BMR Corn Silage: Facts, Fiction and Real World Experience

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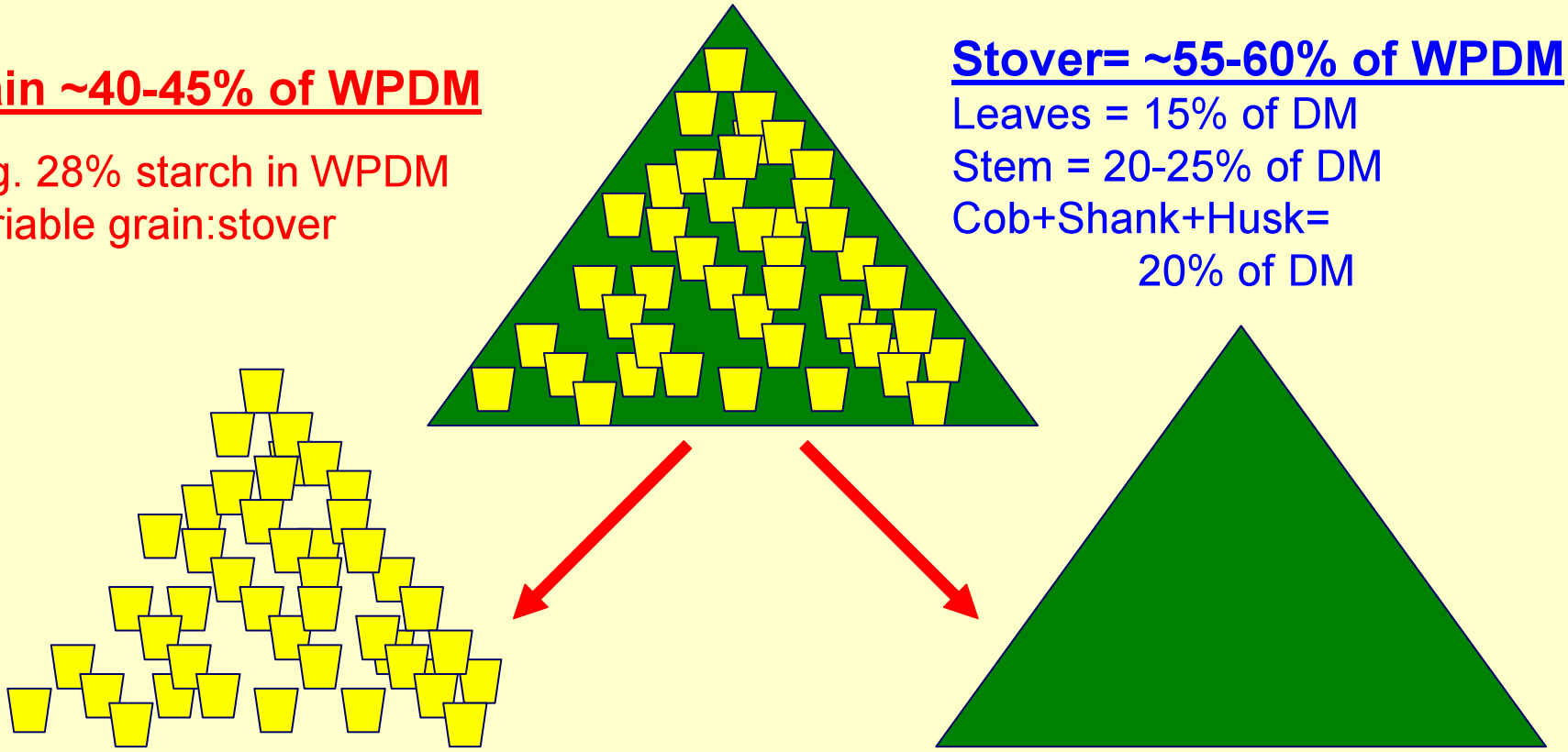
Definition of a High Quality Forage/Silage

- High in nutrients (e.g. energy, CP, etc.)
- Nutrients must be digestible by the rumen microbes and/or cow
- Should have good effective fiber that encourages chewing

Whole-Plant Corn Silage

Grain ~40-45% of WPDM

- Avg. 28% starch in WPDM
- Variable grain:stover



Stover= ~55-60% of WPDM

Leaves = 15% of DM
Stem = 20-25% of DM
Cob+Shank+Husk=
20% of DM

80 to 98% starch digestibility

- Kernel maturity
- Kernel particle size
- Endosperm properties

40 to 70% IVNDFD

- Lignin/NDF
- Hybrid
- Maturity

Shaver et al., 2006

Keys to High Quality Corn Silage

- Good yield and plant health
- High NDF-D
- High starch -D

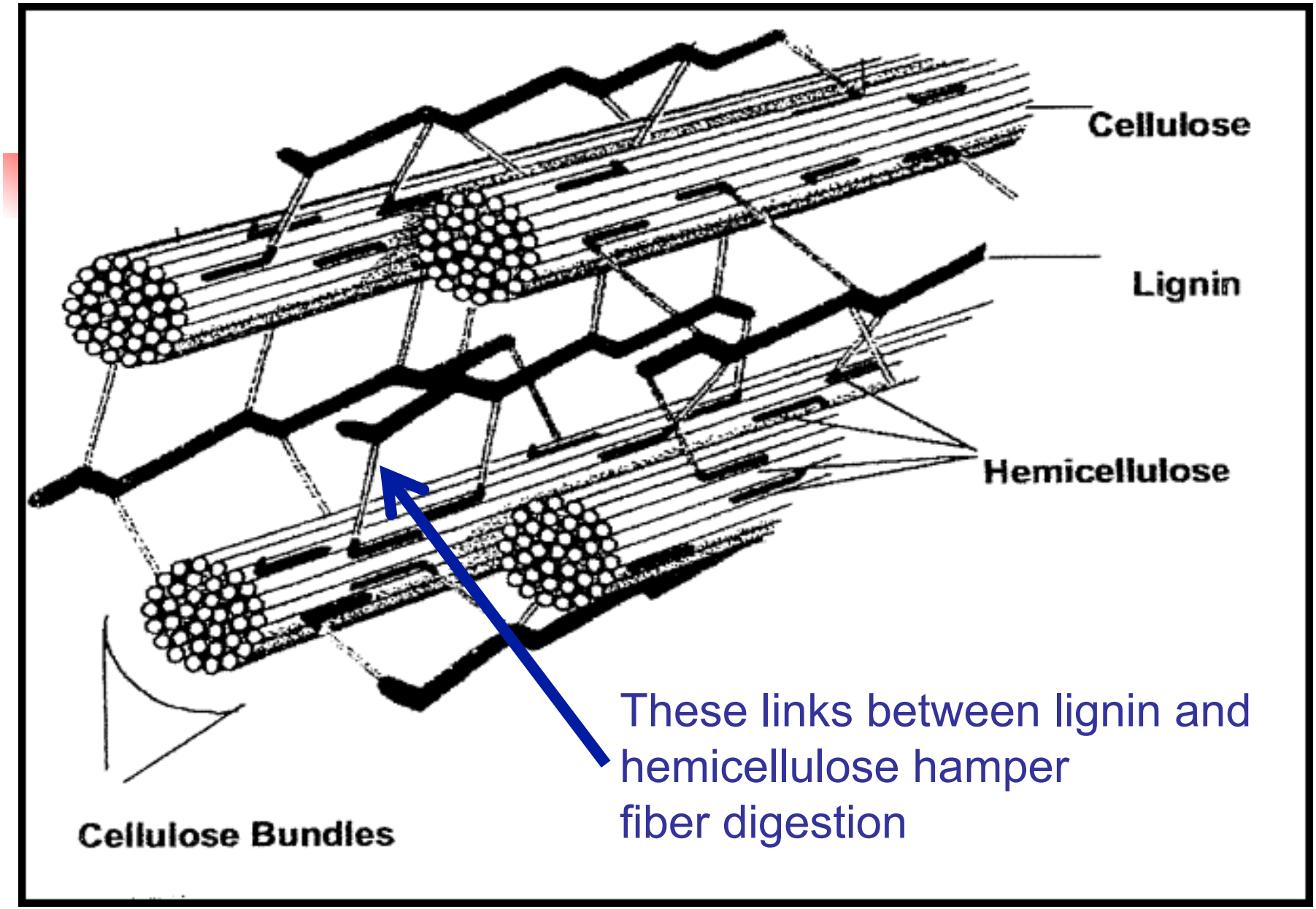
Factors Affecting Fiber Digestion

- Maturity
- Plant species/Genetics

lignin content

- Particle size-
  - Heat damage (interaction with protein/ moisture)

Every increase 1 unit increase in NDF-D =
~ 0.4 lb DM intake and about 0.5 lb/milk

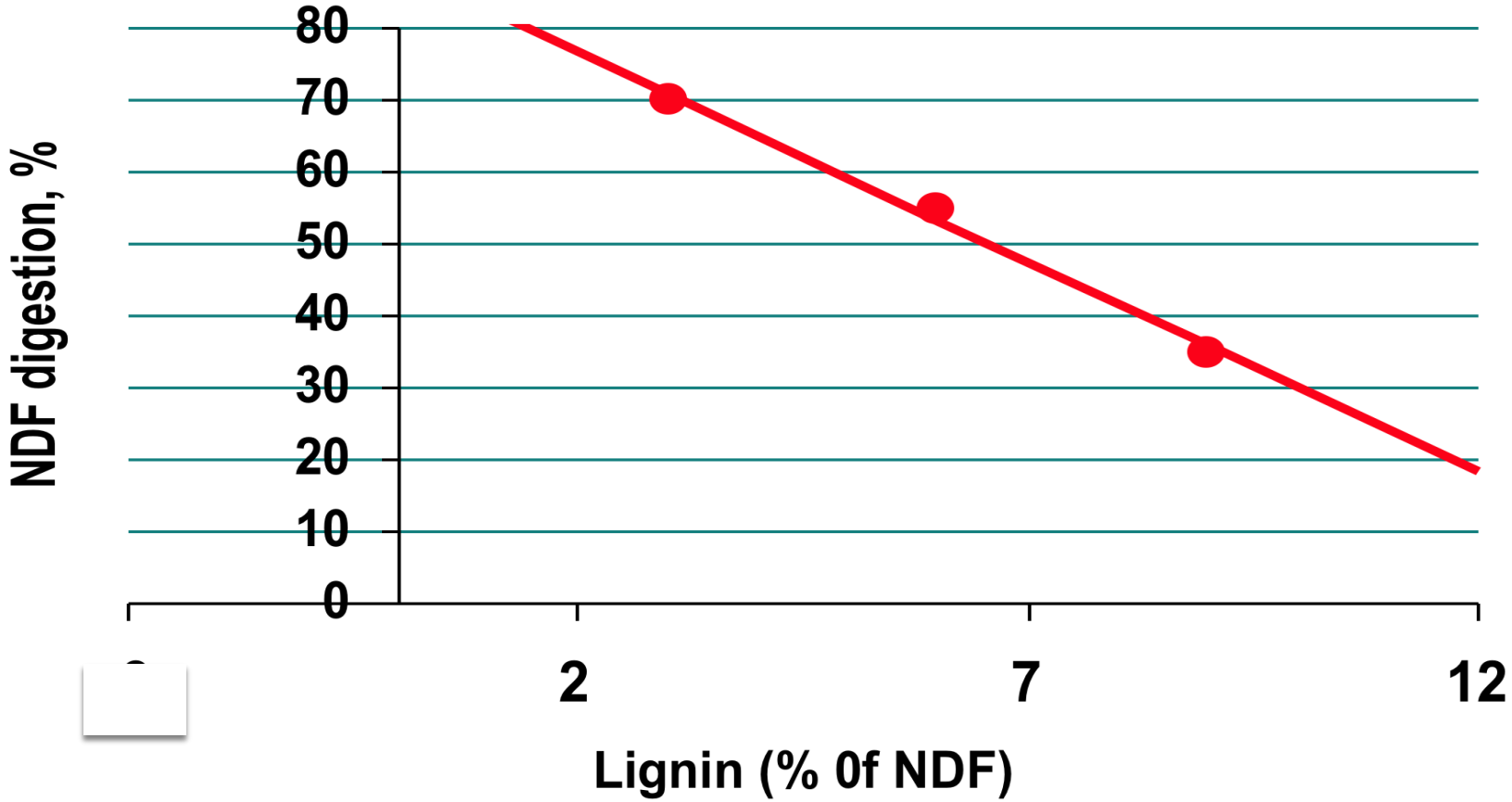

Cellulose
Lignin
Hemicellulose
These links between lignin and hemicellulose hamper fiber digestion
Cellulose Bundles

Lignin – "intracellular linking cement"

- provides mechanical support, strengthens cells walls
- facilitates water movement because lignin is hydrophobic, prevents cell wall collapse during dehydration
- Provides resistance to insects, disease, etc.

Lignin Content is Negatively Associated with Fiber Digestion (within species)

(Jung and Allen. J. Anim. Sci. 1995 73:2774-2790.)



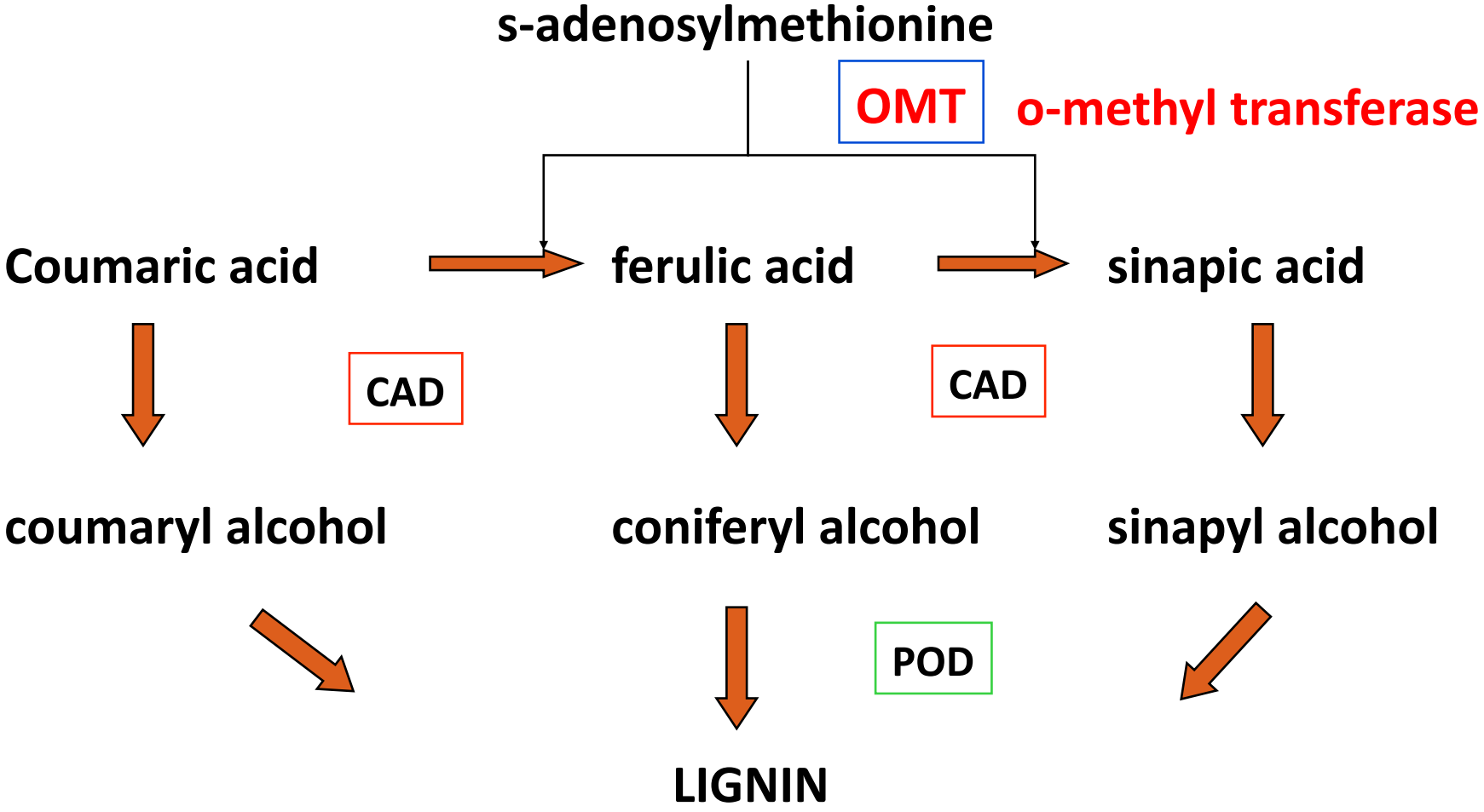
Brown Midrib Mutants

- Four natural mutations identified in the 1930-40's in dent corn
  bm1, bm2, bm3, bm4

- Low in lignin therefore higher fiber digestion

- Brown to red pigment in the leaf midrib, rind and pith

Several Key Enzymes are Involved in Lignin Biosynthesis - *BM3 Mutants Contain Lower Lignin Because of Lower Activity of OMT*



How Does BMR Compare to Normal Hybrids?

	Control		bm3	
	Average	Std. Dev.	Average	Std. Dev.
DM, % of as fed	33.5	3.3	32.5	3.9
Starch, % of DM	30.5	2.9	29.9	4.2
NDF, % of DM	42.0	1.7	40.9	2.1
ivNDFD[2], % of NDF	46.1	9.2	57.6	7.7

[1]In vitro NDF digestibility measured after in vitro fermentation for 30 h except for trial of Weiss and Wyatt, 2006 where a 48 h determination was performed.

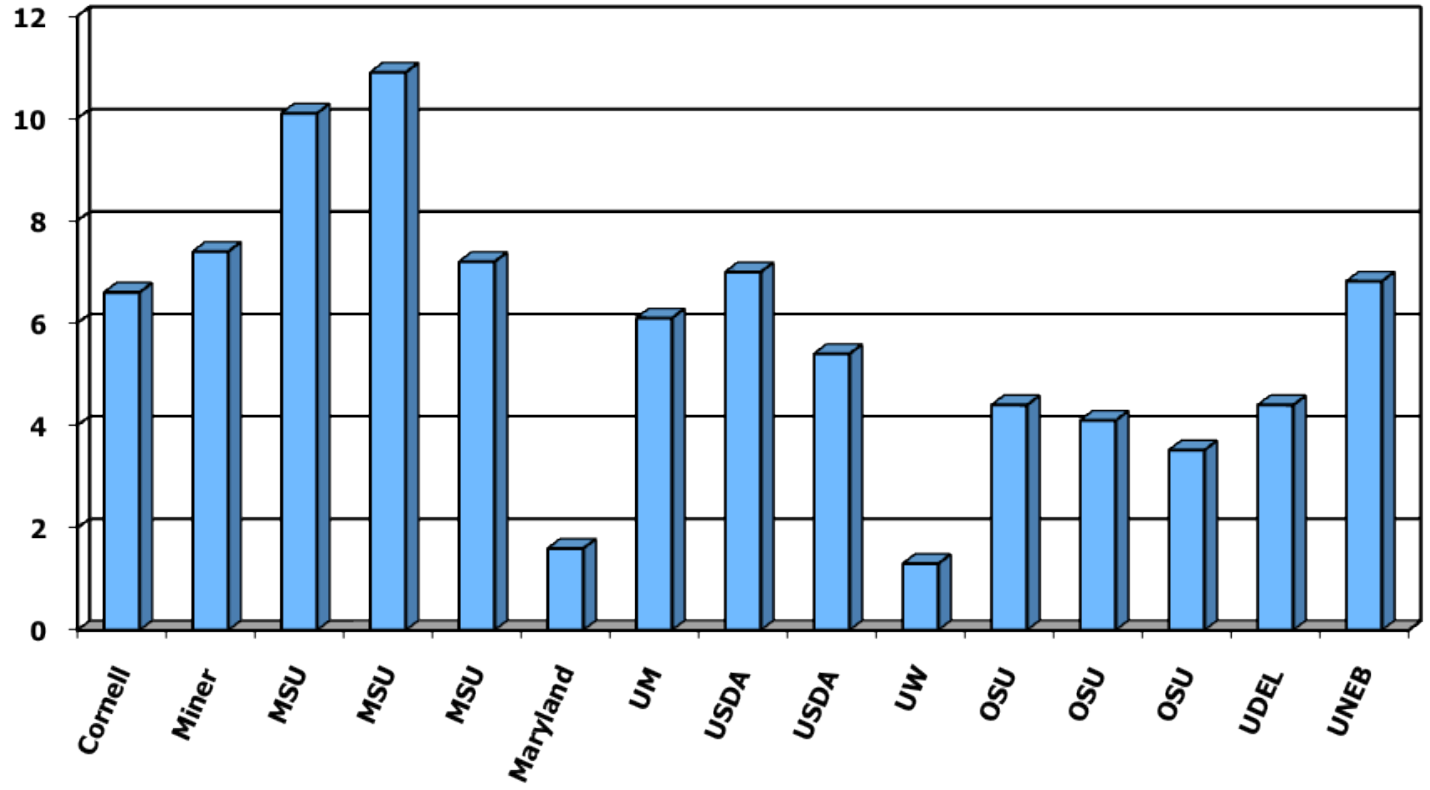
Gencoglu, Shaver and Lauer, UW Madison

Effect of BMR on Production

Item	Normal	BMR
DMI, lb/d	53.2	55.9*
Milk, lb/d	82.9	86.7
Fat, %	3.67	3.59

Results are least-square means from meta-analysis (St. Pierre, 2001) performed on data from 11 trials with 17 treatment comparisons published in the Journal of Dairy Science since 1999;Gencoglu, Shaver and Lauer, UW Madison

Modern BMR Milk Production Research



University

Mycogen Seeds, 2009

How Does BMR Compare to High Cutting?

Effect of High Cutting vs BMR

Item	Normal 7511FQ	High 7511FQ	Normal F2F797 BMR
Yield, t DM/acre	11.16[a]	9.32[b]	9.98[ab]

Kung et al., 2008

Low vs. High Cut and Ctrl vs. BMR Corn Silage - % Change

Item	Low Cut vs. High Cut[a]	Ctrl vs. BMR[b]
Ton/ac, DM, %	-7	-10
NDF Digest, %	+5	+19

[a]Roth, 2003 [b]Eastridge, 1999

Effect of High Cutting vs BMR

Item	Normal 7511	High 7511FQ	Normal F2F797 BMR
ADL, %	3.17	2.76	2.20
NDF, %	42.9	39.6	44.7
Starch, %	29.7	31.7	25.7
30h NDF-D, %	51.7	51.4	63.5

Kung et al., 2008

Effect of High Cutting vs BMR

Item	Normal Cut 7511FQ	High Cut 7511FQ	Normal cut F2F797
DMI, lb/d	59.2	60.1	59.0
Milk, lb/d	103.0^{b}	104.9^{b}	107.4^{a}
Milk fat, %`	3.60^{a}	3.48^{b}	3.50^{ab}
3.5% FCM, lb/d	104.3^{c}	104.3^{c}	106.7^{d}
FE, 3.5% FCM/DMI	1.77^{ab}	1.75^{b}	1.83^{a}

Kung et al., 2008

Effect of High Cutting on Normal and BMR Corn Silage –

Seglar, Owens and Kung 2005

3 Pioneer hybrids- *33J57, 34B23, 38H67*
2 BMR hybrids – *F2F444, F2F581*

Pairs (1 Pioneer and 1 BMR) were grown at each of 8 locations
- *3 in NY, 4 in VT, 1 in DE (116 silages)*

Each harvested at two chopping heights
- *6 inches and 18 inches*

Influence of BMR Trait and Chopping Height on Yield, Production, and NDFD adjusted for Location

Seglar, Owens and Kung 2005

Sample	Height	DM Yield		Milk/ton		Milk/acre		NDFD48	
Non-BMR	6 in	9.02	a	3,795	c	34,346	a	41.6	b
Non-BMR	18 in	8.75	a	3,954	b	34,840	a	40.1	b
BMR	6 in	7.30	b	4,032	a	29,639	b	57.0	a
BMR	18 in	7.22	b	4,071	a	29,586	b	59.5	a

[a, b]Values in columns with unlike superscript differ $p < 0.05$.

1 mm NIR NDFD used for milk2000 input

6 mm in vitro

Should BMR be Chopped Differently? 3/4 in for sure, longer?

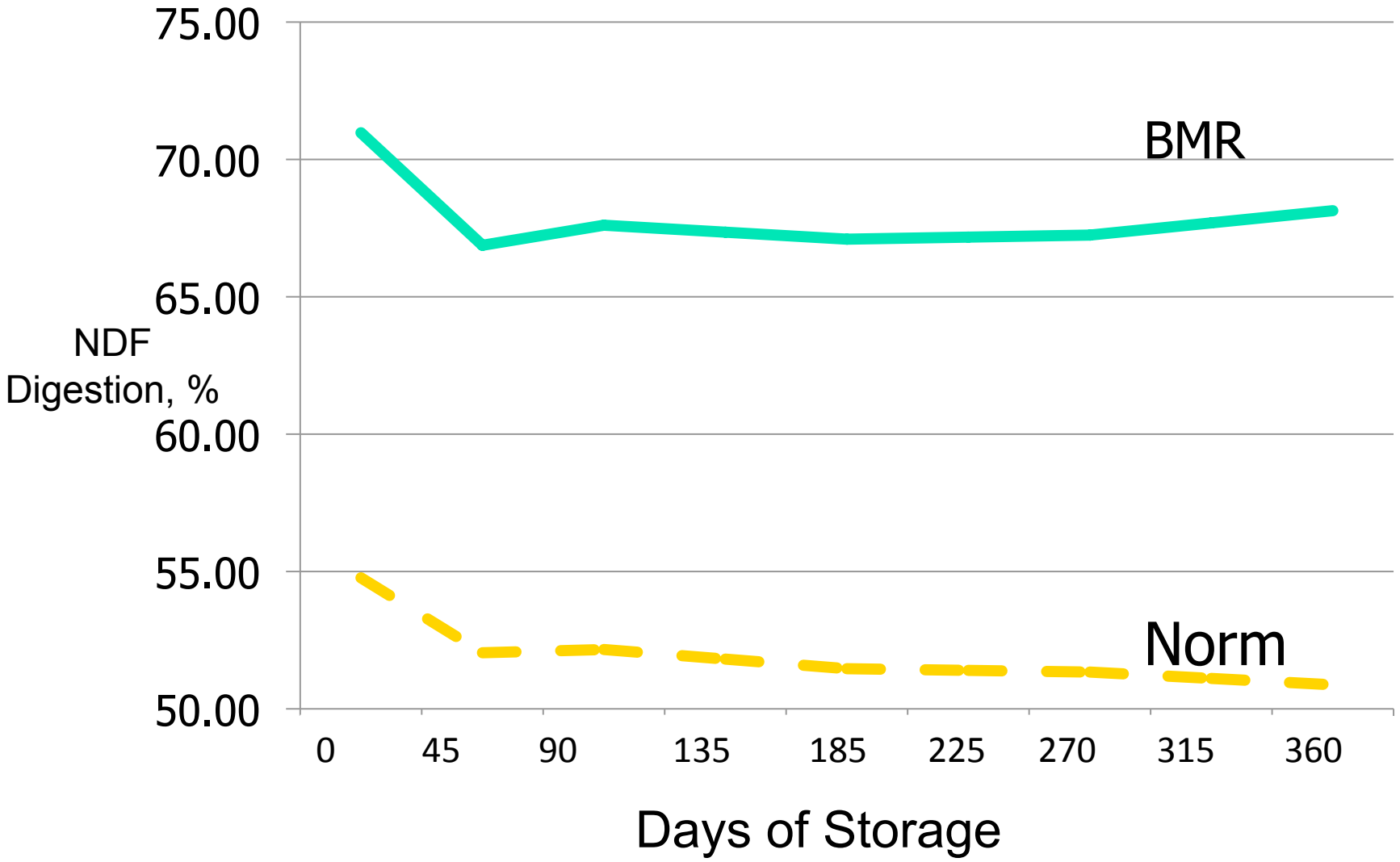
Item	C. Silage*	Processed
Top	3-8%	~15%
Middle	45-65	
Lower	20-30	
Pan	<5	

*2002, Heinrichs. PSU

What Other Factors Might Affect BMR Quality?

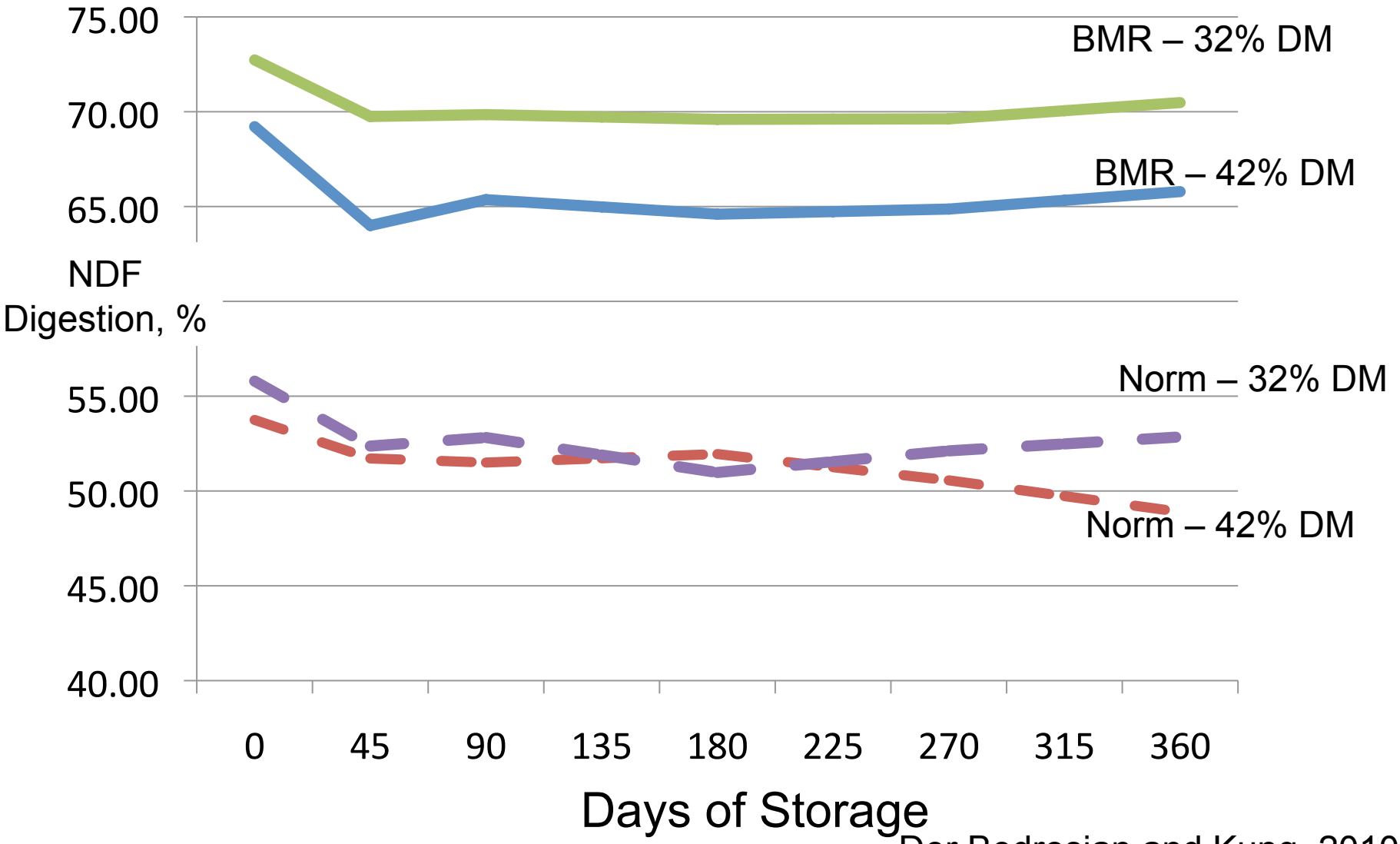
- Maturity (DM)
- Length of Time in the Silo
- Processing
- Additives

In Vitro NDF Digestion of Corn Silage: By Hybrid and Storage



Der Bedrosian and Kung, 2010

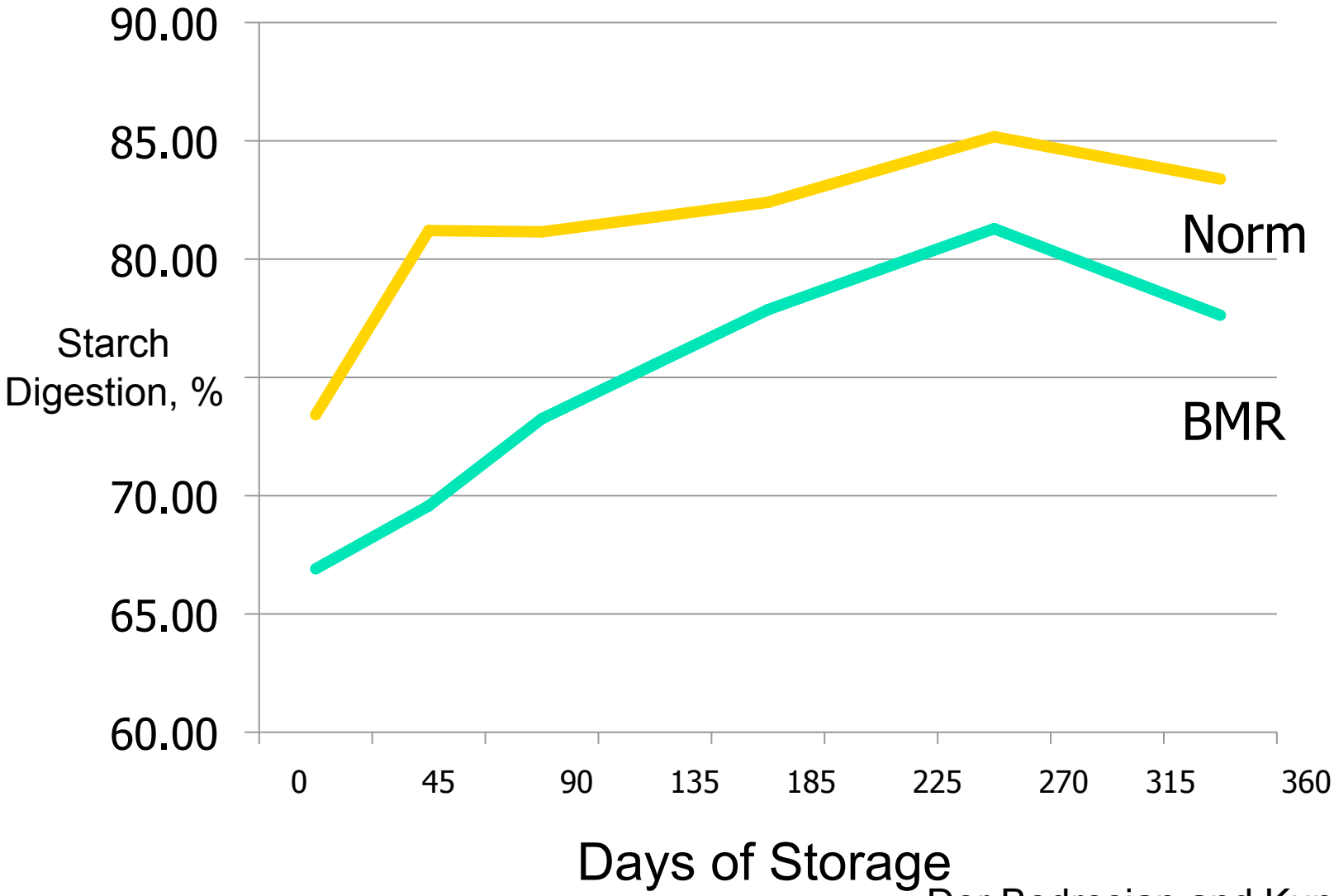
In Vitro NDF Digestion of Corn Silage: By Hybrid, Maturity and Storage



Der Bedrosian and Kung, 2010

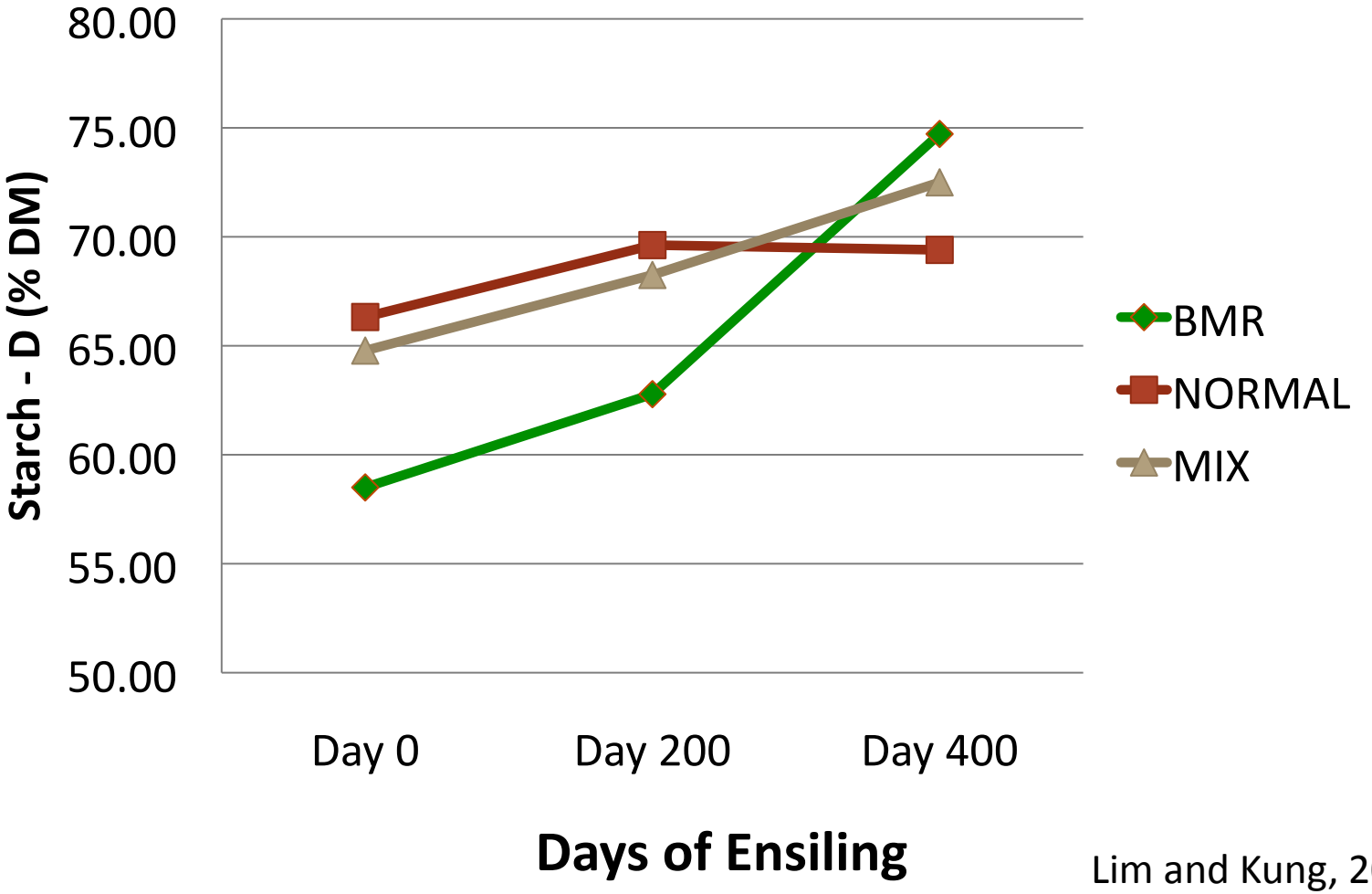
It Appears that the Starch in BMR is a Little More Resistant to Ruminal Breakdown than Normal Hybrids

In Vitro Starch Digestion of Corn Silage: By Hybrid



Der Bedrosian and Kung, 2010

Effect of Hybrid and Storage Time on 7-h In Vitro Starch Digestion, % (42% DM - mature silage)



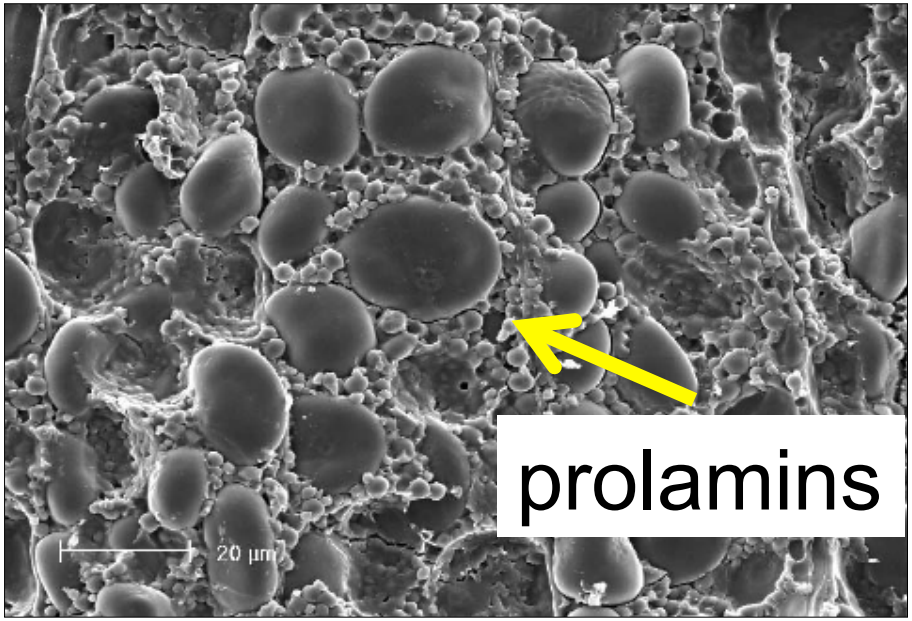
Lim and Kung, 2009

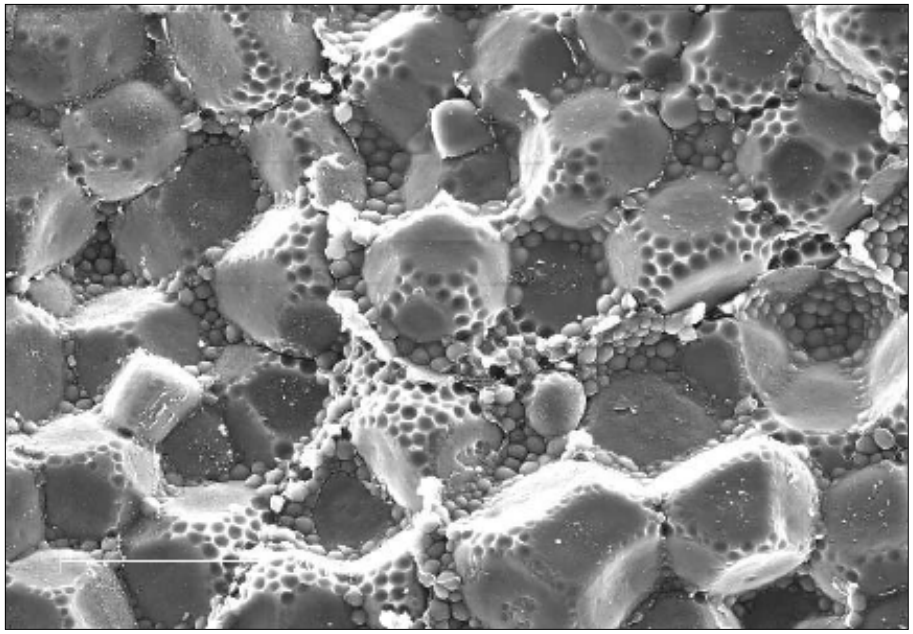
Mechanical Processing Effects On Corn Silage (34% DM - BMR)

Item	Unprocessed	Processed
DM intake, lb/d	52.7	56.8*
Milk, lb/d	93.4	98.0*

Ebling and Kung, 2001

Why does moisture and time of storage affect starch digestion?





-solubilization from acids and ethanol? probably not

-proteolysis? probably

Can Silage Additives Make Turn Normal Corn Silage into BMR?

ANSWER =

NO!

Effect of 11CFT (Contains an L. buchneri Strain that Makes Ferulic Acid Esterase) on Aerobic Stability and NDF-D of Two Corn Silage Varieties - 6mm 48 h in situ

	Hybrid 1		Hybrid 2	
Item	Control	11CFT	Control	11CFT
NDF-D, % 48 h	56.5	58.1	**52.3[b]**	**58.0[a]**
Aerobic stability, h	**58.7**	**116.0[a]**	**102.0[a]**	**81.5[b]**

Kang et al., Univ. of Florida, 2009

Effect of 11CFT on NDF-D (%) of Normal and BMR Corn Silage Hybrids

Hofherr et al. 2008

Days of ensiling	TRT	Plow	Phi	BMR
60	Control	40.5	42.2	59.7
	11CFT	43.2	42.9	58.5
180	Control	42.5	45.4	57.6
	11CFT	44.5	45.4	55.5
360	Control	46.6	45.5^{b}	58.4
	11CFT	48.6	50.6^{a}	58.7

Do I Still Need an Inoculant on BMR?

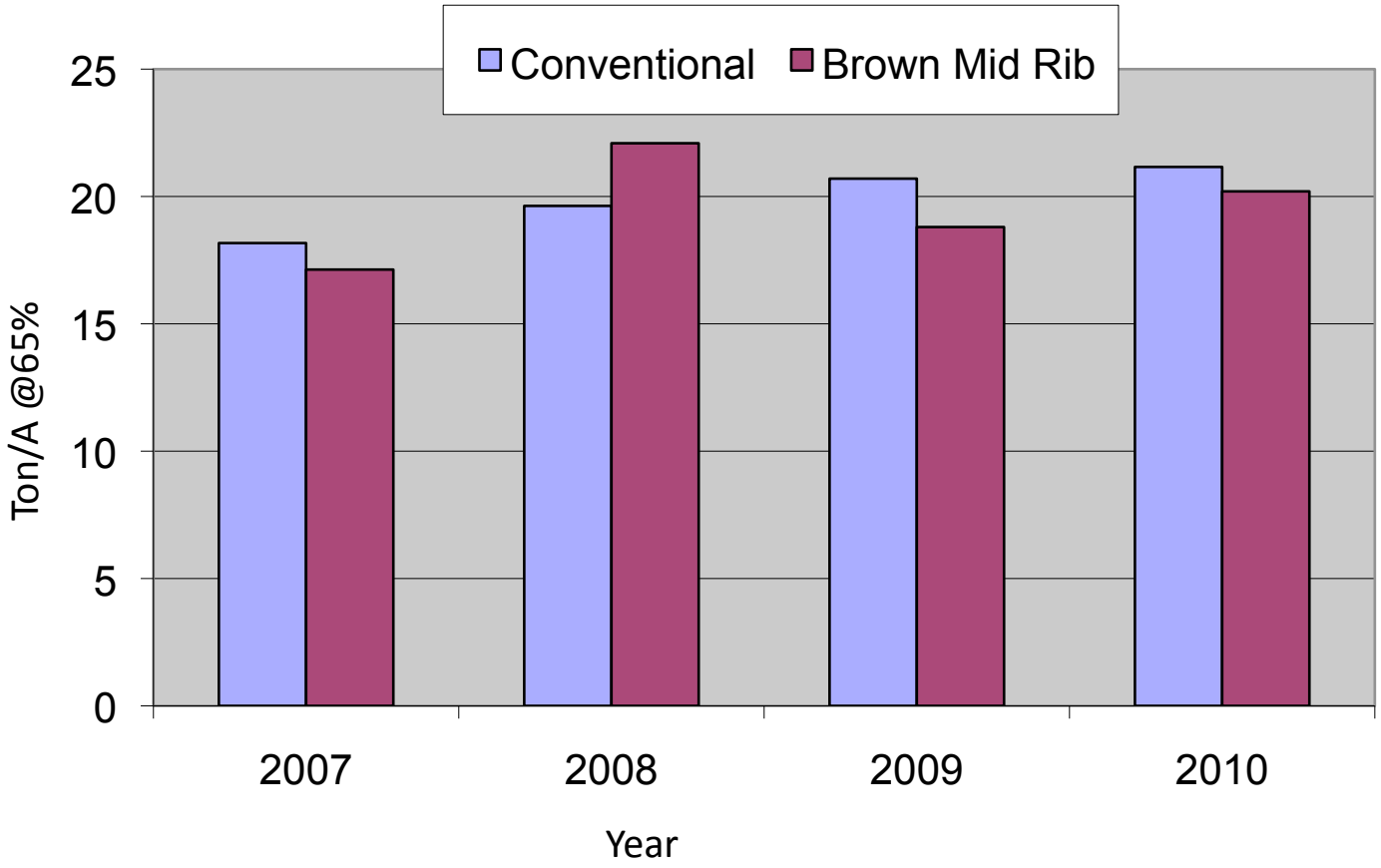
- Yes, but the type of inoculant depends on your situation
- Aerobic stability challenges? L. buchneri
- No aerobic stability challenges? Homolactic

BMR in the Field, Milk lb/d

Nennich et al., Univ. of Minn

Item	BMR	Normal
Parity		
1st	75.2	72.3
2nd or greater	93.3	87.1
Stage of lactation		
early	82.4	80.0
mid	87.7	79.6

DE-MD-VA Silage Yields



Mycogen, 2010

BMR Use at the UD Dairy

- Grown for over 9 years
- Acreage increasing every year (75% in 2010)
- Biggest challenge on our farm
  - harvesting rapidly enough to avoid excessive dry down

2010 UD Test Plots - Planted Late

Item	Normal	BMR
Yield, t/a (35%DM)	20.7	19.7
NDF-D, %, 30 h	57.6	70.8
Milk/ton	3070	3412
Milk/ac	22,431	23,575

2010, UD – average of 4 TMFs and 6 BMRs, RM ~ 110

2010 Farm Corn Silage - UD

Item	BMR	Normal	50:50
Yield, t/ac 35% DM	22.0 (F2F700)	28.7 (TMF2W726)	24.5
NDF, %	43.8	41.3	40.9
NDF-D, % 30 h	76.1	64.9	70.1
Starch, %	27.5	29.0	28.2

2010 UD

BMR Facts

- Highly digestible NDF
- Increased milk production
- Increased intakes
- Great for transition/early lactation cows diets
- Allows feeding of higher forage TMR
- Now with stacked traits

BMR Facts

- Seed is more costly
- In cool weather, dry down can be very slow
- In hot, dry weather dry down can be very fast
- Slightly lower yields, thus more acreage needed
- Seepage issues if put up too wet
- Does poorly in extremely dry/hot weather
- Decrease in NDF-D in mature silage

BMR Facts

- More so than other hybrids, BMR looks "ugly" very quickly above 35% DM
- Tendency to look drier than it really is (mostly true for all corn hybrids)
- Do not let BMR "get away" from you!

Is BMR for Me?

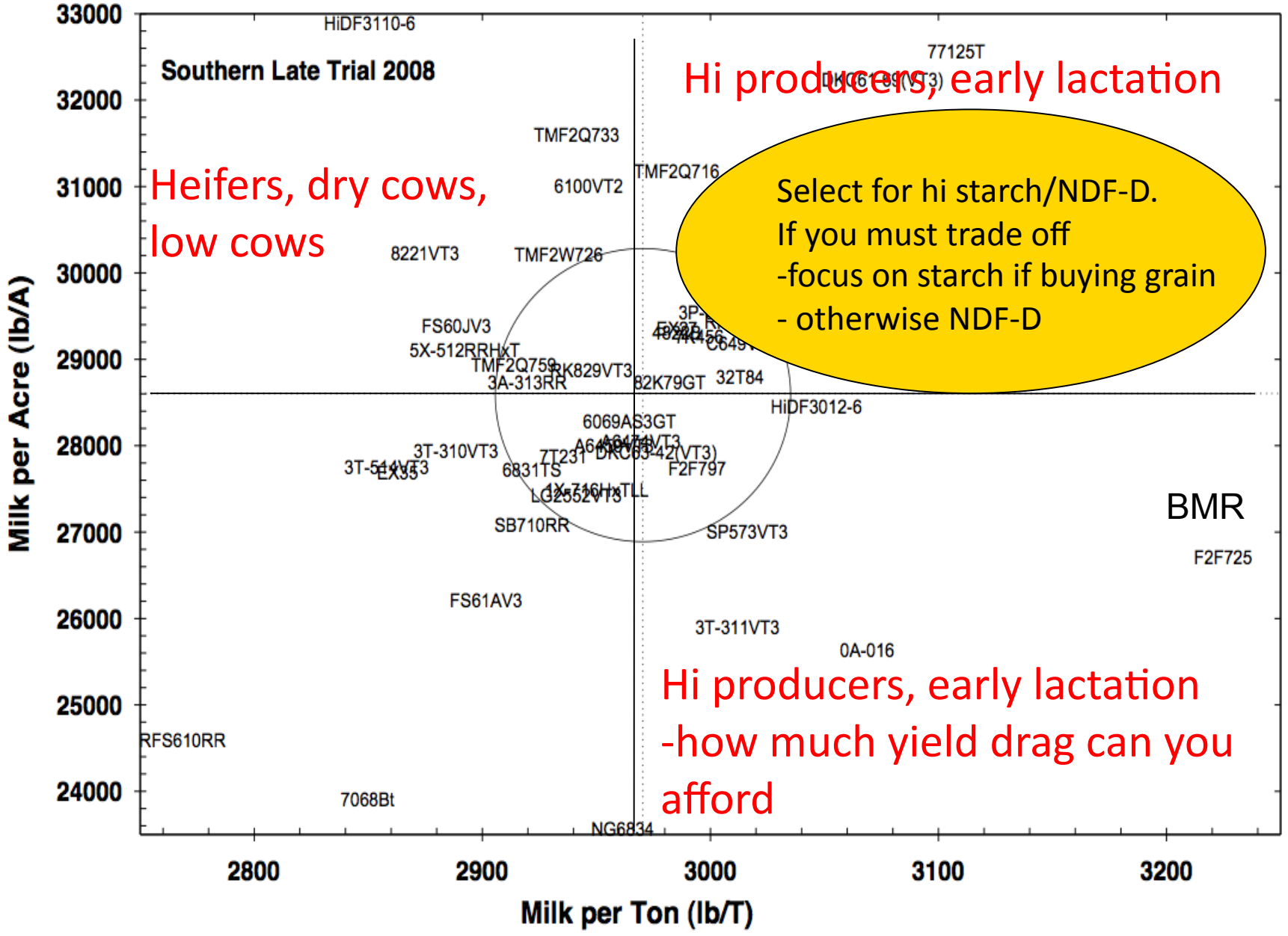
- Work with nutritionists and extension
- Determine growing conditions
- Acreage
- Best uses:
  - pre/post fresh
  - early lactation
  - high groups

Effect of Feeding BMR in the Prefresh Period on Subsequent Milk

Item	BMR	Normal
Pre fresh DMI, lb/d	31.5	29.1
Lactation DMI, lb/d	44.5	40.5
Milk, lb/d	100.1	95.0
Fat, %	3.90	3.85

Diets fed for 3 wk prepartum and 3 wk postpartum. All cows were fed same diet w/o BMR from wk 3 through 15. Intake data represent 2 wk prepartum and 3 wk postpartum and production data represent first 15 wk postpartum. Stone et al. 2008

Using Milk2006 For CS Hybrid Evaluations



Summary

- BMR contains the most highly digestible fiber of any corn silage hybrid; by a long margin
- Agronomics are not equal to many hybrids but traits are catching up
- Best used strategically: pre/post fresh, early lactation, high producers
- Many other companies are starting to release BMR hybrids. What does this tell us?

Thank You!

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