UVM

16 March 2021

Quality Forage

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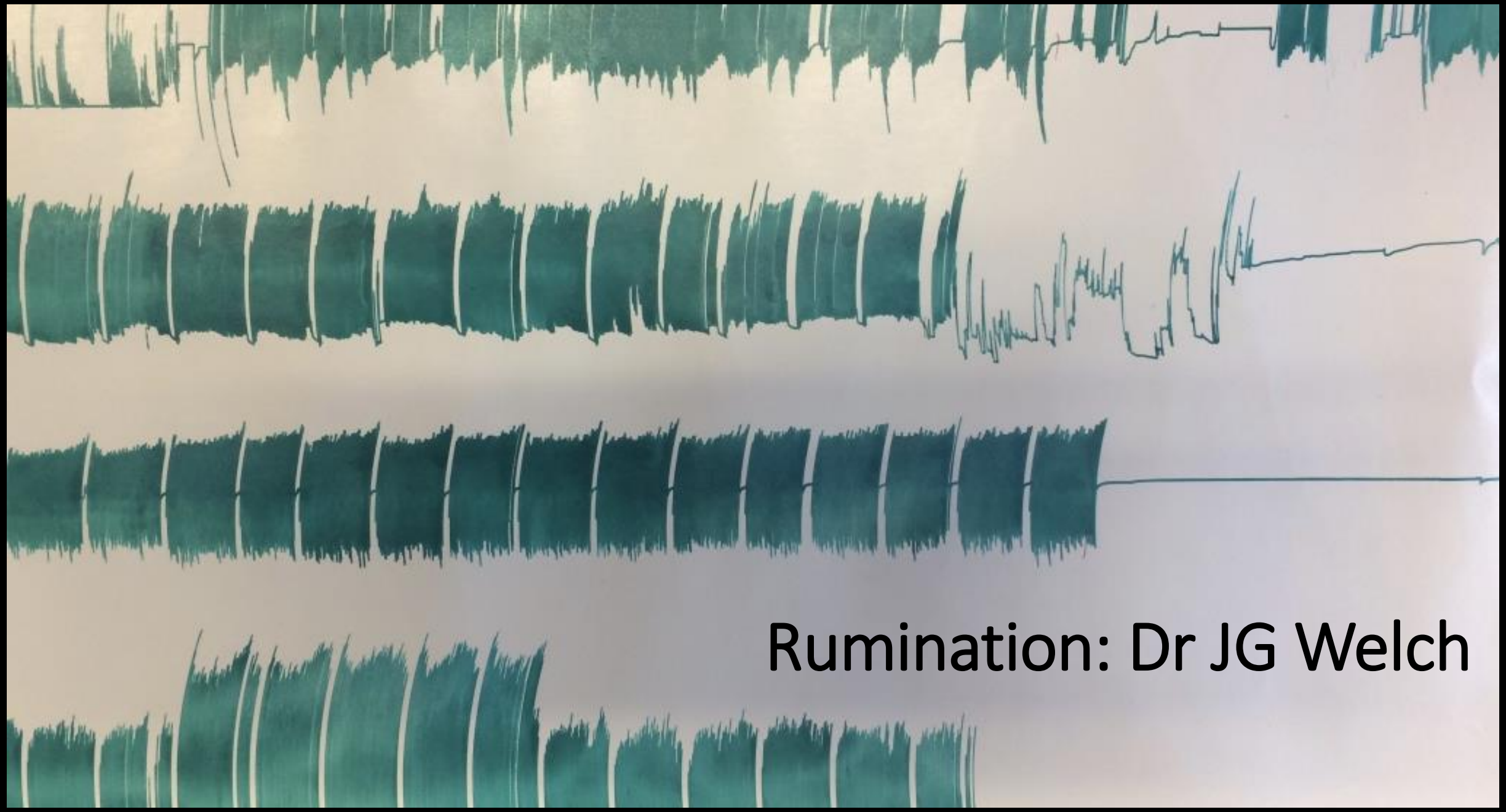
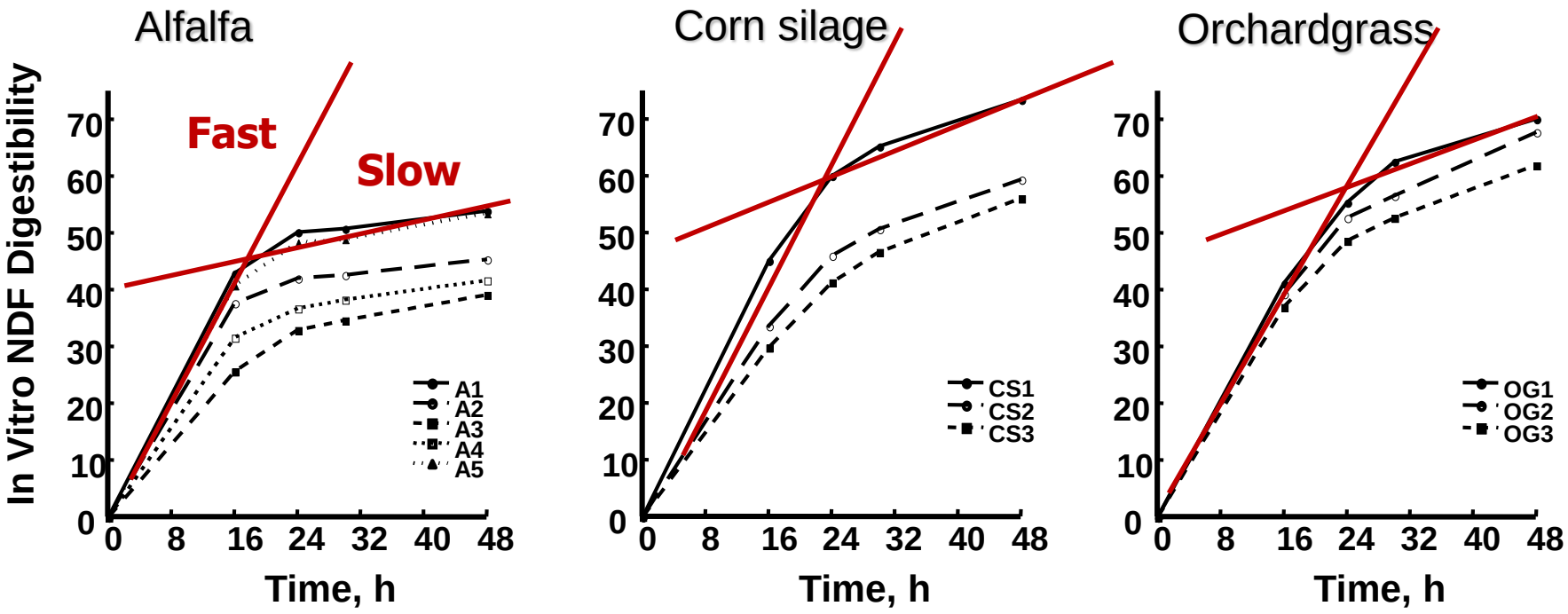
Forage Quality

Nutrition or Management

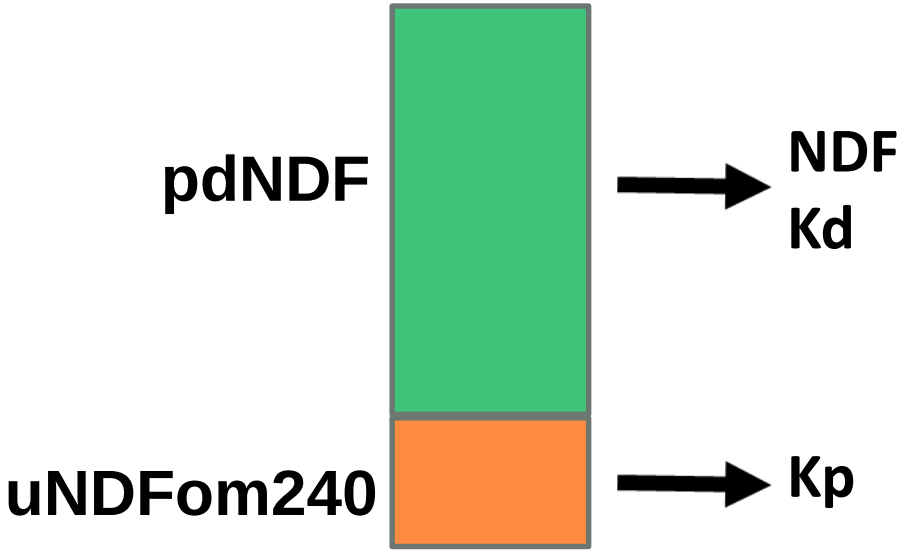

Rumination: Dr JG Welch

Fast and slow NDF exists in all forage types (Allen, 2005, unpublished)



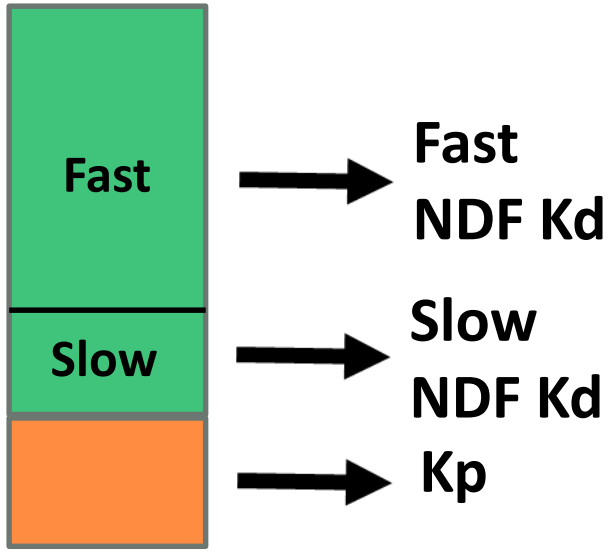
Slide courtesy of Dr. Mike Allen

Improved Model of NDF Digestion and Passage



2-Pool Model

(Waldo et al., 1972)



Better reflects reality!

3-Pool Model

(Fiber Group)

NDS Alfalfa Silage

Nutrient data entry | Constants calculation | Info | Cloning | User lists

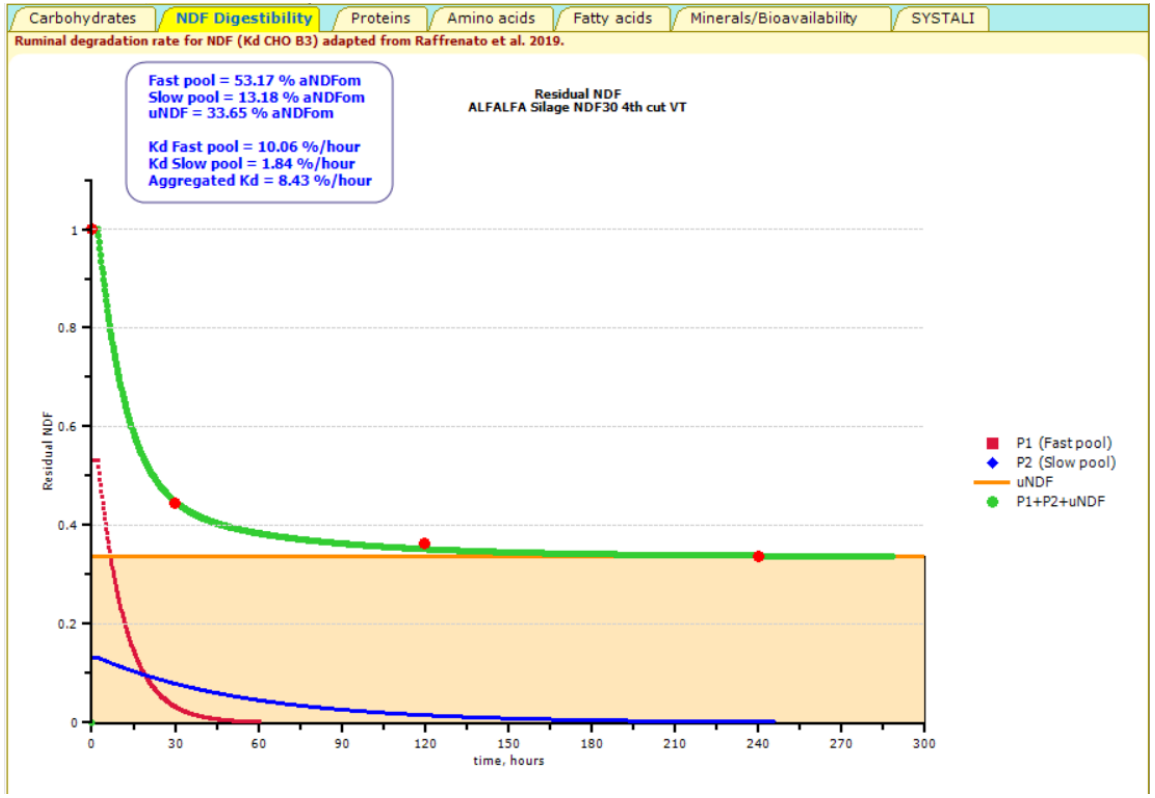
Carbohydrates | NDF Digestibility | Proteins | Amino

aNDFom % DM 30.00

ADL % DM 4.03 13.42 % NDF

NDFD | aNDFom pools

Hours	NDF Digestibility	ND residues
6		
12		
24		
30	55.500	0.4450
48		
72		
96		
120	63.750	0.3625
240	66.350	0.3365



NDS: Grass Pasture

Nutrient data entry | Constants calculation | Info | Cloning | User lists

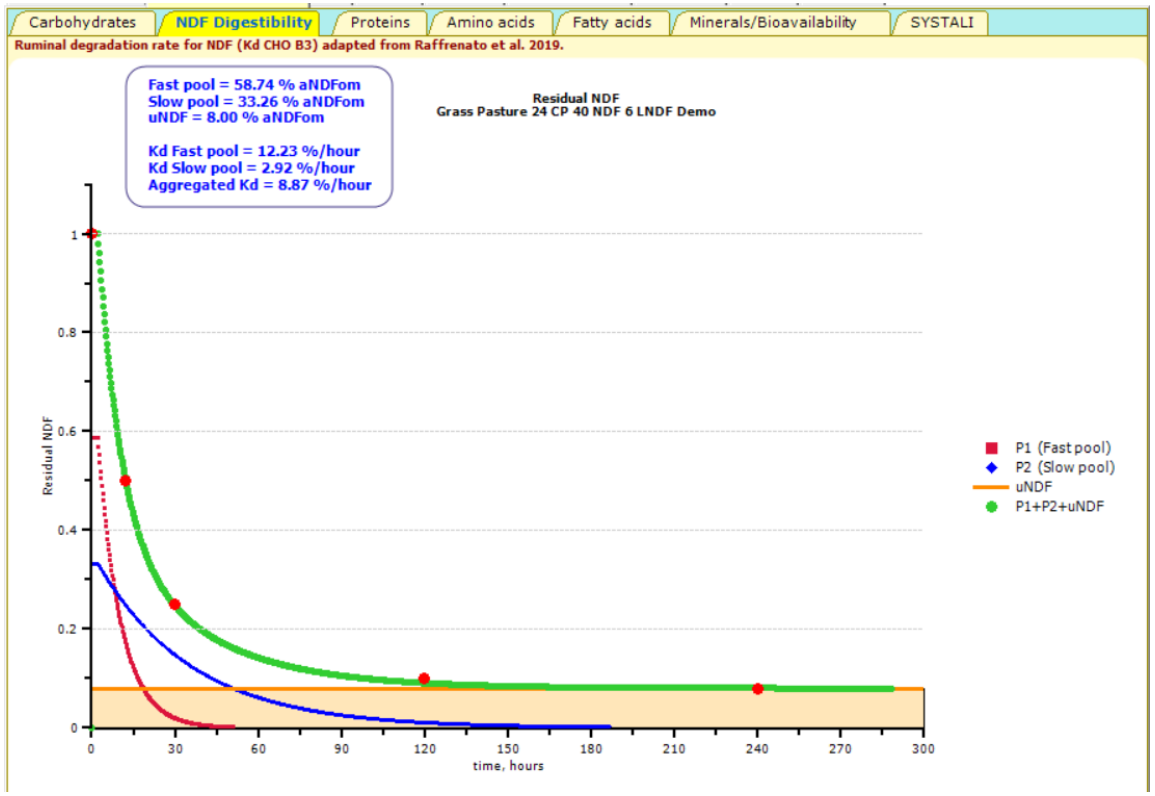
Carbohydrates | NDF Digestibility | Proteins | Amino

aNDFom % DM 36.00

ADL % DM 3.00 8.32 % NDF

NDFD aNDFom pools

Hours	NDF Digestibility	ND residues
6		
12	50.000	0.5000
24		
30	75.000	0.2500
48		
72		
96		
120	90.000	0.1000
240	92.000	0.0800



What influences uNDF profile; (NDF digestibility)?

Maturity

- Lignin

Environment

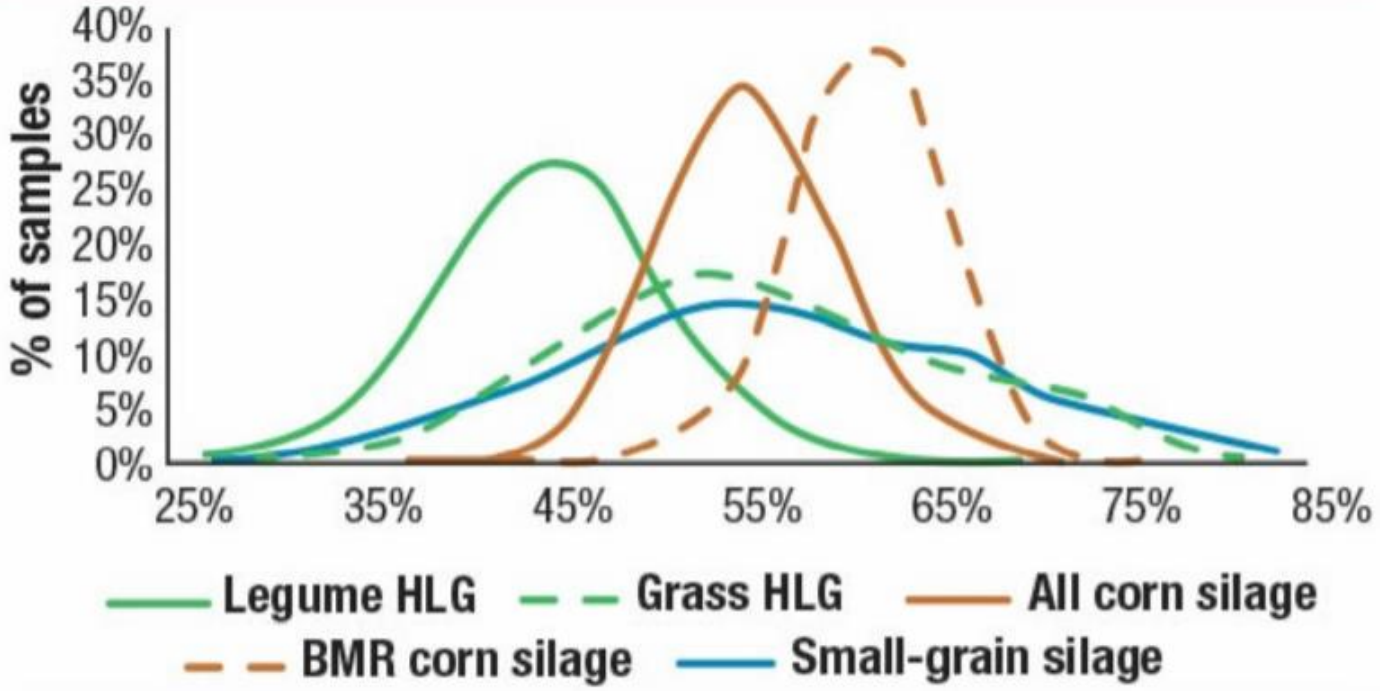
- Hot vs Cool
- Wet vs Dry
- Hot and Wet: ↓Digestiblity/↑uNDF

Genetics

- Grass v Legume
- C3 v C4

Spoilage: disease, frost…

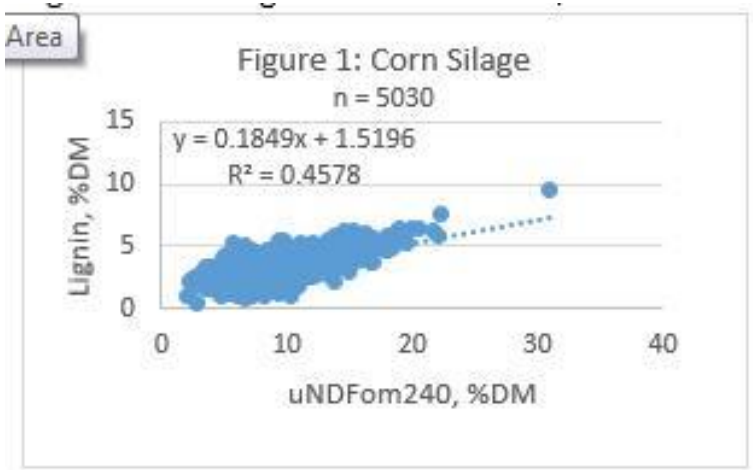
FIGURE 1 NDFD30 across five forages

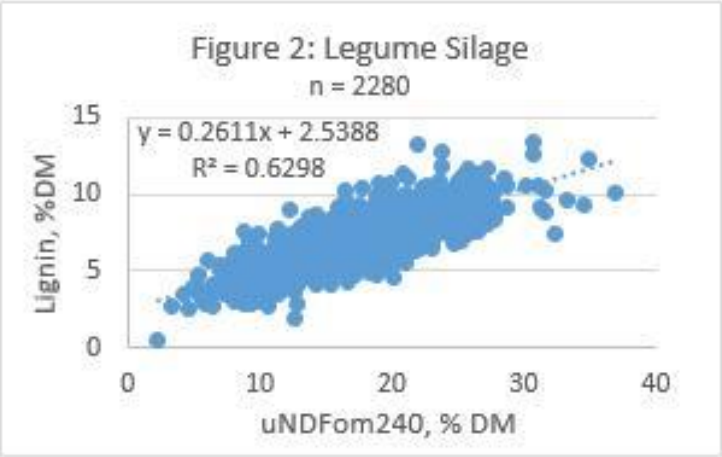


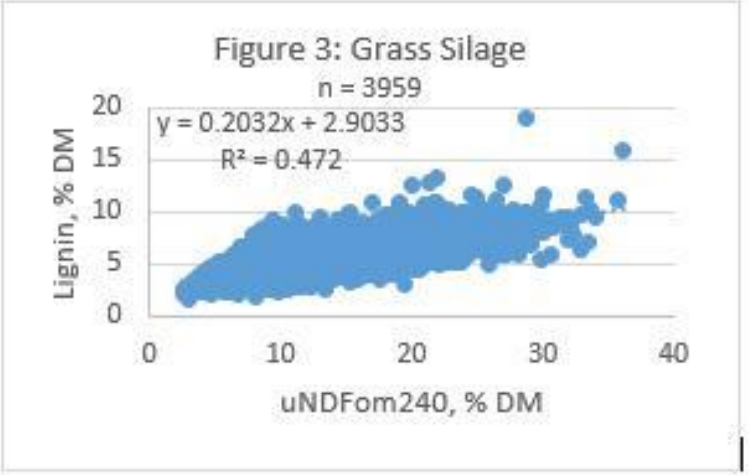
140,964 samples – 2016 crop year.

Legume haylages, also known as alfalfa haylages, had an average digestibility around 45 percent. All corn silages, with brown midrib (BMR) included, averaged around 55 percent. Furthermore, grass haylages averaged around 54 percent digestibility along with cereal grain silages averaging around 56 percent.

Variation in lignin and $uNDF_{240}$







Dairy One, April 2016 newsletter, S. Flis

Importance of rumen digestion: corn silage NDF (47-h in situ)

Grass silage NDF
(47-h in situ)

Wheat straw NDF residue

(47-h in situ)

19
22
25
28
4
7
10
13

Microbial degradation

- Opening of cells
- Bleaching of chlorophylls and pigments
- Fraying of fiber strands
- Size reduction?
- Decreased bouyancy

How Much Forage (NDF) Can a Cow Eat? Traditional values

(1600 lb cow with DMI of 64 lb or 4.0% of BW; diet contains 30% NDF)

- **NDF intake: 1.1 to 1.2% of body weight**
  - 64 lb x 30% NDF = 19.2 lb NDF
  - 29 kg x 30% NDF = 8.7 kg NDF

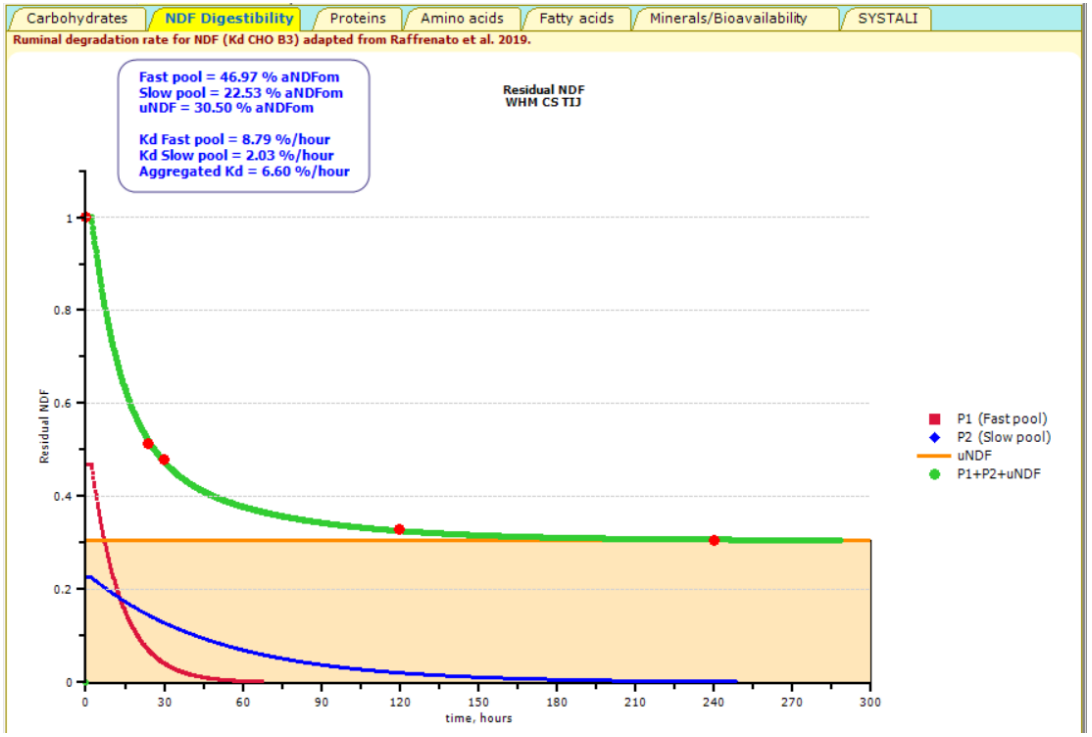
- **Forage NDF (fNDF) intake: minimum of 75% of NDF intake or 0.9% of body weight**
  - 19.2 lb NDF x 75% = 14.4 lb
  - 1600 lb x 0.9% = 14.4 lb

- **Appropriate for highly digestible NDF? (aNDFom)**

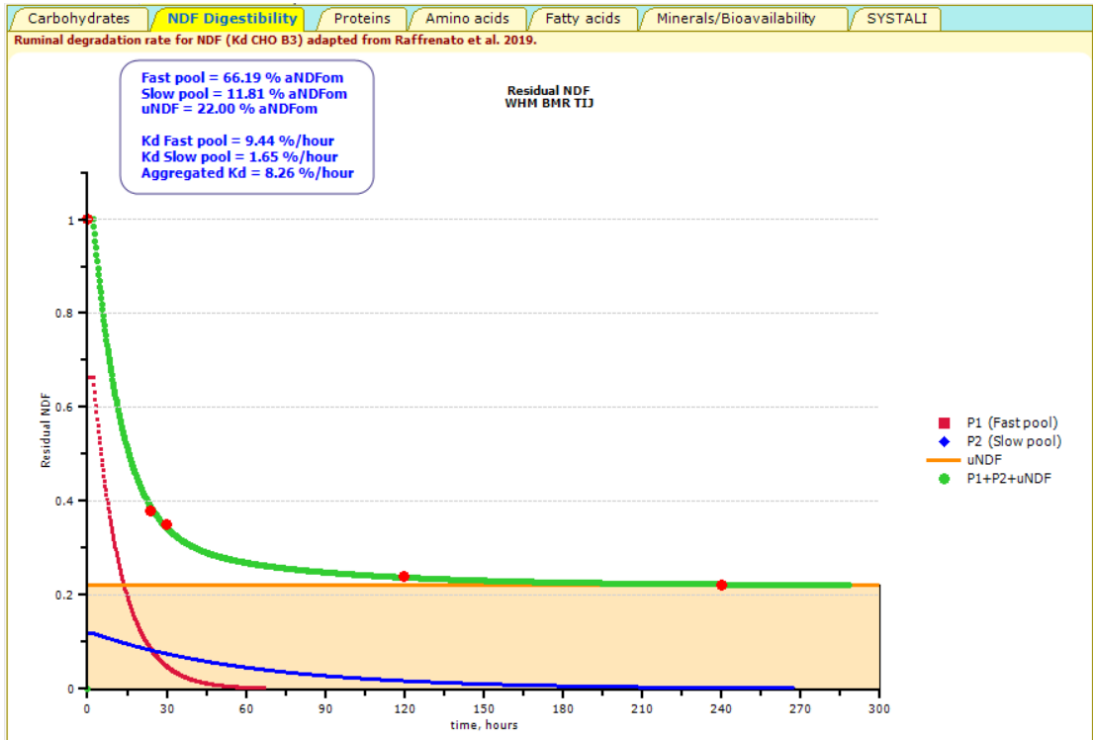
Mertens, 2007

WH Miner 2011: uNDF profiles of CS

Conventional CS



BMR CS



WH Miner 2011: TMR

		Low CS	High CS	Low BMR	High BMR
Forage	%	52.6	68.3	49.5	63.6
aNDFom	%DM	32.4	35.9	31.5	35.6
24h aNDFd	% aNDFom	56.3	54.0	62.0	60.3
uNDFom24	%DM	14.2	16.5	12.0	14.1
uNDFom240	%DM	8.3	10.2	7.1	8.0
Forage NDF (PT post trial)	% DM	20.3	26.0	18.7	23.7
Forage aNDFom (PT)	%aNDFom	70.1	79.0	66.0	74.6

WH Miner 2011: TMR

CS grain $323 BMR grain $316 Milk Component $

		Low CS	High CS	Low BMR	High BMR
DMI	lb	63.8	58.3	64.5	64.2
Milk	lb	103.4	94.8	106.9	103.8
ECM	lb	108.9	101.0	111.8	110.2
aNDFom intake	%BW	1.31	1.33	1.30	1.43
Cost/Cow, total	$	7.22	6.21	7.44	7.08
Cost/Cow, purchased	$	4.71	3.30	4.90	3.88
Income Over Total Cost	$	10.11	9.56	10.52	10.42

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Equal milk but from forage NDF

WH Miner 2011: TMR

HOW MUCH MORE CS WILL THEY EAT?

		Low CS	High CS	Low BMR	High BMR
DMI	lb	63.8	58.3	64.5	64.2
CS/BMR intake	DM lb/d	25.1	32.1	23.3	32.3
@35% DM	AF lb/d	71.7	91.8	66.6	92.4
	T/cow/yr	13.1	16.8	12.2	16.9

WH Miner 2011: TMR

CS grain $323 BMR grain $316 Milk Component $

		Low CS	High CS	Low BMR	High BMR	
DMI	lb	63.8	58.3	64.5	64.2	
CS/BMR intake	DM lb/d	25.1	32.1	23.3	32.3	
@35% DM	AF lb/d	71.7	91.8	66.6	92.4	
	T/cow/yr	13.1	16.8	12.2	16.9	30% more

WH Miner 2011: TMR

CS grain $323 BMR grain $316 Milk Component $

		Low CS	High CS	Low BMR	High BMR
DMI	lb	63.8	58.3	64.5	64.2
CS/BMR intake	DM lb/d	25.1	32.1	23.3	32.3
@35% DM	AF lb/d	71.7	91.8	66.6	92.4
	T/cow/yr	13.1	16.8	12.2	16.9

30% more

High Cows respond best to high NDFD forage

Don't need to feed everybody! 15% More

NDS Rumen Fill: “Fast NDF” = NDF – uNDF30

		Low CS	High CS	Low BMR	High BMR
BW	lb	1487	1480	1480	1480
NDF intake	lb	18.5	19.4	18.3	20.7
uNDF30 intake	lb	5.9	7.0	4.4	5.5
“Fast NDF”	lb	12.6	12.4	13.9	15.2
“Fast NDF”	%BW	0.85	0.84	0.94	1.03
Forage NDF intake	%BW	0.87	1.03	0.82	1.03

More Fast NDF: Take home messages

- Management
  - Timely Harvest at optimal maturity; NDFD
  - Weather window
  - People & Equipment
  - Storage Space: segregation
  - Preservation:
    - pack density >50 lbs cu ft
    - preserve
- Forage Species/Genetics
  - Legume vs Grass/CS vs SGS vs BM varieties
  - C3 v C4
- Double Cropping

High Forage: Benefits

Chase ADN 2012: 2004-2005 16 Farm Survey

- **Improved milk components**
- **Improved $IOFC**
- **Less metabolic disorders, less acidosis**
- **Less foot problems**
- **Longer cow longevity**
- **Less purchased grain**
- **Lower Vet costs: preg and routine health checks**

Thank you

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