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Fingerlings Production and Cost Benefit Analysis of (*Clarias gariepinus*) Brood stock Fed Different Inclusion Levels of (*Azanza garckeana)* Pulp

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ABSTRACT

The study focused on the production of Clarias gariepinus fingerlings produced from Clarias gariepinus broodstock fed inclusion levels of Azanza garckeana. Clarias gariepinus broodstock fed different inclusion levels (0, 5, 10, 15 and 20%) of Azanza garckeana pulp meal, representing diet 1, 2, 3, 4 and 5 in a randomised complete design. The result showed that fish fed with 20% A. garckeana had the highest oocyte and significantly different (p<0.05) from fish fed other diets. 10% inclusion level had the highest percentage hatchability (98%) followed by 5% (96%), 15% (92%), 20% (76%) and the least 0% (62%). At the end of the experiment highest survival of fingerlings were in inclusion levels 5% and 10%. The best cost benefit ratio (CBR) and profit was in 10% inclusion (0.60 and ₦2, 441), followed by 5% inclusion (0.47 and ₦2, 060.22), 15% inclusion (0.35 and ₦1, 746.52), 0% and 20% had negative CBR and profit.

Keywords: *Broodstock, Azanza garckeana, Cost Benefit, Clarias fingerlings.*

INTRODUCTION

Fish is the major source of protein consumption and source of food for human, providing significant portion of nutrient to a large proportion of the people particularly in the developing world (Onyia *et al.*, 2011). Fish require good quality fish feed in high proportion in order to increase the quality of eggs and sperm fertility, so as to achieve maximum protein intake needed for proper growth (Hassan, 2001). In fish production under intensive method, attempts are made to obtain quality eggs and sperm, to produce highest possible number of good quality seeds. Several factors that affect fish seeds quality includes different strains, genetics, nutrition, contents of feed, pH, temperature and activities of modern aquaculture which have introduced several substances such as organic matter, chemicals such as fertilizers and insecticides into the water used as cultured medium (Canyurt and Akhan, 2008). Common practices in hatcheries such as transportation, handling, cleaning, use of chemicals, overstocking; water quality problems are also factors that may negatively influence reproduction (Adeparusi*et al.*, 2010). These common factors affect fertilization success in artificial reproduction commonly used for aquaculture production. As a result of these factors, low quality fish seeds are produced (Adeparusi*et al.*, 2010).

The need for high quality fish seed has necessitated research into various ways of improving egg quality and enhancing fertility of sperm to meet the world protein demand. However the continuing expansion of aquaculture requires shifting from synthetic drugs to natural plants. According to Adedeji *et al.* (2006), wild fruits that have potentials in enhancing egg quality and sperm fertility that are not recognized and valued, are now been investigated, evaluated and included into fish feeds with little or no side effects on the fish. Hence the use of wild fruits as medium to improve egg quality and enhance fertility is now receiving some attention. Dada and Ajilore (2009) used extract of *Garcinia kola* seed to enhance fertility in *Clarias gariepinus,* and Adeparusi *et al* (2010), used *Kigelia Africana* fruit meal to enhance fertility in male *C. gariepinus*.

Nash (2011) defines Aquaculture as the rational rearing of fish and other aquatic organism in control water body. The area in which the Fisheries potential of Nigeria could be exploited is dependent upon factors such as availability of good quality and inexpensive feed ingredients for the formulation of high nutritive compounded feed supplement that will improve the quality of egg and sperm fertility. This feed supplement bring greater yield in the control condition than when the fish are left to depend upon natural aquatic feed (Naylor *et al.,* 2001), this necessitates the need to source for locally available feed ingredient of which wild fruit *Azanza garckeana* pulp meal suffice. *A. garckeana* popularly known as “Morajwa” (African chewing gum) in Botswana, Azanza is widely known as tree hibiscus, 3 snot apple, wild hibiscus (Orwa*et al.,* 2009), and “Gorun Tula” in Northern part of Nigeria (Gombe State). *A. garckeana* is a valuable edible indigenous fruit tree species. In Nigeria, *A. garckeana* is found in Tula, Kaltungo Local Government Area of Gombe State. *A. garckeana* is a deciduous shrub or small spreading tree, 3-13m high, with a diameter at breast height of up to 25cm (Orwa*et al.,* 2009). FAO (1983) reported that *A. garckeana* grows naturally in semi-arid areas receiving lowest annual rain fall of 250mm and height rain fall of 1270mm. Orwa *et al.* (2009) stated that the mean annual rain fall is between 250mm to 500mm with attitude of 0 – 1900m. The fruit has rough and hairy bark; it is grayish brown in colour, fibrous with longitudinal fissures and brown to yellow slash, young *Branchlets stellate – tomentose* becoming glabrescent when mature. According to Orwa*et al.* (2009) the fruit is 2.5 – 4cm in diameter, clearly divided into 5 segments, the fleshy gummy pulp which is generally eaten are a good source of proteins, minerals, fiber, vitamins, and contains five seeds inside with a seed in each segment. The seed is hemispherical in shape, up to 10mm long, 7mm thick with brownish and woolly floss.

The *Clariids* constitute an excellent food fish of high commercial value. It is very important to sustainability of aquaculture industry in Nigeria (Owodeinde and Ndimele, 2011). Catfish (*C. gariepinus*) is one of the most important groups of farmed fishes in the world; it commands a very good commercial value in Nigerian markets (Ayinla, 2003). They are characterised by their ability to grow and develop on a wide range of both artificial and natural feed. It has a very high yield potential, tolerance to low oxygen and has the capacity to grow fast in both intensive and extensive culture system (Anene *et al.*, 2012). Catfish produces thousands of eggs in a breeding period; withstand both handling and environmental stress (Oresegun *et al.*, 2007). It can also withstand disease and many other adverse conditions that can kill some species of fish (Anene *et al.*, 2012). Catfish are very popular to fish farmers and consumers. Ayinla (2003) reported that feeds accounts for at least 60% of the total cost of fish production in Africa, and Kassahun *et al.* (2012) reported that fish feeds accounts for 40-60% of the total cost of fish production in Africa which to a large extent determines the viability and profitability of fish farming enterprise. Fish nutrition has advanced in recent years with the development of new balanced commercial diets that promote optimal fish growth and health (Craig and Helfrich, 2002). According to Abowei *et al.* (2011), the development of new species specific diet formulations supports the aquaculture industry as it expands to satisfy the increasing demand for affordable, safe and high quality fish and sea food products. The objectives of this study are to estimate the fertility and hatchability of broodstock fed varying inclusion level of *A. garckeana* pulp meal evaluate the effects of fingerlings production using different inclusion levels of A. garckeana pulp meal and determine the cost benefit of using *A. Garckeana* pulp meal to produce fingerlings in hatcheries within the Northeast of Ni geria.

MATERIALS AND METHODS

Study Area

The study was carried out at Modibbo Adama University of Technology, Yola Teaching and Research Fish Farm.

Source of Broodstock

Forty-five *Clarias gariepinus* male and female broodstock were collected from the Department of Fisheries production ponds and randomly stocked in five 2 x 4m concrete tanks. The fish were fed different diets with different inclusion levels of *A. Garckeana* pulp meal for fifty-six days.

At the end of the feeding trial, one male and female brood stock were randomly selected from each treatment for artificial inducement to produce fingerlings. Eggs were stripped from the females after 10 hour latency period, weighed and fertilized with the milt from each in the treatment. Fertilized eggs were incubated for 24 hour until the eggs were hatched. The hatchlings were reared for fingerlings production.

Total Revenue Value (TRV) =Total Sales of fingerlings

Net Profit Value (NPV) = Total sales of Fingerlings - Total Cost of Production (₦)
Profitability Index (PI) =
Cost Benefit Rate was calculated using the formula:
CBR = NetProfit (₦)/Investment Cost Analysis (₦)

Data Analysis
The data was analysed using SPSS software and LSD to determine the significant level.

RESULTS
The cost of Broodstock used in all the treatments, *Azanza garckeana* pulp meal and labour are shown in Table 1.The total variable cost(TVC) for the treatments are D1(11,246), D2(11,719.78), D3(11,339), D4(11,343.48) and D5(11.418.66).The TVC increased with the inclusion of *A. garckeana*.

Table1: Cost Of Broodstock, Fish Feeding And Labour

Parameters	D1	D2	D3	D4	D5
2 Broodstock	6000	6000	6000	6000	6000
Feed for Broodstock	296.00	269.78	289.1	243.48	268.66
	411.12g	374.7g	401.5g	338.16g	373.14g
Cost of *A.garckeana*	0.00	50	100	150	200
Cost of Hormone	1500	1500	1500	1500	1500
Cost of feedingHatchlings(₦)	650	650	650	650	650
Total cost of feeding(₦)	946.00	969.78	1039.1	1043.48	1118.66
Cost of Labour	3,600	3,600	3,600	3,600	3,600
Total Variable cost	11,246	11,719.78	11,339	11,343.48	11.418.66

The performances of the broodstock are shown in Table 2. The total weight of eggs obtained was highest in D5 (149.66g), followed by D1 (146.05g), D3 (121.26g), D2 (114.65g) and the least D4 (111.65g). There was very high significant difference among the treatments in the total weight of eggs. The number of eggs/gram was highest in D1 and the least in D2. There was very high significant difference among the treatments in the total number of eggs/gram. The percentage hatchability was highest in D3and the least was in D1; there was significant difference among the treatments. The percentage survival and revenue from the sales of fingerlings was highest in D2 (90% and ₦6480), followed by D3 (88% and ₦6480), D4 (84% and ₦5790), D5 (56% and ₦3180) and the least in D1 (40% and ₦1860). There were significant differences in the survival and revenue from the sales of fingerlings.

Table 2: Performance of broodstock fed different inclusion level of *A. garckeana*

PARAMETERS	D_1	D_2	D_3	D_4	D_5	SEM
Total wt. of eggs (a)	146.05	114.65	121.26	111.65	149.66	13.78
1g of egg (b)	1320	900	1020	1240	1060	27.83
Eggs incubated	250	250	250	250	250	
No. of hatchlings/ % Hatchability(c)	155 (62%)	240 (96%)	245 (98%)	230 (92%)	190 (76%)	1.03
Survival/ % Survival(d)	62 (40%)	216 (90%)	216 (88%)	193 (84%)	106 (56%)	0.88 1.71
Sales @ ₦30/ fingerlings	1860	6480	6480	5790	3180	

Means with different superscripts on the same row are highly significant at ($p \leq 0.0001$).

From Table 3, the NPV in D1 and D5 had negative values while D3 had the highest (2441), whereas, D2 and D4 were (2060 and 1746.52). D1 and D5 had negative values of CBA and PI, while the others had positive CBA and PI. However, D3 had the best CBA (0.6).

Table 3: Profit and cost benefit of fingerlings raised using different inclusion levels of *A. garckeana* pulpmeal

Parameters	D1 (0%)	D2 (5%)	D3 (10%)	D4 (15%)	D5(20)
TRV	1800	6480	6480	6792	3180
NPV	-2146	2060.25	2441	1746.52	-938.66
CBA	-0.54	0.47	0.6	0.35	-0.23
TVC	3946	4419.75	4039	5045.48	4118.66
PI	-2.21	2.12	2.35	1.67	-0.84
Incidence of Cost(r)	6.10	4.49	4.81	5.41	10.55

KEYS
TRV= Total Revenue Value
NPV= Net profit value
CBA= Cost Benefit Ratio
TVC= Total Variable Cost
PI= Profitability Index

DISCUSSION

The need for high quality fish seed has necessitated research into various

ways of improving egg quality and enhancing fertility of sperm to meet the world protein demand. However the continuing expansion of aquaculture requires shifting from synthetic drugs to natural plants. According to Adedeji *et al.* (2006), wild fruits that have potentials in enhancing egg quality and sperm fertility that are not recognized and valued, are now been investigated, evaluated and included into fish feeds with little or no side effects on the fish. Hence the use of wild fruits as medium to improve egg quality and enhance fertility is now receiving some attention. Dada and Ajilore (2009) used extract of *Garcinia kola* seed to enhance fertility in *Clarias gariepinus,* and Adeparusi *et al* (2010), used *Kigelia Africana* fruit meal to enhance fertility in male *C. gariepinus*.
In this study, *A. garckeana* enhance the fertility and hatchability of eggs resulting into high fingerlings production. All the treatments with different inclusion levels of A. *Garckeana* pulp meal produced more fingerlings than the control without *A. garckeana*. This is in agreement with the work of Dada and Ajilore (2009) and Adeparusi *et al* (2010) that used extract of *Garcinia kola* seed and *Kigelia Africana* fruit meal to enhance fertility and fingerlings production in *Clarias gariepinus.*
Inadequate production of viable fingerlings is a great challenge in fish hatchery business in Nigeria and especially in Northeast of Nigeria. There is therefore the need to explore the best option to maximise to profit in the business. Cost Benefit Analysis (CBA) of the investing into the business become imperative. CBA is a systematic process of calculating and comparing benefits and costs of a project, decision or government policy (David *et al*., 2013). According to Cellini and Kee(2015), the main purposes of CBA are to determine if is a sound investment or decision and to provide a basis for comparing total expected costs of each option against the total expected benefits. From this study, the best CBA was the 10% inclusion level *A. garckeana* that had 0.6 when compared to the other treatments. This therefore, is in agreement with definitions of David *et al*., 2013 and Cellini and Kee (2015).

Moreover, Michael *et al*., 2015 reported that 15% inclusion *A. Garckeana* seed meal gave the best CBA in *Clarias gariepinus* juveniles (0.33), showing that the CBA for using the same inclusion of the pulp meal gave a better result (0.35). The Profit Index and CBA of the control had the negative values compared to the best CBA and PI in this study. This result disagrees with the result of Michael *et al*., 2015 where the best CBA had lower PI from the other treatments.

CONCLUSION

The best cost benefit ratio (CBR) and profit of *A. garckeana* to produce fingerlings was in 10% inclusion (0.60 and N2, 441). This showed that in investment in fingerling production would be viable and profitable. However, the treatments that had negative CBR should not be invested into to avoid loss of investment.

Therefore, Fish hatchery Managers are encourage to use 10% inclusion level to produce more fingerlings and make profits from their business.

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