Keeping The Rumen Healthy: A New Approach to Working with Fiber in Rations

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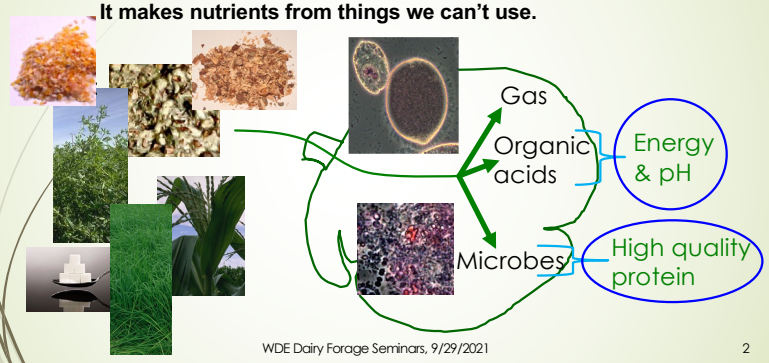
1

The Rumen Is The Cow's Super Power

It makes nutrients from things we can't use.



2

What A Healthy Rumen Provides

Effective Fiber from Forages

-- Rumination
-- Rumen mat to hold feed in the rumen
-- Affects feed passage

Fermentable carbohydrates (starch, sugars, fiber)

-- Ferment to supply energy
-- Grow rumen microbes
-- Can make the rumen more acidic

Done right: meets the cow's needs, keeps her and her rumen healthy.

3

But, How Do We Make That Ration?

Ration
Forage
Particle size
Fiber (NDF)
Starch
Sugar
Protein
Fiber & Starch digestibility

Courtesy of Ken Nordlund

Ration Management
Mixing
Consistency
Slug feeding (bunk space & empty bunk)
Sortability

4

Physically Effective NDF

Physical form affects the rumen environment:

- Enhance rumination
- Allow ruminal retention
- Maintain desirable rumen pH

- Forage has greater impact than nonforage NDF.
- Research focus.

5

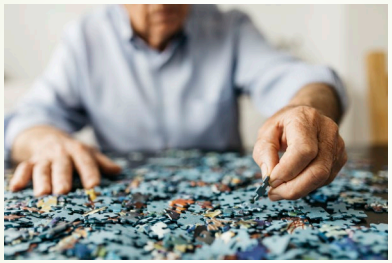
A System Using On-Farm Measurements?

Courtesy of Ken Nordlund

6

The Problem With Research Studies

Low Starch
High Forage
High ADF/NDF

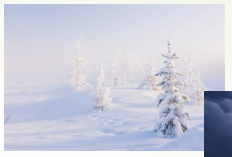


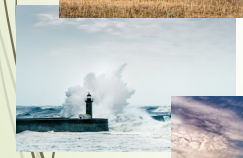
Low Forage
Low ADF/NDF
High Starch

Researchers set up diets to answer their own questions. The data you find won't be complete or balanced for all key variables.

7

Ensemble Models

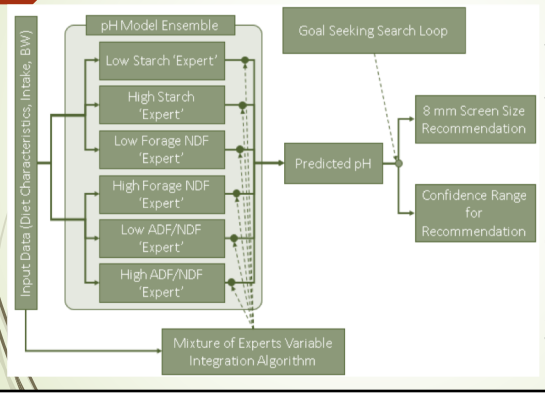




Technique that takes a core concept (i.e. rumen pH) and converts it into a "*constellation*" of models.

8

Ensemble Models & Rations



Ensemble models bring together predictions from multiple different models to yield a mean and range of responses.

Compared to individual models, gives more reliable predictions of events, confidence intervals, and is less likely to generate systematic errors.

White et al. 2017. JDS 100:9551

9

9

Physically Adjusted NDF (paNDF)

- Penn State Particle Separator
- Factors that affect the need for or effectiveness of fiber.
- The target ruminal pH (6.0-6.1) is a proxy for a desirable rumen environment, not a prediction.
- Derived from 60 publications that had 241 treatment means and used an ensemble model approach.

White et al. 2017. JDS 100:9551
White et al., 2017 JDS 100:9569

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10

Physically Adjusted NDF (paNDF)

Inputs:

- Diet characteristics, % of dry matter
  - Forage NDF, total forage, wet forage
  - Cottonseed: whole, hulls, meal
  - NDF, ADF, CP, starch
- Body weight
- Penn State Particle Separator (PSPS)
  - % of TMR DM on 0.75" / 19 mm sieve (1.18 optional)

Output predictions:

- Recommended % of TMR DM on 0.315" / 8 mm sieve
- Minutes per day of rumination

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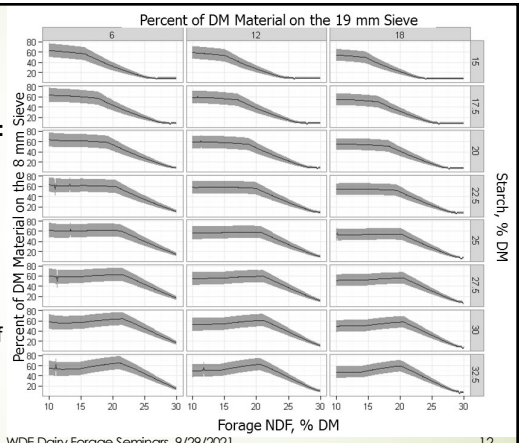
11

paNDF

Ensemble model:
Fixed factors, % of DM:
Starch: 15-32.5%
ForageNDF:10-30%
on19 mm sieve: 6-18%

Response, % of DM:
on 8 mm sieve.
Black line is prediction, gray is min/max range of prediction.



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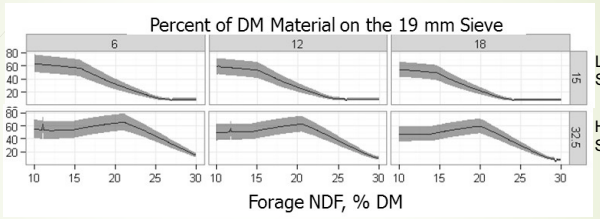
12

paNDF

% of TMR dry matter on 8 mm sieve

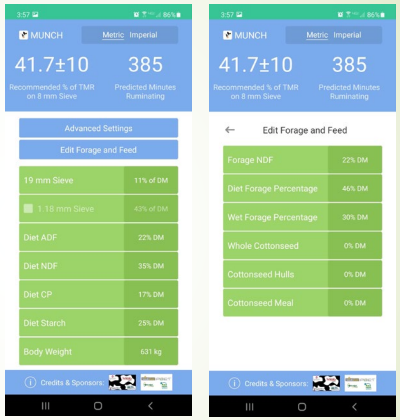


Response, % of DM:
on 8 mm sieve.
Black line is prediction, gray is min/max range of prediction.

13

paNDF

paNDF app available free of charge at Google Play and App Store: "Munch for Dairy Cows"



14

MUNCH: Balancing for paNDF

NebGuide

Nebraska Extension

Research-Based Information That You Can Use

G2316 - Index: Animal Agriculture/Dairy
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MUNCH

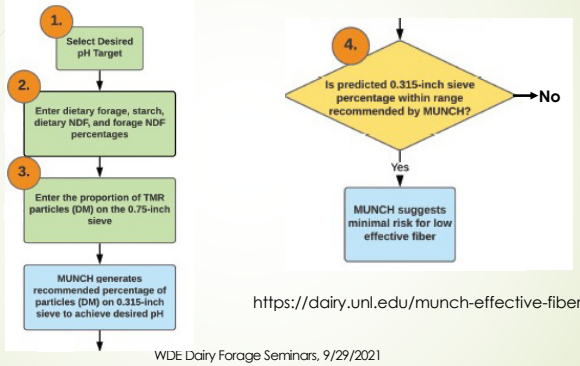
A Smartphone Application for Effective Fiber for Dairy Cows

D. Logan Morris, Animal Science Research Project Coordinator
Kimberly Clark, Dairy Systems Extension Educator
Paul J. Kononoff, Dairy Extension Specialist, University of Nebraska-Lincoln
Robin R. White, Assistant Professor, Animal Science and Poultry, Virginia Tech
Mary Beth Hall, Animal Scientist, U.S. Dairy Forage Research Center
Jeffrey L. Firkins, Professor, Animal Sciences, The Ohio State University

https://dairy.unl.edu/munch-effective-fiber-app

15

Working With Munch



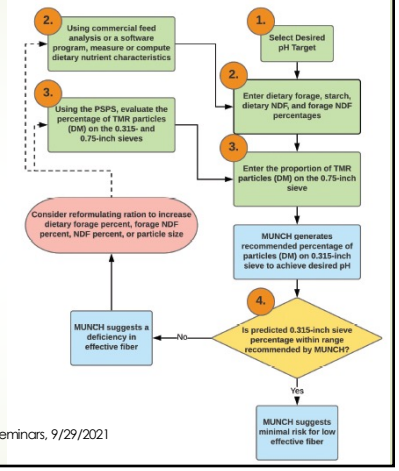
https://dairy.unl.edu/munch-effective-fiber-app

16

Working With Munch

Integrates different factors that influence the need and effect of fiber in the rumen.

https://dairy.unl.edu/munch-effective-fiber-app



17

Questions?

18

Physically Adjusted NDF (paNDF)

No dataset has *complete or balanced* coverage of all key independent variables.

Ensemble Model Approach

- Technique that takes a core concept (i.e. rumen pH) and converts it into a "*constellation*" of models.
- Integrates equations with weighting factors over a range of conditions will be better at "future prediction".
- Particularly useful where minimal data or that from diverse research studies are available for equation development.

19