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Polyculture method of Vietnamese koi and monosex tilapia in pond- A Mini Review

Abstract

Vietnamese koi and monosex tilapia have potential for production in a polyculture as both fish species grow very fast and are adapted in same land. 30 decimals – several acres of land can be selected as pond for the polyculture of Vietnamese koi & monosex tilapia.[1] The average size of fry is 2–3 gm and 300–350 pieces/ decimal mixed fry of koi and tilapia can be stocked in the pond for commercial fish culture.[2] The protein content of the feed should be minimum 30% as koi fish needs higher protein content in their feed for the better growth.[3] The average weights of Vietnamese koi and monosex tilapia are 300 gm and 400 gm within a four- month culture period.[4,5] The productions of Vietnamese koi and monosex tilapia are about 12000 kg/hectare and 9000 kg/hectare after four months of the culture period.[4,5] Although there are few drawbacks to culture of the fish species, but due to their fast growth rates, farmers should culture these fishes more commercially in polyculture system.

Keywords: Vietnamese koi, monosex tilapia, polyculture, growth, production

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Introduction

Polyculture which is also known as multi-trophic aquaculture,[6] is the most common practice of carp culture, and several species combinations and stocking rate have been developed.[7,8] The concepts of polyculture rely on the complete utilization of various spatial niches of a pond to obtain the maximum production per unit area.[9] One or two fish species are used as the main crop, and the others are subsidiary compatible species that utilize parts of the food resources.[10,11]

Polyculture of carps is a popular technology in South- East Asia. Pond preparation, species selection, stocking density, feeding, fertilizer, water exchange and proper husbandry are generally maintained in the system. Koi fish (*Anabas testudineus*) is a local breed of Bangladesh. It is a very tasty and nutritious fish.[12,13] This fish can be found in small river, canal, swamp. But koi fish is farming in pond now- a day's commercially. But due to slower growth rate, small size and grey body colour of koi fish, they are not much preferred by consumers. So a new variety of koi introduced in Banglaesh from Vietnam in 2010.[4,14] Vietnamese koi grows very fast and it is also a highly demanded fish in the local market in Bangladesh.

Tilapia is also a well-known suitable fish species for pond aquaculture in Bangladesh. Tilapia aquaculture plays a major role in fish production, marketing, consumption and agri-economies in Bangladesh.[15] As a first exotic strain of tilapia, Mozambique tilapia (*Oreochromis mossambicus*) was introduced to Bangladesh from Thailand in 1954.[16] But, this strain shows early maturation and frequent breeding behavior, resulting in overcrowding and slow growth rate.[17] Later, in 1974, The United Nations International Children's Emergency Fund (UNICEF) introduced a strain of Nile tilapia (*Oreochromis niloticus*) to overcome these constrains.[18] But, the farming of Nile tilapia has not become popular among farmers in Bangladesh due to lack of knowledge of the management practices of the fish. The World Fish Center developed a synthetic strain of *Oreochromis niloticus,* known as Genetically Improved Farmed Tilapia (GIFT), which was improved by the Bangladesh Fisheries Research Institute (BFRI) and introduced in Bangladesh in 1994.[19,20] The GIFT strain showed better performance than other tilapia species in various aspects.[21,22] Subsequent research was carried out to produce inbreeding- free, faster-growing fish, and the result was to make all male sex- reversed GIFT, which is commonly known as monosex tilapia.[18] Monosex tilapia is now a popular fish species in Bangladesh as the fish can grow fast, live in high stocking densities and consume natural food in pond.[23]

Although polyculture of different fish species is practiced in Bangladesh, polyculture of Vietnamese Koi and monosex tilapia is not available here. But there is much potentiality and feasibility of polyculture of these fish species. In this review- document, we will observe the polyculture method of Vietnamese Koi and monosex tilapia in pond and its advantages and disadvantages to farmers.

Methods

Pond selection: 30 decimals – several acres of land can be selected as a pond for the polyculture of Vietnamese koi & monosex tilapia.[1] Clayey-loam soil is best for an earthen-type pond to culture fish. The edges of the pond should be a minimum 3 feet high,[24,25] otherwise, koi fish can be climbing from the pond in the Rainy season.

Manuring: Inorganic fertilizers such as Urea and TSP can be scattered to the pond when there is lacking plankton in the pond. Urea 200 gm/ decimal and TSP 100 gm/decimal can be used in the pond if the water depth is minimum 5 feet.[26] Excess amounts of manure can create plankton bloom in the pond and create gas which is toxic to fish.

Water quality control: Suitable water conditions for Vietnam koi and monosex tilapia are: temperature = 20 - 30°C, O2 = 6 - 7 ppm, pH: 6 - 8.0, transparency = 30 - 40 cm, NH3 = less than 0.01 mg/L.[1]

Water quality parameters should be checked weekly by test kits. An aerator and oxygen tablet can be used if oxygen becomes short in the pond's water. A net or a bamboo can also be used to blow the pond water to improve the oxygen content in water. Lime 500 gm/ decimal can be used if pH imbalance is found in pond water.[24,25] Turbidity and gas formation in the pond can be reduced by exchanging water or freshwater supply daily. Feeding should be stopped for two days if O2 shortness and turbidity occur in the pond.[24,25]

Fry selection and stocking: The fry should be collected from a reliable hatchery. The quality of the fry is utmost important to get a good production from the culture. Fry should be checked by a Fisheries Specialist during purchase the fry from a hatchery. A minimum of

06 hours of conditioning of the fry is important before packing the fry.[27] Fry size average 2 – 3 gm and 300 – 350 pieces/ decimal mixed fry of koi and tilapia can be stocked in the pond for commercial fish culture (Figure 1,2).[2] Koi and tilapia fry stocking ratio can be 2:1 per decimal.[28] March- April (Rainy season) is suitable season to start the culture.

Figure 1 Vietnamese koi fry; Bangla Krishi Khamar.

Figure 2 Monosex tilapia fry; Exportersindia.com.

Feeding: A commercial feed can be fed to the fish twice daily (at morning and afternoon). The protein content of the feed should be at least 30%, as koi fish requires more protein in their feed to grow well (Figure 3).[3] Feeding to the fish should be according to the body size of the fish (about 8% during nursery, 5% during juvenile and 2-3 % during grow-out stage of the fish).[3]

Figure 3 4 mm fish feed; Indiamart.com.

Sampling of fish: Weight of fish should be recorded fortnightly. 5 -10 pieces of fish can be sampled to get the average weight and length of the fish.[29]

Disease management: Disease can be occurred during the culture period. Cloudy weather, oxygen shortages, overfeeding, injuries to fish etc. can create disease in fish. Bacterial diseases are commonly found in koi and tilapia fish. Oxytetracycline, about 75 mg per kg of fish for ten days, can be used to cure the disease.[30] Besides, water quality should be improved to minimize the problem. Infected and dead fish should be removed from the pond immediately. Biosecurity measures should be followed strictly to maintain the good water environment in the pond.

Results

Vietnamese koi normally reach 300 - 350 gm within a four- month culture period (Figure 4)[4] and monosex tilapia reach 400 - 500 gm within a four- month culture period (Figure 5).[5] Vietnamese koi can be harvested and marketed just after four months of culture. Production of Vietnamese koi is around 12000 kg/hectare and monosex tilapia is around 9000 kg/hectare after four months of culture.[4,5]

Figure 4 Vietnamese koi; Indiamart.com.

Figure 5 Monosex tilapia; Exportersindia.com.

Discussion

The results are agreed with the studies of Begum et. al.,[23] Papoutsoglou et. al.,[31] Kohinoor et. al.,[32,33] Mookerjee et. al.[34] Mookerjee et. al.[34] trialed different diets containing 30, 34.7, 39.5, 44.1 and 48.9% protein on a dry weight basis and found that 39.5% protein is optimum for Vietnamese koi feed. Doolgindachabaporn[35] also suggested that 38.6% protein in feed is required for the better growth and survival rate of Vietnamese koi fry. Dadzie[36] suggested that the polyculture of tilapia with other carps is a potential production system. Begum et. al.[23] reported that tilapia grows to a marketable size (200–250 gm) within 2 -3 months, and it is possible to produce several crops per year. Yang and Huang[37] reported that the polyculture of tilapia with carp did not effect on the growth rate of tilapia, bit it improved the water quality, the survival rate, and the net production of the pond.

Milstein[38] mentioned that sex- reversed male tilapia hybrids are cultured with carp in Israel, and polycultures of Nile tilapia, common carp and silver carp are the major aquaculture practices in African countries. These three species are normally cultivated in semi-intensive system.[39] The growth rate of carp in polyculture depends upon the species percentage and their initial body size.[40] Papoutsoglou et. al.[31] investigated the production of scaled carp (*Cyprinus carpio*) and blue tilapia (*Oreochromis aureus*), in monoculture and polyculture conditions. They found that both species obtained the highest average weight gain, the lowest level of FCR and carcass lipid content when the fish species were stocked at a percentage of 40% carp and 60% tilapia. Another model for the production of Nile tilapia in mixed-sex and all- male polyculture with a predator fish has been studied in African countries where predator fish were required to control the reproduction of Nile tilapia fingerlings.[41]

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Kohinoor et. al.[33] operated an experiment on the production potentials of Thai koi and Vietnamese koi under farm management. They found that the gross production of Vietnamese koi and Thai koi were 15352 kg/ha and 9456 kg/ha, respectively, after a four- month culture period after applying supplementary feed containing 30% crude protein.

Besides, another study was conducted by Kohinoor et. al.[32] on monosex tilapia polyculture with shing and koi for four months in six ponds at a village in Mymensingh. Fingerlings stocking ratio were: 1,25,000 koi fry/ha in all three treatments; 37,500, 32,500 and 27,500 shing fry/ ha in three treatments respectively; 5000, 10,000 and 15,000 monosex GIFT tilapia in three treatments respectively. Feed was supplied at a rate of 5 – 20% of body weight in all treatments where crude protein content was 30%. The final average weight was: koi 140.10 ±5.60, 132.66±5.11 and 129.73± 4.07g; shing 32.47 ± 7.11g, 35.40±6.59 and 37.51± 6.95g and monosex tilapia 210±9.75, 208±7.51 and 206±6.21g in treatments-I, II, and III, respectively. The highest average weight of koi during harvest was found in treatment T1, where the stocking density of monosex tilapia was low.[42–46]

Benefits and drawbacks of polyculture of Vietnamese koi and monosex tilapia:

I. Fast- growing and high- yielding fish species

II. Both fish species can be cultured at high stocking densities

III. Well- tolerated fish species in fluctuating water condition

IV. Both fish species can eat the same feed

V. Both fish species can consume plankton, so the amount of supplementary feed required is reduced

VI. Vietnam koi gets faster growth and body weight than local koi

VII. Growth rates of both fish species are near the same

VIII. Both fish species can be marketed just after four- month culture period

IX. Both fish species are popular and market-demanded in Bangladesh.

High feed costs, infected fry from the source, breeding of tilapia due to improperly hormonized monosex tilapia, sudden low price of tilapia at market are some drawbacks in the polyculture.

Conclusion

It is clear from the results that fast growth and production of Vietnamese koi and monosex tilapia can be obtained from polyculture of these two species in pond. Despite the challenges that farmers face when raising monosex tilapia, farmers should cultivate these species for their rapid marketable size and demand to consumers.

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Conflicts of Interests

Author declares there are no conflicts of interests.

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