Assessing forage quality for high producing dairy cows: Fiber (NDF) and fiber digestibility (TTNDFD)

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1. Who I am

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Forage Utilization and Fiber Digestibility

Predicting in vivo fiber digestibility with NIRS (TTNDFD)

Forage genetic selection based on rate and extent of NDF digestibility (USDA and Hatch projects)
Improving NDF digestibility of crop residues (Hatch)

What causes performance swings in dairy diets?

- ✓ Diet energy is impacted largely by carbohydrates
  - ✓ Fiber (NDF)
  - ✓ Starch
- ✓ Carbohydrate content and

content and **digestibility** affect milk yield

- ✓ Fiber is always lower in digestible energy than starch (grain)
- ✓ 2-3 unit drop in Fiber or Starch digestibility will decrease milk by 0.5 liters

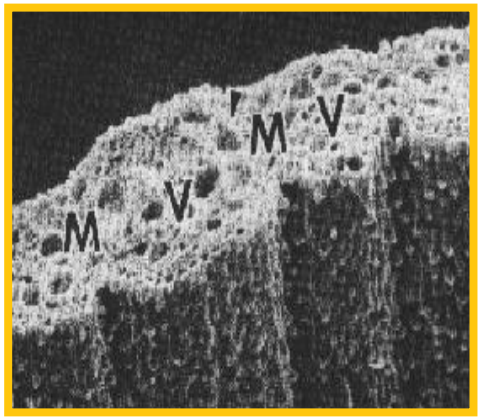
Recommended carbohydrates feeding guidelines for high producing dairy cows

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

Roles of fiber (NDF) in ruminant diets

- ✓ Rumination and rumen environment (peNDF)
- ✓ Milk fat (VFA, Rumen pH)
- ✓ Intake (uNDF)
- ✓ Source of Digestible Energy (TTNDFD)



Undigested fiber

Fiber undergoing microbial digestion, (Akin, 1986)

Lactating cow diets normally formulated to contain between 25 and 33% of DM as NDF

- Inadequate NDF may contribute to rumen acidosis and low milk fat
- Too much NDF will restrict feed intake and milk production

Common Forage Fiber Tests and Their Utility

Test	Rumen Fill/intake	TDN Estimation	Diet Formulation	Quality Index
NDF, NDF_{OM} Total fiber	X	X	X	X
$NDFD_{30}$ undigested fiber after 30 h				X/?
TTNDFD Predicted total tract fiber digestion	X	X	X	X
$uNDF_{240}$ Predicted indigestible NDF	X	?		?
RFQ Quality index: NDF and NDF digestibility				X
Milk/ton Quality index: NDF and NDF digestibility		X		X

Nutrient contributions to DE in a corn silage-based diet for high producing dairy cows. NASEM 2021

Diet Component	Intake, kg/d	Intake adjusted digestibility, %	DE, Mcal/d	Percent of total dietary DE, %
NDF	7.5	50.8	16.1	23%**
Starch	6.9	90.1	25.9	37%
FA	0.6	73.0	4.4	6%
rOM	3.1	96.0	8.6	12%
CP	4.0	92.8	16.5	23%
OM	22.0	77.6	70.7	100%

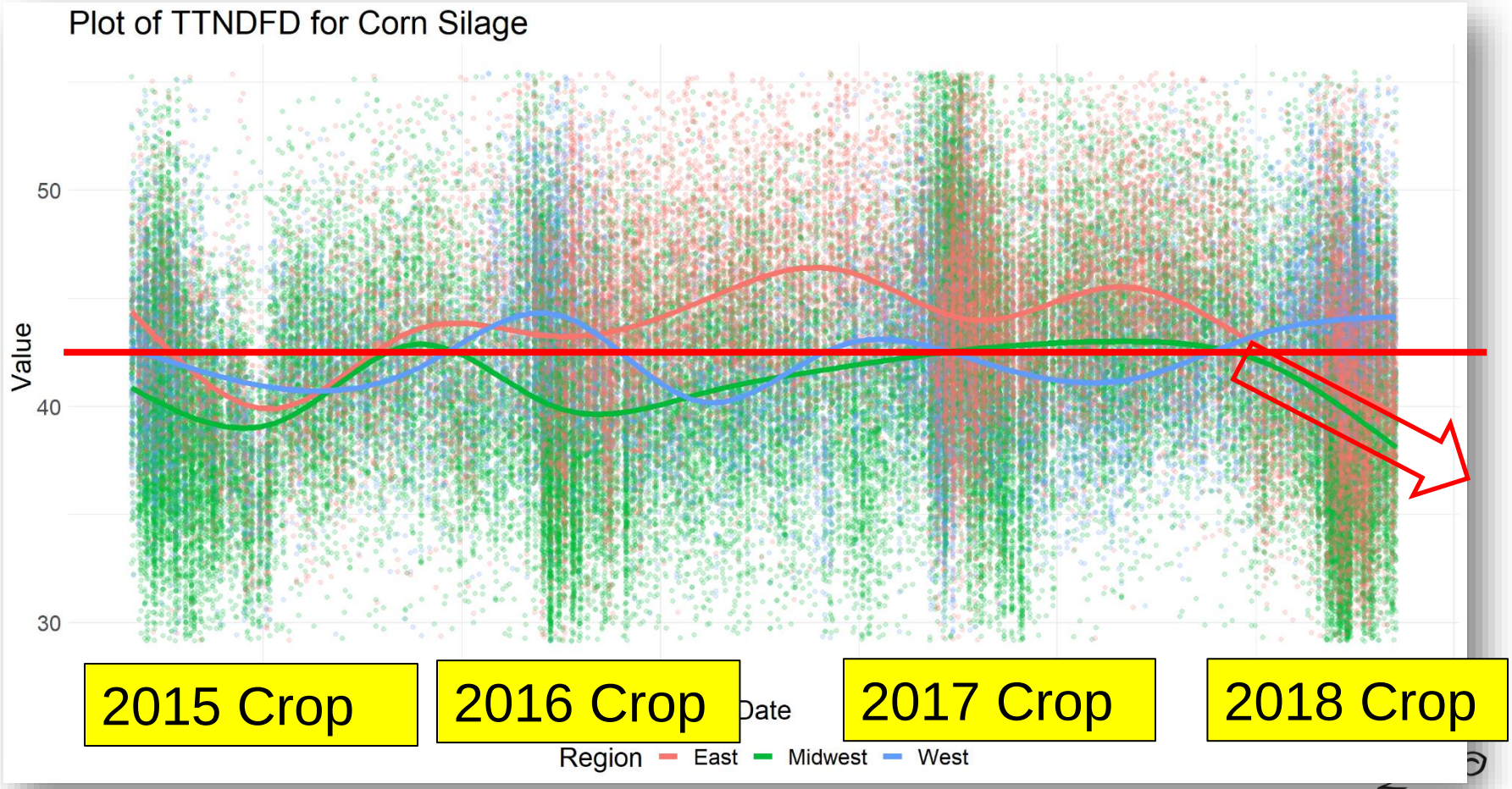
**20-25% of DE for milk production is from digestible NDF!

Fiber digestibility varies in forages

Forage	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 increase milk yield by 0.5 liter

Fiber quality – new school NDFD; **TTNDFD**



Rock River Labs, 2018

Assessing fiber digestion

Poor digestion < 40%

Excellent digestion > 50%

A 2-3 unit change in fiber digestibility corresponds to ½ liter change in milk yield.

First look at a forage: How to assess forage quality from a forage test

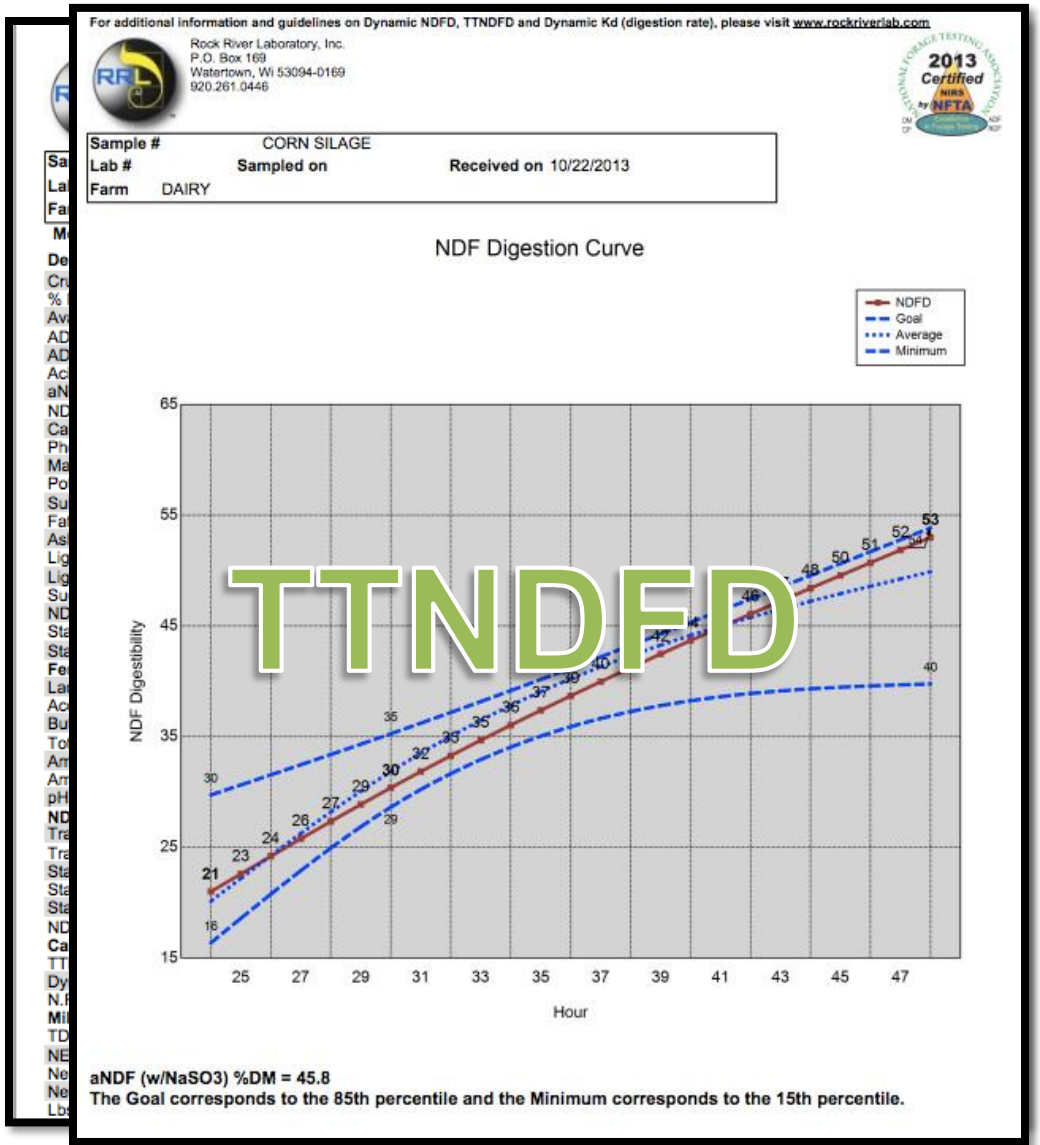
Reading Forage Analyses

- ✓ Dave's Quick List:

1. NDF and Starch
2. Ash Content

- ✓ Evaluate Digestibility

3. TTNDFD
4. StarchD



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Feed Analysis Report

Representative:

2013 Certified Chemistry by NFTA Excellence in Forage Testing

Sample # 1 BK 6 Corn Silage
Lab # 897490 **Sampled on** 12/16/2013 **Received on** 12/19/2013
Farm

Moisture 61.60% **Dry Matter** 38.40%

Description (%DM unless specified)	Dry Matter Basis	60 Day RRL Average
aNDF (w/NaSO3)	39.97%	43.76%
Traditional 48HR	62.30%	62.62%
Traditional 30HR	42.61%	51.08%
Standardized 24HR	12.88%	17.98%
Standardized 30HR	19.31%	27.54%
Standardized 48HR	37.40%	45.57%
NDFD 120HR	68.23%	
Calculations		
TTNDFD	37.10	42.34
Dynamic NDF Kd (using 24,30,48,120 hr)	3.70%/hr	

Low NDF corn silage (good)

BUT- Lower than average fiber digestibility (bad)

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Feed Analysis Report

2013 Certified Chemistry by NFTA — National Forage Testing Association — Excellence in Forage Testing — DM CP ADF NDF

Sample # 1 BK 5 Haylage
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 (w/NaSO3)	42.60%	43.09%
Calculations		
TTNDFD	51.37	44.70
Relative Forage Quality	141	
Dynamic NDF Kd (using 24,30,48,120 hr)	11.53%/hr	
Relative feed value	136	

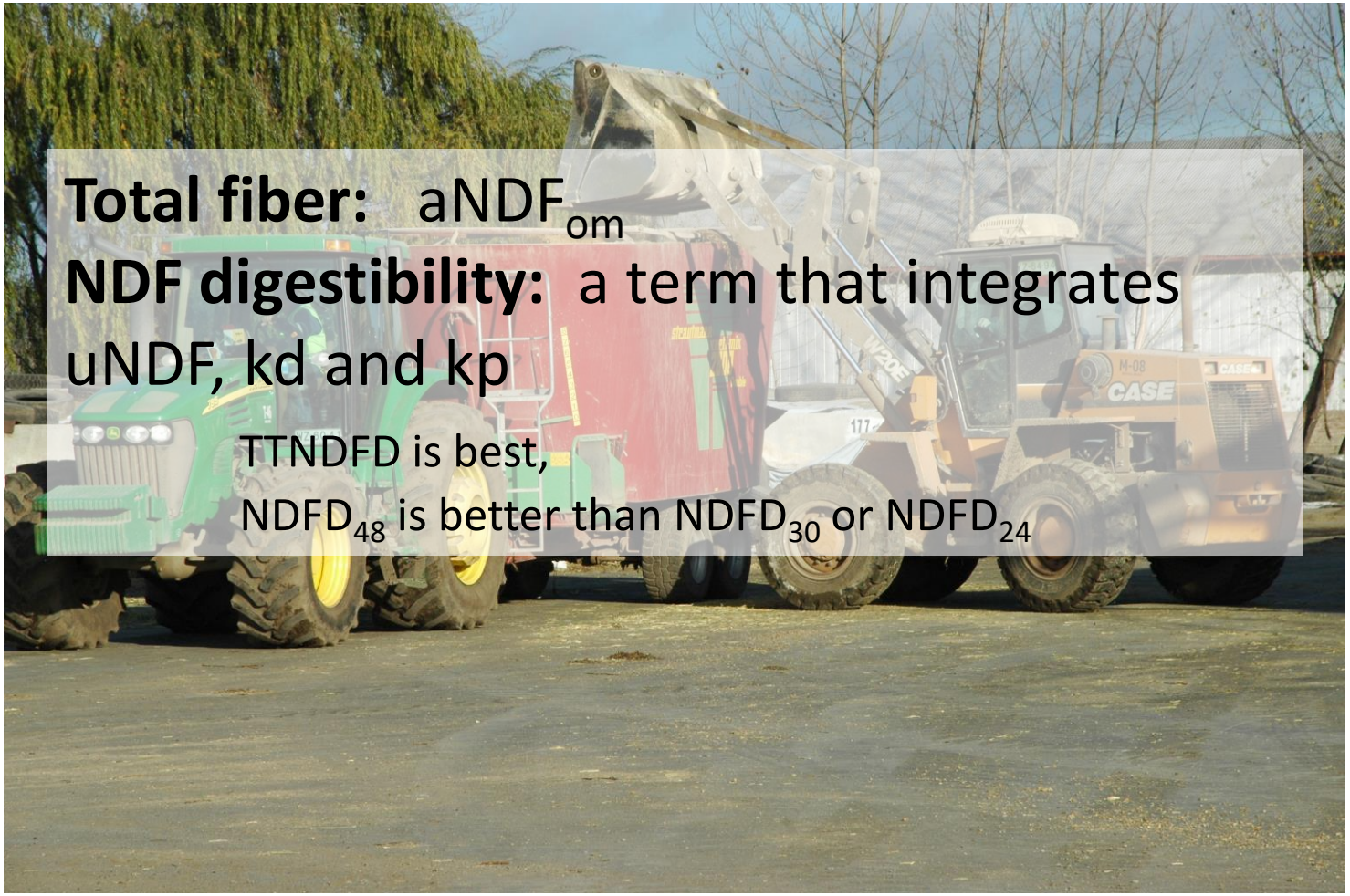
Which is the better Haylage?

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 (w/NaSO3)	42.22%	43.30%
Calculations		
TTNDFD	44.14	44.26
Relative Forage Quality	159	
Dynamic NDF Kd (using 24,30,48,120 hr)	7.72%/hr	
Relative feed value	138	

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 $NDFD_{24}$

THANK YOU!

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