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# BYPRODUCTS OF THE SISAL INDUSTRY AS CATTLE FEED: EFFECT OF GROUND SORGHUM, FISHMEAL OR RICE POLISHINGS IN CATTLE GIVEN DIETS BASED ON SISAL BAGASSE AND ENSILED SISAL PULP[1]

R. Godoy, R. Elliott and T.R. Preston[2]

Escuela de Medicina Veterinaria yZOOIQCrUa, Universidad de Yucatan, Apto 11 6-D, Merida, Yucatan, Mexico

Sisal pulp and fresh sisal bagasse were compared in a trial, using 8 bulls with a mean initial liveweight of 216 kg. The experiment lasted 140 days during which time different supplements were fed over periods of 35 days. The supplements ware (a) urea alone, (b) ground sorghum (2 kg/head/day), (c) fishmeal (0.4 kg/headtday) ant (d) rice polishings (1.6 kg/heat/day). The dietary treatments were maintained isonitrogenous (14% N x 6.25 in DM) with urea. Dry Batter digestibility of the basal diets plus urea was 53.1 (± 2.1) and 55.2 (± 1.4) for the ensiled pulp and fresh bagasse respectively. Liveweight gain (g/day) and voluntary feed intake (kg DM/100 kg liveweight) on both basal diets were as follows. Urea only - 129 and 1.30; sorghum 117 and 2.86; fish meal 443 and 3.43. After 10 days on the rice polishings supplement, the bagasse, animals showed symptoms of chronic acidosis and the experiment had to be terminated. The basal diet of fresh bagasse resulted in slightly higher liveweight gains and voluntary feed intakes compared with the ensiled pulp irrespective of the supplements fed (153 g/day and 2.59 VS. 139 and 2.43. respectively). It was concluded that to increase feed intake and liveweight gain on sisal dicta, a protein supplement of low rumen solubility is needed in conjunction with an energy source. Neither "by-pass" protein nor energy alone was sufficient

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The byproduct obtained from the traditional system of long fibre extraction from sisal leaves is termed bagasse. Recent processing innovations have increased fibre extraction and the remaining residue is termed pulp (Cordemex 1977). At present? there are only three sites of sisal pulp production in the Yucatan and current daily production only some 250 tons, Due to frequent short term shortages of pulp and the distances involved in transportation it has been necessary to develop ensiling procedures, both with or without additives (Yerena et al 1978; Godoy et al 1980), There are over 200 small defiberising mills which still process the fibre in the traditional way producing large quantities of bagasse. Current estimates of daily bagasse production range from 4,000 - 6,000 tons on the Yucatan Peninsula.

Yerena et al (1978) found that the mean apparent digestibility of the dry matter of bagasse in sheep was 48.9% whereas the digestibility of pulp was considerably higher at 63.8%.

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[2] Technical Cooperation Officers, Ministry of overseas Development, London, UK.

The nitrogen content is higher in bagasse than in pulp and Godoy et al (1971) found that bagasse also contained substantially higher quantities of soluble sugars than the pulp.

In view of the differences in the quantities of bagasse and pulp produced, it wee decided to undertake a preliminary investigation to evaluate the comparative nutritional values of the products. Various supplements were examined for their effect on liveweight gain and voluntary intake.

It was pointed out by Ferreiro et al (1978) that sisal pulp is similar to derinded low quality sugar cane both in appearance and composition and it was hypothesised that as in sugar cane feeding systems, by pass nutrients (i.e protein and energy) would be required to achieve adequate levels of animal production (Preston 1977)

## Materials and Methods

*Procedure*: The experiment lasted 140 days, and was divided into 4 periods each of 35 d duration. The order of dietary treatments was that given below (i.e A, B, C and D).

The animals were weighed only at the beginning and end of the experimental periods. Voluntary intakes, however, were measured daily.

*Treatments*: Each basal diet was fed separately to two groups of animals. On both basal diets the following treatments were evaluated consecutively.

(A) Pulp or bagasse, urea and minerals only.
(B) Pulp or bagasse plus 2 kg/d of ground sorghum.
(C) Pulp or bagasse plus 0.4 kg/d of fish meal.
(D) Pulp or bagasse plus 1.6 kg/d of rice polishings.

*Animals*: Eight Swiss x Zebu bulls of approximately 216 kg liveweight were assigned to corrals (2 per corral). The animals were deparasitised before the trial commenced. They were housed under shade in open sided corrals with slatted floors.

*Diets*: The bagasse was obtained daily from local defiberising mills located within a 3 km radius from the station in Merida. Both basal diets were offered on an ad libitum basis to the two groups of animals together with a solution of urea in water which was sprinkled over the diets together with 50g of minerals/animal/day. The sisal pulp was ensiled without additives for a 21 period before feeding to the animals. Water was available at all times.

Digestibility trial: The animals on the basal diets containing urea as the sole N source were subjected to a further three week period in metabolism crates. After a two week adaptation period faeces were collected over the following seven days.

## Results and Discussion

The mean composition of the basal diets and the feed supplements are in table 1.

Table 1:
Feed and supplement composition

| Parameter | Dietary ingredients | | | | |
|---|---|---|---|---|---|
| | Ensiled pulp | Bagasse | Sorghum | Fish meal | Rice |
| Dry matter | 21.1±1.1 | 15.2±1.4 | 95.0±1.0 | 90±1.0 | 89.1±0.08 |
| Nitrogen, % DM | 0.88±0.003 | 1.12±0.006 | 1.47±0.002 | 8.53±0.09 | 2.15±0.28 |
| Crude fibre, %DM | 26.1±1.6 | 30.7±3.4 | 2.73±0.02 | - | 6.63±0.09 |
| Soluble sugar, % DM | 19[1] | 27 | | | |

[1] 3-5% after ensiling.

The mean digestibility (DM) of the ensiled pulp and the fresh bagasse was 53.1 (i 2.1) and 55.2 (+ 1.4) respectively. The value obtained for the pulp is very similar to that reported by Ferreiro et al (1979). However, the digestibility of the bagasse was much higher than that reported in sheep by Yerena et al (1978).

The differences in liveweight gain and voluntary feed intake of the fresh bagasse and ensiled pulp are shown in table 2. The values for the experimental period using rice polishings have not been included in the analysis. This experimental period had to be abandoned after 10 days because all four animals on the bagasse diet developed symptoms of chronic acidosis. Food intake was reduced and characteristic softening of the hooves was observed.

Table 2:
Differences in mean liveweight gan and mean voluntary intake in animals fed basal diets of ensiled sisal pulp or fresh bagasse.

| Parameter | Ensiled pulp | Fresh bagasse SE(P) |
|---|---|---|
| Initial liveweight, kg | 211 | 222 |
| M ean liveweight gain, g/d | 139 | 153±23(0.05) |
| Mean intake, kg/d | | |
| Sisal (fresh weight) | 21.4 | 34.3 |
| Urea | 0.15 | 0.15 |
| Total DM | 5.18 | 6.57 |
| Consumption index[1] | | |
| Sisal | 2.08 | 2.30±0.16(0.05) |
| Total DM | 2.43 | 2.59±0.09(0.05) |

[1]DM intake (kg/IOC kg liveweight).

The reason for this is not clear although the high levels of fermentable starch in the supplement coupled with the normal low pH (3.8) of the fresh bagasse might have exhausted the animal's buffering capacity. The animals on the ensiled sisal pulp did not show symptoms of acidosis during this period.

An important feature of the results is the effect of all supplements in,increasing the voluntary intake of the basal diets. The failure of urea to maintain the liveweight of the animals on the control diet indicates that the level of intake and hence the energy input to the rumen was insufficient for microbial protein production to meet the needs of the animals.

Table 3
The effect of different supplements on the meanliveweight gain and mean voluntary intake in cattle fed ensiled sisal pulp or fresh bagasse.

| Parameter | Control(Urea) | Sorghum | Fish meal SE(P) |
|---|---|---|---|
| Liveweight gain, g/d | 129 | 117 | 443c±50.0(0.001) |
| Voluntary consumption index[1] | | | |
| Sisal | 1.30 | 2.05b | 3.20c±0.09(0.01) |
| Total DM | 1.30a | 2.86b | 3.43c±0.09(0.01) |

[1] DM intake (kg/100 kg liveweight).

The addition of ground sorghum grain to both ensiled pulp and bagasse produced a slight increase in voluntary food intake, which was reflected in a small increase in liveweight gain. It is interesting to note that Russek et al (1976) failed to obtain adequate liveweight gains in cattle fed chopped sugar cane and urea when supplemented with 1.8 kg of ground sorghum/head/day, It has been shown that in certain situations the addition of readily fermentable energy (such as molasses, starch or cereal grains) is necessary before urea can affect substantially the roughage intake (Coombe and Tribe 1960). It could be argued that the effect of the sorghum grain in the sisal diets was to increase microbial protein production and hence achieve the small increase in liveweight gain observed. The supplement which produced the greatest increase in both voluntary feed intake and liveweight gain was fishmeal. The protein in fishmeal is known to have a low solubility in the rumen and hence considerable quantities can by pass rumen fermentation (Kempton et al 1977). Egan (1965) showed that the presence of protein in the duodenum of animals fed low quality (low nitrogen) forages can increase intake of the basal diet. The practical application of such results can be seen in the work with sugar cane (Preston 1977).

Although food intake increased dramatically when fishmeal was included in the diet, the mean liveweight gains were still relatively low. It would seem that the situation is analogous to that observed in sugar cane utilization where"by pass "protein or"by pass"energy, given separately, is of little value to the animal. Rice polishings in this situation is an ideal supplement due to the high biological value of the protein and the starch content, both of which are known to be capable of escaping rumen fermentation (Elliott et al 1978).

The rice polishings used in this experiment, however, was the type used by Ferreiro et al (1980), in which the quantity of starch present as the broken tips of the rice grain (which are known to be able to escape rumen degradation) was low and therefore, little starch passed to the duodenum (see Ferreiro et al 1980).

## Conclusions

It would seem that there is little advantage to be gained from ensiling sisal pulp if fresh bagasse is available. In fact, over the 120 day experimental period, both liveweight gains and voluntary intakes were significantly greater in the animals fed the basal diet of bagasse. From these results it is evident that the primary limitation to obtaining adequate levels of feed intake is a source of "by pass"protein of moderate to high biological value. However, without an adequate energy source perhaps capable of supplying energy at either the rumen or duodenal levels liveweight gains are likely to be suboptimal.

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