JOINT PROCEEDINGS

TROPICAL REGION

21st Annual Meeting of the Caribbean Food Crops Society and 32nd Annual Meeting of the American Society for Horticultural Science — Tropical Region

technology for agricultural development

Hilton Hotel, Port of Spain, Trinidad
8 - 13 September 1985

Host Institutions

— Caribbean Agricultural Research and Development Institute

— Ministry of Agriculture, Lands and Food Production, Trinidad & Tobago

— Faculty of Agriculture, University of the West Indies

Published by the Caribbean Food Crops Society, Box 506, Isabela, Puerto Rico 00662

FEEDING OF CASSAVA SILAGE TO GROWING PIGS
A PRELIMINARY TRIAL

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ABSTRACT

Freshly harvested cassava roots were chopped manually with a machete into slices of 1 to 6cm thickness and ensiled in 45 gallon (180 litres) barrels the following day with either 2% salt or 50% final molasses by weight. After an ensiling period of 7 days material was removed daily for feeding to pigs. Growing pigs, balanced for sex and litter, were fed in groups of 4 with either (a) a corn/soybean meal ration (b) a ration with 50% corn replaced by salt-ensiled cassava and soybean meal, or (c) a ration with 50% corn replaced by molasses-ensiled cassava and soybean meal. A vitamin/mineral mix was fed with each ration at the rate of 30 grams per head per day. The animals were adapted for 14 days and the experimental period ran for 23 days when supply of the ensiled cassava was exhausted. The average daily gains (g) of the pigs on the three rations during the 23–day experimental period were 509, 510 and 447, respectively, and were not significantly ($P > .05$) different.

RESUMEN

Raíces de yuca acabadas de cosechar fueron cortadas manualmente con un machete en trozos de un espesor de 1–5 cm y ensiladas el día siguiente en barriles de 45 galones (200 litros) con 2% de sal o 50% de melaza líquida, por peso. Después de un período de ensilaje de 7 días, se utilizó de esta materia diariamente para alimento de cerdos. Cerdos en crecimiento balanceados por sexo y cría fueron alimentados en grupos de cuatro, con una cualquiera de: (a) una ración de maíz/soja, (b) una ración con el 50% del maíz sustituído por un ensilaje salado de yuca y soja (c) y una ración con el 50% del maíz sustituído por un ensilaje de yuca con melaza y soja. Una mezcla de vitamina/mineral fue dada diariamente en cada ración con una proporción de 30 por cabeza. Los animales estuvieron en un proceso de adaptación que duró 14 días y el período experimental se extendió por 23 días, cuando el suministro de yuca ensilada se agotó. El aumento promedio de peso diario de los puercos alimentados con las tres raciones durante el período experimental de 23 días fue de 509, 510 y 447, respectivamente y no hubo una diferencia ($P > .05$) significativa.

Several root-crops can be fed to livestock (Gerpacio *et al*, 1974; Jeffers and Haynes, 1967; Gohl, 1981; Yeh, 1982) but commercially cassava *(Manihot* spp.) is used most extensively (Muller *et al*, 1974; CIAT, 1978 a).

It can be fed fresh, or processed by chipping, dehydration and grinding. In these forms it can be stored, and incorporated into complete feeds for livestock. While processing is effective, it increases the cost of the final product and is probably more appropriate for large-scale operations. An alternative to processing is ensiling. Reports indicate that cassava can be ensiled for both human (Yen, 1978) and livestock (CIAT, 1978 b) consumption. In the latter case, salt was used in the ensiling process. To investigate the usefulness of the process, a research programme was undertaken to study different methods of ensiling cassava and the practical application of feeding the ensiled product to pigs. This paper reports the results of a preliminary experiment undertaken to determine the feeding value of cassava ensiled with salt and final molasses. The programme has subsequently been expanded to include the ensiling of other crops such as sweet potatoes and rejected bananas.

Materials and methods

Cassava grown on the Central Experiment Station was harvested approximately two years after planting, excess soil washed-off under pressurised water and chopped by hand with a machete into slices varying in thickness from 1 to 6cm. The chopped material was ensiled the following day with either 2% salt or in 50% final molasses by weight. The ensiled material was mixed by hand and stored in steel drums of 45 gallons (180 litre) capacity. This was followed by mixing once per day with a wooden paddle. The first batch of cassava was ensiled on the 13th September, 1984 and feeding of that batch commenced on the 21st September, 1984. The second batch was ensiled on the 20th September, 1984 and feeding commenced on the 16th October, 1984.

The ensiled cassava was mixed with other ingredients and fed to wearned crossbred pigs balanced for sex (females and barrows) and litters. The pigs were held in groups of 4 after being assigned to the different rations. An adaptation period of 14 days was used to allow for a gradual introduction of the molasses-ensiled cassava. The actual experimental period was 37 days. The ingredient composition of the rations offered to the pigs is shown in Table 1. The daily feed offered to each pig is also shown in Table 1. Both salt and molasses-ensiled cassava were used to replace 50% corn in the ration on an approximate dry matter basis. The rations were calculated to supply nutrients as recommended by NRe (1978) and their partial nutrient composition is shown in Table 2. At the end of the experimental period 2 animals (one female and one barrow) from each group were slaughtered and backfat measurements taken.

The data obtained in the study were statistically analysed according to procedures outlined in Steel and Torrie (1960).

Table 1. Ingredient composition of rations fed per head daily according to live-weight

Ration	Ingredient	Weight of ingredient (g) for animals 10-20 kg	Weight of ingredient (g) for animals 20-35 kg
Control	Corn	722	1166
	Soybean meal	280	360
	Vitamin/mineral mix [1]	30	30
Salt-ensiled cassava	Corn	361	583
	Soybean meal	280	360
	Salt ensiled cassava	1050	1700
	Vitamin/mineral mix	30	30
Molasses-ensiled cassava	Corn	361	583
	Soybean meal	280	360
	Molassess ensiled cassava	600	975
	Vitamin/mineral mix	30	30

[1] Contained: 46.67% Dicalcium phosphate, 26.67% limestone, 20.00% salt and 6.66% of a commercial swine vitamin/mineral premix composed of (per gram) vit A 4800 IU, vit D_3 1000 U, vit E 4 mg, vit K 0.8 mg, Folic Acid 0.2 mg, Nicotinic Acid 4 mg, Pantothenic Acid 2.4 mg, vit B 2 mg, vit B_1 0.8 mg, vit B_{12} 4 meg, Pyridoxine 0.8 mg, Biotin 10 meg, 10.56 mg, Se 0,04 mg, Cu 5.6 mg, Fe 32 mg, Mn 20 mg, Zn 40 mg and Co 0.64 mg.

Table 2. Partial nutrient composition of the three rations offered per head daily (calculated on a dry matter basis) according to live weight.

	Control		Cassava-salt silage		Cassava-molasses silage	
	10-20 kg	20-35 kg	10-20 kg	20-35 kg	10-35 kg	20-35 kg
Metabolizable Energy (MJ)	14.55	28.22	14.17	21.69	13.59	20.79
Lysine (g)	10.5	14.1	9.8	12.8	9.8	12.8
Trypotaphan(g)	2.3	3.2	2.0	2.7	2.0	2.7
Threonine (g)	8.1	11.2	6.8	9.2	6.8	9.2
Methionine (g)	3.3	4.7	2.7	3.7	2.7	3.7
Calcium (g)	6.3	6.5	6.3	6.4	6.3	6.4
Phosphorous (g)	3.7	4.2	3.4	3.7	3.4	3.7
Vitamin A (IU)	9600	9600	9600	9600	9600	9600
Vitamin D (IU)	2000	2000	2000	2000	2000	2000

Results and discussion

Observations indicated that the salt-ensiled cassava remained firm and hard with little or no disintegration for 14 to 21 days after ensiling. However, liquid collected in the container and was probably cellular in origin. After 21 days, the slices of cassava became soft and pulpy. There was some insect infestation when the container was not sealed.

Molasses was very effective for ensiling cassava. The slices remained firm and hard throughout the feeding period. However, they became light to dark brown in colour and this was probably due to the presence of molasses in the cassava tissue. There was some fermentation of the mixture as evidenced by an alcoholic odour. The amount of alcohol produced was not determined but was not expected to be high. The ensiled mixtures were readily accepted by the animals and no ill effects were observed over the experimental period.

The average initial weight (kg), final weight (kg), daily gain (g) and the backfat thickness (cm) are given in Table 3.

The average daily gains (g) of the animals on the different treatments over the experimental period were 509, 510, and 447 for the control, salt and molasses-ensiled cassava rations respectively. The differences in the average daily gain were not significantly ($P > .05$) different. Since the metabolizable energy content of cassava on a dry matter basis is somewhat higher than corn (NRC, 1978; Gohl, 1981, Muller *et al.*, 1974) then animal performance is not expected to be significantly different. With the

Table 3. Average liveweights and average daily gains of weaned pigs fed on a control diet and two rations containing cassava silage.

	Control	Silage	
		Salt/ cassava	Molasses/ cassava
Average final weight (kg)	30.25	27.75	25.75
Average initial weight (kg)	17.83	16.03	15.48
Average daily gain (g)	509[a]	510[a]	447[a]
Backfat thickness (cm)	4.17	3.68	4.04

[a] - Means in the same row with identical supercsripts are not significantly (p>.05) different.

molasses-ensiled cassava ration, however, the average metabolizable energy of the mix on a dry-matter basis is lower than the corn/soybean ration but animal performance was not significantly different ($P > .05$), although the average daily gain was numerically lower. The effect on average daily gain of the lower metabolizable energy in the molasses/ cassava treatment will become greater (i.e. a greater decline in average daily gain) as the liveweight of the animal increases. This could be eliminated, at least partially, by substituting the molasses/cassava ration for corn on a metabolizable energy basis rather than a dry matter basis.

The feed conversion efficiency (FCE) was not calculated because of the short feeding period. It would be interesting to see FECs with the silage rations.

The backfat thickness was measured on two animals (one female and one barrow) in each treatment but no statistical analysis was carried out on these measurements (Table 3). Animals on the control diet appeared to have more backfat than those on the cassava silage diets.

Diarrhoea, a problem associated with the feeding of final molasses to pigs (Willett *et al*, 1946; Blanco *et al* 1964; Brooks and Iwanga, 1967; Preston and Willis, 1969) but not with high-test molasses (Mac Leod *et al* 1968; Velazquez *et al* 1969, 1970) was not observed in the animals fed the molasses-ensiled cassava. This was probably due to the low level of molasses in the diet.

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