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Fish Culture in "Wish Ponds" can be "Banking in Water" for Peri-urban Households

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Fish farming in "Wish Pond" system is a new concept of integrated aquaculture which is not only innovative but also beneficial one especially among the poor farmers in the rural & peri-urban areas. Aquaculture is gaining importance to compensate for the declining fish production from the capture source. "Wish Pond" aquaculture system can be done either integration with aquaponic system or without aquaponics in backyard of a household in rural or peri-urban area & can play important role in food & nutritional security in terms of protein requirement of the family besides income generation. This study focuses on the advantages & drawbacks of aquaponic system compared to solitary wish-pond system in terms of water quality & thereby fish production.

Keywords

Wish Pond, Aquaponics, Backyard aquaculture, Pond Preparation, Vegetable planting

Introduction

Fish provide a major source of animal protein for rural households. It has been promoted as a nutritious food containing easily digestible high- quality protein, essential fatty acids, and key micronutrients such as vitamin A, iron, calcium, zinc, and iodine that can address protein and micronutrient deficiencies with better efficiency than nutritional supplements (Kawarazuka and Béné 2010). Fish production is now becoming the fastest growing food production sector globally. As capture fisheries have gradually been declining, thus aquaculture has been playing an important role in food and nutritional security besides income generation. Fish culture systems are predominately small-scaled, family-owned, managed and operated in nature (De Silva and Davy, 2010). Moreover, fish raised in ponds is considered as a more easily liquefiable asset, which can be sold to acquire income (Helgeson et al., 2013; Little and Edwards, 2003). It also provides a buffer for poor fish farmers in the low- income periods to satisfy their seasonal cash shortages (Karim et al., 2020). Farmers with productive ponds can produce fish surplus to subsistence requirements that can be marketed (Edwards and Demaine, 1997; Islam et al., 2004; Little and Bunting, 2005). Small-scale fisheries have been recognized as the main opportunities for improving household nutrition especially for its ability to provide a buffer for poorer households in the low income and food-deficit periods (Bene, 2009; Belton et al., 2012; Karim et al., 2017).In general, small-scale fisheries have the potential to reduce poverty either directly or indirectly (Edwards, 1999; De Janvry and Sadoulet, 2002;Kassam, 2013; Rashid and Zhang, 2019), not only through establishing and strengthening food consumption linkages, but also through “income linkages” and “employment linkages” (Ahmed and Lorica,

tarpaulin sheet (Karim et al., 2017).

2002; Belton et al., 2011; Belton et al., 2014). Small-scale aquaculture is prevalent in many countries in Southeast Asia for its potential to alleviate poverty, enhance food security, diversify livelihoods and promote economic development (Allison, 2011). “Backyard ponds’ for fish culture are most common in South Asian countries. These ponds, mostly on average smaller than 0.4 ha in size, are self-owned or family property partly used for fish culture but also for a variety of other purposes including irrigation of vegetable patches on the embankment, baths or washing of household utensils (Karim, 2006; Karim et al., 2017; Little et al., 2007).Sometimes, farmers do integrated aquaculture with vegetable cultivation or livestock production in the backyard for optimizing the water use and two or three outputs from one particular system. In this perspective, fish farming in “wish pond” is a new concept of integrated aquaculture which is not only innovative but also beneficial one especially among thepoor farmers in the rural or peri-urban areas (Hossain et al., 2020).

“Wish pond” system in backyard

Fish culture in wish pond is a new concept of small- scale fish farming at the homestead level.The wish ponds are small ponds with limited space dug into permeable soil and lined with a backyard or nearby to the residence for well control. The system was given the name “WISH ponds,” derived from the combination of the words “water” and “fish” to reflect the integration of fish cultivation with water for storage and vegetable growing (Johnstone et al. 2012; Kwasek et al., 2015). The term was first coined by WorldFish and Stung Treng Fishery Administration and the Culture and Environment Preservation Association in 2011 (Kwasek et al., 2015)

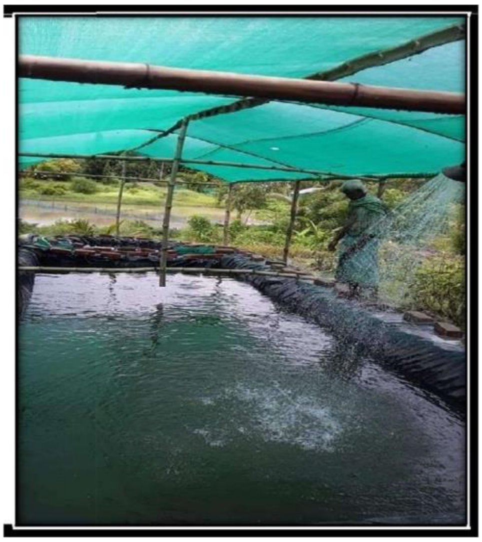

Photo: Wish Pond

Background of wish pond

In 2011, WorldFish, in association with the Stung Treng Fishery Administration Cantonment and the Culture and Environment Preservation Association, Cambodia developed the concept of wishpond to improve the uptake of small-scale aquaculture by communities with limited experience in fish culture and limited water body or space for aquaculture in Stung Treng Province in north- east Cambodia and hence, developed wish ponds (Kwasek et al., 2015). Later on, several research works have been performed in Bangladesh on its production potential (Islam et al., 2018; Hossain et al., 2020,202)

Why Wish ponds?

Culture in wish ponds is targeted towards households with limited space to construct large aquaculture ponds, such as peri-urban households and mainly to meet the needs of household consumption (Johnstone et al. 2012). The system has a great potential for income generation particularly for women. However, the objectives of culture in wish ponds may be as follows:

1. Ensuring household nutritional support,
2. Generating income potential,
3. Improving and refining the technological know-how,
4. Providing an employment scope with a gender balance,
5. Supporting and strengthening the existing small-scale fishery input based enterprise networks at local level,
6. Investigating the business dynamics for scaling potential by fish-based marketing services.

Types of "Wish Pond" system

Based on the nature, the Wish ponds are of two types, viz.

(1) Wish pond without aquaponics system or Solitary Wish Pond: It is a small pond with tarpaulin lining inside to hold water (Figure 1).

(2) Wish pond with aquaponics system: Wish Pond with aquaponics is a small-scale homestead gardening where fish and vegetable are produced with integrated approach. A simplified aquaponics system is incorporated to the wish pond in this category (Figure 2).

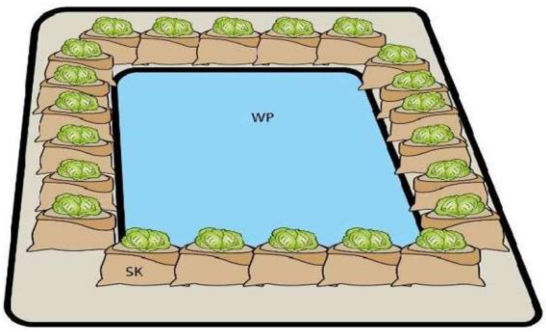

Figure 1. Diagram of Wish Pond system without aquaponics system (WP-Wishpond, SK – Sac Bag) (courtesy: Hossain et al., 2022)

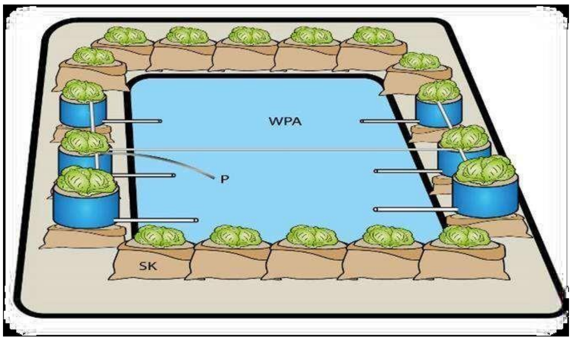

Figure 2. Diagram of Wish pond with aquaponics system. (WPA-Wish pond aquaponics, F- Filter, P-Pump, SK–Sac Bag) (courtesy: Hossain et al., 2022)

Rationale to adopt aquaponics with wish pond system:

Aquaponics refers to a food production system that couples conventional aquaculture (culture of aquatic animals such as fish, snails or prawns in tanks) with hydroponics (cultivating plants in water or media) where the nutrient-rich aquaculture water is fed to hydroponically-grown plants (Rakocy, 2012; Baganz et al., 2021). In this combined culture system, the integration of fish and plants offers a diverse and stable polyculture that increases diversity and yields of multiple products where fish and vegetables are grown at the same time in a mutually beneficial and symbiotic relationship (Salam, 2012). Nutrients in an aquaponics system are generated from uneaten feed in the fish raising tanks and fecal matter together with dissolved wastes released by the fish (Kokou and Fountoulaki, 2018; Dauda et al., 2019). Unionized ammonia is a nitrogenous waste in fish rearing medium but at the same time it could be a potential source of nitrogen highly needed by the plants in aquaponics (Dauda et al., 2019). In an aquaponics system, cultivated plants also need of both macro and micro nutrients for their growth which may be met up from the residual or uneaten feed (Abbo, 2020).

Aquaponics is designed to provide an artificial and controlled environment using only a fraction of water than the conventional aquaculture system, hence saves water resources and acts as a safeguard for the environment (Endut, 2011; Hossain et al., 2022). More importantly, the system is usually free of weeds, pests and diseases that would affect soil, which allows them to produce organic and pollution free crops. Through this system water is being filtered automatically and ensures clean water for fish to grow. It is not only an environmentally friendly system but also economically efficient due to least water usage, effective nutrient cycling and needs little land to operate. It can be set up in areas that have traditionally poor soil quality or contaminated water. Additionally, it allows growing of a large variety of crops to cater to a broad spectrum of consumers especially for the growing number of environmentally conscious ones. As a result, byhaving two sources of profit, farmers can continue to earn money (Blidariu and Grozea, 2011*).*

Considering all these aspects, aquaponics can be an effective management procedure to handle the drawback of solitary wish pond system, which is pollution prone to some extent, might bedue to overfeeding and accumulation of fish metabolites in some cases (Islam et al., 2018). So, if the two systems are combined, pollution drawbacks of the solitary wish pond system can be overcome. In wish pond-aquaponics system, fish waste water went to the vegetable growing media where the plants bacteria convert ammonia into nitrate (Salam et al., 2015). This nitrate was used as the plant nutrients.

Culture practice in wish pond system

A. Preparation of wish pond

The wish pond may be constructed in the farmer's yard. Within the limited space at backyard and easy management consideration, a size of 2.1 x 1.5 x 0.3 m^3 may be preferred for each wish pond. The soil available from digging pond is compiled with some ingredients such as ½ kg urea, ½ kg single super phosphate, ½ kg murate of potash, ½ kg wheat flour and 1 liter molasses to enhance the vegetable productivity. Then a number of plastic sac bag filled with this fertilized soil are arranged around the pond to have a strong embankment as well as for cultivation of vegetables. Following the sac bag setup at the pond side, a tarpaulin (150 GSM) lining is placed inside the pond to facilitate and increase water holding capacity. Some bamboo splits and pillar may be used to tie the bag to keep in place and then water is added. Ponds are filled with underground water or nearby pond water. De-chlorinated municipal waters can also be used. Thesystem is fenced with nylon net to protect the vegetables from the domestic birds and animals. Single layer rack of bamboo splits (Machas) is also placed besides bamboo stands at sides to support vegetables from not falling in the water (Hossain et al., 2020). In Cambodia, concrete tanks (3 x 4 x 1.2 m^3) are also used as wish ponds.

B. Preparation of aquaponics

In wish ponds with aquaponics some food grade plastics containers preferably of 20L capacity are used to facilitate the aquaponics vegetable production. The containers are filled with brick-lets to purify the wish ponds water (ammonia-nitrate) when passing. A filter pump (may be of 20watt) is used to drive the ponds water into the containers where brick lets are used as grow bed and vegetable saplings are to be planted. The brick lets are supposed to filter the fish water and naturally accumulated microbes would convert the ammonia to nitrite and then nitrate to make the water safe for the fish and provides food for the vegetable plants (Hossain et al., 2020).

C. Planting vegetables

In general, plants having low nutrient requirements and high demand in the market are selected for aquaponics system (Bailey and Ferrarezi, 2017; Nozzi et al., 2018). Under this consideration, different types of herbs, seasonal creeper vegetables like beans, gourd, pumpkin, cucumber etc. or leafy vegetables such as chilli, brinjal, lettuce, spinach, cilantro, cabbage, cauliflower, tomato, carrot etc. are planted in different sacs and containers of the aquaponics system. They are plantedboth on the top of the sac and beside the sac by making small hole on the sac wall. In aquaponicssystem, herbs or vegetable plants, which have low nutritional needs, are planted through the bricks and gravels (Abbo, 2020).

D. Stocking of fish

Adaptability and better growth in small water body, ability to take supplementary feed, disease resistance, market demand or price, consumer preference etc. are the pre-requisites for selection of fish species for farming in wish ponds. Tilapia (*Oreochromis nilotica*) and catfish (*Clarias batrachus, Heteropneustes fossilis*) are chosen as most preferred candidate fish spices for this small and intensive culture system due to its known high resistance to poor water conditions (high temperature, high density, low oxygen, etc.) (Watanabe, 2002). Among the tilapia species, monosex tilapia or genetically improved farmed tilapia (GIFT) varieties can be selected for their growth potentiality. Further, freshwater prawn (*Macrobrachium rosenbergii*) and air-breathing fish, pabda (*Ompok pabda*) or climbing perch (*Anabas testudineus*) may also be incorporated in wish ponds for their high market price and consumer preference. Carp fattening mixed with freshwater prawn has also been proven effective for wish pond farming (Islam et al., 2018). However, apart from that, angel, different gold fish, koi carps, guppy etc. may be suited for the system as a mean of backyard ornamental fish farming (Ghosh et al., 2003).

For stocking in wish ponds, healthy, disease-free juveniles/fingerlings with maintaining a uniform size group can be released to ensure better survival and growth conditions, particularlyif the water could not be exchanged more than two times per month (Edward et al. 2010). Again, to achieve better yield, over wintered carp and prawn nursing can be a good option (Islam et al., 2018). However, fish seed should be acclimatized and taken under bath treatment of formalin or potassium permanganate ($KMnO_4$) solution prior to liberation in wish ponds.

E. Management of fish culture in wish ponds:

i. **Duration**: Fish culture in wish ponds can be practiced throughout the year or in cycles. The time-frame may be January– June (Cycle 1) and July–December (Cycle 2).

ii. **Farming calendar**: As per prevailing trend carp (predominantly Indian Major Carps, *Catla catla*, *Labeo rohita*, *Cirhhinus mrigala* etc.) seed can be reared in wish pond system as follows (Islam et al., 2018):

Sl. No.	Culture category	Stocking period in nursery	Stocking period in Grow-out
1	Hatchlings to fingerlings (8-10 gm)	March - May	June – July
2	Advanced fry to advanced fingerlings (80-100 gm)	May –July	July – August
3	Advanced fingerlings for stunted growth (200-250 gm)	October – March (overwinter)	April – June

Similarly for freshwater prawn, the culture scenario may be as follows:

Sl. no.	Culture category	Stocking period	Stocking period in grow-out
1	Post larvae (PL) to Juvenile	May – June, year round	June – July
2	Juvenile to adult	June – July	July – September
3	Juvenile to adult (overwinter)	November– February	March – April

iii. **Pre-stocking management**: Each pond was equipped with a water outlet to help drain it when necessary (important for water exchange, harvesting, etc.). Most of the ponds were covered with an ultraviolet resistant plastic translucent shading frame to protect them from direct sunlight. A small light bulb was also installed above each pond to attract insects at night.

iv. **Ambient water quality management:** Water in wish ponds is used as habitat for fish as well as for their live food organisms. Live fish food organisms of the water consist of several groups and among these, plankton is very important for fish production (Hossain et al., 2013). Production of plankton is mostly dependent on the physico- chemical quality of the water in ponds. In turn, fish production of that water body is also directly depending on the quality and quantity of the available food organisms. Different physico-chemical parameters associated with the wish pond productivity are asfollows:

a. **Temperature:** Water temperature is an important physical parameter which has direct impact on fish production through its influence on physical, chemical and biological factors of water (Hossain et al., 2022). This in turn, effects on fish metabolism and subsequently on their growth. Swan (2009) suggested that the suitable ranges of water temperature would be 24-32ºC for aquaculture. For walking catfish culture suitable water temperature would be 29 ± 1°C (Srivastava et al., 2012). Losordo et al. (1998) found that suitable range of temperature for optimal tilapia growth was 27-29ºC. Tyson and Simonne (2014) suggested that for tilapia production optimum temperature usually ranged from 28-32ºC.

b. **Transparency:** Boyd (1998) reported 15-40 cm transparency range as ideal for proper fish growth.

c. pH: It is another important index for water quality in aquaculture representing the acidity alkalinity condition of a water body. Successful production in wish pond is vastly depends on it. Suitable pH range for fish production is 6.5-8.5.

Srivastava et al. (2012) recorded water pH of 7.2 ± 0.2 for walking catfish culture. In case of tilapia culture and plankton growth optimum pH ranges from 6.0 to 9.0(Tyson and Simonne, 2014; Islam et al., 2022). Wish pond with aquaponics system generally shows lower water pH than the solitary wish pond system because regular water filtration kept the water clean and ensures less pollution. It helps in reducing ammonia content of water and keeps the water pH within the favourable range for fish production.

d. **Dissolved oxygen (DO):** Dissolved oxygen is one of the most crucial parameters for aquaculture, which controls the physiology of the aquatic organism (Hossain et al., 2022). Atleast, 5 mg/l value of DO is required in wish pond farming system as it is recommended for all aquaculture form (Riche and Garling, 2003; Singh, 2010). However, DO concentration of 3 mg/l is regarded as the minimum optimal value for tilapia culture (Ross, 2002).

e. **Electric conductivity (EC):** It is the measurement of electrical movement (µs/cm) through the water. Though EC cannot move through pure water, it may happen when any salt is dissolved in water because of its (+) charged cations and (-) charged anions. Since the changes in EC in the farm soil is associated with the release or depletion of nutrient cations and anions in the soil-water environment, the productivity of the farming system is likely to be influenced by such changes (Mandal and Chattopadhyaya, 1990). Argo (2004) stated that the EC will be higher when greater amount of salt will dissolve in water. Generally higher EC value is found in wish pond with aquaponics system than the solitary wish pond system may be due to having higher salt content.

f. **Total alkalinity:** It indicates the biological productivity of the culture medium. For better biological production, 60-300 mg/l total alkalinity as $CaCO3$ of water should be required for freshwater fish culture (Hossain et al., 2022).

g. **Ammonia (NH_3):** For optimum growth of fish in wish pond system, it is an important to control un-ionized ammonia in medium (Hossain et al., 2022). TNAU (2008) reported maximum range of ammonia value (0.02-0.05 mg/l) for tilapia culture. The concentration of ammonia is found lower in wish pond with aquaponics system than the solitary wish pond system due to its bacteria mediated conversion.

h. **Total nitrogen (N):** Suitable range of total- N for aquaculture is 3.5-5 mg/L. Similar to un- ionized ammonia, the value of total-N is also found lower in wish pond with aquaponics system than the other one system.

i. **Phosphorus (P):** Boyd (1998) stated that 0.20 to 1.15 mg/L phosphorus range is good for aquaculture. Midmore et al. (2011) found this range 0.50 to 0.80 mg/L. However, lower amount of P is found in wish pond with aquaponics system than the solitary wish pond one. It indicates the utilization of nutrients by the plants (Rakocy et al., 2004).

v. **Stocking of fish:** Stocking density in wish pond is definitely fish species dependent. For tilapia species, 200-250 nos. individual can be stocked per m3. In general, 500–600 nos. of fish seed can be released in a wish pond (Edward et al. 2010). However, in wish systems consisted of concrete tanks (3 x 4 x 1.2 m3), density of fish can be tuned to 550-1250 nos. of fish per tank depending upon species. In case of production cycle, comparatively less number is stocked during winter covering cycle.

vi. **Feeding:** Generally, fish feed costs constitute a minimum of 50-70% of total fish production costs in wish ponds; it is therefore imperative to ensure minimal waste of the formulated feed. So, the use of floating pellets is advantageous, as it allows farmers to monitor the amount of feed consumed by fish. Commercial floating pellet feed containing minimum 30% protein is recommended to feed. Feed is given at the rate of 5-10% body weight of the fish. The total feed is divided into two different rations for a day and applied. For air-breathing fish, 70% of the daily scheduled feed is given in the night whereas for other species it is 40%. Animal kitchen waste could be used as supplementary feed for catfish to reduce the use of pellet. Feeding should be ceased whenever any stress or sign of disease is observed in fish. Farmers are recommended to stop feeding or limit feeding to every other day when a disease outbreak occurred in the pond (Lovell, 1998; Sealey et al. 1998).

vii. **Post-stocking management:** At least 30 fish randomly collected from different spots in the pond should be sampled on a regular basis (every 2 weeks) by using a fine mesh net to obtain mean data on fish weights, so that most importantly and more accurately estimation of feeding rate can be ascertained. Besides, screening of fish for potential disease occurrence as well as evaluation of size distribution of fish in the pond may also be observed at that time.

F. Water quality management for aquaponicssystem:

In wish pond with aquaponics system, vegetable gets continuous nutrition from wish pond water, where fish waste is used as fertilizer to the plants. However, plants have the best growth at pH 6.0 to 6.5 (Nelson, 2008), whereas depending on varieties, its pH tolerance may also be ranged between 5.0 and 7.6 (Maynard and Hochmuth, 1997).

G. Harvesting of wish pond system

Vegetable harvesting is a continuous process but varied from plant-to-plant nature. Water spinach was harvested after 15 days of plantation, whereas mint is collected after 30 days. Other vegetables are harvested between 40-60 days. Sometimes 100-120 days may also be considered for final harvesting of crop depending on fruit ripeness.

On the other hand, fish can be harvested either partially in multiple harvesting mode or finally after complete culture period. It is recommended to cease feeding the fish for 24– 48 hours prior to harvesting for enhancing the quality and palatability of fish flesh, (Tidwell et al. 1992). This fasting is also considered to reduce the stress on the fish during harvesting and transport. Exchanging the water in ponds 24–72 hours prior to harvesting is also suggested to improve the flavor of the flesh for consumers.

H. Production of wish pond system:

The overall production is higher in wish pond-aquaponics system than the wish pond system alone. Due to symbiotic exchange between the plants and fish rearing systems in respect of nutrient availability makes the production higher in combined system than the other one. Similarly, not only different growth parameters but also survival rate and total production are found better in wish pond-aquaponics system because this system is more convenient than wish pond system in terms of maintaining water quality and thereby, fish production. The water filtration facility of wish pond-aquaponics system keeps the water clean and pollution free for fishes. Besides, regular water flow of the system also helps in regulating water temperature and other determinant physico-chemical. So that, fish get ambient water quality for their regular growth and production.

Islam et al. (2018) recorded 71 and 76% survival for walking catfish (*C. batrachus*) and nilotica tilapia (*O. niloticus*) respectively in solitary wish pond system, whereas the rate enhanced to 84 and 91 % for those species respectively in wish pond-aquaponics system. He found production quantum of 8.91 and 6.89 tones/ha/108 days for *C. batrachus* and *O. niloticus* respectively in solitary wish pond system. It was 10.29 and 15.80 tones/ha/108 days in case of wish pond-aquaponics system. Nur (2015) found the total production of walking catfish was 5.25 tons/ha/110 days with 90% survivability.

Advantages of wish pond system

1. Adoption of aquaculture in wish pond system contributes to house-hold nutritional and economic security besides to environmental ethics (Abbo, 2020).

2. The system is expected to have two-way consumption linkages either by direct consumption of fish or vegetables by the household or by bringing them down to local market (Ahmed and Lorica, 2002). Thus, it makes food as well as market linkage.

3. Integration of water filtration mechanism through aquaponics with wish ponds improves the water quality. Besides, the system produces vegetables without fertilizer and ensures clean water for fish growth. The system is proved environmentally friendly.

4. Due to least usage of water in the system, it can be implemented in water deficit areas.

5. Wish ponds in backyard are easy to control. Further, due to small size, it is also easy to manage.

6. The wish pond system is generally located adjacent to the house. As a result, women who may normally be restricted to the house, can contribute fully or partially towards culture practice in wish pond system without any need for mobility and even only paying attention during their leisure periods. It is the most important outcome of the wish pond culture system by which women potentially contribute to family nutrition or increase the household income or spend on family needs.

7. It can be a developed as technical tool to improve small-scale aquaculture by understanding costs and benefits and identifying potential sustainable methods for introducing new candidate species and adopting newly developed techniques (Johnstone et al. 2012).

Disadvantages of wish pond system

The system of fish farming in solitary wish ponds is pollution prone to some extent (Islam et al., 2018). Farmers have to exchange the water in their wish ponds six times on average in both cycles. The water often has a strong odor, characteristic of poor water quality resulting from overfeeding and accumulation of fish metabolites. In addition, the water sometimes becomes opaque and hence the fish could not be seen. It was therefore difficult to determine the condition of the fish, the actual mortality, size distribution, signs of disease, etc.

Hinders of wish pond culture system mechanism:

- Lack of basic knowledge on fish farming.
- Overstocking of fish seed.
- Poor water quality management.

- Poor fish diet quality.
- Lack of feeding rate calculations: Indiscriminate and unconscious application of feed also led to either lower growth or nitrogenous load to water body.
- Lack of data on fish growth: Most of the farmers do not record properly on periodical fish growth, which makes them unable to calculate especially the amount of feed to be used actually resulting in both overfeeding and underfeeding of the fish.
- Fish mortality due to bad handling or prevalence of diseases followed by bad weather conditions.

Different market system associated with wish pond system:

A good market system is very important to ensure the timely supply of fish seed, feed and other inputs to farmers. At the same time selling of products to market at its highest possible rate is also essential to complete the chain. Hence, the marketing channel starts with hatchery owners/fish seed suppliers, followed by rearing within certain time frame and ends with selling of advanced fingerlings/yearlings to farmers/consumers through wholesalers or retailers. Under this consideration, different production cum marketing models for wish pond systems may be as follows:

Model	Farmer's responsibility	Detail aspect of model
1	Farmer works individually	Farmers are free to purchase fish seed/saplings and other culture inputs from market and sell their product at prevailing market price. This model is set for individual agro-businessman.
2	Farmer works together with hatchery owner/fish seed or feed sellers	Farmers procure or lend fish seed or feed from hatchery owner/fish seed or feed sellers. In turn, they sell their productto concerned hatchery owner/fish seed or feed sellers at an agreed price.
3	Farmer takes loan from	Farmers take loan from businessman at certain interest and repay after periods in cash or products. The loan interest under businessman/financial institutions this system is included as a variable cost. The farmers may or may not be free to sell their products at market.

Conclusions

Global demand for easily digestible protein rich food like fish has been consistently increasing with ever increasing human population growth. In this context, fish farming has been gaining importance to compensate for the declining fish production from capture sources. Aquaculture production has been increasing at an average rate of 8.2% in the developing countries compared to developed countries (3.9%). With this pace, the socio-economic benefits derived from aquaculture expansion are also getting momentum which includes the provision of nutrients, employment and income generation for different stakeholders. To continue this progress, small scale farmers can play a pivotal role. But their mass involvement is difficult to some extent due to limited water and financial resources (Sarkar et al., 2017). The problem is acute especially in peri-urban areas. In this backdrop, fish farming in wish pond system especially with aquaponics may be a boon not only for nutritional and income generation or self-reliance for women but also it can be footprint for green world.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

Conflict of interest

The authors declare that the manuscript was formulated in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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