USE OF A SLAUGHTER TECHNIQUE FOR TECHNICAL AND ECONOMICAL EVALUATION OF SUGARCANE AND MAIZE SILAGE BASED RATIONS

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Summary

A serial slaughter trial was carried out with 7 groups of 20 Boran steers fed rations containing (DM basis) 59 % chopped sugarcane or 67% maize silage; the balance was urea (0.4%) and cereal and oil seed by-products. Representative groups were slaughtered at the beginning and after 56, 77, 98 and 119 days. Average daily gain in live weight decreased with increasing time on feed from 883 to 648 g for sugar cane and from 1062 to 729 g for maize silage. Specific gravity measurements of the ten rib cut showed that carcasses from cattle fed maize silage were fatter than those on sugar cane. Estimates (Meal/kg DM) of NEm for maize silage and sugarcane rations were 1.77 and 1.67 and for NEg 1.03 and .72. To produce the same increase in carcass weight, it was calculated that 30% more feed DM is required when sugar cane replaces maize silage.

Key words: Maize silage, sugarcane, fattening cattle

Introduction

There is growing recognition of the need for interdisciplinary research to provide quantitative input/output data linking together the work of agricultural scientists and economists to provide the essential framework necessary for making agricultural production more efficient. The subject has been thoroughly reviewed as it relates to beef production by Wragg, Godsell & Williams (1968), who pointed out that a fundamental problem exists in identifying and defining the expense involved in using large numbers of beef cattle in a feeding trial, and these can best be summarized as the problems of conducting trials within accepted "commercial practice".

Thus, especially in a developing country, the selection of appropriate cattle presents a particular problem. in feeding trial design. Whereas a scientist wishes to use as uniform a group of cattle as possible, the commercial feeder and the economist want to see that representative cattle are used.

These cattle may be of indeterminate age and from widely diverse genetic and nutritional backgrounds such that the feeding response is highly varied. But to use uniform young cattle specifically bred for the trials would automatically invalidate the economic data, since specially bred, uniform feeder cattle are seldom commercially available. Another difficulty is that of group feeding cattle; commercially all cattle are group fed, and certainly the Boran cattle of East Africa are shy feeders and their performance is often severely depressed if they are fed individually. On the other hand, there is the disadvantage that group feeding leads to a loss of statistical precision and requires a greater number of cattle.

Finally, there are the problems connected with slaughter. The first, and one of the most difficult, is to estimate the correct feeding period to optimize the benefits of feeding. A slight underestimate, and hence an inadequate finish, can radically affect the carcass grading and hence the financial returns. Then there are the practical problems to be faced if the cattle are to be slaughtered through commercial channels. When cattle are transported by truck or train to an abattoir some distance away, a full load must be sent to avoid heavy bruising losses. This precludes sending animals when they reach a specific liveweight.

These problems have had to be faced since the outset of the FAO Kenya Beef Industry Development Project, and over a period of time a valuable experimental technique has been developed which offers considerable advantages. This paper describes an example of the technique in which a mixture of sugarcane and cottonseed cake (88 : 12) was compared with maize silage (with which the mixture was calculated to be isonitrogenous) both were used as the roughage fraction of a balanced ration.

Materials and Methods

The rations used are shown in table 1. Whole sugarcane, including tops and trash were chopped through a modified forage harvester to the size of coarse sawdust, and mixed with the other ingredients in a horizontal auger mixer-feeder wagon. Animals were group fed on an ad-lib basis, but care was taken not to overfeed the cattle at one time so as to avoid problems of ration fermentation. Feed intake was recorded and frequent checks of the dry matter were made.

Table 1
Rations used in feeding trial (on DM basis)

	Sugarcane	Maize silage
Hominy feed	14.0	14.0
Rice polishings	7.0	7.0
4% urea molasses	9.3	9.3
Cottonseed cake	10.7	2.7
Sugarcane	59.0	-
Maize silage	-	67.0

140 head of Boran steers were purchased from pastoralists in Northern Kenya. These were "blocked" into uniform groups on the basis of liveweight and number of permanent teeth, and were then assigned by random numbers into seven even groups of cattle. One group at random was slaughtered prior to feeding. The remaining six groups were each assigned to one of two pens such that 60 animals were fed on each ration. After 56 days 15 animals were withdrawn from each pen for slaughter. Because of the lack of uniformity, the technique of selection was to weigh all the cattle and plot the gain on feed for each animal versus its current weight on a graph, with each animal point identified by its number. This graph allowed the results to be visualised and the cattle to be blocked into 15 uniform groups of 4 cattle with closely adjacent points. The cattle of each group were then assigned to 4 mobs at random, one of which was sent to slaughter, After selection, the remaining 45 head were returned to each pen and fed until the 77th day. The procedure was then repeated with each pen being split this time into 3 mobs of 15, one of which was slaughtered. The selection of the second slaughter mob was not influenced by the previous selection. .4 further selection was made at 98 days and-the final group sent for slaughter at 119 days. After slaughter, the specific gravity of the tenth rib was used to estimate carcass composition according to the technique described by Ledter et al (1973).

Results and Discussion

The slaughter data from this feeding trial are shown in Table 2:

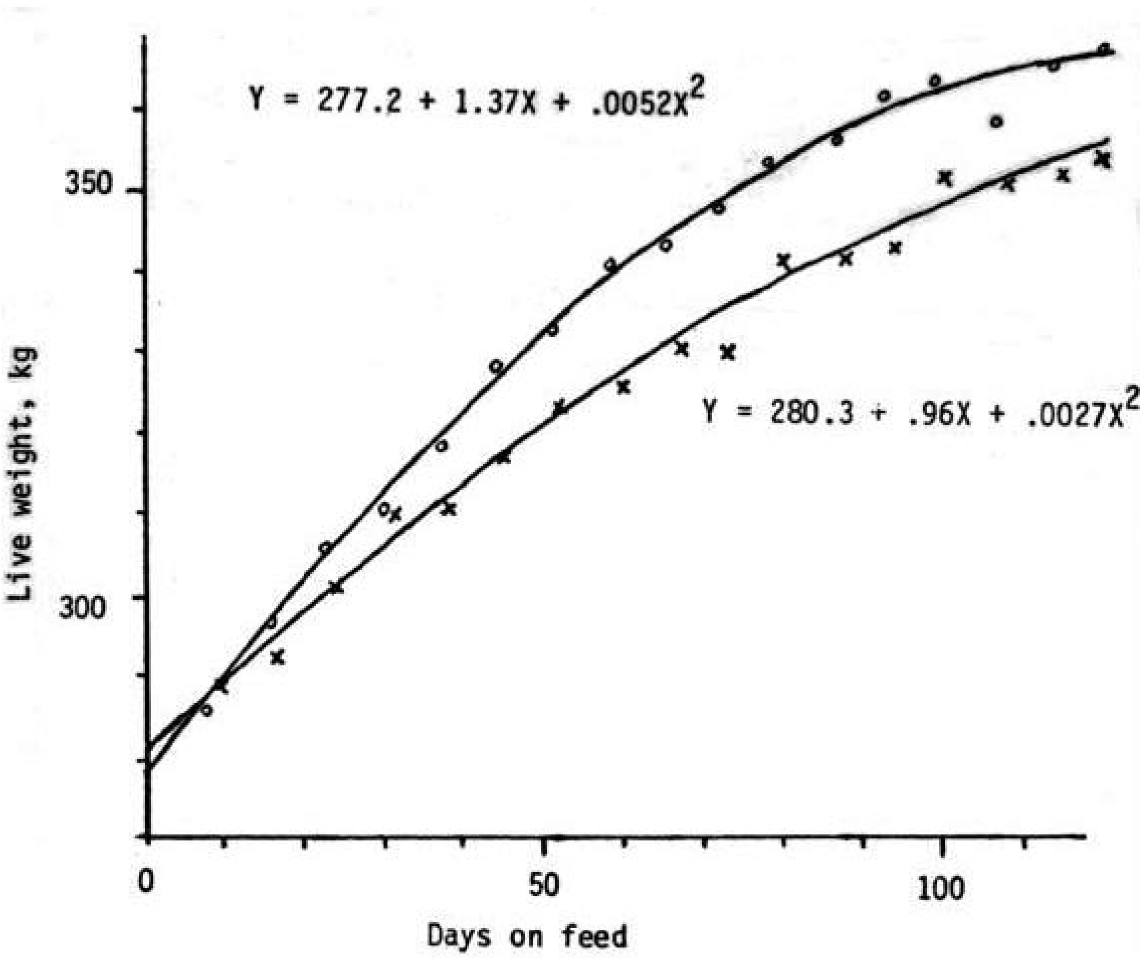
Table 2:
Comparison of Boran steers deaf maize silage or sugarcane

	Initial	ration 3 based on sugarcane				ration 3 based on silage			
Days fed	0	56	77	98	119	56	77	98	119
Initial wt. Kg	283.2	278.4	285.2	281.3	282.1	282.0	278.4	278.1	281.1
Final Wt, kg	-	327.9	344.0	348.0	353.9	341.5	355.2	364.3	367.9
Daily gain, g	-	883.	764	680	648	1062	997	879	729
Daily DM intake , kg	-	7.3	7.5	7.6	7.5	7.2	7.5	7.3	6.9
Conversion ratio	-	8.3	9.8	11.2	11.-	6.8	7.5	8.3	9.5
Carcass weight	133.6	163.4	173.1	178.8	187.1	168.1	178.4	188.8	197.8
Dressing	47.2	49.8	50.3	51.4	52.1	49.4	50.5	51.8	53.8
Adjusted daily gain[1]	-	747	704	706	712	876	953	939	896
Average grading	3.1	4.3	4.3	4.7	4.5	4.3	4.6	4.9	4.7
Fat % in carcass.	22.9	24.8	26.3	26.7	29.4	26.2	28.0	29.7	30.3
Carcass energy/kg, Mcal	3.101	3.237	3.364	3.409	3.621	3.364	3.510	3.646	3.697
Total carcass energy, Mcal	414.3	529.0	582.3	609.5	577.5	567.2	629.6	688.4	731.3

[1] To 51% dressing

But whereas the slaughter data relate to five distinct points, liveweight records are available along with the cumulative feed intake through the trial. Figures 1 and 2 show the respective growth curves both by time and feed intake, and in both cases quadratic regressions have been fitted.

Figure 1: Growth curves of Boran steers fed sugarcane (x) and maize silage (o) rations



It is clear from the data 'that the cattle fed on the sugarcane ration grew more slowly than those on the maize silage ration and that at each slaughter point the carcasses from the latter regimen were heavier and better finished. However , within the slaughter range of 63 days, both groups of cattle grew through a common liveweight range, and the carcasses can be studied between the weights of 170 kg and 185 kg. Thus figures 3 and 4 show the regressions for carcass growth and energy retention with feed input. By calculations from Graphs 1 and 2, it is possible to construct an exact comparison of the feed requirements of each ration to increase the carcass weight from 170 kg to 185 kg CDW.

Starting with the regressions in figure 3 , the DM input of each ration required to produce the carcasses of each weight, can be calculated:

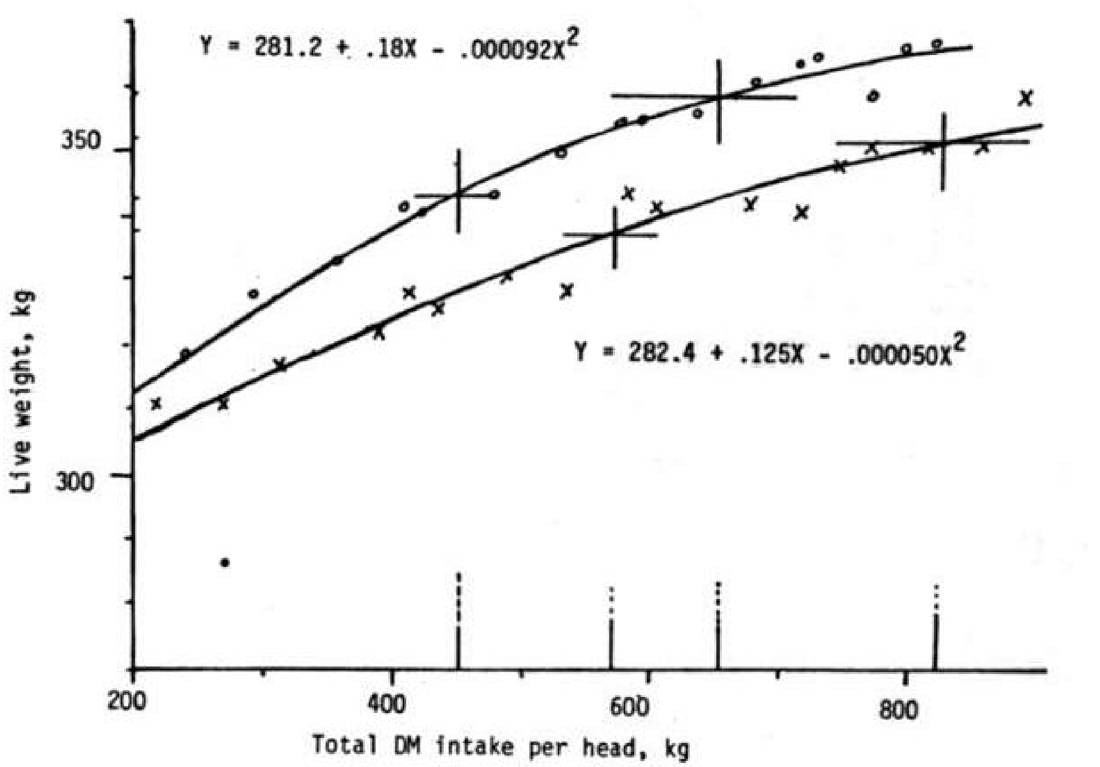
Carcass weight	170 kg	185 kg	Difference
Maize silage ration DM	455.05	649.35	194.30
Sugarcane ration DM	572.30	825.68	253.38

As an interesting sidelight it is then possible to compare the carcass energy resulting from each feed input (figure 4):

Carcass weight	170 kg	185 kg
Carcass Energy on maize ration, (Mcal)	587.99	662.80
Carcass energy on sugarcane ration, Mcal	575.93	647.89

It is interesting to note that despite the very slight difference in the nutritional value of the rations, the maize silage rations have resulted in an increase in fat deposition. Most workers who have studied this subject can find little evidence that plane of nutrition affects final body fat percentage other than through its effect on final body weight (Preston 1971), although commercial feeders are convinced by experience that it does - particularly for fast-growing large framed breeds such as Charollais. To the extent that energy content of the carcass is related to its quality and grade, it is evident that in this instance the final carcasses were not <u>exactly</u> comparable, although the differences are small.

Figure 2:
Live weight response to feed input for boran cattle fed sugarcane (x) and maize silage (o) rations



By reference back to figure 2, the DM input can be used to calculate the liveweight corresponding to each carcass, and thus can be used in figure 1 to calculate the exact time on feed at which the carcasses were achieved. In this way the comparative performance data for the two rations can be compiled as shown in table 3:

It is immediately apparent that due to the differences in dressing percent, slaughter at a given liveweight after different times on feed would not have given similar carcasses.

Table 3:
Comparative performance of Boran cattle fed sugarcane or maize silage to produce a carcass weight of (a) 170 kg (calculated from the regressions).

	Sugarcane		Silage	
Carcass, kg	170	185	170	185
Final wt, kg	337.9	352.0	343.8	358.9
Initial wt, kg	281.4	281.4	279.2	279.2
LW gain, kg	77.1	108.5	63.8	89.7
Daily LW gain, g	733	651	1013	889
Total DM intake, kg	572	826	455	649
Conversion Ratio	10.12	11.70	7.04	8.14
Carcass weight, kg	170	185	170	185
Dressing %	50.31	52.56	49.44	51.55

Equally, the conversion ratio of feed DM gain is not a realistic comparison unless fat cattle are sold on a LW basis. However, since there is an initial slaughter this allows an estimate to be made of the carcass gain at each slaughter (slightly greater for the silage fed animals in view of their lower initial weight).

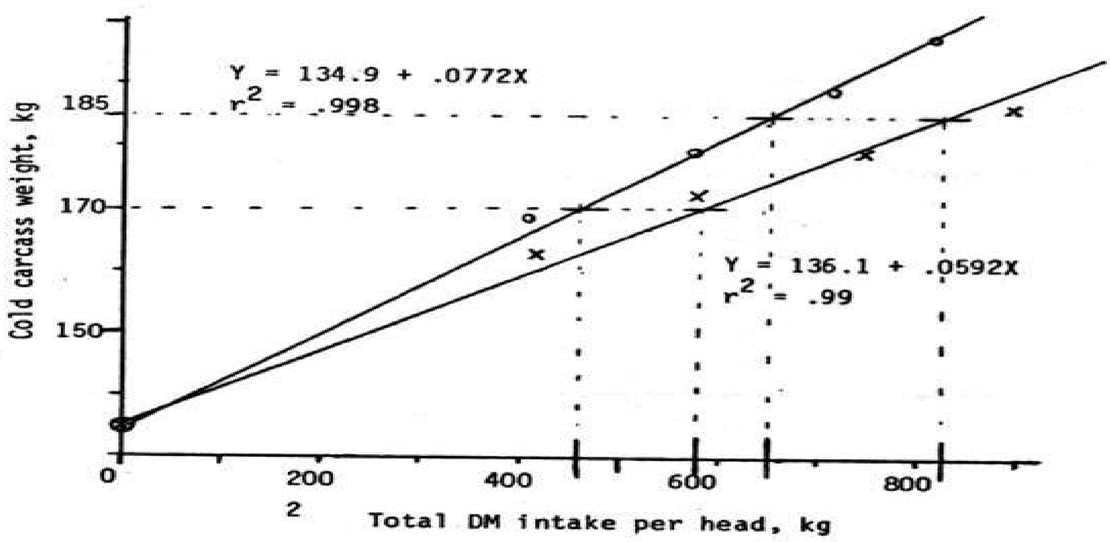
	Sugarcane		Silage	
Carcass Kg	170	185	170	185
Feed DM intake, kg	572	826	455	649
Carcass produced, kg	37.1	53.1	38.1	54.1
Conversion ratio	15.42	15.55	11.94	11.99
Conversion ratio between 170 and 185 kg CDW	16.93 : 1		12.93 : 1	

A study of the conversion ratio shows that on a carcass basis 30% more feed DM is required when sugarcane replaces maize silage in the ration. In terms of ingredients used to balance one ton of fresh silage (280 kg DM), the comparison can be calculated for the fresh sugarcane (at 30% DM) necessary to produce the same carcass weight.

	Silage ration	Sugarcane ration	Difference
	kg	kg	kg
Maize silage	1000	-	-
Sugarcane	-	1068	68
Hominy feed	63.4	82.7	19.3
Rice polishings	31.8	41.3	9.5
4% urea molasses	56.3	84.1	27.8
Cottonseed cake	12.3	63.1	50.8

It is evident that from these physical comparisons, the appropriate local prices can be used to study the production system. However, apart from these simple coatings, the feeding model which has been developed allows returns to be estimated in a variety of ways and coupled with sensitivity analyses of the effect of feeder cattle, or feed, price changes. Furthermore, the resulting fat cattle can be sold on a liveweight, dressed carcass or grader carcass basis - each of which will carry implications as to the expected level of profitability which can be calculated from the model. The advantage of a model based on representative available cattle is that it allows the effects of rate of gain to be reflected through to changes in the non feed costs, which occur by virtue of the reduction of overhead costs on a unit basis when productivity is increased.

Figure 3:
Carcass response to feed input for boran cattle fed sugarcane (x) or maize silage (o)

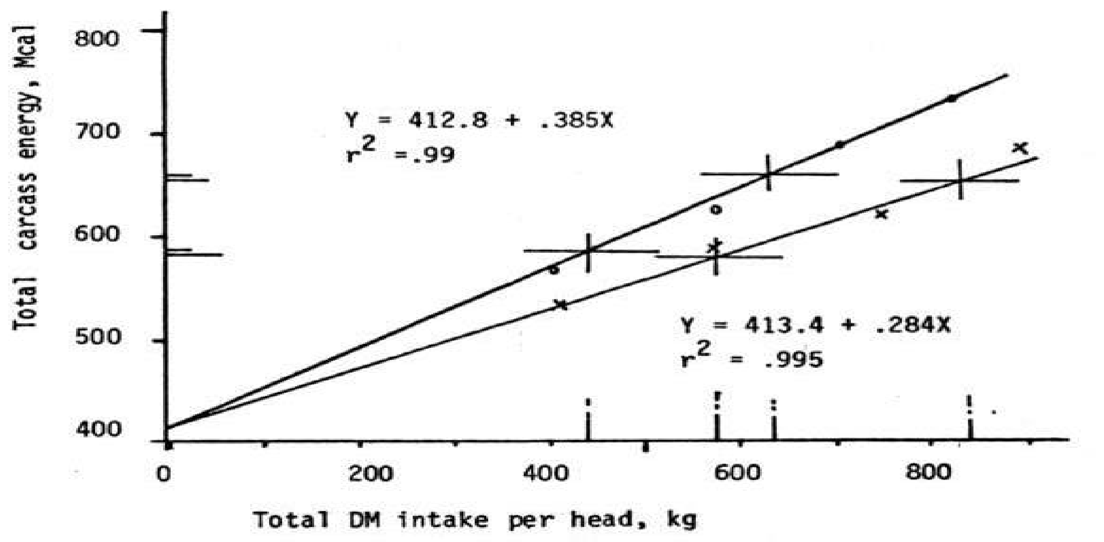


For a more sophisticated economic analysis, the treatments should be repeated for different levels of roughage in the ration to allow the substitution between ingredients to be analyzed.

It should be pointed out that on the technical side, the technique allows an estimate of the Net Energy (maintenance) and Net Energy (gain) to be made, along the lines proposed by Lofgreen and Carrett (1968). Calculations based on the data from this trials give the following Net Energy values (expressed as Kcal/g DM):-

	NE_m	NE_g
Maize silage ration	1.77	1.03
Sugarcane ration	1.67	0.72

Figure 4:
Carcass energy retention as related to feed input sugarcane (x) or maize silage (o) rations



Finally, the cost of this particular experiment was increased by virtue of the initial slaughter of unfed cattle. This was deemed necessary to enable a social cost benefit to be made of the impact of cattle feeding on an area development basis. But for input/output information for use at the farm level the initial slaughter is unnecessary, and under these circumstances the meat produced as a result of the experiment will bear the major part of the cost of the work.

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