FATTENING CATTLE WITH SUGAR CANE: A COMPARISON OF DIFFERENT SUPPLEMENTS

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A total of 64 Zebu bulls was used to study 8 combinations of supplements (combinations of protein, starch and oil) according to a completely randomised design with two replications (4 animals per treatment group). The basal diet was chopped whole sugar cane provided ad libitum in one feed trough, and a liquid mixture of molasses containing 10% urea and 1% ammonium sulphate given ad libitum in a separate feed trough. Addition of 500 g/d of ground maize grain gave no improvement over the unsupplemented control (51 vs 77 g/d) and both of these treatments were markedly inferior to the remainder. Growth was significantly improved (333 g/d) by 500 g/d of a fish meal/ soybean meal mixture (ratio 1:3) and there was a further increment in live weight gain when either 30 ml/d of maize oil (517 g/d gain) or 500 g/d of ground maize (555 g/d) were given. Providing 750 g/d of the fish meal/soybean combination appeared to increase growth rate by a further 100 g/d (to 669 g/d), the performance on this treatment being similar to that achieved on the positive control of 1 kg/d of rice polishings (728 g/d). Supplementation with 1.5 kg/d of rice polishings was no better (651 g/d) than the 1 kg/d level of this supplement. Voluntary intake was higher and feed conversion was better for the treatments which were superior for live weight gain. The increase in voluntary intake was mostly attributable to increases in the amount of sugar cane consumed; the relative intake on the molasses/ urea mixture was relatively constant (1 to 1.4 kg/d) and not related with live weight gain. When the data for the two treatments with rice polishings were omitted, there was a highly significant positive relationship (r = .57) between the amount of true protein provided by the supplements and the growth rate of the animals receiving them.

Key words: Sugar cane, cattle, supplementation

Rice polishings have always produced a growth response in cattle fed diets based on sugar cane and urea (Preston 1977). In contrast, the response to more traditional protein supplements and concentrates has been variable and nearly always less per unit of added protein than when rice polishings is used (Silvestre et al 1977 a,b, Lopez et al 1977). On the basis of these and other findings, it has been postulated that diets of sugar cane/urea are limited by the supply of essential amino acids and glucose precursors at the metabolic level (Leng and Preston 1976),

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As well as having an excellent balance of amino acids, particularly methionine, rice polishings is relatively rich in starch (30%) and unsaturated oil (13%). Sugar cane has less than 1% of total lipid material (Anon 1974), and as most of this is present as saturated waxes, it seems possible that there might be a deficiency of the essential long chain fatty acids. This could be also a factor associated with degree of response to different supplements.

The object of this experiment was to test a variety of supplements providing different combinations of essential amino acids, starch and unsaturated lipids, comparing them with rice polishings as the control treatment.

Materials and Methods

Treatments and Design: Eight different combinations of supplements were fed according to a completely randomized design with two replications. Details of the supplements are given in Table 1.
Animals: A total of 64 Zebu bulls was used with average initial weight 257 kg and slightly more than 2 years of age. There were 4 animals per treatment group. Housing was in open-sided pens with concrete floors.
Diets: In all cases, the supplement was given as the first feed in the morning(7:00 am) before feeding the sugar cane. The maize was ground coarsely in a hand grinder. In treatment D, the oil was mixed with fishmeal and soybean meal prior to feeding. The sugar cane was the mature whole plant including stalk and tops and was chopped in a forage harvester (Gehl CB600). It was fed twice daily, freshly chopped on each occasion at 08:00 and at 12:00 am. The cattle also had free access to a mixture of molasses containing 10% urea and 1% ammonium sulphate (w/w), and to a mineral mixture containing: salt 500 g, rock phosphate 570 g, and trace minerals 30 g. The animals were adapted gradually to the molasses/urea mixture giving increasing concentrations of 4,6,8 and finally 10% urea at 5 day intervals.
Measurements: The animals were weighed individually every 14 days and the gain in live weight was determined by regression of live weight on time. Feed intakes were recorded daily, as was the brix content of the sugar cane while every three days the cane was analysed for DM.

Table 1:
Composition and amounts of supplement fed (g/animal/day)

	A	B	C	D	E	F	G	H
Rice polishings	-	-	-	-	-	-	1000	1500
Maize grain	-	500	-	-	500	-	-	-
Fishmeal	-	-	125	125	125	187	-	-
Soybean meal	-	-	375	375	375	563	-	-
Maize oil	-	-		30	-	-	-	-
Total	-	500	500	530	1000	750	1000	1500

Results

Mean values of animal performance on the different supplements are summarised in table 2. There were highly significant differences in average live weight gain between the different treatments. Addition of 500 g daily of ground maize conferred no benefit over the unsupplemented control (51 vs 77 g/d) and both of these treatments were markedly inferior to the remainder. Growth was significantly improved by 500 g/d of a fishmeal/soybean meal mixture and there was a further increment in live weight gain when either 30 ml/d of maize oil, or 500 g/d of ground maize were given.

Table 2:
Mean values for performance characteristics (2 groups of 4 bulls/treatment: 98 days trail).

			Fishmeal/soybean .5kg/d		Fishmeal/soybean .75kg/d		Rice polishings			
	No Supp	Maize 0.5 kg	-	oil 30 ml/d	Maize 0.5 kg/d		1kg/d	1.5 kg/d.	SEx	Prob.
	A	B	C	D	E	F	G	H		
Live weight										
Initial	210	271	266	260	268	266	267	267		
Final	218	282	302	318	310	338	333	334		
Daily gain[2]	.037	.051	.333	.517	.555	.669	.728	.651	±.06	0.001
Feed intake,kg/d										
Sugar cane	10.6	12	14.8	15.7	15.0	16.6	16.6	15.8		
Molasses	1.19	.97	1.28	1.25	1.42	1.15	1.25	1.15		
Urea		.106	.140	.137	.154	.125	.136	.126		
Total DM intake kg/d	4.16	4.66	5.73	6.00	6.40	6.30	6.64	6.73		
Consumption index[2]	1.89	1.73	1.93	1.99	2.27	1.97	2.14	2.17	±.15	.05
Conversion[3]	111	88	15.4	10.3	10.6	9.10	8.66	10.0	±1.43	001

[1] Determined from linear regression of live weight on time.
[2] Daily intake of DM/100 kg live weight
[3] Determined from linear regression of cumulative DM intake (kg) on live weight (kg).

Supplying 750 g/d of the fishmeal/soybean combination appeared to raise growth rate by a further 100 g daily and performance on this treatment was very similar to that achieved on 1 kg daily of rice polishings which supported a growth rate of 728 g/d. Surprisingly, the treatment with 1,5 kg/d of rice polishings was slightly lower than the 1 kg/d level of this supplement.

There was a close relationship between the effects of the different treatments on live weight gain and on feed conversion, and a tendency for the best treatments to be associated with a higher voluntary consumption index. The increase in voluntary intake was mostly attributable to changes in the amount of sugar cane consumed (figure 1). In contrast, intake of the molasses/urea mixture remained relatively constant and was not related with live weight gain.

This latter finding is at variance with the report of Lopez et al (1976) where both molasses (also containing 10% urea) and sugar cane intakes increased in parallel fashion with the increase in rate of live weight gain, caused by addition of rice polishings to the diet. There is no obvious explanation for this difference in response between the two experiments.

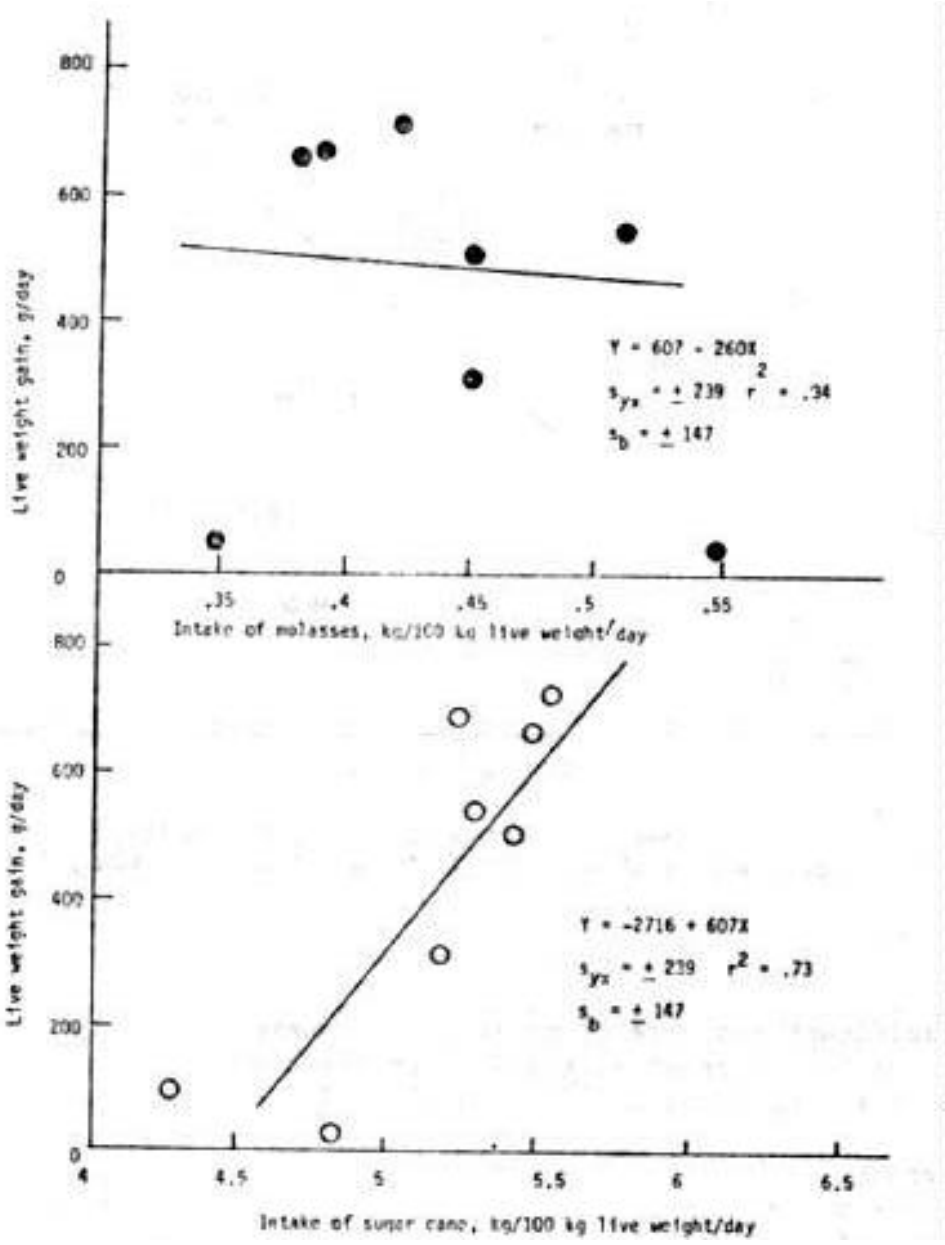

Figure 1:
Relationship between rate of live weight gain and (1) intake of molasses (•) (2) intake of sugar cane (○)

In figure 2, the data for daily live weight gain are plotted against the amount of true protein supplied by the supplements. If the information from the two rice polishings treatments is excluded from the analysis, there is a highly significant relationship (r = 0.97) between the amount of true protein given in the supplement and growth rate.

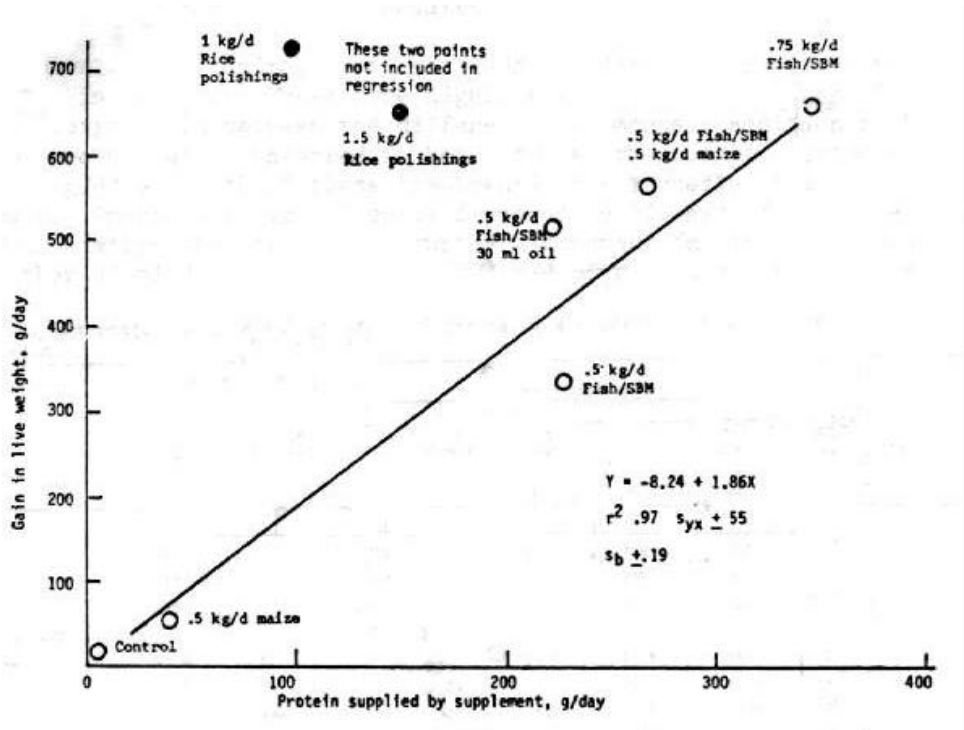

Figure 2:
Relationship between amount of protein supplied by the supplement and the of live weight gain (excluding data for the two groups given rice polishings)

Discussion

The significant response to maize oil is surprising and contrary to the findings of Silvestre et al (1977) when there was no response to supplementation with groundnut oil in a basal ration of sugar cane/urea and meat meal.

Maize grain can be considered as a good source of "by-pass" glucose precursor since maize starch is known to be incompletely fermented in the rumen, and therefore likely to pass through in some degree to the duodenum for gastric enzymic digestion to glucose. The fact that there was no response to 500 g/d of maize (about 350 g starch) implies that glucose precursors may not always improve performance on a sugar cane/urea diet, unless by-pass protein is also supplied. Ferreiro et al (1977) came to a similar conclusion when they obtained no benefit from adding 130 ml daily of propionic acid to a sugar cane/urea basal diet, And similar findings were obtained by Kempton et al (1978) when glucose supplementation of lambs fed a sugar /urea based diet, had no effect unless by-pass protein in the form of fishmeal was also given, That there can be, however, a response to glucose precursors, when by-pass protein is also supplied, is indicated by: (1) the significant growth response from adding 500 g/d maize to a diet which was already supplemented with 500 g of fishmeal/soybean, and (2) superior performance on rice polishings than with mixed proteins from fishmeal and soybean meal, even when the amount of protein provided by the rice polishings was less than half that in the fishmeal/soybean combination,

The only other interpretation for the superiority of rice polishings is on the basis of its higher content of sulphur amino acids, compared with any of the other sources tested in the experiment. However, it seems unlikely that this could account for all of the differences in response per unit of protein, between the rice polishings and the mixture of fishmeal and soybean meal. It is more likely that the superiority of rice polishings is due to a combination of three factors: namely, high quality protein rich in sulphur amino acids; starch which appears to lend itself to rumen by-pass (Elliott R, 1977 unpublished data), and the possible effect of the oil content retarding rumen microbial attack of both the protein and the starch and thus contributing to a more efficient by-pass of these nutrients.

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Received 10 October 1977