

Short Communications

Nitrogen retention of Angora goats receiving alkali-ionophore-treated whole maize containing various levels of urea

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Received 28 February 1984

A nitrogen-balance study was carried out to investigate the utilization of various levels of urea (0–4%) absorbed by alkali-ionophore-treated whole maize when fed to Angora goats receiving a protein-deficient roughage diet. Nitrogen retention was increased significantly ($P < 0,05$) only in the experimental groups receiving 3% and 4% urea in the grain component of the diet.

'n Stikstofbalansstudie is gedoen om die benutting van verskillende peile van ureum (0–4%) wat in alkali-ionofoor-behandelde mielies geabsorbeer is en aan Angorabokke op 'n lae proteïen-ruvoerrantsoen gevoer is, te ondersoek. Stikstofretensie is betekenisvol ($P < 0,05$) verhoog, slegs in die proefgroepe wat 3% en 4% ureum in die graankomponent van die rantsoen ontvang het.

Keywords: Angora goats, nitrogen retention, whole maize, urea

Alkali-ionophore-treated whole maize was initially developed for the purpose of feeding grain on an *ad lib.* basis, without causing digestive disorders, to cold-stressed Angora goats (Wentzel, 1982). Since then, maize treated in this way, has found widespread application in practice as an efficient method of energy supplementation.

During droughts and in certain grassveld areas, supplementation of protein in addition to energy, appears to be essential, especially in the case of growing and lactating goats with a high protein requirement. Marginal protein deficiencies are

usually corrected by the inclusion of non-protein nitrogen (NPN) in supplements with urea being conventionally used for this purpose.

The efficiency of NPN utilization by ruminants has been the object of several investigations. According to these results, NPN is utilized more efficiently in the presence of adequate amounts of carbohydrates (McDonald, Edwards & Greenhalgh, 1973; Morrison, 1950 and Van der Merwe, 1970) and by a slower and more uniform rate of ammonia-N release into the ruminal fluid (Owens, Lusby, Mizwicki & Forero, 1980) which will also reduce the susceptibility of animals to NH_3 poisoning. Preliminary trials have shown that the *in vitro* NH_3 production rate of urea absorbed by whole maize was considerably less than that of maize meal containing an equal amount of urea (Gevers, 1983 — unpublished data). In this respect, favourable results have been obtained with the inclusion of a relatively high level of urea in alkali-ionophore-treated whole maize fed to lactating ewes grazing protein-deficient pastures (Lyle, 1983).

Improved utilization of NPN is made possible when feeding alkali-ionophore-treated whole maize because both dietary energy and a slow release rate of the absorbed urea is provided. This experiment was therefore undertaken to establish the effect of the level of urea inclusion in this treated maize on N retention in Angora goats receiving a protein-deficient roughage.

Twenty Angora goat wethers were allocated at random to five groups and daily received a basal diet consisting of 392 g oat straw and 44 g cane-molasses meal. In addition, experimental animals received 500 g alkali-ionophore-treated whole maize. The average composition of the basal diet is summarized in Table 1. Treated whole maize fed to Groups 1, 2, 3, 4, and 5 contained 0, 1, 2, 3, and 4% urea respectively. Alkali-ionophore-treated whole maize was prepared by wetting the maize with 7% water (v/w) in which the various amounts of urea had been dissolved. Subsequently 10% molasses meal (w/w), 2% $\text{Ca}(\text{OH})_2$ (w/w), and 20 mg/kg lasalocid were pre-mixed and added to the whole maize. After mixing

Table 1 Average composition of the basal diet used

Component	Feed offered (g/day)	N content (%)	Moisture (%)	Crude fibre (%)
Roughage	436	1,19	5,1	30,5
Alkali-ionophore-treated whole maize	500	1,56	11,5	2,1
Total composition	936	1,39	8,5	15,4

Table 2 Nitrogen metabolism data from Angora goats receiving various levels of urea supplementation

Measurement	Level of urea inclusion (%)				
	0	1	2	3	4
Daily feed intake					
Oat straw (g/day)	325 ± 110	327 ± 115	324 ± 135	344 ± 67	288 ± 71
Treated maize (g/day)	500 ± 0	500 ± 0	499 ± 1	476 ± 48	480 ± 9
Total N intake (g/day)	11,6 ^a ± 1,4	14,2 ^{ab} ± 1,6	15,7 ^{bc} ± 1,9	17,8 ^{cd} ± 2,1	18,5 ^d ± 1,3
Total faecal-N excreted (g/day)	11,1 ± 2,0	10,0 ± 1,1	11,1 ± 2,3	9,4 ± 1,9	9,4 ± 1,1
Total urinary-N excreted (g/day)	3,4 ^a ± 1,5	4,6 ^a ± 1,8	4,8 ^a ± 1,5	7,6 ^{ab} ± 3,2	9,2 ^b ± 1,1
N retention (g/day)	-2,9 ^a ± 2,0	-0,6 ^{ab} ± 1,5	-0,3 ^{ab} ± 1,3	0,8 ^b ± 0,9	0,0 ^b ± 1,0
Calculated utilization of added NPN (%)	—	97,3	64,6	59,5	41,4

a, b, c, d Means within the same line bearing different superscript letters differ significantly ($P < 0,05$)

thoroughly, the treated maize was stored in airtight containers until required.

Experimental animals were allowed to adapt to the various diets for 7 days in individual pens and 7 days in metabolism crates, followed by a collection period of 7 days. Standard procedures for determining the N balance of all experimental animals were followed (AOAC, 1960).

From the results presented in Table 2, it is apparent that the average N intake increased progressively with increases in the level of urea inclusion. However, the inclusion of 3% and more urea in treated maize reduced its intake slightly. N retention was increased significantly ($P < 0,05$) in Groups 4 (3% urea) and 5 (4% urea) although the group receiving 3% urea in the treated maize was the only one with a positive N balance.

According to these preliminary results it can be concluded that when Angora goats receive a basal protein-deficient roughage diet supplemented with alkali-ionophore-treated whole maize, the inclusion of up to 3% urea in the maize, could be beneficial. Further investigation of this means of supplementation to ascertain the response in production of Angora goats grazing protein-deficient pastures, seems to be warranted.

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