PRELIMINARY STUDIES OF THE DUAL ROLE OF COTTON - SEED CAKE AS FISH FEED AND FISHPOND FERTILIZER IN AQUACULTURE

by

C.C. Kolawole
Fisheries Division
Ministry of Natural Resources
Ado-Ekiti
Ondo State

ABSTRACT

Many locally available fish feeds have been tried in fish culture. These include guinea corn, soya bean, groundnut cake and rice bran. Cotton seed cake has been successfully used as a fishpond organic fertilizer at Ado-Ekiti Government fish farm. Three fishponds stocked respectively with Common Carps, Heterotis, Tilapia spp., Clarias lazera and Heterobranchus were fed with cotton seed cake. Observations were made over a period of eight weeks for the first three species while the catfishes were watched for a further period of five months. Carps, Tilapia and Heterotis increased rapidly in weight and length while the catfishes did not grow. They were not fed further with any food. After observing for five months more, they were found to have grown very well.

The water in the pond containing the catfishes contained a lot of plankton algae which were utilised by the fish.

INTRODUCTION

Nigeria is capable of increasing many times her present fish production, provided that planning and improved methods of feeding, breeding and management could be brought to bear on her national fish production policy and practice. The vast untapped tracts of potentially good reverine areas and inland waters in the country, the existence of large expanse of land for the cultivation of valuable varieties of fish food, the qualities and nutritive values of most of which remain yet to be ascertained, are indications of the fisheries potentialities of Nigeria. In fact, with more technological advancement in our fish production in fifty years from now, it would seem possible that fish could be produced to such an extent that after adequately meeting the requirements of the rapidly increasing population of Nigeria, surplus fish could become an additional export commodity to other countries. It is, no doubt, due to this excellent fisheries potentialities of Nigeria that the Federal Government earmarked ₦174 million for the fishery sector during the Fourth National Development Plan period.

One of the main obstacles to Fisheries Development in the Country, however, is that of indequate and imbalanced feeding. Thus, the basic problem concerning any fishery improvement in Nigeria is not one, in the first instance, for the geneticist, but for the fish feeder. It is the nutrition of the existing breeds of palatable and nutritious fish species that has first to be put on a higher plane before the geneticist and fish breeder can either select or improve. The majority of fish in Nigeria expecially in lakes, reservoirs and fishponds are reared on very low planes of nutrition. Thus, economically suitable feeds need to be sorted. Different types of feeds have been and are being used for feeding fish by Nigerian aquaculturists. Others do not feed their fish at all. The feeds commonly used are the natural and supplementary feeds. The best supplementary feeds that can be fed into a fishpond are extra natural foods. The natural foods are the plankton algae, snails, worms, insect larvae, small plants and other aquatic weeds and grasses. Some fish are omnivorous, while some are herbivorous and others are carnivorous

or piscivorous. Quite often, a fish may choose only one of these foods, but will eat any of the foods if the others are not available. In many cases, the fish farmer must put other supplementary foods into his pond if the pond is to be more productive. These feeds include guinea corn, breadcrumbs, poultry feeds, kitchen wastes, groundnut cake, soyabean and rice bran. Many fish farmers have not known the use of a specific feed for a species of fish. The choice of supplementary feeds depends on the feeding habits of the fish and the acceptability and efficiency of the food which would promote optimum growth and survival of the animal.

The use of cotton seed cake as food for all species of fish has cast doubt on the minds of many fish farm managers and fish farmers as to how efficient or useful it is for a particular fish. This has prompted the writer to make a preliminary investigation of its use and influence on the development of all the fish species being cultured at the Ondo State Government Fish Production Farm, Ado-Ekiti. The species of fish used as the source of investigation are Clarias lazera, Heterobranchus longifilis, Heterotis niloticus, Cyprinus carpio and three species of cichlids viz., Tilapia melanopleura, Sarotherodon niloticus and Sarotherodon aureus. The observations were made over a period of eight weeks, between July and September, 1980 while more observations on the catfishes were extended over a period of five months.

MATERIALS AND METHODS

In pond A (0.42Ha) were stocked a mixture of juvenile Clarias lazera and Heterobranchus longifilis. Two individuals were selected and tagged among each of the two species. They were weighed.

The Clarias weighed an average of 85gm and the Heterobranchus 80gm. The total lengths were also measured. Common in large numbers in the pond were Tilapia fingerlings.

Another pond B (0.17Ha) was stocked with eight (8) Common Carps (Cyprinus carpio) each weighed an average of 0.8 kg. Tilapia fries were also common in the pond. The pond was impounded with water just a week before stocking with the Carps. A third pond C (0.30Ha) was stocked with few juveniles of Heterotis niloticus while Tilapia fingerlings were also abundant in it. The total lengths of all the fish species were taken.

All the ponds A, B, and C were fed with only cotton seed cake which was soaked in water overnight, at the rate of 2 headpans to pond A, 1 headpan each to ponds B and C per day for three days per week. No supplementary feeds were fed into the ponds. Also no inorganic and other known organic fertilizers were added to the ponds. The temperatures, oxygen content and PH of the three ponds were the same because they were barrage ponds.

The tagged Catfishes were weighed every fortnight. The same thing was done to samples of Heterotis, Tilapia and the eight Cyprinus carpio. They were observed for eight weeks while more observations were kept on the catfishes for another three months.

RESULT AND DISCUSSION

The result obtained is shown in Table 1. From the data it is clear that while Clarias and Heterobranchus did not make any good use of the cotton seed cake in growing, Tilapia, Heterotis and Carp gained a lot of weight comparatively. In fact, the fact that Carps' growth was greatly enhanced by increase in weight from 0.8kg to 2.0 kg shows that it is a good converter of cotton seed cake and this depends on the ability of the fish to use the food given to it. It gained more than 100% of its initial weight. The Carp also has very fatty body.

The colouration of Tilapia melanopleura was whitish during the first week but later returned to normal. No structural changes were seen in Heterotis except the rapid growth. After five months, all the Clarias and Heterobranchus fish in pond A were cropped together with the tagged

fish. They were seen to have weighed 1.5kg (that is, about thirty times their weight three months before). After the first two months of the observations, only fish in ponds B and C were being fed with the cake. Fish in pond C was not fed with any food since the cake seemed not to be useful to it and no other feed was applied to it. Figures 1 and 2 shows the graphs of the growth of the different species of fish.

The usefulness of cotton seed cake as a feed is very obvious considering the weight of 1.2kg gained by the common Carp and the rapid growth of Tilapia and Heterotis. It is also clear from the result that both Clarias and Heterobranchus did not feed on the cotton seed but after a few weeks, it was able to make use of the feed as a fertilizer. The growth curves (Figures 1 & 2) clearly indicate this.

As a result of the differential acceptance of cotton seed cake as feed by different species of fish, an analysis of the content of the cake will be necessary. It is made up of dry matter of 92.2%. The components of the dry matter is shown in Table 2.

The protein amounts to about 42% of the dry matter and it is thus one of the richest sources of vegetable proteins for livestock. This protein was not very well utilized by the two catfishes.

Cotton seed also contains a pigment called Gossypol. This is a toxic phenolic compound which has an inhibiting action on the enzymes pepsin and trypsin in the alimentary tract and thus interferes with protein digestion. This might have been the reason why Clarias and Heterobrachus failed to grow when fed constantly on the cake.

The pigment also diminishes appetite and causes constipation in livestock. Gossypol is also associated with vitamins A and D deficiency and low level of nutrition. It is rich in vitamin E (Table 3). Gossypol is toxic to monogastric animal when fed in large quantities, pigs, rabbit and guinea pigs being the most sensitive animals, next are the dogs, with rats and poultry being the most tolerant. The whitish colour of the skin seen in Tilapia during the first few weeks may be similar to discoloured legs developed by hens when fed with cotton seed cake.

The carp was also very fatty and is comparable to dairy cattle which tends to produce butter fat of high melting point. Large amount of cotton seed cake fed to animals may cause scouring and result in cancer of digestive system. This is not noticeable in all the fish species.

In the Northern States of Nigeria, cotton seed cake is commonly soaked in water and fed to cattle and sheep as supplementary food. This treatment was applied to the one fed to the fish ponds. The cotton seed cake was first soaked in water overnight and fed early in the morning. This hydrolyses in the gossypol thus reducing its toxic effects. Treating the cake with 1 to 2kg of ferrous sulphate per 50kg of the seed makes it safer for some animals.

From Table 2, it is also evident that cotton sed cake can act as a fertilizer. Cotton seed is fairly well supplied with phosphorous, potassium, calcium, sodium and magnesium (Table 3), which are good components of organic fertilizers. It is a known fact that cotton seed meal when applied to clear ponds in warm water of the tropics will stimulate the growth of plankton algae (Swingle, 1947). The plankton algae produced are generally of the chlorophy-ceae family which include Scenedesmus, Staurantrum, Chlamydomonas. It also produces Euglanophyceae and Dinophyceae. The blue-green algae, for example, Microcystis may occassionally become abundant for limited periods. These plankton algae which were therefore produced as a result of the cotton seed cake were the natural foods of fish and

were responsible for the rapid growth of the catfishes after its application for some weeks. It is therefore conceivable that the plakton were generated in large quantity after some weeks. During the early stages they were very few. This might be responsible for the slow pace of development in the catfishes during the early period of feeding.

CONCLUSION AND RECOMMENDATION

In conclusion, it is apparent that cotton seed cake is a pleasnat food for carps Tilapia and Heterotis and is also a good fishpond fertilizer for the enhancement of plankton algae production on which fish species feed as their natural food. It thus serves dual purpose; food and fertilizer for fish species. It also provides essential materials for growth such as vitamins and elements as contained in Table 3. A scientific and economical feeding of animals and fish demands adequate knowledge of the nutritional value of the available feeding-stuffs. It is therefore economical for a fish farmer and fish farm managers to feed their fish with cotton seed cake.

More work shall still be carried out on a mixture of other ingredients with cotton seed cake as feed.

Table 1 - Weight and length increment of Clarias lazera, Heterobranchus longifilis, Cyprinus carpio, Tilapia spp and Heterotis niloticus

Week	Species	Weight Gained (gm)	Length increase (cm)	Remark
2	C. lazera	11.00	0.5	
	H. longifilis	10.00	1.0	
	C. carpio	4.00	38	
	Tilapia spp	27.5	3.8	
	Heterotis niloticus	80		
4	C. lazera	32	1.5	
	H. longifilis	34	1.8	
	C. carpio	700	46	
	Tilapia spp.	53.5		
	H. niloticus	175		
6	C. lazera	43	2.1	
	H. longifilis	48	2.5	
	C. carpio	950	55	
	Tilapia spp.	78.8		
	H. niloticus	254		
8	C. lazera	54	2.3	
	H. longifilis	52.5	2.9	
	C. carpio	1200	64	
	Tilapia spp.	104.3		
	H. niloticus	344		
20	C. lazera	1500	45.5	No further observation was carried out on other species.
	H. longifilis	1700	51.3	

Table 2 - Proximate composition of cotton seed cake (from Gutherie et. al., 1944)

Component Parts	Percentage
Dry matter	92.2
Crude protein	44.8
Ether Extract (oil)	7.4
Crude Fibre	9.9
Nitrogen-free Extract	24.5
Ash	5.6

Table 3 - Mineral and vitamin content of cotton seed cake (from Altschull, 1958)

Constituents	Amount
Calcium (%)	0.18
Phosphorus (%)	1.15
Potassium (%)	1.20
Sodium (%)	0.03
Magnesium (%)	0.54
Iron (%)	0.008
Copper (%)	0.0017
Manganese (%)	0.0028
Thiamine (mg/100g)	0.39
Riboflavin (mg/100g)	0.55
Niacin (mg/100g)	2.9
Pantothenic acid (mg/100g)	0.97
Folic acid (mg/100g)	0.37

REFERENCES

Bennett, G.W. (1962) Management of artificial lakes and ponds. pp 162 - 163

Charkroff, M. (1976) Peace Corps. Freshwater fishpond culture and management. pp 100 - 103

Gutherie, J.D., Hoffpaiur, C.L., Steiner, E.T., & Stanbury, M.F. (1944) U.S. Department of Agric., Bur. Agric. Ind. Chem. Publication A.I.C. 61

Altschull, A.M. (1958). Processed plant protein foodstuffs. Academic Press, New York.

Oyenuga, V.A. (1968) Nigeria's food and feeding stuffs. pp. 60 - 63.

DISCUSSION.

C. Ejike commented that the results of the experiment must be taken with care as there were no controls to compare the results.

D.H.J. Sydenham expressed some doubts on the identification/ taxonomy of Tilapia melanopleura which is now split into three sub-species.

S.O. Talabi asked whether the cost of cotton-seed cake had been compared with ground-nut cake.

C.O. Kolawole - Cotton-seed cake is cheaper than ground-nut cake.

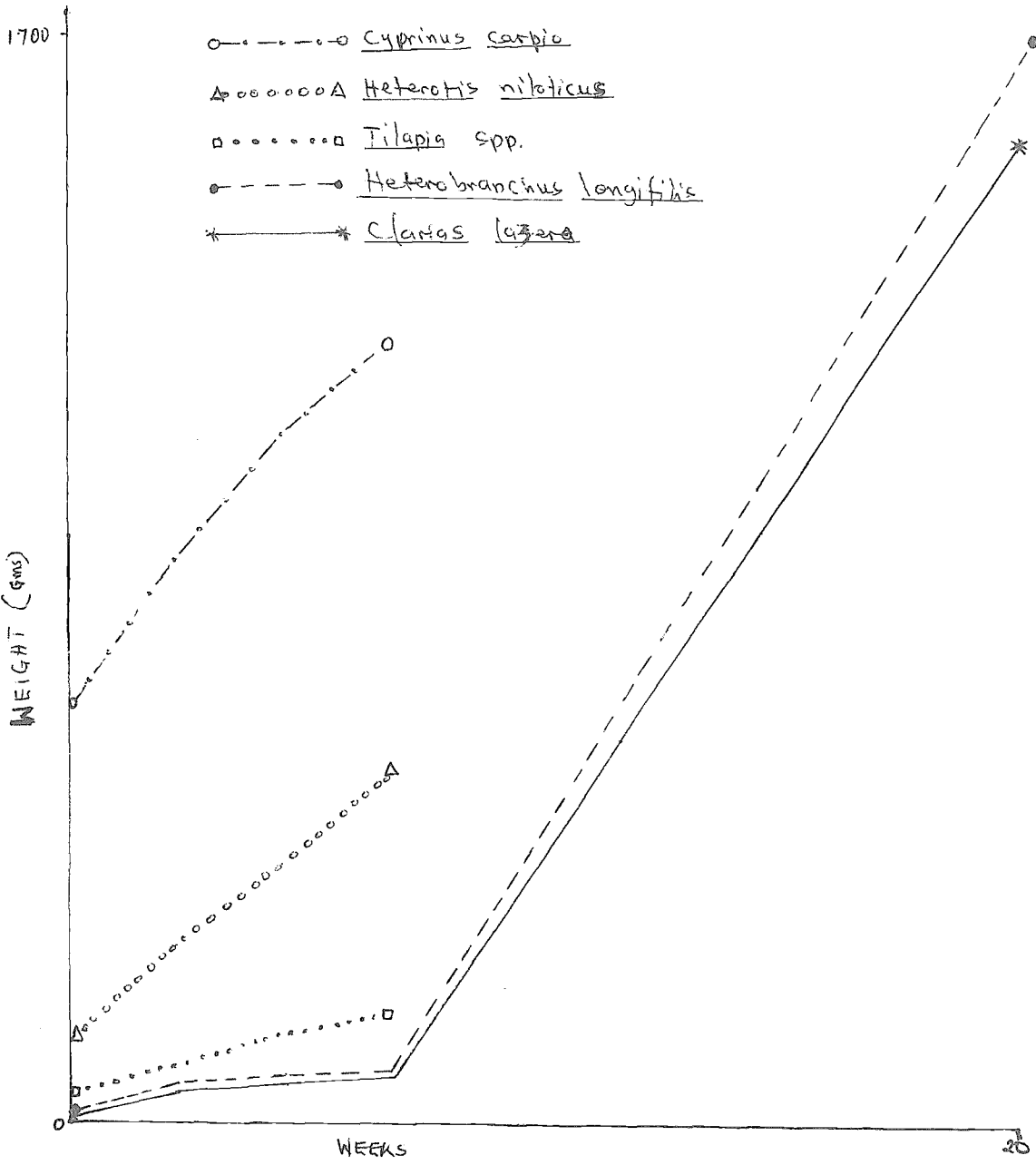

Fig. 1- Comparison of Growth Curve - Variations in weekly weights.

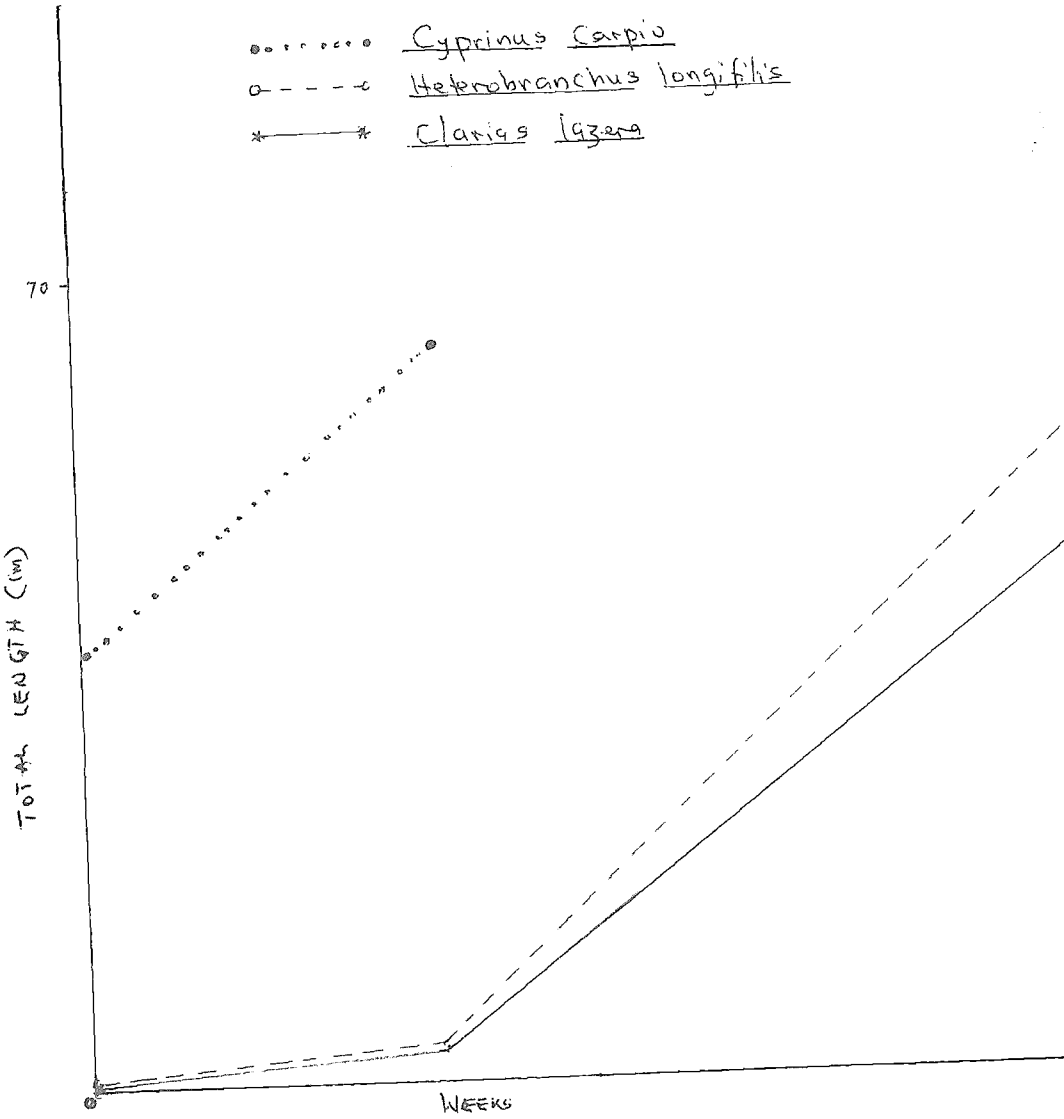

Fig. 2 — Comparison of growth Curve — variations in weekly