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LARVICULTURE OF MARINE SHRIMP *Litopenaeus vannaei* WITH THE APPLICATION OF INORGANIC NANOPARTICLES IN THE WATER

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Marine shrimp (*Litopenaeus vannamei*) are normally found from the eastern border of the Pacific Ocean, close to the city of Sonora, in Mexico, to Thumbes, in the north of Peru (BARBIERE; OSTRENSKI, 2002). Pacific White Shrimp, as they are also known, are one of the most important species cultivated in the Americas, especially in Ecuador and in Mexico (CUZON et al., 2004).

The purpose of this study was to undertake stage II (pl3 onward) larviculture of marine shrimp (*L. vannamei*), with the dosing of inorganic nanoparticles in the water, with the aim of achieving greater zootechnical performance and a reduction in the quantity of organic matter in the breeding tanks. These experiments were conducted at a post-larvae production farm located in the municipality of Aracati, Ceará, during the period of greatest adversity during the year for such cultivation in which temperatures are at their lowest and winds their strongest, i.e., during the months of July to August 2018.

The tanks had volumes of 50 m^3 and were filled with sea water that had a salinity level of 35 that was stored in a larger reservoir and then sent to the tanks. These were fertilized with the microalgae *Navicula* sp., without the use of probiotics. In each tank, varying quantities of post-larvae were stored at average quantities of 2,500,000 during the pl 3 and 4 stages, equalling an average stocking density of 50 post-larvae per liter. The post-larvae were cultivated for a period of 8 to 12 days, during which they received a commercial feed eight times per day. The tanks were artificially aerated by a blower and aero-tube and the water was renewed at a rate of 20% of the tank volume every two days. The experiment consisted of nine treatment situations having two repetitions each (totalling 18 tanks). There were nine control tanks and nine treatment tanks that were dosed with 200 mL per day of Biocelerator 500® inorganic nanoparticles, which are designed to stimulate the degradation of organic matter in the water. The Biocelerator was applied directly into the water where the marine shrimp were being cultivated. The temperature of the water, which varied between 28 and 31 ºC, was measured daily during each repetition.

Upon completion of the experiment, results showed final average survival rates that were 17% higher when Biocelerator 500® was applied as compared to the control treatments, and final weights that were 8.4% heavier for the post-larvae as compared to the averages in the control tanks (Table 1).

Table 1. Principle zootechnical performance parameters for the post-larvae upon completion of the experiment.

Treatment	Final averages			
	Initial quantity	Final quantity	Final survival rate (%)	Shrimp number required per 1 KG of meat
Biocelerator	2.500.000	2,100,000	84,00	119
Control	2.500.000	1.795.000	71,80	130

The results presented above highlight the efficiency of the inorganic nanoparticles in increasing the final survival rates and weights of the marine shrimp (*L. vannamei*) . These results are also very similar to those that were obtained in other aquaculture studies that were conducted in eastern Ceará, which were: the zootechnical performance of marine shrimp (*L. vannamei*), cultivated in low salinity water in the nursery phase during a period of 16 days in the municipality of Russas. In this experiment, the animals displayed better results in terms of survival rate, final biomass and feed conversion ratio, and nitrogenous compounds were maintained within the recommended limits in the six testing batteries that were implemented. Better grow-out results were achieved for marine shrimp (*L. vannamei*), and there were better results with respect to zootechnical performance in the municipality of Beberibe.

Regarding tilapia pisciculture, researchers were able to show a reduction in organic matter and improved zootechnical performance levels in each of the treatment situations that were run, most notable of which was a study that was undertaken in the municipality of Icapuí with fry stage tilapia that were bred in natural ponds lined with plastic tarp. Two different stocking densities were adopted in this study (160 and 76 fish m^{-3}) in which better results were obtained for cultivating fish at the higher stocking density, mainly with respect to their final biomass and the quality of the water, since the inorganic nanoparticles were able to maintain the level of dissolved oxygen in the breeding ponds, thereby making it possible to increase the stocking density and, as a result, productivity.

Furthermore, a Nile Tilapia (*O. niloticus*) grow-out study was also conducted in the same municipality, using the same aforementioned natural breeding ponds, in which the fish presented greater levels of development when inorganic nanoparticles were dosed at a liter per day, as compared to a different product that is purported to reduce organic matter in the water. Parameters such as survival rate, final average weights, final biomass, average daily weight gain and apparent feed conversion ratio were greater regarding the cultivation of the fish in the intensive production system that was evaluated. The fish in this treatment situation (one liter per day) yielded an off- flavor rating of zero in accordance with taste testers, as compared to when 200g day^{-1} of the product was used, which resulted in the fish yielding a low off-flavor rating amongst taste testers. Lastly, when using a different organic matter reducing product at a dosage of 60 g $week^{-1}$, the fish presented a moderate off-flavor rating. Despite the fact that the data was not submitted to statistical analyses, one may infer that when the inorganic nanoparticles were used, the fish had little to no off-flavor characteristics that could be detectable by smell or taste. Such a result is indicative of the quality of the fish meat at the end of the cultivation cycle, especially when using a weekly dosage of this product with which it is possible to increase the fish's market value.

KEYWORDS: marine shrimp, zootechnical performance, larviculture, organic matter

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