



Indigenous technical knowledge: its significance in the current scenario of fish farming in West Bengal

Chandan Haldar^{1*}, Suchismita Nath²

¹ Centurion University of Technology and Management, Paralakhemundi, Odisha, India

² Department of Microbiology, Vidyasagar University, Midnapore, West Bengal, India

Abstract

The term indigenous technical knowledge denotes the distinctive, traditional, local knowledge existing within and developed around specific conditions of men and women indigenous to a particular geographical region. Indigenous technical knowledge (ITK) is the accumulated skill and technology of a locality or a community that has been passed on from one generation to another generation. Indigenous knowledge (IK) is broadly speaking the knowledge used by local people to make a living in particular environment. It can be defined as “A body of knowledge built up by a group of people through generations of living in close contact with nature”. Importance of Indigenous Knowledge System Indigenous Knowledge is an integral part of the development process of local communities IKS provides the foundation for their beliefs and traditional practices Indigenous knowledge helps to promote biodiversity conservation IK learning attitudes and values for a sustainable future IK starting locally: From the “Known” to the “Unknown”. ITK is the information based on society which enables the communication and decision making. It is very dynamic and constantly influenced by internal creativity and experimentation as well as by contact with external systems.

Keywords: indigenous technical knowledge (ITK), innovation, pond maintenance, epizootic ulcerative disease syndrome (EUS), control of algal blooms, microstrip array antenna, x-band frequency range

1. Introduction

The origin of fish culture in India probably dates back to 2000 years. Perhaps, fishery activity started when the human settlement moved away from the riverbanks to the hinterland. During monsoon season, the inundated paddy fields and low-lying areas gave birth to today's aquaculture. The natural seed of fish got trapped after water receded which eventually led to the idea of “trapping and holding” of fish seed and raising them to the table size. Probably this is the milestone of the first innovation in aquaculture. India is home to hundreds of Indigenous Technical Knowledges (ITKs) thanks to the ancient civilisation and the localised way of cultivating crops and rearing of fish as well as livestock. These ITKs play significant role in agricultural production, as Wishard *et al.* (1976) ^[1], observed that ‘the enhancement of the quality of life of the Indians who in great majority live in and depend on agricultural production systems would be impossible by keeping this rich tradition of ITK aside. Howes (1979) ^[2], compiled the ITKs practiced in agriculture in India. They found ITKs being practiced by the farmers in the area of veterinary and animal sciences, pest and disease management in crops, grain/seed storage, horticultural crops, and cropping systems and fisheries.

Indigenous Technical Knowledges (ITKs)

Indigenous Technical Knowledges (ITKs) are treasure troves of ancient wisdom, beliefs and traditional knowledge passed on from generation to generation for preservation, effective utilisation and conservation of natural resources, soil, plant and other organisms. It is mainly passed down generations through folklore, myths, customs, folk songs, proverbs, puppetry and other traditional methods (Bhagawati *et al.*, 1987) ^[3]. According to World Bank (1998), ITKs are local,

tacit knowledge, transmitted orally or through imitation and demonstration, experimental rather than theoretical, learned through repetitions, and are constantly changing.

The indigenous technological knowledge (ITK) innovated by the farmers is stored in people's memories and activities, and supposed to be the thumb rule in combating different situations and constrains faced during the culture practices. The innovations are socially and ecologically acceptable, economically viable and involve little risk. The indigenous technological knowledge can be promoted through scientific approach as a mean of higher and sustainable fish production, which will be eco-friendly too.

Indigenous Technical Knowledges (ITKs) in India

Indigenous knowledge is traditional type of innovation by the farmers that is stored in peoples' memories and activities and it is expressed in the form of stories, songs, folklore, proverbs, dances, myths, cultural values, beliefs, rituals, community laws, local language and taxonomy, agricultural practices, equipment materials, plant species and animal breeds. The origin of fish culture in India probably dates back to 2000 years. Perhaps, fishery activity started when the human settlement moved away from the riverbanks to the hinterland. During monsoon season, the inundated paddy fields and low-lying areas gave birth to today's aquaculture. The natural seed of fish got trapped after water receded which eventually led to the idea of “trapping and holding” of fish seed and raising them to the table size. Probably this is the milestone of the first innovation in aquaculture. As the days went by, the Indian fish farmers practice their own indigenous technology as a common practice through natural resource management. The close and intimate observation of farmers through their age-old practices has developed the

expertise of acquiring knowledge in aquatic ecosystem in particular. Admittedly, the multifarious knowledge and skill possessed by local people can substantially contribute to productive efforts and endeavors. Scientific attitude to this indigenous technologies of the farmers are yet to be exposed. The viability of indigenous technologies failed to approach short and long-term perspective. Under this context the present study was undertaken to document indigenous technology common among the fish farming communities. Most of Assam's tribal people survive on local knowledge base. It is therefore important to identify and preserve these traditional technologies in order to sustain the productivity and protect the ecosystem. ITKs related to inland fisheries were documented mainly on fish harvesting by some researchers (Choudhury *et al.*, 1992) [4]. Very few systematic works have been done in recent times in bringing the indigenous knowledge on important aspect of fisheries such as pond maintenance, fish health management and fish seed preparation to light (Goswami *et al.*, 1994) [5]. Moreover, none of these studies have attempted to characterise the scientific rationale, adoption, awareness and perceived effectiveness of the traditional practices. A study was conducted for documentation of indigenous technological knowledge in fish farming in district 24 Parganas (South), West Bengal. In rural areas, traditionally associated technical knowledge of fish farmers followed from generation to generation to cope up with different situational constraints. The tested and proven innovations of our ancestors needs to be valued validated and blended with new technological support.

Different Types of Indigenous Technical Knowledges (ITKs)

The indigenous knowledge is the accumulated knowledge, skills and technology of the local farmer derived from the interaction of ecosystem.

1. Control of unwanted fishes in pond

Elimination of unwanted fishes is pre-requisite in fish seed rearing and culture for the better survival of fish seed and growth of culture fish. Farmers of study area monitored traditional technique to remove unwanted fishes before stocking fish seed in culture pond. The Bish lata (*Glaricidia sepium*) is a common TK to control unwanted fishes in pond. Extract equipped from 18 - 20 kg plant was enough for one kani (0.16 ha) pond water and spreading method of application was used. Toxicity influence of the extract in pond water remained for 15 - 19 days and fish could be stocked after that.

2. Control of snakes in fish pond

In many parts of West Bengal, one Water snake, locally known as Dura Saph (*Chekered keelback*), is a common predator for culture fish. Traditional technique using hook was practiced by the farmers to control water snake where koi fish (*Anabus testudeneus*) was used as prey for the snake. Operculum spine of Koi fish was strong and sharp enough to injure the mouth of water snake while engulfing it. Once the snake was injured, the chances of attack were reported to be reduced.

3. Control of tadpole

Presence of tadpole in fish culture pond effect the growth of culture fish as it competes for food and habitat in pond ecosystem. Farmers reported to apply ash or lime around

pond periphery. Around 60 – 62 kg ash or 20 kg lime was applied for one ha water area and disappearance of tadpole was observed after two weeks of ash application and when lime is applied to control tadpole, it took lesser time (10 – 12 days) after application.

4. Control of algal blooms

A trend of high nutrient mass or heavy metal load creates the problem of algal bloom formation in fish culture pond. Such problem affects the health and growth of fish. Farmers followed traditional techniques to mitigate such problem using a floating aquatic plant i.e. water hyacinth (*Eichhornia crassipes*), which is locally known as Kochuri phana. They used this invasive plant carefully in the pond water with algal bloom so as to absorb the nutrient and heavy metals. Besides this TK, farmers also reported to apply considerable quantities of cattle urine to control the problem of algal bloom formation in pond water. They applied cattle urine @ 17 L / ha spreading it evenly throughout the pond surface (De *et al.*, 2001) [6].

5. Checking water pH

Scientific fish culture prefers a neutral to slightly alkaline water pH for better growth of fish. But the soil and water pH sometimes become acidic in nature and farmers hardly have laboratory facility to check it out. They followed a traditional technique to check water pH using blotting paper and red Camellia (*Camellia japonica*). Firstly, they rubbed red camellia in blotting paper to make it violet-bluish. Then the violet-bluish coloured paper soaked in pond water. Change of the paper colour to red indicated acidic nature and to blue indicated alkaline nature, whereas no change in colour indicates a neutral nature of water. Although the TK didn't provide very specific measure of water pH, but it provided the information whether the water was acidic or alkaline. Based upon this crude observation, farmers decided to take required action to correct water pH suitable for fish culture.

6. Control of snails in the pond

Farmers used traditional technique to control over population of snail that created hindrance in fish culture. For that coconut leaf or date palm (*Phoenix dactylifera*) or palm leaf or bamboo basket plays were thrown in the pond for a period of 15 – 20 days. It was observed by the farmers that snails used those materials as substratum. Then those materials were removed from ponds along with attached snails.

7. Control of humus gas from pond sediment

Farmers faced problem of humus gas formation at pond bottom sediment due to over loading of manures. In such cases, fish get stressed due to water quality deterioration. Farmers identified this kind of problem by observing flow of air bubbles in pond surface water from bottom sediment. They used cutting pieces of dumra tree and banana stem in considerable quantities to manage such problems. Another manual traditional practice was also reported by farmers. They manually dragged bamboo pole horizontally at the pond bottom to release out the humus gas from sediment. To make the pole weight enough to be submerged in the water, farmers tied breaks along with the bamboo poles.

8. Reduction of water turbidity

Many fish pond encountered the problems of turbidity, since most of soil of the state has red clay soils and bathing was

common. To control the turbidity farmers applied considerable pieces of banana leaf/stem after cutting into several pieces. When farmers remove these periodically they got better result.

ITK related to pond maintenance

9. Control of wild cat

A predator on fish attack of udhbiral or wild cat (*Festis selvestris*) in fish pond is a problem encountered by the respondent farmers. These animals usually stay in jungles near pond periphery. It attacks the fishes during night and preys on them. The fish farmers of the study area followed various traditional practices to control this fish predator. Some of these traditional techniques followed by the farmers are discussed below:

Stocking of Calbasu (*Labeo calbasu*), a candidate species for freshwater aquaculture in the pond @ 250 Nos/ kani (0.16 ha) were found to be effective by the farmers to avoid the problems of wild cat attack. They believed that stocking of the mentioned fish species (Calbasu) in the pond provides a characteristic odd smell to keep wild cat away from the pond. Farmers used a local citrus fruit namely chalita to manage the problems of wild cat attack on fish. The fruits were cut into several pieces and distributed the pieces over the pond water. Fruit pieces that float in pond water surface resembled the floating fish head and it attracted wild cat. Wild cat catch up those citrus fruit pieces and experienced a bitter taste. Thus wild cat avoided catching fish.

In severe cases of wild cat attack, farmers used lime and bird egg shell (poultry and duck egg shell). They filled up the egg shell with lime and kept it in the periphery of pond where the animal usually moved. Wild cat fed on egg and they engulfed the lime filled egg shell mistaking it as good egg. As an immediate effect, lime of the egg shell caused burning in wild cat's mouth cavity and thus, it avoided the place.

ITK related to pond construction and maintenance

The fish farmers of Hills district were observed to have selected low-lying areas near the home as an ideal site for constructing fishpond. Such ponds facilitate bathing, washing of cloth and utensils in addition to rearing fishes. They usually prefer to construct embankment ponds to the dugout ponds. This is because constructing an embankment to block a small hill stream or to erect an embankment on one or two sites in a naturally enclosed area becomes cheaper. Usually ponds are constructed in low-lying areas along hill streams. In such cases, filling and draining of the ponds by gravity becomes possible, thereby, helping in ease of operation.

a. Spillway

The farmers of the district have devised indigenous spillway to protect their embankment. The spillways are simple and efficient. The spillway consists of hollow bamboo pipes fitted in the embankment at a certain height from the bottom. One end of the pipe facing inside the pond is blocked with stone and clay soils. At times of extra ordinary heavy rainfall, when there is a danger to the embankment, the extra runoff is drained out by opening the pipe. They also compact the embankment by using small hand-held devices, locally known as *Dhurmuch*. It consists of a castiron slab fitted at the end of a bamboo tube. Yet another simple compression device is a wooden log whose one end is made tapering for helping in operation with hands.

b. Protection of pond dyke

Since most embankment ponds are constructed by blocking

streams or by covering open sides of depression surrounded by hillocks, such embankments are normally very tall and have steep sides. Since, the district experiences heavy rainfall, most dykes are prone to erosion and damage. To prevent this, farmers plant plantation crop like coconut and betelnut on the dykes. They also practice turfing of the side of the embankments with grasses immediately after construction (Yadava *et al.*, 1986)^[7].

Fish seed

a. Natural seed collection

The fishers collect spawn of murels specially *Channa punctatus* from natural water of the district. Spawn of murrel moves in shoals and periodically comes to the surface for air breathing. It is easily visible from above the water surface. The spawn is easily collected by bamboo sieve or fine mesh cloths like mosquito net or even local bath towels (Gamocha). It is easily collected by small children during monsoon months.

b. Transport and acclimatization

The state of Assam has reportedly attained self-sufficiency in production of fish seed at the fry stage¹⁰. However, fish farmers of Karbi-Anglong district depend on neighbouring plain district especially Nagaon for its fish seed requirement. Fish seed vendors transport seed in aluminum hundies. They add about 50 ml of local rice beer for every 10 litres of water in these hundies. The vendors believe that the survival of fry is better when rice beer is added into hundies during transport. Though effectiveness or otherwise of this practice could not be evaluated, it appears that the rice beer may act as some sort of an anaesthetic agent during transport. The farmers submerge the hundy containing seed into pond water. They remove the hundy after sometime and remove the seeds that fail to move out of the hundy. It is logical because only weak seed will remain in the hundy and the stronger one will immediately escape into pond water.

The farmers prefer seed of Indian major carps, grass carp and common carp (red variety). The farmers distinguish fry of catla from rohu and mrigal by its bigger heads. They prefer fingerlings to fry since they grow quickly to table size. However, fingerlings are in short supply in this district and cost much more than fry.

ITK related to fish health management

1. Management of dissolved oxygen deficiency

Most of the small ponds of this district tend to dry up during winter and summer months. When the water level is reduced considerably, depletion of dissolved oxygen especially during morning hours becomes common problem faced by the farmers. The farmers tide over this problem by many indigenous methods like channelising fresh spring water, beating the pond surface with bamboo poles or spraying water with open containers. They continue this practice as long as fishes continue to grasp atmospheric oxygen.

2. Turbidity control

Many fishponds encounter the problem of persistent turbidity, since most of the area of the district has red clay soils and bathing is common. To control persistent clay turbidity the farmers apply paddy straws or pieces of banana stem (Plate 2). When the hay or banana stems rot, the farmers periodically remove them from the pond. This method of controlling clay particles was found to be quite effective. Reportedly, to control algal bloom, the farmers spray cattle urine in considerable quantities on pond surface.

3. Control of *Argulus*

Many fishponds of the district have *Argulus* (a crustacean ectoparasite) infection. In such cases, the farmers conventionally drive pieces of split bamboo into bottom sediments in such a way that the bamboo pieces remain in vertical position throughout water column. The farmers believe that the fishes can get rid of *Argulus* insects by rubbing their bodies against the split bamboo pieces. Some farmers also keep old gunny bags submerged in pond water and remove them periodically to dry and kill eggs of the *Argulus* deposited over them.

4. Leach control

To control leaches, the farmers throw peels of cucumber or leaves of bitter melon made into paste form. The farmers believe that these plant materials are bitter and, therefore, help in eradication of leaches.

5. Control of Epizootic ulcerative disease syndrome (EUS)

Epizootic ulcerative disease syndrome (EUS) is a common problem in fishponds of this district, especially, during winter months when the water level in pond is considerably reduced. To control EUS, most farmers apply paste of powder of turmeric into pond water. Some farmers also use ash of hay or bamboo plants. The ashes were found to be less effective than turmeric in controlling EUS. According to some farmers, applying branches of "*Neem*" plant into fishpond helps in controlling ulcers on the body of fishes.

One of the scientific pre-requisite for control of EUS is to make the water alkaline. As the hay locally known as *sai* makes the water alkaline, it may be useful in preventing EUS. The spread of EUS shows that it involves the role of an infection agent in association with the water quality parameters. Hence, the application of "*Neem*" leaf extracts, turmeric, banana stem suspension, which have antimicrobial action, has been reported to control this syndrome to a certain extent.

6. Control of muscle damage

In culture pond, muscle spoilage of Indian major carps was common in study area. Farmers practice a traditional technique by making dip treatment of affected fish in salt water. They generally used 1 kg salt in 5 L of water and dipping the affected fish for 1-2 minutes. Farmers reported to get positive result within seven days of treatment.

Better growth of fish

Equal quantities of Mustard Oil Cake (MOC) and Rice Bran (RB) mixture was the common fish feed used by the farmers. They traditionally added another component in feed composition, i.e. local rice beer which was prepared from fermented rice to achieve better growth of fish. Farmers reported a mixture of MOC, RB and local rice beer @ 5:5:1 provided a better growth of fish as compared to conventional feed.

Conclusion

The indigenous technical knowledge on pond construction and maintenance, fish seed transportation and fish health management were perceived high on cost effectiveness and easy to follow, moderate on scientific value/logic, efficacy, availability of material, cultural appropriateness and environmental soundness. Therefore, it is imperative to analyze these technologies so that the scientific principles/basis behind them could be properly understood. Once this is done, it will be easier for extension of

ITK, further refine and upgrade them by blending them with the modern scientific knowledge.

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