FRUITS AND FRUIT BY-PRODUCTS AS CEREAL SUBSTITUTES IN ANIMAL FEEDING

by

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INTRODUCTION

In tropical areas as well as in temperate ones, the intensification of animal production calls for the use of concentrate feeds in which the proportion of cereals is very important (70 to 80%).

Many developing countries cannot afford this luxury, the cereals primarily being intended for man. Cereal importation for animal feeding is possible but very costly for these countries; therefore alternatives must be found.

Many studies have shown that it is possible to substitute all or part of cereals in animal feeding by various by-products having a high energetic value, but the implementation of this technique has been limited.

1) Bananas (Fig. 1)

About 10 to 15% of the production is rejected and can be used in animal feeding. Hence about 5 to 10 million metric tons of rejected bananas are available every year.

The use of fruits and fruit by-products in animal feeding initially implies that these products are available in sufficiently large volume to allow their usage. These products are available either from units of production (large scale or zone of production as for banana) and as by products of industries (from canning pineapple and citrus industries).

2) Cannery/factory by-products (Fig. 2)

By-products account for 40% (pineapple) and between 45 to 65% (citrus) of the weight of the fruits that come into the factory.

World availability of these products is about 7-8 million metric tons for citrus by-products and 400 000/500 000 metric tons for pineapple by-products.

Utilization of cannery/factory by-products

Whenever possible, these will be used fresh without treatment. If this statement is relevant for bananas, it is not desirable for citrus and pineapple by-products. In fact, the low level of dry matter of these products restricts intake and consequently performance of animals fed on these. Hence it is advisable to use pressed by-products with dry matter levels two or three times higher than the original product.

Production is often seasonal, and ensures good availability. It is sometimes necessary to store a large part of the production.

Storage can be done in either of the two ways.

1. Drying: There has to be an economical interest in this method in the light of increasing energy costs.

2. Silage-making: Silage is nowadays the most simple and most economical method of storing such by-products.

For all the products mentioned, silage is made without any additives, either directly from pressed citrus and pineapple by-products or with chopped green bananas.

In all cases, the quality of the silage obtained is very good in terms of pH, fermentation characteristics, and palatability.

Specifications of fruits and fruit by-products

Table 1 below gives the principal characteristics of the different products.

The energy value of these is generally not far from that of cereals (rice, oat, barley) making them a good substitute for cereals. However, the levels of crude protein are generally low, ranging from 5-8% hence implying protein supplementation.

Production levels achieved on fruits and fruit by-products

Mention will be made only of some results achieved with rations where substitution rates are known, both for milk and meat production.

1. Milk production from whole bananas

Bananas (Table 2)

The different trials mentioned show that it is possible to substitute all cereals in cow or goat rations with fresh ensiled bananas.

Milk production is not affected by substitution of cereals by bananas, and liveweight increases with fresh banana silage but decreases with dehydrated banana meal. In this form, the rate of passage in the animal is quicker than other forms and so the digestibility and the energetic value of the starch in dehydrated bananas are lower.

Pineapple by-products

Many articles report on the use of this by-product in dairy cattle rations, but the results of these experiments in which the cereal is substituted by pineapple by-products, are not clear.

Citrus pulp (Table 3)

As with bananas, it is possible to substitute all cereals in a ration for milking cows by citrus pulp - without affecting milk production. However liveweight of animals on these diets decreases.

2. Meat production from fruits and fruit by-products

Bananas (Table 4)

- Ruminants: in the trials carried out the substitution of part or the whole of cereals in fattening rations does not alter the performance of the animals.

- Other classes of animals

  Rabbits: fresh green bananas used in rabbit production can lead to a saving of about 35% of the concentrate feeds without affected growth.

  Pigs: the growth of animals fed bananas is lower than with concentrate feeds but carcass and meat quality is higher (less fat, no exuding meat).

Pineapple and citrus (Table 5)

The results of these experiments with ruminants demonstrate that these by-products can also be used as a substitute for cereals without alteration of the performances of animals fed on them.

In conclusion, it is possible to substitute part or the whole of cereals in milking and fattening rations by whole bananas and canned by-products of citrus and pineapple without affecting the animals' performance.

There is nothing new about the use of these products but these techniques have not known the development and application that could be hoped for.

In the French West Indies, besides human factors such as aversion of novelty and lack of information, the main restricting factor of the use of these by-products is in the high cost, mainly due to the bulkiness of the products and high transport costs (Figure 3). Furthermore, the production zones of such by-products are rarely animal production zones.

The question hence remains as to whether it is possible to reduce the price of such by-products. It is difficult to reduce the price of treatment but in return it is possible to reduce the transport costs, by bringing the animals to a feedlot near to the cannery instead of carrying the by-products to the animals.

Figure 4 gives the outline of a fully integrated system whereby the fruits and fruit by-products are used on site for animal production.

In fact, this system:

1. increases income surface unit
2. reduces the time usually spent digging into the ground leaves and stems which could in the proposed system, be used as fodder for cattle
3. reduces the need for chemical fertilizers by use of liquid manure
4. allows diversification of production on the exploitations

This system is currently tested in Martinique in the French West Indies on the basis of a pineapple production unit. It is hoped that such a system if successful will be applied to other by-products and in other countries.

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Table 1: Specifications of fruits and fruit by-products

		DM %	CP (% DM)	ME (Kcal/kg DM)
Bananas	Fresh (Green/Yellow)	18-22	5.8 ± 0.3	Sheep - 3 086 ± 41
	Ensiled	29.0 ± 0.8	5.1 ± 0.4	Swine 3 664 ± 99
Pineapple	Fresh	10-12	5.0 ± 0.3	Sheep - 2 800
	Pressed	25.4 ± 1.2		Swine - 3 300
	Ensiled	21.7 ± 0.7	6.5 ± 0.5	
Citrus pulp	Fresh	16-19	6-8	Sheep-2 740 ± 134
	Dried	89.5		Swine-3 178 ± 172
	Ensiled	16- 20	7-8	

Table 2: Milk production from whole bananas

Authors	Type of Animal	Ration	Results
GEOFFROY F. (1980)	Goats	Forage + maize + soybean meal Forage + maize 50% Ban.Silage 50% + soybean meal Forage + Ban. Silage + Soybean meal	- milk production - no significant difference - liveweight decreaee with maize increase with banana
(1977)		Forage + Ban.(meal) + Soybean meal + urea Forage + Ban.(sil) + " " " Forage + Ban.(fresh)+ " " "	- milk production - no significant difference - liveweight: decrease with ban. meal; increase with ban. silage and fresh bran.
RHIS and ISLER (1976)	Cows	Forage + Conc (cereal) Forage + Conc (Banana meal)	- no significant difference

Due to low energy level, the use of fresh or banana silage is not recommended for milking sows or rabbits.

Table 3: Milk production from citrus pulp

Author	Type of Animal	Ration	Results
RODRIGUEZ (1971)	cows	Forage + conc maize 100% " + " 70%+D.cit.30% " + " 55%+ " 45% " + " 40%+ " 60% " + " 25%+ " 75%	milk production - no significant difference
WICKES and BARTSCH (1978)	cows	Hay + conc barley 100% " + " " 82% + D.cit.18% " + " " 51% + D.cit.49% " + " " 0 + " 100%	milk production - no significant difference between treatment 1 and 4 liveweight decreases with D. citrus pulp 100%
LANZA and MESSINA (1979)	cows	Forage + conc cereals 100% " + " D.citrus 100%	milk production - no significant difference

Table 4: Meat production from bananas

Authors	Type of Animal	Ration	Results
SPIRO 1973	Calves	- Conc cereals 100% - Conc cereals 35-40% Ban. meal 60-65%	- daily gain: no significant difference
SPIRO 1973	Steers	- Conc corn 100% - Conc corn 40% + Ban. meal 60%	- daily gain higher with banana meal
CHENOST et al - 1971	Kids	- Conc cereals 100% fresh banana 100%	- daily gain: No significant difference
GEOFFROY 1985	Steers	- Forage + conc (cereals 100%) - Forage + silage Banana	- daily gain: no significant difference
GIDENNE MATHERON 1984	Rabbit	- Conc (cereals) ad lib - Conc (cereals) ad lib + banana green ad lib	- daily gain: no significant difference savings of 35% of conc.
SEVE et al 1976	Pig	- Conc cereals 100% - Ban.fresh or silage + milk compl.	- daily gain lower with banana: no significant difference between the different forms of banana

Table 5: Meat production from cannery by-products

	Authors	Type of Animal	Ration	Results
Pineapple	GEOFFROY 1983	Steers	Forage + conc (cereals 100%) " + Pineapple silage + nitrogen compl.	- daily gain: no significant difference
	GEOFFROY 1983	Lambs	Forage + conc cereals 100% Forage + Pineapple silage + soyabean meal Pineapple silage + soyabean meal	- daily gain higher with pineapple silage
Citrus	HENTGES et al 1966	Steers	Corn cobs + conc cereals 100% " + " cereals 77% citrus 23% " + " cereals 53% citrus 47% " + " cereals 28% citrus 72% " + " cereals 0 citrus 100%	- daily gain: no significant difference
	KIRK and KOGER 1970	Steers	Hay + maize Hay + citrus pulp	- daily gain: no significant difference

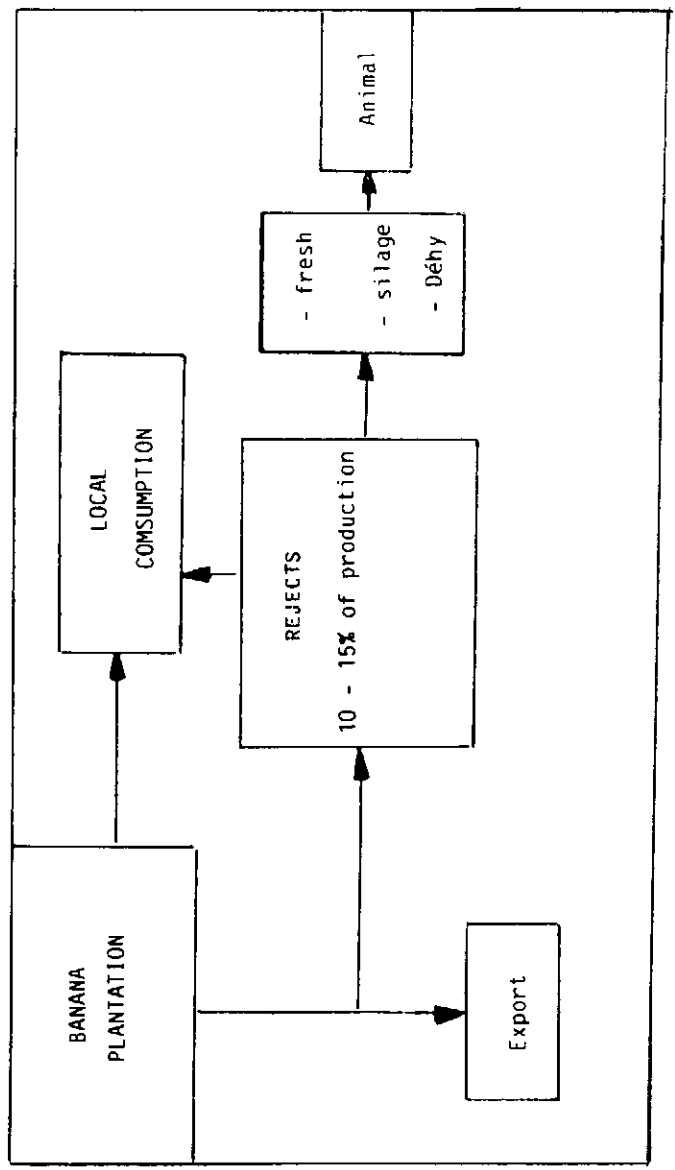

Figure 1: Banana

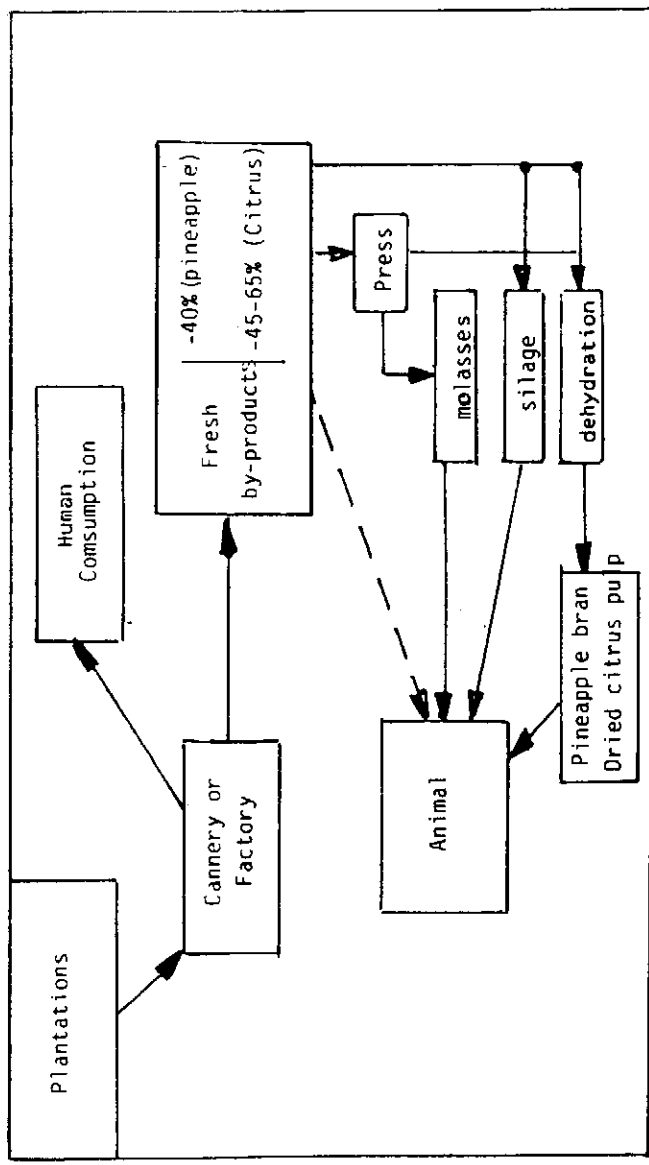

Figure 2: Citrus and pineapple

Figure 3

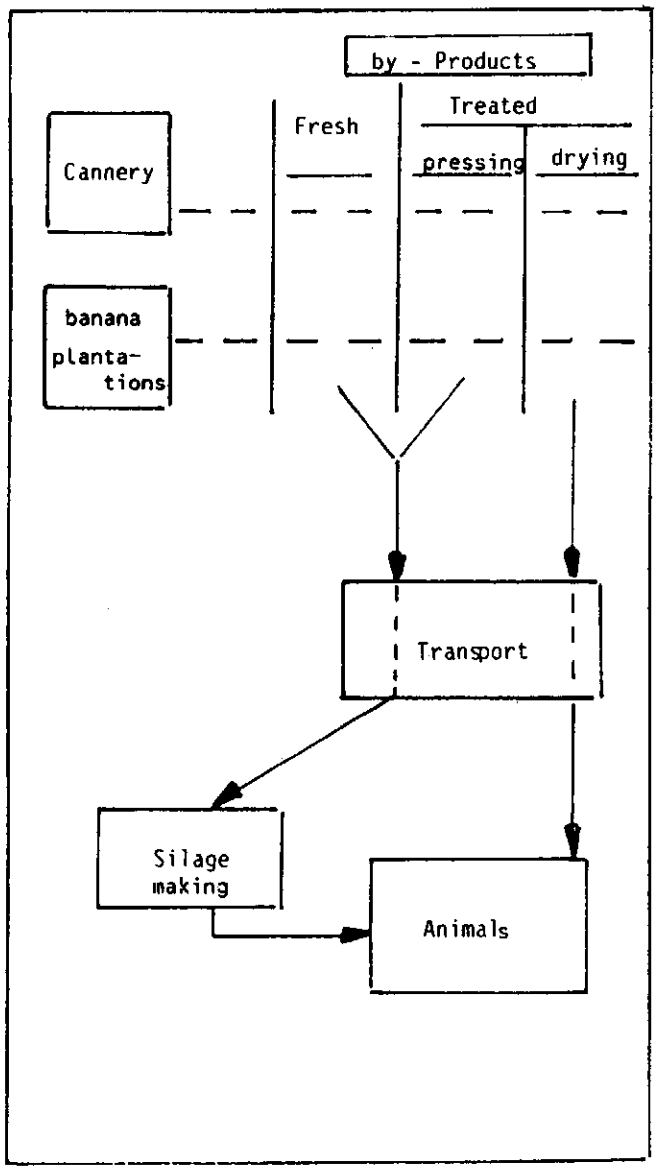
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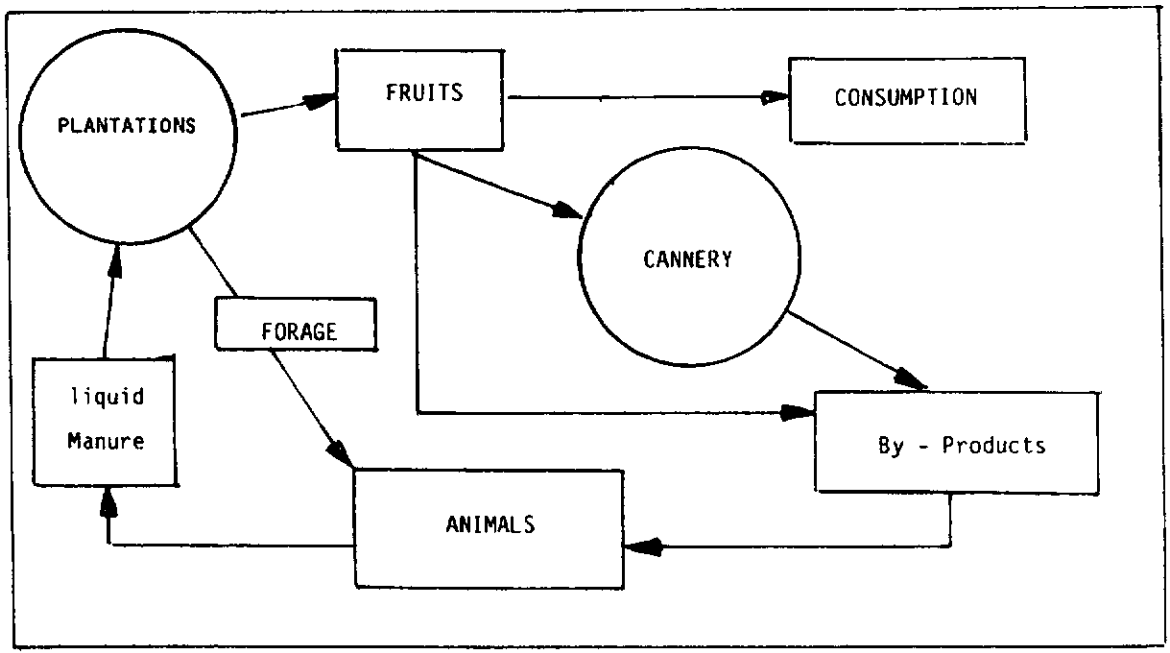
Figure 4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