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THE USE OF TREATED STRAWS IN DIETS FOR GROWING RABBITS

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Introduction

Several studies have shown that the rabbit generally utilizes dietary fibre poorly (e.g. Schurg et al., 1977; Uden and Van Soest, 1982). Some reports have shown that chemical treatment of fibre sources may increase their utilization by rabbits. De Blas et al. (1979) noted that rations which contained sodium hydroxide-treated straw promoted small increases in growth rate and decreased food conversion ratios when treated straw replaced alfalfa hay in pelleted rations. Both Lebas et al. (1979) and Lindeman et al. (1982) found that sodium residues in alkali treated straw were not detrimental to the growth of rabbits although water consumption increased when caustic treated straw was fed (Eggum et al., 1982).

The present experiment set out to investigate the effects of incorporating either caustic soda or ammonia treated barley straw in diets for growing rabbits. Ammonia treatment of straw has been gaining popularity in recent years as a relatively safe method of increasing the nutritive value of straw in ruminant diets (Sundstøl et al., 1978).

Material and Methods

Rabbits

Crossbred male and female rabbits were used, New Zealand White sire x (New Zealand White x Californian) dam. They were maintained on a standard diet until they weighed around 750 g (4-5 weeks of age). Over the next 2 days the test diet gradually replaced the standard diet and on the 3rd day they were weighed again and then offered their test diet to appetite for the duration of the experiment.

Diets

There were ten experimental diets (Table 1). The basal mix (A) contained sufficient good quality protein such that even after maximum dilution with straw and assuming no increase in food consumption, the daily crude protein intake would be sufficient for the growing animal. All diets were pelleted through a 4.7 mm die.

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Treated Straws

Ammonia treated Bales of barley straw were treated with anhydrous ammonia in a commercial oven at 80°C.

Caustic soda (NaOH) treated Thirty-two litres of water were added to 90 kg of ground barley straw (3 mm screen) in a horizontal mixer. Dry sodium hydroxide prills (6.12 kg) were then added carefully to the mix. After 15 minutes the straw had reached an even golden colour suitable for incorporation in the diets.

Digestibility trials

Each diet was fed to four rabbits housed in the metabolism cages described by Spreadbury (1978). After a preliminary period of 7-10 days all rabbits were offered 70 g/d of air dry diet for a one week collection period.

Analytical methods

The procedures used have been described elsewhere (Spreadbury, 1978; Spreadbury and Davidson, 1978).

Experimental procedure

Rabbits on the growth trial were caged individually and fed from 750-850 g starting weight up to 2 kg body weight. There were eight animals in each diet group and if any rabbits died during the first two weeks of the trial they were replaced.

Results and Discussion

The results of the growth trial are summarized in Table 3. A preliminary analysis of the data showed no significant difference between the sexes in any of the parameters measured. Mortality rates of growers in the present trial were unusually high at 26% overall and were unaffected by dietary treatment. Most losses were attributable to enteritis with subsequent scouring and rapid death. Pre-experimental treatment of weaners with antibiotic in the drinking water reduced, but did not eliminate this problem.

As the proportion of the straw in the diet increased there was an overall depression in the growth rate. There was some evidence that at high inclusion levels of straw (450 g/kg) both ammonia and caustic treatment promoted higher daily gains than untreated straw (35.6 and 35.2 cf 31.2 g/d for diets G, K and D respectively). The food conversion efficiency (FCE) of rabbits given these treated straw diets was also higher than those given untreated straw diet. At lower levels of straw inclusion these differences were not detectable. The animals' performance on diet J (caustic treated straw, 300 g/kg) did not follow the general trend of the other diets and both FCE and growth rate were unexpectedly low. The reasons for this were unclear, although the nitrogen and ash contents of this diet (Table 2) were slightly lower and higher respectively than calculated. There was a suggestion from the results that inclusions of 150 g/kg straw promoted higher growth rates than the basal diet alone (diet A cf diets B, E and H), although the differences were not significant. Measurements of killing out percentage were not made in the present study but it is possible that a

portion of this increased weight gain was attributable to an increase in the gut fill on the high fibre diets, an effect noted by Spreadbury and Davidson (1978).

The rabbits responded to increases in straw concentration by increasing their voluntary food intake, dry matter intakes on diets A to K being 92, 106, 109, 132, 104, 120, 132, 109, 112 and 114 g/d respectively.

The digestibility data was analysed by regression analysis, to compare the three types of straw. Table 4 contains a summary of these results. Untreated straw depressed the digestibility of DM, OM and energy more than both treated straws but the differences were small. Apparent nitrogen digestibility was, however, depressed to a much greater extent in diets containing caustic treated straw. A similar effect has been noted in the ruminant (Ørskov, 1979). There are two possible explanations for this effect. Firstly that the caecal bacteria are able to adhere to the caustic treated straw more easily and that they are consequently being lost in the hard faeces, so reducing the apparent digestibility of protein. Alternatively the high caustic soda levels could be affecting gastric pH sufficient to reduce pepsin activity and thereby reduce proteolysis. Further studies would have to be done to elucidate these points.

The small improvements in growth rate and digestibility reported by De Blas et al. (1979) and Lindeman et al. (1982) were both confounded with simultaneous changes in other dietary ingredients, making interpretation and comparison with the present study more difficult. De Blas et al. (1979) used a maximum inclusion rate of 150 g/kg sodium hydroxide-treated straw and our results would suggest that at this level of inclusion treating barley straw with either ammonia or caustic soda would not be cost effective in rations designed for growing stock. A similar conclusion was reached by Jensen (1979) in his experiments using alkali treated straw at 10% in rabbit rations. It would appear, however, that the growing rabbit does have a requirement for non-digestible cellulose in the diet to reduce the risk of enteric disease (Lebas, 1975; Cheeke and Patton, 1980) and ground barley straw at 10-15% in the diet should meet all or a large proportion of that need.

Table 1 Diet composition (g/kg)

	A	B	C	D	E	F	G	H	J	K
Basal mix*	900	750	600	450	750	600	450	750	600	450
Untreated barley straw	–	150	300	450	–	–	–	–	–	–
Ammonia treated barley straw	–	–	–	–	150	300	450	–	–	–
Caustic treated barley straw	–	–	–	–	–	–	–	150	300	450
Vitamin mix	25	25	25	25	25	25	25	25	25	25
Mineral mix	50	50	50	50	50	50	50	50	50	50
Sucrose	25	25	25	25	25	25	25	25	25	25
Coccidiostat≠	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

* Contains (g/kg): ground barley 390; white fish meal 280; soyabean meal 220; grassmeal 110.

≠ Cycostat 66R robenidine

Table 2 Diet analysis (g/kg DM)

	A	B	C	D	E	F	G	H	J	K
Crude protein (N x 6.25)	308	261	215	180	266	239	204	260	177	168
Ash	126	114	105	91	110	101	97	126	144	134
Crude fat	39	37	33	30	37	36	14	37	22	29
Acid detergent fibre	99	162	263	357	163	270	321	162	279	354
Gross energy (MJ/kg DM)	18.3	18.5	18.1	18.2	18.7	18.2	19.1	19.4	18.4	18.4

Table 3 Results of growth trials

	Basal	Untreated			Ammonia treated			Caustic treated			
Diet ...	A	B	C	D	E	F	G	H	J	K	sed
Straw inclusion rate (g/kg)	–	150	300	450	150	300	450	150	300	450	–
Growth rate (g/d)	38.3	42.7	37.0	31.2	42.0	41.5	35.6	41.2	33.5	35.2	2.46
Total dry matter intake (kg)	3.03	3.18	3.70	5.27	3.21	3.71	4.34	3.37	4.27	3.86	0.036
Days of growth (0.8-2.0 kg)	33	30	34	40	31	31	33	31	38	34	2.2
Dry matter food conversion efficiency	0.41	0.39	0.33	0.23	0.39	0.34	0.27	0.38	0.29	0.31	0.019
No. of rabbits completing trial	7	8	7	7	7	7	8	7	7	8	–

Table 4 The percentage decrease in digestibility of the basal diet per 1% inclusion of straw over the range 0-45% inclusion

	Type of straw			
Basal diet digestibility	Untreated	Ammonia treated	Caustic treated	sed
Dry matter				
0.68	1.03	0.87	0.90	0.091
Organic matter				
0.73	1.11	0.95	1.05	0.088
Nitrogen				
0.81	0.19	0.27	0.55	0.060
Energy				
0.74	0.90	0.86	0.88	0.112

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Summary

Young growing rabbits (0.8 to 2.0 kg) were offered diets containing different levels of either untreated, ammonia treated or caustic soda treated barley straw. The inclusion levels of barley straw were 0, 150, 300 and 450 g/kg, the remainder of the diets consisting of a high protein basal mix, sucrose, vitamins and minerals. Increasing levels of straw depressed growth rate, particularly at the highest inclusion rate (450 g/kg). At this level there was a suggestion that the treated barley straw diets were promoting slightly higher growth rates and food conversion efficiencies than the untreated straw diet. Digestibility studies revealed that all straw types remained virtually undigested by the rabbits and that caustic soda treated straw at 450 g/kg in the diet significantly reduced the apparent digestibility of dietary protein. It is suggested that at normal inclusion levels (say 100-150 g/kg in the diet) any small improvements in growth performance achieved are unlikely to warrant the increased cost of straw treatment.

Resume

Des lapins (0.8 à 2.0 kg) en croissance ont reçu un régime constitué par du melange forte en protéine, de la sucrose, des vitamines, des minéraux et de la paille d'orge (0, 150, 300 et 450 g/kg) telle quelle ou après traitement par la soude ou par l'ammoniac. Le taux de croissance a diminué quand on a augmenté la quantité de paille, surtout avec 450 g/kg. A ce niveau il semblait que les pailles traitées augmentasse le taux de croissance et l'utilisation du fourrage un peu forte que la paille telle quelle. Dans des études de digestibilité on a montré que les pailles ont été indigeste par les lapins, et que la paille traitée par la soude à 450 g/kg ont causé une diminution en la digestibilité apparente. On suggère que les amelioratıons petites de la croissance avec les niveaux practiques (10-15% du régime) sont peu probable à justifier le coût augmenté du traitement de la paille.