

ABSTRACTS ANNUAL MEETING CIEG AND ESAT MEXICO JOINT ANNUAL MEETING OF THE CENTRO DE INVESTIGACION Y EXPERIMENTACION GANADERA, CHETUMAL, Q ROO AND THE CENTRO SUPERIOR DE AGRICULTURA TROPICAL, CARDENAS, TABASCO, MEXICO: 2 to 4 MAY 1977

*Feed composition and nutritive value*

1 EFFECT OF VARIOUS ADDITIVES IN THE ENSILING OF SUGAR CANE TOPS: Alpuche and F J Alvarez, CIEG, Chetumal, Mexico

Sugar cane tops were chopped and ensiled in 3 kg capacity bags with different additives: (B/kg of fresh cane tops), (A) 13.3 g molasses; (B) 13.2 molasses and 3.4 g urea; (C) 13.2 molasses and 54 g aqueous ammonia (28%  $\text{NH}_3$ ) (D) 3.4 g urea; (E) 52 g poultry litter (F) control with no additives. Samples were taken at the time of mixing and when the silos were opened at 2, 5, 10 and 20 days (a different silo for each day). Initial pH varied from 4.9 (control) to 7.7 (ammonia); on the second day all treatments had a pH between 3.8 and 4.6 and stayed in this range until day 29. The highest value was with poultry litter r. Brix values varied from 7 to 9.2 at the start falling subsequently in all treatments with time except for the poultry litter treatment which stayed high throughout the experiment in the range 8.4 to 10. DM % in the samples was in the range 19.1 to 22.6, except for the control treatment which fell to 11.9%.

2 A MICROMETHOD FOR THE ESTIMATION OF MIMOSINE IN LEUCAENA LEUCOCEPHALA: Milegros Bobadilla and R A Leng, CEAGANA, Santo Domingo, Republica Dominicana.

The following procedure, based on macro-method of Matsumoto & Sherman (1951), was developed for estimating the basic amino acid mimosine in *Leucaena leucocephala*. 10 mg of dry forage (or other parts of the plant) were accurately weighed in a small weighing vessel and quantitatively transferred to a graduated centrifuge tube, and 10 ml of 1 N HCl added. The tube was placed in a boiling water bath for 1 hr the volume made up to 10 ml with water and the tube centrifuged .5 ml of the supernatant was pipetted into another centrifuge tube and 30 mg of activated carbon added. The tube was again shaken and incubated at 100° for 75 min and then centrifuged. This effectively removed pigment. 1 ml of supernatant was taken and added to 10 ml  $\text{H}_2\text{O}$ .

Two 5 ml samples were pipetted into separate tubes; to one, 2 ml water added, to the other 2 ml 0.05% (w/v)  $\text{FeCl}_3$ . The second sample was read against the first sample as blank at 535 in a Spectronic 70. The levels of mimosine in the dry matter of growing leaf tips, whole leaves, stems, forage stems and seeds will be presented.

3 CHANGES IN COMPOSITION OF SUGAR CANE STALK AFTER CUTTING AND STORAGE: J A Rivera, CSAT, Cardenas, Tabasco, Mexico

2 tons of cane (variety L 4262) were cut at the base of the stalk; stacked in an organized pile (A) or indiscriminate (B). In the sugar cane in a loose heap (B) pH fell during a 30 day period from 6.09 to 4.62. The fall was more gradual with the stacked sugar cane (5.9 to 5.05). Total acidity increased from 3.2 to 42.5 on the loose cane and 2.7 to 11.4 ( $P < .04$ ) on the stacked cane; and total soluble carbohydrates fell from 34.0 to 1.72 and from 34.0 to 8.4 ( $P < .001$ ).

*Growth and fattening*

4 EFFECT OF CASTRATION ON PERFORMANCE OF CATTLE FED MOLASSES UREA DIETS WITH AND WITHOUT SUPPLEMENT: R A Gonzalez, CSAT, Cardenas, Tabasco, Mexico

78 commercial Zebu of 200 kg live weight were allocated to the following treatments: (A) bulls supplemented with 1 kg/d of rice polishings; (B) bulls without supplement; (C) steers with supplement and (D) steers without supplement. All animals had free access to molasses containing 2.5% urea and had restricted grazing 4 hr daily. The experiment lasted 255 days from April to December. Bulls grew faster than castrates (.77 vs .64 with supplement and .54 vs .51 kg/d without supplement respectively). Supplementation increased live weight gain 20%. The results show that there is no advantage in castrating bulls intended for fattening on a molasses/urea restricted grazing system.

#### 5 GENETIC AND ENVIRONMENTAL FACTORS INFLUENCING GROWTH OF CALVES IN THE SEMI-HUMID TROPICS OF MEXICO: R Sahagum, CSAT, Tabasco, Mexico

Studies were carried out with 164 F1 animals obtained by crossing Zebu females with the following sire breeds; Indo Brasil, Brahman, Holstein, Hereford, Itacial group I (Charolais, Simmental and Limousin) and racial group II (Ayrshire and Guernsey). The animals born in April and May had a tendency to weigh more at weaning and to have better growth rate to weaning. For growth post weaning, weight at 18 months and overall growth to 18 months, best results were with animals born in the months July/September. With respect to paternal breed, Brown Swiss gave highest values for growth to weaning, and weaning weight while for performance after weaning and overall gain to 18 months, group I was superior. Males better than females for growth to weaning and weaning weight; there was a significant breed x sex interaction for daily gain to weaning but not for weaning weight.

#### 6 ANIMAL PRODUCTION IN THE HUMID TROPICS DURING THE PERIOD OF NORTHERLY WINDS: G Navarro, CSAT, Cardenas, Tabasco, Mexico

The hot humid regions of Mexico are characterised by a winter period affected by polar fronts accompanied by constant rains and cloud cover of up to 60%. As a result, plant growth is reduced due to less photosynthetic activity. Forage availability is affected and, in consequence, production of beef and milk. On this basis it is concluded that the season of northerly winds is really the critical period of the year for animal production in Tabasco, and that the dry season is the most favourable time. In this respect the region is different from other areas where scarcity of water is the major factor in the dry season.

#### 7 PERFORMANCE OF STEERS ORIGINATING FROM SINGLE PURPOSE BEEF OR DUAL PURPOSE BEEF/MILK HERDS: O Escobar, CSAT, Cardenas, Tabasco, Mexico

Steers from beef and milk/beef herds (54 animals) were observed during a period of 804 days. There were 3 breed groups Zebu (18) from the beef herd and 13 Holstein x Zebu and 18 crossbred animals (mixture of Criollo, Zebu and Swiss) from the dual purpose herds.

Initial weight of the Zebu was 200 kg and of the crossbreds 117 to 138 kg. Each breed group was subdivided receiving either pasture (Elephant grass) alone or with 1 kg/d of concentrate. For the breed groups with and without supplement respectively (corrected for initial live weight) daily gain was (g/d) 245 and 245; crossbreds 383 and 539; Holstein x Zebu 489 and 310. There were differences due to supplementation within the crossbred groups but not with Zebu.

#### 8 RESPONSE TO NITROGEN FERTILIZER IN AFRICAN STAR GRASS (CYNODON PLECTOCSTACHYUS): F Melendez, J Perez and J Alvarez; CSAT, Tabasco Mexico

During 2 years (75/76 and 76/77), response in live weight gain was evaluated for 4 levels of nitrogen (0/100 200 and 300 kg/ha) given in 6 applications annually, Criollo/Zebu steers of initial weight 180 kg were used on the variable stocking rate procedure to maintain appropriate stocking rates according to grass production. There was a significant response in live weight gain per hectare due to nitrogen level, the values being 407 578 654 and 658; and 291 395 434 371 kg/ha for the first and second years respectively. Daily gain per animal did not differ between nitrogen levels. There was a significant relationship between carrying capacity and TDN production per ha.

#### 9 BEEF PRODUCTION ON ECHTOCULOA POLYSTACHYA WITH DIFFERENT STOCKING RATES: H Moreno, J Perez, F Melendez and J Alvarez, CSAT, Cardenas, Tabasco, Mexico.

From June 1974 to June 1976 28 Criollo Zebu steers were allocated to stocking rates of 2, 3.3 and 4 animal/ha. A set stocking system was used. Daily gain in live weight per ha varied according to stocking rate and time of year. There was a strong tendency for speed of infiltration of water to be reduced and for the weed content in the pasture to be higher, as stocking rate was increased. Soil compaction was also increased by high stocking rate.

10 THE AERIAL PART OF CASSAVA AS A COMBINED SOURCE OF ROUGHAGE AND PROTEIN IN FATTENING DIETS BASED ON MOLASSES/UREA: Angela Fernandez, N A MacLeod and T R Preston; CDIPCA, CEAGANA. Santo Domingo, Republica Dominicana

4 groups each of 3 Zebu bulls of initial live weight 170 kg were used to evaluate the effect of chopping (Gehl stationary forage chopper) or giving whole cassava forage as the combined source of roughage and protein in diets based on molasses/urea. The cassava forage was given at the rate of 3% of live weight (fresh basis) while the molasses/urea (2.5%) was given free choice. The animals had free access to a mineral mixture. In the trial which lasted 120 days there were 2 distinct phases in time with respect to animal performance, although there were no effects due to method of processing of the forage. During the first 56 days, increase in live weight was at a low level (11 and .05 kg/d for whole and chopped forage) while for the remaining 64 days there were consistent gains in live weight (.58 and .66 kg/d for whole and chopped forage respectively). In the second period of consistent growth, voluntary consumption index (kg DM/100 kg live weight) was 2.53 on both treatments while feed conversion (DM basis) was 9.16 and 7.76 for whole and chopped forage. Samples of rumen fluid taken by stomach tube at the end of the trial showed tendencies due to processing in pH (6.91 vs 7.09;  $P < .24$ ) and in molar  $C_3$  (11.7 vs 13.3;  $P < .17$ ) for whole and chopped forage. There were no differences in  $C_2$  (57.7 vs 56.8) or in  $C_4$  (30.6 vs 29.9). There were highly significant effects in almost all parameters due to time of sampling. Values before and 3 hr after giving the cassava forage were pH 7.16 and 6.83 ( $P < .04$ );  $C_2$  52.9 and 61.6 ( $P < .07$ );  $C_3$  13.3 and 11.8 ( $P < .21$ );  $C_4$  33.9 and 26.6 ( $P < .08$ ). Protozoal biomass packed cell volume in rumen fluid, % was detected in three of the animals receiving the chopped forage and in only one animal receiving the whole forage. However in all cases except for one animal on the chopped forage (PCV = .45 and .71 & at 0 or 3 hr), the values were low ( $P = .18$ ).

11 EFFECT OF HISTADINE AND METHIONINE ON FEED INTAKE AND ANIMAL PERFORMANCE FOR DIETS BASED ON SUGAR CANE: A Priego, T M Sutherland and A Wilson; CIEG, Chetumal, Mexico

8 Holstein calves of 139 kg live weight were used in a 4 x 4 latin square to evaluate effect of histidine and methionine as limiting nutrients in sugar cane diets. The treatment periods were 14 days and the basal ration chopped sugar cane with 50 ml of a 20% urea mixture in molasses per kg of fresh cane. Minerals and salt were also given. The daily supplements (1 litre/d) given from a teat to stimulate reticulum groove closure were: (A) 10% glucose; (B) 10% glucose + 4.2 g methionine; (C) 10% glucose + 2.7 g histidine; and (D) 10% glucose + 4.2 g methionine and 2.7 g histidine. There was a significant increase in live weight gain for the treatments containing methionine ( $P < .03$ ).

12 EFFECT OF TWO LEVELS OF CASSAVA FORAGE IN SUGAR CANE DIETS ON ANIMAL PERFORMANCE AND RUMEN FERMENTATION Luz Meyreles, N A MacLeod and T R Preston; CDIPCA, CEAGANA, Santo Domingo, República Dominicana

Two experiments were carried out: the first levels of cassava forage without urea, and the second with two levels of cassava forage in the presence or absence of urea. The sugar cane contain on average 27.8% DM 14.2 Brix and pH 5.15 and was approximately 18 to 19 months old. The cassava was cut at an average age between 3 and 4 months using the aerial part of the plant (30 cm above level) with a mean DM of 26.6% and 2.7% N in the DM. In the first experiment which lasted 70 days the design consisted of cassava forage levels (% fresh basis) of 0, 15, 30 and 45 with 3 replications of each treatment (one group of 3 animals per treatment replication). In experiment 2 (56 days) the treatments in a 2 x 2 factorial design were levels of 20 or 40% (fresh basis) of cassava forage in the absence or presence of urea (100 and 80 g/d for the levels of 20 and 40% of yuca respectively). There were two replications with three animals in each treatment group. At the end of both experiments, samples of rumen fluid were taken by stomach tube to measure rumen fermentation parameters. On experiment 1 the control treatment without cassava forage showed losses of live weight (-184 g/d) with significantly better results on the diets with cassava forage with no differences between levels (166, 148 and 155 for 15, 30 and 45% of cassava respectively). Voluntary consumption index (kg DM/100 kg LW) increased significantly ( $r = .93$ ) with increase of cassava forage in the ration, this parameter being related positively to daily live weight gain ( $Y = -.493 + .27X$ ;  $r^2 = .24$ ) where  $Y$  = gain in live weight (kg/d) and  $X$  = voluntary consumption index. In experiment 2, the rations with urea were better than those without urea but there were no differences

between levels of cassava forage. Mean values were .24 .16 for the treatments with and without urea and .19 and .21 for the different levels of cassava. Voluntary consumption index values showed similar tendencies to gain in weight. The level of cassava forage did not affect pH, tended to increase protozoal biomass ( $r = .41$  and  $.37$  at 0, and 3 hr after feeding), reduce molar proportions of  $C_2$  ( $r = .66$  and  $.73$ ), increased  $C_3$  at 0 ( $r = .75$ ) and 3 hr ( $r = .33$ ) and increased  $C_4$  ( $r = .36$  and  $.79$ ). In experiment 2 there were no significant effect which could be attributed to the principal treatments in terms of rumen fermentation pattern. The only exception was a higher proportion of  $C_4$  at 0 and 3 hr in the presence of urea compared with its absence. The data indicate a positive effect due to the presence of urea, in diets based on sugar cane and cassava forage. The reduction in acetic acid and increases in propionic and butyric with increasing levels of cassava forage in the ration in experiment 1, perhaps can be attributed more to the presence of nitrogen than to cassava forage as such. There were suggestions of similar tendencies in experiment 2 with respect to the diet with urea compared with those which had lower levels of nitrogen.

13 EFFECT OF MEAT MEAL, DRIED CASSAVA ROOT AND GROUNDNUT OIL IN DIETS BASED ON SUGAR CANE/UREA, OR MOLASSES/UREA: R Silvestre, N A MacLeod and T R Preston: CDIPCA, CEAGANA. Santo Domingo Republica Dominicana

48 Zebu bulls in 16 groups of 3 were used to study the following treatments in a  $2 \times 2 \times 2 \times 2$  factorial design with one replication: 0 or 600 g/d of meat meal; 0 or 30 g/d of groundnut oil; 0 or 1,000 g/d dried cassava root; basal diets of chopped whole sugar cane supplemented with urea and ammonium sulphate or final molasses/urea with a mixture of cane tops and bagasse a, source of forage. The sugar cane and the molasses/urea were given at libitum while the mixture of roughages on the molasses diet was given at a level equivalent to 1% of live weight (DM basis). The experiment lasted 84 days. Animal performance was better on the molasses diet than on sugar cane mean values being live weight gain(g/d) 396 and 252 and feed conversion (DM basis) 13.4 and 24.1 for molasses and sugar cane respectively. On the sugar cane diet the addition of cassava root significantly improved daily gain (348 vs 156 g/d,  $P < .02$ ) and feed conversion (13.6 vs 34.7;  $P < .14$ ). This supplement tended to reduce performance on molasses in the molasses diets (358 vs 441) g/d,  $P < .23$ ; 17.4 vs 9.31;  $P < .15$ ) for with and without cassava respectively. There was a tendency for better live weight gain with addition of protein in the form of meat to the sugar cane diets (289 vs 215  $P < .23$ ) and for better conversion (16.3 vs 31.9;  $P < .24$ ). The effect of protein was highly significant in the molasses diets for gain (520 vs 272 g/d;  $P < .02$ ) but less so for conversion (9.16 vs 17.6  $P < .14$ ). There were no effects of the oil in either diet. Samples of rumen fluid taken by stomach tube showed no differences in the molar proportion of VFA which could be attributed to addition of supplements however there were highly significant differences between diets. At 3 hr after giving the new feed of sugar cane or giving the forage (in the case of the molasses diets), the proportions of the different acids for the sugar cane and molasses diets respectively were:  $C_2$  63.5 vs 53.7 ( $P < .01$ ),  $C_3$  23.4 vs 16.8 ( $P < .001$ )  $C_4$  13.3 vs 29.5 ( $P < .001$ ). The tentative conclusion from this experiment is that the order of limiting nutrients is different for diets of sugar cane/urea and molasses/urea. For sugar cane/urea and molasses/ urea. It appears that glucose precursors (starch from the cassava root) are the first limiting while on molasses/urea the first requirement is for bypass protein (meat meal).

14 NUTRITIONAL LIMITATIONS IN DIETS BASED ON SUGAR CANE: H M Ferreiro, T M Sutherland, A Wilson and T R Preston; CIEG, Chetumal, Q R, Mexico

64 Zebu steers of initial weight 257 kg were used in a random block design with two replications (4 animals per group) to compare the following additives in a basal diet of chopped whole sugar cane given in one feeder and a solution of molasses containing 10% urea in another. The treatments were: (A) control (no additives); (B) .5 kg/d of a mixture of fish meal and soya bean meal (25% fish meal, 75% soya bean meal). © .75 kg/d of fish meal soya bean meal; (D) .5 kg/d of maize meal; (E) .5 kg/d of fish meal/soya bean meal and (F) .5 kg/d of fishmeal/soya bean meal plus 30 ml/d of sesame oil; (G) 1 kg/d rice polishings; (H) 1.5 kg/d rice polishings. After 98 days of trial the mean values for the respective treatments were: daily gain in live weight (g/d) 37 333 669 51 555 517 728 651; for voluntary consumption index (kg DM/100 kg LW) 1.89 1.93 1.97 1.63 2.27 1.99 2.14 2.17; and for conversion rate (kg DM/kg LW gain) 111 15.4 9.188 10 10 8.7 10.

15 DIFFERENT RATIOS OF BANANAS :MOLASSES ON FOR GROWING PIGS CSAT, Cardenas, Tabasco, Mexico

128 hybrid pigs of initial weight 23 kg were allocated to the following treatments (A) 70:30 ratio of molasses: bananas (B, 50 :50; © 30:70; and (D) control diet with commercial pig feed. Housing was sided in open building with concrete floors. The bananas were fed green chopped with a machete and mixed with the molasses at the moment of feeding. A 40% protein concentrate was given at the rate of 1 kg/d. The experiment lasted until the animals reached 90 kg live weight. During the growth phase (23 to 60 kg) the control animals gained faster (459 kg/d in comparison with those receiving the different ratios of molasses /bananas (.445 .419 .492 respectively). Intake of DM was higher on the banana treatments (1.86 1.73 and 1.54) than on the control treatment (1.59) (P <.001). Conversion became worse as the amount of molasses increased. (4.6, 3.9, 3.3, 2.7); P <.001). During the finishing phase (60 to 90 kg) daily gain did not differ between banana treatments and the commercial control (.56, .58 .55 and .55 kg/d) There was a saving of some 30% in feed cost in the experimental diets compared with the pig meal control. It is concluded that the ration of 70:30 banana / molasses was the most profitable.

16 PROTEIN LEVELS FOR GROWTH AND FATTENING OF PIGS FED BANANAS AND MOLASSES: L Zaragoza, CSAT, Cardenas, Tabasco, Mexico

120 hybrid pigs of mean weight 38 kg were allocated to the following treatments: (A) bananas :molasses 70:30 and 1 kg/d of a 20% protein concentrate; (B) the same but with a 30% protein concentrate; (C) a 40% protein concentrate and (D) control of commercial pig meal. The bananas were given green and chopped mixing them with molasses at the time of feeding. The experiment was terminated when the animals reached a live weight of 83 kg. Gain in live weight was better on the control diets (.68 kg/d); however there was a linear response due to protein intake in the diets of bananas and molasses (.38 .49 and .53) respectively. Daily intake was the same for all diets, thus conversion was poorest with 20% protein concentrate (6.56) compared with 4.67 and 4.94 for 30% and 40% protein concentrate. Cost per unit gain in live weight was lowest for the treatments with 30 and 40% protein in the concentrate; poorest economic results were with the diet with 20% protein in the concentrate.

*Milk and Weaned Calf Production:*

17 EFFECT OF TWO PLANES OF FEEDING ON INTERVAL BETWEEN CALVING AND CONCEPTION IN A ZEBU HERD: H Losada, CSAT, Cardenas, Tabasco, Mexico

120 commercial Zebu cows of mean weight 410 kg were allocated to the following treatments: (A) no supplement before mating but supplement during mating; (B) supplement before and during the mating period. The supplement was molasses contain" 2.5% urea in troughs fitted with revolving wheels to restrict intake. Management was according to the restricted grazing system in the case of animals receiving molasses. Heats were observed at ° 700 and 17.00 hr using marker bulls. A1 was 12 1, after detection of heat . Conception rate was determined 35 days after the last insemination. The calves received a diet based on molasses contains 2.5% of urea ad lib and 1 kg/d of rice polishings with minerals and water. intake of milk was calculated by weighing before and after suckling. Weaning was at

three months. The experimental lasted 186 days. There were no significant differences in daily gain before mating; daily gain in live weight without and with supplement for cows with calves was -.156 vs -.224 kg/d and for pregnant animals -.305 vs -.279 kg/d. Live weight gains during the mating season were .219 vs .371 ( $P < .05$ ) .185 vs .197 for the same combination of treatments and overall gains .026 vs .066; -.065 vs -.046. Conception rate 50 days after beginning of breeding season was 43.7 and 56.2 (NS) and 6.9 vs 22.2 ( $P < .05$ ) and 100 days 75 vs 81; 46.5 vs 66.6 ( $P < .05$ ) . Interval from calving to first heat was 104 vs 98; 89 vs 104; 89 vs 68 ( $P < .01$ ); and the interval calving to conception 122 vs 118 (NS) and 108 vs 93 ( $P < .10$ ).

19 EFFECT OF UREA LEVELS ON MILK PRODUCTION ON COWS FED SUGAR CANE: EAranda, CSAT, Cardenas, Tabasco, Mexico

A total of 18 Holstein cows of 435 kg live weight in their second lactation were allocated to the following 3 treatments, 70 days post calving : (A) chopped sugar cane with 70 g/d of urea as a solution in molasses, (B) the same but with 140 g/d of urea; © with 210 g/d of urea. All the animals received a 22% protein concentrate at the rate of 3 kg/d . The animals were housed throughout the experiment which was divided in three phases: Standard, experimental standard with total length of 120 days. Intake of sugar cane and of total DM was higher 12.2 and 15.5 kg with 210 g/d of urea than with 140 or 70 g/d (10.3 and 13.7 ; 10.3 and 13.7). Milk production showed the same tendency to increase with urea levels, but the differences were not significant (6.4, 6.7, 7.0). Daily gain of live weight of the cows also showed a tendency to increase with urea levels (66, 132 and 200 g/d).

20 EFFECT OF SUPPLEMENT LEVELS ON MILK PRODUCTION IN COWS FED SUGAR CANE: J A Rivera, CSAT, Cardenas, Tabasco, Mexico

A total of 21 Holstein cows of mean weight 445 kg in the second and third lactation 70 days after calving, were divided into 3 groups of 7 animals each according to the following treatments: (A) chopped whole sugar cane 1 kg/d of molasses containing 21% urea and 2 kg/d of a 22% protein concentrate; (B) the same but with 3 kg/d of supplements; © with 4 kg/d of supplements. The animals were housed all the time. The sugar cane and molasses/urea were given in two feeds in the morning and afternoon. Half of the supplement was given in the feed and half at the time of milking. The experiment was carried out in 3 stages: a period of standard feeding, experimental and standard feeding with a total duration of 120 days. Consumption of sugar cane tended to increase with level of concentrates (10.0, 12.0 and 12.1 kg MS/d;  $P < .001$ ); milk production also increased linearly with concentrate level (7.6, 8.7 and 9.5 kg/d;  $P < .001$ )

21. POTENTIAL LOSSES OF CALVES DUE TO SLAUGHTER OF PREGNANT COWS IN TABASCO STATE: A Agiler and G. Lanestosa; CSAT, Cardenas, Tabasco, Mexico

534 Zebu and Zebu cross Criollo cows were sampled post mortem at random in the meat abattoir of Tabasco during August and September 1976. Age of the foetus was determined by the formula of Keller (1970):  $X(X + 2)$  47% of the cows in the sample were pregnant, the major proportion (34.6%) being in the 3 to 5 month stage. 63% of the pregnancies were in the right horn of the uterus. There were a greater number of males in the group up to 5 months pregnancy and more females in the group 5 months onwards. On the base of the data obtained it is calculated that each year 18,000 females are slaughtered out of which 8,300 are pregnant.

22. OBSERVATIONS ON COMMERCIAL MILK AND BEEF PRODUCTION IN a DUAL PURPOSE HERD OF SWISS X ZEBU AND SWISS X HOLSTEIN UNDER GRAZING CONDITIONS: E Salcedo, A Arriaga y F J Alvarez, Unidad Demostrativa de Produccion de leche, Egido C41, FIRA, fianco de Mexico, Residencia Regional del Sureste, Tabasco, Mexico

Observations were made in a commercial crossbred herd (the content of European blood being about 60%) manager under conditions of unsupplemented grazing in chontalpa, Tabasco. Comparisons were made (I) of milking with and without the calf to stimulate letdown: 21 cows were milked twice daily without calves while 26 cows were milked once daily using the calves to stimulate down. The calves were suckled for a few seconds prior to milking and then for 30 minutes after milking. The calves in the firts treatment were reared artifically after the third day using whole cows milk. Both groups of calves received 200 g/d of a mixture of rice polishings and coconut meal and had 200 g/d of molasses containing 3% urea. The results were: cows dried off prematurely 11 vs 0; salable milk (kg/d) 3.1 and 5.1; consumed by the calf 3.0 and 2.5; total milk 6.1 and 7.6; daily gain of the calves 110 and 310 g/d. II Incidente of mastitis in cows milked with and without the calf: 92 cows were sampled on three occasions weekly using the California test to determine incidente of mastitis in 47 cows milked with the calf and 45 without the calf. The mastitis incidence with and without suckling was: negative 78 and 54; suspicions 14 13; positive 6 and 21; highly positive 1 and II. III Effect of milking frequency in cows milked without the calf. 42 cows were allocated to single or double milking by machine daily. During 70 days the results were: milk yield before the trial 4.6 and 4.5 kg/d; during the trial 2.7 and 3.9 (P<.001): persistency .70 and .96 (P <.001); change in live weight of the cows(g/d) 122 and -88 (P<.04). IV Effect of milking frequency on milk production in cows managed with their calves: 30 cows at start of lactation were divided into treatments of once or twice daily milking by machine, the calf being used to stimulate let-down and for suckling after milking. During the firts 30 days, results were saleable milk (kg/d) 4.69 and 5.46; consumed by the calves 2.22 and 3.0; total milk production 6.5 and 8.5 daily gain of the calves 343 and 360 g/d.

#### *Digestion and Metabolism:*

23 DYNAMICS OF GLUCOSE METABOLISM IN BULLS FED SUGAR CANE, UREA AND RICE POLISHINGS: M H Ferreiro, J Lopez, A Priego, F Salais T R Preston and R A Leng; CIEG; Chetumal, Q R, Mexico

The utilization of sugar cane diets by growing cattle appears to be depen dent on supplement being given with the most consistent growth responses on rice polishings being recorded. Data on rumen function indicate that this is unaffected by supplementation and it has been suggested that these supplements are providing essential nutrients for absorption by the animal (see Valdez et al 1977). Recent studies with sheep have indicated that glucose requirements for growth are high (for discussion see Kempton et al 1977). Calculations based on stoichiometric principles of rumen fermentation suggest that at high growth rates, glucose requirements could not be x t from propionic acid (the only glucogenic VFA), indicating a need for other glucose precursors to be made available (see Leng and Preston 1976). These findings suggest that at least part of the response to supplements of rice polishings in cattle given sugar cane diets is due to by-pass starch becoming available to be absorbed as glucose from the small intestine. As part of a project to investigate this hypothesis, isotope dilution procedures have been used to examine the amounts of glucose available for metabolism . Bulls (4 per group) on sugar cane diets supplemented with 0, 200, 400, 600, 1,000 and 1,200 g/d of rice polishings were injected with tritium labelled glucose (2-3 H glucose) and the specific radioactivity and concentration of palsa glucose determined at intervals of 30 min for 3-4 hr after the injection. The bulls were injected 4 hr after fed in the morning at a time when it was anticipated that glucose absorption, if it occurred, would be at a maximum. A positive linear relationship (P <.04) between glucose entry rate into plasma and level of rice polishings was +found as follows:  $Y = 345 + 14X - .034$  ( $r^2 = .62$ ) where X = rice polishings (g/d) and Y is glucose entry rate (mg/min). This indicates that for every increase of 100 g of rice polishings in the ration an extra 14 mg/min of glucose was made available to the animal. This implies a minimum glucose absorption rate and supports the hypothesis that glucose is an essential nutrient in these animals.

24 RUMEN FERMENTATION IN SUGAR CANE DIETS SUPPLEMENTED WITH DIFFERENT PROPORTIONS OF CASSAVA FORAGE AND UREA: Luz Meyreles, N A MacLeod and T R Preston; CDIPCA, CEAGANA, Santo Domingo, Republica Dominicana

In a 4 x 4 latin square design, comparisons were made of 4 diets with urea levels (fresh basis) of .1 .3 .5 and .8% with corresponding levels of cassava forage (% fresh basis) of 60, 40, 20 and 0; the remainder of the ration was provided by chopped whole sugar cane. The diets were isonitrogenous and the experimental periods of 11 days. The sugar cane contained 27.5% DM and 14.2 Brix. For every 1 g of urea was included 0.28 g of ammonium sulphate. The cassava was the variety of Zenon with 20% DM and 2.4% N in dry matter. All the animals received a mineral mixture of 50% salt and 50% dicalcium phosphate. The diets were ad libitum. The cassava forage was the aerial part of the plant (cut approximately 36 cm above ground level) and included leaves, petioles and stalk. On the last day of each experimental period, samples of rumen fluid were taken at 0, 1, 2, 3 and 4 hr after giving the mixed feed in the morning. Samples of blood were taken at 0, 2 and 4 hr. The proportion of total N represented by urea was 8, 30, 52 and 77% while the corresponding amounts of cassava N were 84, 56, 29 and 0 respectively. The average N in DM of the mixed diet was 1.70%. Voluntary intake of DM was lowest on the ration with the lowest level of urea ( $P < .03$ ). There were no treatment effects of rumen fermentation parameters, the range of values being pH 7 to 6.6, protozoal biomass (packed cell volume, rumen fluid) .1 to .8,  $C_2$  (% molar) 70 to 66,  $C_3$  16 to 21 and  $C_4$  14 to 15. The levels of urea in blood varied between 9 to 14 mg/100 ml. The fermentation parameters varied significantly with time of sampling: the pH decreased, protozoal biomass increased (to maximum values 2 hr after feeding),  $C_2$  fell and  $C_4$   $C_3$  increased (to maximum values at between 1 and 2 hr after feeding) with no consistent changes in  $C_4$ . The experimental findings indicate: (1) that apparently there are no differences in the rate of degradation of the protein in cassava forage and of urea in view of absence of differences in rumen ammonia and blood urea, even between the extremes of treatment in terms of proportions of cassava and urea; (2) the fact that there were higher intakes of DM with cassava forage, despite absence of differences in rumen fermentation, indicates that the effect of cassava forage on animal performance is probably mediated through increasing the availability of nutrients for direct absorption.

25 DETERMINATION OF STARCH IN ABOMASAL CONTENTS OF CATTLE FED SUGAR CANE, UREA AND DIFFERENT CONCENTRATES: T R Preston, S Minor and R A Leng; CDIPCA, CEAGANA, Santo Domingo, R D

The role ascribed to concentrates in sugar cane diets in determining the rate of animal performance is based on the assumption that part of the starch present in the supplement escapes rumen fermentation to be digested and absorbed in the small intestine. To study this hypothesis, we examined abomasal contents of cattle fed sugar cane diets and slaughtered 4 hr after giving the supplement. Starch was estimated as follows: abomasal contents were homogenised with water to give a mixture of approximately 3% dry matter. Representative samples of 100 ml were taken, one for determination of dry matter while the other was transferred to a beaker with an equal quantity of N NaOH. The mixture was permitted to boil gently for 2 hr, keeping the volume constant at approximately 8 to 9 ml after the first hr. The mixture was then transferred to a graduated centrifuge tube and washed to a final volume of 10 or 15 ml. 5 ml of the mixture was placed in another tube and to this was added 5 ml of 95% alcohol. On cooling the mixture, the starch was precipitated. The tubes were centrifuged and the supernatant removed by drying the tubes over filter paper. The starch was hydrolysed to glucose by incubating in a water bath with 10 ml of 0.5N HCL. At the end of this period, the tube was made up to 10 ml, then 1 ml to determine glucose by the oxidase method. The starch in abomasal contents (% of DM) was determined in cattle fed sugar cane and urea 1 kg/d of the following supplements: starch in the feed supplement was determined by the same method): Commercial concentrate supplement (30% starch) gave 4, 5 and 0% starch in DM of abomasal contents in three animals respectively, dried cassava chips (67% starch) gave 1.1 and 0.9% in two animals: rice polishings (30% starch) gave 1.2 and 2.0% starch in 2 animals.

26 EFFECT OF DIFFERENT RATIOS OF MOLASSES/UREA AND CASSAVA FORAGE ON RUMEN FERMENTATION: Angela Fernandez, N A MacLeod and T R Preston; CDIPCA; CEAGANA, Santo Domingo, R D

4 Zebu steers with rumen cannulas were used in a 4 x 4 latin square design to study mixtures containing 85, 75, 65 and 55% cassava forage and 15, 25, 35 and 45% fine: molasses. Urea levels were 0.2, .3 and .5(% of fresh weight of the ration). Nitrogen from urea was 0, 18, 29, and 37% and from cassava forage 86, 67, 54 and 43. The experimental period was 10 days on each ration, removing rumen fluid on the last day of each period, before and at intervals after giving the forage (molasses was always ad libitum). Consumption tended to be higher on the diet with higher content of molasses/urea. Rumen pH was high in all treatments (6.4 to 6.9). There were significant differences in molar VFA, the proportion of  $C_4$  increasing as the amount of molasses in the diet increased ( $\% C_4 = 12.9 + .46X$ ) ( $X = \% \text{ final molasses}$ ;  $r^2 = .97$ ). For  $C_3$  the relationship was poorer and negative ( $\% C_3 = 7.5 - 0.07X$ ;  $r^2 = .42$ ); and highly significant and negative for  $C_2 = Y = 69.6 - .40X$ ;  $r^2 = .88$ ). The effect of time after feeding was to reduce  $C_4$  and increase  $C_2$  with a tendency for  $C_3$  to be decreased in the rations with highest content of final molasses. On diets with low content of molasses the effect of time was minimal.

27 DETERMINATION OF APPARENT DIGESTIBILITY OF A RATION BASED ON SUGAR CANE TOPS: F J Salais, A Wilson and R Elliott; CIEG, Chetumal, Q R, Mexico

8 Zebu steers of initial weight 171 kg were used in two 4 x 4 latin squares, one with and the other without supplementation, to study the effect of size of particle (of the cane tops) on apparent digestibility of rations based on sugar cane stalk or molasses. The levels of supplementation were 0, and 750 g/d of rice polishings. The experimental diets were: (A) sugar cane tops chopped with a machete in pieces of 5 to 20 cm given at 3% of live weight plus a solution of molasses containing 3% urea and 1% ammonia sulphate given free choice, plus 60 g/d of minerals, (B) the same diet but with the sugar cane tops ground finely, (C) sugar cane tops chopped with a machete at 3% of live weight plus chopped sugar cane stalk supplemented with an aqueous solution of urea in water according to the Brix of the cane juice (Ferreiro et al 1977; Trop Anim Prod 2 Vol 2). (D) the same as (C) but with ground tops. There were no differences in digestibility of dry matter due to addition of rice polishings (62.2 vs 65.9%); there were significant differences ( $P < .001$ ) in DM digestibility in favour of molasses compared with sugar cane stalk (71.9 vs 58.7 with rice polishings and 73.7 vs 58.1 without rice polishings). Rice polishings increased voluntary intake on all diets (3.78 vs 3.08). However there were no differences in DM intake within level of supplementation (3.97, 4.12, 3.79 and 3.3 for the 4 diets respectively with rice polishings and 3.49, 3.15, 2.94, 2.75 for the diets without the supplement). Voluntary consumption index was higher with molasses than with cane stalk (2.30<sup>a</sup>, 2.34<sup>b</sup> vs 2.04<sup>ab</sup> and 1.83<sup>a</sup> with rice polishings; and 2.09<sup>ab</sup>, 1.97<sup>b</sup> vs 1.71<sup>ab</sup>, 1.47<sup>a</sup> for the diets without rice polishings). Digestible DM/100 kg LW/d increased significantly ( $P < .001$ ) with addition of rice polishings (1.36 vs 1.20). There were similar responses due to substitution of cane tops by molasses. Although, the differences did not reach significant levels, there were tendencies in all comparisons for cane tops chopped with a machete to be superior to cane tops ground finely.

28 EFFECT OF COCONUT OIL ON VOLUNTARY INTAKE IN STEERS FED CHOPPED WHOLE SUGAR CANE: A R Gonzalez, CSAT, Cardenas, Tabasco, Mexico

Four Swiss X Zebu bulls of 400 live weight were allocated to the following treatments in a 4 x 4 latin square: (A) chopped sugar cane and molasses with 21% urea both free choice and 1 kg/d of rice polishings; (B) chopped sugar cane, molasses/urea free choice and 150 g/d of coconut oil; (C) the same but with 200 g/d of oil and; (D) with 250 g/d of oil. The age of the sugar cane was approximately 12 to 14 months. Housing was in individual pens on a concrete floor in an open sided building. Feeding was twice daily at 0800 and 1400 hr the coconut oil being given once daily in the morning. The experiment lasted 112 days and was divided into 4 periods of 28 days each. Intake of sugar cane (kg/d) was 9.56, 8.68, 9.07 and 8.13 for the 4 diets. Intake of molasses/urea was 1.42, .96, 1.08 and 1.12 kg DM/day. There appeared to be no consistent effect of oil on animal performance.

### 29 EFFECT OF LEUCAENA LEUCOCEPHALA ON FERMENTATION AND FLOW FROM THE RUMEN IN SUGAR CANE DIETS: R J Alvarez and

O Alpuche, CIEG, Chetumal,  
Q R, Mexico

12 rumen fistulated steers were used to determine effect of restricted grazing (3 hr/d on *Leucaena leucocephala*) in combination with rice polishings as a protein supplement on a basal diet of chopped sugar cane plus urea. The treatments were 3 hr/d of grazing on *Leucaena leucocephala*; 3 hr grazing plus 0.5 kg/d of rice polishings; 1 kg/d of rice polishings and no grazing. All animals had free access to chopped sugar cane and urea. The experimental period was 16 days, 14 for adaptation, sampling being carried out on days 14 and 16. Rumen fluid was taken at 0, 3 and 6 hr after giving the sugar cane in the morning. Grazing for the first 2 treatments corresponded to the period 0 to 3 hr after giving sugar cane. On day 17 PEG was infused into the rumen of 3 animals on each treatment to determine flow rate. For the treatment of *leucaena*, *leucaena* plus rice polishings and rice polishings alone results were: pH 6.71, 6.86 and 6.66 ( $P < .01$ ); protozoal biomass (% PCV in rumen fluid) 39, .68 and .49. total VFA (mm) 11, 93, 101 ( $P < .28$ ); molar  $C_2$  79.7 75.8 69.8 ( $P < .001$ );  $C_3$  13.8 17.2 19.4 ( $P < .001$ );  $C_4$  5.8 6.3 9.6 ( $P < .001$ );  $C_5$  .67 .70 .83; rumen flow rate (litres) 42 21 20 ( $P < .010$ ); transit time (hr); 10.7 10.8 13.8 (NS); turn over rate daily 2.04 2.23 1.74 (NS). There was a positive relationship between rumen flow rate and molar proportions of  $C_2$  and a negative relationship between flow rate  $C_3$  and  $C_4$ .

### 30 EFFECT OF SODIUM HYDROXIDE ON VOLUNTARY CONSUMPTION IN CATTLE FED

CHOPPED WHOLE SUGAR CANE: H Losada, CSAT, Cardenas, Tabasco, Mexico

4 bulls of 229 kg were used to compare the following levels of sodium hydroxide added to a basal diet of chopped whole sugar cane: a solution of 20 g NaOH/litre at levels of 0, 2%, 4% or 6% of fresh cane. On all treatments the diets were left for 24 hr before being fed. All the cattle received molasses containing 21% urea and had 1 kg/d of rice polishings plus minerals and water. The diets were given twice daily at 0800 and 1400 hr. The design was a 4 x 4 latin square the total duration being 112 days. There were highly significant differences ( $P < .003$ ) for intake of sugar cane (6.8, 7.7, 7.9 and 8.1 kg MS/d). pH of the cane increased linearly with levels of NaOH both in the material that was fed (3.0 8.1 9.8 and 11.5) and refused (2.9 4.9 7.9 and 9.2).

### 31 VOLUNTARY CONSUMPTION PATTERN AND ITS RELATION WITH RUMEN FERMENTATION IN SHEEP FED DIETS BASED ON SUGAR CANE: E Aranda, CSAT, Cardenas, Tabasco, Mexico

6 sheep 30 kg live weight with rumen fistulas were used to compare the following treatments: (A) chopped sugar cane, minerals and vitamins; (B) the same basal diet but with all the N requirements as urea; (C) the same basal diet but with half of the N requirement provided by rice polishings and half by urea. The urea was given as a 25% solution in molasses. The animals were housed in individual pens on concrete floors in an open sided building. Feeding was at 0800 1400 and 2000 hr. The experiment lasted 20 days at the end of which samples were taken of rumen fluid. Highest intake of dry matter was on the diet with rice polishings (.42 .78 and .95 kg/d;  $P < .01$ ); however, highest production of VFA was on the diet with 100% urea N (45.2 103 and 69 mM/litre;  $P < .001$ ). There were highly significant differences for %molar  $C_2$  ( $P < .001$ ) with highest values on sugar cane/urea (70.5) compared with sugar cane alone (65) or with urea and rice polishings (67). There were higher proportions of  $C_5$  in animals which only received sugar cane (2.7) compared with urea (1.04) and urea plus rice polishings (0.80). Ammonia in the rumen was higher on the sugar cane plus urea diets (19.2 mg/100 ml) with intermediate values for sugar cane alone (11.7) and with rice polishings plus urea (5.7).

### 32 RUMEN FLUID LOW RATE ON SUGAR CANE DIETS: THE EFFECT OF SUPPLEMENTATION WITH RICE POLISHINGS: A Priego, T M Sutherland and A Wilson; CIEG, Chetumal, Q R, Mexico

4 bulls of approximately 290 kg live weight with rumen cannulas were used in a 4 x 4 latin square design to measure the effect of level of supplementation with rice polishings in sugar cane diets on rumen fermentation and flow rate. The animals were 15 days on each treatment, 9 for adaptation, rumen samples being taken on days 10, 12 and 14 of each period one hour before feeding and 3 and 6 hr afterwards. On day 15, PEG was introduced into the rumen, and samples taken during the following 24 hr. The basal diet was chopped whole sugar cane with 50 ml of urea solution (200 g of urea/litre)/kg of fresh sugar cane + salt, minerals. Three levels of rice polishings were 0, .5, 1.0 and 1.5 kg/d. Voluntary consumption index (kg DM/100 kg live weight) was significantly increased ( $P < .003$ ) 1.72 1.75 1.95 and 2.08. There were no significant differences in protozoal biomass before or after feeding due to treatment but levels were higher at 3 hr with similar values at 6 hr (approximate overall means .39 and .9 PCV as % rumen fluid. pH was higher before feeding 6.57 to 6.65 falling after feeding the lowest values being on the highest levels of rice polishings ( $P < .04$ ) 6.63 6.25 6.17 6.10. There were no differences between treatments at 6 hr. Molar  $C_2$  did not vary with level of supplementation, but fell according to sampling time from 79.2 before to 70.1% after feeding. Molar  $C_3$  rose with time after feeding (14 to 20%) but there was no effect due to supplementation.  $C_4$  showed little change either due to treatment or the sampling time. Rumen ammonia was within the range 4.7 to 5.2 m-equiv/litre before feeding rising to 10.8 to 12.8 after 3 hr and 9.8 to 13.6 after 6 hr. The turnover rate (per day) tended to increase with supplementation, 1.99, 2.04, 2.28 and 2.30; 6 rumen volumes (litres) were similar on all diets 28.8 31.6 30.9 and 31.2. Flow rate (litres/day) from the rumen increased ( $P < .03$ ) with supplementation (56.4, 63.1, 70.4 and 71.5). The results show that it is difficult to modify rumen fermentation pattern with supplementation on sugar cane diets, and that the increase in voluntary intake due to supplementation with rice polishings is due to increased flow from the rumen.

### 33 RUMEN FERMENTATION ON PATTERN ON SUGAR CANE DIETS SUPPLEMENTED WITH CASSAVA ROOT MEAL: A Priego, G. Caffarel and A Wilson; CIEG, Chetumal, Q R, Mexico

4 bulls approximately 270 kg live weight with rumen cannulas were used in a 4 x 4 latin square to evaluate the effect of dried cassava root meal on rumen fermentation and flow rate. The animals were 15 days on each treatment, the first 9 being for adaptation, samples of rumen fluid being taken on days 10, 12 and 14, one hr before feeding and 3 and 6 hr afterwards. PEG was infused into the rumen on day 16. The basal diets were chopped fresh sugar cane with 50 ml of an aqueous urea solution (200 g urea/litre)/kg of fresh cane, 400 g/d of fish meal: soya bean meal (1:3), minerals and salt free choice. The supplement was dried cassava root meal at levels of 0, .4, .8 and 1.2 kg/d. Voluntary consumption index was in the range 1.54 to 1.71 and not affected by treatment. pH was in the range 6.57 to 5.69 before feeding; at 3 hr afterwards it decreased with level of supplementation (6.36, 6.18 6.12 and 6.08), the differences being highly significant ( $P < .008$ ) 6 hr after feeding (6.28 6.04 5.94 and 5.92) Protozoal biomass (% PCV in rumen fluid) did not differ between diets before feeding but increased by 46% at 3 and 6 hr after feeding. Total VFA tended to be higher with supplementation ( $P < .07$ ) before feeding (range 134 to 154 mequiv/litre) but there were no differences after feeding. Molar proportion of VFA were not affected by supplementation but showed the usual pattern of variation due to feeding: a reduction in  $C_2$ , increase in  $C_3$  and no change in  $C_4$ . Rumen ammonia was not affected by supplementation nor time of sampling. Lactic acid was in the range 6.6 to 11.1 m-equiv/litre and was not affected by supplementation or sampling time. Turnover (per day) tended to be with supplementation ( $P .09$ ) 1.94, 1.77, 1.85 and 1.82. Rumen flow rate (litre/d) was not affected by supplementation (range from 44, 61, 52 and 52) however rumen volumes tended to be greater ( $P .09$ ) (22.7 34.4 28.1 and 28.6 litres), as did flow rates (44 61 52 and 52 litres/day).

## 34 STUDIES ON GLUCOSE METABOLISM IN CALVES RAISED BY RESTRICTED SUCKLING:

Angela Fernandez N A MacLeod and R A Leng; CDIPCA, CEAGANA, Santo Domingo, R D

Studies on restricted suckling of calves where the calf receives between 2 and 3 litres/d of milk have shown that even when the ration is poor quality (sugar cane and molasses/urea) high rates of growth can be obtained. Milk taken by suckling bypasses completely the rumen via the reticulum groove and in this way provides the calf with approximately 100 g/d of glucose in the form of lactose, with a similar quantity of high quality protein. The rate of absorption of glucose and its effect on glucose available to the animals during the day are of considerable interest. To study this situation, we have examined the concentration of glucose in plasma and the entry rate of glucose in calves receiving one, 2 or 3 litres of milk daily using a bottle and teat. Glucose entry was measured by isotope dilution of (2-3/H) glucose, immediately after consumption of milk. Samples were taken at intervals afterwards for up to 6 hr during which time the animals were already eating sugar cane/ molasses and urea. The calves that received no milk supplement were hypoglycaemic (glucose in plasma less than 50 mg/100 ml). Plasma glucose was in the range 60 to 70 mg/100 ml animals receiving sugar cane and milk.

## 35 STUDIES ON GLUCOSE METABOLISM IN CATTLE AFFECTED BY MOLASSES TOXICITY: J

Lora, G Ravelo, T R Preston and R A Leng; CDIPCA, CEAGANA, Santo Domingo, R. D.

Molasses toxicity occurs in cattle given molasses based diets and has been shown to be induced within a 2 to 6 day period following removal of roughage from the ration. The metabolic disorder is characterised by dysfunction of the central nervous system with staring eyes and loss of coordination of the limbs; the final stage is a necrosis of the brain. The removal of roughage from a molasses-based diet results in a rapid fall in propionic acid concentration in the rumen, which is the main glucose precursor in these animals. The treatment of cattle with glycerol (400 g/day) prevented the syndrome from occurring and this was associated with a higher blood glucose concentration (Gaytan et al 1976) which suggests that lack of glucose may be involved in producing the syndrome.

For these reasons, glucose metabolism has been examined in cattle given diets of molasses/urea groundnut meal and bagasse. 8 animals were used: 4 were controls and the other 4 had the bagasse removed abruptly from the diet. After 2 days on this regimen, 2 of the 4 animals showed obvious symptoms of molasses toxicity whereas the other two appeared to be in the early stages of the disorder. None of the animals consumed molasses during the experiment when glucose entry rate was measured, using (2-3/H) glucose. Analysis of blood showed that the animals with the obvious symptoms were hyperglycaemic (plasma glucose levels above 100 mg/100 ml) whereas the animals with early symptoms had normal to low plasma glucose level. The control animals which had not consumed molasses for about 4 hr all tended to be high hypoglycaemic. It is hoped to present data on glucose entry rates. However the preliminary results suggest that hypoglycaemia occurs early in the syndrome immediately consumption of molasses ceases, but that when clinical symptoms appear a hyperglycaemia results. Since it is difficult to maintain high blood glucose levels from body reserves this indicates that a hormone imbalance is occurring, reducing the utilization of glucose. This syndrome is similar to pregnancy toxemia in sheep where plasma glucose levels are often high in the terminal stage of the disorder, when the animals had stopped eating and glucose entry rates are low.

## 36 EFFECT OF LEVEL OF UREA ON RUMEN FERMENTATION IN CATTLE FED SUGAR CANE: A M

Ferreiro, A Priego, J M Lopez, F J Salais, A Wilson and T M Sutherland; CIEG, Chetumal, Q R, Mexico

8 Zebu bulls of mean live weight 220 kg live weight, fitted with rumen cannulas were used in a 4 x 4 latin square design with two animals per treatment. The basal ration was chopped whole sugar cane to which was added (A) 10 g of urea/ kg fresh cane (B) 13 g of urea © 16 g of urea, while in treatment (D) the urea was given as a 10% solution in molasses provided free choice alongside the sugar cane. The experimental period was 16 days, 14 days were for adaptation and samples were taken over a 24 hr period on days 14 and 16. For the first 12 hr, samples were taken at 3 hr intervals and subsequently at 4 hr intervals. pH tended to be similar on all the treatments however the highest values were observed in treatments with 60 g of urea /kg sugar cane. On all diets there were reductions in percent molar C<sub>2</sub> and increases in molar C<sub>3</sub> in the 8hr period after feeding in the morning. This was the period of maximum

feed consumption. Rumen ammonia concentration was higher in the animals receiving the ration with 16 g of urea/kg of fresh cane. Highest values of ammonia were observed between 6 and 9 hr after feeding however in the overall sampling period the range was from 7 to 23 m-equiv/litre. The animals fed sugar cane and molasses/urea had the lowest levels of rumen ammonia. Voluntary consumption index (kg DM/100 kg live weight) was low on all treatments.

#### 37 EFFECT OF SODIUM BICARBONATE ON RUMEN FERMENTATION AND FLOW RATE IN CATTLE FED SUGAR CANE: J M Lopez and A Wilson, CIEG, Chetumal, Q R, Mexico

4 Zebu bulls of 236 kg live weight fitted with rumen cannulas were used to study two levels of sodium bicarbonate and two levels of rice polishings according to a 2 x 2 factorial design within a 4 x 4 latin square. The basal diet was chopped whole sugar cane supplemented with urea according to the sugar content (Brix) of the cane (6 g urea/100 g sugars). The treatments were: (A) control; (B) rice polishings at 500 g/d; (C) 2 litres /d of 5% (W/V) solution of sodium bicarbonate, (D) sodium bicarbonate plus rice polishings. Each experimental period was 15 days, samples of rumen fluid being taken on days 12 and 14, followed by an infusion with PEG on day 15 with subsequent sampling over a 24 hr period. In general, there was little effect of dietary treatment on the pattern of rumen fermentation. Mean values, with and without sodium bicarbonate 3 hr after feeding were: molar % VFA, C<sub>2</sub> 70.6 and 71.5; C<sub>3</sub> 21.8 and 22; C<sub>4</sub> 6.9 and 6.0; C<sub>5</sub> .65 and .5 total VFA (m-equiv/litre) were 133 and 145; pH 6.36 and 6.03 and protozoal biomass (PCV as percent of rumen fluid) .36 for both treatments. There were no differences due to level of rice polishings. There were significant differences in rumen flow rate (litres/d) with values of 42 and 28 for treatments with and without rice polishings but no differences with and without sodium bicarbonate (33 vs 37). For the treatments A, B, C and D respectively, turnover rates (per day) the rumen were 1.54 2.66 1.54 and 1.63 . Transit time (hr) 15.8 9.1, 15.6 and 15.4 and rumen fluid volume (litres) 15.5 19.3 21.5 and 20.6.

#### 38 EFFECT OF UREA LEVEL ON RUMEN FERMENTATION, BLOOD METABOLITES AND MILK COMPOSITION IN COWS FED SUGAR CANE: E Aranda CSAT, Cardenas, Tabasco, Mexico

18 Holstein cows of 435 kg live weight in their second lactation, 70 days after calving, were allocated to three treatments in groups . (A) 70 g/d urea in a solution of molasses; (B) 140 g/d of urea; (C) 210 g/d of urea. The basal diet was chopped sugar cane ad libitum and 3 kg/d of a 22% protein concentrate. Salt, minerals and water were freely available. The animals were housed throughout the experiment, which lasted 45 days. Samples of milk were taken during the last 7 days of the experiment and rumen samples on the last day before and 6 hr after feeding. Blood samples were taken at intervals of 3 hr on the last day. Milk fat was higher on the 70 g/d urea treatment (6.1%) compared with the others (4.6 and 5.7); however milk production was related linearly with urea level (6.4, 6.7 and 7.1 kg/d). Molar C<sub>3</sub> was low in all treatments (10.3, 14.6 and 11.5%) while molar C<sub>5</sub> increased with urea level(.96 1.33 3.0; P <.001). Rumen ammonia showed the same relationship (68, 126 and 153 mg/100 ml). The effect on blood glucose appear to be quadratic (50, 61, and 55 mg/100ml.).

#### 39 EFFECT OF BLOOD MEAL AND RICE POLISHINGS ON VOLUNTARY INTAKE DIGESTIBILITY AND N BALANCE IN CATTLE FED MOLASSES/UREA AND RESTRICTED FORAGE: Alderete, CSAT, Cardenas, Tabasco, Mexico

4 bulls of mean live weight 184 kg were allocated at random to the following treatments: 500 g/d of blood meal; 375 g/d blood meal and 250 g/d rice polishings; 250 g/d blood meal and 500 and rice polishings; 125 g/d blood meal and 750 g/d blood meal; 1000 g/d rice polishings. Star grass was fed twice daily 0800 and 1200 hr at the daily rate of 10 kg/d. The rest of the day the cattle had free access to molasses containing 2.5% urea and were given the appropriate supplement. The experimental periods were 14 days of adaptation and 7 days for collection of faeces and urine. Total intake of DM increased when blood meal was substituted by rice polishings (5.1, 5.7, 6.1, 6.3 and 6.4 kg/d; P <.01); there was a similar tendency for retention of nitrogen (42.8, 48.9, 44.2, 48.9 and 59.2 P <.01) due to reduced losses of N in urine (28.5, 24.2, 19.6, 17.2 and 13.9; P <.01).

## 40 KETOSIS OR MOLASSES TOXICITY: H Losada, CSAT, Tabasco, Mexico

6 F1 Holstein/Zebu bulls of 312 kg live weight were divided in two groups of three for the following treatments. (A) molasses with 2% urea at libitum, 500 g/d of fish meal and restricted forage (1.5 kg/100 kg LW) and minerals; (B) fresh forage of elephant grass ad libitum plus minerals. Two animals were selected at random in each group and received increasing amounts of adrenalin (from 1 to 21 mg/d) during a period of 15 days. Blood samples were taken 3 times daily before giving the adrenalin intramuscularly. Glucose in plasma was higher for the animals fed molasses compared with those given forage. Adrenalin increased the values on both diets. One animal on the molasses treatment showed classic symptoms of toxicity with necrosis in the brain, 5 days after stopping administration of adrenalin. The values for glucose in plasma and ketone bodies at the moment of intoxication were 30 mg/100 ml and 123 mg/100 ml respectively.

## 41 EFFECT OF SUPPLEMENTATION ON RUMEN FERMENTATION, BLOOD METABOLITES AND MILK COMPOSITION IN CATTLE FED SUGAR CANE: H Losada, CSAT, Cardenas, Tabasco, Mexico

21 Holstein cows of 455 kg live weight in their second and third lactation, 70 days after calving, were divided in groups of 7 according to the following treatments: 2 kg/d of a 22% protein concentrate; 3 kg/d of concentrate; 4 kg/d of concentrates. All the animals received chopped sugar cane at libitum and 1 kg/d of molasses containing 21% urea. Minerals and water were freely available. The cattle were housed during the experiment which lasted 45 days. Milk samples were taken during the last 7 days, rumen fluid 1 hr and after feeding on the last day and blood samples at 3 hr intervals on the last day. Milk production increased with level of supplement (7.7, 8.7 and 9.5,  $P < .001$ ) with no differences in milk fat percent (4.2, 4.1 and 3.9). Molar  $C_2$  was in the range 69 to 74 and  $C_3$  14 to 15. Rumen ammonia was 51, 57 and 45 mg/100 ml. There were no differences in glucose or urea levels in blood