PVC Geomembranes in Agricultural Uses

Meldau, Adolpho Engineer,[1] Duarte, Jucieli Engineer[2]

[1] Cipatex® Group Cerquilho, São Paulo , Brazil. Av. 1º de Maio, 1341
adolpho.meldau@cipatex.com.br
[2] Cipatex® Group Cerquilho, São Paulo , Brazil. Av. 1º de Maio, 1341
jucieli.silva@cipatex.com.br

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ABSTRACT

Geomembranes have shown a considerable increase in the variety of their applications in recent years, such as in mining works, the environment, tunnels, agriculture, etc. The purpose of this work is to delve into the use of geomembranes in one of the fields that has been gaining prominence, fish farming. Currently, Brazil is one of the pioneers in the agricultural sector, due to the wide variety of production, and the sector of fish farming in water depths created in terrestrial areas is one of the most outstanding. The production of farmed fish in the country was 841,000 tons in 2021 (tilapia, native fish, and others), which represented an increase of 4.7% compared to 2020, with Nile tilapia accounting for 63.5% of the total. production and growth from 2020 to 2021 was 9.8%, more than double the average overall fish production growth. Nile tilapia is present in all Brazilian states and is one of the most resistant fish to be raised in culture, with an ideal temperature for development in the range of 25-30°C.

INTRODUCTION

The creation of fish in culture can be done by different production systems, however, the objective of the present work is to create fish in tanks and ponds lined with geomembranes. One of the advantages presented by the use of geomembranes is in the manufacture of tanks and ponds of the most varied sizes, being this in the most varied places, including urban regions. Many of these productions use a low volume of water, since they allow its reuse through the filtering process. It can be subdivided into armed tanks that do not require soil excavation and ponds; the geomembranes can be prefabricated with the necessary dimensions for the application, which makes the installation very feasible. Geomembranes that are used in tanks are normally pre-made or made in a factory and then shipped to the project site.

The constructions are normally designed considering the available space, the budget to be used and the quantity (production that is intended). In the case of ponds, construction with the use of geomembranes practically does not differ in any way from the construction of ponds for other uses, which allows an installer accustomed to the use of geomembranes to find no difficulty in operating in this market.

DEFINITION OF GEOMEMBRANE COLOR

One of the important factors for the quality and productivity of the fish is the level of stress that it is submitted, and this level is influenced by the color of the geomembrane used to produce the ponds. In Brazil, agriculture??? tanks are manufactured in most cases with black or blue geomembranes, with the predominant black color, due to the lower level of stress generated, reducing the agitation and sudden movement of the fish.

GENERAL INFORMATION

Among the aspects that can influence the quality and development of fish are the depth of the pond, water pH, temperature and production capacity per m3; this information is not part of the scope of the present work, but they are fundamental in the elaboration of a project; as an example, we can comment on the creation of Nile tilapia, which needs an average pH in the range of 7.2, height of the water layer with a depth of one meter, average temperature of 25°C, average cycle is 4 to 6 months for the fish to reach an average size for commercialization and an average production of 15 to 35kg/m3

An important fact is water filtration, which can be through phytoremediation, decantation or similar processes, the main factor to be controlled is the ammonia index, which in high concentrations can cause contamination and death of fish.

The cleaning system is one of the most important points, as any accumulation of dirt can contaminate the entire creation, often the cleaning outlet nozzle is central, as in Figure 1, which demonstrates the drainage system for cleaning.

To assist in the oxygen index of the water, the producers use aerators, (Ex: for 500 m2 of tank an aerator of 0.5 cv is used on average) that also bring benefits in the ammonia index, when used weekly.

MATERIALS AND ACCESSORIES

These sections discuss the materials and accessories that are needed to construct tank liner systems for agricultural applications.

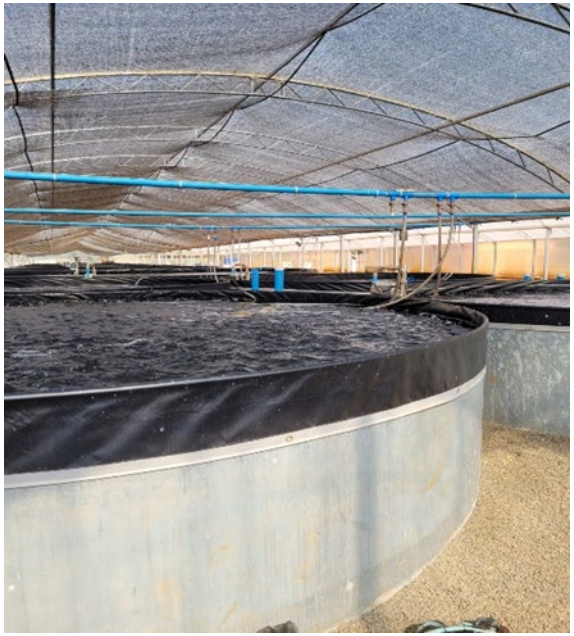
SUSPENDED TANKS

Suspended tanks are usually made of galvanized sheets or masonry (in this case, preferably in concrete blocks). Among the most used materials for the production of masonry tanks are concrete, cement and reinforced mortar, in some cases the bottom is finished in soil, with only the sides coated. This type of tank is generally used for high density production with high water turnover.

A relevant information about the shape of the tank is that some species adapt better in circular tanks, since this shape simulates the movement of water with great similarity to the natural habitat of fish.
In Figure 2, we have an example of an excavated tank, which we can see that was molded with concrete blocks and coated with PVC geomembrane, which helps in the movement of fish and water, consequently, increasing the oxygen level.

Figure 2: Suspended tank

Figure 3 shows an example of a suspended tank produced with galvanized sheet, which has excellent mechanical strength and can be moved to another location.



EXCAVATED TANKS

The construction of excavated tanks complies with the general rules of construction of tanks for other purposes, and there is the possibility of checking the slope of the site to reduce costs with earth moving.

Although the construction techniques of excavated tanks are well known, as mentioned in the geomembrane installation recommendations manual issued by the Cipatex ® Group (2022), the following best installation practice is important:

The surface to be coated must be flat, continuous and free from all rocks and stones, sticks, roots, sharp objects or debris of any kind that could damage the geomembrane. The surface must be firm, and stable. There should be no standing water, mud, snow and moisture - in this case, geomembrane placement will be allowed. It is also important to check for underground water or the possibility of gas appearing - in both cases, the placement of drains is essential. A 100% visual inspection of the open area should be done.

Being circular, square or rectangular, the excavated ponds are the closest to the natural conditions in which the fish are born, grow and develop, which is beneficial for production.
In Figure 4, we have an example of the shape of the tanks, which is configured according to the needs of the project.
As mentioned before, the tanks can have formats that suit the needs of the producer. Figures 5 and 6 represent the rectangular and circular tanks, coated with PVC geomembrane.

Figure 4: Shape of the excavated tank

Figure 5: Circular tank coated with PVC geomembrane

Figure 6: Rectangular tank coated with PVC geomembrane

SYSTEM COVERAGE

The ideal is to make plastic greenhouses to maintain a constant temperature in the breeding sites and we noticed that these greenhouses are more efficient than metal sheet roofs, because the latter do not allow heat to pass through.

GEOMEMBRANE PROPERTIES

One of the main properties of geomembranes in this area is their flexibility and conformability, in relation to supports, whether suspended or ground tanks. Another great property is the ability to produce panels, and many times, depending on the dimensions, they already leave the factory in the exact necessary size, without the need for welding in the field.

CONCLUSION

Among the systems for raising fish in captivity, suspended tanks and ponds lined with geomembranes (here in this case, we comment on the use of PVC geomembrane) show that, in addition to having excellent cost-effectiveness, that is, they are cheap, quick to install and easy to maintain, making it a great solution for raising fish in captivity. It is important to emphasize that the information contained in this document, for the most part, was obtained from the experience of Cipatex®.

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Thanks for your attention

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