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Indonesia, Animal Health - Fisheries and Aquaculture
August 6, 2026

Indonesia: Feed Supplements and Additives Against Motile Aeromonas Septicemia (MAS) and TiLV in Tilapia Farms

Introduction

As Southeast Asian countries have grown rapidly over the past few decades, access to nutritious and affordable sources of protein have been a growing challenge. Aquaculture is one of the fastest-growing sectors in production globally, and is essential for supporting coastal communities, job opportunities, and economic diversification of food production for food security. Specifically in Indonesia, tilapia farming is an essential part of the aquaculture industry, providing an accessible source of protein while supporting the local economy. However, due to the rapid intensification of tilapia farming in recent years, infectious diseases, specifically Motile Aeromonas Septicemia (MAS) and Tilapia Lake Virus (TiLV), have resulted in significant mortality across Indonesian tilapia farms. This is not only a threat to the Indonesian economy, but also a rising issue to national food security especially in rural Indonesia.

Background on Country and Family

As of 2026, Indonesia has a massive population of approximately 287 million people, making it the fourth most populated country in the world, following the United States. Indonesia is a country that has experienced rapid urbanization over the past couple decades, with 58% living in urban areas and 41% living in rural communities. According to the World Food Programme, over 23 million people are food insecure and are unable to meet their nutritional requirements, which is roughly 8-9% of the whole population. Specifically, approximately over 20% of children under the age of five years old have impaired growth or malnutrition. Food insecurity rates in Indonesia have generally spiked up since the COVID-19 pandemic, however in recent years since 2024 there has been a dropping rate of food insecurity due to governmental intervention and economic growth.

Additionally, Indonesia is the global largest tropical archipelago consisting of over 18,000 islands with varying land topography and biodiversity spanning across Southeast Asia. As Indonesia lies almost directly on the equator, the climate is extremely hot and humid. The archipelago nature of Indonesia contributes to the success of both land-based agriculture and seafood industries from tropical water access and humid climate (Climate Change Knowledge Portal, 2021). Roughly 30% of Indonesia's land is currently cultivated for agricultural purposes with large permanent farm areas in Sumatra. The aquaculture industry has significantly been flourishing in recent years, with major seafood exports such as shrimp, tuna, and tilapia. A variety of rice and grains are widely available for families in Indonesian communities, as well as poultry and fish being the main sources of meat (FAO, 2018). With the humid and tropical environment, there are diverse types of produce suitable to grow under these conditions.

As of 2025, the average Indonesian family size has declined to approximately four people per household. For the majority of middle-class families, family-run businesses (street vendors, family-run shops and restaurants), manufacturing, and especially agriculture are the main areas of employment and job

opportunities (World Bank, 2021). The agricultural sector has greatly improved with the innovation of new technology, but still remains the top employment area for rural households. The average wage for Indonesian workers is approximately 5.6-7 million Indonesian Rupiah (IDR) or roughly 300-400 USD, with a typical family of four requiring about 40 million IDR per month for comfortable living, with rising food and housing costs. Unfortunately, Indonesia has always had a large economic and educational gap between the upper and lower class, especially when it comes to food insecurity and poverty. Socioeconomic disparities have pushed for change from the Indonesian government, enabling free lunch programs in schools and homes. However, there are still prevalent differences of affordability and accessibility between rural and urban areas, and lower to upper class.

Challenge and Impact

Nile Tilapia (*Oreochromis niloticus*), *ikan Nila* in Bahasa Indonesia, is a freshwater fish species that has risen to popularity globally and domestically in Indonesia. Currently, Indonesia is the second largest tilapia producer globally with production skyrocketing over the past couple years, with an estimated annual Nile tilapia production of over 1.4 million metric tons (Poernomo, 2025). Nile tilapia is renowned in the aquaculture community for its ability to adapt to various diverse environmental and water conditions, and its shorter cultivation cycle relative to other freshwater fish species (Dimas, 2025).

As tilapia farming diversified in location, production is concentrated on two large islands: Java and Sumatra. Tilapia thrives in freshwater lakes located near volcanic mountains, brackish ponds, and in rice fields (ACAP, 2023). Due to a high domestic demand of tilapia, cost of production has been rising and in turn feed quality and management have been harmfully impacted. While it seems as though tilapia farming has skyrocketed recently, the intensification of tilapia farming has in turn greatly increased susceptibility to infectious disease strains. Major issues arose in Javanese fish farms such as high concentrated stocking density, when fish farms rear disproportionately large numbers of tilapia in a smaller water volume, which maximizes fish production while being detrimental to fish immunal health.

Aeromonas hydrophila, *Aeromonas veronii*, and *Aeromonas caviae* are the prominent infectious bacteria that have severely impacted mortality rates among Indonesian tilapia farms, especially across Java, Sumatra, and Kalimantan (García-Vásquez, 2025). Of these three bacterial strains, Aeromonas hydrophila is a key contributor to one of the most common and lethal bacterial infectious diseases known as Motile Aeromonas Septicemia (MAS). Aeromonas hydrophila is a naturally occurring gram-negative bacterium found in freshwater/brackish environments, however, only becomes infectious when fish are immunocompromised, caused by weak immune systems and overcapacity stress. Furthermore, MAS causes several symptoms of tilapia such as severe internal bleeding, ulcers, body and fin erosion, and most notably hemorrhagic lesions. Motile Aeromonas Septicemia (MAS) has a high mortality rate in tilapia and has been absolutely detrimental to fish farm populations, spreading fast within close proximity of healthy and infected fish causing mass mortality events across Java and Sumatra (Anggi, 2024). With the antibiotic-resistant nature of Aeromonas bacteria, MAS has been extremely difficult to manage and reduce.

In addition to bacterial infections like Motile Aeromonas Septicemia, Indonesian tilapia are extremely vulnerable to viral illnesses like Tilapia Lake Virus (TiLV/TiLVD). Red tilapia is a specific crossbred species between Mozambique tilapia and Nile tilapia (O. mossambicus x O. niloticus) raised largely in Malaysia and Indonesia and has been one of the main casualties of TiLV in the past decade. TilV is caused by a single-stranded RNA virus known as *Tilapia tilapinevirus*, and is extremely contagious through water

spread as well as direct fish-to-fish contact, which occurs very frequently in packed Indonesian tilapia farms. Globally, TilV causes 90% mortality in tilapia and has no known commercial vaccine and can only be prevented (Aich, 2021). TiLV is known to cause severe skin hemorrhages, organ failure, and exophthalmia which is painful bulging eyes. Furthermore, according to Isti Koesharyani and her research team from the Indonesian Journal of Aquaculture Research (Jurnal Riset Akuakultur), RT-PCR analysis confirmed that the 2018 tilapia mass mortality events observed in Java, Sumatra, and Lombok were caused solely by TiLV which was detrimental to populations (Koesharyani, 2018). As TiLV remains viable in the water for more than twenty-four hours, fish in close contact are able to spread and succumb to TiLV rapidly under intensive conditions.

Here is where the problem lies: the rapid spread of bacterial and viral diseases among tilapia fish farms from Motile Aeromonas Septicemia and TiLV have resulted in a significantly lower national supply of tilapia in Indonesia. These illnesses cause the growth and survival rate of Indonesian tilapia to decrease to less than 40% compared to over 70% over a decade ago. While survival rates are decreasing, production costs are rising with the higher demand of feed and energy to match intensified farming. With more frequent tilapia-kills from disease, production of tilapia has been slowed in recent years, contributing to culling of whole fish farm populations. Tilapia is among the top sources of seafood for Indonesian families, and reductions in supply due to disease significantly impacts seafood sector affordability. Due to socioeconomic disparities, rural populations are disproportionately affected by tilapia supply decline, as the species remains a staple in local diets. According to 2023 data from *Statistik Kementerian Kelautan dan Perikanan*, malnutrition among children persists in Indonesia alongside different micronutrient deficiencies, partly from the lack of seafood in their diets (Singh, 2024).

Exploring Solutions

With the threat of tilapia viral and bacterial co-infections on the rise, researchers in Southeast Asia, in Thailand and Indonesia specifically, have been exploring preventative strategies to Aeromonas Septicemia and TiLV, with one major solution consisting of feed additives and supplements. Currently, standard commercial pellet feed in Indonesia primarily consists of crop-based ingredients such as grains and soybeans, with as little as 8.8% fishmeal and 1.5% fish oil content. This contributes to insufficient nutrient nourishment in commercial Indonesian tilapia and has contributed to a net protein loss of over 65% as of 2020 (Seafood Watch, 2020).

This issue of poor nutritional quality in tilapia feeds has sparked a solution in recent years of addressing diseases in tilapia farms by adding organic acid supplements as well as natural immunostimulants to dietary feed. In an experimental study done at the animal research facility at Petchaburi province in Thailand, a group of 160 red tilapia was given supplemented diets of 0.3% organic acid blend with 0.1% natural immunostimulant blend, with the purpose of increasing immune responses as a preventative measure for both MAS and TiLV. Following the initial feeding period of this supplemented diet, fish were injected with both 50 µL of TiLV and 100 µL of A. hydrophila to simulate an infectious farm outbreak. Twenty one days post-infection, the fish were observed for mortality rate, immune gene expression, and organ damage. Researchers observed that the tilapia mortality rate for the feed-additive (organic acids + immunostimulants) was significantly lower at 41.7% mortality compared to the control group with regular commercial feed at 76.3% mortality. Furthermore with this solution, immune gene expression in the tilapia was exhibited with a significantly lower IL-8 expression, which is the gene responsible for inflammation signaling. This indicates that as a controlled immune response, organ and skin inflammation (a key impact of TiLV and MAS) was reduced and succeeded as a preventative solution to a

great extent. Results clearly indicated that there is a profound effect of organic/natural feed additives on tilapia survival in fish farms (Mohamad, 2024).

While organic acid and immunostimulants additives are a more broad commercial feed solution, probiotics and prebiotics additives are a more local preventative solution used extensively in Indonesia. Probiotics specifically for tilapia utilize probiotic bacteria, specifically *Bacillus spp.*, *Lactobacillus spp., Saccharomyces cerevisiae (yeast)*, and *Enterococcus spp.,* and have been incorporated previously into Indonesian tilapia feed. As *Aeromonas hydrophila* is extremely anti-biotic resistant, probiotics are the next best solution in preventing MAS especially. Probiotics such as Bacillus spp. are a crucial additive for commercial fish feed and even water treatments as they have proven to not only reduce bacterial disease and mortality rate, but also improve growth and nutrient absorption. As they are introduced into the gastro-intestinal tract (GIT) through feed, there is a resulting increase in the production of digestive enzymes and increased feed conversion efficiency, which creates more nutrient rich tilapia. Similarly, prebiotics are also added into feed, which are defined as non-digestible compounds that increase GIT bacterial growth, and prebiotic additives such as mannan oligosaccharides (MOS) and insulin are typically added into Indonesian tilapia feed as well. Both probiotics and probiotics greatly improved digestive enzyme activity as well as immunal responses which prevent MAS and TiLV (Mohammed, 2026).

Both solutions of feed additive options have been tried in Indonesia on a smaller scale, and have greatly contributed to an overall lower mortality rate of Indonesian tilapia. This increase in tilapia survivability plays a vital role in supporting Indonesian food security by keeping one of the top sources of protein affordable and abundant for all Indonesian communities.

Recommendations

Organic acid and immunostimulant additives and probiotics have both been proven to reduce mortality rates from co-infection of TiLV and Aeromonas, but can be costly with inconsistent amounts of each in commercial feed and inaccessible ingredients. For this reason, it is recommended that Indonesian tilapia farms, incorporate a multi-integrated feed additive approach, which applies a combination of both additives (organic acids and immunostimulants), focusing on using natural immunostimulants derived from widely available Indonesian plants like Echinacea (*Echinacea purpurea*) and benzoic acid, into traditional commercial feed pellets, while also using dual application of probiotics. The dual-application of probiotics involves introducing local probiotic bacteria, prioritizing Bacillus spp. a bacteria easily accessible in Indonesia, both into the water body two to three days a week and into the feed the remaining days (Destianingrum, 2017).

This multi-integrated feed additive approach realistically involves adding approximately 0.2-0.3% organic acid additives, 0.1% benzoic immunostimulants, and 0.05-0.08% probiotics (*Bacillus spp.*) in feed using an oil-binding method to coat feed pellets with these additives (Dos Reis, 2026). Low inclusion percentage levels of each additive cycled into commercial tilapia feed helps reduce and regulate management and feed costs, making this method suitable to both small-scaled rural tilapia farms and highly-intensified farms. Tilapia remains a vital source of high-quality protein, especially considering over 87% of Indonesia's population is Muslim which means certain alternative protein sources like pork are not acceptable. Applying this recommendation would drive down both tilapia mortality and tilapia prices, which will improve seafood affordability in rural communities. This recommendation is highly feasible for both small and large farms, and would be implemented and managed by the tilapia farmers

themselves, with potential involvement from feed manufacturers for larger-scale operations. The average cost for this recommendation is roughly $0.40 – 0.55 USD per kilogram of feed, and will be highly cost effective in the long run based on increased tilapia production output. However, the primary limitation of this recommendation is the increased labor and time required to carry out this approach. As the probiotics and additives need to be mixed with fish or vegetable oil, then added to the feed pellets, it demands manual work. The positive aspect of this limitation is that it expands employment opportunities on tilapia farms, providing job opportunities for Indonesian people.

Furthermore, for this solution there is substantially possible implementation and support from Indonesia's government agencies and extension cooperative programs as of 2026. For instance, *Kampung Perikanan Budidaya* (KKP), Indonesia's Ministry of Marine Affairs and Fisheries, have launched the development of a program named the *Fisheries Village Program* (FVP) since 2022 that aims to strengthen economic resilience for remote aquaculture villages throughout the nation. Specifically, three categories are supported and developed: inland freshwater commodities (freshwater aquaculture), coastal brackish commodities (ex: tilapia), and marine commodities off the shores (KKP, 2022). Additionally, the *Red and White Fishers' Villages Cooperative* is another national initiative launched by current President Prabowo this year, targeting over 100 remote fishing villages and providing the necessary infrastructure, facilities, and funding for fisheries in formerly traditional areas. Both of these programs are direct government subsidies for local Indonesian farmers which could make this multi-integrated feed additive approach affordable and directly actionable in current times with governmental support and funding for feed (SFS, 2026).

As a direct future impact on food security for Indonesian children, especially, the *National Free Nutritious Meals Program*, known as *Makan Bergizi Gratis (MBG)* launched in 2025. The KKP Director General of Aquaculture, Haeru Rahayu, attests that tilapia as well as catfish will become one of the main commodities of the program in the future as the industries are rapidly evolving. This program could directly integrate local tilapia farming into the nationwide fight against poverty and food insecurity. Through this program, community hubs known as *Satuan Pemenuhan Pelayanan Gizi (SPPG)* are where meals are prepared and stored, located throughout the islands, and then distributed to health centers and schools. Child malnutrition is one of the leading issues in Indonesian food insecurity, and this solution causing improved tilapia output could strongly impact these local communities.

Conclusion

Recent rapid expansion of the tilapia aquaculture industry in Indonesia has improved access to affordable protein and strengthened food security. However, it also increased susceptibility to infectious diseases like TiLV and Motile Aeromonas Septicemia (MAS). These lethal illnesses have significantly reduced tilapia survival rates and posed a direct threat to food security in rural populations. As effective treatments are nearly impossible, utilizing preventative measures is highly essential. Proven strategies include incorporating feed additives such as organic acids, natural immunostimulants, and probiotics. Combining these solutions, a practical method would be to adopt a multi-integrated feed strategy, along with the dual-application of probiotics in the feed and water. Ultimately, while challenges still remain, strengthening tilapia health and aquaculture practices can stabilize market prices, maintain affordability and access, protecting the livelihood of millions of rural Indonesians relying on tilapia as their primary protein source.

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