THE USE OF LOCALLY AVAILABLE MATERIALS IN FISH FEED PRODUCTION

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ABSTRACT

In Nigeria, the culture of fish is gaining importance, but local fish farmers face a set back because of the stoppage on importation of fish feed.

Locally available raw materials such as yam, plantain, banana, cowpeas, macuna, maize, cassava, millet, sorghum, groundnut, sunnhemp seed and brewery wastes are considered as potential materials for fish feed. These have been examined on their minimum protein contributions since this is the most expensive part of the fish feed.

Alternative sources to animal proteins are also examined. Plant protein from groundnut, melon, mucuna and others compare favourably with bloodmeal mixture and thus can be used to replace the more expensive animal proteins.

Fish feed can be produced on a small scale or commercial basis from the locally available raw materials and the fish farmer is advised to seek assistance from qualified fisheries personnel.

INTRODUCTION

In Nigeria, the artisanal fishing is decreasing in importance and the trend is towards intensive fish culture. This has its advantages in that useful man hours are not spent searching for fish in the wild. But the problem is that an intensive fish culture demands extra feeding in order for the fish to attain table size within a short time. To a large extent, fish seeds are still imported. With the constraints on importation currently being experienced all over the Federation, the fish farmer is facing a major setback in his business. This paper emanated from the demand of local fish farmers (some intending fish farmers) who are now facing problems with restriction on importation of fish feed. This paper therefore, intends to highlight those raw materials locally available that can be used in making pellets as fish feed.

Fish Basic Requirement

Like other animals, fish need protein, carhohydrate, lipids, minerals and vitamins for growth and. maintenance of physiological activities. These they get from the organisms they feed on in the wild. With intensive culture where there is competition for food, extra food,. in form of pellets or mash has to be added to the system for fish to attain table size within a short time.

Some of the locally available raw materials in Nigeria include maize, cowpeas, groundnut, melon, potato, cassava, yam, banana, plantain, pawpaw, soyabean, millet, guinea corn, rice, palm oil, brewery wastes and fish. These have been analysed for their chemical composition (Table 1) An examination of this list shows that there are more carbonhydrate than protein foodstuffs and therefore, the energy requirement of fish would be adequately met. However, the most expensive part of feed is the protein and this is the more important because it is used for body building. Experience has shown that one source of protein is not adequate, a combination of various sources such as animal and plant sources, is best (Bryant *et al*, 1980). The reason is that the essential amino acid composition of each protein source varies from source to source (Table 2). Thus, the addition of three to four different sources of protein should complement each other and hence improve the essential amino acid composition of the feed, making it adequate for the fish.

Locally Available Raw Materials Brewery Wastes

There are a lot of breweries in Nigeria, perhaps on the average of one brewery per State. These daily turn out several tonnes of brewery wastes such as spent beer plus solids, spent beer, brewery grain waste that hitherto have not been put into any use. They can be incorporated into fish feed. Ezenwa (1979) has reported beer waste to contain 46.4, 22.8, 7.8 and 18.8% carbohydrate, protein, fat, and fibre respectively.

In Peurto Rico, Kohler and Pagan–Font (1978) evaluated various waste products such as rum distiller's yeast; pharmaceutical wastes, rum distiller's solubles; spent beer plus solids, inorganic fertilizer of N–P–K (8–8–2); commercial fish feed containing 36–5–and 7% crude protein, fat and fibre respectively; and a locally manufactured chicken feed containing 18, 2.5 and 4.0% crude protein, fat and fibre respectively. Water quality criteria such as pH, dissolved oxygen and temperature were used as guideline for applying the rum and pharmaceutical wastes to the pools. They found that survival at harvest ranged from 80.0% for commercial chicken feed to 96.7% for commercial fish feed. The highest mean standing crop was got from the fish fed, the commercial fish feed and this was closely followed by the spent beer treatment. However, the weight of offspring from the spent beer treatment was higher than that from the fish feed treatment. The fish from the unmanaged system yielded the lowest mean standing crop while the other treatments gave moderate yields but the yield from the inorganic fertilizer was greater. There was more than three fold increase of fish weight over that of the unmanaged system in the rum distriller's yeast treatment, though poor water quality conditions were observed in the water of the pools. They concluded that "some potentials" exists for the utilization of the rum and pharmaceutical wastes for rearing *Tilapia aurea* in Puerto Rico" and the "dried forms of the by-products should be evaluated for their possible incorporation as part of a local feed". They also suggested that the application of the commercial chicken feed be limited to supplemental feed in conjuction with some intensive fertilization in view of the fact that the bits of hard corn in the chicken feed were not assimilated by the fish.

Rice, Maize, Sorghum

Uchida and King (1960) in Hawaii tested the acceptability of various feeds using Javatilapia *(Sarotherodon mossambicus).* Finely ground rice bran and chicken mash were suitable for the adults as they could not strain small particles from the water, and thus much of the feed was wasted and tended to foul the tanks. The pelletized pond fish and trout feeds were consumed by the adult fish with little wastage, while the rabbit feed, which has a high percentage of crude fibre, passed through the fish undigested and left much residue in the tank. Alfalfa pellets were less acceptable due to their large size and their high fibre content.

In Brazil, Castagnolli (1975) found that carp fingerlings fed on either opague-2-maize or hybrid maize gave the same conversion rate and performance. In another test, he showed that sorghum can be substituted for maize at 70% level in the diet for mirror carp *(Cyprinus carpio)* and tilapia *(Tilapia rendalli).* Under the same environmental conditions, mirror carp grew twice as fast and gained three times as much weight as the tilapia. Similar feeding studies carried out on fishes at Ellah Lakes at Obrikom in Rivers State showed species of *Clarias, Gymnarchus* and *Heterotis* to accept pelleted diets made from maize and other local materials. In this case, the maize and other ingredients were milled together. These studies are still in progress.

Kitchen Garbage

There are many kitchen wastes such as bean testa, plantain, cocoyam, potato, banana, pineapple, orange, pawpaw, yam and cassava peels which are thrown away daily. Most of these could be included in fish feeds. Even though they have low protein contents (From 7.87–11.21%), they can still supply some amount of it in addition to their normal contribution of minerals and vitamins to the feed. It is interesting to note that the protein contents of these peels are higher than those of the actual edible portions of the same foostuff (Table 1). These have their own attraction in that they are readily available and very much within the reach of small scale fish farmers who can easily throw them into the ponds for fish to nibble on.

Given the mineral and vitamin composition of these foodstuffs, it would be necessary to find out what percentage of these are in the peels.

Leaf Concentrates

Naturally, some local species of fish such as *Distichodus engrycephalus, D. brevipinis* and *D. rostratus* are *herbivorous* in their feeding habits. Thus, other raw materials worth including in fish feed are the leaves such as water leaf, green (tete), pawpaw, sweet potato, garden egg, yam, banana, plantain, okro, groundnut, maize, cassava and cocoyam. These leaves are daily consumed by ruminants without any pathological effect on them. Hence the leaves can be used as both fibre and filler in fish feed.

For instance, the sweet potato leaves have successfully been included in fish diet by the author to act as both filler, fibre and most importantly as colourant. Some of their mineral contents would be made available to the fish through processing.

Apart from the herbivores, the omnivorous species such as *Clarias, Heterobranchus* and *Cyprinus carpio* would feed on this type of pellet too.

Alternative Protein Sources

Since protein is the limiting item in feeds in terms of its cost as well as its body building properties, consideration of alternative sources is hereby attempted. Traditionally, fish and bloodmeals are the usual sources of protein in fish feed. These are becoming very expensive (about ₦1,000/metric tonne of fishmeal) and scarce, thus making fish feed exorbitant or out of reach of the average fish farmer.

A critical examination of the protein contents (Table 1) of some of our plant feeding stuffs such as water melon, sunnhemp seed, greengram seed, groundnuts seed and cake, cowpea, mucuna and cotton seeds, show that they compare favourably with bloodmeal mixture. Although these may not have the same amount of amino acid contents as either fishmeal or bloodmeal, they can still be used to supplement the blood or fish meals in order to reduce the quality and cost of the latter without necessarily reducing the biological quanlity of the feed. Igbinosun et al (in NIOMR Technical Paper No.7) found that soyabean meal can be used to replace fishmeal partially or completely, however, the growth of the Nigerian catfish on this meal was poorer than in the fishmeal. Research is needed on the optimum protein requirement of the warmwater fishes.

CONCLUSION

From the foregoing, it is realized that enough raw materials are available locally to produce fish feed in commerical quantity. Perhaps the majo, problem is the technical know-how. This can be referred to qualified fishery personnels who are prepared to render such services with minimum charges.

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Table 1 – Chemical composition of some Nigerian feeding stuffs (per cent of dry matter*)

Common Name	*Scientific Name*	*Dry Matter*	*Crude Protein*	*Oil*	*Calories per 100g*	*Total Ash*
Maize	Zea mays Lin	90.38	10.65	4.09	409.65	3.68
Cowpea seed	Vigna unguiculata Walp	91.36	24.67	2.46	389.94	3.78
Cowpea testa	Vigna unguiculata Walp	–	–	–	–	–
Groundnut	Arachis hypogaea Linn	95.10	27.20	50.92	605.00	2.79
Groundnut cake	Arachis hypogaea Linn	90.36	51.41	10.16	–	5.51
Water melon	Citullus vulgari Schrad	91.92	34.48	46.74	576.06	4.37
Soya bean	Glycine max Merr	93.23	44.08	19.10	452.42	5.06
Millet	Pennisetum typhoides Stapf and Hubbard	88.76	9.02	4.99	413.79	2.13
Rice	Oryza sativa Linn	90.10	9.10	0.14	397.14	0.58
Guinea corn	Grain sorghum pers	88.40	15.03	3.25	394.09	2.60
Banana	Musa sapientum Linn	27.43	4.49	1.45	384.10	7.60
Banana Peels	Musa sapientum Linn	14.08	7.87	11.60	–	13.44
Plantain	Musa sapientum var. paradisiaca Linn	27.43	4.59	1.63	377.22	7.97
Plantain peels	Musa sapientum var. paradisisaca Linn	18.35	9.14	5.62	–	17.18
Pawpaw leaves	Carica papaya Linn	24.60	32.6	0.8	–	11.47
Pawpaw fruit	Carica papaya Linn	15.00	4.1	0.6	–	3.9
Cassava	Manihot utilissima pohl	31.94	2.38	–	375.93	2.89
Cassava leaves	Manihot utilissima pohl	25.60	14.69	8.39	–	16.07
Cocoyam	Xanthosoma sagittifolium schott	24.89	7.85	–	382.63	5.22
Cocoyam	" " "	33.18	9.40	0.75	–	8.81
Cocoyam peels	" " "	9.43	20.62	11.74	–	12.18
Sweet potato	Ipomea batatas poir	28.08	5.36	0.54	391.06	3.15
Sweet Potato peels	Ipomea batatas poir	11.73	6.33	1.34	–	4.55
Sweet Potato leaves	Ipomea batatas poir	12.45	24.65	3.58	–	11.47
Yam white	Dioscorea rotundata poir	26.17	5.87	0.46	381.18	4.30
Sunn hemp seed	Crotalaria juncea Linn	95.99	40.27	1.41	344.65	5.61
Mucuna	Mucuna spp Adams	94.15	28.59	0.67	–	4.01
Palm kernel cake	Elaeis guineensis Dacq.	91.60	20.40	8.32	–	5.67
Cotton seed	Gossypium sp Linn	94.56	28.47	14.05	–	4.75
Prickly Amaranthus (Tete Elegun)	Amaranthus spinosus	19.4	31.9	3.7	–	15.1
Water L .f	Talinum triagulare Wild	9.68	21.09	1.47	–	34.56

**Table adapted from Oyenuga (1968).*

Table 2 – Essential Amino Acid Composition of some Nigerian Foodstuffs (mg/gN)*

	Arginine	*Histidine*	*Isoleucine*	*Leucine*	*Lysine*	*Phenyl alanine*	*Terosine*	*Cystine*	*Methionine*	*Threonine*	*Tryptophan*	*Valine*
Cassava flour (gari)	931	106	113	181	244	131	100	–	63	175	–	163
Cocoyam (Tania)	525	106	206	425	235	325	188	175	81	225	–	413
Sweet Potato	181	88	225	300	269	269	–	–	106	238	113	350
Yam (white trifoliate)	344	113	256	450	263	275	300	–	63	269	–	350
Cowpeas	444	194	256	456	394	325	190	106	119	239	60	325
Groundnut whole	775	150	250	438	319	325	220	81	88	244	70	312
Soyabean meal	519	175	306	488	406	306	200	94	94	244	81	319
Coconutseed protein (globulin)	1046	151	277	449	273	319	–	–	126	254	41	370
Cotton seed	706	169	250	375	219	375	200	138	106	188	81	300
Palm kernel cake	1075	113	313	519	294	300	–	–	144	250	50	400
Guinea corn grain	293	110	324	827	162	325	260	58	29	197	64	295
Maize grain whole	300	156	400	938	144	313	375	94	194	231	38	331
Mullet, bulrush	–	119	369	606	244	256	–	–	106	–	119	400
Rice polish	495	233	322	406	370	286	418	89	256	233	203	376

*. *Table adapted from Oyenuga (1968).*