Proceeding of the International Conference on Fisheries and Aquaculture, Vol. 4, 2018, pp. 15-20

ISSN 2386-1282 online
DOI: https://doi.org/10.17501/23861282.2018.4102

Aspects of Tilapia Culture in Punjab, Pakistan

Zafar Iqbal

Department of Zoology, University of the Punjab, Pakistan

Abstract: Tilapia culture is growing gradually in the province of Punjab, Pakistan. The mono sex culture of tilapia, *Oreochromis niloticus* is practiced on semi-intensive fish farming system. Both locally produced and imported mono sex tilapia fry is stocked in earthen ponds (stocking density 6250-10000 fry/ha). The fish is fed on high quality floating tilapia feed (30% protein). The fish is reared from April onwards and harvested in winter. The fish yield varies from 4400-7000kg/ha. This yield variation may be due to fish farm management and input administrated by the farmers. The tilapia has high local demand. The price of fresh iced fish depends on size of the fish. This year fish (600-700g) fetched good price (US$ 2.0/kg). However, last year the price of fish was almost half than this year price. The polyculture of mono sex tilapia with major carp; *Labeo rohita* is also practiced by some fish farmers. The yield of these two species in polyculture is very high (average weight 900g and 3100g for *O. niloticus* and *L. rohita* respectively). Tilapia culture is growing fast in Southern and Central Punjab. Yet, fish farmers have raised the issues of high priced fish feed, low fry survival, fish health issues, fish processing and marketing. The aspects of tilapia culture in the province of Punjab, Pakistan are discussed.

Keywords: Tilapia; mono sex; poly culture; semi intensive

Introduction

Tilapia is the second most popular farmed fish around the world after carp and is reared commercially in, over 140 countries (Fitzsimmons, 2018). Tilapia is source of low price animal protein. This fish is quickly growing in popularity in Europe, China and across South and South Eastern Asia (FAO, 2016). The main cultured species and strains are' Nile tiapia, *Oreochromis niloticus* and red (hybrid) tilapia (*O. niloticus x O. mossambicus*), (*O. niloticus x O. aureus*); GIFT (Genetically Improved Farmed Tilapia). China is the largest tilapia producer, consumer and exporter in the world. China produced 1,800,000 MT of tilapia in 2016. Tilapia production was 6,265,300 million tons in 2016 which is expected to rise to 6,500,000 MT in 2017. Fitzsimmons (2018) has estimated tilapia production of 9,000,000 MT by 2028.

The carp polyculture has shown tremendous growth in recent years in private sector in the province of Punjab, Pakistan. There are nearly ten thousands private fish farms covering area of approximately 66020 acres in Punjab which produce 23.869 metric tons of five carp species (*Labeo rohita; Catla catla; Cirrhinus mrigala; Ctenopharyngodon idella* and *Hypophthalmichthys molitrix*) (DOAF, 2018). In addition to carp culture, tilapia culture has also developed in the province of Punjab in last couple of years. The tilapia culture in the Punjab gained attention through a United States Department of Agriculture (USDA) funded project "Feeding Pakistan" which started in 2011. A large number of positive initiatives were taken under this project for fish farmers, academics and other stockholders. Under this project seven significant steps were taken: 1) fish farmers were trained in Thailand and USA; 2) GIFT, tilapia fry was imported from Thailand for culture; 3) production of soy based extruded floating tilapia feed was started with the establishment of first fish feed mill (Oryza Organics); 4) First international conference on Tilapia was held in Pakistan in 2014; 5) A book, The

Corresponding Authors' Email: dr.zafariqbal.pu@gmail.com

Aquaculture Handbook-Fish farming and Nutrition in Pakistan was also published by the project. The book contains 12 chapters. The author also contributed one chapter (Chapter No.VIII, on Fish Diseases and Health Management pp 281-325) (Fitzsimmons et al., 2015); 7) A Manual for Tilapia (Veverica and Janjua, 2015) has also been launched by Soy Pak too.

During the same period a private tilapia hatchery, Tawakkal tilapia hatchery was established in 2013 in district Muzzafarghar. By 2014, fish farmers' stocked 3,000,000 fry of both imported and locally produced tilapia (Janjua and Fitzsimmons, 2015). Recently two research projects on tilapia health management were completed in University of the Punjab, Lahore and the findings were presented in international conferences (Iqbal, 2017; Iqbal et al., 2017). This paper describes the present status of tilapia farming in some parts of Punjab and the problems and constrains faced by the farmers.

Materials and Methods

The methodology applied for collection of data is based on number of procedures. These included; visit to tilapia fish farms, interviews of tilapia fish farmers / tilapia hatchery manager. The interviews were conducted on fish farms as well as through survey questionnaire and by telephonic contact. All the data collected has been analyzed and discussed various parameters such as: type of fish culture; area of rearing facility, stocking density, source of tilapia seed, water source, input administrated into the fish farms, average size of fish harvested, total fish production, whole sale fish price.

Results

In this study twenty fish farmers, two hatchery managers and a feed mill manager were contacted and interviewed in 2016-2018. The districts included in this study were randomly chosen and these districts are: Multan, Muzzafarghar, Khanawal, Lahore, Kasur, Sheikhupura, Faisalabad, Sargodha and Islamabad. The tilapia fish farms are grouped on the basis of fish culture practiced: 1) Mono sex tilapia culture, 2) Poly culture of tilapia with major carp or shrimp, 3) tilapia hatchery and fry production locally. The constrains and bottlenecks faced by the fish farmers are also discussed.

Mono sex Tilapia culture

A private fish farm Near Lahore, (which is actually a very famous carp hatchery) stocked 10000 tilapia fry (all male from Tawakkal Tilapia Hatchry) in 4 acres earthen pond, (stocking density 2500/acre). The fish was reared and fed on prepared feed (Oryza feed) at the rate of 5-6% body weight in the beginning in April-May and later on rate of feeding was reduced to 1-2% body weight in October-November. They partly harvested two batches of fish: 2500 + 2350 fish average weight 700 grams (total weight 1750 kg/acre + 1645 kg/acre). The estimated fish produced can be stated to be in the range of 4375 kg/h and 4112.5 kg/h. The market price for 500-600g fish was US$ 70-80/40 kg and the retailer sell fish at US$ 2.0/kg. One interesting and particular point noted was that this farmer sold some valued added fish (marmalade fish at the rate of US$ 5.0/Kg) on trial basis and there was encouraging response from the consumers.

2. Another fish farm (pond area 25 acres, Number of ponds 8) of district Multan stocked 10,000 imported tilapia seed in 2.5 acre pond (at the stocking density of 4000 per acre). They fed fish by their own prepared feed (35 % protein) twice a day and harvested 700 gram average size tilapia in winter.

The fish production per acre was almost 2800kg. The total production can be estimated to be in the range of 6500-7000kg/acre.

3. In another fish farm of district Multan the stocking was 4000 per acre. The fish was fed three times a day. In six month the weight of the fish harvested was 250-350 grams. The estimated production may be about 1200kg. Such a small size fish do not fetch good price. This stock was sold at US$ 40 /40kg fish.

4. Another fish farm form district Khanawal stocked 4000 fry per acre and in four months (July to October) the harvested tilapia had average weight of 400 grams. The production may be estimated to be around 1600 kg. This stock fetched US$. 60-64 per 40 kg sale price. The results for Mon-sex culture of tilapia are given in Table 1.

Poly culture of tilapia with carps

Tawwakkal tilapia hatchery is pioneer in se reversed tilapia fry production in Pakistan. However, they also culture tilapia to marketable size. They stocked 700 tilapia fry produced at their own hatchery and added 700 *Labeo rohita* fish seed. The total stocking density was 1400 per acre. The fish was reared and fed on prepared feed. The average fish weight at the time of harvest was; tilapia 900 grams and L. rohita was 3100 grams. The total fish production after rearing for 9 months (April to December) was estimated to be tilapia 630kg and L. rohita 2170 kg.

Tilapia fry production at Government Fish Hatchery Mian Channu, District, Khanawal

At this government hatchery an estimated 100,000 sex reversed fry all male tilapia, were produced using α-methyl testosterone in 2016. In the following year the production of tilapia fry increased to 370,000 which were supplied to private fish farmers. During current year the fry production has gone up to 600,000. The hatchery manager claims to have above 90% success in production of sex reversed all male fry.

Tilapia culture at Government fish farm Faisalabad

At brood fish farm in Faisalabad GIFT tilapia from Thailand was stocked at stocking density of 6000 fry per acre. The fish was fed on Oryza feed (30% protein) and harvested in the following winter. The average size of fish was 600garms. The fish was sold at US$ 60 per 40 kg. In 2017 locally produced tilapia fry was stocked at 6000 fry / acre and fed on the same feed. The average size of the fish was 450-500grams. The imported tilapia fry gave better results than the locally produced fry.

Tilapia Poly culture with Shrimp

During 2015, 20000 post larvae (PLs) of Pacific White shrimp, *Penaeus vannamei* and 5000 GIFT tilapia fry from Thailand were imported by Punjab Fisheries Department and were stocked together in poly culture condition at Fish seed Nursing Farms, at Shahpur district Sargodha. The fish was fed on 30 % crude protein feed. In six months the shrimp grew to average 13 grams and tilapia attained average weight of 487grams. In 2016 the same stocking ratio of shrimp and GIFT tilapia were cultured for same duration and fed on same feed. The shrimp were harvested with an average weight of 21.0 grams and tilapia was average at 491 grams.

Discussion

Tilapia is considered as a source of low-priced animal protein. It grows faster and is easy to breed in warmer water. There are no Y-bones in muscles of this fish. It has white flesh and mild flavor. The nutrition value of fish has been measured to be one of the highest as compared to any other commonly available food product. Tilapia can tolerate wide range of environmental conditions. Hence, Pakistan is suitable for tilapia farming. Promotion and support of tilapia culture in Pakistan is advantageous because it represents lower level in food web and thus, its culture is economical and eco-friendly. Even small fish farmers can adopt tilapia culture and make reasonably good livelihood and improve their life standard and protein deficiency. Mono sex tilapia farming has become a profitable industry in many countries of the world. Majority of the fish farmer culture Nile tilapia as compared to any other strains or tilapia species worldwide. The genetically improved farmed tilapia (GIFT) farming is increasing gradually. The farmer prefer to keep only all-male in grow out ponds. Mono sex culture of tilapia has proved more profit generating, as these fish grow larger, faster and attain more uniform size when harvested. The male tilapia is more time and energy efficient. Tilapia has entered the list of bestselling species like shrimp and salmon. China is the largest producer of tilapia. However, Indonesia, Thailand, Philippines and Taiwan are also major contributor of tilapia in global market (Mahapatra, 2015). In Pakistan majority of the tilapia culture is pond based mono sex culture. Poly culture of tilapia with L. rohita is also practiced in Pakistan at a small scale (Iqbal, 2017a). In the same way poly culture of tilapia with shrimp, *P. vannamei* has also been reported in a government fish nursery in Punjab on trial basis (Qureshi et al., 2017). There are some reports of reduction in virulence of shrimp diseases when grown in poly culture with tilapia. Tilapia is fed on pelleted diet. The major ingredients in tilapia feeds include soybean meal, wheat and wheat byproduct, corn and rice bran and also include a vitamin and mineral premix. Typical formulation for nursery stage provides 40% crude protein and 7% lipid. But for grow out, a typical formulation would provide 32% crude protein and 5% lipid (Menaga and Fitzsimmons, (2017). In Pakistan major tilapia feed producers are, Oryza Organics and AMG Feeds. The fish farmers have three major reservations; high cost of pelleted floating feed, low price of fish when high tonnage of fish arrive in the market, the unguaranteed sex reversed tilapia fry which breed at early stage in ponds. Janjua et al., (2017) have reported high yield of GIFT tilapia (3450kg/acre) at stocking density 5000 fry per acre, grown under good pond management and fed on soy-based pelleted floating feed as compared to less yield (2700kg/acre) grown under normal condition at stocking density of 5000 fry per acre and fed on powdered home-mixed feed (mash). The average weight of fish was 690 grams and 540 grams respectively and FCR was 1.2 and 4.1 respectively in these two groups of fish. The profit per acre was 3.9 times higher in soy-based feed floating feed fed ponds as compared to mash feed fed ponds. Chauhan (2014), Iqbal, (2017) and Iqbal et al., (2017) have reported parasitic and fungal diseases in cultured tilapia in India and Pakistan. Anon (2017) has also reported parasitic diseases in tilapia and their treatments. Hence, health and welfare of the fish has to be taken into consideration during the rearing phase of the fish in ponds. Subasinghe (2017) has rightly stressed on aquatic animal health and biosecurity and its role in global food security. For further improvement and strengthening of tilapia culture in Pakistan; the following steps must be taken into consideration: the availability of improved stocks of fry be guaranteed, for this YY FISH GEN'S Male technology may be adopted by the concerned (Roderick, 2017), cheap formulated soy-based floating feed be available to fish farmers, introduction of advance aquaculture production system at national level seems essential now as

adopted by neighboring countries, and application of constant quarantine and strict biosecurity, discouragement of the misuse of antibiotics and other drugs.

Table 1:Tilapia culture in Punjab, Pakistan

S. No	Stocking density /acre	Fish Feed	Average weight harvested (g)	Estimated production (kg)	Culture period (months)	Sale price per 40kg
	Yield in Mono sex tilapia culture					
1	2500*	Oryza feed	600-700	1645-1750	7-8	Rs.7000-8000
2	4000**	Own feed	700	2800	9	Rs.8000-8500
3	4000*	Own feed	250-350	1200	6	Rs.3500-4000
4	4000*	Own feed	400	1600	7-8	6000-6400
5*	6000 ** 6000*	Oryza feed Oryza feed	600 450-500	3000 2600	8-9 (2017) 8-9(2018)	Rs. 6000 Rs.4500-5000
	Yield in poly culture of tilapia with carp and shrimp					
1	700 tilapia 700 L.rohita	Oryza feed	900 3100	630 2170	8-9 18	Rs.6500-7000 Rs. 9000-9500
2*	5000 tilapia 20000 shrimp	Oryza feed	487 13.0	2000 200	8-9 (2015)	Rs. 4500-5000 Rs.16000/kg
2*	5000 tilapia 20000 shrimp (PLs)	Oryza feed	491 21.8	2050 327	8-9 (2016)	Rs.4500-5000 Rs. 24000/kg

Stocking density - * (locally produced sex reversed tilapia fry). ** Imported sex reversed fry. 5* and 2* Government fish farm (Currency conversion 1US$= 125 Pak. Rs August 2018)

Acknowledgement

I am grateful to the University of the Punjab, Quaid-i-Azam Campus, Lahore, Pakistan for providing travel grant to present this paper at 5th ICFA 2018, at Colombo, Sri Lanka.

References

Chauhan, R., 2014, Fungal attack on tilapia mossambicus in culture pond, leading to mass mortality of fishes. Inter. J. Pharma Sci. Res (IJPSR)., 5(07): 425-428

Veverica K, L and Janjua, R.S.N., 2015, A Manual for Tilapia. SoyPak (ASH/WISHH), Karachi, Pakistan. PP. 73

Mahapatra, H, N., 2015, Tilapia farming in India. The daily Pioneer, Monday 14th December 2015, New Delhi.

Janjua, R.S.N., Fitzsimmons, K., Shoaib A and Woiwode, J., 2015, Development of Tilapia Aquaculture Industry in Pakistan. SoyPak (ASH/WISHH), Karachi, Pakistan (https://www.was.org/meeting/mobile/MG_Paper.aspx? i= 35636)

FAO, (Food and Agriculture Organization of the United Nations) 2016, State of the World Fisheries and Aquaculture. Rome, Italy.

Anon. 2017, Parasitic Diseases of Tilapia. 2017. www.thefishsite.com/articles/294/parasitic-diseases-of tilapia/ pp1-5.

Iqbal, Z., 2017, Parasitic diseases of tilapia Oreochromis sp. from earthen ponds in Punjab, Pakistan. In: 6th International Fisheries Symposium and Exp0-2017.8-9th Feb., 2017 Lahore. Pakistan Abstract pp-82-83

Iqbal, M, S., 2017a, Poly culture of Tilapia and carps in Pakistan. In: 6th International Fisheries Symposium and Expo-2017.8-9th Feb. 2017 Lahore. Pakistan. Abstract pp-36

Iqbal, Z., Maqsood, M and Saleemi, S., 2017, Fungal infection in tilapia fish cultured in ponds. In: 2nd International Conference on New Trends in Natural Sciences (NTNS) held at Lahore College for Women University, Lahore 25-27th October 2017 (oral presentation) Abstract.Pp-36-37.

Janjua, R.S.N., Fitzsimmons, K., Iqbal., S and Munawar, S., 2017, Study of Economical Benefits of Soy-Based floating feed versus mash feed in monoculture of tilapia (GIFT) in Pakistan. In: 6th International Fisheries Symposium and Expo-2017. 8-9th Feb, 2017 Lahore. Pakistan Abstract pp-62-63

Menaga, M and Fitzsimmons, K., 2017, Growth of the Tilapia Industry in India. www.was.org WORLD AQUACULTURE September 2017. Pp 49-52

Qurshi, I. A., Hayat, S., Mahmood, S., Ambreen, H.S and Zuliqarnian., 2017, Studies on Poly culture of Penaeus vannamei and genetically improved Farmed Tilapia (GIFT). In: 6th International Fisheries Symposium and Expo-2017. 8-9th February, 2017 Lahore. Pakistan Abstract pp-39

Subasingha, R., 2017, Aquatic Animal Health and Biosecurity: its Role in Global Food Security. In: 6th International Fisheries Symposium and Expo-2017. 8-9th Feb, 2017 Lahore. Pakistan Abstract pp-7

Roderick, E.E., 2017.,The Aquatic Chicken comes of Age - FishGen's YY Male Technology update. In: 6th International Fisheries Symposium and Expo-2017.8-9th February, 2017 Lahore. Pakistan Abstract pp 4-5

DOAF, 2018, Private fish Farms in Punjab. Annual report Directorate of Aquaculture Punjab, 2-Sanda road, Lahore. Pakistan

Fitzsimmons, K., 2018, Global Developments and Market Trends in Tilapia. Oral Presentation In: Skretting Tilapia Forum- First Ever-Global Tilapia Business Conference held at Cairo, Egypt 26th Feb-1st March 2018.