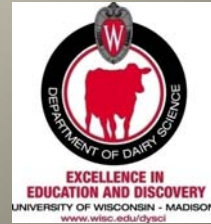


Nutritional Application of Corn Shredlage™ in Dairy Cattle Feeding

Luiz Ferraretto & Randy Shaver
Dairy Science Department, UW Madison



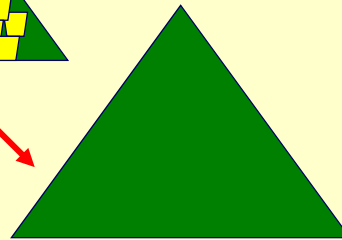
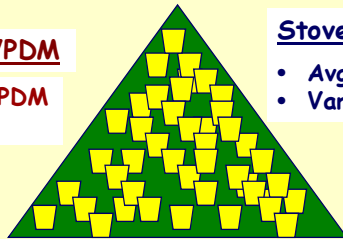
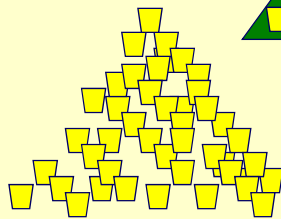
Whole-Plant Corn Silage

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% starch digestibility

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

?

40 to 70% IVNDFD

- Lignin/NDF
- Hybrid
- Maturity

?

?

Variable peNDF as per chop length

Adapted from Joe Lauer, UW Madison Agronomy Dept.

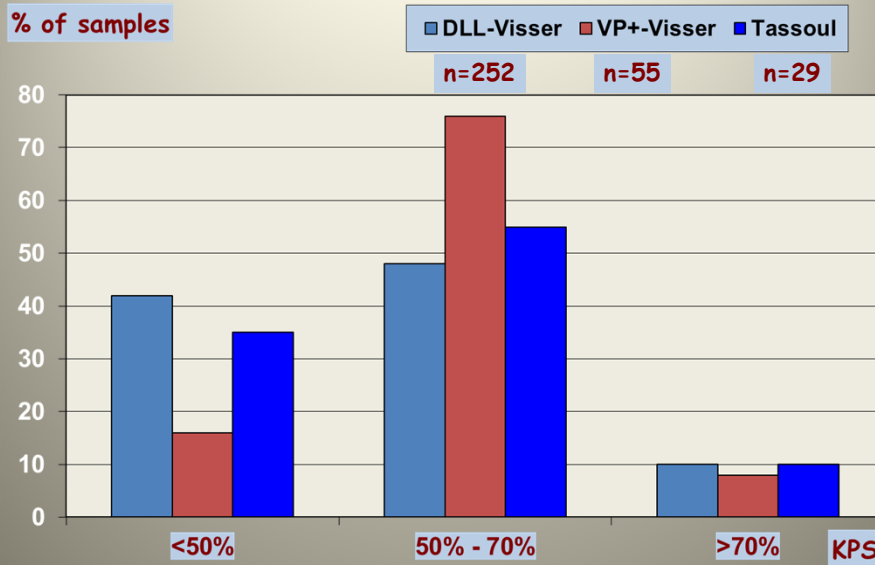
Kernels and Large Fragments Retained on > 4.75-mm Sieves



USDA-ARS

US Dairy Forage Research Center

Corn Silage KPS

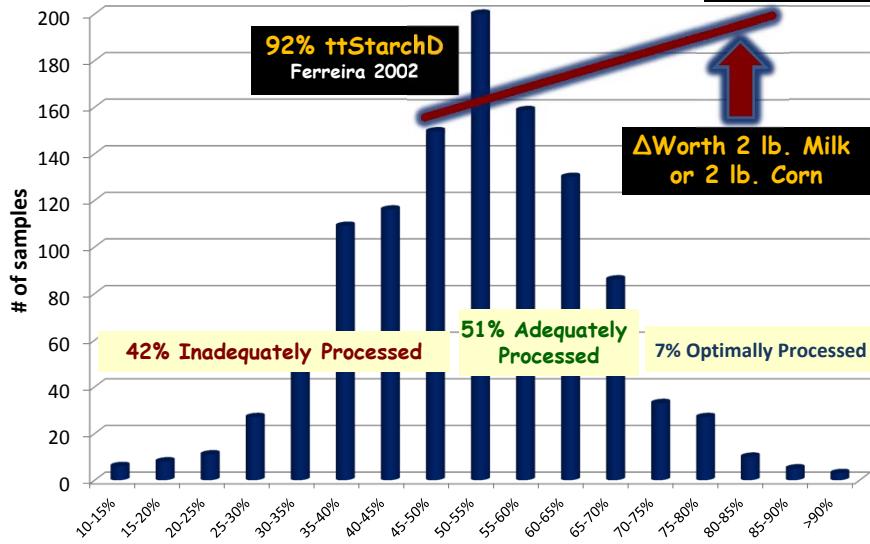


Shaver, 2007

Corn Silage Processing Score

1131 Samples, CVAS 2010 - 2011

98% $\dagger\dagger$ StarchD
Ferreira 2002



<http://www.shredlage.com/>



Corn Shredlage™

26-30 mm TLOC; 2-3 mm roll gap





UW Trial Methods

	Shredlage	KP
Hybrid	DKC 57-79	DKC 57-79
Planting date	5/7/11	5/7/11
Location	Arlington, WI	Arlington, WI
Row spacing	30"	30"
Seeds per acre	34,000	34,000
Harvest date	9/8/11	9/9/11
Acres harvested	9.1	8.9
DM tons per acre	8.3	8.2
SPFH	CLAAS Jaguar Kutz Farms, Jefferson WI	JD - UW ARS
Harvester Settings	30 mm TLOC; 2.5 mm Roll Gap	19 mm TLOC; 2 mm Roll Gap
Silo Bag	10' diameter	10' diameter
Inoculant	None	None

Penn State Shaker Box (as-fed basis)

Samples obtained during feed-out from the silo bags

Screen, mm	Shredlage	KP
19	31.5%	5.6%
8	41.5%	75.6%
1.18	26.2%	18.4%
Pan	0.8%	0.4%



Kernel Processing Score

Samples obtained during feed-out from the silo bags

	Shredlage	KP
% Starch Passing 4.75 mm Sieve	75.0% ± 3.3	60.3% ± 3.9



WI Dairy Farm Survey Results

	Corn Silage									
	Fall				Spring					
	n	Avg	Std	Min	Max	n	Avg	Std	Min	Max
CSPS%	30	57.0	11.1	34.9	74.4	35	61.1	12.4	38.6	88.7

Huibregtse, Heuer et al., 2012, unpublished; RRL sample analyses



Nutrient composition of feed-out samples

	Shredlage	KP
DM, % as fed	33.9% ± 2.1	33.7% ± 3.2
CP, % DM	7.3% ± 0.4	7.7% ± 0.3
Starch, % DM	35.1% ± 2.2	35.6% ± 2.2
NDF, % DM	36.4% ± 2.4	36.3% ± 1.4



Fermentation profile of feed-out samples

	Shredlage	KP
pH	3.59 ± 0.05	3.61 ± 0.03
Ammonia, % of CP	4.7 ± 0.8	4.8 ± 0.8
Lactic Acid, % of DM	6.0 ± 0.9	5.1 ± 0.4
Acetic Acid, % of DM	1.0 ± 0.1	1.0 ± 0.1



Bag Packing Densities (lb DM/cu. Ft)

$$\text{Volume} = 3.14 \times \text{Radius}^2 \times \text{Length}$$

	L	Shredlage	KP
Entire Bags At Filling	158'	17.7	17.2
During Feed-out near back of bags	4'	17.5	17.2



Feeding Trial

- 10/20/11 - 12/28/11; UW - Arlington Dairy
- 14, 8 cow pens; 112 mid lactation cows
- Cows stratified by breed, parity & DIM, assigned to pens, and pens randomly assigned to 1 of 2 treatments
 - Shredlage™
 - KP
- 2-week adjustment period with all pens fed 50:50 mix of Shredlage & KP in TMR
- 8-week treatment period with all cows fed their assigned treatment TMR



Experimental Diets (DM basis)

	Shredlage	KP
Shredlage	50%	---
KP Silage	---	50%
Alfalfa Silage	10%	10%
Ground Dry Shelled Corn	10.3%	10.3%
Corn Gluten Feed	7.4%	7.4%
SBM 48%, solvent	6.9%	6.9%
SBM, expeller	9.3%	9.3%
Rumen-Inert Fat	1.9%	1.9%
Min/Vits	4.2%	4.2%

TMR Nutrient Composition (DM basis)

	Shredlage	KP
CP	17.2%	17.3%
Total NDF	28.1%	28.3%
NDF from Forage	22.3%	22.5%
Starch	25.4%	25.5%
Crude Fat	4.8%	4.5%

Penn State Shaker Box (as-fed basis)

TMR Samples

Screen, mm	Shredlage	KP
19	15.6%	3.5%
8	38.2%	52.9%
1.18	38.9%	35.8%
Pan	7.3%	7.8%



TMR Sorting - PSU Shaker Box

% of Predicted Intake

Screen, mm	Shredlage	KP	<i>P</i> <
19	99.3	99.5	0.72
8	99.7	99.8	0.66
1.18	100.1	99.7	0.09
Pan	102.1	101.7	0.54

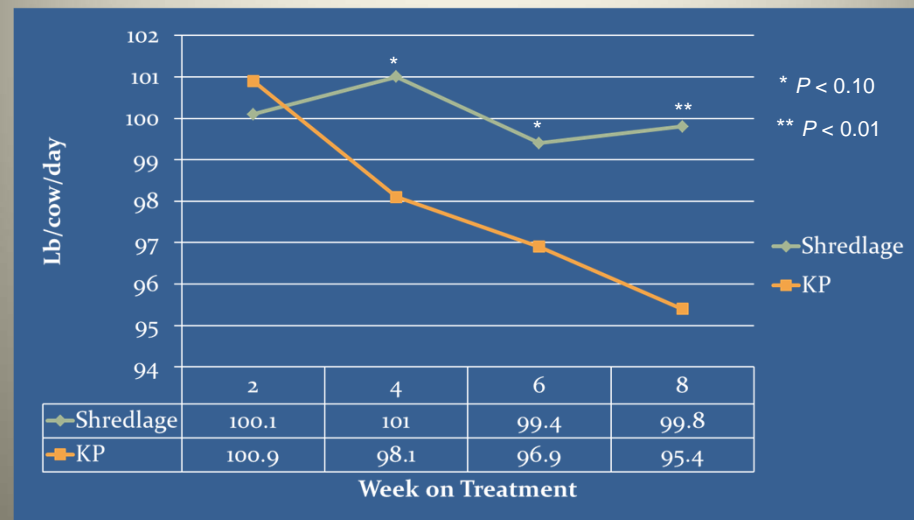
Dry matter intake & milk yield

	Shredlage	KP	<i>P</i> <
DMI, lb/d	55.8	54.4	0.08
Milk, lb/d	96.0	94.2	0.14
Milk/DMI	1.72	1.73	0.74

Milk composition

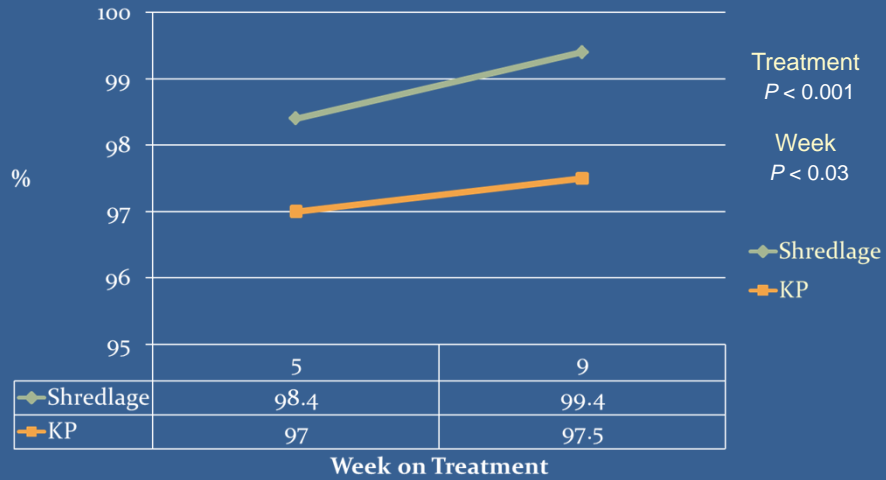
	Shredlage	KP	<i>P</i> <
Fat %	3.74%	3.70%	0.66
Protein %	3.18%	3.21%	0.29
MUN, mg/dL	13.9	13.6	0.48

3.5% FCM Yield by Week

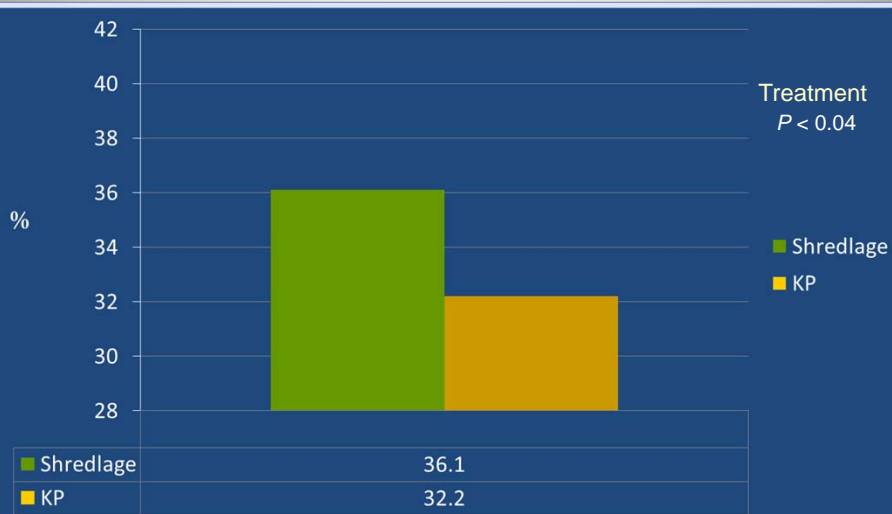


Week × Treatment Interaction (*P* < 0.03)

Total Tract Starch Digestibility



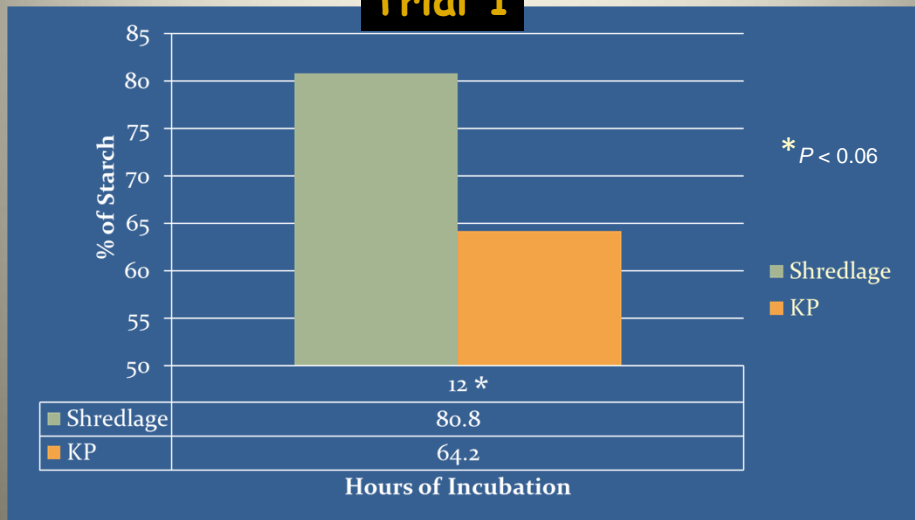
Total Tract NDF Digestibility





Ruminal In Situ Starch Digestibility

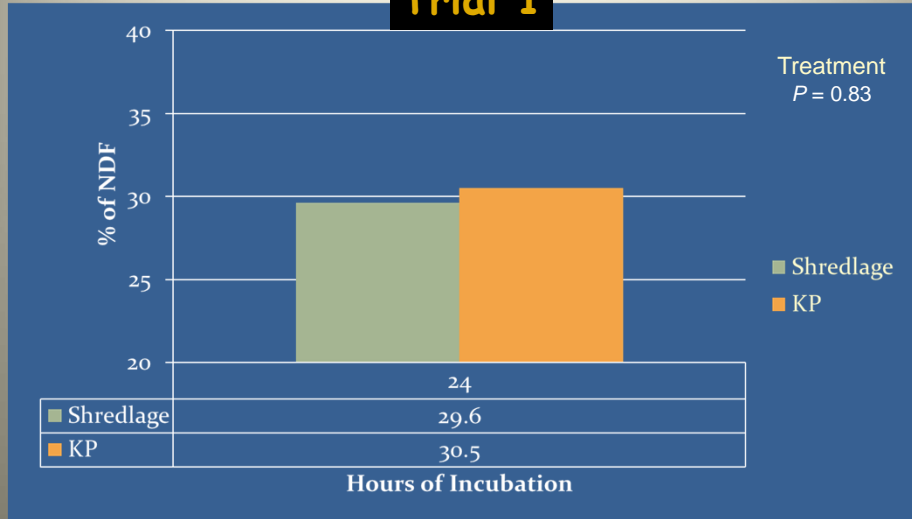
Trial 1



Ruminal incubations on undried, unground samples

Ruminal In Situ NDF Digestibility

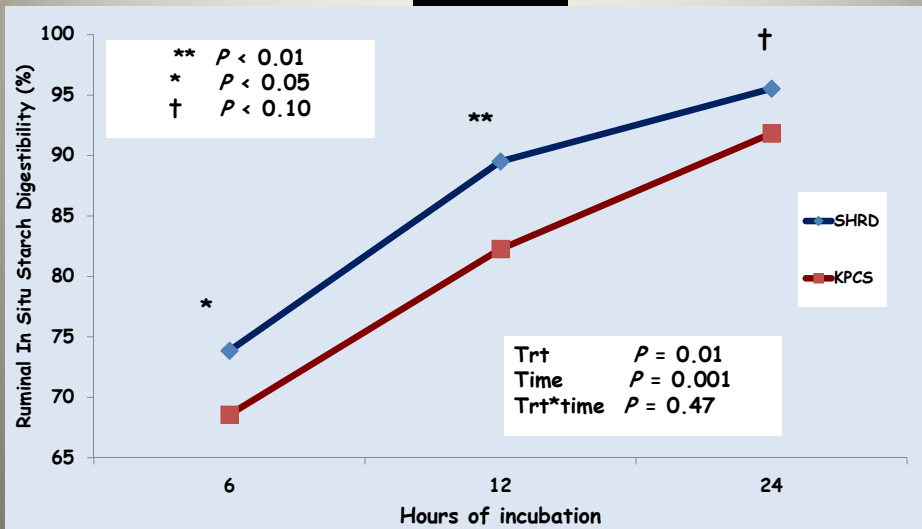
Trial 1



Ruminal incubations on undried, unground samples

Ruminal In Situ Starch Digestibility

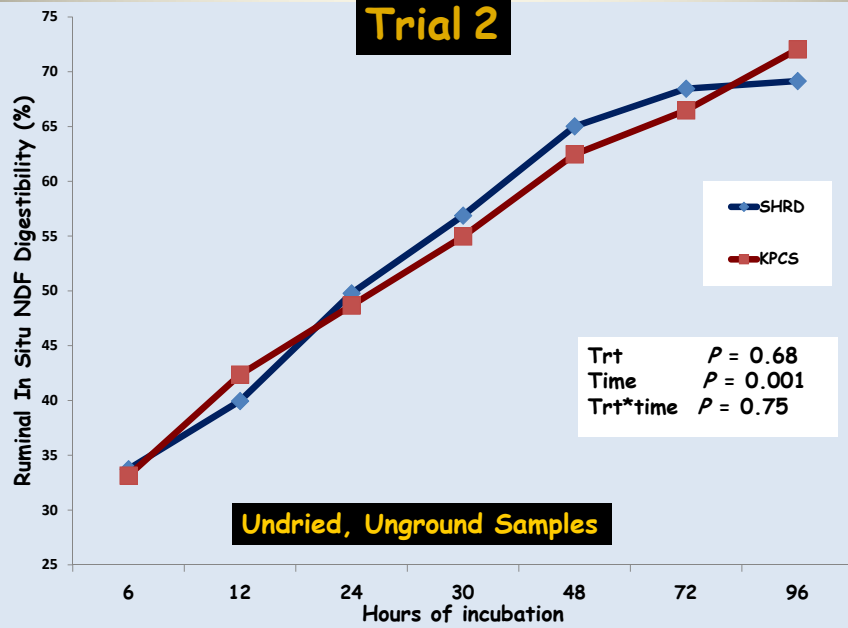
Trial 2



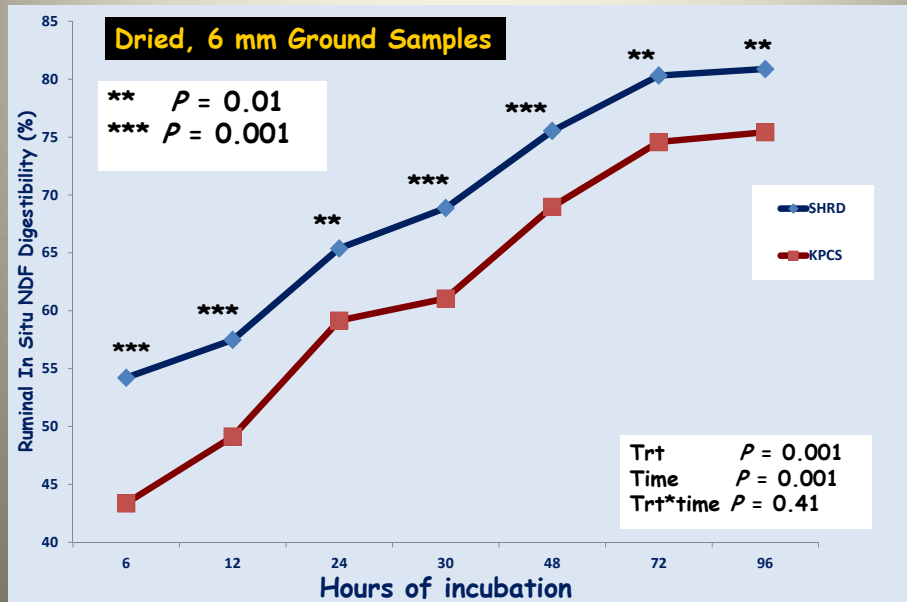
Undried, Unground Samples

Ruminal In Situ NDF Digestibility

Trial 2



Ruminal In Situ NDF Digestibility



Conclusions

- The proportion of material on the top (coarsest) screen of the PSU shaker box was greater for Shredlage
 - This was also the case for the Shredlage TMR
 - There was no sorting of either TMR
- DMI tended to be greater for Shredlage
- FCM & ECM tended to be greater Shredlage
 - Response increased as study progressed
- Kernel processing score and ruminal & total tract starch digestibility were greater for Shredlage treatment
- Total-tract NDF digestibility was greater for Shredlage treatment, while ruminal NDF digestibility response varied by in situ methods

Some Follow-Up Questions

- **Greatest response potential?**

- ❖ **Starch digestibility**

- > DM content
- > TLOC
- < time in silo before feed-out

Corn Silage Fermentation
Increases Starch Digestibility!



Some Follow-Up Questions

- **Greatest response potential?**

- ❖ **Physically effective NDF**

- Low forage rations
- High corn silage rations
- Chopped hay or straw replacement?
- BMR corn silage?

- ❖ **Digestible NDF**

- Low NDFD corn silages?

Item	COV	BMSH	BMKP	BMKPH
<u>Ingredient, % of DM</u>				
Corn Silage	25.0	---	50.0	40.0
Corn Shredlage	25.0	50.0	---	---
Alfalfa Silage	10.0	10.0	10.0	10.0
Chopped Dry Hay	---	---	---	10.0
Dry Ground Shelled Corn	10.3	10.3	10.3	12.9
Soybean Meal, expeller	9.0	9.0	9.0	9.0
Soybean Meal, solvent	6.9	6.9	6.9	4.3
Corn Gluten Feed, dried	7.4	7.4	7.4	7.4
Energy Booster 100 ^{®3}	1.85	1.85	1.85	1.85
DM, % of as fed	45	45	45	45
CP	17.5	17.5	17.5	17.5
EE	5.0	5.0	5.0	5.0
NDF	28	28	28	28
Forage NDF	24	24	24	24
Starch	25	25	25	25

Some Follow-Up Questions

- **Process control?**
 - ❖ **TLOC**
 - **Shaker box proportions**
 - ❖ **Roll gap spacing**
 - **Processing score**
 - ❖ **Harvest DM content**

Kernel Processing Score

Field shredlage samples obtained during 2012 harvest

	n	Average	Min
% Starch Passing 4.75 mm Sieve	21	74%	69%

Data source: Roger Olsen



How does it pack & ferment?



Do cows sort the TMR more?



Processor & SPFH?

<http://www.shredlage.com/>

A screenshot of the Shredlage LLC website. The header features the company logo and navigation icons for Home, About Us, Products, and Contact Us. Below the header is a banner image with the text "It's all about the cow!". The main content area is titled "Product Directory" and lists three product categories: HPS, HPMS, and HDS. Each category includes a small image of the product and a list of supported models. The HPS category lists Class Super 400 Series - 900, 950, 990, 990 (2012) & 0400. The HPMS category lists Class Super 400 Series - 900, 950, 990, 990 (2012). The HDS category lists Class 400 & 600 Series - 900, 950, 970, 970, 990 (2012) & 0400. There is also a section for "In Development" with the text "The Shredlage™ product line is constantly expanding. Check back soon for new models and models." The footer contains the text "Website Design by Paul De Franco" and "©2012 Shredlage LLC".

Shredlage rolls can be used for earlage/snaplage



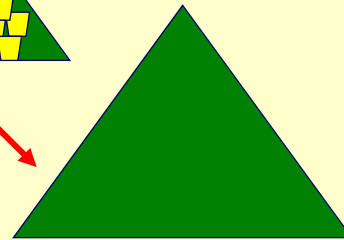
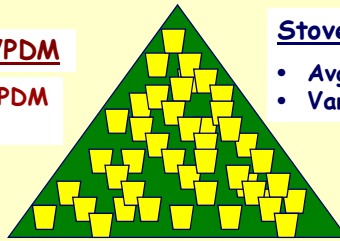
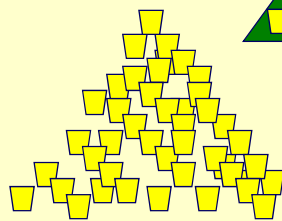
Whole-Plant Corn Silage

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% starch digestibility

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

40 to 70% IVNDFD ?

- Lignin/NDF
- Hybrid
- Maturity

Variable peNDF as per chop length ★

Adapted from Joe Lauer, UW Madison Agronomy Dept.

Visit UW Extension Dairy Cattle Nutrition Website

<http://www.uwex.edu/ces/dairynutrition/>

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Dairy Cattle Nutrition UW-Extension

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Welcome to Dairy Cattle Nutrition UW-Extension

The Dairy Cattle Nutrition UW-Extension site is designed to provide research-based information for the public seeking resources on applied aspects of the nutrition of dairy cattle.

Web Site Highlights

- [Dairy News from the University of Wisconsin](#)
- [2007 1st State Dairy Nutrition & Management Conference Proceedings](#)

UW Feed Grain Evaluation System

- [Technical note: A method to quantify protein contents in corn that are negatively related to starch digestibility in ruminants](#) (Josh Larson and Pat Hoffman - JDS paper)
- [Corn Starch Digestibility Factors related to starch digestibility in ruminants](#) (Pat Hoffman and Randy Shaver - Conference paper)
- [Corn Starch Digestibility Factors related to starch digestibility in ruminants](#) (Pat Hoffman and Randy Shaver - slide set)
- [A guide to water-soluble carbohydrates](#) (Pat Hoffman and Randy Shaver)
- [UW Feed Grain Evaluation System](#) (Pat Hoffman and Randy Shaver)
- [Forage Starch Stability - RSS](#) (Pat Hoffman and Randy Shaver)

Spreadsheets

- [MS Excel 2000 Corn Starch Calculators TDN, N, NEL, TD, MEV per ton, and MEV per acre](#)

Publications


- [Research notes for age, nutrient, composition, and digestibility](#)
- [Research Notes on Milk Production Data Herds](#)

Presentations


- [Research notes for age, nutrient, composition, and digestibility](#)
- [Data fed to selected AMM on selected data herds](#)

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