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MANAGEMENT OF INPUTS RESOURCES IN SMALL-SCALE CATFISH FARMING IN OYO STATE, NIGERIA

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ABSTRACT

This study examined management of pre-stocking, stocking and harvest activities of small-scale catfish farmers in Oyo State, Nigeria. Structured questionnaires were used to collect the needed information and descriptive statistics was use to analyze the collected data. The results show that earthen and concrete pond are the two major ponds utilized by catfish farmers. The cost of pond construction varied with size, location, soil type and the cost of materials; so most farmers rented their ponds. The dimension of earthen pond varies between 53.51m^2 and 891.87m^2 with a mean of 197.34±2.48m^2. The dimension of concrete pond varied between 13.94m^2 and 83.61m^2, with a mean of 45.89 ± 8.04m^2. Many (41.5%) catfish farmers financed their business with their personal savings. Most fish farms are located close to streams for steady supply of water. Most (68.5%) farmers stocked juvenile while 31.5% stocked fingerlings. Farmers fed their fish with respect to their weight, satiation or availability of feed; but majority fed twice per day. Most farmers harvest catfish twice per year. Farmers should therefore know that proper and efficient management of input variables are prerequisite for profitability in catfish production.

Keywords: Earthen pond; juvenile; fingerlings; feed; Water; Profitability

INTRODUCTION

Fish farming provides full or part-time job opportunities for many individuals that are interested in making their livelihood from the business. The business of fish farming has been established in Nigeria; but it is not evenly distributed as noted by Dauda *et al*. (2015). However, fish farming in Nigeria is majorly practiced as small-scale business. Fish farming can be integrated with other forms of agricultural business, such as crop and livestock farming with appreciable returns. The objective of commercial fish farming is to produce fish to market at a competitive price and make profit. It is generally believed that fish farming business is a viable and profitable business; it is a good antidote to non-employment and poverty (Iruo *et al*. 2018). However, it must be remembered and emphasized that fish farming is a demanding and relatively risky business.

Fish farming business, irrespective of scale of production is a management-intensive business. Catfish production requires intensive management that covers nursery management, stocking density, pond management, daily water quality monitoring, adequate feeding management, labour management,

sorting, security, etcetera (Dauda *et al*. 2017; Engle, 2010).

The essence of management in catfish farming business is to the reduce cost of production by efficient use of input resources and to increase profitability. If small scale fish farming is poorly managed, capital invested can be lost quickly. According to Engle (2010), catfish farmers need to ask themselves some critical questions such as: What type(s) of fish species should be produced? Is there market or demand for the fish to be produced? What quantity of fish is to be stocked? What is the source of water? Is it available in the right quality and quantity? How much input should be used? How can the resources be combined efficiently? What type of pond is appropriate for the proposed business? Is the chosen land/site suitable for pond construction? What is the optimal size of the business? How should risks be managed? How will the business be financed? Will family members be supportive and helpful? These are questions fish managers must answer sincerely to guarantee success in the business. Therefore, this study aims to examine the management of pre-stocking, stocking and harvest activities of small-scale catfish farmers in Oyo State, Nigeria.

MATERIALS AND METHODS

The Study Area

This study was carried out in Oyo State, south-west Nigeria. Oyo State is bounded in the north by Kwara State, in the east by Osun State, in the south by Ogun State and in the west partly by Ogun State and partly by the Republic of Benin. Oyo State is made up of thirty-three Local Government Areas (LGAs). Oyo State covers approximately an area of 28,454 square kilometers. The capital city of Oyo State is Ibadan. It is blessed with freshwater ecosystem; the state is favored, suitable for aquaculture with little or no record of pollution caused by oil spillage or mining activities.

Sampling procedure and analysis

Structured questionnaire was designed to collect the data needed for this study. The information collected includes data on pre-stocking management activities; earthen pond and concrete pond analysis with stocking and harvest management. A random sampling technique was used in the collection of data. The first stage involved random selection of four local governments in Oyo State. One local government area was selected randomly from each of the four Agricultural extension zones in Oyo State. The agricultural zones under Oyo State Agricultural Development Programme (OYSADEP) are divided into Ibadan/Ibarapa, Ogbomoso, Oyo and Saki. The selected local government areas are Oluyole, Ogbomosho North, Saki West and Iseyin. The second stage involved random selection of registered small-scale catfish farmers in each selected local government areas. In each selected local government area 50 structured questionnaires were administered to give a total of 200 respondents. Descriptive statistics such as frequency, percentage, mean and standard deviation were used to analyze the management activities involved in small-scale catfish production.

RESULTS

Management of Input Resources

Table 1 show that most (44.5%) farmers used earthen ponds; 18.5% used concrete pond; while 37.0% used both the earthen and concrete ponds to cultivate their catfish. This implies that earthen pond is the most used pond in the study area; because it is easier to manage and it maintains good water quality. The cost of construction of ponds varies with respect to some factors. Many (47.5%) catfish farmers reported that the cost of pond construction varied with size and location, other reported that it varied with size only, size and soil type and materials. Most (58.5%) farmers rented ponds while 41.5% owned their ponds. Many (41.5%) farmers financed their business with their personal savings. Many (48.5%) farmers use all available sources of water to run their farms. Among the farmers in the study area, 56.5% analyzed their water while 43.5% did not. Majority of the farmers applied lime and de-mud their ponds for pond preparation and eradication of obnoxious organisms.

Table 1: Pre-stocking Management Activities

Variables	Frequency	Percentage (%)
Pond Categories		
Earthen pond	89	44.5
Concrete pond	37	18.5
Combination	74	37.0
Variation in Cost of Construction		
With size	66	33.0
With size and soil type	36	18.0
With size and location	95	47.5
With materials	3	1.5
Pond ownership		
Owned	83	41.5
Rented	117	58.5
Source of Fund		
Personal savings	82	41.0
Personal saving & Family fund	49	24.5
Personal saving &credit/loan	32	16.0
Family fund	25	12.5
Credit/loan	12	6.0
Water source		
Stream	76	38.0
Well	19	9.5
Borehole	8	4.0
Combination	97	48.5
Water analysis		
Yes	113	56.5
No	87	43.5
Application of lime		
Yes	148	74.0
No	52	26.0
Elimination of Unwanted fish		
Picking	55	27.5
Phostoxin	39	19.5
De-mudding/liming	62	31.0
Combination	44	22.0

Meanwhile, Table 2 shows that the average cost of renting an earthen pond was ₦38,166.67 ± 2082.82 while the cost of construction was ₦129,890 ± 5,552.73. The average dimension of an earthen pond was 197.34 ± 2.48m^2 while the dimension of concrete was 45.89 ± 8.04m^2. The average durability of an earthen pond was 10.42 ± 0.32 years while the durability of concrete was 4.78 ± 0.46 years with good pond management. The number of ponds used by catfish farmers varies between 1 and 30 with an average of 5 ponds. On the average, a catfish farmer used about 5 earthen ponds with or without concrete ponds.

Table 2: Earthen Pond and Concrete Pond Analysis

Statistics	Min	Max	Mean ± SD
Cost of pond rent (₦)	20,000	60,000	38,166.67±2.08
Earthen pond dimension (m^2)	53.51	891.87	197.34 ± 2.48
Number of earthen pond	1	30	4.96±0.76
Earthen pond durability (years)	5	20	10.42±0.32
Cost of construction of earthen pond (₦)	78,000	255,000	129,890±5,552.73
Number of concrete pond	2	10	6.22±1.09
Concrete pond dimension (m^2)	13.94	83.61	45.89±86.55
Concrete pond durability (years)	3	8	4.78±0.46
No fish stocked	200	10,000	2,141.82±237.56

Stocking and Harvest Management

Table 3 shows that most (68.5%) farmers stocked juvenile while 31.5% stocked fingerlings catfish. Most (53%) farmers fed their fish with respect to their age and sizes. Since there is no general method of feeding catfish, an individual farmer follows his mind. Based on these, majority 58.5% fed their fish twice per day. This implies that catfish is best fed twice per day for effective growth and development. Catfish farmers fed their fish with various types of feeds; 13.5% fed their fish with sinking type of feed, 34.5% of the farmers fed their fish with local floating feed, 15.5% fed their fish with imported floating; 5.5% fed their fish with non-conventional feed such as poultry wastes, chicken intestines blood meal etcetera; while 31.0% of the farmers fed their fish with all available feed. These farmers used the opportunity of catfish feeding habit, being an omnivorous animal that can consume anything available in the pond. The farmers justified their actions by confirming that this will either reduce the cost of production or promote fast growth of the fish, or both.

Most (70.5%) farmers carry out sorting while 29.5% did not. This may be as a result of lack of space (non-availability of extra fish ponds). Most (79%) farmers harvest catfish twice in a year. Most (47.5%) farmers employed no labour for the production of their fish. Results shows further that most (78.0%) farmers engaged in table size (growout) catfish production, while 22.0% of the farmers engaged in breeding of fish seed, that is, fingerlings and juvenile catfish. This implies that there are more people engaged in catfish table size production.

Table 3: Stocking and Harvest Management

Variables	Frequency (200)	Percentage (%)
Catfish stocked		
Fingerlings	63	31.5
Juvenile	137	68.5
Feed quantity		
To satiation	47	23.50
Varies with size/age	106	53.0
Availability of feed	26	13.0
Combination	21	10.5
Feeding frequency/period		
Once	49	24.5
Twice	117	58.5
Thrice	19	9.5
Varies with size	15	7.5
Feed type		
Sinking	27	13.5
Local floating	69	34.5
Imported floating	31	15.5
Non-conventional feed	11	5.5
Combination	62	31.0
Fish sorting		
Yes	141	70.5
No	59	29.5
Production frequency/year		
Once	17	8.5
Twice	158	79.0
Thrice	25	12.5
Employed labour		
0	95	47.5
1	42	21.0
2	39	19.5
3	19	9.5
4	3	1.5
>5	2	1.0
Aquaculture enterprise		
Breeding	44	22.00
Grow-out / Table size	156	78.00

DISCUSSIONS

Catfish farming is management intensive. It is the efficient management of input resources that yield expected profits. Earthen pond is the most common fish pond in the study area. This corroborates the findings of Iruo *et al*. (2018) and Ogidi (2016) that most catfish farmers in the Niger Delta Region and Benue State prefer earthen fish ponds. It is economical to construct; maintain good water quality; easy to manage the production of natural foods to supplement the feed given to the fish. However, this is not true in other parts of Nigeria, where there is non-availability of suitable land for pond construction. The soil may be full of sand or prone to seepage of pollution due to oil spillage. For example, Edet *et al*. (2018); Okoror *et al*. (2017) reported that majority of catfish farmers used

concrete ponds to cultivate catfish in their respective studies.

Many farmers chose to rent ponds for cultivation of catfish in the study area. This may be due to insufficient capital and problems of securing safe, reliable and useful lands for the construction of ponds. Renting of ponds encourages clustering of catfish farmers in a particular location. The advantage of this is that farmers can put resources together to help themselves; for example security, buying feeds in bulk to reduce cost. It also makes it easy for them to share experiences. This observation corroborates the findings of Ebukiba and Anthony (2019) that many catfish farmers rented land/ponds for catfish production in Karu Local Government Area, Nassarawa State, Nigeria. But, Ogidi (2016) and Olaoye *et al*. (2013) reported that few farmers rented land/ponds for cultivation of catfish while majority purchased the lands in Benue and Oyo States respectively.

Most farmers financed their business with their personal saving. This observation was earlier reported by Issa *et al*. (2014). They also observed that this shows that catfish farmers were operating on small-scale that required small capital, lack required collateral and the interest rate on loans may be too high for them to bear. Most farmers raised their fish with stream/river water. Water is the major factor in cultivation of fish, because the immediate environment of fish is water. Water is to fish what air is to man. Therefore, it has to be available in good quality and abundant in quantity. Olaoye *et al*. (2013) reported that most farmers depend directly on either stream or river as their major source of water. But, Edet *et al*. (2018) and Ebukiba and Anthony (2019) reported that most catfish farmers use borehole water in their respective studies. It is observed that catfish farmers that used concrete tanks are those that depend on well and borehole, while those that used earthen ponds are usually located close to natural source of water. Lime is used to control the pH of the soil, condition or sterilizing ponds prior to stocking, and helps fertilizers to work by increasing the availability of nutrients (Lazur *et al*. 2006; Chakrof, 1976).

It can be easily noticed that catfish farmers in Oyo State operate small earthen ponds. Likewise, Issa *et al*. (2014) reported an average of $100m^2$ of pond size in Kaduna State, Nigeria. Iruo *et al*. (2018) reported an average of $600m^2$ of pond size in the Niger Delta Region of Nigeria. Onyekuru *et al*. (2019) reported an average of $900m^2$ of pond size in Nsukka local government area of Enugu State, Nigeria. This may be in proportion to availability of land available for ponds construction. However, the advantage of this is that small ponds are easy to manage and maintain. This observation is consistent with Carballo *et al*. (2008) who reported that larger ponds are difficult to manage and are not very common with most producers. Earlier, CTA (2007) had recommended $100m^2$ as the minimum size of earthen pond. This shows that fish ponds in the study area are within the recommended and standard size. Nevertheless, the most interesting thing about different sizes of fish ponds according to Chakrof (1976) is that whether the pond is large or small, expensive or inexpensive, ponds are all very much the same. A larger and more expensive pond will not necessarily be a better pond. But size of pond is principally determined by the size of land available, farmers' financial strength, management expertise and purpose to be met. Most farmers stocked juvenile they justified their choice by confirming that juvenile catfish has higher percentage of survival than fingerlings. This is consistent with the findings of Dauda *et al*. (2017) that majority of catfish farmers stocked juveniles in their grow-out tanks in Katsina State, Nigeria. But, this is against the observation of Okoror *et al*. (2017) that majority of catfish farmers in Benin Metropolis used fingerlings as their stocking materials.

Farmers fed their fish either with respect to their age and sizes, to satiation or the availability of feed. But, Robinson and Li (2015) and Robinson *et al*. (2001) reported that feeding to satiation is highly subjective and is often difficult to achieve in ponds containing a high standing crop of fish without adversely affecting water quality. Likewise, feeding fish with respect to their age and sizes is supported by Agbeko *et al*. (2018). Fish are most fed twice in the study area. This is in agreement with the work

of Awoyemi and Ajiboye (2011). But, Dauda *et al*. (2017) reported that frequency of feeding of two and three times daily were commonly practiced in Katsina State, Nigeria. Nevertheless, Robinson *et al*. (2001) reported that there is no particular best method for feeding catfish. There is considerable variation in feeding practices on commercial catfish farms. Catfish farmers should daily make decision on the quantity of feed and number of times to feed with respect to nutritional demand of fish in each of his ponds; fish feeding behaviour differ per pond and per day, depending on water quality parameters.

CONCLUSION Catfish production involves a combination of various input variables which must be efficiently and properly managed to obtain maximum profit. Farmers have options either to construct or rent ponds for cultivation of fish. It is advisable to locate fish farm along natural source of water to reduce cost of production due to construction of borehole or wells. Feed must be given efficiently to achieve minimum feed conversion ratio (FCR). Daily pond management is essential to monitor water quality and the health of fish.

RECOMMENDATIONS

Catfish farmers should feed their fish to meet their nutritional requirement at the right time and in the right quantity without polluting the pond water. The use of destructive chemical like phostoxin is discouraged among catfish farmers for pond preparation. Farmers should know that proper and efficient management of input variables is a prerequisite for profitability in catfish production.

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