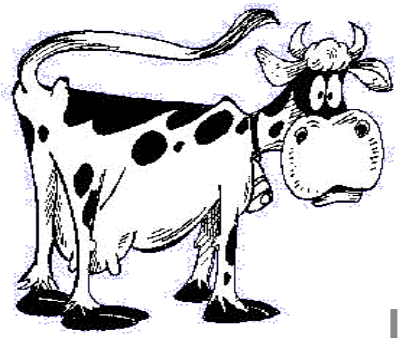
Cows agree with Total Tract NDFD

A new (and) better tool for assessing forage quality



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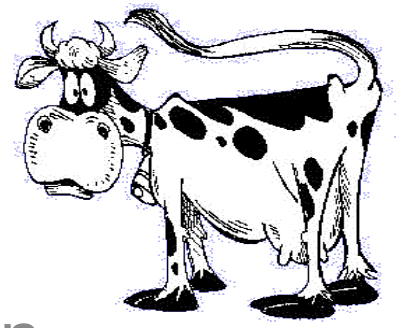


Balancing rations for carbohydrates (starch and NDF) are critical for health and production in high producing dairy cows.

Milk production is affected by variations in:

Fiber digestibility => 6-7 lbs of milk

Starch digestibility => 3-5 lbs of milk

Assessing fiber digestion is not easy

Poor digestion < 40%

Excellent digestion > 50%

A 2-3 unit change in fiber digestibility corresponds to 1 lb change in milk yield.

Fiber digestibility varies in forages

	Range in TTNDFD
	% of NDF
Alfalfa hay and silage	25-70
Corn silage	25-80
Grass hay and silage	15-80

Two units increase in diet TTNDFD can potentially

The ‘Alphabet Soup’ Forage Fiber Tests

Test	Rumen Fill	TDN Estimation	Diet Formulation	Herd Diagnostics	Quality Index	Agronomy Trials
NDF	X	X	X	X		
$NDFD_{(30 \text{ or } 48)}$	X	X			X	X
TTNDFD	X	X	X	X	X	X
$uNDF_{240}$	X		X	X		
NDF kd			X			
RFQ					X	X
Milk/ton					X	X

TTNDFD ➡ T*otal* T*ract* NDF D*igestibility*

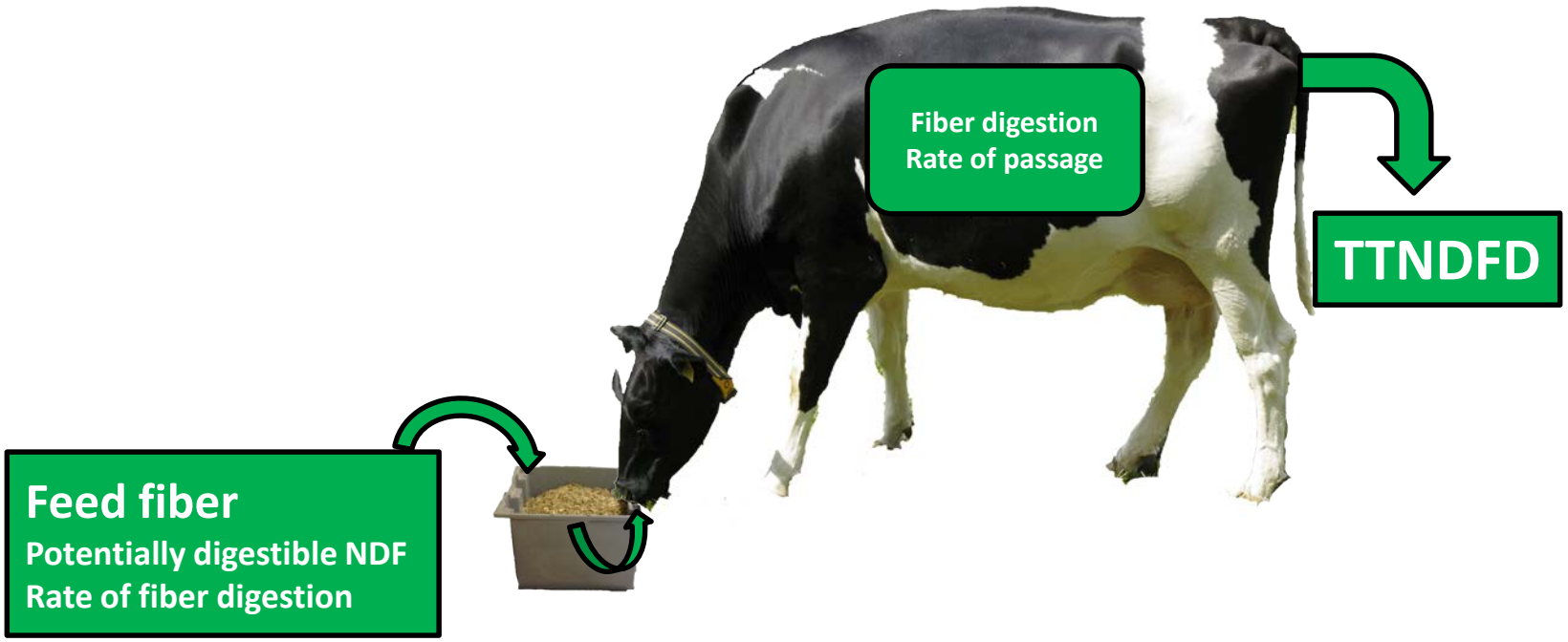
Licensed procedure through the University of WI

>15 years of research, > $500,000 invested in development

A precise laboratory test that accurately predicts how fiber is utilized by high producing dairy cows

TTNDFD➡*Total Tract* NDF *Digestibility*

Feed and cow factors are combined to measure true fiber digestion



A 2-3 unit change in ration TTNDFD corresponds to 1 pound change in milk yield.

Think of forage quality as how far you can travel on a tank of gas:

You can't calculate how far you can go unless you know:

How much fuel is in the tank (pdNDF)
AND
The miles traveled per gallon (kd)

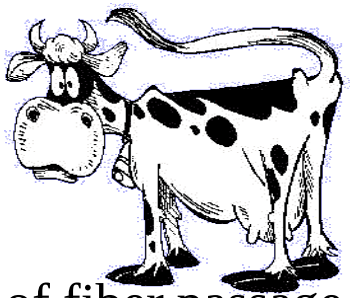
HOW much milk your forage will make depends on the <u>amount of potentially digestible fiber</u> AND the <u>rate of fiber digestion</u>!

How is TTNDFD determined?

Forage sample

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

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



Rate of fiber passage, (kp)

Rumen and
hindgut digestion

TTNDFD
(total tract NDF Digestibility)

Feed Analysis Lab Report

Cost of analysis TTNDFD report (NIR) $26 vs $22 for a standard analysis w/o TTNDFD

		60 Day Average (DM)
		8.14%
		0.70%
		24.50%
		43.33%
Calcium	0.25%	0.26%
Phosphorus	0.18%	0.20%
Magnesium	0.18%	0.17%
Potassium	0.79%	0.95%
Sulfur	0.11%	0.11%
Fat (EE)	1.91%	2.19%

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.

Standardized 24HR	23.73%	22.06%
Standardized 30HR	34.57%	33.08%
Standardized 48HR	53.65%	52.75%
Calculations		
TTNDFD	47.98	42.34
N.F.C.	44.48%	4.33

Milk 2006 Energy calculated using avg of 30 & 48h Std NDFD, compared to lab avg = 35.275 (Processed\Un-Processed)

TDN maintenance	77.08%	75.27%
NEL 3x maintenance Mcal/lb	0.74	0.71
Net energy of gain Mcal/lb	0.62	0.59
Net energy maintenance Mcal/lb	0.91	0.88
Lbs. Milk/Ton	3615	3468

*ND - None Detected

Feed Analysis Lab Report

Lab # **Sampled on** 1/8/2014 **Received on** 1/9/2014
Farm

Moisture 54.44% **Dry Matter** 45.56%

Description (%DM unless specified)	Dry Matter Basis	60 Day RRL Average
Crude Protein	22.55%	21.80%
aNDF	42.6%	43.09%
TTNDFD	51.4	44.70
Relative Forage Quality		
Dynamic NDF Kd (using 24,30,48,120 hr)	11.53%/hr	
Relative feed value	136	

Which is the better Alfalfa?

Both forages have similar RFV

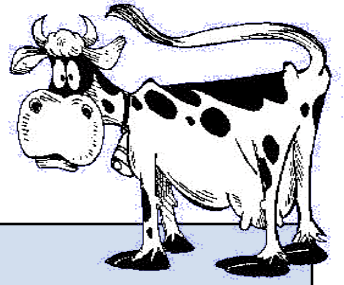
Sample # 1 Haylage
Lab # **Sampled on** 12/26/2013 **Received on** 12/27/2013
Farm

Moisture 69.47% **Dry Matter** 30.53%

Description (%DM unless specified)	Dry Matter Basis	60 Day RRL Average
Crude Protein	20.87%	21.86%
aNDF	42.2%	43.30%
TTNDFD	44.1	44.26
Relative Forage Quality		
Dynamic NDF Kd (using 24,30,48,120 hr)	7.72%/hr	
Relative feed value	138	

Validating the TTNDFD model

What do the ‘real experts’ say?



Legume/grass feeding trials
(20 trials, 64 observations
In vivo NDF diet digestibility)

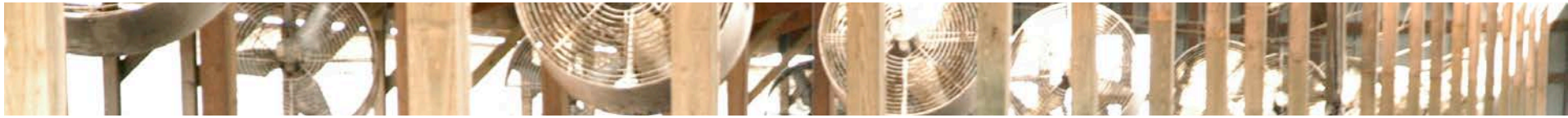
Mean	**47.3 % of NDF**
Median	**47.5 % of NDF**
Range	**31.1-66.2 % of NDF**
St. Dev	**8.1**

Cows report that TTNDF digestibility of legume/grasses are higher than TTNDF digestibility of corn silage.

Corn Silage/Sorghum feeding trials
(25 trials, 81 observations,
In Vivo NDF diet digestibility)

Mean	**40.2 % of NDF**
Median	**41.1 % of NDF**
Range	**20.1-58.8 % of NDF**
St. Dev.	**8.8**

Validating the TTNDFD model



J. Dairy Sci. 92:3833–3841
doi:10.3168/jds.2008-1136

An alternative method to assess 24-h ruminal in vitro neutral detergent fiber digestibility[1]

J. P. Goeser and D. K. Combs[2]
Department of Dairy Science, University of Wisconsin-Madison, Madison 53706

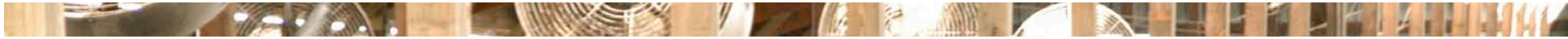
Validating the TTNDFD model

J. Dairy Sci. 92:3842–3848
doi:10.3168/jds.2008-1745

Modification of a rumen fluid priming technique for measuring in vitro neutral detergent fiber digestibility[1]

J. P. Goeser, P. C. Hoffman, and D. K. Combs[2]
Department of Dairy Science, University of Wisconsin, Madison 53706

Validating the TTNDFD model



Patents | Application | Grant

Find prior art | Discuss this application

Method for measuring fiber digestibility

US 20090272889 A1

ABSTRACT

Described is a method of measuring fiber digestion in ruminants and calibrating spectrophotometers using the measured fiber digestion values. The method includes the steps of harvesting rumen fluid from at least one ruminant animal and combining the rumen fluid with a primer composition comprising a carbohydrate. The rumen fluid and carbohydrate are then incubated in a sealed container until a pre-determined pressure is achieved within the sealed container. A plant matter sample is digested with the rumen fluid so treated. The digested sample is the measured for absorbance or reflectance using a spectrophotometer. The digestion values and the absorbance or reflectance values are then correlated to construct a standard curve for predicting fiber digestion values using spectrophotometric analysis, preferably NIRS analysis.

Publication number	US20090272889 A1
Publication type	Application
Application number	US 12/405,650
Publication date	Nov 5, 2009
Filing date	Mar 17, 2009
Priority date ⓘ	Mar 17, 2008
Also published as	US8501493
Inventors	David Kenneth Combs, John Phillip Goeser
Original Assignee	David Kenneth Combs, John Phillip Goeser
Export Citation	BiBTeX, EndNote, RefMan

Referenced by (1), Classifications (8), Legal Events (1)

External Links: USPTO, USPTO Assignment, Espacenet

Validating the TTNDFD model

J. Dairy Sci. 98:574–585
http://dx.doi.org/10.3168/jds.2014-8661

Validation of an in vitro model for predicting rumen and total-tract fiber digestibility in dairy cows fed corn silages with different in vitro neutral detergent fiber digestibilities at 2 levels of dry matter intake

F. Lopes, D. E. Cook, and D. K. Combs[1]
Department of Dairy Science, University of Wisconsin, Madison 53706

Validating the TTNDFD model

J. Dairy Sci. 98:2596–2602
http://dx.doi.org/10.3168/jds.2014-8665

Validation of an approach to predict total-tract fiber digestibility using a standardized in vitro technique for different diets fed to high-producing dairy cows

F. Lopes, K. Ruh, and D. K. Combs[1]
Department of Dairy Science, University of Wisconsin, Madison 53706

Validating the TTNDFD model

J. Dairy Sci. TBC:1–13
http://dx.doi.org/10.3168/jds.2014-8662

Effects of varying dietary ratios of corn silage to alfalfa silage on digestion of neutral detergent fiber in lactating dairy cows

F. Lopes, D. E. Cook, and D. K. Combs[1]
Department of Dairy Science, University of Wisconsin–Madison, Madison 53706

In vivo – pool and flux method

- **Omasal digesta and rumen fluid collected**
- **Fecal samples collected**
- **Rumen contents were evacuated manually at 1300h (4h after feeding) on d 20 and at 0800 h (1 h before feeding) on d 21**

Rumen kinetic and pool size

- **Rumen pools of iNDF and pdNDF (kg)**
- **Ruminal passage rates of iNDF and pd NDF (%/h)**
- **Ruminal digestion rate of pdNDF (%/h)**




Can the in vitro TTNDFD test detect a difference in fiber digestibility as ratios of corn silage (36% TTNDFD) and alfalfa(42% TTNDFD) change in the ration?

Corn silage:alfalfa ratio	100CS 0AS	67CS 33AS	33CS 67AS	0CS 100AS	
					SE
DMI, lb/d	55^{ab}	56^{a}	54^{b}	48^{c}	0.8
4% FCM, l/d	80	78	77	79	0.9
Observed TTNDFD, in vivo	**38.3^{a}**	**40.9^{ab}**	**39.4^{ab}**	**43.8^{a}**	**1.9**
Predicted TTNDFD, in vitro*	**38**	**41**	**41**	**45**	**2.1**

In vitro TTNDFD analysis of feeds matched the observed (in vivo) NDF digestibility values

Lopes et al, 2015

Fiber digestibility TTNDFD vs. in vivo

	Method			P-value
	TTNDFD	In vivo	SEM	Method
NDF digested in rumen, lb	5.3	5.7	0.4	0.6
NDF digested in hindgut, lb	0.4	0.7	0.2	0.4
NDF digested in total tract, lb	5.9	6.4	0.2	0.7
Total tract NDF digestibility, % of total NDF	40.6	41.8	1.86	0.5

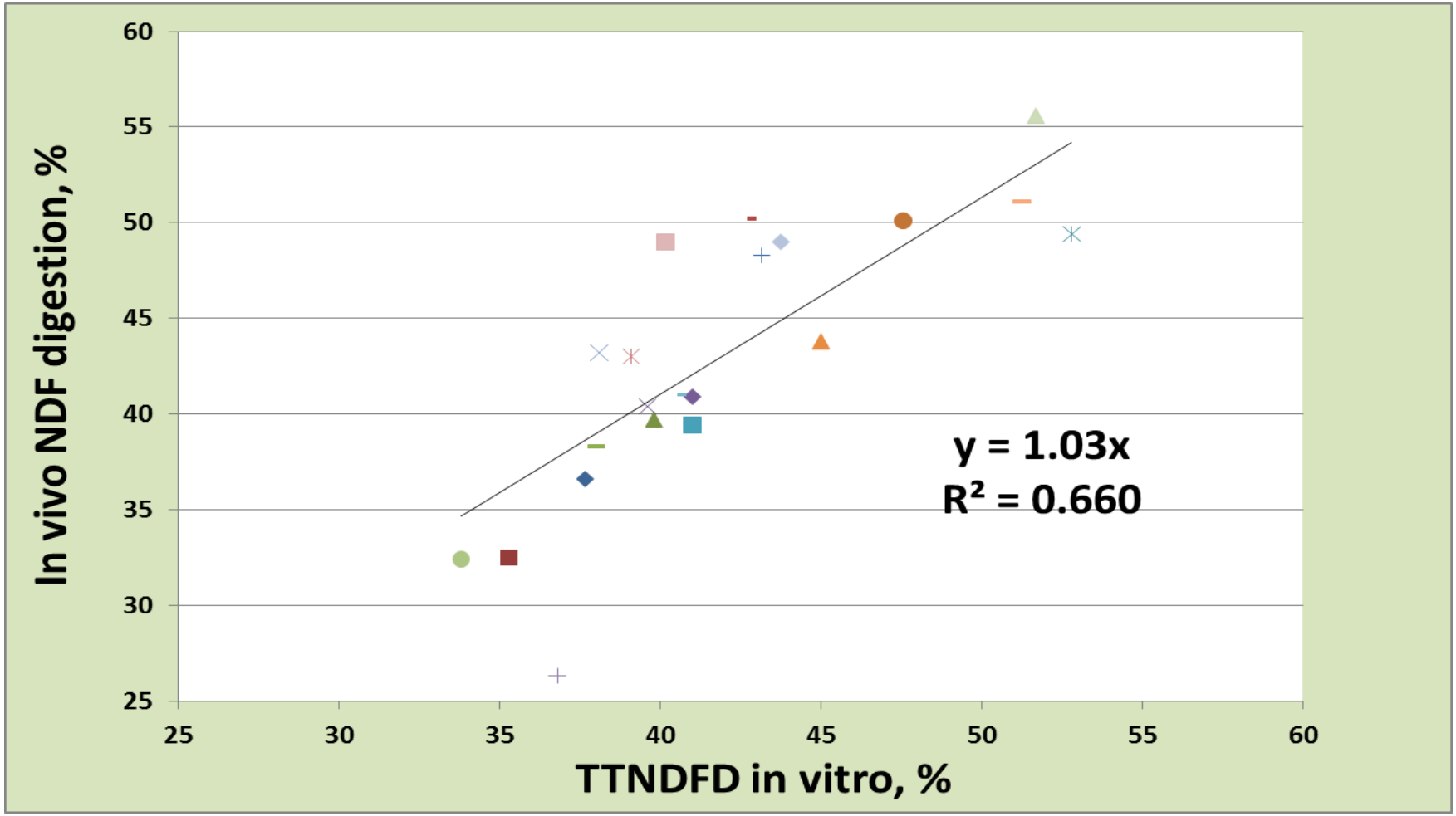
Lopes et al, 2105

TTNDFD validation: Comparing lab prediction to results from feeding studies

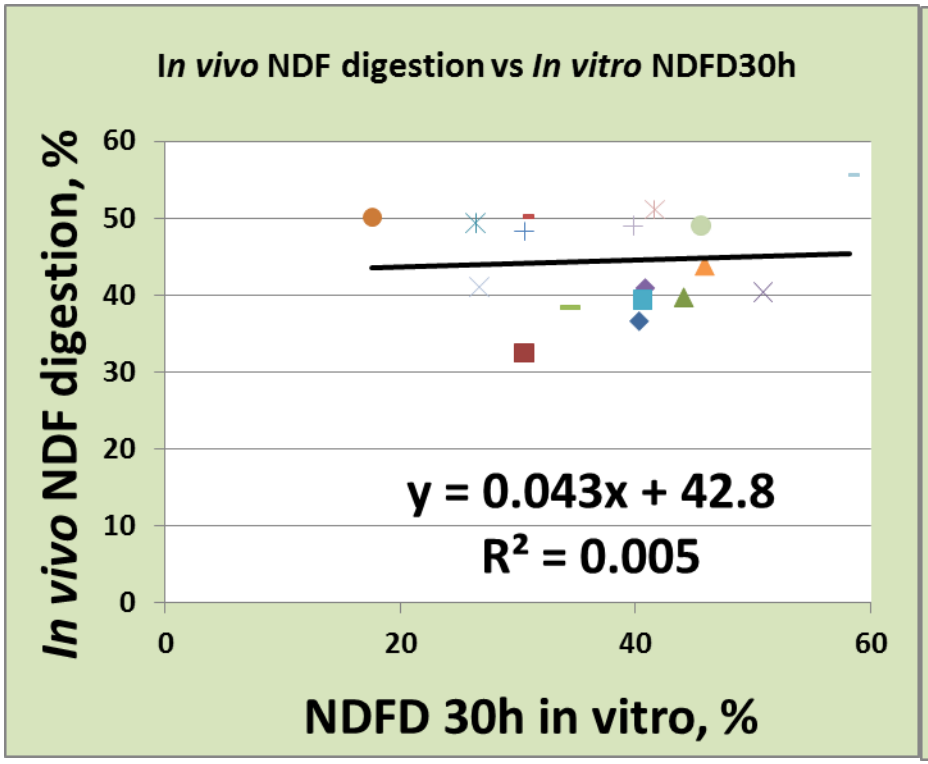
- Total tract NDF digestibility in vivo studies
  - Seven studies (total of 21 diets) conducted at UW-Madison
- Total tract NDF digestibility in vitro evaluation of diets
  - 21 diets
  - TTNDFD predicted from TMR samples

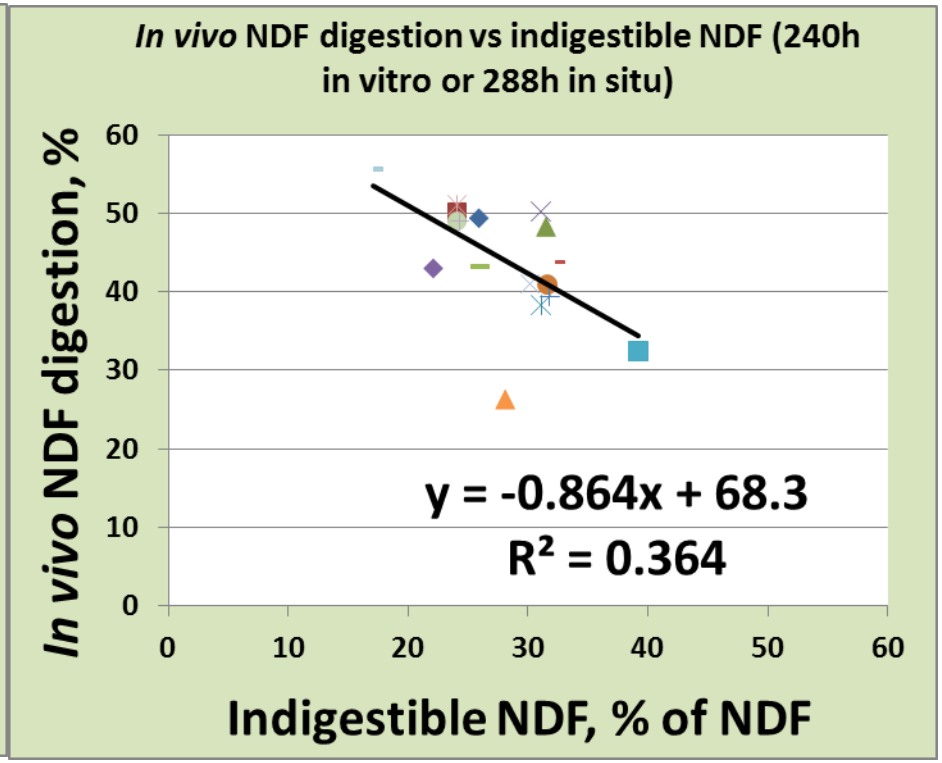



TTNDFD combines *in vitro* rate of NDF digestion with *iNDF* to improve the prediction of *in vivo* fiber digestion



Stand-alone *in vitro* NDFD30 or iNDF values are poor predictors of in vivo fiber digestion





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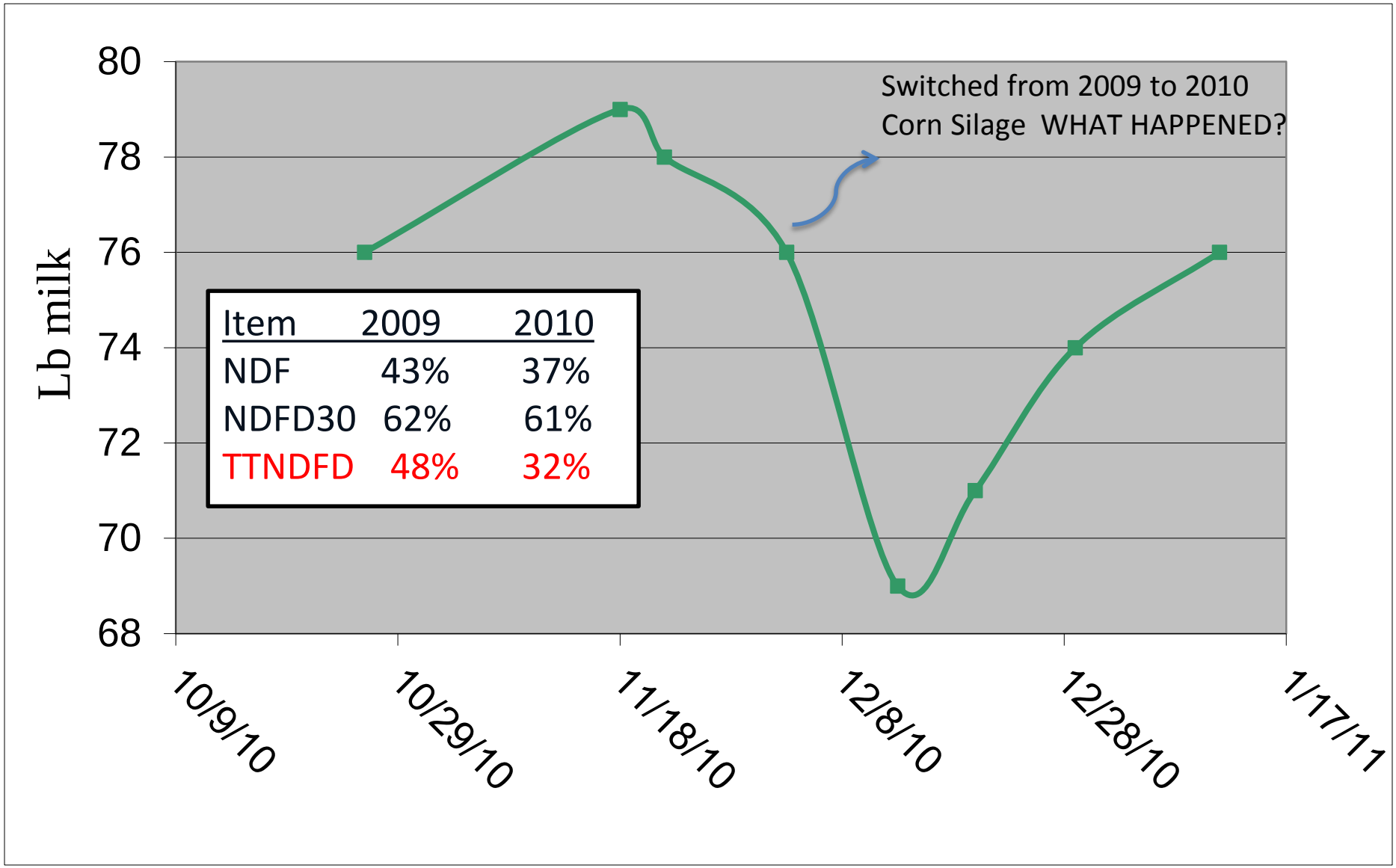
Lopes. F., D. E. Cook and R. W. Bender and D. K. Combs. 2013b.. J. Dairy Sci. 96(E-Suppl 1): 16..

Verbeten, W. D., D. K. Combs and D. J. Undersander. 2011. J. Dairy Sci. 94 (E-Suppl 1): 556.

How to use TTNDFD

Troubleshooting with TTNDFD



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

Alforex Introduces Hi-Gest 360

Alfalfa with Improved TTNDFD

28 Day Cut System (5 cuts)*

Alfalfa Variety	pdNDF	Dyn Kd	TTNDFD
Hi-Gest 360	73.3	7.2	55.1
Conventional Check	68.2	6.6	48.2
% Difference:	7%	10%	14%

35 day Cut System (3 cuts)*

Alfalfa Variety	pdNDF	Dyn Kd	TTNDFD
Hi-Gest 360	59.1	5.9	39.3
Conventional Check	54.8	5.4	35.6
% Difference:	8%	8%	10%

Low lignin: higher fiber digestibility

TTNDFD: Tells you how fiber digestibility was improved


NutriFiber

TTNDFD: The Take Home Message

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

A 2-3 unit change in ration TTNDFD corresponds to a 1 pound change in milk yield.

2. The TTNDFD test was developed to predict fiber digestibility in high producing dairy cattle

Can be used across forage types and byproduct feeds

Can be used in ration balancing and evaluation

Is a more accurate measure of forage quality than

TTNDFD Guidelines

- Remember **42%** TTNDFD
  - Corn silage and haylage average!
- **Goal = 48+%**

THE WISCONSIN IDEA

*The **Wisconsin Idea** is a philosophy embraced by the University of Wisconsin System, which holds that research conducted at the University of Wisconsin System should be applied to solve problems and improve health, quality of life, the environment and agriculture for all citizens of the state.*