Assessing forage quality for high producing dairy cows: How can we use TTNDFD in formulating diets

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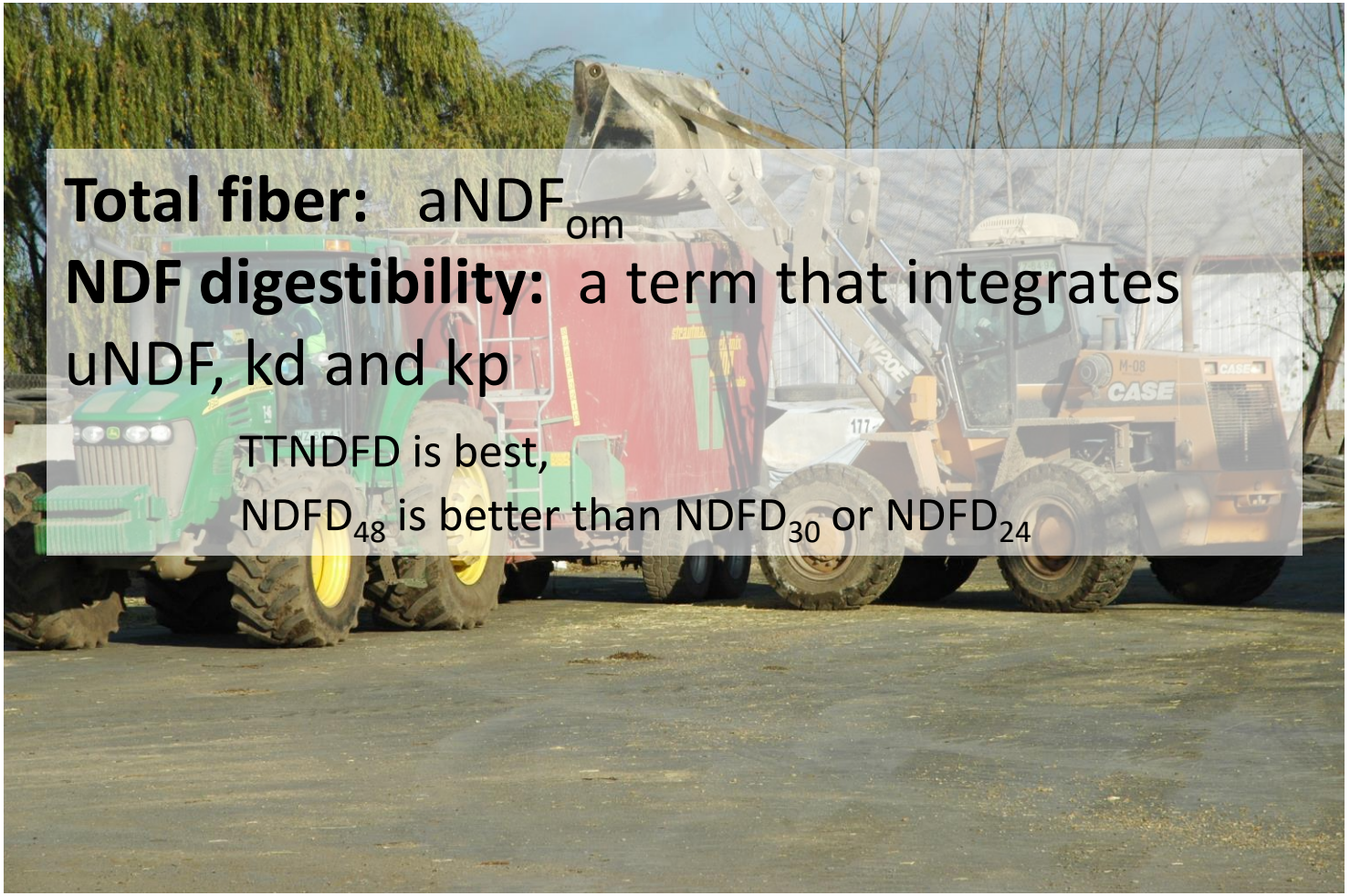
Balancing rations for carbohydrates (starch and NDF) are critical for health and production in high producing dairy cows.

Milk production is affected by variations in:

Fiber digestibility => 2.5-3 liter of milk

Starch digestibility => 1.5-2.5 liter milk

Which forage tests are most relevant to predicting forage quality



Total fiber: $aNDF_{om}$

NDF digestibility: a term that integrates uNDF, kd and kp

TTNDFD is best,

$NDFD_{48}$ is better than $NDFD_{30}$ or $NDFD_{24}$

How Can We Equate Feed Fiber Measurements to Animal Utilization of NDF

?

How does fiber digestibility affect milk production?

Oba and Allen (1999)
A 1% change in vitro or in situ NDF digestibility (primarily 30-h or 48-h NDFD) was correlated with:

- ✓ 0.4 lb increase in dry matter intake
- ✓ 0.5 lb increase in 4% fat corrected milk yield

The Process of Fiber Digestion

Feed and cow factors both affect fiber digestion

How is TTNDFD determined?

Forage sample

Standardized iv NDFD (24, 30, 48h) and iNDF

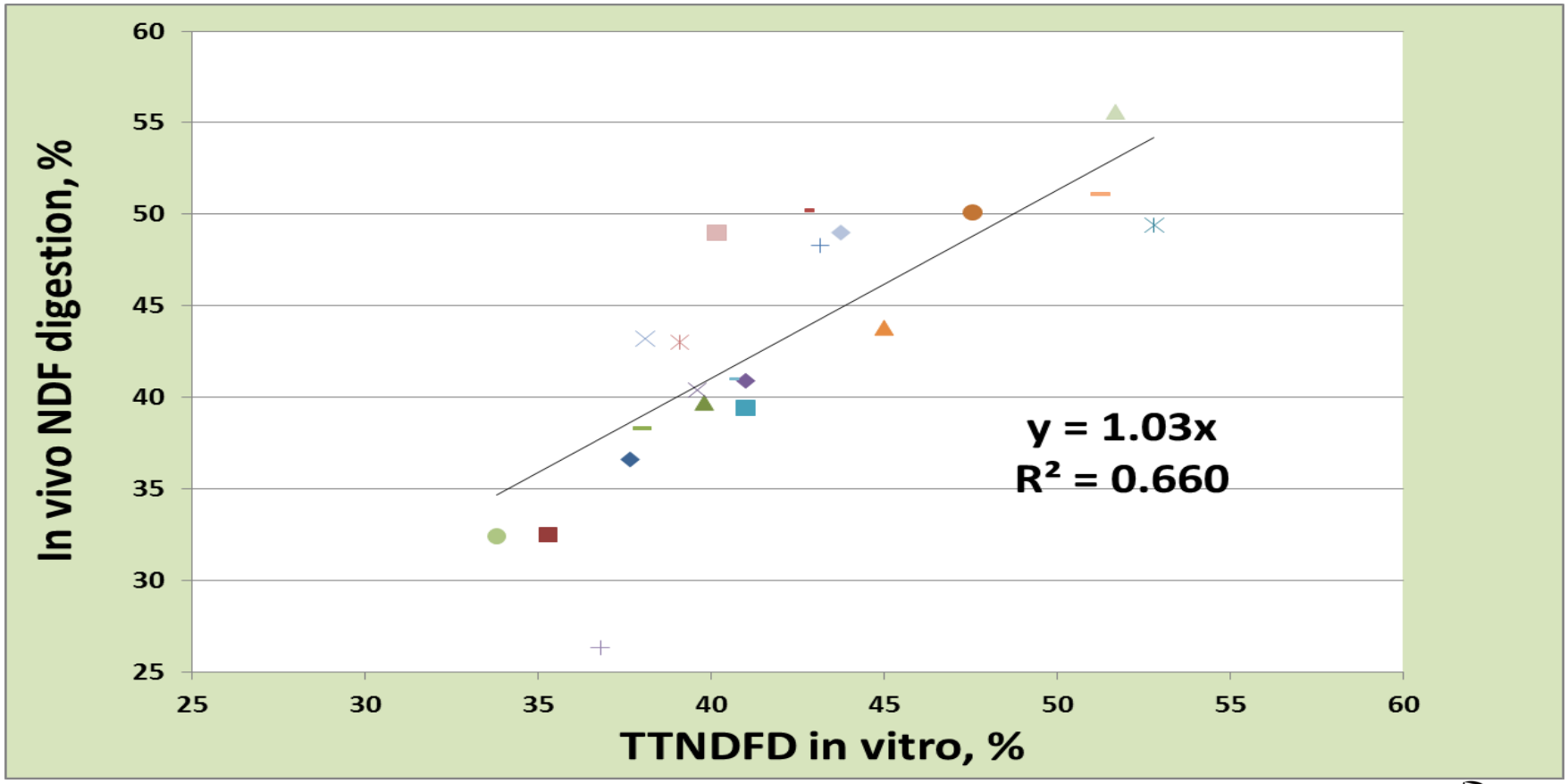
Rumen and hindgut digestion

Rate of fiber digestion (kd)
Potentially digestible NDF (pdNDF)

Rate of fiber passage, (kp)

TTNDFD
(total tract NDF Digestibility)

TTNDFD combines *in vitro* rate of NDF digestion with *iNDF* to improve the prediction of *in vivo* fiber digestion



Lopes et. al. 2015 JDS

Feed Analysis Lab Report TTNDFD can be quickly and cheaply analyzed by NIRS

Moisture 64.49% **Dry Matter** 35.51%

Description (%DM unless specified)	Dry Matter Basis	60 Day Average (DM)
Crude Protein	7.85%	8.14%
% Protein Solubility %CP	51.21%	
Avail. Crude Protein	7.24%	
ADF Bound Protein	0.61%	0.70%
ADICP %CP	7.77%	
Acid Det. Fiber	24.45%	24.50%
aNDF (w/NaSO3)	43.19%	43.33%
Calcium	0.25%	0.26%
Phosphorus	0.18%	0.20%
Magnesium	0.18%	0.17%
Potassium	0.79%	0.95%
Traditional 30HR	54.71%	54.94%
Standardized 24HR	23.73%	22.06%
Standardized 30HR	34.57%	33.08%
Standardized 48HR	53.65%	52.75%
TTNDFD	47.98	42.34

TTNDFD is a prediction of NDF digestibility for a feed (or diet) in 1400 lb cow consuming 53 lb DM of a 28-30% NDF diet.

TTNDFD in this forage is higher than normal:

Expect more energy/kg forage DM

Expect higher intake than normal

3. Using fiber digestibility to evaluate/formulate diets

How to calculate diet TTNDFD

Feed	kg DM	NDF g/100 g DM	TTNDFD g/100 g NDF	NDF kg	TTNDFD kg
Corn silage	10	38	42	**3.80**	**1.60**
Grass silage	5	52	52	**2.60**	**1.35**
Barley grain	8	14	48	**1.12**	**0.54**
Protein supplement	4	15	42	**0.60**	**0.25**
Mineral/vitamin	0.25	0	0	**0.00**	**0.00**
Total	**27.25**			**8.12**	**3.74**
Diet NDF	**30%**	(8.12/27.25) x 100			
Diet TTNDFD	**46%**	(3.74/8.12) x 100			

Recommended carbohydrates feeding guidelines for high producing dairy cows

Item	
NDF, % of DM	25-33
TTNDFD, % of NDF	> 42%
Starch, % of DM	21-28
Fecal Starch Digestibility, % of starch	>95%
7h in situ starch D	>75
peNDF	15-19% fNDF*

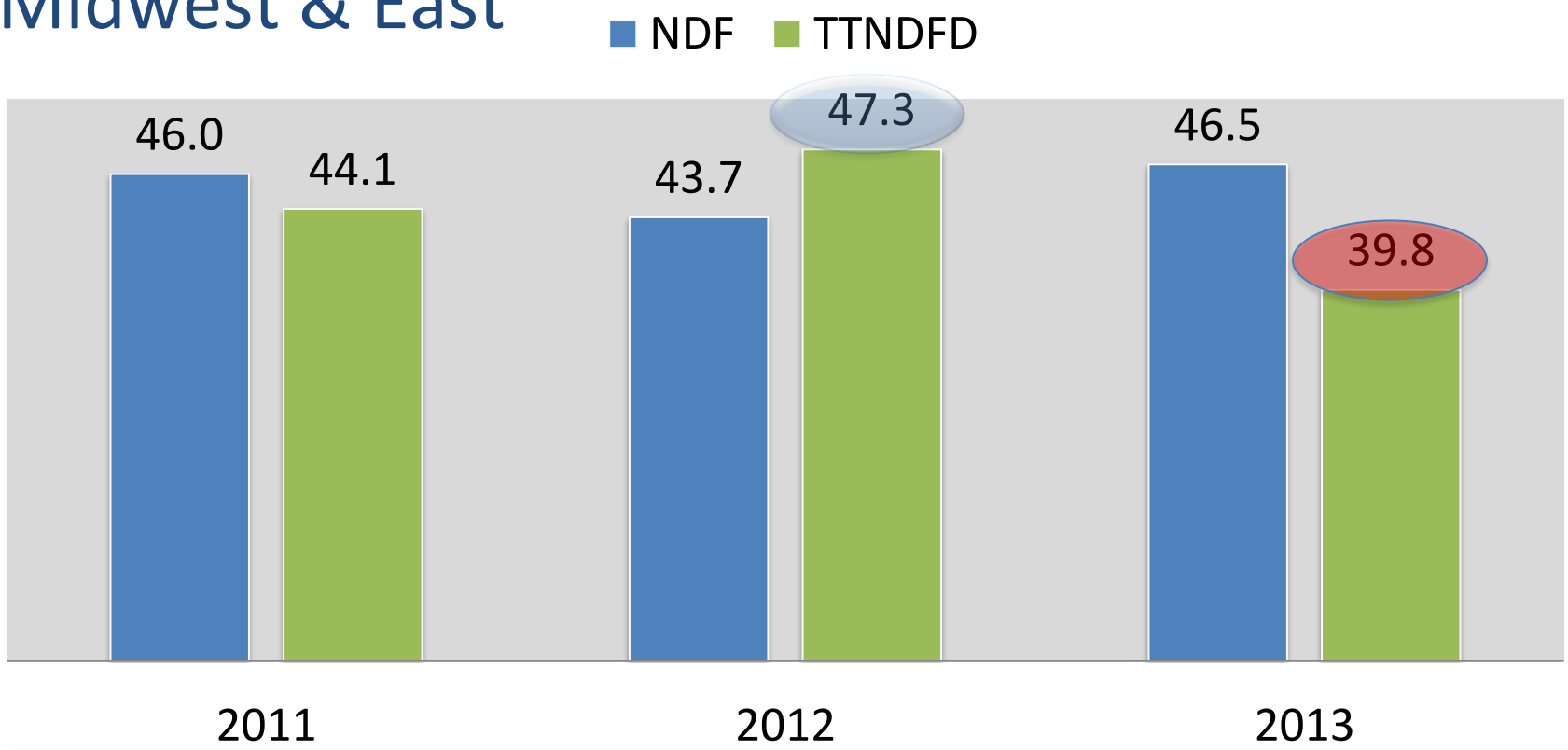
*minimum forage NDF(fNDF) depends on dietary NDF and dietary starch content

Fiber digestibility varies

	Range in TTNDFD*	
	Avg	% of NDF
Alfalfa hay and silage	42	30-50
Corn silage	40	25-48
Grass hay and silage	49	38-60
Cereal silage	40	25-55
Corn Stover	30	25-35
Soy hulls	70	65-80

*Rock River labs ± 2 standard deviations

2011, 2012 and 2013 Corn Silage Quality, Midwest & East



On average, 2013 crop corn silage is nearly 8 units lower in fiber digestibility (TTNDFD) last year's corn silage

Adapted from Goeser, 2013 Hoard's Dairyman, Nov. Issue

Ration Balancing With TTNDFD

- ✓ TTNDFD values are consistent across feed types
- ✓ Target rations for > 42% TTNDFD
- ✓ ‘Dynamic kd’ and iNDF are compatible with AMTS and CNPCS ration software
- ✓ Co-product feed tables available

Feed tests you need to know to get the most out of forages

- ✓ DM (should be done on farm)
- ✓ NDF or NDF_{om} MOST IMPORTANT
  - ✓ NDF drives intake and is negatively correlated to digestibility
- ✓ Starch (corn silage)
- ✓ Fiber digestibility (TTNDFD or $NDFD_{48}$)
- ✓ Starch digestibility (in vitro 7h starchD)
- ✓ Ash content (soil contamination)

Take Home Message

1. Fiber digestibility has a big impact on milk yield.

   NDF digestibility varies greatly among forages and this variation can significantly affect milk production and feed intake.

2. Fiber digestibility is an integrated number (intake, rate of digestion and rate of passage) but can be measured quickly and accurately with new lab tests

   TTNDFD is a better indicator of fiber digestion than $NDFD_{30}$ or iNDF values

THANK YOU!

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