International Research Journal of Agricultural Science and Soil Science (ISSN: 2251-0044) Vol. 1(7) pp. 268-272 September 2011
Available online http://www.interesjournals.org/IRJAS

Full Length Research Paper

Substitution value of sundried cashew apple bagasse in the diets of *Clarias gariepinus*

[1]Adebowale B.A.*, [1]Olubamiwa O., and [1]Ogunjobi M.A.K

[1]Cocoa Research Institute of Nigeria, PMB 5244, Ibadan, Nigeria

Accepted 13 September, 2011

Sundried cashew apple bagasse, grinded into powder was substituted for groundnut cake at five levels (0,10,20,30 and 40%) to formulate five experimental diets (1,2,3,4,5), in which A is the control diet. 375 *C. gariepinus* juveniles were randomly allocated into five groups each with three replicates in a completely randomized design. These were fed at 5% for a period of eighty-four days. Its nutritive and cost effectiveness of the feeds were assessed at the end of the feeding period. Live weight gain of fish increased corresponding with increasing inclusion of cashew apple bagasse. There was no significant difference (P>0.05) in the mean weight gain of fish fed diets 4 and 1(Control diet). Feed conversion ratio were also observed to be similar among diets 1 to 4, while that of diet 5 decreased significantly from 1 (control). However, both cost/kg of feed produced and cost of feed consumed per weight gain decreased correspondingly as more of the substitution was made, indicating a profitable and worthwhile study. Cost per feed intake and cost/g weight gain were significantly lowered (P>0.05) as Cashew Apple Bagasse meal increases in the diets. In summary, a good economic return is possible if this cashew waste can be processed into fish diet (particularly for fingerling and juvenile production).

Keywords: Bagasse, juvenile, C. gariepinus, cashew apple.

INTRODUCTION

Africa is endowed with multi-variant climate and soil conditions and about 70% of their population depend on agriculture for survival (James, C. McCann (1978). Agricultural by-products in the tropics are as abundant as there are wide arrays of plants and fruits. Majority of such crop residue and by-products were formally not reckoned with and are hence discarded either on farms as waste or as by-products from most agro-based industries. As a result of dirth information on the nutrient potentiality of many of these by-products, feed millers as well as livestock farmers were left with virtually no substitute than to survive on costly essential conventional feedstuffs of dwindling supply. Today, more emphasis is been placed on substitution possibility of some of these by-products whose nutritive values have been ascertained. As reported in dozens of livestock research literatures, dwindling supply which resulted into arbitrary hike in the prices of most essential feedstuffs like: Maize, Soya beans, and groundnut cake warrants concerted efforts in sourcing for alternatives for those feedstuffs. Nigerian livestock consumption level deviated by 24.07% away from the World Health Organization (WHO) recommended (27g/cap/day) level of consumption. This was partly due to the gross inadequate feed supply from feed millers which could have promoted the growth of the Nigerian livestock sector from total collapse; concerted efforts needs be geared towards sourcing for alternative feedstuffs from the available agro-industrial wastes as well as by-products. Cashew, as generally believed is a hardy plant with a high resistance to drought. Cashew scientists have reported its ubiquitous nature. It possesses the ability to thrive well on most tropical soils and climates. Cashew has two major economic parts viz: the nut- from where industrial products like edible cashew nuts and cashew shell liquid for dye production are derived. Also is the edible succulent juicy apple which is utilized by industries to make cashew apple juice. This juice is reported to be a rich source of vitamin C, known as ascorbic acid. Ascorbic acid is an indispensable and multifunctional micronutrient substance (that is essential in minute amount for the proper growth and metabolism

*Corresponding author email: walebab2007@yahoo.com
Tel: +2348058044650

of a living organism). It plays important roles in improving immune function (Hardie et al., 1991), improving growth (Boonyaratpalin and Phromkunthong, 2001), providing good health, feed conversion, survival (Khajarern, and Khajarern, 1997), resisting stress (Henriqu et al., 1998) and oxidation (Shiau and Hsu, 2002). Several authors have reported that most fish species are highly sensitive to dietary inadequacy of vitamin C. Deficiencies in fish can cause reduced growth rate, deformation of skeletal and cartilage.

It also causes slow wound repairs, increased mortality rate, abnormal pigmentation,(Xie and Niu, 2006). For these reasons some catfish producers provide high vitamin C in feed, which contained more than 1000 mg [kg.sup.-1] hoping to enhance immune function of fish. As cited in literatures fresh cashew apple were commercially processed into a sugar-rich juice for human consumption. The by-product derived therefrom was fed dry into pig and poultry. Utilization of cashew apple bagasse as ingredient in feeding fish is however absent in literatures. The main objective of this study is to evaluate the possibility of incorporating the erstwhile waste cashew apple bagasse into fish diet so as to reduce its wastage.

MATERIALS AND METHODS

Cashew Apple Bagasse

Freshly harvested cashew apple was carefully selected by hand-picking them from under cashew plantation. Nuts were removed from the fruits and juice was extracted with a manually operated cashew juice extractor. This was then spread thinly on a concrete slab to sundry for about a week to reduce moisture content less than 7%. This is because the fresh apple easily goes rancid if allowed to stay beyond a day or few hours after senescence. This dry apple bagasse was milled into fine powder, packaged and stored in an air-tight polythene bag. This powdered test ingredient was mixed in calculated proportions with other feed ingredients to formulate five experimental diets for the feed trial.

Crude lipid was done by ether extraction, Ash content was carried out by ashing in a Muffle furnace at 550C. Moisture content was determined by oven dying to constant weight at 85C, while crude fibre was done by acid based digestion method (Arthur, 1970).

Experimental Fish and Design

A total number of 375 *Clarias juveniles* of an average weight of 10.0± 0.08g were purchased from a reputable fish farm. The experiment was carried out in a water flow-through unit consisting of fifteen 25L plastic tanks. Clean water of an average temperature of 25^{o}C was allowed to flow from a big plastic tank into each of the flow-through tanks serially arranged from the overhead inlets at a flow rate of 0.45L/min. About 60% off the water in the plastic receptacle was removed through each outlet devices at the base of each tank. Fresh water is then allowed immediately to avoid fish stress and water quality parameters were monitored regularly. *Clarias gariepinus* juveniles were randomly grouped in triplicates of 25 fishes per tank into the fifteen tanks serially arranged.

Feeding Method

Fishes used were acclimatized for a week before the commencement of the trial. Initial weight of each group was taken at the beginning of the experiment. Experimental diets were administered at 4% of body weight. Proximate analyses of Cashew bagasse, diets and fish were taken before and after the experiment. Crude protein contents were determined using micro-kijeldahl method (AOAC, 1990).

Data Collection and Analysis

Weights of each group were taken weekly. Water quality parameters were taken fortnightly to provide a suitable environment for the fish. Proximate composition analyses of diets, and fish were determined before and after the experiment using AOAC (1990) standard analytical methods.

RESULTS AND DISCUSSION

Results of proximate composition of both whole and sundried Cashew apple were given in Table 1. Similar values was obtained by a previous author, but with slight variations which may be due either to cashew breed type or to method of analysis. Table 2 shows the results of the proximate analysis of the five formulated diets. Average values of temperature, dissolved oxygen and pH monitored (Table 3) were respectively 26.27^{o}C, 7.5mg/L and 7.14. Feed acceptability was uniformed across the five treatments, despite the gradual increase in the percentage crude fibre in diet 1 down to diet 5. Percentage crude fat however decreased conversely as we move from diet 1 to 5. This might probably due to the decreased proportion of groundnut cake as replacement levels moved up. Percentage growth rate of fish increased progressively to the end of the feeding period. Values obtained for diets A and E were however statistically different ($P< 0.05$) from those of other diets. Similar increment in the average wet weight gain of the fishes fed varied levels of cashew bagasse meal and the control shows a better feed conversion ratio. This thus established the biological efficiency of this test feedstuff as a substitute. Falaye et al. (1999) observed same when

Table 1. Results of Proximate composition of Whole Cashew Apple and Sundried Apple Bagasse

% (DM)	Whole Cashew Apple	Sundried Cashew Apple Meal
Crude Protein(%)	14.42	12.68
Crude fibre	5.22	10.05
Ash	2.15	1.06
Calcium	0.32	0.21
Phosphorus	0.31	0.26
Total Sugars	52.82	22.80

Table 2. Ingredient composition of the experimental diets (%) kg

	DIETS				
Ingredients	**1(0%)**	**2(10%)**	**3(20%)**	**4(30%)**	**5(40%)**
Maize	32.00	32.00	32.00	32.00	32.00
Groundnut cake	16.00	14.40	12.80	11.20	9.60
Cashew Apple Waste	-	1.60	3.20	4.80	6.40
Soya bean meal	32.00	32.00	32.00	32.00	32.00
Fish meal	18.00	18.00	18.00	18.00	18.00
Bone meal	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Grower premix	0.10	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25	0.25
Carboxymethylcellulose	1.00	1.00	1.00	1.00	1.00
TOTAL	100.00	100.01	100.00	100.00	100.00
Calculated crude Protein level(%)	39.80	40.01	39.65	39.45	39.80
(Analyzed proximate composition (%dry matter)					
Crude protein (%)	40.16	40.10	39.88	40.10	38.22
Moisture	6.35	6.80	8.50	7.20	7.10
Ash	9.60	8.10	9.40	9.55	10.60
Crude fibre	5.42	4.81	4.77	5.84	7.09
Crude fat	4.68	4.55	3.38	3.15	3.02

Soybean milk residue was substituted for groundnut cake in the diet of *Indian carp* fingerlings.

Growth Performance and Nutrient utilization of Experimental fish

Summary of the growth response of *C. gariepinus* juvenile fed Cashew apple based diets is shown in Table 4. The mean initial weight of fish was 10.56+/ 0.05g while the mean final weight gain was 30.14g. Figure 1 presented the graphical representation of the variation in weight gain. The profitability of converting erstwhile waste agricultural by-products to alternative feedstuff cannot be overemphasized. This has severally been reported Olubamiwa and Oduwole (2010), Olubamiwa et al. (2006). It is very interesting to note that some of these by-products have a replacement potentiality of about 50 % (Babatunde et al. (2001), Falaye et al. (1999) and 60% (Olubamiwa et al. (2000). The idea of substituting agro wastes for conventional feedstuffs seems to have a general trend. Reports from several authors usually con-

Table 3. Water quality parameters for the period of the experiment

Parameter	Mean
Temperature (°C)	26.55
pH	6.88
Dissolved oxygen (mg/l)	7.25
Carbon dioxide (mg/l)	10.4
Total alkalinity (mg/l)	72.5

Table 4. Growth parameter and nutrient digestibility of *C.gariepinus* fed CHE based diets

PARAMETERS	D I E T S				
	1(0%)	2(10%)	3(15%)	4(20%)	5 (25)%
Initial mean weight (g)	18.05	18.10	18.04	18.51	18.05
Final mean weight (g)	24.77	24.47	24.63	24.81	24.08
Mean weight gain (g)	6.72	6.37	6.59	6.79	6.04
% weight gain	37.22	35.21	36.53	36.68	33.46
Mean total feed intake	4.31	4.06	4.11	4.18	3.99
Feed conversion ratio	1.89^{a}	1.95^{ab}	1.89^{a}	1.87^{a}	1.41^{b}
Protein efficiency ratio	1.32^{a}	1.25^{a}	1.26^{b}	1.30^{a}	1.27^{c}
Cost of Feed (₦/ Kg)	360^{ab}	352^{ab}	340^{a}	332^{b}	328^{c}
Cost of Feed Intake (₦)	4579.20^{a}	4364.80^{b}	4239.80^{b}	4216.40^{b}	4093.40^{c}
Cost of Feed/ g wt. gain (₦)	682.12^{a}	685.10^{a}	643.27^{b}	620.95^{c}	678.27^{b}

ab Means with different superscript are significantly different (P <0.05)

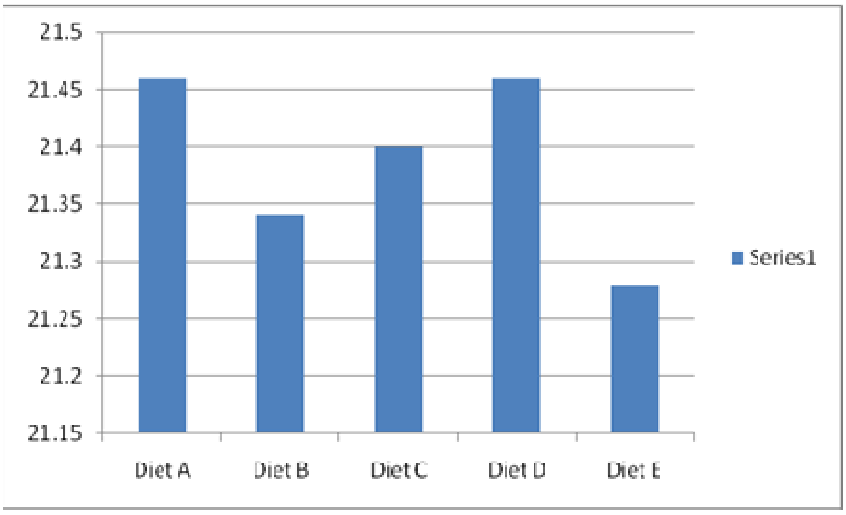

Figure 1. Growth performance chart of C. gariepinus fed varied levels of Cashew apple bagasse based diets.

cludes that increasing inclusion of most of these by-products to the level of total replacement spells a live weight reduction (Adebowale *et al.* (2008) and Olubamiwa, (2011).Report of Fanimo et al. (2003) further establish the nutrient potentials of cashew apple waste when he observed similar trend in the growth and nutrient utilization pattern of growing pigs (another monogastric) fed this apple waste. However, the economic return

accruable from this practice is good enough to argument the continuous inclusion of most of these agro-wastes into animal diets.

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