SESSION 36

Evaluating rations for high producing dairy cows using three metabolic models

N. Swanepoel*[,1,2], P.H. Robinson[1], L.J. Erasmus[2]

[1]UCCE, University of California, Davis, CA [2]University of Pretoria, South Africa

E-mail: *nanswanepoel@gmail.com*

Introduction

Maize proteins have an AA profile that is believed to be poorly matched to milk protein produced by dairy cows, primarily due to its low lysine content.

Expansion of the ethanol distillation industry has increased the use of maize based feedstuffs in dairy rations, raising concerns that higher CP levels in the ration, in order to meet animal requirements for limiting AA, might lead to increased excretion of N in urine and faeces.

Improving efficiency of dietary N capture in milk (often considered low at 25-35% in lactating cows) by increasing the utilization of intestinally absorbed AA through supplementation of AA in a ruminally protected form, is of worldwide interest.

Studies have suggested lysine to be the most limiting AA for milk production, but results from previous studies, during which lysine was supplemented, are inconsistent and a study we conducted using a ruminally protected lysine showed a substantial negative response (Swanepoel et al. 2009), raising the question of whether lysine is indeed limiting in contemporary dairy rations

During this study the nutrient profiles of TMR samples from 'high groups' on 16 California dairy farms were evaluated using the metabolic models Amino Cow (2007), CPM Dairy (2006) and Shield (Robinson, 2009) in order to:

1. Predict AA profiles of intestinally delivered protein,
2. Identify potentially limiting AA, and
3. Determine if the nutrient profiles of these rations were consistent enough to produce a RPAA package to provide cows with their 'ideal' intestinally delivered AA profile as predicted by each model, since research suggests that animals may respond better to supplementation of multiple AA together, rather than a single limiting AA.

Materials and Method

The 16 dairies chosen for this study were judged to be representative of dairy farms in Tulare and Kings county areas of California and all milked more than 1000 cows.

➢Visits to each farm were scheduled in conjunction with their regular Dairy Herd Improvement Association (DHIA) milk test.

➢TMR preparation was observed before TMR samples were collected from the bunks as feed was being fed at the specified pens. Commodity feeds, mixed into the TMR, were identified, sampled and sent with TMR samples for chemical analysis.

➢Herd records (Dairy Comp 305), with milk production and composition data from the most recent milk test (i.e., milk yield, protein and fat proportions, SCC, DIM and lactation numbers), was downloaded prior to the start of the project, and again after the DHIA milk test.

➢Depending on the method used to monitor mixing and feeding, feed delivery records were collected for at least 5 days prior to the milk test from computerized programs or mixing sheets provided by the dairies.

Conclusions

➢There appears to be a high degree of consistency within model in the predict limiting AA sequence among dairies.

➢Results suggest that there is sufficient consistency in the nutrient profiles among rations to support creating a RPAA complex to supplement California dairies.

BUT

➢The metabolic models suggested three dramatically different AA packages.

➢There appears to be no good way to decide on which model is most correct without further research on animal responses to the model predicted AA packages.

General farm and production information on the 16 dairies

Farm number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Total lactating cows	1000	1143	3000	1192	1809	2772	824	5000	1200	2648	2200	4100	5000	932	4400	1378
Cows in high group pen*	149	123	170	190	189	145	265	408	158	513	191	264	364	223	587	167
Milk yield (kg/d)	32.8	37.9	40.3	40.9	41.2	41.4	41.7	42.8	43.3	45.2	45.4	46.6	46.7	47.7	48.5	51.3
True Prot %	3.23	2.91	2.77	2.88	2.93	2.87	3.13	2.81	3.00	2.72	2.84	2.95	2.87	2.92	3.01	2.73
Fat %	3.32	3.49	3.19	3.67	3.14	3.49	3.54	3.08	3.68	3.04	3.32	3.54	3.19	3.49	3.45	3.79
SCC (,000)	739	270	75	187	70	122	262	264	219	163	132	95	375	438	416	364
Intake (kg DM/cow//d)	24.2	21.4	26.8	24.9	28.5	22.5	28.4	26.6	25.0	27.3	26.9	27.4	24.0	26.0	30.1	29.2

Results

Ration evaluation

➢Figure 1 shows the ingredient profiles (as a % of DM) of the ration mixed for each of the 16 dairies.

➢Maize products (mainly maize grain, DDG and maize silage with maize gluten fed in two and maize earlage in one of the dairies) make up 31 to 55% of DM.

➢There was no relationship between the contribution of maize CP to the ration and milk production, and increasing the total maize inclusion level in the TMR therefore did not have any depressing effect on milk yield.

Model evaluation

➢The sequence of AA limitation among dairies was very similar within each model (Table 1), but due to the differences among models in their predicted AA limitation sequences, the calculated AA supplementation packages varied sharply by model.

➢Average AA supplementation packages were calculated to bring model estimated AA deliveries to a minimum of 120% of model estimated requirements (Figure 2).

➢Amino Cow focused on Met and Lys, CPM Dairy on Leu and Ile and Shield on Lys and Ile.

Figure 1: Ingredients most commonly used (% DM) in the 16 rations.

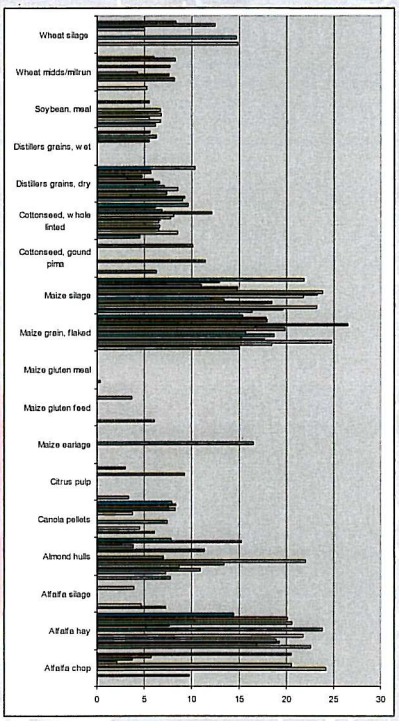

Table 1: The sequence of amino acid limitation according to 'Amino Cow', 'CPM Dairy' and 'Shield'

Farm	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Amino Cow	met	met lys his leu	met	met lys his	met lys his	met lys his leu val ile	met lys his leu	met	met lys his leu	met lys	met lys his leu	met lys his leu val ile	met lys his leu val ile	met lys his leu val ile	met lys his leu	met lys his
CPM Dairy	ile	ile leu lys met arg val		ile leu met	leu ile	ile leu met lys arg val his	ile leu lys met	ile leu	leu ile met lys arg val his	ile leu met lys	ile leu lys met arg val	ile leu met lys	ile leu lys met arg val his	ile leu met lys arg	leu ile met lys arg	ile met leu lys arg
Shield	lys his	lys ile his	ile	lys ile his	lys ile his val	lys ile his val arg	lys ile his val	lys ile his	lys ile his val	lys ile	lys ile his val	lys ile his val	lys ile his val arg thr	lys ile his val	lys ile his val	lys ile his

Only AA predicted to be supplied below 120% of requirements are listed

Figure 2: RPAA supplementation packages, supplying 120% of cow requirements, according to the metabolic models Amino Cow, CPM Dairy and Shield