THE ECONOMIC IMPLICATION OF SUBSTITUTING COCOA POD HUSK FOR MAIZE IN LIVESTOCK FEEDS IN NIGERIA.

C.A. AFOLAMI, D. ERUVBETINE AND S.O. AFOLAMI

*Department of Agricultural Economics and Farm Management
Department of Animal Nutrition and Department of Crop Production and Crop Production,
University of Agriculture, Abeokuta.*

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ABSTRACT

A study was conducted to estimate the amount of maize that could be conserved by substituting cocoa pod husk (CPH) for maize in livestock feeds. For this purpose a conversion coefficient between dry cocoa beans and dry CPH was estimated by using data collected from a survey of 50 cocoa farms. Some livestock feed millers in Nigeria were also surveyed to obtain the composition of feeds for different livestock species.

Using the conversion coefficient between dry cocoa beans and dry CPH together with dry cocoa bean outputs between 1970 and 1996 it was estimated that Nigeria produced an average of 274,800 metric tonnes of CPH per year.

Using the amount of livestock feed consumption in Nigeria from 1977 - 1996 and the percentage of maize component of the rations, the amount of maize utilized in livestock feeds for the period was estimated. Further, using the safe levels of CPH substitution in the various livestock feeds as suggested by research conducted in the past, the amount of maize which could be conserved by incorporating CPH in the various feed types was estimated as an annual average of 39,473 metric tonnes of maize. This saving was found to bridge the deficit between demand and supply as given by supplementation done by importing maize.

The study concluded that by utilizing CPH in compounding various livestock feed rations, the high price of maize arising from excessive demand can be reduced. The limiting role of maize in making available livestock feeds will be alleviated. Furthermore, increased revenue to cocoa producers would accrue as a result of additional revenue generated from sale of CPH and

good environmental sanitation reducing the incidence of black pod disease and consequently reducing investment in chemicals and labour for the control of the disease. Finally, more maize would be available for human consumption and the supplementation that was done in form of maize importation may not be necessary.

Keywords: Cocoa pod husk, maize, substitution, feeds.

INTRODUCTION

Cocoa has not only become an international crop, it has shapen the economic, social and political fortunes of many countries of which Nigeria is one. The bulk of cocoa production in Nigeria (94.2%) takes place in Ogun, Oyo, and Ondo States (Olayide and Olatunbosun, 1975). Peasant farmers scattered in these states contribute about 90% of the production. These farmers, cultivate, maintain, harvest, depod, ferment and dry the products before eventual marketing. The by-product from de-podding of cocoa pod husks (CPH), are left on site usually under the cocoa trees. These pod husks have been implicated as sources of black pod disease and other infections because of poor environmental sanitation created by improper disposal of CPH (Williams, 1974). Proper disposal of CPH is proffered as a measure for controlling black pod disease, but the massive size of the bulk of the husks and the cost likely to be involved in the exercise, makes proper disposal unattractive to the farmers. If CPH utilization in livestock feeds is embraced, it would serve as another potential source of revenue to farmers as well as reduce the incidence of black-pod disease on farmers' cocoa farms.

Much work has been done since the 40's on

the possibility of using cocoa pod husk (CPH) as a substitute for livestock feeds (Braude and Foot, 1942; Haines and Echevaria, 1955). The extent to which CPH substitution could be safely utilized for livestock feeds had also been examined (Adeyanju *et al.*, 1975; Okai *et al.*, 1984). However, the adoption of these findings was not pursued because the demand for maize then was not much in deficit of supply. Moreover, the liberal policy on maize importation masked the problem of supply deficit in the domestic production of maize. The prevailing situation now dictates the need to substitute CPH for maize in livestock rations so as to make maize available for human consumption in desired quantity.

The general objective of this study is to examine the possible ways of substituting CPH for maize in the production of livestock feeds for the estimation of the amount of maize which can be conserved from the exercise.

The specific objectives are to :

- (i) use the quantity of dry cocoa beans produced in Nigeria over some past years in the derivation of dry CPH produced over the same period.
- (ii) discuss the level of substitution of CPH in feeds for different livestock species.
- (iii) estimate the quantity of maize that can be saved as a result of substitution by CPH.

MATERIAL AND METHODS

The amount of dry CPH derivable from the production of dry bean was estimated by sampling 50 cocoa farms in Ogun, Ondo and Oyo State. Cocoa pods mainly F3 Amazon and Amelonado were collected from the farmers and depodded. The cocoa beans were fermented in baskets covered with plantain leaves for 3 days. The beans and the cocoa pod husks were sun-dried and weighed when they attained 10% moisture content. The conversion factor between dry cocoa beans and dry pod husk was estimated using the accrued data and this was used in estimating the dry CPH derivable from dry cocoa bean outputs from Nigeria over some past years. (1970-1996).

For the determination of the quantity of maize which goes into compounding livestock feed

ration four major livestock feed millers who compound feed ration for cattle, pig, sheep, goat and poultry were selected and the quantity of ingredients used in compounding feed rations over some past 5 years were obtained. The mean percentage composition of maize of the total ration over the period for the various rations were estimated. The product of this estimate and the data on the various types of livestock feed consumption in Nigeria between 1977/78 and 1995/96 was found to provide data on the amount of maize, which would have been used, in compounding livestock feeds in the nation. Using published results of the safe levels of CPH substitution for maize in various livestock feed types, the maize component of livestock feed consumed in Nigeria between 1977/78 and 1995/96 which CPH could have been substituted for were estimated for the various feed types. The total across feed types for any year gives the maize component of livestock feed consumed from which CPH could have been substituted. The annual average over the period of the study was found and given.

RESULTS AND DISCUSSION

Cocoa production in Nigeria and estimates dry cocoa pod outputs:

Table 1 gives the annual output of cocoa beans in Nigeria between 1970 and 1996. The values ranged between 95,600 to 308,000 metric tonnes which corresponded to 1983 and 1971 respectively. The general trend is a declining one and has been of great concern. It is attributable to the neglect of agriculture arising from oil boom of the 1970s. The results of the empirical study undertaken to estimate the equivalent of dry CPH from a tonne of dry cocoa beans showed that about 1.65 tonnes of dry CPH is derivable from a tonne of dry cocoa beans which were mainly F3 Amazon and Amelonado. Based on these information, the dry CPH outputs in Nigeria in some past years are also given in Table 1.

Cocoa pod husk, which is of interest in this study, is dependent on the dry cocoa beans produced and the type of cocoa. The more cocoa beans are produced, the more CPH will be available for use as a substitute for maize in livestock feeds. Furthermore, the more CPH-based livestock feeds are produced, the more of CPH will be utilized and more maize conservation would be realized.

TABLE 1: NIGERIA'S ANNUAL DRY COCOA BEAN OUTPUTS AND COCOA POD HUSK ESTIMATES, 1970-1996 ('000 METRIC TONNES)

YEAR	DRY COCOA BEAN OUTPUTS ¹	DRY COCOA POD HUSK ESTIMATES ²
1970	223.0	368.0
1971	308.0	508.2
1972	225.0	371.3
1973	241.0	397.7
1974	215.0	354.8
1975	205.0	339.0
1976	225.0	371.3
1977	188.8	311.5
1978	161.3	266.1
1979	144.3	238.1
1980	146.5	241.7
1981	173.9	286.9
1982	150.3	248.0
1983	95.6	157.7
1984	101.1	166.8
1985	102.0	168.3
1986	100.0	165.0
1987	105.0	173.3
1988	150.0	247.5
1989	240.0	396.0
1990	170.0	280.5
1991	170.0	280.5
1992	110.0	181.5
1993	130.0	214.5
1994	135.0	222.8
1995	135.0	222.8
1996	145.0	239.3
TOTAL	4496.3	7419.1
ANNUAL AVG.	166.5	274.8

¹Source: Gill and Duffus, Cocoa Market Report, 1980, 1985, 1990, 1994 and 1996.

²Conversion factor between one metric tonne dry cocoa beans is 1.65 metric tonnes cocoa pod husk.

Level of CPH substitution for maize in livestock feed rations

The various livestock feed rations considered for possible CPH substitution for maize are those of beef cattle, dairy cattle, Pig, sheep, goats, poultry viz; layers, broilers, growers, and chicks.

Research has shown that cocoa husk meal (CPHM) may be successfully used as a component of livestock feeds. However, CPH as a potential livestock feedstuff has been found to be limiting due to its high crude fibre content (Bateman and Fesmillo, 1967; Abiola, 1988). Reduced performance was observed in livestock as the CPH component increases in diet. Alkaline treatment was found to decrease the crude protein and increase the total ash content of the diet. (Atuahene et al, 1984). A toxic substance - theo-bromine has also been identified in CPH. However, low level of CPH does not cause any deleterious effect (Abiola, 1988.).

(i) **Cattle** :- Literature shows that a CPH level of 59% in the concentrate diets for beef and dairy cattle did not produce any deleterious effect. Haines and Echevaria (1955) obtained improved dry matter digestibility when CPH was substituted for corn on tropical dairy rations. Adomako (1975) reporting on studies conducted by Cocoa Research Institute of Ghana (CRIG), showed that beef cattle could be fed up to 50% CPH in rations containing

TABLE 2: LIVESTOCK FEED CONSUMPTION IN NIGERIA 1977/78-1995/96(TONNES)

Feed	77/78	78/79	79/80	80/81	81/82	82/83	83/84	90/91*	95/96*
Cattle Feed	38535	43289	44548	44470	44661	42257	45982	47959	50021
Pig Feed	13486	15428	16254	16843	14586	13775	14037	15328	16739
Goats Feed	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
Sheep Feed	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
Layers Mash	217703	268872	271414	281301	289478	231477	234188	240979	247968
Growers Mash	65577	68845	71485	75065	73466	74546	75059	78061	81184
Chick Mash	19266	24645	25646	20662	24419	20934	24719	25708	26736
Broiler Starter	11560	15228	16852	17284	17189	15484	16535	17196	17884
Broiler Finisher	26972	28950	29058	30014	29414	276611	28347	29481	30660
Total	393099	465257	475257	491639	493213	426084	438867	454712	471192

Source: Okuneye and Banwo (1990)

*Projected values based on livestock population growth rates, sourced from CBN Annual Report and Statement of Accounts (1996)p92

groundnut cake, maize and molasses. Smith and Adegbola (1988), reported a similar finding. Llamosas et al (1984) substituted CPH for elephant grass up to a level of 80% and found no significant difference in weight gains. We have however used 50% CPH substitution for maize for our analysis.

TABLE 3: QUANTITY AND VALUE OF IMPORTED MAIZE IN NIGERIA (1978-1998)

YEAR	QUANTITY (METRIC TONNES)	VALUE
1978	66,260.10	14,472,636
1979	40,480.10	22,930,166
1980	N.A	N.A
1981	144,708.8	38,858,136
1982	8,574.90	69,066,047
1983	498,990.30	12,746,858
1984	1,605.90	13,992,120
1985	4,494.80	800,842
1986	436.90	48,063
1987	325.90	8,590,000
1988	283.30	2,050,000
1989	3.26	50,000
1990	58.70	1,760,000
1991	2.27	40,000
1992	13473.60	40,130,000
1993	59.13	16,420,000
1994	N.A	N.A
1995	8.00	40,000
1996	19.24	230,000
1997	0.50	10,000
1998	16.13	200,000
TOTAL	743369.83	224*10 ⁰⁰
Annual Average	39,124.7	12.8*10 ⁰⁰

Source: Federal Office of Statistic, (FOS), Lagos
Nigeria Trade Summary, 1987-1998
(1 U.S. \$ = N 80 in 1998)

(ii) **Pigs:-** Literature reveals that CPH can safely replace 25% of the maize component in rations of finisher pigs (Barne et al, 1984). Okai et al (1984) also reported that a level of up to 25% CPH in diets of pigs recorded live weight similar to the control. Consequently 25% substitution of CPH for maize was used for our analysis.

(iii) **Sheep and Goats:-** Adeyanju et al (1975) reported that CPH could make up to 25% maintenance ration for sheep and goat without any deleterious effect. Atuahene et al (1984) in their evaluation for CPH as a feed ingredient for confined sheep concluded that CPH could be substituted up to a level of 30% along with other ingredients with no loss in weight gain. For our analysis 25% substitution for maize by CPH was used for sheep and goats.

(iv) **Broilers and Layers:** Atuahene et al (1984) in an experiment with broiler chicken concluded that up to 10% CPH incorporation in starter diets was a safe level of inclusion. Adeyanju et al (1975) and Boa-Amponsem et al (1984) found CPH to be an economical feedstuff in poultry layers mash if it does not constitute more than 20% of the ration. For our analysis 10% CPH substitution of maize was used for all types of poultry.

Livestock feed consumption, maize utilization and substitution patterns.

Feed has become a limiting factor in livestock production in Nigeria and inadequate maize availability plays a major role in this regard. Results of sampled feed millers showed that

TABLE 4: ESTIMATED MAIZE COMPOSITION OF LIVESTOCK FEED CONSUMPTION IN NIGERIA*, 1977/78 - 1995/96 (TONNES)

Feed	77/78	78/79	79/80	80/81	81/82	82/83	83/84	90/91	95/96	Average
Cattle Feed	23121	25973	26729	26682	26797	25354	27589	28775	30013	
Pig Feed	8092	9257	9752	10106	8752	8265	8422	9197	10043	
Layers Mash	130627	161323	168781	168781	173687	138886	140513	144587	148781	
Growers Mash	39346	41307	42891	49039	44080	44728	45035	46837	48710	
Chick Mash	11560	14787	15388	15997	14651	12560	14831	15425	16042	
Broiler Starter	6936	9137	10111	10370	10313	9290	9921	10318	10730	
Broiler Finisher	16183	17370	17435	18008	17648	16567	17008	17689	18396	
Total	235859	279154	285154	294983	295928	255650	263320	272864	282715	

*Source: Author's estimate derived from Table 2.

TABLE 5: ESTIMATED MAIZE COMPONENT OF LIVESTOCK CONSUMED WHICH CPH COULD HAVE SUBSTITUTED FOR IN NIGERIA, ** 1977/78 - 1995/96 (TONNES)

Feed	77/78	78/79	79/80	80/81	81/82	82/83	83/84	90/91	95/96	Average
Cattle feed	11561	12987	13364	13341	13398	12677	13795	14388	15007	
Pig feed	2023	2314	2438	2526	2188	2066	2106	2299	2511	
Layers Mash	13062	16132	16285	16878	17369	13889	14051	14459	14878	
Growers Mash	3935	4131	4289	4504	4408	4473	4504	4684	4871	
Chick Mash	1156	1479	1539	1600	1465	1256	1483	1543	1604	
Broiler Mash	694	914	1011	1039	1031	929	992	1032	1073	
Broiler Mash	1618	1737	1743	1801	1765	1657	1701	1769	1840	
Total	34048	3969	40670	41687	41624	36947	38631	40174	41784	39473

** Author's estimate derived from Table 4.

maize can make up to 60% of whole ration. Ogunfowora and Fetuga (1977) also reported that coarse grains like maize comprises over 60 percent of the total weight of most compound feeds. The increasing demand for maize has contributed to high cost of feeds.

Table 2 gives the livestock feed consumption in Nigeria between 1977-1996. The total feed consumption reached its peak in 1981/82 with 493,213 tonnes, thereafter declined to 471,192 tonnes by 1995/96.

In Table 3, the maize imported into the nation over some years is given to provide a comparative basis for maize which could have been saved by utilization of CPH in livestock feed rations. About an annual average of 39,125 metric tonnes of maize was imported over the period. (Table 3). The estimated amount to be saved from incorporation of CPH in livestock feeds completely makes the nation self-sufficient, thus nullifying the need to import maize.

Going by the estimate that maize can make up to 60% of whole feed rations, the amount of maize utilized in compounding livestock feed rations in Nigeria between 1977 - 1996 is given in Table 4. These values represent the annual total feed consumption with the maximum utilization of 295,928 tonnes in 1981/82 and thereafter declining to 282,715 tonnes by 1995/96. An average annual maize consumption of 273,954 tonnes was recorded over the period.

As shown in Table 5, if CPH is substituted for maize in various livestock feeds, using the safe levels recommended by research, the following respective amounts of 34,048; 39,693; 40,670; 41,687; 41,624; 36,947; 40,174 and 41,784 metric tonnes of maize would have been available for other uses than livestock consumption. This gives an annual average of 39,473 tonnes (Table 5).

CONCLUSION

The quantity of maize that can be conserved, if CPH is substituted for maize in livestock feeds in Nigeria, would go a long way in bridging the deficit between demand and supply for human consumption. It will possibly prevent the soaring cost of livestock feeds and alleviate its being limiting for feed production. The extent of lowering the cost however would depend on the cost of the CPH and other feed components, which need be further incorporated to prevent a decline in the quantity of feeds. Furthermore, utilization of CPH will assist in good sanitation on cocoa farms, alleviate the incidence of black pod disease and thereby reduce farmers investments on pesticides and labour, provide additional earnings to cocoa farmers from sale of CPH to feed millers and consequently increase the net revenue of cocoa producers.

CPH substitution for maize in livestock feed rations promises a bright future for the Nigerian economy in the area of self-sufficiency in food and raw material supply.

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