THE DIGESTIBILITY OF CHOPPED SUGAR CANE SUPPLEMENTED WITH MOLASSES OR WHEAT BRAN

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The digestibility of chopped whole sugar cane supplemented either with wheat bran, or final molasses containing 2.5% urea, wee measured with Zebu bulls (200 kg, 18 months) in two experiments of 4 x4 latin square design. Supplementation with 0, 0.5, 1.0 or 1.5 kg/d of wheat bran was without effect on cane consumption, the linear increase in dry matter intake being due to the wheat bran. Digestibility of try matter (DM) or organic matter (OM) was not affected and was (± SE of mean) 60.7, 58.7, 57.7 and 58.4 (± 2.3) for DM and 60.4, 58,4 56.7, 61.6 (± 1.7) for OM for the control and three levels of supplementation respectively. Inclusion of molasses/urea (2.5%) sexed into the cane to give 0, 28, 46 or 55% of DM resulted in a linear increase in DM and OH intake and digestibility up to the 46% levels but a significant (P .015) reduction in DM intake at 55% molasses. Digestibility and intake value for the control and three cane/molasses dicta respectively were (± SE of mean) 59.3, 64.0, 68.0 and 67.2 (± 1.1), and 62.5, 66.4, 69.8 and 70.1 ± 2.7 for DM and OM respectively. The voluntary intakes of digestible DM and digestible OM were: 2.00, 2.57, 3.24 and 2.73 (± 0.12) kg/100 kg live weight (DDM), and 1.99, 2.4, 2.80 and 2.45 (± 0.13) kg/100 kg live weight (DM). It is concluded that supplementation of wheat bran had no effect on cane intake and little, if any, on digestibility. The inclusion of molasses depressed cane intake, but the DM intake and digestibility of the mixture were increased.

Key words: Sugar cane, cattle, molasses, wheat bran, digestibiltiy voluntary intake voluntary intake

Sugar cane based diets may be fed supplemented with a concentrate, or in conjunction with molasses. It is well established that concentrates can depress the overall digestibility of high fibre diets.

The objective of the two experiments reported here was to measure the digestibility of chopped whole sugar cane supplemented with fermentable carbohydrates provided by wheat bran (expt 1), or final molasses (expt 2).

Materials and Methods

Animals: Four Zebu bulls of approximately 200 kg and eighteen months of age were used in each experiment. The animals were accustomed to the digestibility cages and to the stalls used in the adaptation period.

Treatments and Design: Both experiments used a 4 x 4 latin square design. The experimental treatments were as follows:

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Expt 1:

Diet A: Chopped whole cane
Diet B: Chopped whole cane + 500 g wheat bran/d
Diet C: Chopped whole cane + 1000 g wheat bran/d
Diet D: Chopped whole cane + 1500 g wheat bran/d

Expt 2:

Diet E: Chopped whole cane
Diet F: Chopped whole cane + 150 g molasses/kg fresh cane
Diet G: Chopped whole cane + 300 g molasses/kg fresh cane
Diet H: Chopped whole cane + 450 g molasses/kg fresh cane

All animals received in addition 9 g urea and 2.5 g ammonium sulphate per kg fresh cane which was mixed into the cane as a solution in water, plus 60 g/d of a 50:50 mixture of salt and dicalcium phosphate. The animals in experiment 2 also received 300 g extracted soya bean meal/d. The molasses contained 2.5% urea (w/w, fresh weight). The average dry matter and Brix (by refractometer) of the cane were 24.8% and 11.4° respectively (equal to 39.0% sugar in DM calculated by the formula of Ferreiro et al (1977). The molasses was final molasses with a dry-matter content of 82%.

Procedure: The animals were tethered in stalls for the first six days and were kept in the digestibility crates for the last eight days of each period. A total collection of faeces was mate during the last seven days. A 10% sample was taken daily, bulked, mixed and dry matter determined at the end of the period. The molasses was thoroughly mixed into the cane (expt 2) and in both experiments the cane or cane/molasses mixture was offered at libitum. The soya (expt 2) and wheat bran (expt 1) were fed on top of the cane, and were assumed. to be completely eaten.

Results and Discussion

Expt 1: Dry matter intakes and digestibility data are summarised in table 1, and figures 1 and 2. Supplementation with wheat bran had no effect on cane intake -the suggestion of a depression with diet D was entirely due to one animal (see table 1), and was eliminated if a missing value was calculated for this animal. The net effect of adding wheat bran was therefore to produce a linear increase in digestible dry matter intake.

Overall digestibility was unchanged by the addition of wheat bran. The data thus imply that either the digestibility of the wheat bran was the same as the cane (overall mean 58.9), or that if greater, there was a slight depression in cane digestibility.

Expt 2: Dry matter intakes and digestibility data are summarised in table 2, sod figures 3 and 4. The design of this experiment were slightly different from expt 1 in that in this case the molasses was mixed into the cane, rather than being fed as a supplement as was the wheat bran. The digestibility data show a linear increase as the proportion of molasses dry matter was increased up to 46%, but no increase thereafter -although the deviation from a linear regression was not significant statistically. Dry matter intake also increased linearly to diet C (46% molasses in DM). but there wee a decrease to diet H (55% molasses) which was significant (P-=015). Expressed as digestible dry matter or digestible organic matter, the decline in intake was detectable with a confidence of P - 0.02 and 0.11 respectively.

Table 1:
Digestibility and voluntary intake by Zebu bulls of sugar cane supplemented with wheat bran (expt 1)

Diet	A	B	C	D	SEx
Wheat bran, % DM/d	0	11.6	20.5	30.8	
Consumption, kg DM/d					
Chopped wholecane	3.02	3.05	2.97	2.72	0.23
Wheat bran	-	0.43	0.86	1.30	-
Urea/ammonium sulphate	0.15	0.15	0.15	0.15	-
Minerals	0.06	0.06	0.06	0.06	-
Total	3.23	3.70	4.18	4.22	0.29
Consumption index[1]	1.69	1.96	2.09	2.20	0.37
Digestibility %					
Dry-matter (DM)	60.7	58.7	57.7	58.4	2.26
Organic matter (OH)	60.4	58.4	56.7	61.6	1.72
Consumption kg/ c					
Digestible DM	1.96	2.17	2.4	2.46	0.21
Digestible OM	1.95	2.21	2.27	2.39	0.19

[1] Kg DM/100 kg live weight
[2] Difference entirely due to one animal. Missing value calculation corrects to 2.99 kg cane/d

Table 2:
Digestibility and voluntary intake by Zebu bulls of sugar cane supplemented with molasses (expt 2)

Diet	E	F	G	H	SEx
Molasses,% of DM	0	25.3	46.4	54.6	-
Consumption, kg DM/d					
Chopped whole cane	3.07	2.55	2.15	1.55	
Molasses/urea	-	1.17	2.21	2.31	
Soya	0.25	0.25	0.25	0.25	
Minerals	0.05	0.05	0.05	-	
Urea/ammonium sulphate[1]	0.14	0.11	0.10	0.07	
Total	3.51	4.13	4.76	4.23	0.11
Consumption index[2]	1.69	1.90	2.36	2.07	
Digestibility, %					
Dry-matter (DM)	59.3	64.0	68.0	67.2	1.13
Organic matter (OM)	62.5	66.4	69.8	70.1	2.67
Consumption kg/d					
Digestible DM	2.00	2.57	3.24	2.73	0.12
Digestible OM	1.99	2.21	2.80	2.45	0.13

1 Mixed into cane. Additional to urea in molasses (at 2.5% fresh material) This was not included in the calculation of digestibility
[2] kg DM/100 kg live weight

Figure 1:
The relation between PM digestibility and contribution of wheat bran to diet DM (expt 1)

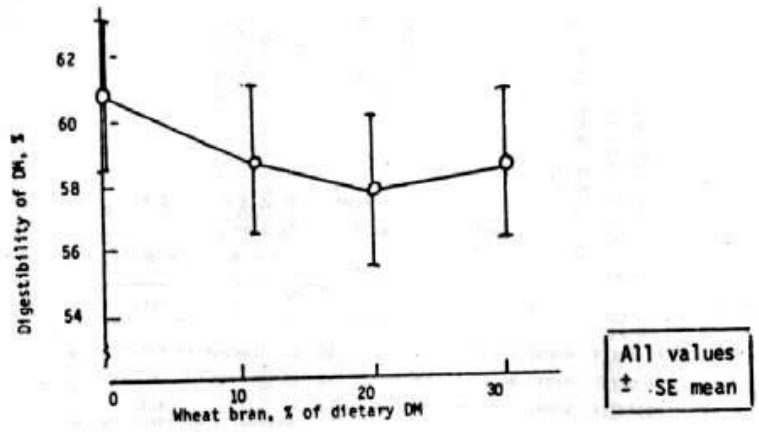

Figure 2:
The relation between digestible DM intake and contribution of wheat bran to dietary DM (expt 1)

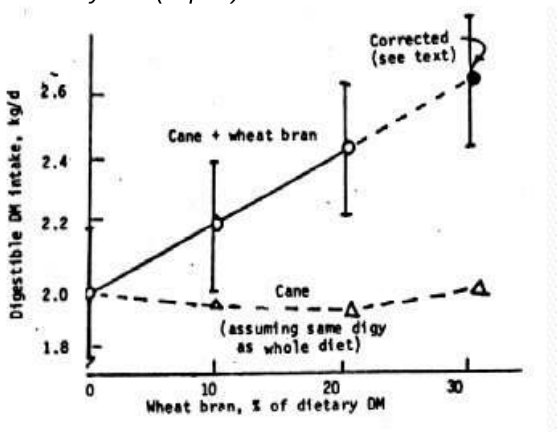

Figure 3:
Relation between digestibility of DM and contribution of molasses to dietary DM (expt 2)

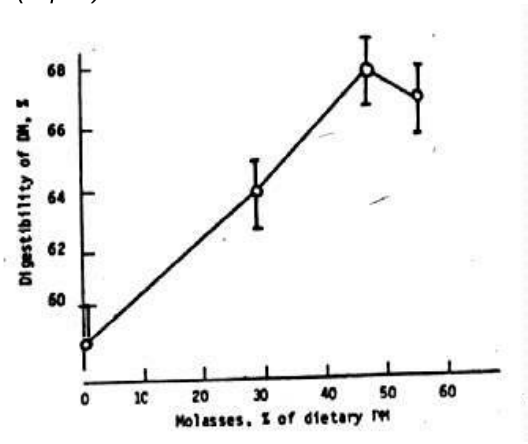

Figure 4:
Relation between DM digestibility and contribution of molasses to dietary DM (expt 2)

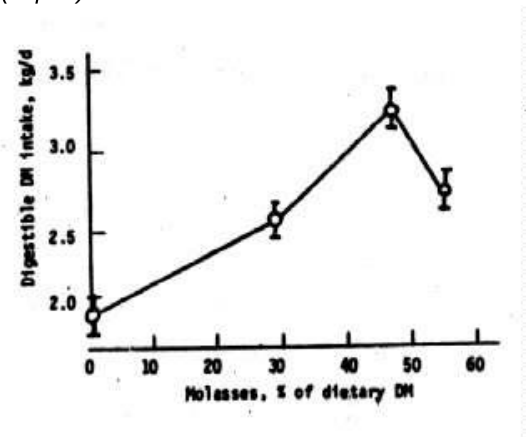

Table 3:
Relationship between the molasses content of molasses/cane diets, and digestibility or voluntary intake (consumption index)

Source	Highest level of molasses(% of diet)	Dependent variable (Y)	Independent variable (X)	Equation	r	SExy	SEb
Expt 2[2]	29	Dry matter digestibility (%)	Molasses DM In diet (%DM)	Y=59.1 +0.18X	0.60 [1]	3.12	0.05
Expt 2[3]	30	Dry matter digestibility (%)	Molasses In diet (%)	Y=59.2 +0.40X	0.62 [1]	3.05	0.10
Paulino et al (1977)	25	Dry matter digestibility (%)	Molasses in diet (%)	Y=58.3 +0.44X	0.48	5.34	-
Montpellier & Preston (1976)	25	Dry matter digestibility (%)	Molasses In diet (%)	Y=63.0 + 0.40X	0.72	-	0.12
Expt 2	29	Consumption index(kg/100)	Molasses in diet (%)[1] [2]	Y=1.56 +0.03X	0.83	0.13	0.0004
Paulino et al(l977)	30	Consumption index (kg/100 kg)	Molasses In diet (%)[1]	Y=1.66 + [2]0.03X	0.41	0.36	-
Montpellier & Preston(1976)	25	Consumption Index(kg/100 kg)	Molasses in diet (%)[1]	Y=1 .96 +0.0074X[2]	0.32	-	0.0005

[1] Fresh weight basis
[2] Consumption Index kg DM per kg live weight
[3] Expt 2 Diets E F and G only

The effect of the highest level of molasses is not in agreement with the results of Paulino et al (1977) and Montpellier and Preston (1976) who reported a linear increases in digestibility and dry matter intake as the level of molasses was increased,(up to 30 or 25% of fresh weight). Their data and our data are summarised in table 3. This shows the agreement between the three experiments to be very good if we exclude diet H (55% molasses DM) from the regression equations of our data.

The fact that we found a depression at this highest level of molasses implies that at about this level (similar to the highest level used by Paulino et al (1977) and above that used by Montpellier and Preston (1976), some factor begins to limit digestibility and voluntary intake. It is probable that the high sugar content of the diet is associated with lower fibre digestibility (0rskov and Hovell 1978), and hence lower DM digestibility and intake.

Experiments 1 and 2 were carried out at the same time with the same cane. The agreement between the two experiments for dry matter digestibility (60.7 and 59.3%) and voluntary intake (consumption index 1.69 and 1.69 kg/100 kg live weight) of the controls was very good. Thus the average digestibility of our cane was 60.5 ± 1.79 and voluntary intake 1.69 ± 0.2 kg DM/100 kg live weight, measured with eight animals.

Conclusions

The supplementation of sugar cane dicta with wheat bran is without effect on the voluntary intake of cane. Any effect on cane digestibility is small. The addition of molasses to sugar cane diets up to about 50% of dry matter results in an overall increase in dry-matter intake (cane intake per se falls), but much over 50% molasses DM, the intake of molasses cannot compensate for the fall in cane consumption.

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