Precision feeding

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In brief

Precision feeding is based on knowing the cow individual feed intake
Feed efficiency is based on knowing the cow individual feed intake

Monitoring Cow individual feed intake

• Direct measurement
• Sensor (and model)-based estimation
Please ask during the presentation
Incentive (1)

• Feed intake is the most costly single factor in intensive livestock operation.

• Feed costs make up 64% of the total farm day-to-day costs.
• (all medicine and vet treatments < 20 % ; labor < 20 % , energy, water etc)

• Other intensive livestock species: over 70% fish netcages (FAO 2008), Beef, and poultry

• Therefore,

• Animal Feed efficiency (via feed intake) should be monitored
Calculation -

• Animal Feed efficiency (via feed intake) should be monitored

Animal Feed efficiency = \frac{\text{animal input (feed costs, \$)}}{\text{animal output (milk production, \$)}}

are well known factors. measured in real time on individual level

Feed Conversion Ratio FCR = \frac{\text{Feed (kg)}}{\text{Weight Gain (kg)}}
The animal output is well known, accurate, in real-time on animal level

Walk-through body weight scale


Milk meters
Milk analyzer
Incentive (3)

• The ‘animal output’ is known (milk yield, body weight gain, milk contents)

• But,

\[
\text{Animal Feed efficiency} = \frac{\text{animal input (feed costs, \$)}}{\text{animal output (milk production, \$)}}
\]
Knowing the cow individual feed intake:

Two potential ways:

- Models
  - NRC. DMI etc

Direct measurement

regression, indirect, interpretation (NRC, Halachmi et al., JDS 2004. cow individual DMI)
Direct monitoring of feed intake


A commercial farm

*Computers and Electronics in Agriculture*, 20: p. 131-144.

The ARO’s research farm

DCRC Foulum Denmark Research farm
The classic ways: direct monitoring of feed intake
Feed efficiency among breeds

Feed efficiency among individuals

Which individual cow does deliver the best feed efficiency?

Knowing the cow individual feed intake:

Two potential ways:

Models
NRC. DMI etc

Direct measurement

regression, indirect, interpretation (NRC, Halachmi et al., JDS 2004. cow individual DMI)
Models. NRC and...

Cow individual feed intake =

\[ DMI_{0,i} = b_{0,i} + b_{1,i} \frac{MY_0}{BW_0} + b_{2,i} \frac{MY_{-1}}{BW_{-1}} \]

\[ + b_{3,i} \frac{MY_{-2}}{BW_{-2}} + b_{4,i} BW_0 + b_{5,i} \frac{BW_{-1}}{BW_0} \]

\[ + b_{6,i} fat + e, \]

J. Dairy Sci. 87:2254–2267

Predicting Feed Intake of the Individual Dairy Cow

I. Halachmi,¹ Y. Edan,² U. Moallem,¹ and E. Maltz¹
Models for cow individual feed intake (2)

DMI vs. NRC

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Predicting Feed Intake of the Individual Dairy Cow
I. Halachmi,¹ Y. Edan,² U. Moallem,¹ and E. Maltz¹

Feed intake of Holstein, Danish Red, and Jersey cows in automatic milking systems
I. Halachmi a, C.F. Børsting b, E. Maltz a, Y. Edan d, M.R. Weisbjerg c
Applying the cow individual feed intake (DMI or NRC)

Feeding according to cow individual energy balance.
Maltz et al. JDS 2013

Predicting the feed intake of the individual dairy cow
Halachmi et al., JDS 2004
The DMI Model with additional parameter – feeding behavior

Cow individual (2628) Feed intake over time. $R^2 = 0.91$

Cow individual (2573) Feed intake over time. $R^2 = 0.86$
Knowing the cow individual feed intake:

Two potential ways:

Models
NRC, DMI etc

Direct measurement

regression, indirect, interpretation (NRC, Halachmi et al., JDS 2004. cow individual DMI

An accurate cow individual feed intake measures
In brief

• Feed intake can be applied in:
  • estimating the cow individual feed efficiency.
  • feed efficiency

• Feed intake can be monitored
  • directly (research farms) or
  • via sensor based models (commercial farms)

• Feeding behavior can be a parameter in a DMI model

Dissuasion further research -
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Panel discussion

The WWH questions:
• Where are we?
• Where do we go?
• How do we go?