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Effective Microorganism 'Em1' and Their Effects on Performance of Pond Cat Fish (Clariasgariepinus)

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Abstract
In production ponds, the performance and yield of catfish (Clariasgariepinus) is determined among other things on the water quality. EM activated for both nutrient EMAS and against pests EM5 were used to treat cat fish concrete ponds at a concentration of 1 per 10,000 parts of water at each water change, to assess its efficacy to improve yield by reducing the incidence of pests and diseases in aquaculture. Juveniles of catfish were stocked at the rate of 50 per 1.4m x 1.1m x 1.1m concrete ponds. The treatment constituted of 3 ponds treated to EMAS, EMAS +EM5 and no treatment (control), respectively. Average length and weight of fish were taken 4 weekly for 20 weeks. Results showed that generally fish weight and lengths were higher in treated ponds than the untreated ponds. At 20 weeks, the ponds treated with EMAS+EM5 had significantly higher weights than the untreated at 1.9kg average weight over 1.6kg in the control. The fish in ponds treated with EMAS+EM5 and EMAS increased by 237.5 and 152.1% on their initial weights. At a table size of 1.0kg, the treated ponds could be harvested at 16weeks for better profit.

Key Words*: Catfish yield, EMAS, EM5*

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I. Introduction

Clariasgariepinus or African sharptooth catfish is a species of catfish of the family *Clariidae*, the airbreathing catfishes.*Clariasgariepinus*exists in the wild but it is also cultivated in ponds, cages, and pens and is of great commercial importance. Propagation of these fishes is widely practiced in the tropics. (Khedkar and Khedkar, 2003). It is among the most commonly eaten fishes in homes, hotels and bars in Nigeria. It is a highly nutritious fish that contains high number of vitamins, proteins, minerals and a little or no saturated fat and is low in carbohydrates (lee 1991).

In Nigeria, research has shown that a higher number of fish farmers use concrete ponds (73%) compared to 27% using earthen ponds (Ugwumba, 2010). Fishes cultivated in these controlled environments has been found to be contaminated by pathogenic and opportunistic microorganisms (Fafioye, 2011, Amande and Nwaka, 2013, Omojowo and Omojosola, 2013, Afolabi et al, 2020. The feed used for the fish in these ponds contain organic materials and introduces a wide variety of microorganisms into the ponds (Okpokwasili and Ogbulie, 1999).

Effective microorganisms (EM) are mixed cultures of beneficial naturally occurring organism that can be applied as inoculants to increase the microbial diversity of soil ecosystem. EM are different blends of common anaerobic microorganisms in a carbohydrate-rich liquid carrier substrate (molasses nutrient solution). The main components of EM are the photosynthetic bacteria (*Rhodopseudomonas spp*.), lactic acid bacteria, (*Lactobacillus spp*.) and yeasts (*Saccharomyces spp*.), actinomycetes and fermenting fungi(Zuraini et al., 2010). These microorganisms are physiologically comparable with one another and can coexist with liquid culture.

EM Microbial Inoculants is concentrated culture of effective microorganisms which is in its dormant state and won't be effective unless environmental conditions are ideal especially temperature of 25^0C. EM used on its own will take a long time to become effective and besides, this is not the most economic way of applying it. Therefore, the best way to use EM is to 'activate' it. The resultant product could be EMAS - Effective Microorganism Activated Solution, EM5- Effective Microorganisms insecticide and repellent to prevent disease and pests problems in plants and animals(Higaand Parr., 1994).

It has been reported that activated EM1 presents an effective way of controlling things like microbial infestations, dangerous sludge that can deplete the pond of oxygen, and ailments that can harm fish production. It is also reported that Laboratory tests show that EM1 is also effective at clearing away the lignin, carbohydrates, cellulose and other starches, that can make up the sludge found in some ponds.(Teraganix.com 2012)

The production of catfish in Nigeria based on current studies, it showed that catfish production, distribution and marketing are way lower than its demand. It has been reported that load of bacteria/microflora due to restricted movement is high in ponds than in the natural environment and this negatively affects the yield of fish. This study is on effectiveness of the use of activated EM1 to ameliorate this condition and therefore increase yield.

II. Materials And Methods

Experimental Site

This research was carried out in the research ponds of the Department of Fisheries and Aquatic Environment inthe Rivers State University Port Harcourt, Nigeria. The site is located at longitude 4.7923^0N and 6.9825^0E with an elevation of 13m above sea level. The site has an average annual rainfall of about 2400mm, relative humility is 69.08% and a mean annual temperature of 31.03^0C.

Preparation of Effective Microorganism Activated Solution (EMAS)

The microbial inoculants product (EMAS) was produced in the Crop/Soil Science laboratory of the Rivers State University Port Harcourt Nigeria. 'Effective MicroorganismInoculant'(EM1) was activated for nutrients by mixing with molasses and water in a composition of 94% of water, 3% of molasses and 3%of EM1. The mixture was stirred, dissolved and left for seven days in a plastic container without exposure to direct sunlight. It was ready for use at a constant pH of 3 giving a sweet and a sour aroma.

Preparation of EM5

EM was activated for pesticide blending the molasses with warm water to make certain that it has been completely dissolved. 75cl vinegar, 75cl distilled spirit,500g crushed peeled garlic clove,500g crushed hot peppers, 500g crushed ginger, 500g neem and EM1 were added to the dissolved molasses. The mixture was poured into a plastic container that was shut tightly to maintain anaerobic condition. The container was stored in a warm place out from direct sunlight and was allowed to ferment for about 2weeks with a pH of 3.5 and a sweet aroma.

Treatment Application

Cat fish (*Clariasgariepinus*) was procured from Momoh Farm Limited, Rivers State. Fifty juveniles of cat fish were stocked in three different ponds each measuring 1.4m x 1.1m x 1.1m. One of the ponds was treated with EMAS, the second one withEMAS+EM5; at a concentration of 1 per 10,000 parts of water. The third pond which served as the control was untreated.The juveniles were fed with 2mm size feed at 30g per pond and twice daily. The feed was changed to 5mm feed size when the fish weighed 300g. The pond water was changed two times a week to enable collection of a good concentration of the effluent, which was used for some other research. The treatments were repeated with each change of water. The average fish length and weights were estimated from 10 fish from each pond; from the 4th to the 20th week after stocking.

III. Results And Discussions

Result of the mean chemical properties of fish pond effluent is as shown on Table 1.The effluent from pond treated with EMAS+EM5 had the highest organic carbon content, followed by the pond treated with EMAS and was least in the control pond. The coefficient of variability was over 500%. The total nitrogen content of the effluents from the three treatments was in the order 0.92 > 0.75 > 0.63% for the EMAS, control and EMAS+EM5 treated ponds, respectively.Although the coefficient of variability was about 2%. The pH across the treatment was acidic.

Table 1: Average Chemical Properties of Fish Ponds Effluent

Treatment	Organic Carbon (%)	Total Nitrogen (%)	pH
CONTROL	15.63	0.75	5.4
EMAS	20.96	0.92	5.7
EMAS+EM5	42.35	0.63	5.9
CV (%)	506.72	2.06	0.83

Generally, the average weight of catfish were higher in the treated ponds than in the untreated ponds (Fig.1); up to the 16weeks after stocking (WAS). At 20WAS, the ponds treated with EMAS+EM5 had significantly higher average weight yield of $1.90kgfish^{-1}$ when compared with the untreated pond with an average weight yield of $1.60kgfish^{-1}$.

At the 16WAS, the treated with only EMAS had average yield weight yield not significantly higher than the untreated pond ($P<0.05$). This suggests that combined use of activated EM1 for nutrient (EMAS) and

EM1 activated for pest management (EM5), would give a better result than EMAS alone. This agrees with reports of Teragamix.com (2012) that the use of EM1 to treat fish ponds will provide a better condition for higher productivity. Onibalusi (2015) got similar yields without EM1 but at six months after stocking.

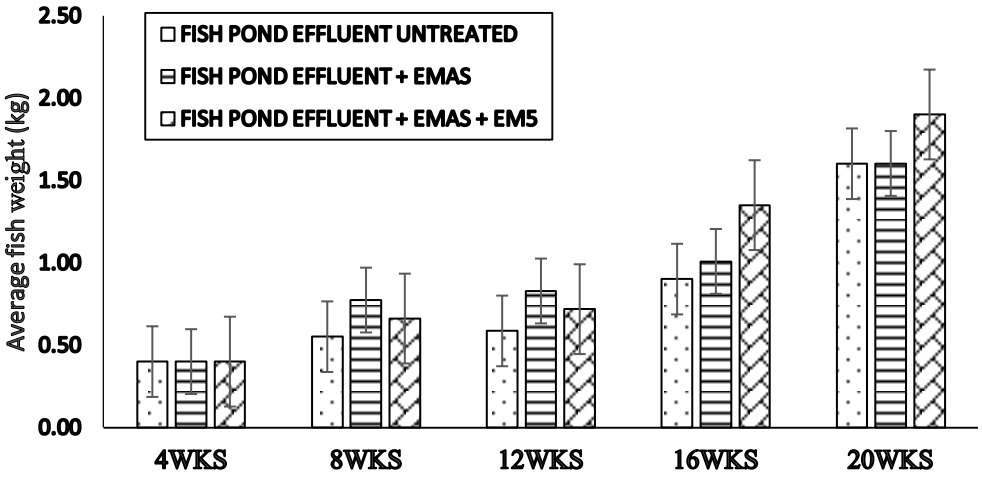

Fig. 1: Effects of treatments on average fish weight

With to fish length (Fig. 2), the treated ponds generally had longer fish across the 20WAS; although these differences were not significant ($P<0.05$). it was also observed that ponds treated with EMAS+EM5 got to maximum for harvest at 16WAS. This is evidenced by the no significant change in length at the 20WAS, although they kept gaining weight.

Given a recommended table size of catfish average weight of 1kg (nairaland.com, 2017), ponds treated with EMAS+EM5 could be harvested at 16WAS with an average weight of 1.35kgfish^{-1}. This will greatly reduce the cost of producing to 6 months before harvesting.

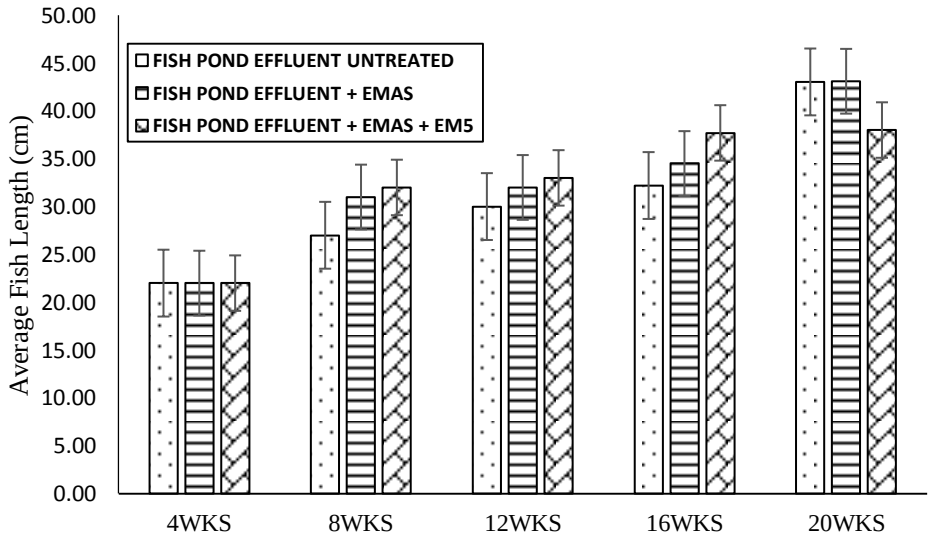

Fig.2: Effect of treatments on Average Fish Length

Results showed that the average weight yield of fish in the untreated pond could still get to the weight of the treated pond. However, this would take a longer length of time and therefore, higher cost of production.

The percentage increase in weight and length of fish with weeks, as affected by treatment is as shown on Figs. 3 and 4.

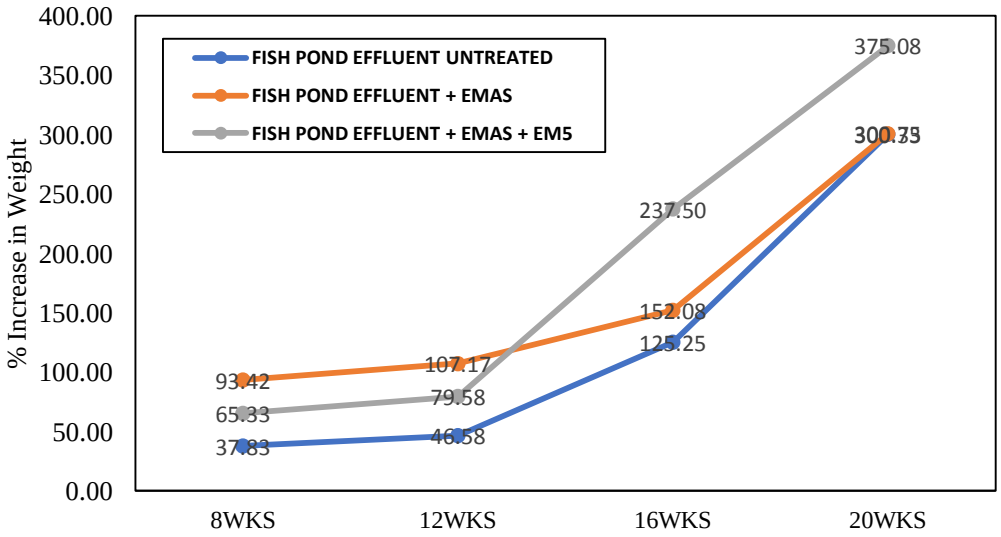

Fig. 3: Percentage Increase in Fish Weight with Weeks

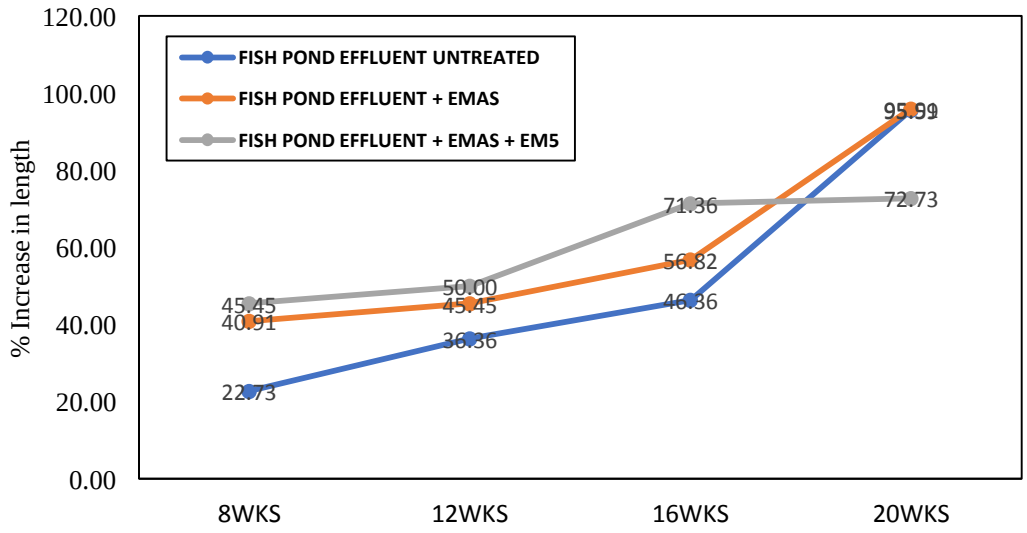

Fig. 4: Percentage Increase in Fish Lenght with weeks

Up to the 16WAS fish in the untreated pond had the lowest percentage increases, in both average weight and height and was followed by those in pond treated with only EMAS. At 16WAS the average weight of fish in the pond treated with EMAS+EM5 had increased by 237.5% on the initial weight, while those treated with EMAS and the control increased by 152.1 and 125.3 respectively.

This suggests that treating of the ponds with these activated EM1 products should be started at the early developmental stages of the fish; as fish is said to grow rapidly during the early stage but growth slows with time.

IV. Conclusion

The control of aquaculture systems through the manipulation of microbial activity has become an important and commonly discussed technology arising from the development of intensive aquaculture.Results have shown that the use of activated EM1for both nutrient (EMAS) and pest management (EM5) can be used effectively in controlled environments like concrete ponds, to enhance catfish production. Table size catfish of over 1kg can be harvested in 16 weeks after stocking as against the usual 6 months; thereby saving cost of production and maximizing profit.

However, there is need for further studies on the frequency of application and for other fish species.

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