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Economics of fish fingerlings production in outdoor culture system

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ABSTRACT: The cost of acquiring a fingerling for stocking had always been haphazardly fixed to the detriment of the fish farmer because the cost of acquisition has no economic consideration of its cost of production. More often that not the fish farmer pays more far above the cost of production.

This paper looks into the economics of producing one fingerling in two separate outdoor culture systems aerated and unaerated.

The paper concludes that it is cheaper to produce a fingerling under unaerated system than the aerated one even though highest survival was obtained at stocking density of 250fry/m^3 in aerated ponds while stocking density of 1,500 fry/m^3 gave the least survival rate in both aerated and unaerated treatments.

Key Words: Unit cost; Fish Production, Fingerling, Aerated system, Unaerated system.

Introduction

Economic analysis is an important part of fish farming activities. It allows farm managers to evaluate the performance of the farm and project managers to assess impacts of development programmes and food production, household food security and the economy (Brugere, 2003). The need to increase fish production in Nigeria has become most desirable because of the exorbitant cost of beef. This need is further enhanced by the ban on importation of frozen and stock fish. The source of new production will be mainly through fish farming. A reliable and consistent source of fish seeds is a pre-requisite for successful fish farming enterprises and a reliable source of fingerlings for stocking ponds is to breed the fish in the hatchery. Production under hatchery conditions ensures maximum survival of fry through adequate care and management. Investment in hatchery system is therefore considered a reasonable project.

Fish breeding, sometimes referred to, as fingerling production or hatchery management is a development in aquaculture in the World, in fact not up to 30 years old in Nigeria. The cost of acquiring a fingerling for stocking has always been haphazardly fixed to the detriment of the fish farmer because the cost of acquisition has no economic consideration of its costs of production. More often than not the fish farmer pay more far above the cost of production.

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Aeration has been successfully used in outdoor hatcheries to improve the growth and production of fry to fingerling by Dada, 2001 and Dada *et al*., 2002. In view of this, there is a clear need to look at the cost of producing fingerlings in two separate outdoor culture systems, aerated and non-aerated.

The focus of this paper is to evaluate the cost structure to determine the unit cost of fish fingerling production of two separate outdoor nursery systems, aerated and non-aerated.

Materials and Methods

The experimental fry were obtained by induced spawning with hormonal injection. The fry were reared in indoor hatchery for three weeks as described by (Dada *et al*., 2000). Prior to transfer of the fry into the outdoor concrete tanks (2mx2mx1m), each tank was filled with filtered water to a depth of 0.5m and maintained at that level. Dried pig manure was applied as the initial ponds fertilizer at $100g/m^2$ to develop plankton blooms. At the start of the experiment, pooled fish were weighed and the length measured. Acclimated catfish fry were randomly assigned to each of the 24 experimental tanks at different stocking densities. The stocking densities adopted were 500, 1000, 1500, 2000, 2500 and 3000 fry per tank which translated to 250, 500, 750, 1000, 1250 and 1500 fry per m^3. The fry densities were based on the previous work on the same species. *H. bidorsalis* by Dada *et al*., (2000). Twelve of the tanks were aerated while the remaining twelve were not aerated.

Throughout the experimental period, the fry were fed a powdered artificially prepared feed containing 40% crude protein using fish meal (14.70%). Soybean meal (54.10%), blood meal (4.70%), yellow maize (25.00%), vegetable oil (1.00%) and vitamin premix (0.50%) twice daily between 9.00am) and 6.00pm at 40% of their body weight according to Dada *et al*., (2002). Every two weeks, about 30% of the fish populations were weighed using electronic top-loading balance (Mettler E200) and fast growers ("Jumpers") were separated from the experimental stock. The amount of feed was adjusted every two weeks based on the total weight of fish.

Dissolved oxygen, pH and temperature were determined following the methods described by Boyd (1981). Mean weight gain was calculated using the approach of Pitcher and Hart (1982), specific growth rate was obtained according to Brown (1957). The experiment lasted 10 weeks. At the end of the experiment, the total number of fish in each tank, mean number of "jumpers" and mean survival percentage were estimated.

Care was taken to take adequate financial records of fixed items of cost and variable items of cost utilized in the two culture systems throughout the period of experiment.

Statistical Analysis

The data collected were subjected to one-way analysis of variance and difference among meanswere detected by the Least Square Difference Multiple Range test at the 5% probability level (Sokal and Rohlf, 1981).

Results and Discussion

Table 1 shows the fixed assets depreciated for outdoor aerated ponds while Table 2 shows the total variable cost of producing fingerlings in the aerated and non-aerated outdoor culture system. The highest total cost (₦4,022.27) of producing fingerlings was obtained in aerated tank with stocking density 500 fish/tank while the least total cost (₦670.92) was obtained in non-aerated tank stocking density 3000 fish/tank. The total cost of producing fingerlings decreased significantly ($P<0.05$) with increase in stocking level and ranged between ₦1,178.08 to ₦4,022.87 aerated tanks while the total cost ranged between ₦670.97 to ₦2,560.77 in non-aerated tanks.

Table 3 shows the total cost of production i.e. fixed cost and variable cost while Table 4 shows the unit cost of producing fingerlings in the outdoor culture systems. The unit cost ranged between ₦7.66 and ₦12.32 in outdoor aerated tanks while the range was between ₦3.03 and ₦10.83 in non-aerated tanks observed to vary with the stocking levels. The highest unit cost of production ₦12.32 was obtained with 50 fish/tank aerated tanks while the least unit cost of production ₦3.05 was obtained in 3000 fish/tank in non-aerated.

Table 1: Fixed Assets Depreciation for Aerated Ponds.

S/No.	Cost Item	Life Span (yrs)	Cost Price(₦)	Salvage Value (CP-10%)	Yearly Depreciation Value
1.	Ponds (No.12) 2mx2mx1m	25	60,000	6,000	2160
2.	Empty Gas cylinder(1)	20	2,000	200	90
3.	Car compressor 504 (1)	5	2,200	220	396
4.	Engine pulley (1)	5	400	40	72
5.	Roll of ⅜" x m^2 Horde (1 bundle)	1	2,300	230	2070
6.	Electric motor (1)	3	1,200	1,200	3600
7.	Dongil Fan Belt (1)	1	250	25	225
8.	Engine wire (4yds)	5	240	24	43.20
9.	Small Hose (47yds)	1	1,410	141	1269
10.	Coil of 2.5m twin earth cable	5	200	20	36
11.	15A plug tap (4 No.)	5	200	20	36
12.	15A Socket (4 No.)	5	640	64	115.2
13.	Screw nails of 9"x6"	5	50	5	9.0

The results of this study have shown that total cost of production decreased with increased stocking level. Fish stocked at higher densities showed a significant decreased in total cost of production and unit cost of producing fingerlings.

Survival increased in aerated tanks compared with non-aerated tanks (Table 4). Although average final weight was not significantly different among aeration treatments. Most mortality in tanks occurred during the first two weeks of stocking. This may be due to change in the environment of the fish from the indoor and outdoor tanks which require acclimatization of the fish to the new environment. The water quality parameters measured were within the desired range recommended for Clariid catfishes by Veveen *et al*., (1986).

The result of the study for the stocking level of 2000 fish/tank aerated and stocking level of 1500 fish/tank non-aerated tanks shows the least unit cost of production. These are more economical and this fact should be taken into account when stocking outdoor nursery tanks for practical fry rearing to fingerlings stage. It is also the stocking level to be recommended to private hatchery owners/operators towards setting unit price affordable by the farmers.

Most hatcheries in Nigeria are in private hands giving an impression that hatchery produced fingerlings are already privatized. This statement is even more valid from the standpoint that the government hatcheries scattered all over Nigeria are not functioning. This study indicated that hatchery produced fingerlings should not be sold more than ₦15 per fingerling, giving 25% mark up price on the cost of production against the current sale of between ₦25 - ₦50 per fingerling. If this is done, fish farmers will be able to increase their stocking level which will ultimately lead to increase fish production in Nigeria.

Table 2: Total variable cost of producing fingerlings in the aerated and non-aerated outdoor culture system (Paper 4037).

	Aerated						Non-aerated					
S/No.	**Feed (#)**	**Labour (#)**	**Hormone (#)**	**Electricity (#)**	**Breeder (#)**	**Total cost (#)**	**Feed (#)**	**Labour (#)**	**Hormone (#)**	**Electricity (#)**	**Breeder (#)**	**Total cost (#)**
1.	3360	110.7	416.67	52.217	83.33	4022.82	1950	110.77	416.67	-	83.33	2560.77
2.	5478.2	110.7	416.67	52.217	83.33	6140.87	889	110.77	416.67	-	83.33	1499.77
3.	2282	110.7	416.67	52.217	83.33	2944.87	786.8	110.77	416.67	-	83.33	1392.57
4.	1439.2	110.7	416.67	52.217	83.33	2102.07	274.4	110.77	416.67	-	83.33	885.17
5.	890.4	110.7	416.67	52.217	83.33	1553.28	247.8	110.77	416.67	-	83.33	858.57
6.	515.2	110.7	416.67	52.217	83.33	1178.08	60.2	110.77	416.67	-	83.33	670.97

Table 3: Total cost of production in the aerated and non-aerated outdoor culture systems.

S/No.	Aerated			Non-Aerated		
	Fixed Cost (₦)	**Variable Cost (₦)**	**Total cost of production (₦)**	**Fixed Cost (₦)**	**Variable Cost (₦)**	**Total cost of production (₦)**
1.	179.78	4022.82	4202.65	179.78	2560.77	2740.55
2.	179.78	6140.87	6320.65	179.78	1499.77	1679.55
3.	179.78	2944.87	3124.65	179.78	1397.57	1577.35
4.	179.78	2102.87	2282.65	179.78	885.17	1064.95
5.	179.78	1553.28	1733.06	179.78	858.57	1038.35
6.	179.78	1178.08	1357.86	179.78	670.97	850.75

Mean values in the same vertical row with similar alphabets are not significantly different (P>0.05). Values are means of two replicates.

Conclusion

This study concludes with the observation that raising fry to fingerlings stage before distribution to private hatchery owners is best done at the stocking level of 2000 fry/tank where cost of aeration facilities could be afforded and at 1,500 fry/tank where cost of aeration could not be afforded. In either of the two culture systems (aeration and non-aeration) fry raised to fingerlings could be sold at #15 per one to fish farmer. Such selling price will lower cost of input in fish farming and possibly lower selling price of table-size fish in the market.

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Table 4: Unit cost of producing fingerlings in the aerated and non-aerated outdoor systems.

Tanks	Aerated					Non-aerated				
	INItial average weight(g)	Final average weight(g)	No. of fish survived	Total cost of production(#)	Unit cost of production(#)	Initial average weight (g)	Final average weight(g)	No. of fish survived	Total cost of production (#)	Unit cost of production(#)
1.	0.06	7.19[a]	341	4202.65[a]	12.32[a]	0.05	4.59[a]	253	2740.55[a]	10.83[a]
2.	0.06	5.91[a]	632	6320.65[b]	10.00[a]	0.05	2.20[a]	416	1679.55[b]	4.04[b]
3.	0.06	4.72[a]	660	3124.65[c]	4.73[b]	0.05	2.13[a]	518	1577.35[b]	3.05[d]
4.	0.06	3.75[a]	624	2282.65[d]	3.66[b]	0.05	2.02[a]	218	1064.95[c]	4.89[c]
5.	0.06	3.40[a]	390	1733.06[e]	4.44[b]	0.05	1.35[b]	218	1038.35[c]	4.76[c]
6.		2.57[a]	303	1357.86[c]	4.48[b]	0.05	1.45[b]	163	850.75[d]	5.22[c]

Mean values in the same vertical row with similar alphabets are not significantly different (P>0.05 values are means of two replicates.

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