DAIRYLAND
Laboratories, Inc.

Independent laboratory providing extensive testing of Feed, Forage, Soil, Manure and Water.

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By the Numbers

1958
Dairyland Laboratories established

>115
Feed, soil , and water parameters analyzed

>100
Trained chemists, technicians and support personnel

>42
States with Dairyland customers

>20
Countries served

5
Dairyland Laboratories Locations

>28
Partner lab locations worldwide

3
Generations of family-owned, service-oriented enterprise

Lignin, NDFD, uNDF and kd rates of NDF and Starch.

Why are these values important?

- "Laboratory Inputs" for modern day ration balancing programs and forage quality evaluation systems have taken on a new dimension in the last 3 -5 years.

- Today programs use a variety of measurement's for determining important forage characteristic.

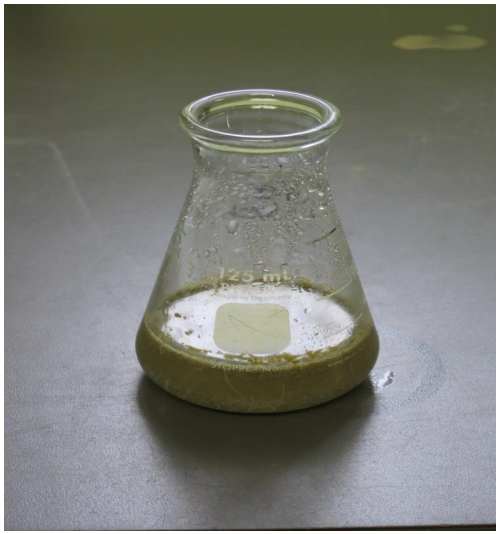
  - Potential Digestible NDF (NDF – uNDF 240hrs.)

  - Rates of Starch & Fiber digestibility (kd rates).

  - Fast and slow pools of fiber digestibility.

Definition of "Digestion in the Laboratory and in the Animal"

"in vitro" or "in situ"



Starch or fiber x kd

Digestibility = (1-exp(-kd x t)

in vivo

Starch or Fiber x kd

Starch or fiber x kp

Digestibility = kd/(kd + kp)

kd = *rate of starch or Fiber digestion*.

kp = *rate of passage out of the rumen*.

Modeling Starch and Fiber (NDF) Digestion

Models (ration programs) use combined digestion and passage rates to calculate digestion:

- Digestion rate determined from in vitro measurements
- Passage rate estimated from inputs:
  - Body weight
  - Milk production
  - DMI

Starch or Fiber x kd

Starch or Fiber x kp

Digestibility = kd/(kd + kp)

kd = *rate of starch or Fiber digestion*.
kp = *rate of passage out of the rumen*.

What is uNDF and how is it related to NDFD and lignin.

uNDF is the undigested NDF residue after fermentation at a given length of time.

Used to calculate NDF digestibility.(NDFD)

uNDF must be accompanied by length of fermentation time i.e. 24, 30, 48,120 or 240hrs.

uNDF 240- is the portion of fiber that is the functional component of fiber in terms of physical effectiveness, gut fill, digestion, and passage rate of forage .

Lower uNDF is better.

uNDF, dNDF and NDFD

Procedure

Determine aNDF of the original sample.

Run .5g (DMwt,g) IV for 48 hours (or anytime point) in rumen fluid and extract residue with NDF solution. This gives you the NDFres.

uNDF – NDFres/original Dry Matter wt.

dNDF = NDF – uNDF

NDFD = 100*dNDF/NDF

Only NDF method with AOAC approval

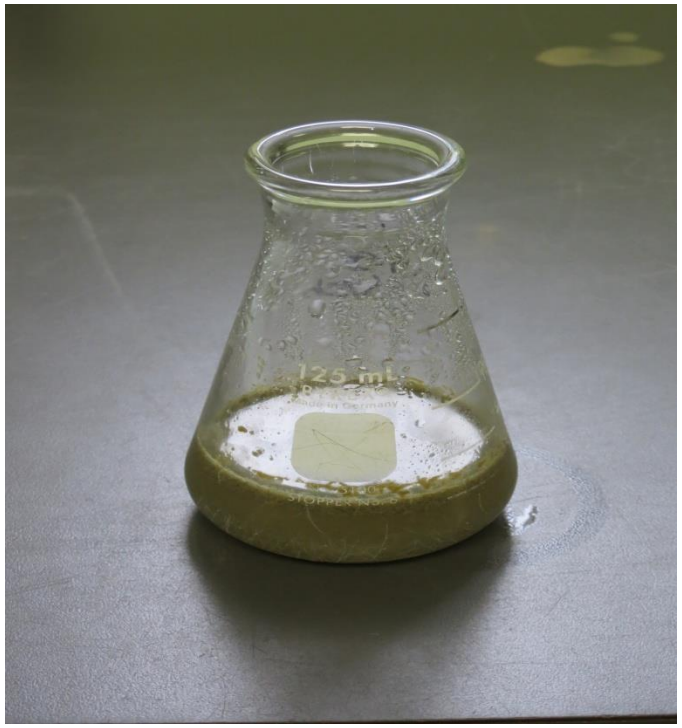
Gooch Crucible

Rumen Collection from minimum of 3 donor animals

Triplicate analysis each sample.

Constant CO2 and Temperature

Incubate for 7,12, 24, 30,48, 120 or 240hrs.



Traditional Goering and Van Soest (GVS)

Only NDF method with AOAC approval

Gooch Crucible

uNDF, dNDF and NDFD Equations

Example:

aNDF = 50%

Sample DMwt = .5 g

Amount of NDF residue = 0.1 g

uNDF = 0.1g/.5g = 20%

dNDF = 50 – 20 = 30%

NDFD = 100(30/50) = 60% NDF*

Undigestible NDF 240

uNDF240 : the amount of NDF that no matter how the diet is formulated, nor the milk production of the cow, this portion of NDF will not be digested by rumen microbes.

Potentially Digestible NDF (PDNDF)= NDF – undigestible NDF 240 (uNDF240).

uNDF obtained by two procedures:

1 Measure lignin and multiply by 2.4 = uNDF

2) Measure uNDF directly using Invitro 240 hrs.

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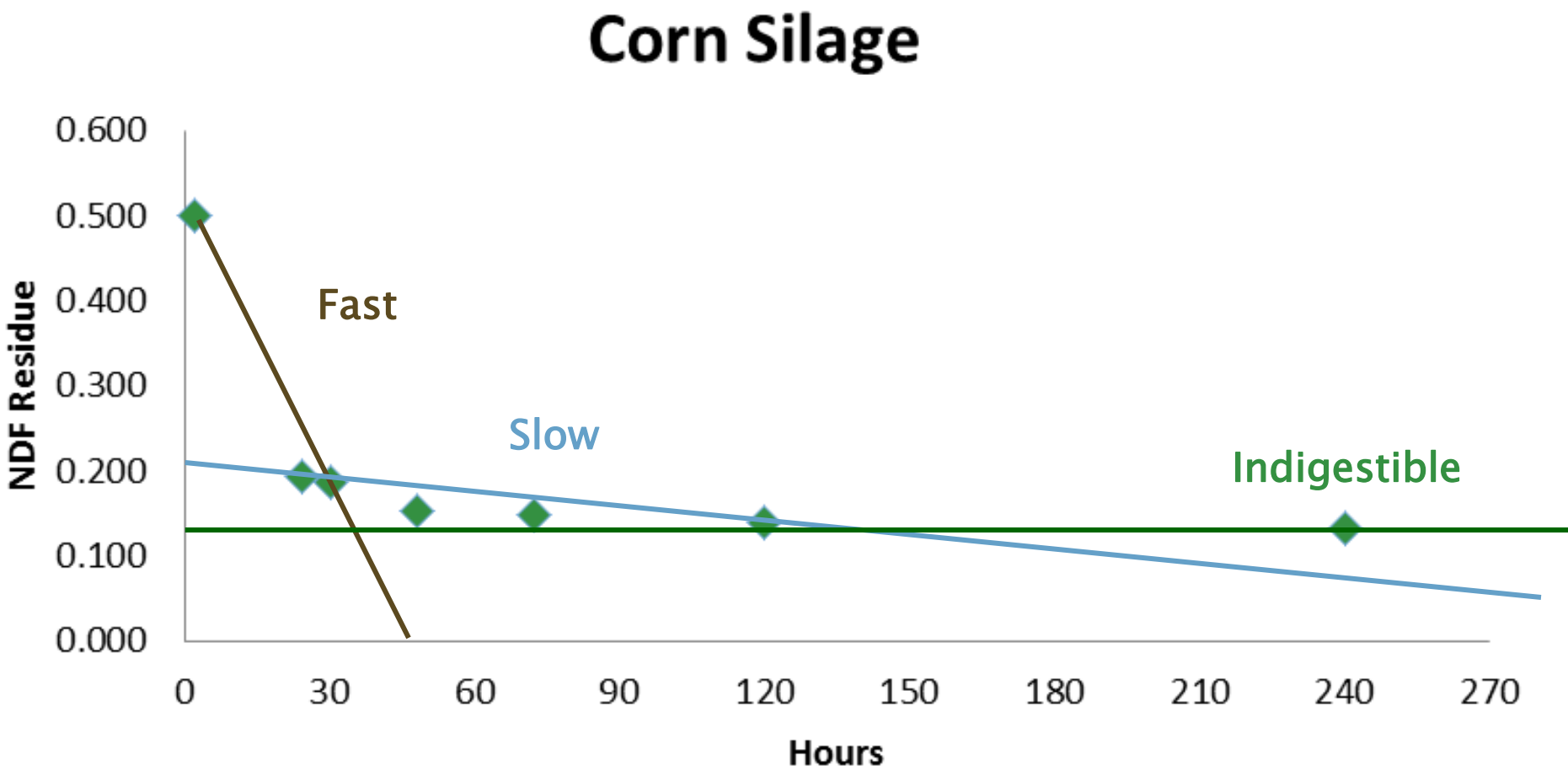
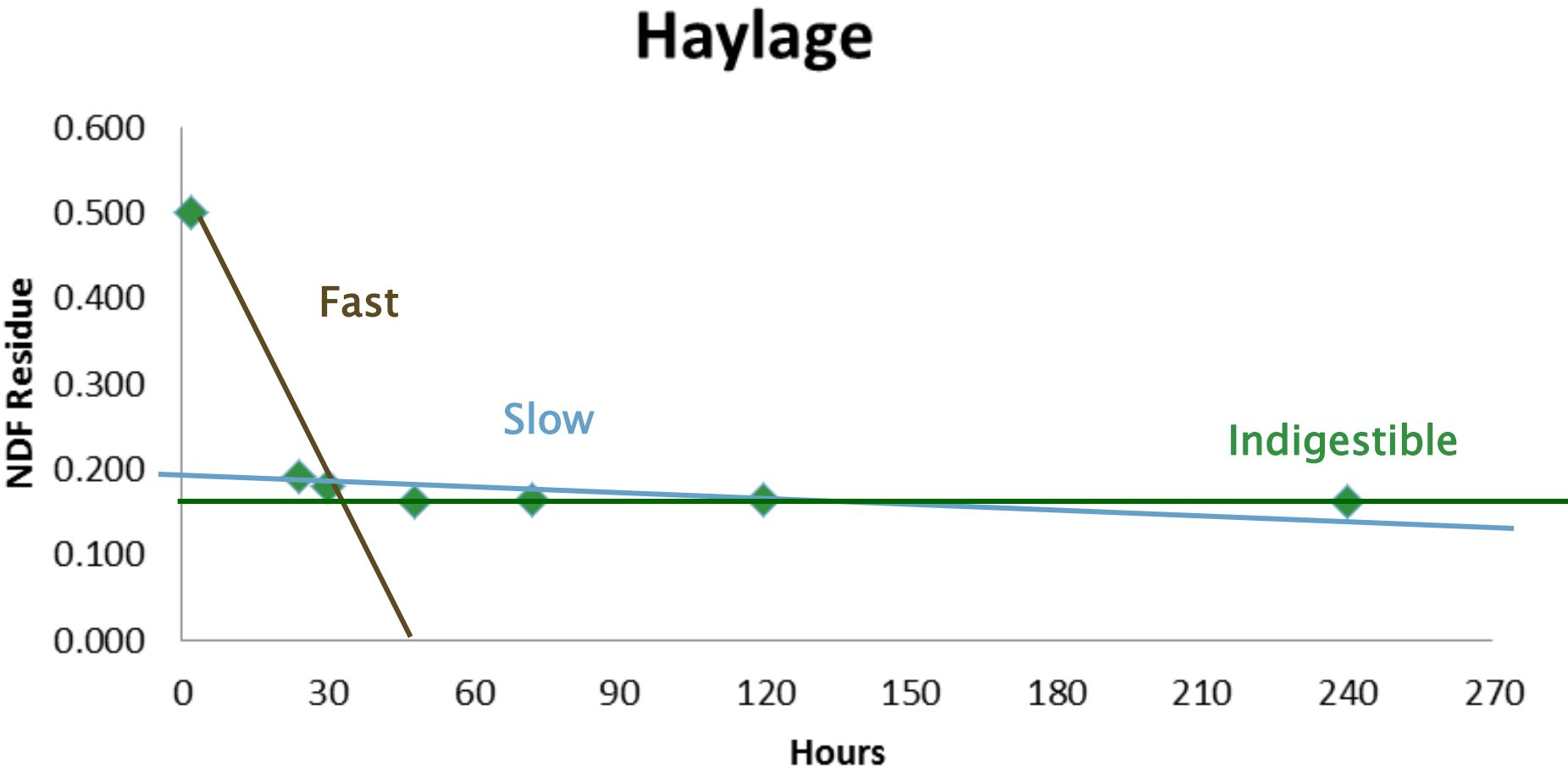
Fast/Slow/Indigestible

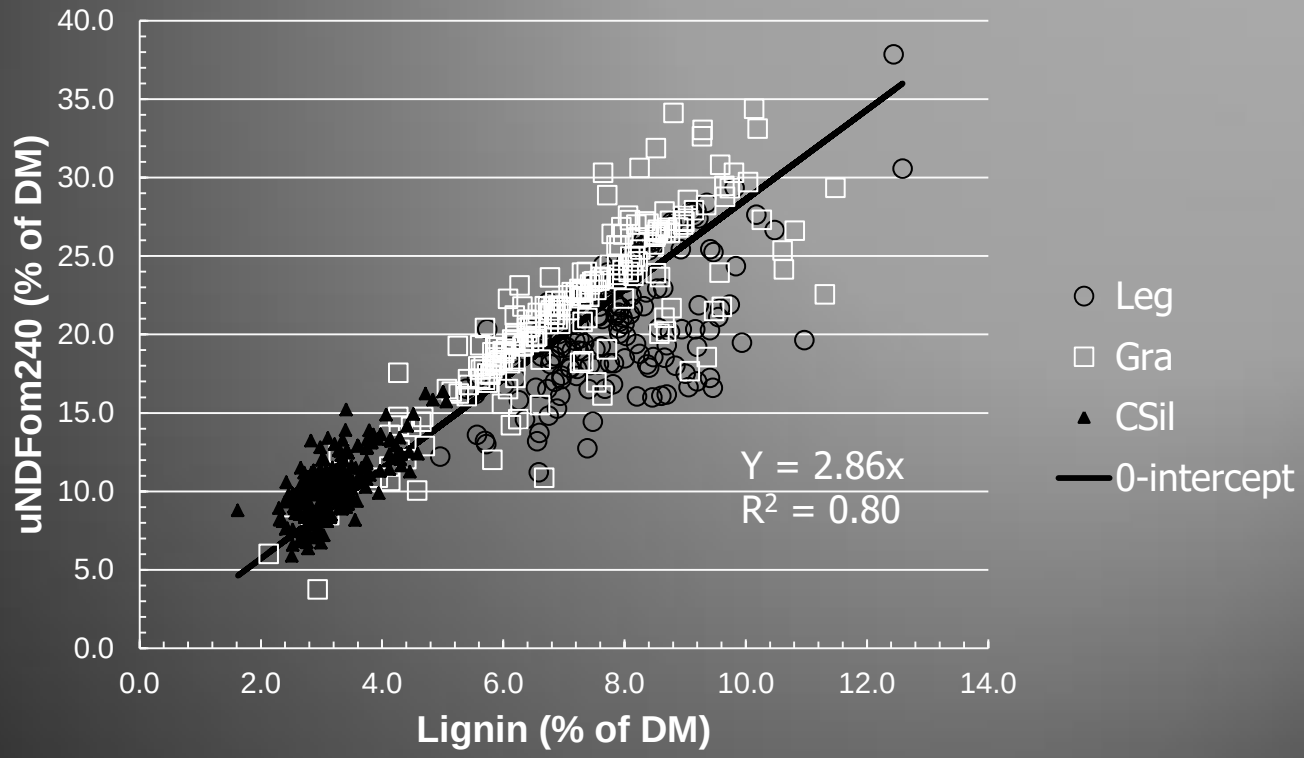


Fast/Slow/Indigestible



Relationship of Lignin and uNDF

(2015 Minn Nutr Conf). Data from Dairyland Laboratories Inc.



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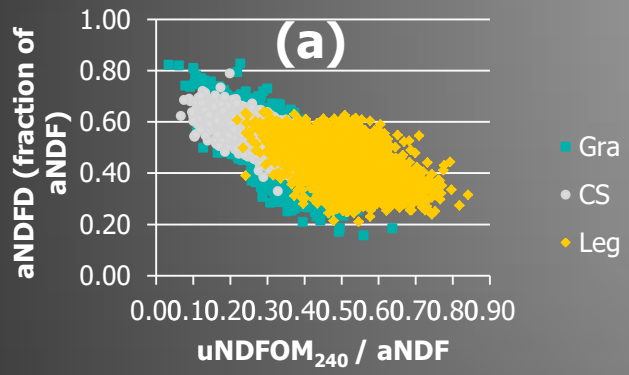
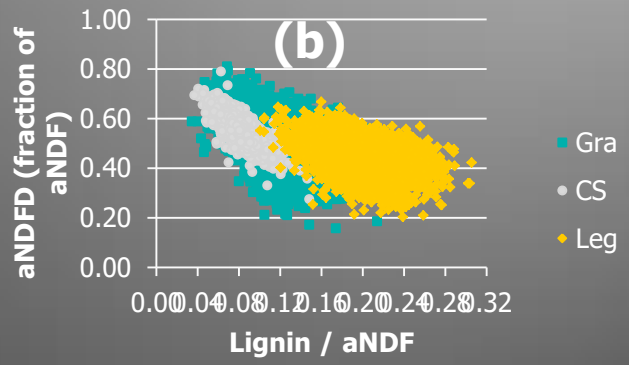
Using uNDF to Improve Dairy Nutrition

(2015 Minn Nutr Conf) Data provided by Dairyland Laboratories, Inc.



uNDF is a better indicator of feed quality than NDFD or lignin

$uNDFOM_{240}$ is more consistent among feeds and explains 70% of variation in $NDFD_{30}$



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Why uNDF240

- Is a uniform fraction across feedstuffs.
- The chemistry procedure has more range.
- The chemistry is more repeatable than lignin.

Analysis	Lignin	uNDF240
Range	1.7–10.2	8.4–34.0
Units of Range	8.5	25.6

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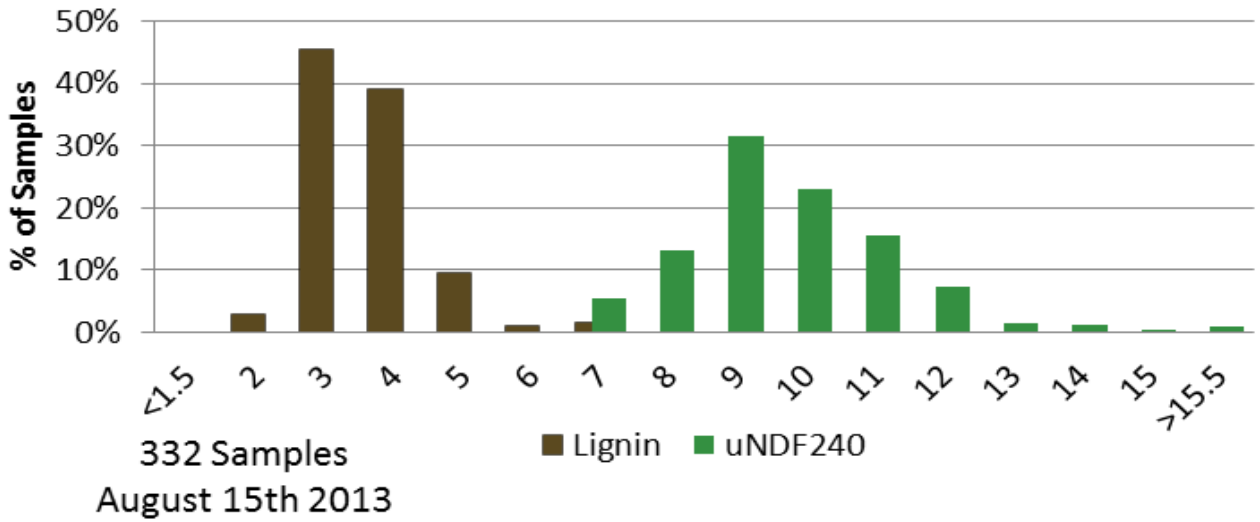
Corn Silage Lignin and uNDF240
% DM



332 Samples
August 15th 2013

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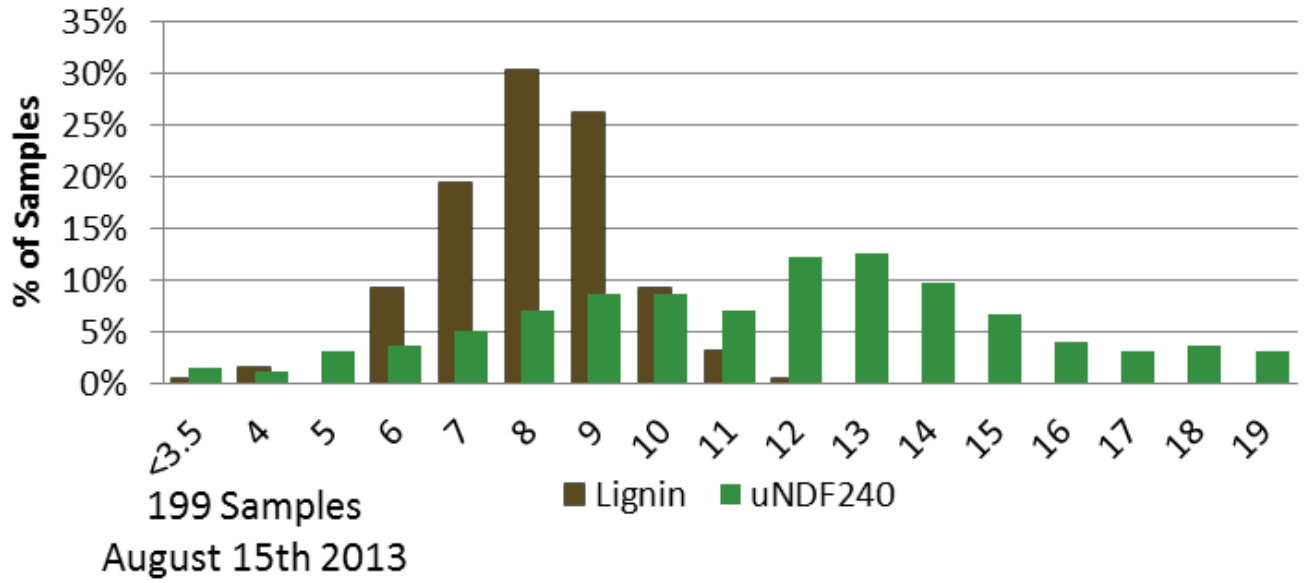
Haylage Lignin and uNDF240
% DM



199 Samples
August 15th 2013

Summary

- uNDF, NDFD and Lignin measurements are correlated.
- kd rates of Fiber and Starch are used in some models and ration balancing programs.
- ***uNDF 240hr***. is used as a replacement for lignin in ration balancing models.
- ***uNDF 240hr***. is a "very good" NIR calibration.
- ***uNDF 240hr***. is a better measure than lignin for determining the fiber digestibility of 'reduced" lignin alfalfa.

DL In Vitro/Insitu/Gas Production Systems for digestion measurements

2000 –Ankom system

2002 – Converted to GVS method using Water baths and crucible method
1 water bath – 72 flasks.

2006 – Moved from commercial dairy to our own facilities.

2010 – 2nd water bath – 144 flasks

2011 – 3rd water bath – 216 flasks

2012 – 4th & 5th water baths – 360 flasks

2013 – warm room – total capacity > 1,000 flasks

Warm room.

- Long term incubations
- Gas Productions

2 Pens of Fistulated Dairy animals.(8 total).

1) High Starch Diet
2) High Fiber Diet.

Located next to New Digestion Laboratory

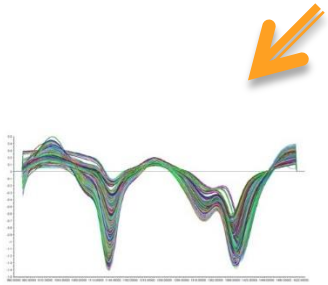
February 2016

New 3500 square ft. building.
Dedicated for Digestion analysis.

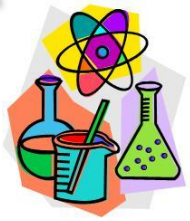
- In vitro
- In situ,
- Gas Production

NIR Calibration

Minimum of 500 specifically selected samples



Spectra



Wet Chemistry

NIR Calibration

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North America NIR Network.

Master NIR

Arcadia, WI.

St. Cloud, MN, Stratford & Depere, WI

❖ Jerome ID (June 2017)

❖ Litchfield MI

❖ Leola Pa

❖ Calgary Alberta Canada

❖ London Ontario, Canada

Salida CA

Stratford Ontario Canada

Guelph Ontario Canada

Hastings NE

Amarillo TX

Des Moines, IA

Paris TX

❖ Laboratory provides complete Dairyland NIR Programs.

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International NIR Network

South Africa (2)

India

Australia

Germany

New Zealand

France

Italy (3)

Hungary (2)

China(2)

1 Reference Chemistry Lab. 28 + NIR Laboratories

Thank you.