surface (Fig. 3). These banana stem strips and leaves were removed from the pond from time to time and replaced by new ones. It was reported this innovative technique was effective in ridding such stressful conditions.

Banana stem juice is a rich source of potassium. Hariharan and Manimaran (2014) reported the potassium concentration was highest (901 mg/L) among all the micro-elements present in banana shoot juice. The high potassium content in banana shoot juice played a key role in improving the pH of the water body. Cut pieces of banana stem and leaves were effective in controlling clay turbidity and were being widely practiced in hill zones of Assam, India (Kalita *et al*. 2004). In addition, cut pieces of banana stem and leaves are used by fish farmers in Tripura to control turbidity and humus gas produced from bottom sediments in fishponds (Das *et al*. 2013). However, the banana stem strips and leaves had to be removed before they started rotting to avoid depletion of dissolved oxygen in the fishponds, which may have had adverse effects on fish stocks.

Innovative Transportation Strategy of Carp Seed in Bamboo Baskets

This innovative technique of transporting carp seed (fry/fingerlings) in large cylindrical bamboo baskets lined with nylon sheets (Figs. 4a and 4b) is practiced by Naba Sarma, a progressive fish breeder from Panikhaity, Kamrup Metro district, Assam. Fry/fingerlings were stored in a cylindrical bamboo basket with an inner lining of nylon (polyamide) sheet and transported in a mini-van. This basket, known as a *duli* in Assam, has been used traditionally by farmers of the state for storing paddy rice. A medium-size basket usually measures 1.5 m in height and 1 m in diameter. Water depth of around 1 m was maintained in the basket. The water volume of one such basket was approximately 3000 L. It could be used to transport 3500-4000 carp fingerlings of approximately 10 cm in length.

Fingerlings carried in such baskets were transported to Damalbeel in Morigaon district from Panikhaity, a distance of around 100 km, for stocking in cages installed by ICAR-CIFRI Regional Centre, Guwahati. The duration of the journey was 2.5 hours with only 10-15 percent mortality. During the entire transportation process, water in the baskets was splashed manually to increase the dissolved oxygen levels. When we asked the breeder why he preferred this open-container for fish seed transport over the prescribed seed transport in oxygenated plastic bags (Jhingran and Pullin 1988), he indicated that the cost involved was approximately 30-40 percent less in the large open bamboo containers.

Constructing Floating Beds in Weed-infested Backyard Ponds

Backyard ponds are a common feature in households of rural Assam. These ponds were used to culture fish for household consumption. However, one of the major problems perceived for fish

FIGURE 4. *Fish seed transport in bamboo containers* (duli) *lined with polyethylene (left). Preparation of the fish seed container prior to transport (right).*

culture in these ponds was infestation of noxious weeds, especially water hyacinth, mainly brought about by seasonal floods. Mukunda Saikia, a farmer from Bortharabari village, Darrang district, Assam, devised an innovative method of utilizing such water bodies by constructing floating beds for cultivation of leafy vegetables. With this technique, water hyacinth was gathered in one corner of the backyard pond. This made the remaining portion of the water body free from weeds and rendered it suitable for fish culture. Water hyacinth was arranged in layers one above the other and then covered with a layer of soil and cow dung to form a floating bed, which was, then, regularly watered. A portion of the water hyacinth was also decomposed on the pond bank. After about four days, a thin layer of decomposed water hyacinth was spread over the bed. The bed was surrounded with small-mesh netting tied to bamboo poles. This technique could be quite useful in flood-prone districts of Assam, where weed infestation of water bodies had been detrimental to proper utilization.

Conclusion

Most of these innovative aquaculture practices are cost-effective and easy to implement. These techniques pay dividends to the farmers. In a country like India, where the majority are small-scale fish farmers and a great share of them suffer from financial constraints, the knowledge of such techniques can be a boon. Innovation drives growth and is essential for addressing global and social changes. There is a need to empower people to innovate and then create and apply such knowledge.

Notes

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MOST OF THESE INNOVATIVE AQUACULTURE PRACTICES ARE COST-EFFECTIVE AND EASY TO IMPLEMENT. THESE TECHNIQUES PAY DIVIDENDS TO THE FARMERS.