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Current Development Situation, Problem and Countermeasures on Tilapia Seed Industry in Fujian Province

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Abstract As one of the four main production areas of China's tilapia farming, Fujian province plays a critical role in China's tilapia industry development. "Quality seed makes the industry a half success", therefore, the study on seed industry has a very important significance for the development of tilapia industry. Based on the field survey, study and analysis, we found that there is a broad prospect of the seed industry development in Fujian province. However, in recent years, some problems have emerged during the development process, such as the serious germplasm degeneration, frequent disease occurrence, etc., which to some extent has restricted its further development. Establishment of tilapia seed production base, financial support and quality and security system should be strengthened, so that the tilapia seed industry in Fujian province will get better development.

Key words Tilapia, Seed production, Problems and suggestions, Fujian Province

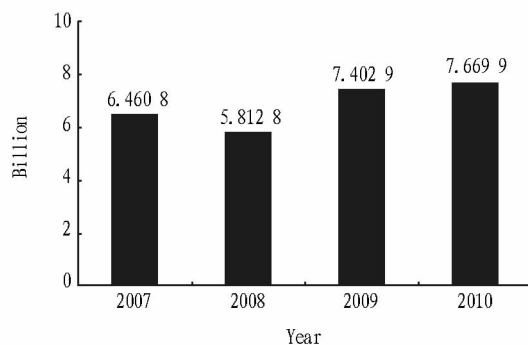
Fujian Province is located in tropical and subtropical area with mild climate. In Fujian Province, it is not hot in summer and not cold in winter. It is very suitable for breed and cultivation of tilapia seed, as its annual average temperature is 20°C and annual average hours of sunshine are 1 889.7. Meanwhile, it has created favorable conditions for the establishment of many tilapia seed fields and big-sized seed multiplication farms based on its abundant water resources, good water quality environment, criss-cross inland rivers and streams, numerous reservoirs and lakes as well as adequate fresh water and brackish water area resources. And its annual average precipitation is about 1 359 mm. Besides, located in China's southeast coastal region, southwest connected to Guangdong Province, east at opposite side of Taiwan Island across Taiwan Strait and close to Guangxi and Hainan, it provides a great convenience for breed and cultivation of tilapia seed in Fujian Province, importing and update of seed as well as the sales of seedlings, as Guangdong and Guangxi areas, Hainan and Taiwan are all main production areas for tilapia seedlings in China.

1 Current development situation of tilapia seed industry

The tilapia seed fields in Fujian Province are mainly distributed in Zhangzhou, Xiamen and Quanzhou due to big differences among geographical conditions with the largest number in Xiangcheng District, Longhai, Nanjing, Zhangpu, Pinghe and Changtai of Zhangzhou. In general, the seeds in Fujian Province have not been standardized, scaled and collectivized in production with only a part of seed production enterprises forming a certain scale.

The individual seed fields under decentralized operation are in the majority.

1.1 Scale and Variety Fujian Province has a state-level seed multiplication farm, 10 big tilapia seed production enterprises and numerous individual households for tilapia seed production which generate an annual output at about 700 million presenting a growth trend (see Fig.1), accounting for about 26% of total output for fresh water seed in the province. The main production enterprises include Guangzhou Luye Fisheries Co., Ltd., Zhangzhou fish nursery, Mingyue tilapia seed field, Kexing Special Fishery Breeding Farm, Xilong fish seedling farm, etc.



Note: Data source: *Fishery Statistical Yearbook of Fujian* (2007–2010).

Fig.1 2007–2010 tilapia seed annual output in Fujian Province

Currently, the main breeding varieties include Gift tilapia, hybrid tilapia and Taiwan Nile Tilapia. Gift tilapia has the advantages of faster growing, higher dressing percentage and ease of catching, but it is easy to have a disease with low disease resistance; hybrid tilapia has a lower growth speed and a low output but a strong disease resistance; and Taiwan tilapia has a strong disease resistance, can be adapted to a wide range of temperatures and will not reproduced excessively but its market share is small be-

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cause its high quality seed can not be further produced with seed production technique due to its germplasm and parent problems. Most farmers select Gift tilapia to breed so as to improve the output. Especially, "New Gift" tilapia received strong support and promotion from the government due to its good quality, so the market demands for Gift tilapia seedlings increased by years.

1.2 Seed breeding technique and cultivation approach Fujian Province has not carried out industrialized breeding of tilapia seed, and the techniques such as natural breeding in outdoor breeding pool and fishing for small seeds manually are still adopted in seed breeding. Though the technique is simple, but the seed fishing rate is low because the big seeds may swallow the small seed when some small seeds left in the breeding pool due to incomplete fishing.

The two main cultivation approaches adopted by Fujian Province currently are as follows:

(1) Net cage cultivation. This cultivation method applies to early-stage seed generally. 5 000 to 10 000 small tilapia seeds per square meter can be cultivated in every 20 to 30 m² cultivation net cage, and the detailed number should be in this range, depending on oxygenation condition.

(2) Cultivation in the pool. This cultivation method is generally adopted to cultivate middle-stage and later-stage seeds with cultivation in different pools as the main method. After the seedlings hatched out from parent fishes' roes reached 1 to 1.5 cm in length, the seedlings will be moved to another pool for cultivation when using fish screen to divide them. The general area of cultivation pool is 2 to 4 mu, and 100 000 to 150 000 seedlings can be cultivated each mu. The seedlings will be screened after 15-day cultivation, and 5 cm tilapia seedlings will be produced after 20-day cultivation^[1].

(3) Supply-demand and sales of seed. In recent years, early-spring and autumn tilapia seedlings have been over-demand due to unstable weather and streptococciosis. Only a part of distributors and heavy buyers can get the seedlings while the demand for some small customers and retail buyer can not be met. However, in its peak production period from middle of April to early June every year, oversupply phenomenon will appear in the market with the lowest price in the whole year. In this case, several enterprises will sell the seedlings at low price or stop production, the processing plants will purchase the tilapia at an excessively low price, and the initiative of the farmers will be reduced sometimes. In general, farmers will select cheaper seedlings because they can not compare the breeding conditions of the same variety seedlings in a large number of seed fields under equal conditions and they also think the difference is not very great.

In general, the market demand for tilapia seeds in Fujian Province has a great potential, as the breeding area, total output, processing amount and output value of Tilapia in Fujian Province all showed a growth trend in recent years (see Table 1). From the table, we see the output in 2009 is less than 2008, but the output value in 2009 is higher than the previous year. The reasons for this

phenomenon are that the undersupply of tilapia seeds caused by the closing down of many seed fields due to large-scaled occurrence of streptococciosis leads to the decrease of raw material tilapia demand of processing enterprises, and output decrease results in over-demand of tilapia in the market and price rising, thus leading to a output value growth.

Table 1 Statistics of tilapia breeding area, total output and processing amount in Fujian Province in 2007 – 2010

Year	Output mt	Area hm ²	Output mt	Output value 10 ⁴ yuan
2007	99 406	9 991	/	/
2008	96 809	9 554	63 653	54 027
2009	107 993	9 725	48 319	73 890
2010	109 450	9 826	68 669	113 259

Tilapia seeds will be sold in the following two methods mainly: providing technical services to farmers and through seed intermediary enterprises. The end customers of tilapia seedlings will be always farmers no matter what method adopted. The Tilapia seeds of Fujian Province have been sold to Anhui, Shandong and Beijing, with the sales targets in local market are mainly seedlings and the seeds sold to outside are mainly big-sized seeds or summer young fishes. The sales price will depend on detailed seasons and regions.

(4) Seed industry policy. Tilapia has been listed as one of the ten varieties of "Seed Industry innovation and Industrialization Project" of Fujian Provincial Government. And the provincial government will spend 1.45 million yuan to carry out "Cultivation and Promotion of Good Quality Tilapia as well as Integration and Innovation of Key Industrialization Technologies" project. In this project, the government will build up one tilapia breed conservation and seed selection base to conserve four tilapia varieties and form perfect elite breeding system; rebuild and expand three standard tilapia nurseries to make the annual output of good quality tilapia seedlings reach above 100 million and summarize a set of technical specifications on large-scaled seeding of tilapia and early-spring seeding; establish four cultivation fields for tilapia over-winter seedlings to make annual output of good quality over-winter seedlings reach above 5 million. This industrialization project, which adopts special funds to support "one fish, one project" model, sees first attempt in Fujian Province, and will have a big promotion action on the development of Tilapia seedlings production in Fujian Province^[2].

2 Existing problems

Though the development of Tilapia seed industry in Fujian Province has many advantageous conditions and a wide outlook, the overall technology level is still relatively backward that germplasm degeneration is serious and there are a series of problems in seed production.

2.1 Serious germplasm degeneration Germplasm degeneration exists in several major production areas of tilapia in China and Fujian Province is no exception, which has become the primary

bottleneck to restrict further development and growth of tilapia seed industry in Fujian Province. The protospecies including Nile Tilapia and *Oreochromis aurea* are introduced from Taiwan, but it is impossible to produce good quality seed by further using seed production technology due to the problems about germplasm and parent. After that, the tilapia varieties from Guangdong also have the same problems which result in a weak disease resistance and a relatively slow growth, thus failing to provide big-sized adult tilapia applicable for processing, so it is very necessary to pay close attention to the improvement of tilapia variety and the research on production technology of good quality seed. Currently, though Fujian Province provides a large sum of money to support the variety cultivation and technology innovation of tilapia, this will need a process, as germplasm degeneration is difficult to be solved in a short time.

2.2 Low seed cultivation technology level There are many private seed fields in Fujian Province, and the farmers of these fields, breeding and cultivating tilapia seedlings based on their own experiences, can not upgrade the variety immediately, as they are lack of professional technical guiders, get less training on seed production. Only the seedlings occur some problems (such as eruption of severe disease) will they seek for professional technical service personnel to provide on-site service. Therefore, the technical content of the seedlings cultivated privately is low.

Though relevant scientific research departments conduct cultivation and research work of tilapia seeds all the time, there are still some difficulties: for example, some experiment stations do not have their own nurseries, so that they can only provide the seedlings researched to seed fields or farmers for probation freely, resulting in failure to track the situation of new seed at any time and difficulty to find problems in time; while some city- and county-level scientific research departments are lack of funds and relevant equipments, which restricts their initiative of seed research.

2.3 Seed production management is to be strengthened urgently due to many "knockoff" seed fields Though Fujian Province has launched special renovation project for seeds, such as "Affirmation and Management Methods for Fisheries seed fields in Fujian Province" unveiled in 2011, defined production license regime for fishery seeds, and will weed out fishery seed production enterprises with small size, poor condition and weak management gradually, however, the implementation of this action involved in numerous links needed to be solved step by step. And during the process of implementation of this action, those unlicensed "knockoff" seed enterprises will persist in a certain period. And their existence will to some extent disturb seed market. Some farmers may buy the bad quality seed produced by them, so that a certain potential threat will be brought to the breeding and sales of adult fishes. Besides, parent conservation and screening methods used by these seed fields are very rough, and multi-channel sources of parent also result in unevenness and big difference of the quality of imported tilapia.

In addition, a large number of "knockoff" seed fields also

bring hidden danger to seed quality security. Currently, there is only one state-level tilapia seed multiplication farm and a few special province- and city-level seed multiplication farms. Private seed fields is the majority which mainly include family workshops with small size, extensive production, simple and crude facilities, weak technical strength, various source channels of germplasm and unstable seed quality. Aiming at these problems, relevant departments of the government conduct a large amount of work and takes measures to solve them at all times, but the regulation on these "knockoff" seed fields is still difficult to be in place due to various reasons and seed quality still faces a large hidden danger.

2.4 Frequent occurrence of diseases and big impact caused by natural disaster Fujian Province is located in China's South-East coastal areas, which has a high occurrence frequency of typhoon. The extraordinary rainstorm, accompanied by typhoon, can make low-lying ponds and pool reservoir suffer from flood, thus bring great loss to the production of tilapia seed production. Meanwhile, the persistent rainy weather also causes the reduction of seedling survival rate. In recent years, seed diseases have transferred from common and prevention and control ease types to rare and difficult-to-prevent and control types due to unstable weather, extensive breeding, high breeding density, the use of inferior feed and increase of breeding pollutant discharge, which shows a year-on-year rising trend.

In recent years, many seed fields owners and farmers were down the drain due to mass outbreak of streptococciosis, which is a kind of explosive epidemic disease popular in spring, summer and autumn with a wide attack range and long duration. It can bring great loss to the production of tilapia seeds, which makes seed fields owners and farmers be deeply feared, and cannot be prevented and controlled effectively domestically. When water temperature is 25°C to 37°C, it will at peak popularity.

3 Relevant suggestions

In consideration of the important position and broad prospect of tilapia industry development in Fujian Province, we should value the problems existing in its seed industry development highly and find effective solutions. Only in this way, can tilapia seed industry in Fujian Province develop healthily, thus laying the foundation for healthy and rapid development of tilapia industry.

3.1 Establishing seed parent breeding system and accelerate improved variety base construction Tilapia, a kind of tropical fish, which is easy to mingle and sexually mature early, is easy to degrade in temperate environment of China. So we should establish and improve seed parent breeding system, perfect management regime for fishery seed field, vigorously promote the industrialization process of tilapia seeds in Fujian Province, unify seed introduction, parent standard and production specification as well as realize large-scale and standardized production of tilapia seed as soon as possible, in order to make our own brand seedlings. It is recommended to enhance research on seed breeding technology and germplasm improvement technology, pay close attention to the

development and introduction of new improved variety, improve germplasm level, establish scientific and rational tilapia germplasm resources development mode and selective breeding technology, speed up selective breeding process of tilapia, establish satellite seed network with state-level improved tilapia variety as the core and mass seed production and supply in secondary seed field as the supplementary^[3].

3.2 Enhancing team building for breeding talents, vigorously cultivate application-oriented technical talents It is recommended to promote industry-university-research cooperation, enhance the cultivation of tilapia breeding talents from different levels and different layers by the methods from conventional breeding to the breeding with molecular biology way, from selective breeding to seed production and from seed research to seed cultivation. Meanwhile, it should vigorously cultivate application-oriented professional technical talents of seed, implement professional qualification certificate system that takes job based on certificate; strengthen on-the-job training on technical personnel of seed and improve their technical levels immediately; establish perfect examination system and cultivate a batch of application-oriented talents with high technical level, strong innovative ability and dedication to their work, so as to provide strong talent support for continuous development of tilapia seed industry.

3.3 Increase regulation force for tilapia seed production

Give full play to the guiding and regulation actions of government, set up sound management mechanism for tilapia seed, increase regulation and enforcement force; intensify the introduction and protection of germplasm resources, establish source documentation for germplasm; formulate strict market access system for seed, carry out standardized production and fully implement license system for seed production; build quality security management system with HACCP as the main mode inside seed production enterprises; establish and perfect all-around track and management system for the production and sales of tilapia seed. Meanwhile, vigorously promote the establishment of tilapia seed association, combine self-discipline of the industry association with the regulation and guiding of the government, formulate fishery seed quality standard applicable for Fujian Province and corresponding production technology operation specification and enterprise standards, in order to provide scientific basis for standardized, normalized and legalized management of seed production.

3.4 Valuing disease research and establishing a long-term mechanism for disease prevention and control

It is recommended to establish long-term mechanism for tilapia disease prevention and control, cultivate the seed enterprises and individuals to have the awareness of "prevent in case of no disease, treat early in case of disease; prevention takes first and better than treatment"; make a careful research on environmental elements for disease breakout of tilapia, explore its main pathogenic bacteria, understand disease occurrence conditions and establish perfect warn-

ing prevention and control system; develop safe and effective new feeds such as plant-based protein source, perfect safety detection system for feed quality; vigorously carry out nutrition and immunology research, develop immunopotentiator and microecologics instead of antibiotic and chemical sanitizer, intensify the research and development on prevention drugs for pathogenic bacterium as well as oral and soaking vaccine, so as to improve disease resistance and anti-retroviral ability^[4].

4 Conclusions

Tilapia is a kind of fresh water cultured fish which is regarded as key cultivation fish by World Aquaculture Society and the main fingerling recommended to the world by United Nations Food and Agriculture Organization due to its easy breeding and processing under the backgrounds that global fishery resources is facing with exhaustion, fuel price is high and the cost for sea fishing increases. The fish, one of the fresh water fishes with fastest growth of breeding output, has been cultivated in over 80 countries and regions. It is praised as one of the main sources for animal protein in the future and is referred to as "the fish of 21st Century". Fujian Province is one of the main tilapia distribution regions in China with its output and export volume occupying an important position in China. "Quality seed makes the industry a half success", therefore, the seed quality is the basis for development of tilapia industry and the critical link of its healthy breeding. So Fujian Province should take full advantage of its advantageous natural conditions to do a good job on tilapia breeding, solve the problems existing in seed production gradually, accelerate the establishment of parent breeding system, update seed breeding and cultivation technology continuously, strongly promote industrialization construction of tilapia seed, cultivate and develop brand seedlings, so as to make Fujian tilapia seedlings move towards to the whole country or even to the whole world.

References

- [1] WANG WB, HUANG JC. The propagation technique of the larval of *Tilapia mossambica*[J]. *Inland Fisheries*, 2008, 33(5): 23-24. (in Chinese).
- [2] <http://www.foodqs.cn/news/gnspsz01/201181291317014.htm>. [EB/OL]. (in Chinese).
- [3] LI SF. The development measures of breeding industry in the mainland of China [J]. *Chinese Fisheries Economy Research*, 1999, (1): 14-15. (in Chinese).
- [4] ZHONG QF, FAN HP. Investigation on main diseases of *Tilapia mossambica* in Fujian Province [J]. *Scientific Fish Farming*, 2007, (2): 48-50. (in Chinese).
- [5] ZHENG JY, XU LQ. The research on development situation and suggestion of Tilapia industry chain [J]. *Chinese Fisheries Economics*, 2011(5): 75-79. (in Chinese).
- [6] WANG HZ, CHE B. SWOT Analysis and strategies of Chinese Tilapia industry [J]. *Hunan Agricultural Sciences*, 2010(1): 125-127. (in Chinese).