Guidelines to measure individual feed intake of dairy cows for genomic and genetic evaluations

Roel F. Veerkamp, Yvette de Haas, Jennie Pryce, Mike Coffey, Dianne Spurlock & Mike Vandehaar

LIVESTOCK RESEARCH
WAGENINGEN UR

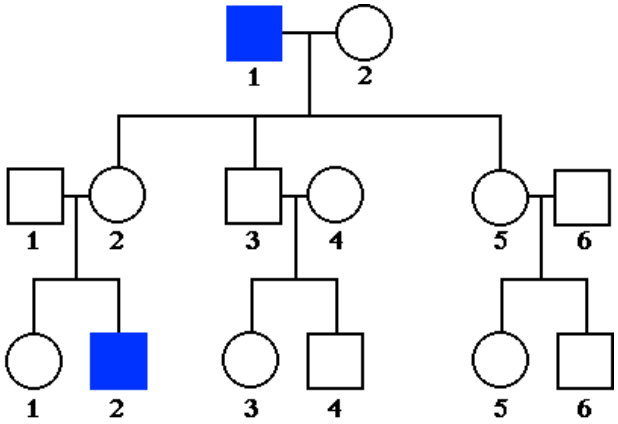
Norges miljø- og biovitenskapelige universitet

Interest in genetics of feed efficiency

- Feed efficiency
  - Feed important variable cost
  - Environmental pollution
  - Greenhouse gases
- Genetics
  - Cheap, permanent, cumulative

Dilemma: progeny testing for feed intake

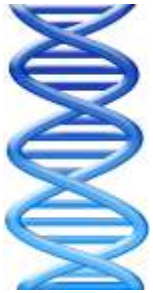
Pedigree



Phenotypes

Breeding value for selecting bulls

Solution: Genomic selection

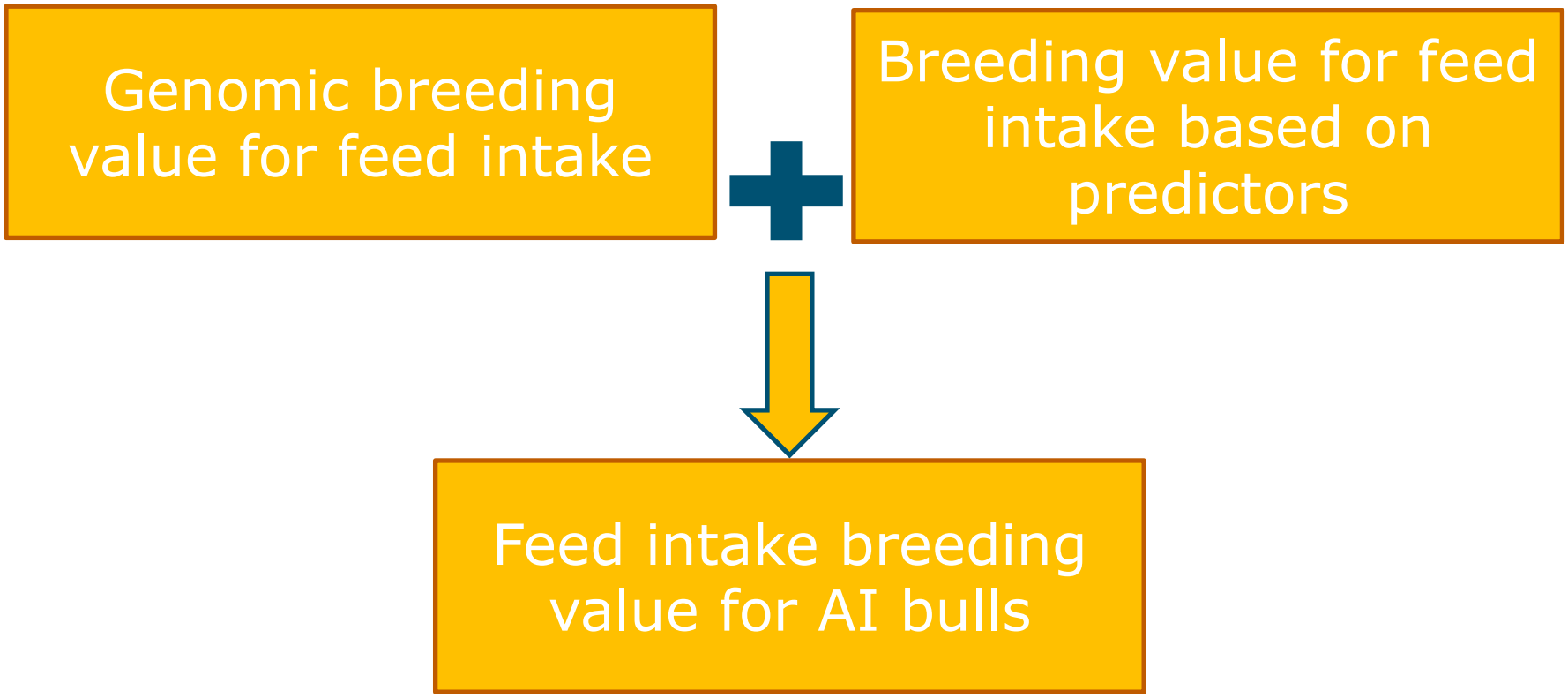


Cows with feed intake records and DNA

Bulls with DNA

Breeding value for feed intake

Breeding values for AI bulls in the Netherlands and Australia



Still a lot of individual feed intake records are required

“what we have”-approach

Global Dry Matter Initiative: gDMI

- 10 countries, 15 parties

- Key research questions:
  - Combine, homogenise and standardise phenotypes? (Berry et al., JDS 2014)
  - Imputation & genomic similarity between populations (Pryce et al., JDS 2014)
  - Can we predict genomic breeding values for DMI? (De Haas et al., JDS 2015)

Aim of this presentation

Can we use our experiences to give recommendations on recording of feed intake on individual dairy cows?

Questions addressed

- Measuring individual feed intake?
- What to record?
- Genotyping & imputation?
- What feeding system?
- Bulls, young stock or cows?
- How many cows to record?
- Which cows to record?
- When to record during lactation

Measuring individual feed intake

Insentec RIC system

Calan Broadbent

Growsafe system

n-alkane technique

NZ & Aus Callagher equipment

LIVESTOCK RESEARCH
WAGENINGEN UR

Recommendations: Measuring feed intake

- Each system unique challenges
  - Labour: weighing, feeding, refusals, training
  - Accuracy of equipment
  - Cows per gate(s)
- Issues
  - Wastage and stealing by cows
  - Sorting of feeds
  - Contamination of refused feed by drinking
  - Not affect feeding behaviour: space and time

Recommendations: What to record?

- Offered and refused feed or feed eaten every visit
- Dry matter percentage

- Additional recording: “horses for courses” + “loft data”
  - Energy sinks: milk yield and composition, live weight, and body condition score (RFI)
  - Health and fertility traits
  - Diet composition/content
  - Insurance!

Recommendations: Genotyping & imputation

- Different SNP chips over time/experiments
  - A set of common SNP
  - Impute genotypes to higher density (HD); if reference dataset of bulls or cows are available
- Animals with feed intake records, but no DNA
  - H-matrix, combing pedigree and genotypes
  - Imputation when offspring (sire+MGS) are genotyped (Bouwman et al., 2014, Pimentel et al., 2013)

Recommendations: What feeding system?

- Common practise fed *ad libitum*
- Meet requirements (protein, minerals, and vitamins)

- Well-mixed TMR to minimize sorting
- Dry cubed feed, measure the %DM in the refused feed
- No feeding according to production
- The same feed for a contemporary group (> 5 animals)

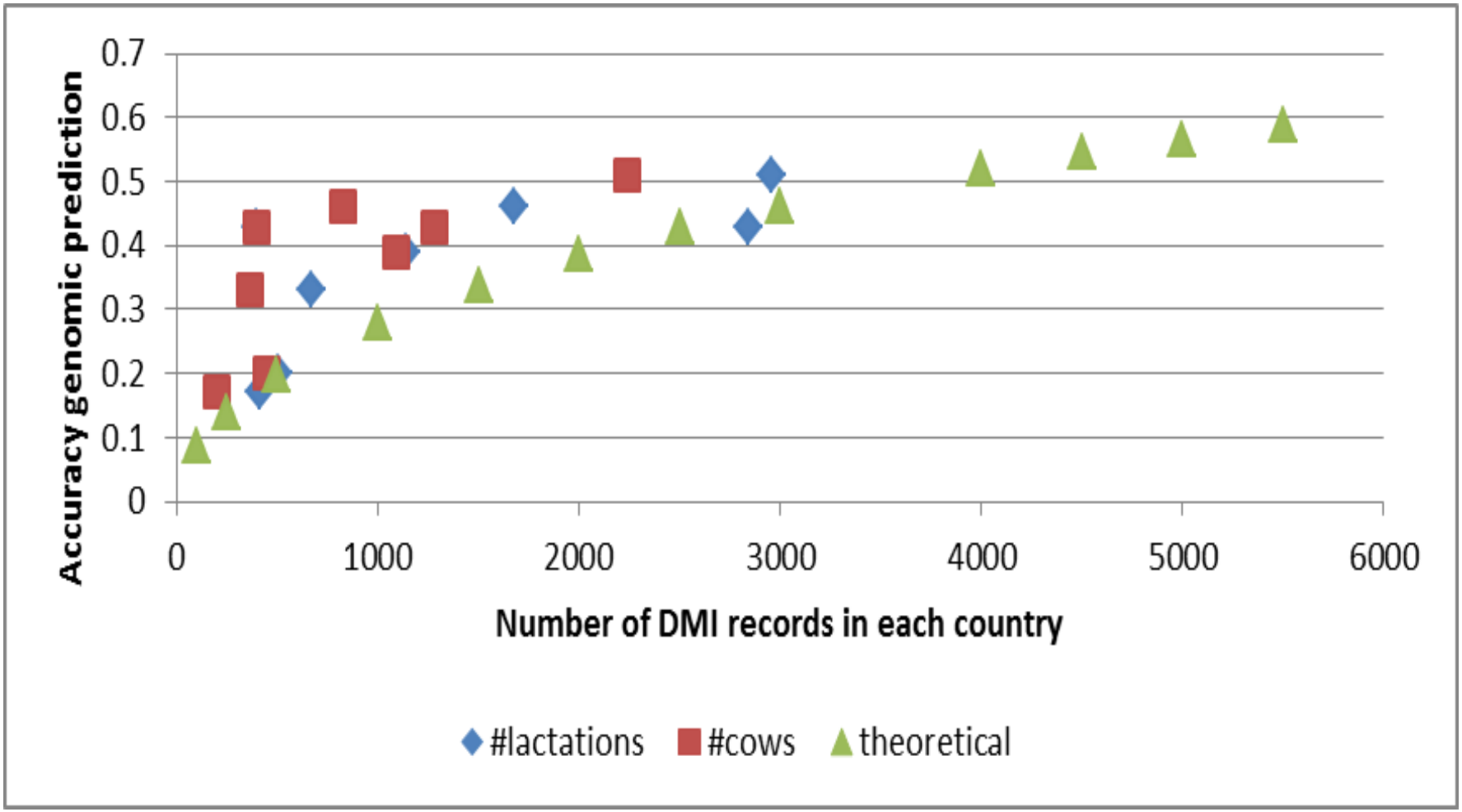
Recommendations: bulls, youngstock or cows?

- Genetic correlations non-lactating animals with lactating animals were above 0.74 (Nieuwhof et al., 1992)
- Australia and New Zealand, selection on RFI in growing heifers -> observed in lactating cows

- What is cheapest/practical?
- Better genetic parameters are needed for informed decision making (that requires recording of both)

→Combine in reference population

Recommendations: How many cows?



LIVESTOCK RESEARCH
WAGENINGEN UR

gDMI; de Haas et al JDS 2015

Recommendations: Which cows?

- Optimise number of “gate-days per year” by “number of cows x recording period “
- Recorded animals closely related to selection candidates
- Not too small contemporary groups (>5)
- Linkage between contemporary groups (sires/mgs)

Recommendations (1): When during lactation?

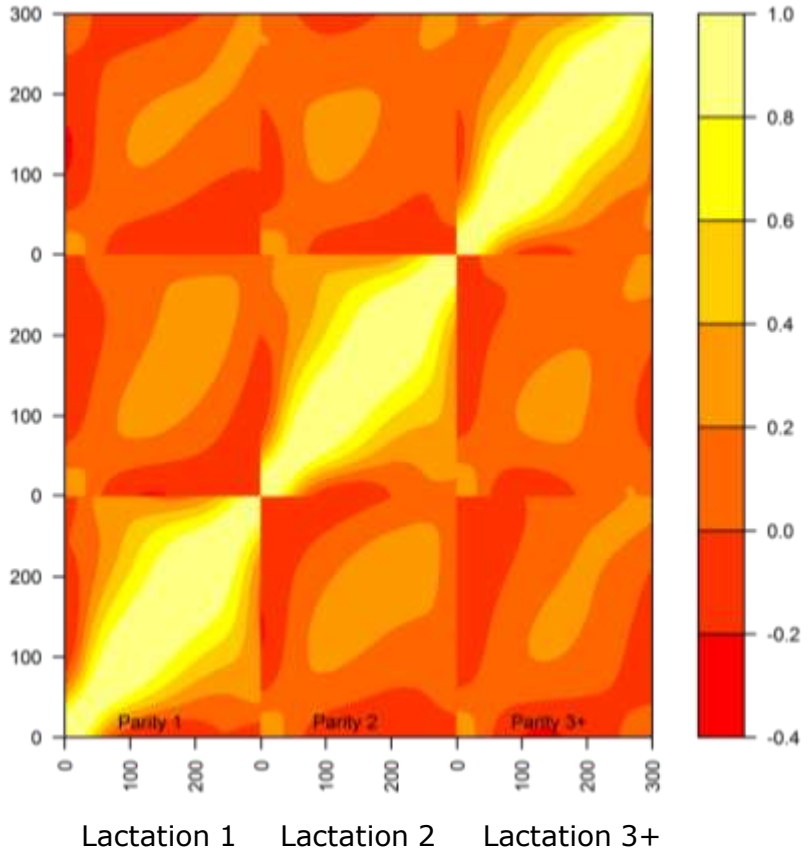
- across the lifetime of an animal
- compensate a more negative energy balance in early lactation by a higher intake during late lactation
- examining all energy sinks and calculating RFI, then the time and duration to record feed intake can be shortened and conducted earlier in lactation

Recommendations (2): When during lactation?

- More variable than milk yield and less correlated within and across lactations

→ measure feed intake at different stages and lactations

Correlations between feed intake at different days in milk in lactation 1, 2 and 3+



Recommendations (3): When during lactation?

- Selection index methodology
- Recording DMI in mid or late lactation gave higher accuracy predicting lactation DMI

Weeks recorded	Accuracy prediction
5	0.28
10	0.47
15	0.58

Manzanilla Pech et al., 2014

Conclusions

- Feed efficiency is important in dairy production
- Selection for feed efficiency impossible a few years ago, with genomics a realistic prospect
- Measuring feed intake important
  - "what we have"-approach
  - Recommendations cost dominated
  - Global collaboration remains essential!

Acknowledgements

- Dutch:

- USDA project: