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Farm Ponds of Konkan Suited for Cage Culture

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Abstract

Farm ponds are constructed by farmers with intention to store water for irrigation of the agricultural crops and livestock. Recently these farm ponds are being utilized by many farmers for fish culture. As far as the management is taken into consideration, there are certain limitations in the culture of fish in farm ponds. The most important amongst all management aspects is fish harvesting due to depth of pond and sloppy nature of plastic lined farm ponds. In order to overcome this problem cage culture in farm pond model was developed at Khar Land Research Station, Panvel under DPDC, Raigad funded project. This model was successfully followed by a farmer of Khandpe, Karjat to rear Pangasius and Tilapia in farm pond. The yield of 12.96 tonnes of Pangasius was harvested from the 10 cages and 1.12 tonnes of Tilapia from one acre of farm pond. The "Cage culture in farm pond" model is beneficial and needed to be included into blue revolution scheme so as to benefit farmers of Maharashtra.

Keywords: Cage culture, farm ponds, Pangasius, Tilapia, Doubling Farmers' Income, DFI.

Introduction

India has vast coastline of 7,517 km and exclusive economic zone of 200 nautical miles, gifted with reservoirs, lakes, estuaries, rivers and other inland water bodies. With this enormous potential India can easily surpass any other nation in fish production. The exports of Indian seafood reached $5 billion in 2014 and have been on the increase with many Indian brands in the preferred list of Europe, America and other highly developed nations (Mahapatra 2015). However, the capture fisheries production in India is becoming sluggish and the rate of culture fisheries in India is increasing rapidly. The demand for fish in domestic as well as international market is increasing day by day with the increase in the rate of fish consumption due to nutritional benefits and growth in the population.

Aquaculture has been recognized as an important component of rural development strategies aimed at improving food supply and generating more income for poor farming households (Miller 2009). Aquaculture is the solution to overcome the situation and provide fish as a food and protein source to the nation. Fish farming in other way also supports the farmer either for food or for money in case of failure of other crops by any reason. In this scenario farm ponds are better source of income generation and role models for doubling farmer's income. Although there are many problems associated with the fish farming in farm ponds which are constructed for the purpose of irrigation. The main constraint is the depth of the farm pond and slippery nature of plastic lining that leads to problem in harvesting of fish as per the demand in the market. Also the ponds which are built for irrigation purpose cannot be drained to harvest fishes as it affects the irrigation purpose for other agriculture crops and livestock. In such situation farmers are not willing to utilize the farm ponds for fish culture. To overcome this problem, a model of cage culture in farm pond is the best option as it surpasses all the odds related with the fish harvesting in farm ponds. The cages used in this model are floating in nature and installed in the farm pond. The fishes are reared inside as well as outside cages so as to utilize the leftovers from the cages to avoid the water quality degradation issues and better nutrient utilization.

Scenario of Cage Culture

The cage-pond integrated system has been developed

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and practiced by Lin (1990) and Lin and Diana (1995) for catfish-tilapia. It is practiced for tilapia-tilapia at AIT by Yi *et al.* (1996), Yi (1997), Yi and Lin (2001). This practice is also used for mixed-sex tilapia-tilapia (Shrestha 2002), sahar-carps (Shrestha *et al.* 2005) and catfish-carps (Shrestha *et al*. 2009). These systems were found effective to increase nutrient utilization efficiency and gross fish production. Thailand, Vietnam and Cambodia are practicing this culture system successfully and it is one of the widely accepted fish culture systems among small scale rural farmers in these countries (Yi 1997).

Technological Interventions of DBSKKV

This cage culture in farm pond model was first time developed in Maharashtra at Khar Land Research Station, Panvel (Dr.B.S.Konkan Agricultural University, Dapoli) farm ponds under DPDC funded project for rearing of Asian sea bass, *Lates calcarifer*. This system was demonstrated to the farmers of Maharashtra state and they were encouraged to take up this activity.

Success story

This model was taken up by one farmer named as Shri. Ashok Gaikar at Vandevta Dairy Farms, Khandpe, Karjat in his one acre farm pond. He has successfully reared the *Pangasius* and *Tilapia* fish (Fig. 1). The fish rearing was conducted in 10 cages with plastic lined ponds of 4000 m^2 size. The cages occupied 25% of the farm pond area. The ponds were drained and filled with rain water to 4 m and HDPE knotless cages of 25 mm mesh with floating GI frame were installed. The water was added weekly from the nearby self owned dam to compensate for evaporation and seepage losses. A floating feeding ring was used and placed in each cage. GI railing was used to connect cages to the bank for feeding, cage monitoring and other activities. *Pangasius* sp. (Basa fish) fingerlings (approximately 6-7 cm) were stocked in cages at 60 m^{-3} and male Tilapia fingerlings (approximately 5 cm) were stocked outside cages in pond at 1 m^{-2}. Caged fish were fed thrice daily with a extruded floating pellet feed of 1 mm (34/5), 2 mm (32/4), 3 mm (26/3) and 4 mm (20/3) size during the culture period. The rate of feeding was 8% of the body weight for first month for 1 mm feed, 6% of the body weight for second and third month for 2 mm feed, 4 % of the body weight for fourth, fifth and sixth month for 3 mm feed and 2% of body weight for seventh to eleven month for 4 mm feed. This feeding was decided by weighing the pooled sample of fishes at the end of month. Feed rations were adjusted based on sampling weights and observed mortality of tilapia and Pangasius. Weekly measurements of water quality parameters were conducted at morning 09.00 a.m. Water temperature, dissolved oxygen (DO) and pH, were measured weekly using a DO and pH meter. Simple economic analysis was conducted to determine economic returns (Shang 1990). The analysis was based on wholesale market prices in Raigad, Maharashtra for harvested fish and all other items, which were expressed in local currency. Market prices of harvested Tilapia and Pangasius were 100 ₹ kg^{-1}. The details of the cage culture in farm pond is as below,

- Name of the farmer with mobile - Shri. Ashok Rajaram Gaikar (9867557717)
- Address of the farmer- Vandevta Dairy Farms, Khandpe, Karjat, Raigad
- Area of the farm pond- 1 acre
- Depth of the farm pond- 5 meter
- Plastic lines or earthen- Plastic lined pond
- Year of start -2016
- Size (number) of cages – 4 x 3 x 3 m (10 cages)

Table 1. Mean values and ranges of water quality parameters measured weekly during the culture period.

Parameter	Average (Range)
Temperature (°C)	30.0 (27.5 - 31.5)
Dissolved oxygen (mg L^{-1})	4.9 (4.6 - 5.5)
pH	7.6 (7.4 - 7.7)

Table 2. Economic analysis of Cage culture in farm pond model

Parameter	Amount (₹)
Operation cost (₹ ha^{-1})	
Cage depreciation	20,000
Feed cost	6,54,000
Fish seed cost	1,10,000
Worker salary $year^{-1}$	1,20,000
Electricity charges $year^{-1}$	12,000
Total	9,16,000
Fish production (kg)	14,080
Gross revenue (₹ ha^{-1})	14,08,000
Net return (N ₹ ha^{-1})	4,92,000
Benefit-cost ratio	1.53

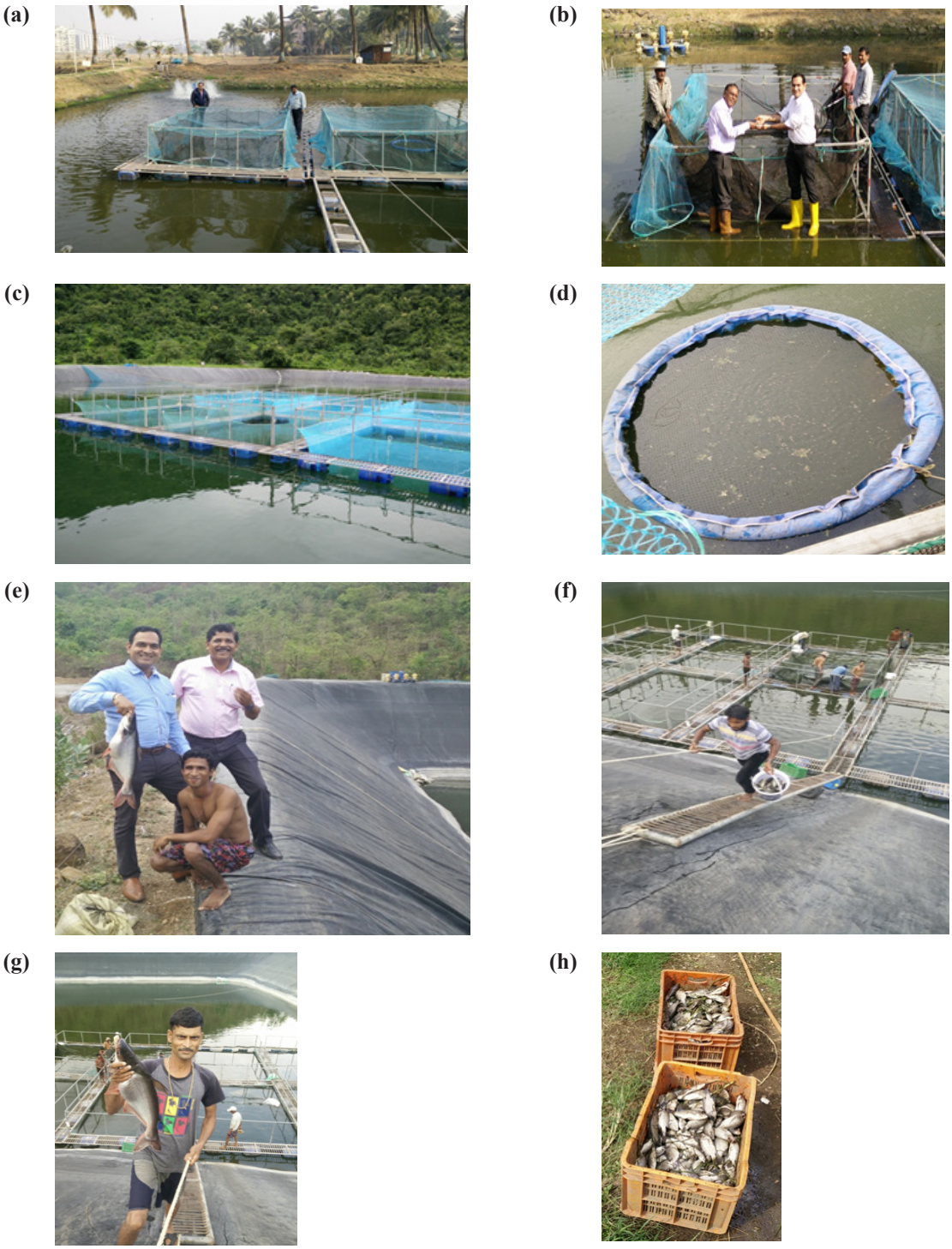

Fig. 1. Cage culture demonstrations and success stories: (a) Cages in farm ponds at Khar Land Research Station, Panvel, (b) Harvesting of Asian sea bass advance fingerlings from cages in farm pond at Khar Land Research Station, Panvel (c) Cage culture in farm pond" at Vandevta dairy Farm, Khandpe, Karjat (d) Floating Feeding ring in cages (e) authors with Pangasius fish and successful farmer Shri. Ashok Gaikar, (f), (g) & (h) Harvesting of fish from cages and pond at Vandevta farm, Karjat.

- Size of seed and stocking density for Pangasius- 6-7 cm fingerling stocked @ 60 m^{-3}
- Total numbers stocked per cage- 1,800
- Average survival and weight at harvest after one year- 80% with 0.900 kg
- Total yield from 10 cages- 12,960 kg
- Size of male Tilapia seed and stocking density - 5 cm fingerling stocked @ 1 m^{-2}
- Total numbers Tilapia seed stocked per pond- 4,000
- Average survival and weight at harvest for tilapia after eight months- 70% with 0.400 kg
- Total yield from 1 acre pond- 1,120 kg

Way Forward

The system is very recent and adopted by one farmer but many farmers are willing to adopt the model in their farm ponds. The main constraint in the adoption of this system is the involvement of cost of cage. The complete cage structure with floating assembly costs ₹ 70,000 to 80,000. The state government has included the cage culture activity for financial assistance in "Blue Revolution" scheme with 50% subsidy to be carried out in reservoirs. The cage culture in reservoir requires lot of capital investment and not affordable to marginal farmer. It has also other limitations of monitoring, poaching, local issues, menace of predators in reservoirs, isopod infestations in reservoirs etc. On the other hand, cage culture in farm ponds will surely gain the popularity in the state due to controlled situation. In this situation, cage-pond integrated fish culture model needs to be included in the "Blue Revolution" scheme with subsidy. If this comes to reality, the farm pond owners will certainly adopt this technology for increasing fish production and doubling their income (DFI).

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