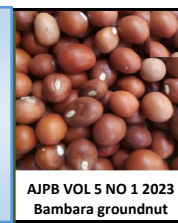


ASIAN JOURNAL OF PLANT BIOLOGY

Website: <http://journal.hibiscuspublisher.com/index.php/AJPB/index>



Growth Performance of *Clarias gariepinus* in Paddy Rice Field in Kwadon, Gombe, Nigeria

A.Z. Abubakar^{1,*}, I. Ibrahim¹, Z. Isah¹ and M.A. Umar¹

¹Department of Biological Sciences, Faculty of Science, Gombe State University, PM.B 127, Tudun Wada, Gombe, Nigeria.

*Corresponding author:
Zainab Adamu Abubakar
Department of Biological Science,
Faculty of Science,
Gombe State University
PM.B 127, Tudun Wada
Gombe,
Nigeria.
Email: zeepha22@yahoo.com

HISTORY

Received: 12th May 2023
Received in revised form: 20th July 2023
Accepted: 30th July 2023

KEYWORDS

Rice and fish culture
Clarias gariepinus
Faro 44
Jamila
Nigeria

ABSTRACT

In this scenario, a rice and fish farming system is merged, where the fish are farmed alongside or interchangeably with the rice. Integrated fish farming is a sequential linkage between two or more farming operations. However, occasionally the advancement of rice-fish farming has been hampered by changes in rice-growing methods as well as the widespread use of insecticides and artificial fertilizers. A cutting-edge agricultural technique where the primary crop is rice and fish fingerlings are used as a secondary source of income. By generating employment opportunities and ensuring food security, rice cum fish culture not only helps farmers who are living in poverty to earn more money but also increases the output of their paddy crops. This study aims to assess the performance of the fish as a result of the rice-fish culture. Kwadon, in the Yamaltu-Deba local government area of Gombe State, Nigeria, practised rice-fish culture. The study used six (6) rice paddy fields with the labels "pond X and X1 received artificial feed, pond Y and Y1 received poultry dropping, and pond Z and Z1 serve as control." at twenty-one (21) days following planting, local rice seedlings Jamila and improved rice seedlings Faro 44 were transferred into the paddies. Each pond received 5 g of *Clarias gariepinus* per fingerling. However only one treatment (X and X1) produced positive results for the rice variety faro 44, which managed to live. When compared to the other 2 treatments (poultry dropping and control), the fish output in treatment one (artificial feed) had an overall weight (g) of 54000 g, which is considerably greater. The study's high mean in Faro 44 reading of 96264.73 g was observed. An analysis of resource use efficiency found that, with the exception of labour, irrigation, and insecticide, most resources in the rice-fish industry were underutilized by farmers. In order to improve food security and maintain sustained rural development, it is crucial that the government actively supports the integration of rice and fish farming.

INTRODUCTION

In many regions of the continent, the catfish (*Clarias gariepinus*) is one of the most significant marketable freshwater fish species. It is renowned for its adherence to and endurance under adverse environmental conditions. According to [1], *Clarias gariepinus* is typically refined because of its ease in navigating ecological boundaries, towering assembly, and high rate of feed adaptability. An important global problem of anguish is the rise in human population and the portrayal of excessive numbers of hungry or ravenous individuals, mostly in wealthy nations. Agriculture, aquaculture, and fisheries are the three most significant kinds of activities that contribute to the production of supplies. Fish yields can vary widely from 1.5 to 174 kg/ha/season depending on the

nature of the rice-fish system, the species present, and the board used. Incorporated rice fields or rice field/pond compounds where fish are grown alongside or alternately with rice are known as rice-fish systems. Fish may be purposefully stocked (fish culture), or may enter fields in nature from neighboring water ways when flooding occurs (rice field fisheries), or a fragment of both depending on the rice fish system, the species available, and the board used, fish production might vary greatly from 1.5 to 174 kg/ha/season.

The goal of integrated fish farming is to combine multiple compatible agricultural operations into a working, integrated whole farming system. It is a "zero waste," low-cost, and low-livelihood production system that puts as much work into one

product as another. It is impossible to overstate the advantages of integrated agricultural systems over fixed farming systems [2]. Numerous research has revealed that rice-fish culture can increase yield and net advantage by 5% and 64.4%, respectively [3] it has been established that the integration of rice and fish is extremely desirable from an ecological and commercial standpoint. Fish can increase income more quickly than crops alone in a rice-based farming strategy, which reduces poverty, malnutrition, and vulnerability. Reduce the gap between the supply and demand of food fish, reduce the strain on fishing resources, provide foreign exchange over revenue, provide employment and profession prospects, and provide farmers and fishermen with more food and other sources of money. Control the mollusks and insects that eat rice.

MATERIALS AND METHODS

Study area

The study on rice fish culture was carried out in Kwadon, Yamaltu-Deba L>G.A of Gombe State, Nigeria, about 272 miles (or 437 km) east of Abuja, the country's capital city (**Fig. 1**). The growth performance of fish cultured paddy fields are illustrated in the tables below. A randomized complete block design was used to conduct the experiment. Six ponds, each measuring 450 by 270 cm and 95 cm deep, were used for the experiment. Treatments include artificial feed (X and X1), chicken droppings (Y and Y1), and control (Z and Z1). Morning and evening feeding frequencies were used in the treatments (**Table 1**).

The dorsal and anal fins of the catfish genus are exceptionally long, almost reaching or reaching the caudal fin, and both fins have only soft fin rays, giving the fish an eel-like appearance. The pelvic fin typically has six soft trays, and the outer pectoral ray is shaped like a spine. The body is coated in a smooth, scale-less skin, and the head is flattened and heavily ossified, with the skull bones (above and on the sides) forming a casque. On the dorsal and lateral sections of the body, the skin is typically darkly colored. According on the substrate, the color is equally marbling and ranges from greyish olive to blackish. The skin's color often lightens when exposed to light. A total of 600 catfish were used, each weighing 5 g.

In six (6) ponds, each measuring 450 cm by 270 cm and 95 cm in depth, the experiment was carried out using a randomized complete block design. The treatments included commercial feed (X & X1), poultry droppings (Y & Y1), and control (Z & Z1). The treatments included two feeding frequencies per week (morning and evening).

Table 1. Research plan to examine how fish feeding affects *Clarias* species growth in an integrated rice-fish farming system.

Treat- ment	Stocking volume of <i>clarias</i>	Feedstuff	Body weight % (g) <i>Clarias</i>	Week one application day	Appli- cation
X	100		5	6	M&E
X1	100	Commercial Feed	5	6	M&E
Y	100		5	6	M&E
Y1	100	Poultry droppings	5	6	M&E
Z	100		5	6	M&E
Z1	100	Alternative feed	5	6	M&E

Key: commercial feed (x), poultry droppings (y) and alternative feed (z). Treatments comprised of two feeding frequencies in a week (morning and evening (M&E)).

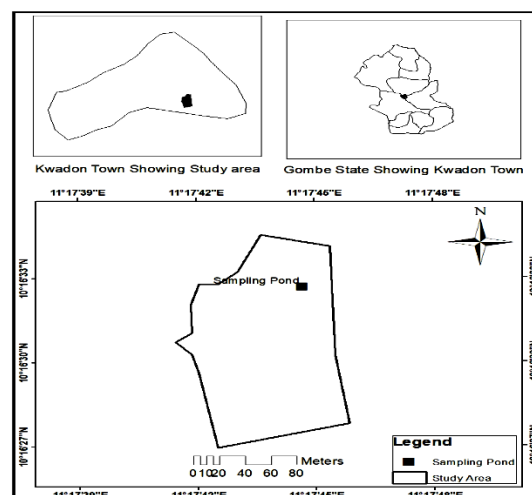


Fig. 1. Map Of Kwadon town showing study Area: (Source Dept. Of Geography Gombe State University).

RESULTS AND DISCUSSION

The current study demonstrated how using native fish in rice-fish culture increases rice output due to a potential fertilizing effect of fish faeces. A fish that is able to adapt to its surroundings plays a sustainable role in the formation of a well-balanced ecosystem in rice-fish culture. As a result, the use of inorganic fertilizer in rice-fish culture can be reduced because it is anticipated that the rice yield from such a rice-fish culture will be comparable to that of rice monoculture. Contrary to these findings, the pond treated with artificial feed yields more than the pond treated with poultry droppings; this may be because the feed has more nutrients.

However, the direct as well as indirect impact of fish activity on paddy fields also reduce insect pests and weeds [4]. Additionally, rice cultivated in an integrated rice and fish culture that has been shown to be more suited and effective has value added in terms of safety and security for human health [4,5]. Because of this, adopting rice-fish culture enables more reliable production techniques and benefits farmers economically [4-8]. Consequently, a sustainable farming system can be realized by utilizing the multi-functionalities of rice-fish culture, which provide good and reliable results to farmer, consumer, and ecosystem.

As a result, rice-fish culture's many functions can be used to create a sustainable farming system that benefits the environment, consumers, and farmers alike. According to the culture system's results, which are displayed in **Table 2**, the growth concert of the fish species is encouraging and is consistent with the outcome reached by [9]). It has been demonstrated that the longer a fish species is cultured, the larger the final mean weight and weight gain is (when the culture phase lasted for five months). The length of time the fish are cultured depends on how easily they can find water. However, in rice-fish culture, the size of the fish during stocking is very important. The larger size fingerlings (juveniles) of catfish that were stocked grew quickly because they could consume the pelleted feed quickly. The faro 44 cultivar grew noticeably higher in our trial, and the genetic variations between the cultivars were blamed for this, which is consistent with the conclusion reached by [10].

However, improved growing circumstances in the rice-fish integration were blamed for the much taller rice plants in rice-fish culture as compared to those in rice monoculture. This was most likely caused by increased nutrient availability brought on by fish faeces as well as aeration of the growth medium by the fish's movement. A rice crop with fish has a higher capacity to create and capture nitrogen (n) than one without [11] and fish are known to lower the need for fertilizer [12]. It has been demonstrated that fish in rice fields have the power to consume a variety of insect pests, not the least of which is weeds by eating or uprooting them. Our findings would suggest reducing pesticide use by simply stocking fish. Both the rice growers and the ecology as a whole will benefit from this. Our findings add to the evidence gathered by [11] that rice-fish farmers in Bangladesh employ fewer pesticides than those who cultivate only rice.

With an increase in feeding frequency, it was seen that the fishes' mean weight increased significantly (P 0.05). The survival percentage for the *Clarias* species that were fed commercial feed (X) six days per week was 88%. The culture that produced the largest yields of *Clarias* species at 5400 kg/pond, according to (Table 2), was also from x.

Table 2. Growth performance and production of *Clarias* sp.

Treatment	Fish species	Stocking density	Mean initial weight(g)	Mean final weight(g)	No. Of fish harvested	Overall weight of fish(g)
X	<i>Clarias</i> sp.	100	22	600	88	54000
Y	<i>Clarias</i> sp.	100	20	590	86	40000
Z	<i>Clarias</i> sp.	100	23	550	89	38500

In Table 2, the average fish weight, stocking density, mean initial weight, mean weight gain, and mean final weight are all listed. In treatments x, y, and z, catfish had a mean initial weight of 22 g, 20 g, and 23 g, and it had a mean weight of 600 g, 590 g, and 550 g, respectively. Catfish gained an average of 578 g, 570 g, and 527 g in weight. This outcome is comparable to [13] findings in Dadin-kowa, Gombe State, Nigeria.

The growth performance of the fish varied from 239.5 ± 7.04 (x), 265.5 ± 6.25 (y) and 304 ± 4.12 (z) in their mean weight while survival rate and yield are at respectively at the high levels from pond x to moderate in pond y to lowest in pond z (Table 3).

Table 3. Growth performance of *Clarias* species in the integrated rice – fish farming system.

Treatment	Mean weight	Survival rate	Yield
	<i>Clarias</i> sp	<i>Clarias</i> sp	<i>Clarias</i> sp
X	239.5 ± 7.04 ^a	83.5 ± 0.97 ^a	4833 ^a
Y	265.5 ± 6.25 ^b	79 ± 0.98 ^b	3440 ^b
Z	304 ± 4.12 ^c	73 ± 1.31 ^c	3676.25 ^c

Note: Values reflect means and standard errors, with various superscript letters indicating significant differences at p<0.05 in the same column. Important: supplemental feed, commercial feed, and chicken droppings

Plant height was observed to be significantly higher than (95±0.36) for faro 44. We notice 30 days (23.8±0.53) after transplantation, faro 44 trend continued to 45 days (43.6±0.98) of post-transplantation. This was also observed in number of leaves (Table 4)

Table 4. Plant height (cm) and leaf count for two rice varieties in a rice-fish farming system at different post-plantation times.

Days	Plant Height(cm)	No. of leaves
	Faro 44	Faro 44
30 days	23.8±0.53	10.5±0.32
45 days	43.6±0.98	19.1±0.60
60 days	64.9±0.19	28.1±0.15
75 days	95±0.36	44.8±0.50

Note: Values reflect averages; superscript letters in the same column denote differences that are significant at p<0.05.

Feeding rates were examined, and it was found that they significantly affected plant height, seed production, leaf production, and catfish growth performance (p<0.05). For faro 44, the yield of rice, plant height, seed quantity, and leaf count were all high; this may be attributed to nutrient enrichment, availability, and a favorable environment for growth, as demonstrated by the current study. These are similar to the findings of [14], who claimed that high nutrient availability can be used to explain rice and fish growth performance in integrated rice fish farming. The fish can also obtain food from the surrounding environment, such as earthworms, planktons, insects, and young tilapia species, in addition to the feed that is provided. The maximum rice and fish yield was found in pond x, and the feeding rate revealed high yield, indicating that the integrated system was beneficial for the expansion and effectiveness of rice and fish production. This outcome is consistent with what [15] and [16] found. as seen in the current study, faro 44 is suited for rice-fish farming systems due to its high yield, plant height, and number of leaves, all of which may be related to the rice's genetic makeup.

Due to the genetic makeup of the cultivar, plant height can be predicted. Furthermore, environmental conditions, such as the level of soil fertility, may have an impact on plant height. Due to factors in the environment, including soil fertility, temperature, fish faeces, and aeration of the growth medium as the fish move around, the plant height recorded during the study period was high. There is no significant relationship between the length and weight of the fishes among the entire experimental ponds except for pond x which indicate significant difference (Table 5). Regression analysis representing the path of relationship between the growth parameters in all experimental ponds is shown in (Fig. 2).

Table 5. Regression analysis output of length and weight of the fishes in all experimental ponds.

Treatments	Intercept	R-square value (%)	P-value
X	In.length= -1.445 + 0.850 ln.weight	81.83	0.000
X1	In.length= 5.442 + 0.094 ln.weight	31.08	0.094
Y	In.length= 4.127 + 0.443 ln.weight	27.29	0.121
Y1	In.length= 0.127 + 0.559 ln.weight	23.36	0.157
Z	In.length= 2.589 + 0.108 ln.weight	6.48	0.478
Z1	In.length= 2.245 + 1760 ln.weight	20.34	0.191

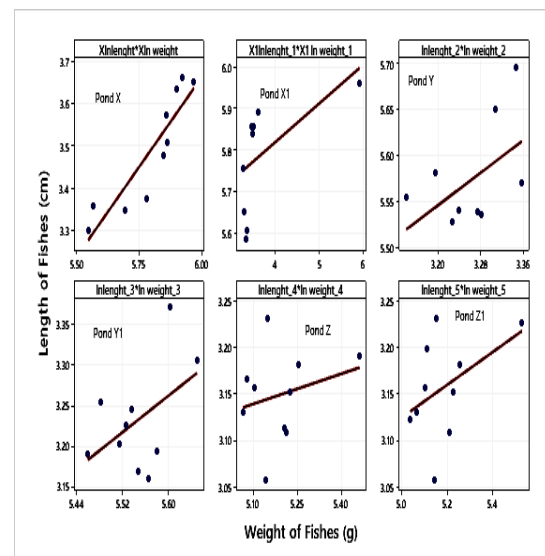


Fig. 2. Relationship between length and weight of the fishes in the experimental ponds.

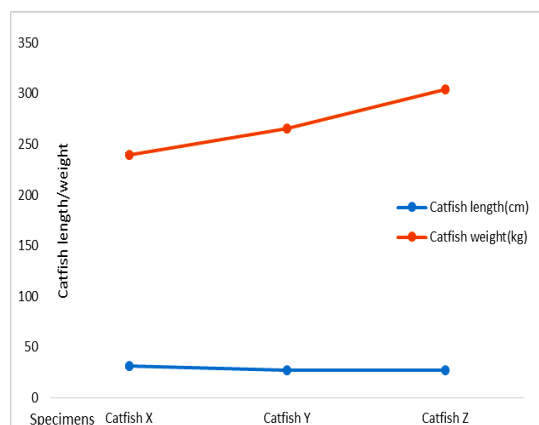


Fig. 3. Length (cm) and weight (g) of catfish in a rice- fish farming system among three treatments.

The pattern in length of the catfish is shown to increase from pond x through to y and z while the weight of catfish was invariable all through the experimental ponds (Fig. 3). Mean of fishes in pond x (0.98)^b and x1 (0.96)^b have been observed to be significantly difference as compared to the mean of fishes in ponds y (1.52)^a, y1 (1.58)^a and z (1.68)^a, z1 (1.66)^a respectively which have shown an increased steepness in pattern of growth aligned to the standard (Fig. 4).

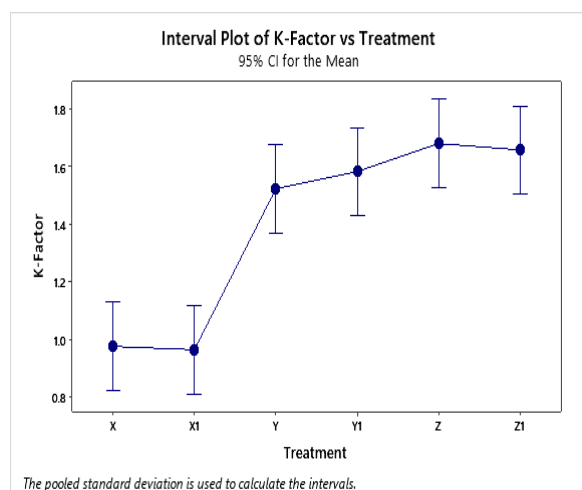


Fig. 4. Condition factor of the fishes in all the experimental ponds.

CONCLUSION

The progress performance of the fish species and rice yield are encouraging based on the results obtained. Rice-cum fish is possible. The longer a fish species is cultured, the higher the final mean weight and weight gain, according to studies (where the culture period lasted for five months). When composts and additional feeds are used precisely in rice-fish culture methods, fish yield can be increased. Pond preparation's primary goal is to increase the yields of tiny fish, which serve as the fishes' regular source of nutrition. Rural areas have a lot of potential for improving food security and nutritional deficiencies through rice-fish farming. Additionally, it offers employment and surroundings that are cleaner and healthier. However, in rice-fish culture, the size of the fish during stocking is very important. The larger size fingerlings (juveniles) of the catfish species that were stocked grew rapidly because they could consume the pelleted feed quickly.

REFERENCES

- Purkait ST, Abraham TJ, Karmakar S, Dey B, Roy A. Inhibition of fish pathogenic *Aeromonas hydrophila* and *Edwardsiella tarda* by *Centella asiatica* in-vitro. J Aquac Res Dev. 2018;9(2):10-4172.
- Ugwumba CO. Environmental sustainability and profitability of integrated fish cumcrop farming in Anambra State Nigeria. Agric J. 2010;5(3):229-33.
- Parvez MS, Salekuzzaman M, Hossain ME, Azam K. Economics and productivity of rice cum freshwater prawn (*Macrobrachium rosenbergii*) in the gher farming system. Int Res. 2012;1(3):39-49.
- Tsuruta T, Yamaguchi M, Abe SI, Iguchi KI. Effect of fish in rice-fish culture on the rice yield. Fish Sci. 2011;77(1):95-106.
- Tsuruta T, Yamaguchi M, Abe SI, Iguchi KI. Effect of fish in rice-fish culture on the rice yield. Fish Sci. 2011;77(1):95-106.
- Halwart M. Biodiversity, nutrition and livelihoods in aquatic rice-based ecosystems. Biodiversity. 2008;9(1-2):36-40.
- Berg H. Rice monoculture and integrated rice-fish farming in the Mekong Delta, Vietnam—economic and ecological considerations. Ecological economics. 2002 Apr 1;41(1):95-107.
- MacKay KT, editor. Rice-fish culture in China. IDRC; 1995.
- Eyiunmi AF. Prospects and Problem of Rice-Fish Culture in Nigeria. National Institute for Freshwater Fisheries Research, Maiduguri Zonal Office Borno State. 2003.
- Rasowo J, Auma E, Ssanyu G, Ndunguru M. Does African catfish (*Clarias gariepinus*) affect rice in integrated rice-fish culture in Lake Victoria Basin, Kenya?. Afr J Environ Sci Technol. 2008;2(10):336-41
- Gupta MV, Sollows JD, Mazid MA, Rahman A, Hussain MG, Dey MM. Integrating aquaculture with rice farming in Bangladesh: feasibility and economic viability, its adoption and impact. ICLARM; 1998..
- Cagauan AG, Arce RG. Overview of Pesticide Use in Rice-Fish Farming In Southeast Asia. In: Rice-Fish Research and Development in Asia. De La Cruz C. R., Lightfoot C., Costa-Pierce B. A., Carangal V. R., Bimbao M. P. (Eds), Pp. 217-234, Iclarm Conference Proceedings 24, 1992;457 P.
- Sule DO, Bello M, Diyaware MY. Polyculture and fish yield in rice-cum-fish culture system in Dadin Kowa, Gombe, Nigeria. Anim Res Int. 2007;4(3).
- Billah, M.M., Uddin, M.K., Samad, M.Y., Hassan, M.Z., Anwar, M.P., Kamal, A.H.M. and Shahjahan, M. Fertilization effects on the growth of common carp (*Cyprinus carpio*) and Nile tilapia (*Oreochromis niloticus*) and rice yields in an integrated rice-fish farming system. Aquac Aquar Conserv Legis. 2019;12(1):121-132.
- Billah MM, Uddin MK, Samad MY, Hassan MZ, Anwar MP, Kamal AH, Shahjahan M. Effects of different stocking density of Nile tilapia (*Oreochromis niloticus*) and common carp (*Cyprinus carpio*) on the growth performance and rice yield in rice-fish farming system. Aquac Aquar Conserv Legis. 2020;13(2):789-803.
- Mohanty RK, Verma HN, Brahmanand PS. Performance evaluation of rice-fish integration system in rainfed medium land ecosystem. Aquaculture. 2004;230(1-4):125-35.