

CABBAGE AND BANANA/PLANTAIN LEAF

IN RABBIT DIETS

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INTRODUCTION

The rabbit, Oryctolagus cuniculus, utilizes plant material directly and more efficiently than ruminants which require the intermediary metabolism of herbage by micro-organisms prior to nutrient uptake. A potential exists for meat production from rabbits, 84 kg meat/4 kg doe/year. Like in any other tropical country, peak rabbit production in Cameroon must coincide with the seasonal herbage growth periods. This would minimize competition with man and ruminants for herbage or feed resources.

In the Bamenda highlands of Cameroon, cabbage (Brassica oleracea var capitata) is in excess of local consumption during the months of August-November. These excesses go to waste. Banana (Musa sapientum) and plantain (Musa paradisiaca) leaves are trimmed in large quantities from the stem and left to rot all year round.

Cabbage is rich in Vitamin A and to a lesser extent in calcium and phosphorus. However, feeding trials have shown that cabbage induces goitre in rabbits (McCarrison, Sankaran and Madhava, 1933; Downs, 1936; Bonadoma and Pozzi, 1957).

This study attempts to evaluate the value of these plant material in rabbit diets.

MATERIALS AND METHODS

ANIMALS: In the first trial 45 weanling rabbits of mixed breed - Mankon (local breed), New Zealand and Californian - were fed test diets (Table 1). The first diet contained 30% dry leaves, the second diet contained 30% fresh leaves, while the third diet contained 30% level of leaves of which 15% of this amount was fresh and the remaining 15% of the leaves was dry. The design was a completely randomized design with 15 rabbits per treatment and the trial lasted 48 days.

The second trial contained 42 rabbits (21 Mankon and 21 Californian). These weanling rabbits were fed diets (Table 2) in which 5%, 15% and 25% levels of fresh cabbage leaves replaced maize as an energy source. The design was a 3x2 factorial consisting of two breeds of rabbit and three levels of leaves. The experiment lasted six weeks.

MANAGEMENT: Feed and water were given ad libitum to rabbits in separate cages 42x40x60 cm arranged in two tiers. The cages were separated by galvanized zinc sheets. The bottom cage was raised 20 cm from the ground. The rabbits had twelve hours of daylight.

Table 1: PER CENT COMPOSITION OF BANANA/PLANTAIN LEAF IN RABBIT DIETS

FEED INGREDIENTS	FORM OF LEAF			Banana/ Plantain Leaf
	Dry	Fresh	Fresh and Dry	
Dry banana/plantain leaf	30.0	-	15.0	
Fresh banana/plantain leaf	-	30.0	15.0	
Rice bran	4.0	4.0	4.0	
Brewers dried grains	9.0	9.0	9.0	
Corn	33.7	33.7	33.7	
Palm oil	2.0	2.0	2.0	
Blood meal	3.0	3.0	3.0	
Palm kernel cake	3.0	3.0	3.0	
Cottonseed cake	13.0	13.0	13.0	
Vitamin/Mineral premix*	0.3	0.3	0.3	
Bone meal	1.5	1.5	1.5	
Salt	0.5	0.5	0.5	
	<hr/> 100.0 <hr/>	<hr/> 100.0 <hr/>	<hr/> 100.0 <hr/>	
CALCULATED ANALYSIS:				
Energy DE (Kcal/kg)	2570	2570	2570	338.4
Dry matter %	98.0	94.9	95.3	20.0
Crude protein %	15.7	15.7	15.7	3.6
Crude fibre %	8.2	8.2	8.2	12.0
Lysine %	0.6	0.6	0.6	0.1
Methionine/Cystine %	0.8	0.8	0.8	1.0
Calcium %	0.6	0.6	0.6	0.1
Phosphorus %	0.6	0.6	0.6	0.03
Cost/kg feed (frs CFA)**	88.0	88.0	88.0	20.0

** (Francs Community French Africa; US \$1 = 390 frs CFA)

* A vitamin mineral premix manufactured by YOUNGS PREMIX, USA for sows to contain per kilogram, 27 g Calcium, 10 g Phosphorus, 6 g Iron, 3.5 g Zinc, 2.4 g Manganese, 600 mg Copper 20 mg Iodine, 26 mg Cobalt, 4 mg Selenium, 45000 IU, Vitamin A, 14000 IU Vitamin D, 90 mg Vitamin E, 18 mg Vitamin K, 16 mg Vitamin B12, 113 mg Pantothenic Acid, 27 mg Riboflavin.

Table 2: PER CENT COMPOSITION OF CABBAGE IN RABBIT DIETS

FEED INGREDIENTS	LEVEL OF CABBAGE			Cabbage
	5	15	25	
Cabbage (fresh)	5.0	15.0	25.0	
Corn	25.0	15.0	5.0	
Palm oil	1.0	2.0	4.0	
Rice bran	15.0	13.0	10.0	
Wheat bran	28.0	28.0	28.0	
Fish meal	1.0	2.0	3.0	
Cottonseed cake	11.0	11.0	11.0	
Palm kernel cake	12.5	12.5	12.5	
Bone meal	1.0	1.0	1.0	
Vitamin/Mineral premix*	0.3	0.3	0.3	
Salt	0.5	0.5	0.5	
	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	
CALCULATED ANALYSIS				
Energy DE (Kcal/kg)	2949	2902	2722	214.3
Dry matter %	91.3	85.8	75.3	10.0
Crude protein %	16.2	15.7	15.6	2.2
Crude fibre %	7.8	7.3	5.2	1.0
Lysine %	0.6	0.6	0.7	-
Methionine/cystine %	0.5	0.5	0.5	-
Calcium %	0.6	0.6	0.7	.05
Phosphorus %	0.9	0.9	0.9	0.02
Cost/kg feed (frs CFA)**	98.0	95.0	93.0	35

* See Table 1

** See Table 1

PLANT MATERIAL: Banana/plantain leaves were harvested from four-year old plants and were sundried for 96 hours on black polythene sheets, bagged and stored in jute sacks until ready for use. Cabbage leaves were harvested when they were three months, from the Institute of Animal Research garden.

RESULTS

The weight gains of rabbits fed banana/plantain leaves were similar (Table 3). However, significantly ($P < 0.01$) more feed was consumed by the rabbits fed fresh leaves, followed by rabbits fed the mixed fresh and dry leaves. Rabbits fed the dry leaf ate the least amount of feed and more efficiently utilised their feed.

One rabbit was lost from the group fed the fresh leaf. Two of the rabbits fed the dry leaf and one of the rabbits fed

the mixed form leaf had diarrhoea during the first two weeks of the experiment.

Table 4 shows that significantly (P 0.01) more money was used to convert feed into a kilogram of meat for the rabbits fed the fresh leaves and least for the rabbits fed the dry leaf. Total revenue less feed cost confirmed the above trend.

Table 3: GROWTH CHARACTERISTICS OF RABBITS FED TEST DIETS CONTAINING BANANA/PLANTAIN LEAVES

CHARACTERISTICS	FORM OF LEAF			
	Dry	Fresh	Dry and Fresh	S E M
Total weight gain (kg)	0.9	0.9	0.8	0.05
Total feed intake (kg)	2.1 ^x	3.2 ^x	2.4 ^y	0.05**
Average daily weight gain (g)	20.1	20.2	19.3	1.09
Average daily feed intake (g)	44.6 ^x	67.4 ^y	53.8 ^z	3.20**
Feed/gain ratio	2.2	3.6	3.8	0.15**
Livability (%)	100.0	93.3	100.0	3.72
Diarrhoea	2/15	1/15	0/15	

x y z within rows means bearing the same superscript are not significant (P 0.01)

** Significant at P 0.01

Table 4: ECONOMIC DATA OF RABBITS FED BANANA/PLANTAIN LEAF DIET

CHARACTERISTICS	FORM OF LEAF			
	Dry	Fresh	Dry and Fresh	S E M
Total feed cost (fCFA)	25968	38350	31261	
Cost/kg weight gain (fCFA)	1971 ^x	3012 ^y	2470 ^z	0.08**
Total number of live rabbits	15	14	15	0.01
Final live weight rabbits (g)	2.01	2.13	2.00	0.03
Total revenue (fCFA)	61040	59080	60140	0.02
Revenue less Feed Cost	35072 ^z	20730 ^x	28879 ^y	0.01**

In the second trial (Table 5) more weight was gained and feed was more efficiently utilised by rabbits fed the 15% cabbage level diet. Feed intake, weight gain and feed conversion were similar for the two breeds of rabbits, although the Californian breed non-significantly (P>0.05) utilised their feed more efficiently than the Mankon breed. Table 6 shows that neither breed effects nor diet effects were important as far as carcass measurements were concerned.

Table 5: GROWTH TRAITS OF RABBITS FED TEST DIETS CONTAINING CABBAGE

BREED MEANS	Total feed intake (kg)	Total weight gain (kg)	Average Daily weight gain (g)	Average feed intake (g)	Feed/Gain Ratio	Livability (%)
Californian	4.6	0.7	14.7	106.8	7.0	95.2
Mankon	5.0	0.7	14.4	111.1	7.2	90.5
SEM	0.21	0.06	1.40	4.90	1.48	3.40
RATION MEANS						
5% cabbage	3.7 ^x	0.6 ^a	13.2 ^a	89.8 ^a	8.2	100.0
15% cabbage	5.2 ^y	0.8 ^b	18.1 ^b	115.4 ^b	6.7	85.7
25% cabbage	5.5 ^y	0.6 ^a	12.4 ^a	121.6 ^a	10.9	92.7
SEM	0.26**	0.08*	1.71	5.90	1.80	3.40

a b c within columns means bearing the same superscript are not significant at P<0.01

x y z within columns means bearing the same superscript are not significant at P<0.05

* Significant (P<0.05)

** Significant (P<0.01)

Table 6: CARCASS TRAITS OF RABBITS FED DIETS CONTAINING CABBAGE

BREED MEANS	Final Live weight (kg)	Carcass weight† (%)	Liver weight (%)	Kidney weight (%)	Thyroid weight (g/kg live weight)
Californian	2.2	54.8	2.8	0.5	0.4
Mankon	2.4	57.4	2.8	0.5	0.5
SEM	0.1	1.13	0.16	0.04	0.02
RATION MEANS					
5% cabbage	2.3	54.8	2.6	0.5	0.5
15% cabbage	2.4	56.9	3.0	0.5	0.4
25% cabbage	2.2	56.6	2.7	0.5	0.4
SEM	0.12	1.38	0.2	0.05	0.03

† Expressed as per cent live weight

DISCUSSION

The results in this experiment show that daily weight gains of 20.1 g, 20.2 g and 19.3 g for rabbits fed the dry, fresh and mixed form of leaves were lower than daily weight gains for those fed other tropical forages of 34.5 g for cassava leaves, of 34.5 g for wing bean and 33.5 g for *Stylosanthes guyanensis*, but better than daily weight gains of 16.0 g and 16.1 g for rabbits fed *Amaranthus* spp and sunflower leaves respectively, (Harris, Cheeke, Telek and Patton; 1981; Harris and Patton, 1981).

However, daily weight gains for rabbits in the temperate zone are generally higher than those in the tropical zone. Average daily weight gains of rabbits fed cabbage leaves were generally poor, reflecting the low nutrient content of cabbage.

Feed conversion on the other hand of 2.20 for dry banana/plantain leaves, of 3.63 for fresh leaves and of 2.78 for the dry/fresh banana/plantain fed rabbits, were better or comparable to those of 2.60 for alfalfa leaf, of 3.13 for Stylosanthes and of 2.62 for Desmodium intortum fed rabbits, (Harris et al, 1981). Rabbits fed banana/plantain leaves judiciously used their feed to produce meat although at a slower rate than rabbits fed tropical forages in the temperate area but quite satisfactory if the nutrient quality and cost of banana/plantain leaves are considered. McNitt (1980) showed that rabbits fed cabbage leaves with poultry broiler diet as concentrate had feed/gain ratio of 6.3, which is similar to 6.0 as shown in this study for that of rabbits fed the 15% cabbage level diet. Feed conversion values for rabbits fed cabbage suggest that cabbage leaves do not support active growth.

Banana and plantain leaves contain tannins, phenolic compounds which bind proteins and inhibit enzymes (Butler and Bailey, 1973) while cabbage contains cyanogenic glucosides (Conn, 1969) which release cyanide, a deadly poison upon hydrolysis. To what extent these non-nutrients affected diet palatability and utilisation cannot be estimated from this study. Efficient utilisation of dry leaves and not fresh leaves may result from the decomposition or transformation of these compounds to less toxic components during drying.

No detectable diseases were observed in these rabbits except for the few diarrhoea cases noted earlier. Thyroid weights of rabbits were similar, suggesting that either the level of cyanide in the cabbage was low or rabbit liver detoxification systems effectively eliminated the cyanide thus avoiding thyroid enlargement by the effects of thiocyanate (Oke, 1973; Fomunyam, 1982). Livability of the rabbit was generally high (85-100%).

Ademosum (1976) showed that 80% of the cost of animal production in the tropics can be attributed to feed costs. The economic data (Table 4) and carcass traits (Table 5) show that incorporating banana/plantain and cabbage leaves reduce feed costs and show a great potential for profit, especially for the rural and urban Cameroon farmer who can readily obtain these feed items. These leaves would also be of great value in the dry season when grain prices are at their most expensive price in Bamenda. Competition between man and livestock would be limited while meat production from rabbits would still be possible.

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SUMMARY

Weanling rabbits fed test diets containing 30% levels of dried, fresh or a mixture of fresh and dried banana/plantain leaves respectively had daily weight gains of 20.1 g, 20.2 g and 19.1 g. Feed/gain ratios of 2.20, 3.63 and 2.78 showed that dried leaves were more efficiently utilised than fresh leaves. It is suggested that incorporating 30% banana/plantain leaves into rabbit diets reduced feed costs and increased profit margins for small farmers. Fresh cabbage leaves fed at 5, 15, and 25% levels respectively were of greater value for dry season or maintenance feeding.

RÉSUMÉ

Les lapereaux après sevrage, nourris par une ration test contenant 30% en mesure de feuilles de banane ou de plantain sèches, fraîches ou sèches et fraîches en mixture, ont en moyenne un gain journalier en poids égal respectivement à 20.1 g, 20.2 g et 19.1 g. Le rapport de la quantité absorbé par le poids gagné présentant les valeurs de 2.20, 3.63, 2.78, à montre que les feuilles sèches ont produit plus d'effet en poids dans leur utilisation. Il est suggère que l'incorporation de 30% de feuilles de banane ou de plantain dans l'alimentation des lapins réduit le cout de la nutrition et élevé les chances de profit marginales pour les petits fermiers. Les choux fraîches nourrissant selon un pourcentage de 5, 15 et 25% présentant ainsi la plus grande valeur pour la saison sèche ou pour la maintenance nutritionnelle.