What have we learned about silage processing and nutrient digestion?

Luiz F. Ferraretto, Ph.D., PAS
Department of Animal Sciences
University of Florida

UF IFAS
UNIVERSITY of FLORIDA

US Corn Silage Quality Summary

Parameter	Indicates Better Quality	n	Normal Range
NDF (% DM)	↓	384,715	36 - 46
Lignin (% DM)	↓	344,134	3 - 4
$uNDF_{240}$ (% DM)	↓	81,418	8 - 13
$NDFD_{30}$ (% NDF)	↑	170,634	48 - 60
TTNDFD (% NDF)	↑	27,954	36 - 46
Starch (% DM)	↑	347,759	25 - 39
Milk per ton	↑	136,056	1344 - 1674

Summary of combined multi-year, multi-lab (CVAS, DairyOne, RRL, DLL) data, except TTNDFD only from RRL

Slide courtesy of Dr. Randy Shaver, UW-Madison

Corn Silage Quality Indicators

Indicator	Practical Implication
NDF (% DM)	▪ Intake limitation through rumen fill
Lignin (% DM)	▪ Impact milk yield and the establishment of high-forage diets
$uNDF_{240}$ (% DM)	
$NDFD_{30}$ (% NDF)	
TTNDFD (% NDF)	

Corn Silage Quality Indicators

Indicator	Practical Implication
Starch (% DM)	▪ Alter energy density ▪ Impact milk yield or feed efficiency
StarchD (% starch)	
Prolamin (% DM)	

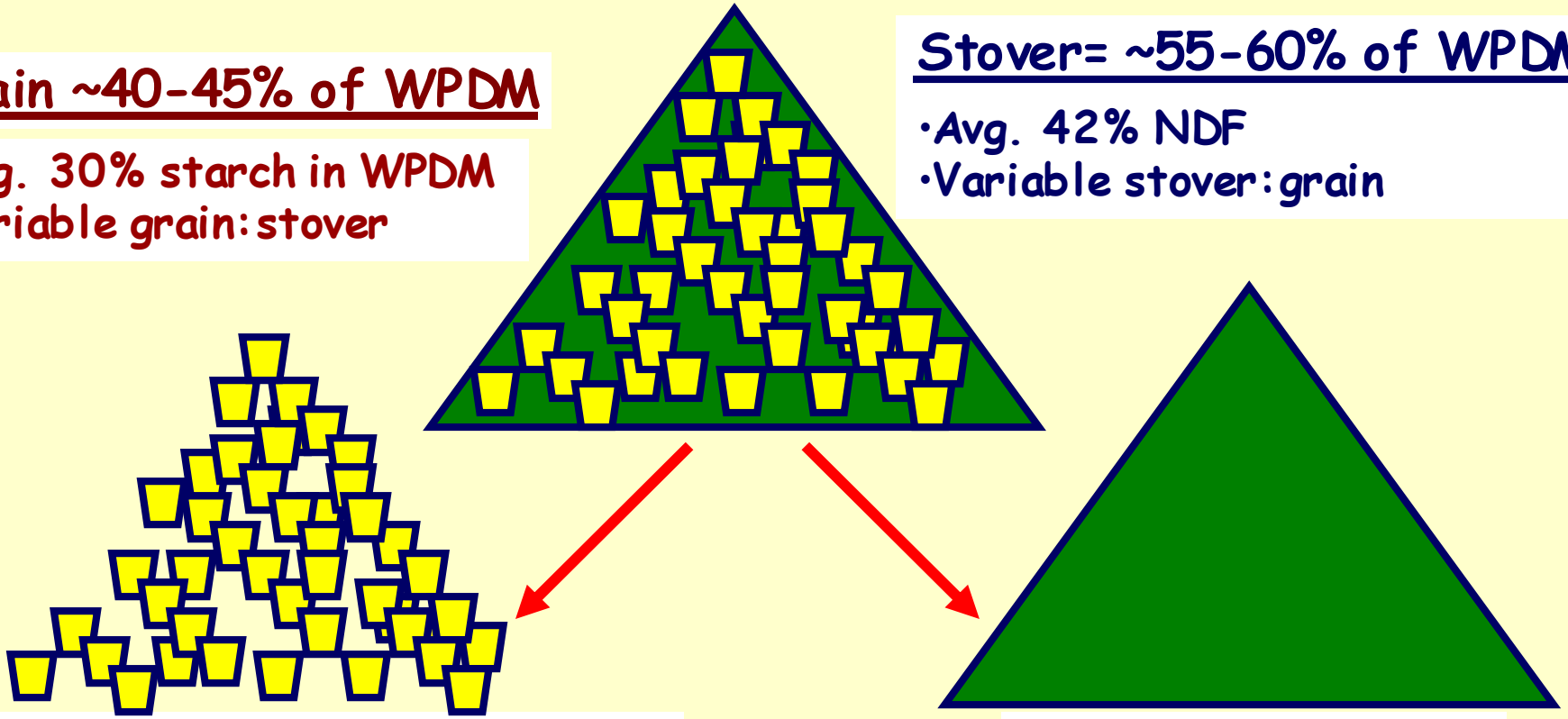
Whole-Plant Corn Silage

Grain ~40-45% of WPDM

- Avg. 30% starch in WPDM
- Variable grain:stover

Stover= ~55-60% of WPDM

- Avg. 42% NDF
- Variable stover:grain



80 to 98% StarchD

- Kernel particle size
- Duration of silage fermentation
- Kernel maturity
- Endosperm properties
- Additives

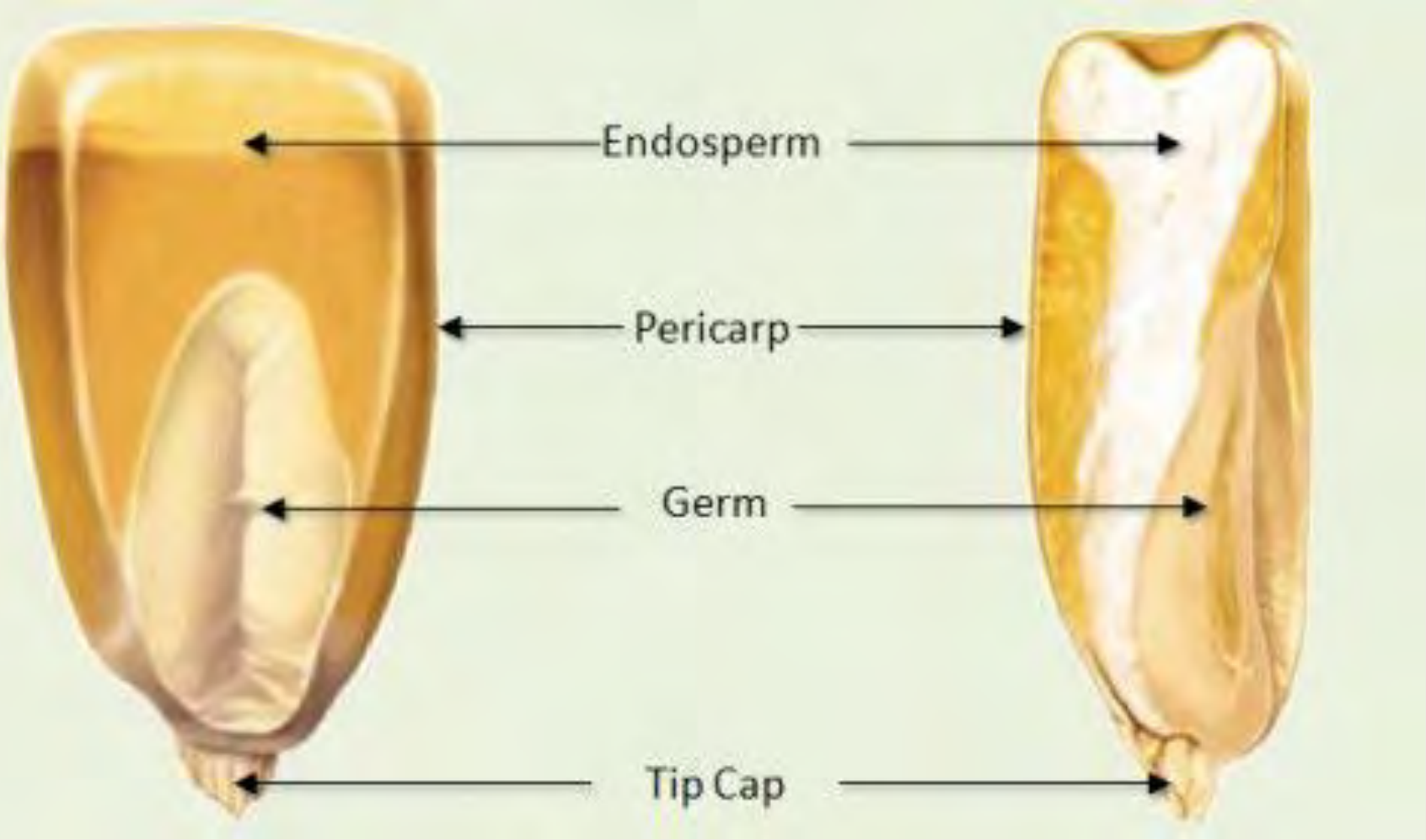
40 to 70% IVNDFD

- Lignin/NDF
- Hybrid Type
- Maturity
- Additives

Variable peNDF as per chop length

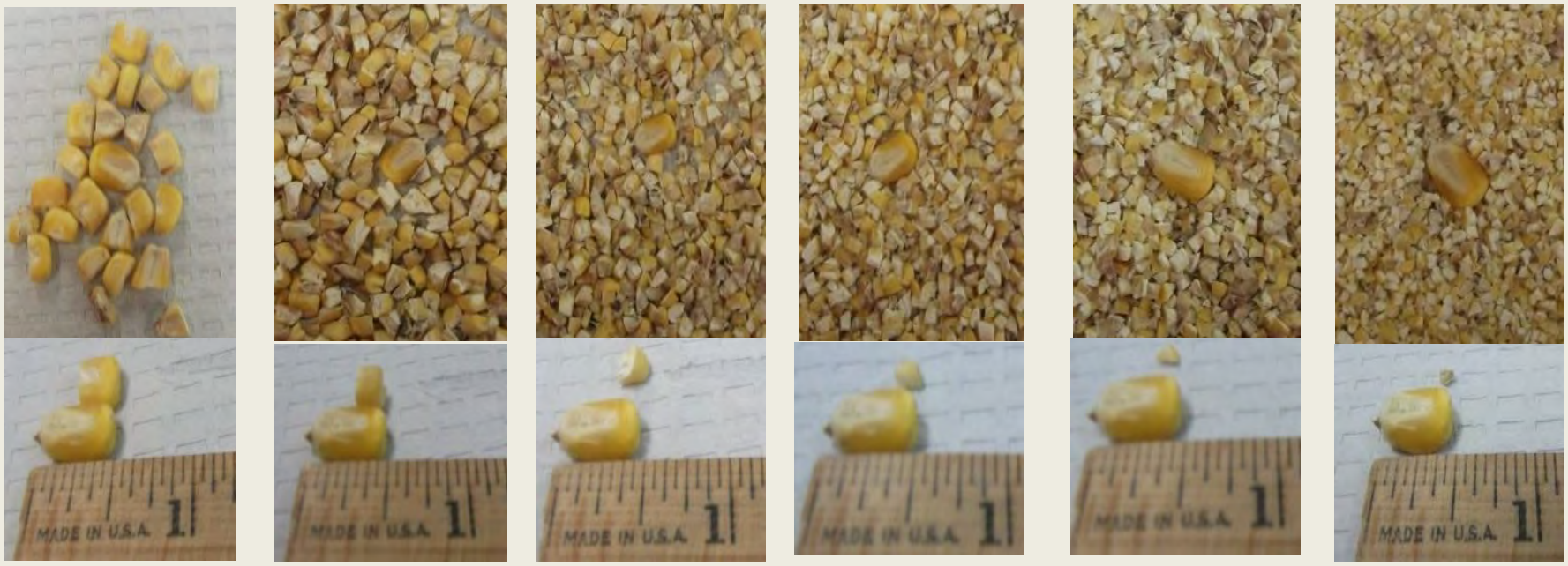
Adapted from Joe Lauer, UW Madison Agronomy Dept.

Corn Kernel



Kernel particles

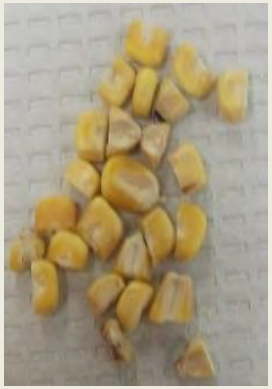
2P 4P 8P 16P 32P 64P



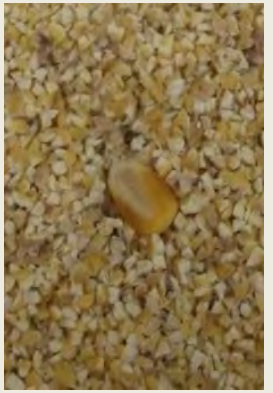
P = pieces

Dias Junior et al., 2016

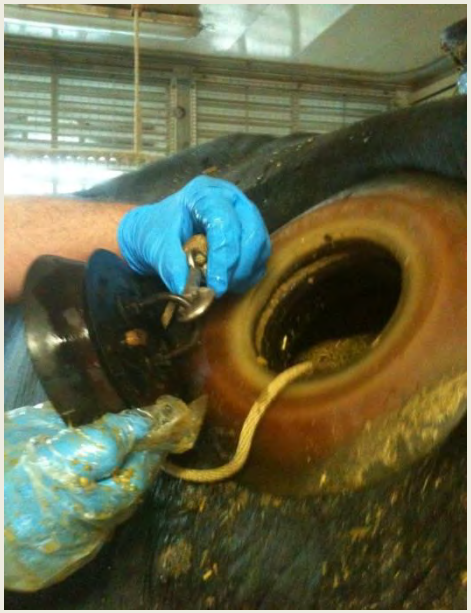
Ruminal in situ incubation



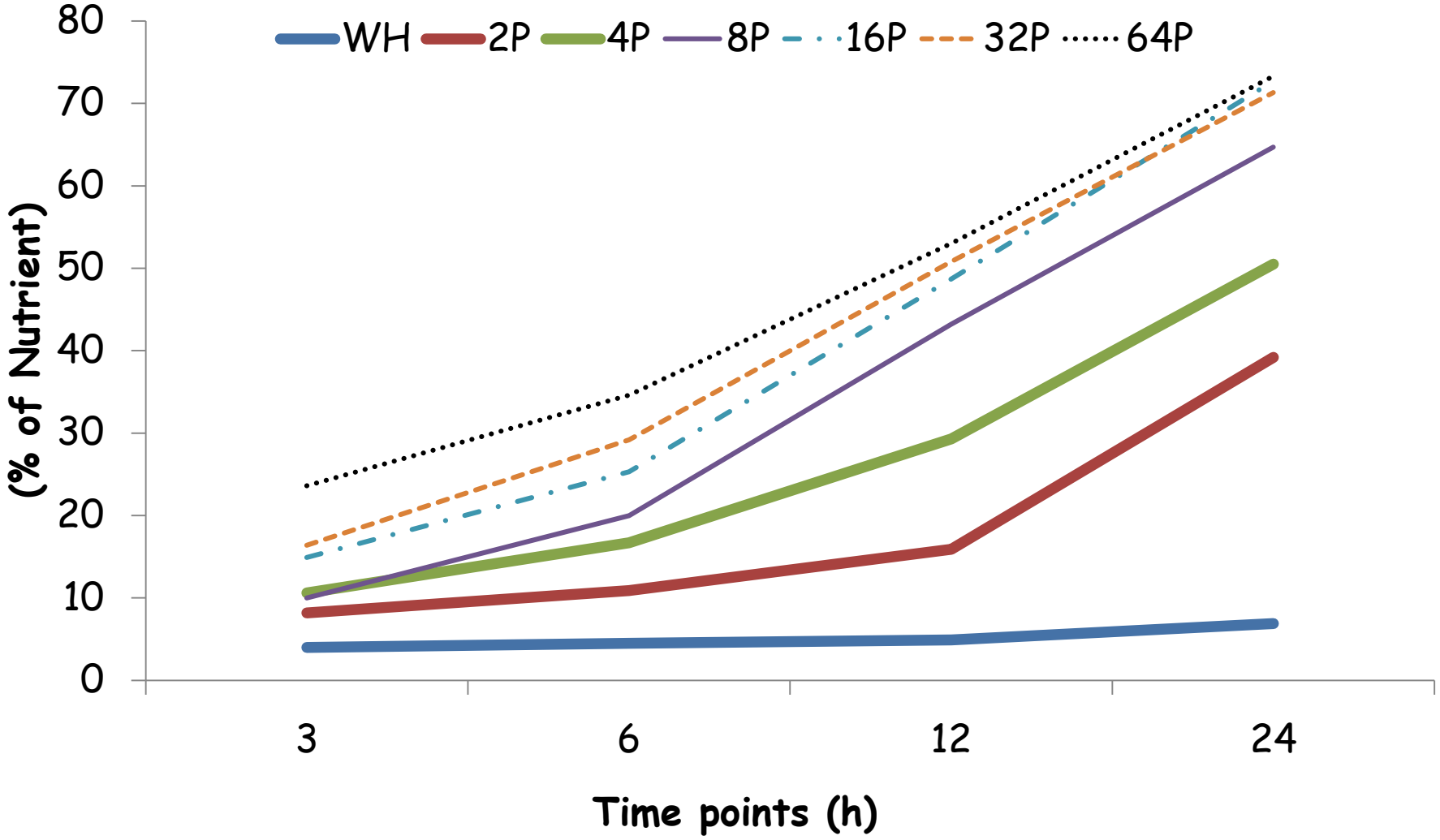






Ruminal in situ DM digestibility of unfermented kernels



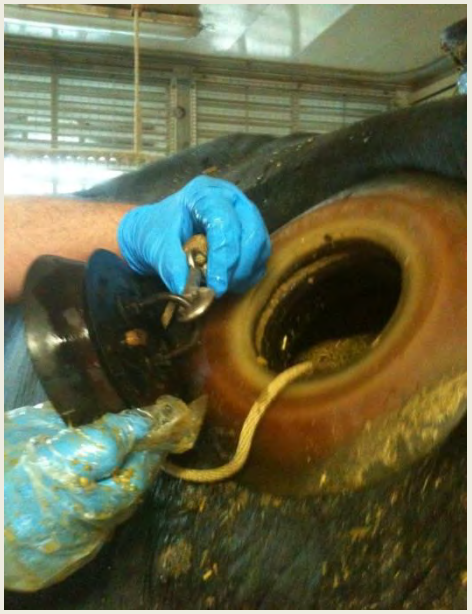
Dias Junior et al., 2016

Sorghum Kernel particles

Ferraretto et al., unpublished

P = pieces

Ruminal in situ incubation



0h

6h

12h

4 Piece

24h

48h

120h

0h

6h

12 h

2 Piece

24h

48h

120 h

0h

6h

12 h

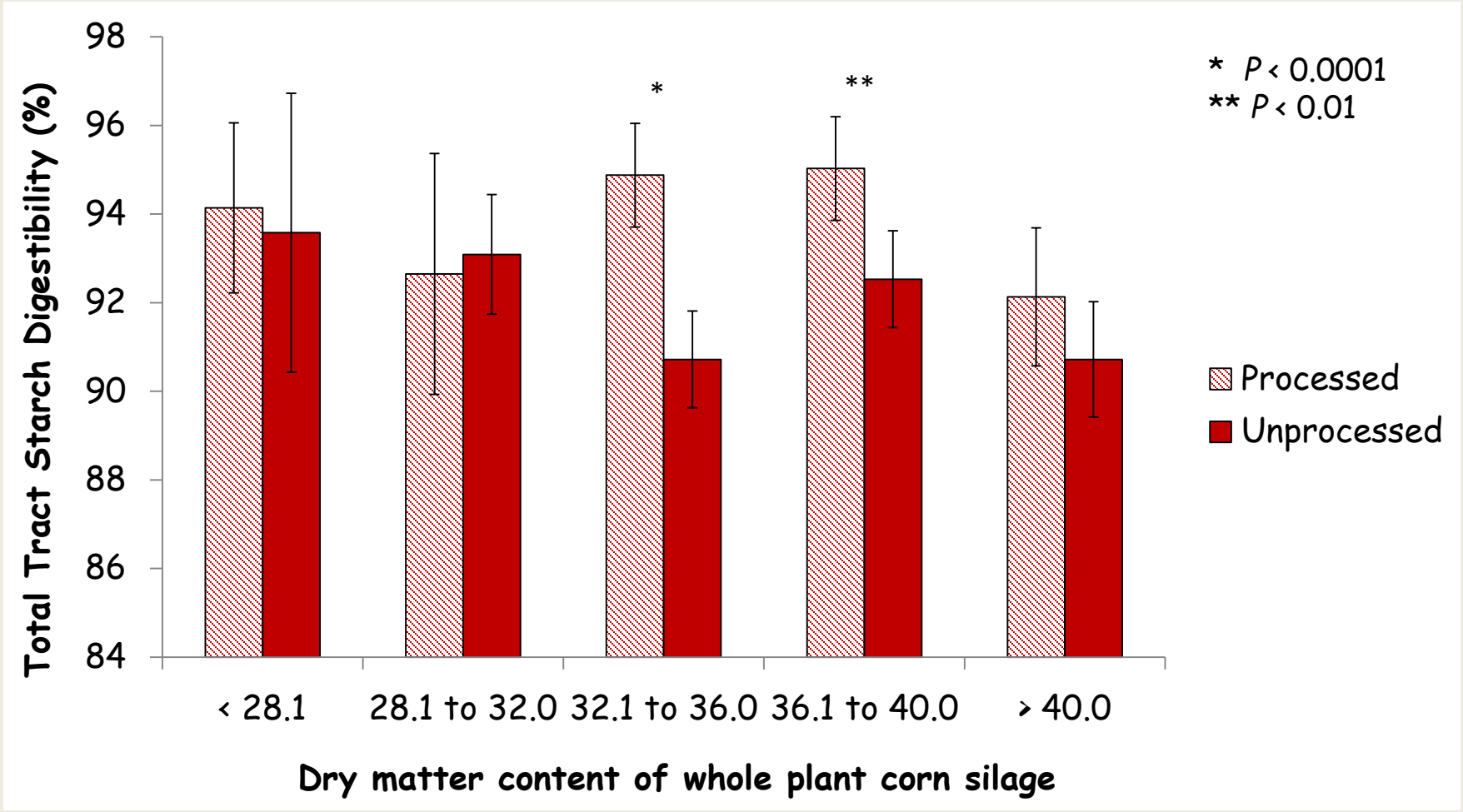
Whole Grain

24h

48h

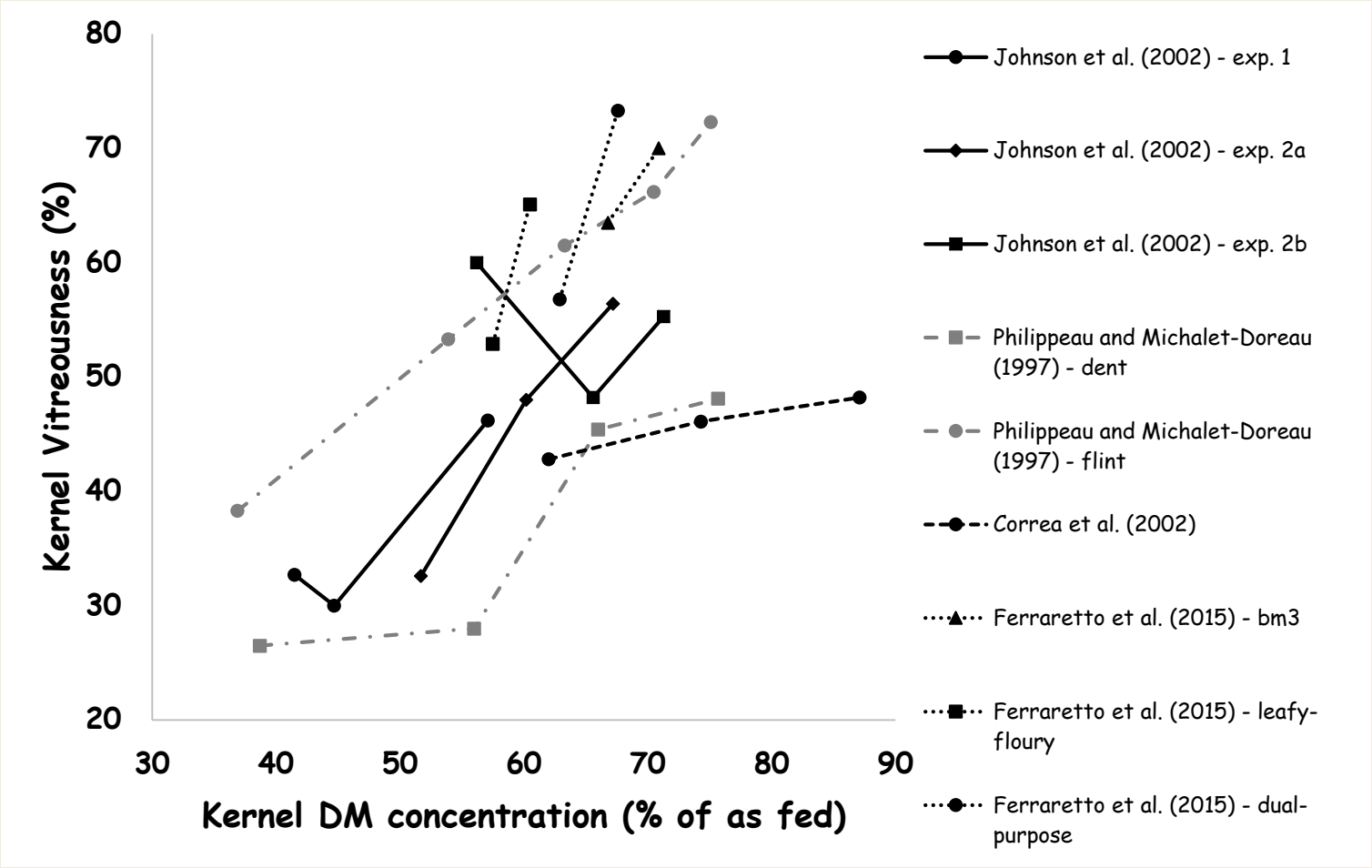
120 h

Kernel Processing * maturity



Ferraretto and Shaver, 2012

Kernel vitreousness



Ferraretto et al., 2018

How to obtain excellent processing?

- The key: adequate and constant monitoring

Focus on Forage

Wisconsin TEAM Forage

Making Sure Your Kernel Processor Is Doing Its Job

by Kevin J. Shinners and Brian J. Holmes

www.uwex.edu/ces/crops/uwforage/KernelProcessing-FOF.pdf

Figure 1. Chopped whole-plant corn placed into water.

Figure 2. Gently agitating material to help the kernels sink to the bottom of the container.

Figure 3. Skimming and removing the floating stover.

Figure 4. Carefully draining the water so only the kernels remain in the container.

Figure 6. Separated kernels showing three levels of kernel processing. Only the material on the right could be considered adequately processed.

Take home message 1

Break more kernels!

Corn Silage Fermentation Increases Starch Digestibility!

Response across multiple trials

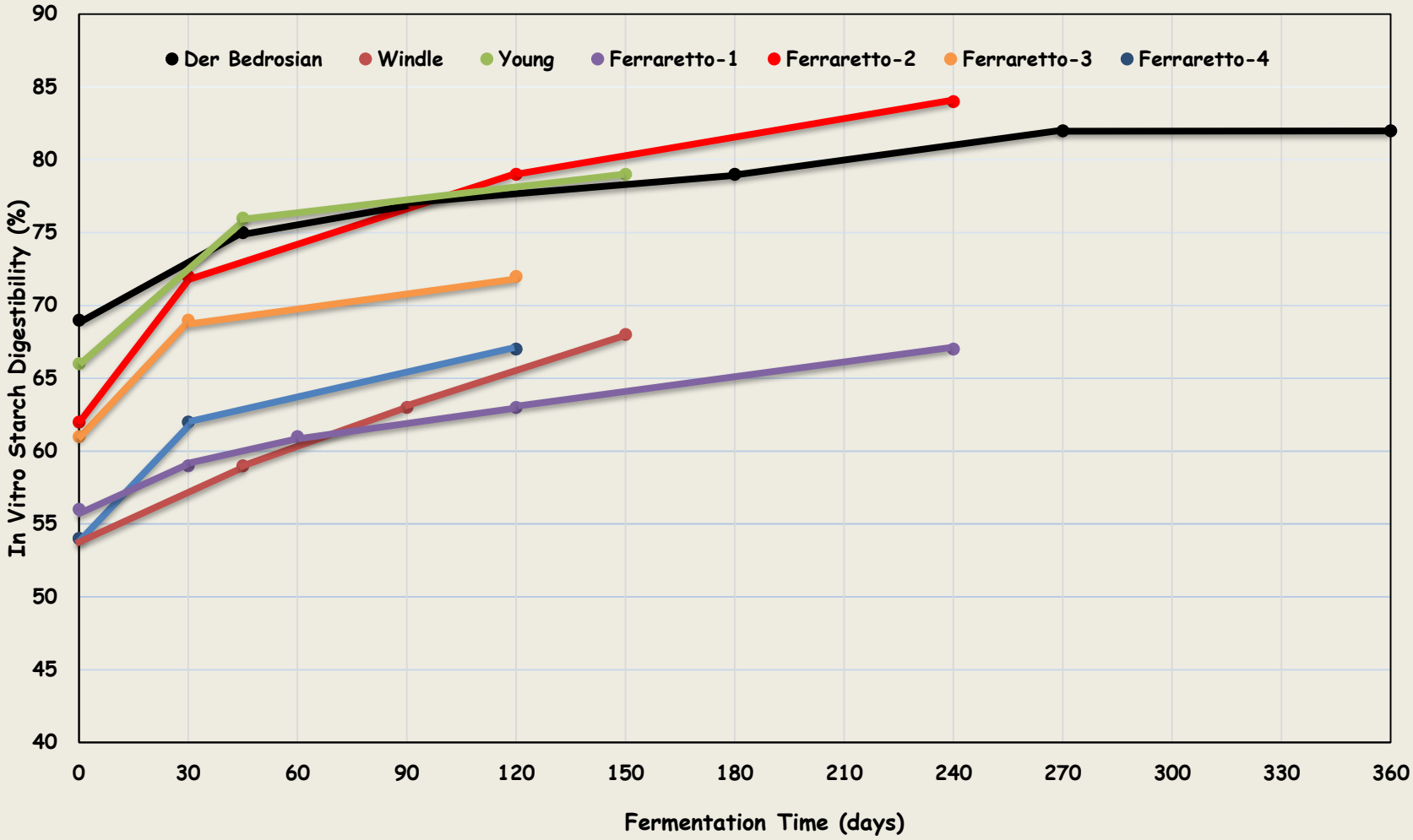


Figure 1. Effect of days of ensiling on ruminal in vitro starch digestibility. Data from Der Bedrosian et al., 2012; Windle et al., 2014; Young et al., 2012; Ferraretto-1, Ferraretto et al., 2015a; Ferraretto-2, Ferraretto et al., 2015b; Ferraretto-3,4, Ferraretto et al., 2016.

Kung et al., 2018

Take home message 2

- Research supports the use of inventory planning so a newly harvest crop would be fed only after 90-120 days in storage
- Ensiling time does not attenuate differences in starch digestibility caused by hybrids or maturity
- It requires proper management during filling, packing and covering

Normal vs. high cutting height

Average of 7 studies		
Cutting height, cm	17	52
NDF, %	40	37
ivNDFD, % of NDF	52	56
Starch, %	32	35
Yield, ton of DM/ac	7.7	6.8
Milk, lb/ton	3291	3422
Milk, lb/ac	21407	19917

Ferraretto et al., 2018

Take-home message 3

- Cutting height improved quality but at the expense of reduced yield
- Cutting height may be a feasible option to improve forage quality when acreage is not a limiting factor

Questions

lferraretto@ufl.edu

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