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Tilapia vaccines: important disease prevention, biosecurity tools

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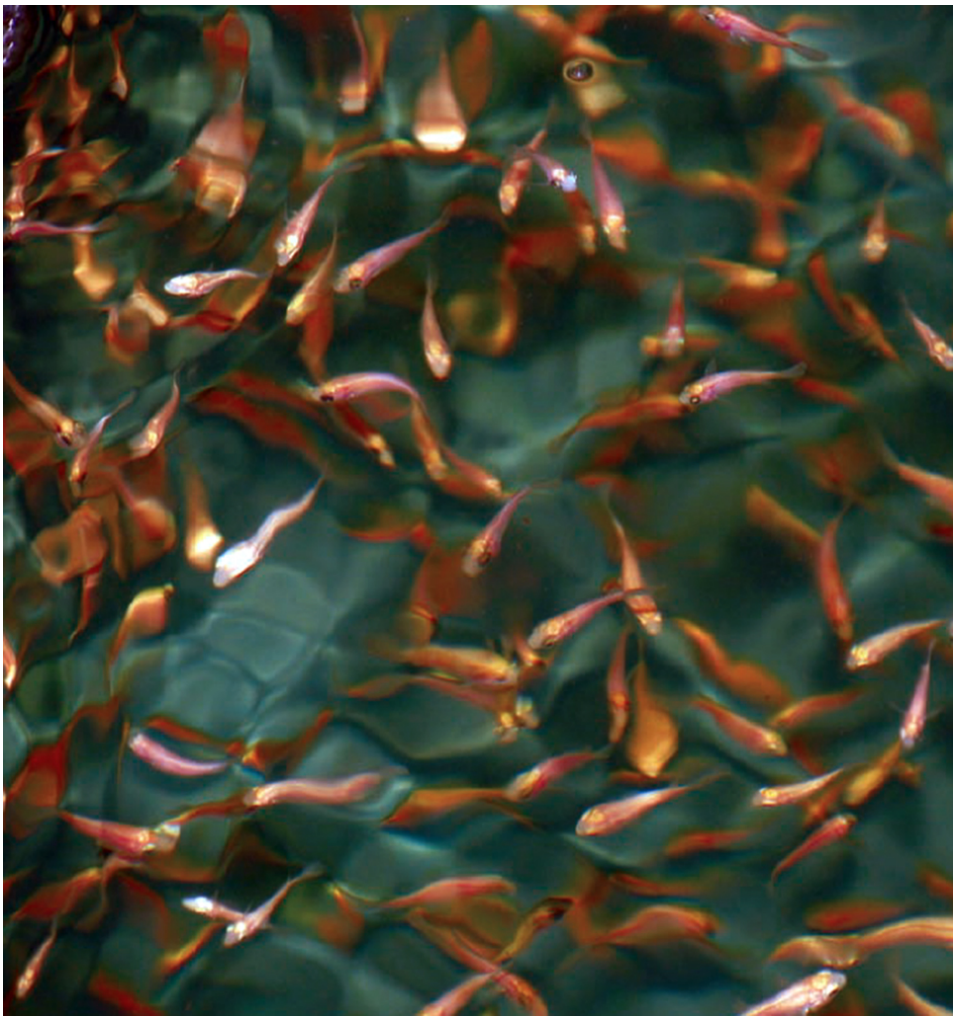
Vaccination can prevent outbreaks where disease occurs with predictable frequency



Tilapia fingerlings can be vaccinated against several pathogens by immersion. Other treatments require injections.

The Nile tilapia is one of most widely cultured fish species in the world because of its good feed conversion, fast growth, high reproduction, and ease of production. But, in contrast to what was believed during the early years of culture intensification, this fish is highly susceptible to various diseases that affect producer profits and consumer product costs.

The demands of consumers and environmental and government groups for wholesome tilapia products and an environment free of potentially harmful drugs and chemicals in aquaculture continue to grow. The tilapia industry can meet these challenges through better health management practices that include the use of vaccines to prevent diseases and increase economic predictability and profitability.

Major tilapia diseases

Among the major bacterial pathogens of Nile tilapia are *Strepto*coccus *iniae, S. agalactiae, Aeromonas hydrophila, Edwardsiella tarda,* and *Flavobacterium columnare.* The major parasite pathogen is *Ichthyophthirius multifiliis.*

The Gram-positive bacteria *Streptococcus iniae* and *S. agalactiae* are highly virulent to cultured tilapia and cause disease in a wide variety of fish species in more than 23 countries worldwide. These streptococcal pathogens are responsible for significant morbidity, mortality, and economic losses of more than U.S. $150 million annually.

Infections of *S. iniae* and *S. agalactiae* can occur singularly and concurrently in Nile tilapia. Both pathogens can rapidly spread from fish to fish year-round, especially in warm climates. Stressful conditions or poor nutrition favor streptococcal infection.

A. hydrophila infection can occur in Nile tilapia in conjunction with these streptococcal pathogens and others. *F. columnare* infection has also been reported in fingerlings and adult Nile tilapia. High morbidity and mortality have been associated with this skin and systemic disease. Nile tilapia are also susceptible to *E. tarda* that results in serious disease problems in stressed or malnourished fish.

Vaccination: 'insurance' and biosecurity tool

Vaccination can be thought of as an insurance policy against specific disease outbreaks that can cause serious economic damage. At production sites where a specific disease occurs with a predictable frequency, vaccination can prevent the outbreaks. Disease risk, vaccine efficacy, vaccination cost and expected market losses are among the factors that need to be evaluated before vaccination protocols can be implemented.

Vaccination is also a biosecurity tool to prevent the spread of a pathogen from one location to others. Streptococcal pathogens are an excellent example of rapidly spreading and emergent diseases that can be prevented by vaccination.

Vaccines

Fish vaccines are regulated biologics that are licensed for manufacture, use, and distribution in most countries. These regulations ensure that the licensed vaccines are safe, pure and efficacious. The efficacy of a vaccine is most often expressed as the "relative percent survival."

Vaccines can be produced against a single pathogen (monovalent) or multiple pathogens (polyvalent). The efficacy of each component of a polyvalent vaccine must be shown to not interfere with that of other components in vaccinated fish. Autogenous vaccines can be produced for use at a single farm if the vaccine master culture is obtained from that farm. Such vaccines can also be licensed for use on multiple farms, if the vaccine is universally efficacious and fully licensed.

Killed bacterin and live, avirulent vaccines are the most common types used in aquaculture. Both have advantages and disadvantages. While safety is an advantage for bacterins, their short several-month duration of protection is a disadvantage. Avirulent vaccines offer years-long duration but a lower level of safety.

Studies led to the development of safe and effective *S. iniae* and *S. agalactiae* vaccines applied by both immersion and injection. Ongoing studies are now focused on the development of a combined *S. iniae* and *S. agalactiae* vaccine that can be given by immersion of fry or juvenile Nile tilapia. A licensed avirulent *F. columnare* vaccine is administered by immersion, while an *F. columnare* bacterin is administered by injection.

Technology transfer

The development, manufacture, licensing, distribution, and use of a vaccine require partnerships between researchers, manufacturers, regulatory licensing agencies, stakeholders and aquaculturists. Stakeholder meetings, workshops and questionnaires spur communication between partners to establish the severity ranking of diseases and the vaccines needed to prevent them.

In the United States, technology transfer coordinators work to establish a cooperative research and development agreement that defines the goals, responsibilities, and time line of vaccine development between the researchers and manufacturer. The roles of the researchers and manufacturer are to jointly develop a safe and cost-effective vaccine that can be used for mass vaccination of tilapia against a particular pathogen.

The biologic manufacturer develops an outline of production and protocols for testing the safety, purity, and efficacy of the developed vaccine prior to the actual testing. The manufacturer must meet all U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS), and Center for Veterinary Biologics regulations and directives, and submit its data to APHIS or a similar agency for licensing approval.

When the cost benefit of manufacturing and distribution can not be met, governmental agencies may need to provide supplemental support for vaccines needed as preventative tools against particular pathogens. This support can be in the form of small business grants or other types of grants from governmental agencies and
fish producer groups.

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