RICE POLISHINGS AS A SUPPLEMENT IN SUGAR CANE DIETS: EFFECT OF LEVEL OF RICE POLISHINGS IN WET AND DRY SEASON CONDITIONS

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Fifty Zebu bulls of approximately 290 kg and two years were used in a completely randomized design to determine the response in animal performance to increasing levels of rice polishings. The levels were 400, 600, 800, 1000 and 1200 g/day supplied as a supplement to the basic diet of chopped sugar cane and molasses/urea (100 g urea/kg). The experimental animals were allowed free access to both these feeds, and to minerals and water. Linear and quadratic regression analyses were carried out to define some of the functional relationships involved. The most important of these were between rice polishings (X = g/day) and daily gain (Y = g/day) Y = 202.8 +.73X;r^2 =.98) and between total dry matter intake (X=kg/d) and daily gain (Y = kg/d) (Y = -1.82 +.34X; r^2 =.99).

Key words: Sugar cane, cattle, rice polishings, season

Previous work with diets based on sugar cane and urea have shown a marked response to the inclusion of rice polishings as a supplement. In an experiment carried out in this centre during the dry season of 1974 (Preston et al 1976), using 400 animals, growth rates of up to 900 g/day were observed at the highest level of supplementation with rice polishings.

The purpose of this experiment was to quantify this relationship and in particular to examine the response to various levels of rice polishings in the rainy season, The animals were also allowed free access to a solution of molasses/urea. The level of urea included in the molasses was 10% which according to the results of Ferreiro and Preston (1976), gave optimal performance.

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Materials and Methods

The experiment was carried out in the rainy season in the humid tropics. 50 Zebu males were selected with a mean weight of 290 kg and a mean age of 2 years. The animals were allocated at random to open corrals 14 m x 8 m with a palm roof with a concrete floor covering the area adjacent to the trough, the remaining floor area being earth. The experimental treatments used were 400, 600, 800, 1,000 and 1,200 g/day of rice polishings per animal. The experiment was carried out over a period of 112 days.

The whole sugar cane was chopped into particles (size range 0.2 to 2 cm) and fed twice per day, preceded by the rice poll strings. The animals had free access to a solution of molasses with urea included at 100 g per kg. The animals had access to a mixture of minerals (50% common salt, 47% rock phosphate and 3% trace minerals), as well as to clean water supply.

Live weights (before the morning feed) were recorded daily every 14 days and consumption of cane and molasses/urea daily.

Results and Discussion

Mean values for animal performance and feed intake are shown in table 1. Growth rate, feed consumption and conversion all show a marked improvement with increasing level of rice polishings. Highly significant linear regressions were observed between growth rate and rice polishings and conversion and rice polishings (figures 1 and 2) The relationship between growth rate and level of rice polishings showed no evidence of a diminishing response at the levels employed The calculated F value for a quadratic term in this regression was highly insignificant (F = 0.25) suggesting that the biologically optimum level of response to the rice polishings had not been approached.

The quadratic term in the regression of feed conversion on level of rice polishings was also not significant, although examination of the data does suggest that at the highest level of rice polishings, there is little potential for further improvement in feed conversion ratio. It would seem reasonable to conclude that further work is necessary to define better the asymptopic response in this area both in terms of improving feed conversion ratio and daily live weight gain.

Table 1:
Mean values for animal performance with various levels of rice polishings in a cane based diet (one group of 10 animal peer treatment for 112 days)

	Level of Rice Polishings, g/day				
	400	600	800	1000	1200
Live weight, kg					
Initial	289.2	283.0	292.3	290.7	290.8
Final	299.3	308.8	333.4	356.2	361.0
Daily gain	.090	.230	.366	.585	.645
Consumption, kg/d					
DM total	5.65	5.96	6.34	7.07	7.22
Fresh cane	13.35	13.64	14.16	14.91	15.02
Molasses	1.50	1.55	1.63	1.79	1.95
Urea	.187	.193	.203	.223	.243
Conversion[1]	55.94	63.37	42.06	14.82	14.21
N in DM, %	2.02	2.05	2.09	2.22	2.31
N as urea, g/kg DM	14.85	14.87	14.70	16.40	15.39
Index of consumption[2]	1.9	1.97	1.99	2.15	2.18

[1] kg DM/kg gain
[2] kg DM/100 kg LW/day

The increased efficiency of rumen function stimulated by increasing levels of rice polishings is reflected in the improved intakes of fresh cane (figure 3) and molasses/urea (figure 4). In the case of the relationship between molasses/urea intake and level of rice polishings, the quadratic term was found to be significant ($P < .05$). The consumption of molasses/urea observed at the higher levels of intake of rice polishings agrees closely with the consumption found by Ferreiro and Preston (1976). Figure 5 shows improvement in daily liveweight gain with increasing consumption of total DM. There is, again, a marked linear relationship.

It should be pointed out that the rates of liveweight gain observed in this experiment were lower than expected. The gain at an intake of 1200 g/day of rice polishings was only 645 g/day as compared with 822 g/day observed by Preston et al (1976) at the same level of intake of rice polishings. However, the

latter experiment was carried out during the early part of the dry season, whereas the last 456 days of this trial occurred during the wet season, when the animals were subjected to considerable environmental stress. The effects of the rainy season on animal performance are well documented by Alvarez et al (1976) and Ferreiro and Preston (1976).Figures 6 and 7 show the contrasting response of liveweight gain to increasing levels of rice polishings and total dry matter intake in this experiment and that of Preston et al (1976). The regression lines for the two experiments are parallel and emphasize the possibility of widely differing responses in terms of animal performance to the same supplement inputs. Since no parameters of cane quality are available from the first piece of work it is not possible to assign the responsibility for the reduced level of performance in this experiment to that variable. However, the evidence presented in figure 8 does suggest that the quality of the cane used in the present experiment did fall quite considerably during the course of the trial. Since this fall in ° Brix (soluble solids) was accompanied by a reduction in animal performance this does suggest the necessity of further study in this area and, perhaps, a better analytical definition of cane quality.

Figure 1:
Relation between daily live liveweight gain and intake of rice polishings

Figure 2:
Relation between feed conversion and intake of rice polishings

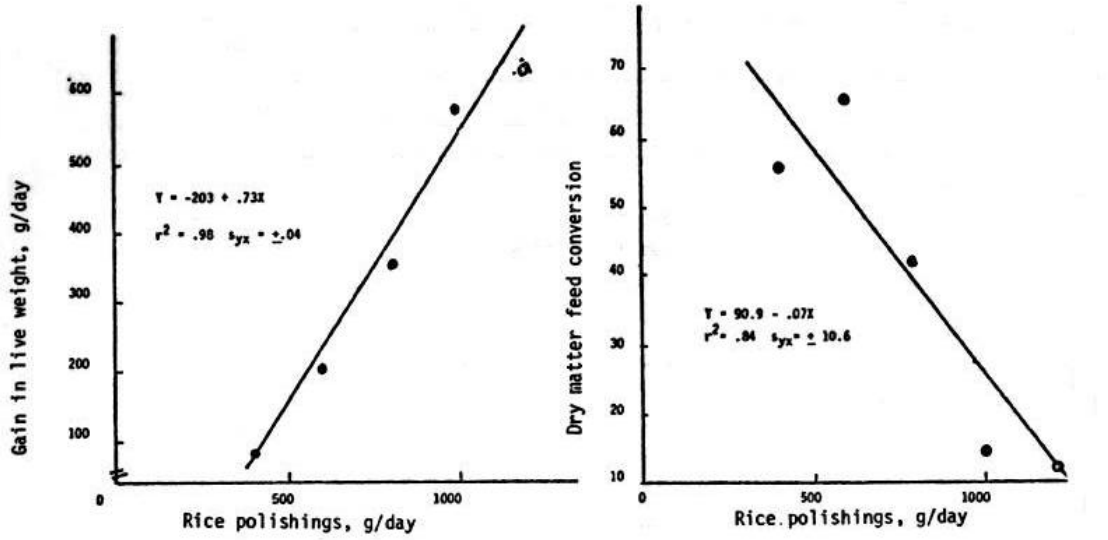


Figure 3:
Relation between intake of fresh cane and intake of rice polishings

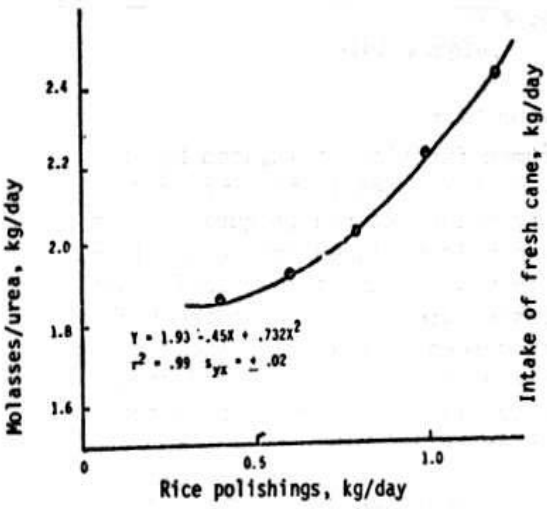


Figure 4:
Relation between intake of molasses/urea and rice polishings

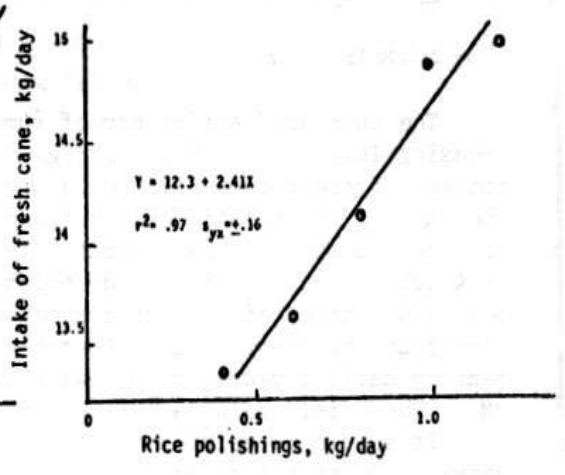


Figure 5:
Relation between daily live weight gain and total intake of dry matter

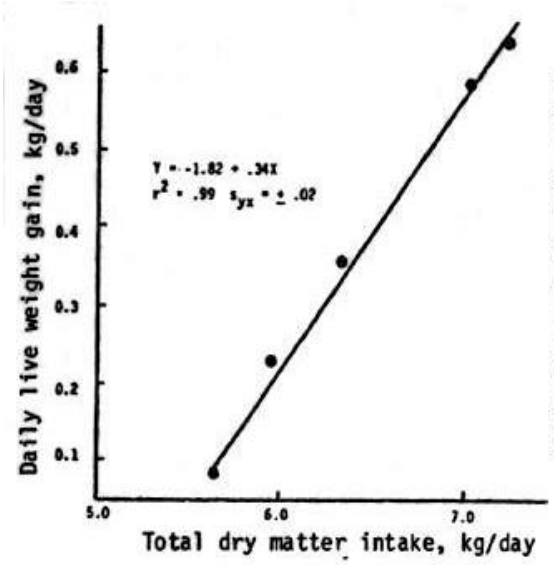


Figure 6:
Relation between gain in five live weight and intake of rice polishings, comparing the results of Preston et al and those obtained in the dry season of the present experiment

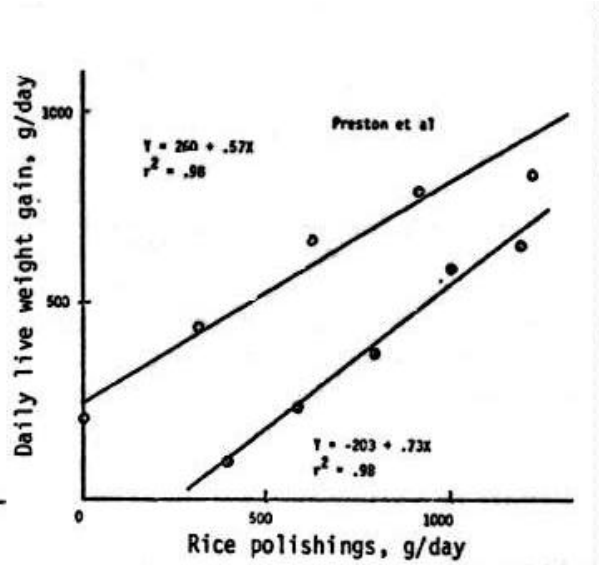


Figure 7:
Relation between gain in live weight and total intake of dry matter, comparing results of this experiment and those of Preston et al

Figure 8 :
Brix values in cane juice during the course of the experiment

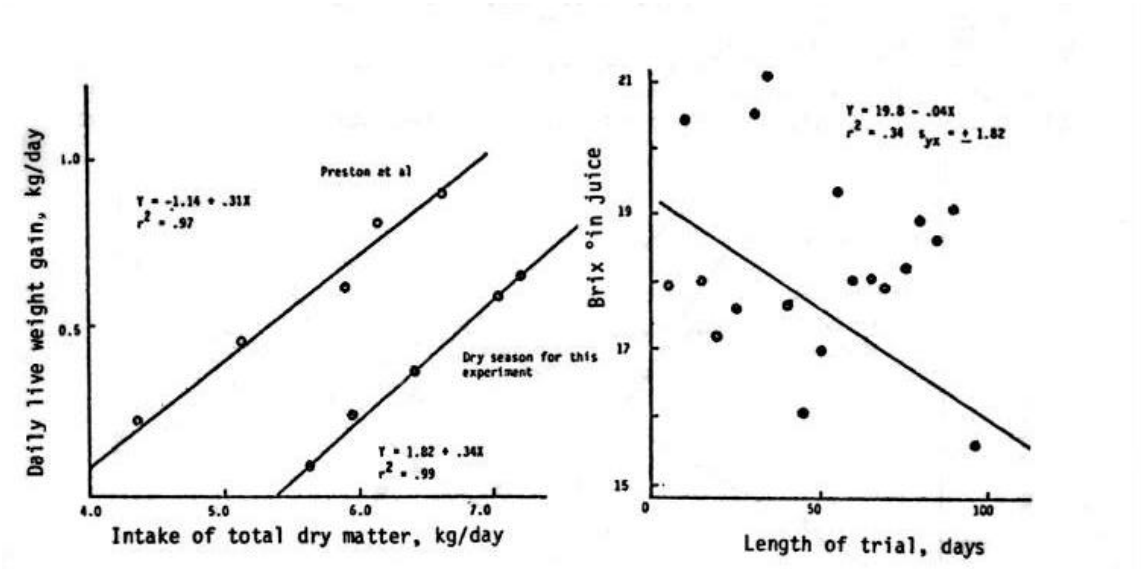
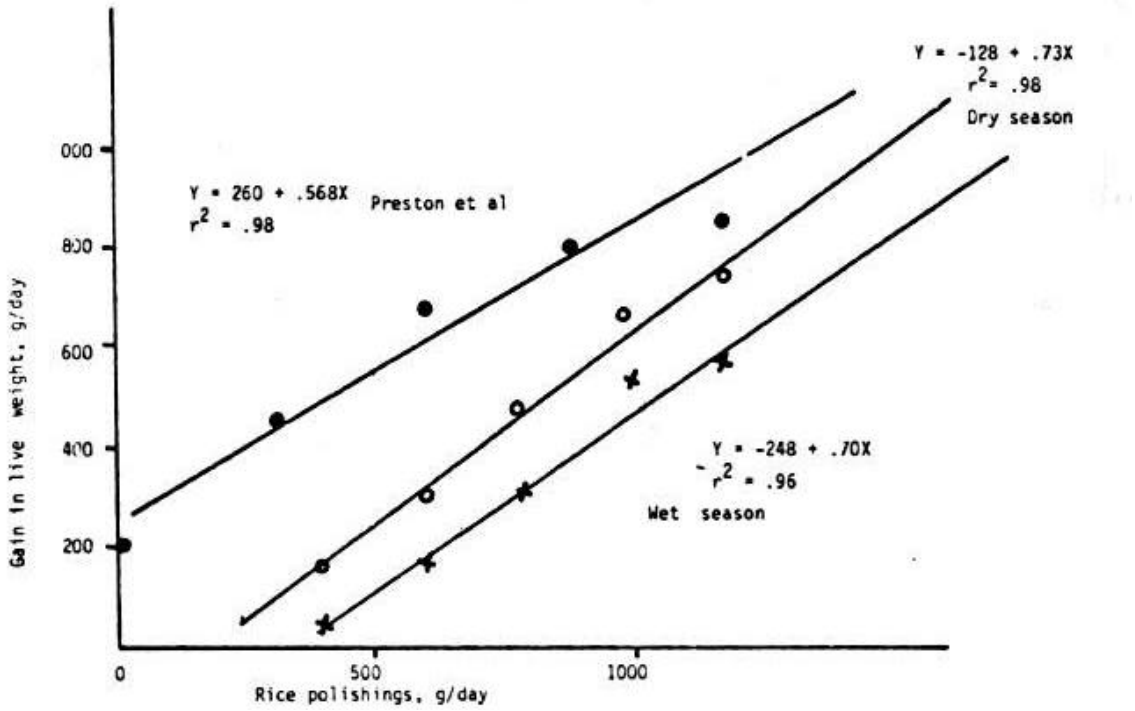


Figure 9 shows the response of growth rate to increase in level of rice polishings during the dry and wet periods of this experiment separately, compared again with the data of Preston et al (1976). In figure 10, liveweight gain is plotted against digestible dry matter intake for this experiment divided into the same two periods of growth in this experiment and compared with the data of Preston et al (1976). There is a very clear increase in the requirement for digestible dry matter at maintenance in the present experiment compared with that of Preston et al (1976). Translated into energy terms the intercepts of the X axis gives maintenance values of 0.137 Mcal/kgW.73 for the experiment of Preston et al (1976),0.208 Mcal/kg $W^{0.73}$ for the dry season period of this experiment and 0.193 Mcal/kg $W^{0.73}$ for the wet season period. The experiment of Preston et al (1976) was conducted during the dry period at the beginning of the year 1974 and was probably associated with near minimal environmental stress. The present experiment was conducted during the summer months of June to October 1975 in conditions of high ambient temperature and relative humidity. Maintenance energy as a function of temperature is minimal at about 20° for temperate climate cattle (McDowell 1972). This minimum is of course likely to be appreciably higher for Zebu and crossbred animals which show stress symptoms at some 8° higher than European breeds and retain their thermoregulatory mechanisms functional up to about 35° (Williamson and Payne 1959).

Figure 9
Relation between gain in liveweight and intake of rice polishings comparing wet and dry season results for this experiment with those of Preston et al

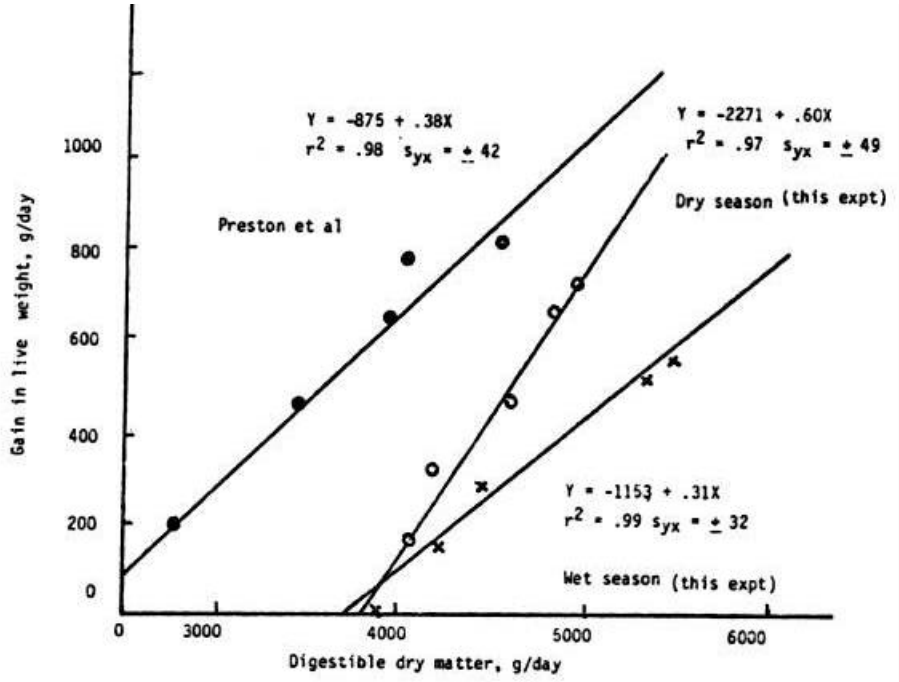


Thermal stress is of course highly dependent on humidity. Between this experiment and the former both temperature and humidity were higher, the experiment of Preston et al was carried out during a period when the temperature ranged from 8.0 to 38.1° while the present trial had temperatures ranging from 16 to 38°. No figures were available for relative humidities during these periods, but it is obvious that relative humidity during the wet season would be considerably higher than during the dry season.

The requirement for growth (digested dry matter/weight gain) as evidenced by the inverse slope of figure 10 showed little difference between the former experiment (10.5 kg DM/$W^{0.73}$) and the wet period of this experiment (12.9 kg DM/$W^{0.73}$) but was appreciably lower in the dry period (6.6 kg DM/$W^{0.73}$).

It is generally considered that the poorer performance and conversion under conditions of hot climate stress (McDowell 1972; Payne and Williamson 1959) are due to reduced feed intake. The comparisons shown in figure 10 suggest that maintenance energy requirement and energy requirement for growth under conditions of high temperature and humidity merit further investigation.

Figure 10:
Relation between gain in live weight and intake of digestible dry matter in the experiment of Preston et at and in the dry and wet season of the present experiment



Conclusions

It is suggested that the poorer performance of the cattle on cane diets observed during the wet season (Ferreiro and Preston 1976; Alvarez et al 1976) is due to a combination of poorer nutritional quality of the cane (Preston et al 1976) and an increase in maintenance requirement due to environmental stress. At low rates of gain the response to rice polishings supplementation seems reasonably constant with a slope of 0.7 kg gain per kg of rice polishings.

References

Alvarez F J, Wilson A, Sutherland T M and Preston T R 1976 Studies in urea utilization in sugar cane diets: effect of different methods of incorporating urea in the ration Trop Anim Prod:

Ferreiro H M and Preston T R 1976 Effect of different concentrations of urea in final molasses given as a supplement to chopped sugar cane for fattening cattle Trop Anim Prod 1:66-73.

McDowell R F1972 Improvement of Livestock Production in Warm Climates Freeman: San Francisco

Preston T R, Carcaño C, Alvarez F J and Gutierrez D G, 1976 Rice polishings as a supplement in a sugar cane diet: effect of level of rice polishings and of processing the sugar cane by derinding or chopping Trop Anim Prod 1:150-161

Williamson G and Payne W J A 1959 An introduction to animal production in the Tropics Longman:London

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