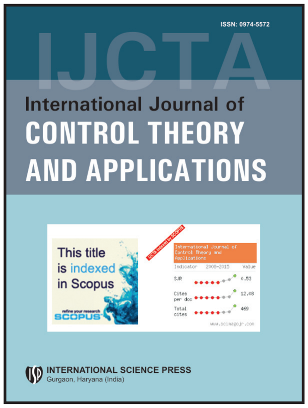

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Economic Evaluation, for the Production of White Cachama and Nilotíca Tilapia (Black) in Cultivation Systems Bioflocs

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Abstract: The objective of this study was to evaluate the seed densities for the management and production of white Cachama and Black Tilapia species in biofloc culture systems, analyzing the level of protein adequate for the management in the stage of fattening of the species. For the accomplishment of the objectives an experimental analysis was carried out, in which juveniles Tilipia Nilotíca and Cachama Blanca were obtained from fish stations in the department of Córdoba and/or certified companies of the interior of Colombia, with an average weight of 1g. For the measurement of the protein level, juveniles of Cachama Blanca and Tilipia Nilotíca were used, in monocultures from the tests carried out in the precrying phase, taking as reference the initial average weight with which they left the initial stage. During the 45 days of pre-culture, a ration was established at 10% of the live weight, given four times a day. Commercial feed was presented in 45% crude protein (PB) meal during the first 15 days of culture, followed by a transition stage with 45% extruded PB feed and 45% PB flour during the following 15 days ; To finish the culture time (until day 45) with extruded feed of 45% PB. For all variables to be evaluated (precritical density, adequate level of protein in fattening, fattening in monoculture and in polyculture of the species evaluated), a completely random DCA (3 × 3) design in a single path with three treatments and three replicates For each, for a total of 9 experimental units. All variables studied will be tested for normality (Shapiro-Wilk test) and homogeneity of variance (Bartlett's test). It was established that the variables fulfilled these assumptions were applied ANOVA in one way, establishing significant differences between them by Duncan's multiple range test. If the assumptions of normality and homogeneity of variance of the variables are not met, the data will be submitted to Kruskal-Wailis non-parametric analytical data. In all cases $p < 0.05$ will be used as a statistical criterion to establish significant differences. The data will be analyzed with software SAS 9.2 Institute Inc., Cary, NC, USA (2008). In the simulation of large-scale production, the results obtained with this technique of bioflocs showed evident economic advantages, which confirms the viability of this system in comparison with the direct storage of larvae in ponds.

Keywords: White Cachama, Nilotíca tilapia (Black), Cultivation systems Bioflocs.

1. INTRODUCTION

Reducing the supply of freshwater fishery products, coupled with technological advances in aquaculture production, has contributed to more competitive aquaculture [1] and to its establishment as an economically promising activity.

Even with the great improvement in production techniques, native fish larviculture in South America is one of the main problems in the production cycle, presenting many limitations and frequent failures. One of the possible causes of this lack of success could be related to the breeding technique used in Brazil, which is in general an adaptation of the techniques used in other countries; therefore, it is not always suitable for the species and climate of each area [2].

An alternative technique for larviculture is the intensive system, which provides better survival conditions since the larvae are initially reared in the laboratory before being transferred to the ponds. However, intensive larviculture brings an increase in youth production costs due to expenditures related to the production of live food and labor. The economic evaluations of intensive larviculture provide important information to help fishermen to increase juvenile production and profitability by adopting more efficient techniques [3], [4].

2. METHODOLOGY

For seed densities, three treatments were evaluated with three replicates each, establishing a completely randomized design with only one route, and a total of 9 experimental units (Table 1), in order to evaluate seed densities for the management and Production in the pre-weeding stage of the red tilapia species Oreochromis sp. And Tilapia nilotica Oreochromis niloticus, in biofloc culture systems, with 400, 700 and 1000 fish/m^3 (treatments). For the white Cachama species Piaractus brachypomus, densities of 200, 400 and 600 fish/m^3 (treatments) were managed (Table 2).

The treatments were evaluated in 9 rectangular geomembrane tanks with a capacity of 4.5m^3 of water, equipped with air diffusion units (PVC grids with polydifferent hose) connected to a 1.5 HP Blower for the constant aeration supply.

Table 1
Treatment to be evaluated in the seed densities for the handling and production in the pre-weeding stage of the species Red tilapia Oreochromis sp. And Tilapia nilotica Oreochromis niloticus, in biofloc culture systems

Tratamiento	*Densidad de siembra Replicas*		
T1 (400 peces/m^3)	R1	R2	R3
T2 (700 peces/m^3)	R1	R2	R3
T3 (1000 peces/m^3)	R1	R2	R3

Table 2
Treatment to be evaluated in the seed densities for the handling and production in the pre-weeding stage of the white Cachama species Piaractus brachypomus, in biofloc culture systems

Tratamiento	*Densidad de siembra Replicas*		
T1 (200 peces/m^3)	R1	R2	R3
T2 (400 peces/m^3)	R1	R2	R3
T3 (600 peces/m^3)	R1	R2	R3

Following the initial measurement of water quality, ammonium chloride (NH4CL) was added, in a ratio of 1g/100L of water and molasses in relation to 3g/150L of water, in order to form the growth medium for bacteria

Nitrificants (BN) and other organisms that make flocs. As an additional substrate for the floc, cassava flour was added at 5 g/100 L. The BN, for the inoculation in the system will be obtained from the bottom of the ponds of culture of culture ponds of the station Piscine Meléndez, in relation to 250 ml/200L of water. For maintenance of alkalinity 5 g of sodium bicarbonate ($NaHCO_3$)/100L of water will be added [5].

Table 3

Parámetro	*Intervalo recomendado*
Temperatura	25-30 °C
Oxígeno disuelto	4-5 ppm
PH	7.2-8.0
Dureza total ($CaCO_3$)	> de 150 ppm
Alcalinidad total	> de 100 ppm
Amonio no ionizado (NH_3)	< de 0.03 ppm
Nitrito (NO_2)	< de 1 ppm
Nitrato (NO_3)	< de 60 ppm

Physicochemical parameters of water quality for the production of Bioflocs (Lango, 2015)

Table 4
Total of fingerlings to be planted per experimental unit in the evaluation of planting densities for the handling and production in the pre-weeding stage of the species Red tilapia Oreochromis sp., Tilapia nilotica Oreochromis niloticus and White Cachama Piaractus brachypomus in biofloc culture systems

Tratamientos	*Número de animales a sembrar tilapia roja*	*Número de animales a sembrar tilapia nilotica*	*Tratamientos*	*Número de animales a sembrar cachama blanca*
T1R1 (400 peces/m^3)	1800	1800	T1R1 (200 peces/m^3)	900
T1R2 (400 peces/m^3)	1800	1800	T1R2 (200 peces/m^3)	900
T1R3 (400 peces/m^3)	1800	1800	T1R3 (200 peces/m^3)	900
T2R1 (700 peces/m^3)	3150	3150	T2R1 (400 peces/m^3)	1800
T2R2 (700 peces/m^3)	3150	3150	T2R2 (400 peces/m^3)	1800
T2R3 (700 peces/m^3)	3150	3150	T2R3 (400 peces/m^3)	1800
T3R1 (1000 peces/m^3)	4500	4500	T3R1 (600 peces/m^3)	2700
T3R2 (1000 peces/m^3)	4500	4500	T3R2 (600 peces/m^3)	2700
T3R3 (1000 peces/m^3)	4500	4500	T3R3 (600 peces/m^3)	2700
Total alevinos	28350	28350	Total alevinos	16200

At the end of this adaptation period an initial sampling of the culture will be carried out randomly taking 250 animals on average of the total sample and performing measurements of total length (Lt) and weight (g) with the aid of a Ictiometer graduated to the nearest millimeter for the case Of the size and a precision analytical balance, respectively. Starting from this initial sampling, a 45-day culture period will be estimated, carrying out biweekly biometrics of the population, organizing and digitizing these data for the required statistical analysis and evaluation of the zootechnical performance of the crop.

During the 45 days of pre-culture, a ration will be established at 10% of the live weight, supplied four times a day. Commercial feed in the presentation of 45% crude protein (PB) meal was used during the first 15 days of culture, followed by a transition stage with 45% extruded PB feed and 45% PB flour during the following 15 days ; To finish the culture time (until day 45) with extruded feed of 45% PB. Note: the use of commercial food brand AGRINAL is recommended, which has the presentation of these types of food.

3. RESULTS AND DISCUSSION

Evaluation of growth: Biometric sampling was performed biweekly in each experimental unit of the evaluated treatments, taking a random sample of the population. Each individual will be measured the total length (Lt) (cm) and total weight (Wt) (gr).

For the measurement of size a Ictiometer graduated to the nearest millimeter was used, also for the estimation of the weight was used a digital scale with capacity of 5000 grams (DS ± 0.05g) [6].

For the protein level, three treatments with three replicates were evaluated, establishing a completely randomized design with a single pathway, for a total of 9 experimental units (Table 5), in order to evaluate the level of protein adequate for the Management and production in the fattening stage of the species Red tilapia Oreochromis sp., Tilapia nilotica Oreochromis niloticus and White Cachama Piaractus brachypomus, in systems of biofloc culture, evaluating during a cycle (T), 30 (T2) and 38 (T3)% PB (crude protein), respectively in each of the three (3) species [7], [8], [9]. All treatments will be planted at a density of 80 fish/m^3, with estimated initial size of 15 ± 5 g until the culture time is reached according to the species studied (tilapias: 120 days and cachama 90 days). During the research cycle, laboratory tests (bromatological analysis) will be performed on the types of food to be used, in order to establish the actual protein content to be evaluated.

The treatments will be evaluated in 9 circular tanks with a useful capacity of 12 m^3 each, with constant aeration through the use of a blower of 2.5HP in the biofloc system, distributed through 4 "PVC pipe and diffused by means of pipe of 2" And polydisperse hoses (Blue Line).

Table 5
Treatment to evaluate in the determination of the level of protein suitable for the handling and production in the fattening stage of the species to be evaluated in cultivation: Red tilapia Oreochromis sp., Tilapia nilotica Oreochromis niloticus and White Cachama Piaractus brachypomus

Tratamientos	*% Proteína Bruta Réplica*		
T1 (24%PB)	R1	R2	R3
T2 (30%PB)	R1	R2	R3
T3 (38%PB)	R1	R2	R3

The results obtained are shown in the Table 6.

Tabla 6
Final biomass

Treatment	*Final biomass (kg)*	*Volume (m^3)*	*Loading capacity (Kg/m^3)*
T1R1	4,6	12	0,38
T1R2	4,3	12	0,36
T1R3	4,2	12	0,35
T2R1	4,2	12	0,35
T2R2	6,7	12	0,56
T2R3	2,9	12	0,24
T3R1	2,7	12	0,22
T3R2	2,2	12	0,18
T3R3	7,5	12	0,63
Total	39,2		

4. CONCLUSION

The implementation of the super-intensive production systems of tilapias Oreochromis sp. And Oreochromis niloticus and, White Cachama Piaractus brachypomus with low water consumption and alternative energy source in the department of Córdoba, allowed [10], [11], [12]:

- To develop a sustainable fish culture in the department of Córdoba, through the implementation of superintensive technologies, biofloc culture systems, for the cultivation of commercially important species (Cachama blanca and Tilapia) and their future replication in the cultivation of other species.
- Standardization of the protocols for the management and super-intensive production of the species Red Tilapia Oreochromis sp., Tilapia nilotica Oreochromis niloticus and White Cachama Piaractus brachypomus for the management of its pre-crop, monoculture and polyculture stage in the fattening phase in the Biofloc, providing information on the productive performance and management of the species in cultivation, establishing a protocol for the installation of floc inocula.
- Generate knowledge on the management, installation and maintenance of units of crop units under biofloc technology and the conditions of the region and with species of productive tradition.

REFERENCES

[1] Cocke, W.J., 1967: Statistical time symmetry and two-time boundary conditions in physics and cosmology. Phys. Rev., 160, 1165-1170, doi:10.1103/PhysRev.160.1165.

[2] Cunningham, S., Neiland, A.E., Arbuckle, M.A. and Bostock, T. (2009) Wealth-based fisheries management: using fisheries wealth to orchestrate sound fisheries policy in practice. Marine Resource Economics 24: 271-287.

[3] Gonzalez A.G. 2011. Diagnóstico del Sector de la Acuicultura de Recursos Limitados de Colombia. Informe Técnico Final de Consultoría. FAO-RLC, Oficina Regional de la FAO para América Latina y el Caribe, Santiago, Chile. 41p.

[4] González, E.; R. Norambuena and R. Molina. 2011. Aquaculture Big Numbers in Chile: socioeconomic status with focus on small producers. Unpublished technical report. FAO-Rome. 41p.

[5] Naylor, R.L., R.W. Hardy, D.P. Bureau and 8 others (2009). Feeding aquaculture in an era of finite resources. Proceedings of the National Academy of Sciences 106(36): 15103-15110.

[6] Amelec Jesus Viloria Silva (2016), "Predicting of Behavior of Escherichia Coli Resistance to Imipenem and Meropenem, using a Simple Mathematical Model Regression" . En: India Indian Journal Of Science And Technology ISSN: 0974-5645 ed: v.9 fasc.46 p.1 – 5.

[7] Martínez-Cordero, F.J. y M.A. Saavedra, 2011. Plan Nacional para el Desarrollo d ela Acuicultura de Pequeña Escala y Recursos Limitados (APERL) en Nicaragua: Acuicultura Urbana y Periurbana. Informe Técnico Final del Proyecto TCP/NIC/3201. Docto. de circulación restringida. FAO-Nicaragua, Managua.90p.

[8] Munro, D.R. (2010). From Drain to Gain in Capture Fisheries Rents. FAO Fisheries Technical Paper 538. Rome, 49 p.

[9] Srinivasan, U.T.. W.W.L. Cheung. R. Watso. and U. R. Sumaila (2010) Food security implications of global marine catch losses due to overfishing. Journal of Bioeconomics 12(3): 183-200.

[10] Stevenson, J.R. and Irz, X. (2009). Is aquaculture development an effective tool for poverty alleviation. A review of theory and evidence. Cahiers d'Agriculture 18: 292-299.

[11] Pacheco, G. V., Fernández, L. H., Medina, R. P., Montoya, L. A., & Borrero, T. C. (2016). Rasgos de la administración de la microempresa en Barranquilla, Colombia. Revista ESPACIOS| Vol. 37 (Nº 09) Año 2016.

[12] Stanley, D.L. (2003) The economic impact of mariculture on a small regional economy. World Development 31(1): 191-210