Differences in productivity of grazing dairy cows with low versus high genetic merit for milk urea

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Introduction

Using Milk Urea Nitrogen to Predict Nitrogen Excretion and Utilization Efficiency in Lactating Dairy Cows[1]

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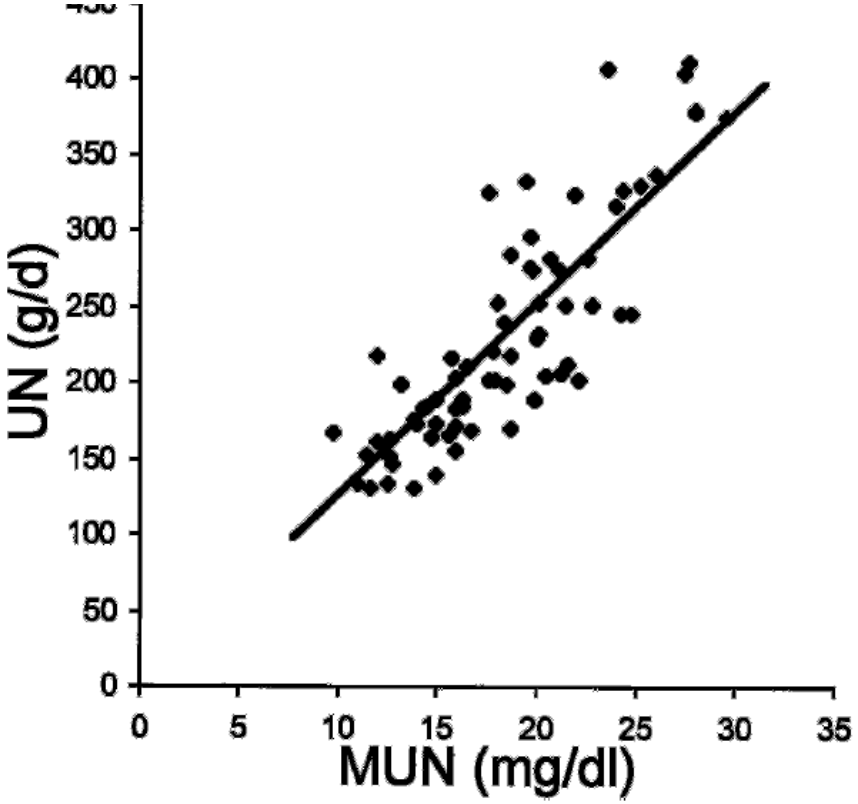

Figure 1. Relationship between milk urea N (MUN; milligrams per deciliter) and urinary N excretion (UN; grams per day); slope = 12.54 ± 0.24.

- Genetic selection for low milk urea nitrogen has been proposed as a tool to reduce nitrogen excretion;
- but potential effects on production and quality of milk have not been evaluated under grazing conditions

Objective

The present study provides estimates of genetic parameters for milk urea (MU) concentration and evaluates productivity differences between cows with low versus high genetic merit for milk urea in two dairy herds

Materials and Methods

- Massey University Dairy Farms
  - Dairy 1
    - 66 Holstein-Friesian (F), 55 Jersey (J) and 137 crossbred (FxJ) cows milked once daily
  - Dairy 4
    - 51 F, 3 J and 156 FxJ crossbred cows milked twice daily
  - Progeny of 157 sires (41 sires had at least one progeny in both herds)
- Cows calved in spring 2016 and were milked until May 2017
- At least 3 herd-tests for milk yield, fat%, protein%, lactose%, milk urea and SCC for each cow during the lactation
- Monthly records of live weights and body condition scores
- **Feed quality records in synchrony with herd-tests**

Material and Methods

- Lactation curves for daily yields of milk, fat, protein and lactose
- Lactation curves for live weight and body condition score
- Apparent dry matter intake (DMI = kg DM/cow/day) was estimated based on total ME requirements for maintenance, pregnancy, production and live weight change, divided by ME content of any feed offered
- Apparent crude protein intake (CPI = kg CP/cow/day based on DMI and content of crude protein from feed quality analyses
- Daily ECPU was calculated as CP yield/CPI × 100
- Milk urea yield (MUY = g/cow/day) was calculated as the multiplication of MU concentration by daily milk yield

Statistical analysis

- Single-trait repeatability animal models
  - Fixed effects
    - Herd-test date
    - Lactation number
    - Stage of lactation
    - Deviation from median calving date by herd (covariate)
    - Proportion of Friesian (covariate)
    - Heterosis coefficients of F×J (covariate)
  - Random effects
    - Cow permanent environment
    - Animal
    - Residual error
- Restricted maximum likelihood procedure as implemented in the ASReml package (Gilmour et al. 2009) of VSN International Ltd.

Results

Descriptive statistics, heritability, heterosis and breed effects

Variable	N	Mean	CVg (%)	h2	Rep	Heterosis FxJ		Breed F-J	
Yield, kg/day									
Milk	3,504	17.58	8.2	0.20	0.50	0.78	*	3.80	*
Fat	3,504	0.86	6.4	0.14	0.37	0.06	*	0.01	
Crude protein	3,504	0.69	6.5	0.12	0.40	0.05	*	0.08	*
Lactose	1,286	0.95	7.4	0.20	0.46	0.05	*	0.19	*
Content, %									
Fat	3,504	5.10	7.8	0.37	0.58	-0.04		-1.12	*
Crude protein	3,504	4.07	6.0	0.59	0.67	0.03		-0.45	*
Lactose	1,286	5.06	1.2	0.19	0.59	0.04	*	-0.08	*
Body condition score	3,504	4.44	3.9	0.35	0.88	0.01		-0.06	
Live weight, kg	3,504	491	7.2	0.72	0.95	12	*	105	*
Crude protein intake, kg	2,896	2.48	4.0	0.26	0.65	0.13	*	0.30	*
ECPU, %	2,896	27.11	0.7	0.11	0.50	0.56	*	-0.05	
Milk urea, mg/dL	1,284	24.90	10.1	0.24	0.42	0.10		2.73	*
Milk urea yield, g/day	1,284	4.55	13.2	0.19	0.54	0.23		1.46	*

Results and Conclusions

Productive performance of cows of low and high genetic merit for MU concentration within each milking frequency (farm)

	OAD					TAD				
	Low (N=84)		High (N=87)			Low (N=69)		High (N=70)		
	Mean	SE	Mean	SE		Mean	SE	Mean	SE	
MU EBV	-0.88	0.09	3.49	0.09	*	0.05	0.11	3.21	0.11	*
Milk	4011	96	4448	90	*	5060	100	5554	101	*
Fat	214	4.6	222	4.3		235	4.8	248	4.8	
Protein	165	3.6	176	3.4	*	193	3.8	205	3.8	*
Lactose	202	5.2	222	4.9	*	287	5.4	308	5.5	*
Live weight	480	6.1	487	5.7		484	6.3	489	6.4	
MU	22.8	0.4	33.2	0.3	*	17.1	0.4	25.1	0.4	*
MU yield	930	33	1485	31	*	965	34	1493	34	*
ECPU	24.9	0.20	25.8	0.19	*	33.4	0.21	33.6	0.21	

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Compared with low MU BV cows, high MU BV cows produced more milk, protein and lactose per lactation, but total lactation fat yield and live weight were not significantly different

The high MU BV cows had a greater ECPU only in OAD

Great caution must be used when selecting against MU as a tool to reduce nitrogen excretion

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