Shredlage® in Dairy Cow Diets

奶牛日粮中的揉丝青贮

Alvaro Garcia DVM PHD Professor
Alvaro Garcia 博士 教授
Director of Agriculture and Natural Resources
South Dakota State University
南达科他州立大学农业和自然科学中心 主任

New Silage Processing Should:
新技术的青贮加工需要：

1. Process the grain better than previous ones’
籽粒的加工需要比此前的更好

2.Allow for greater flexibility at harvest.
在收获时有更大的灵活性

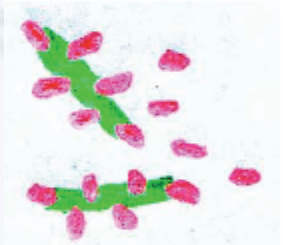
3.Reduce feed sorting by the cows
奶牛挑料减少

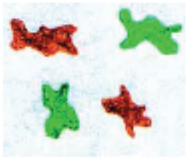
4.Slow-down the chopper a minimum

Cows Obtain More Energy By:
奶牛通过以下方式获得更多的能量：

- Increasing feed intake 增加饲料采食量
- Increasing feed retention 增加饲料存留率
- Ingesting finer particles摄入更细的颗粒
- Chewing/ruminating intensely
- 更多的咀嚼/反刍

Separation by Density
按密度分离





发酵=生成气体
气泡=逆向推移

fermentation = gas production
gas bubbles = updrift

Flotation and sedimentation only work in a liquid medium
浮选和沉积只在液体培养基中有效

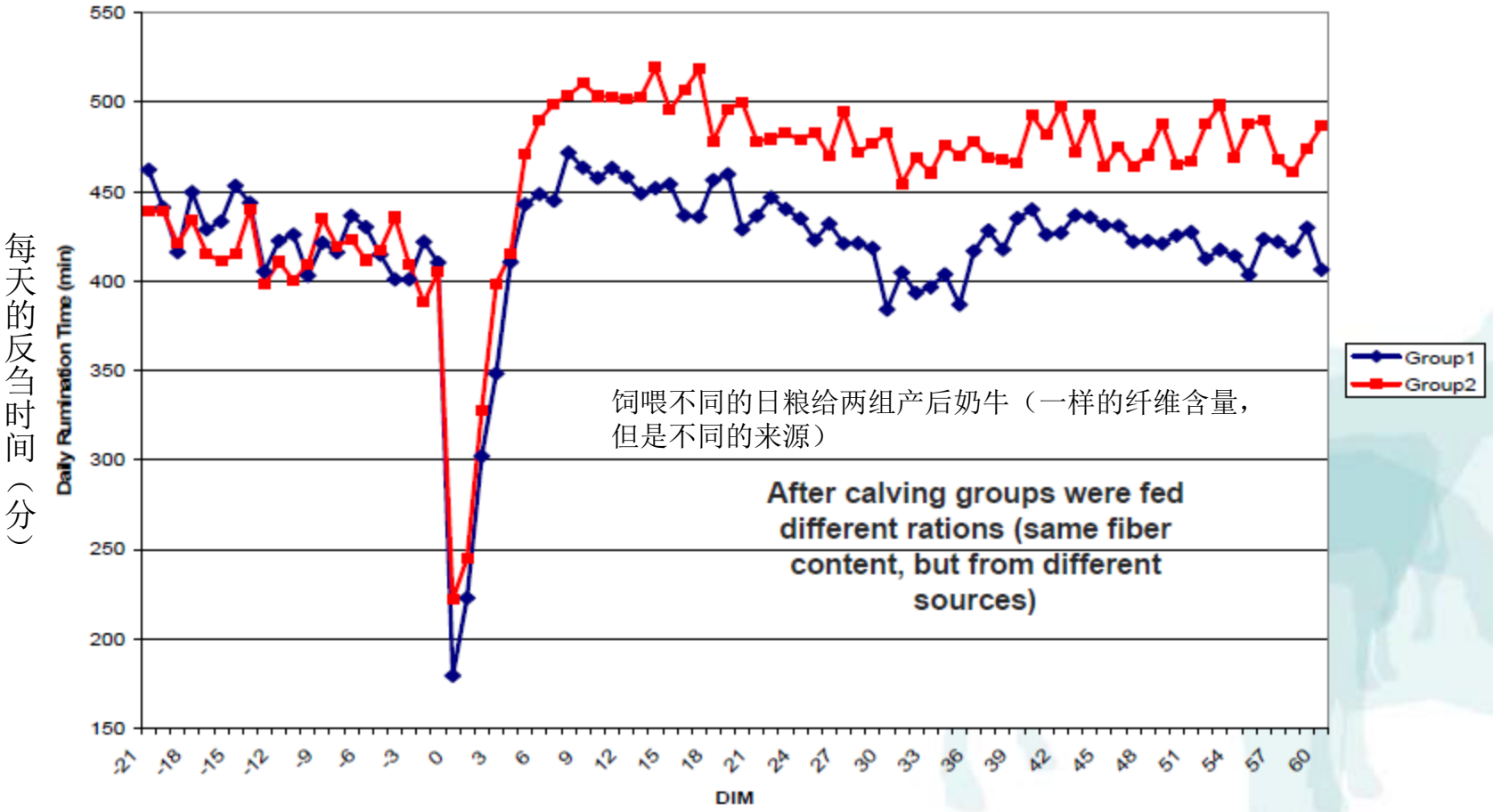
fermented particles
no gas bubbles = high density

发酵颗粒
没有气泡=高密度

HR Tags- Heatime® With Rumination Monitoring

Rumination sensitivity to nutritional changes.

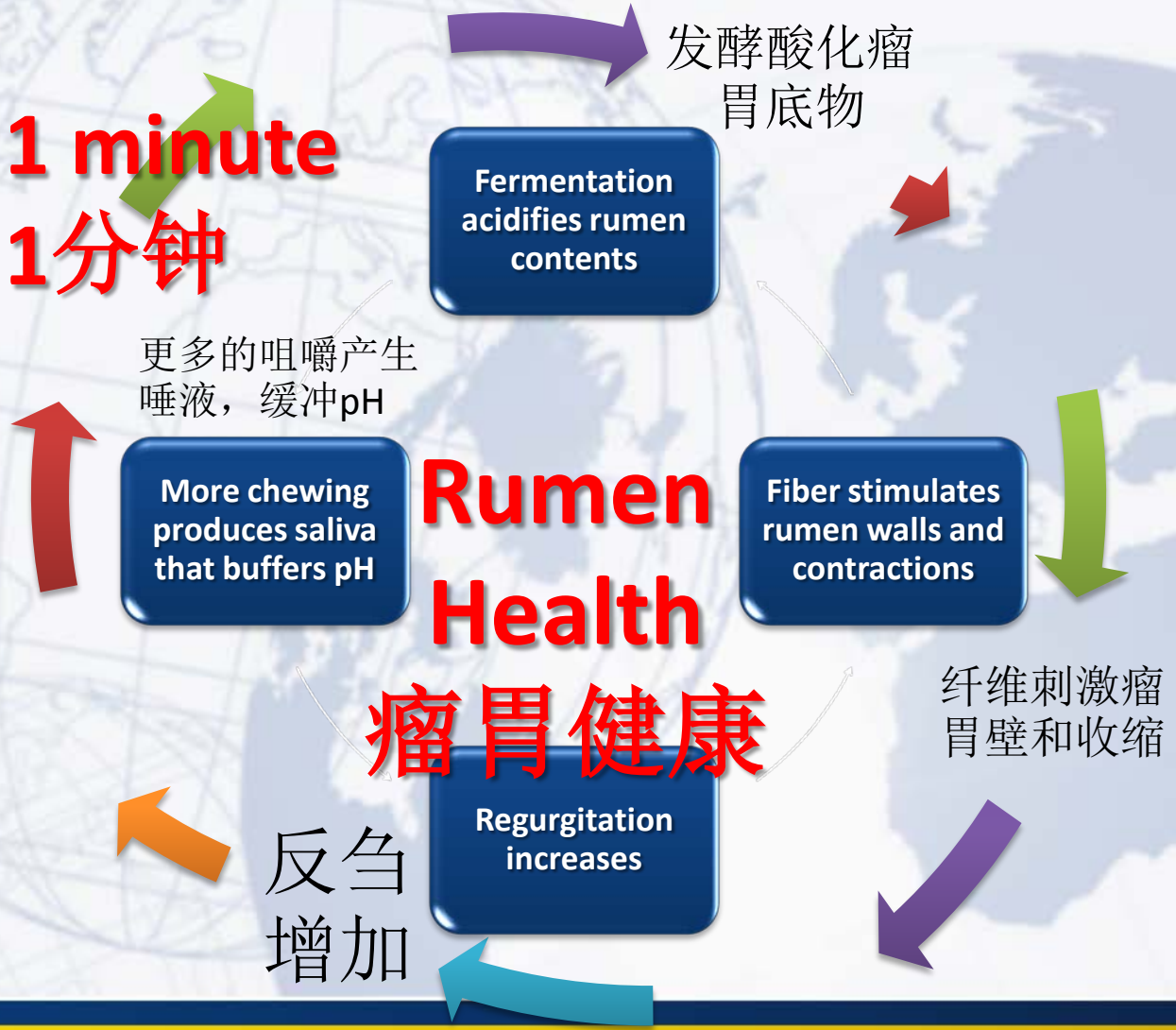
营养变化导致反刍时间不同



Adin et al. JDS. 2009 92:3364-3373

Effective Fiber有效纤维

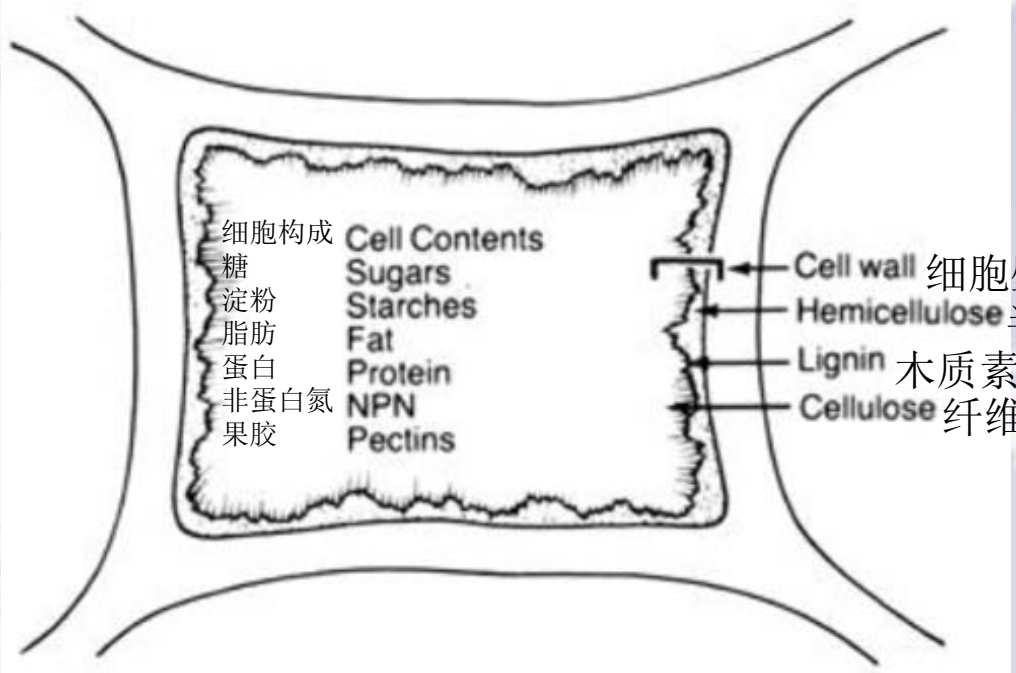
-modulates pH and motility -调节pH值和能动性



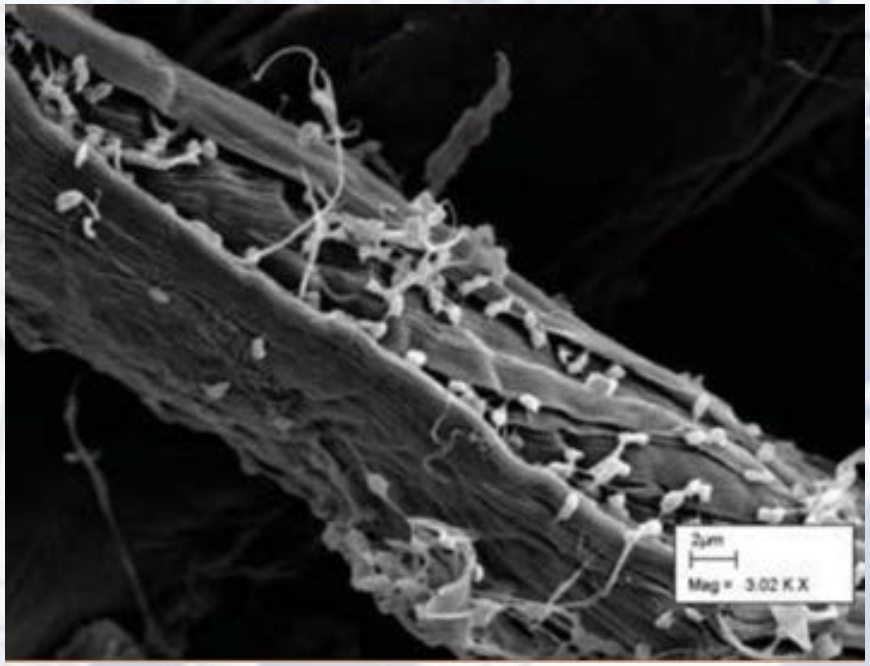
What is shredlage®? 什么是揉丝青贮?

- “Shred” (narrow torn-of strip) + “lage” (suffix from silage)
- “Shred”(切丝，切成条状)+“lage” (青贮的后缀)
- Better grain processing, longer forage particles (26–30mm TLC), stems torn longitudinally in planks and fibers, improved effective fiber, better compaction plant cells better exposed to microbial digestion.
- https://youtu.be/8QCcmqaEMPI
- 籽粒加工更好，粗料颗粒更长(26-30毫米),茎类纤维纵向撕裂,改善有效纤维、更好的压实植物细胞，有助于微生物消化。
- 来源：https://youtu.be/8QCcmqaEMPI

Plant Cell Walls and Contents
植物细胞壁和组成



Bacterial fermentation细菌发酵

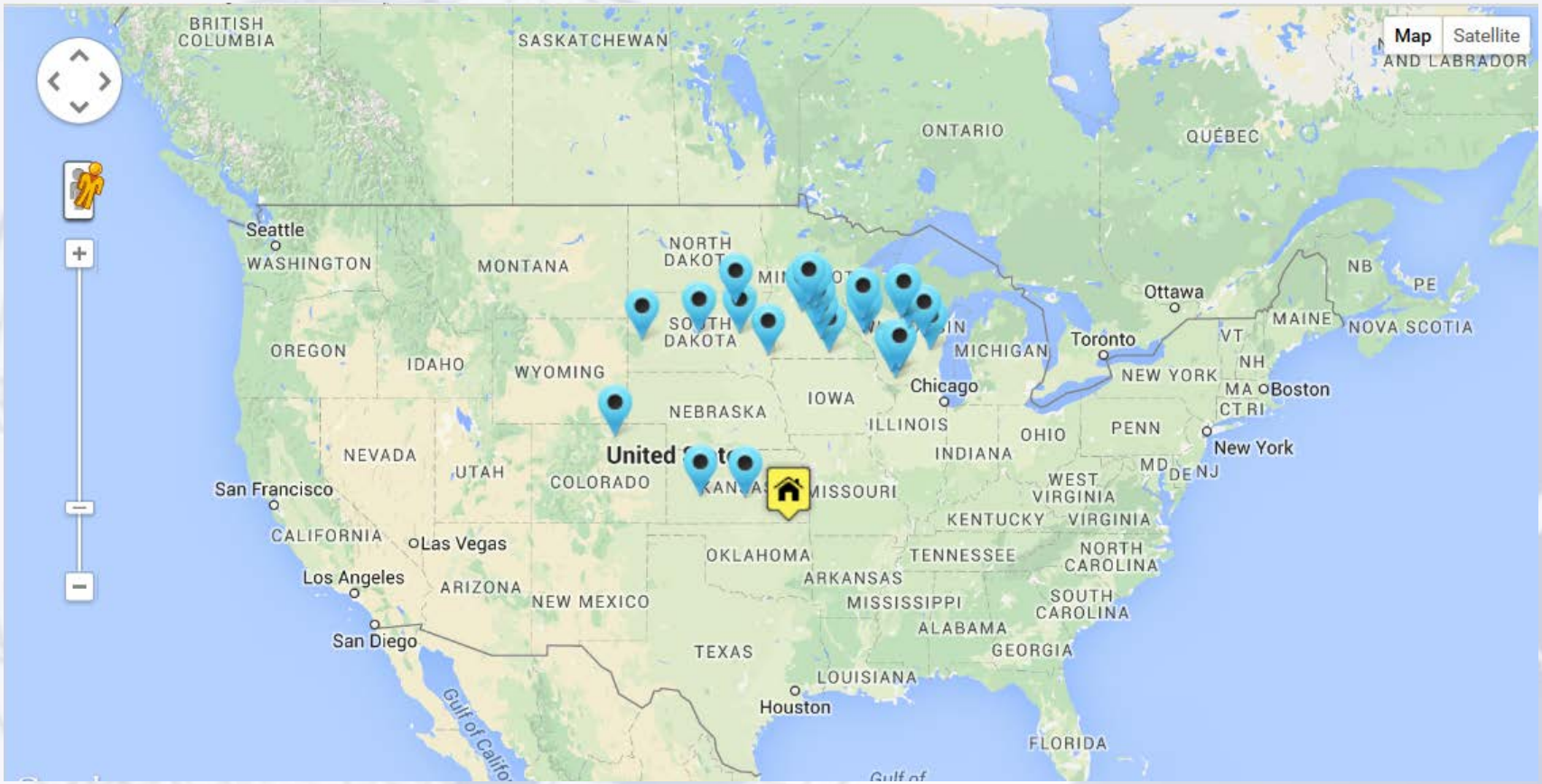


Adherence to a forage particle in the rumen
附着在瘤胃中粗料颗粒上

History 历史

- 2010 First prototype produced 出现第一个雏形
- 2011 6 processors are evaluated 6家企业进行评估
- 2012 38 processors up for sale 38家企业打算出售
- 2012 Out of season evaluation in NZ 不适合新西兰
- 2013 Adaptation to other choppers 适用于其他的切割机

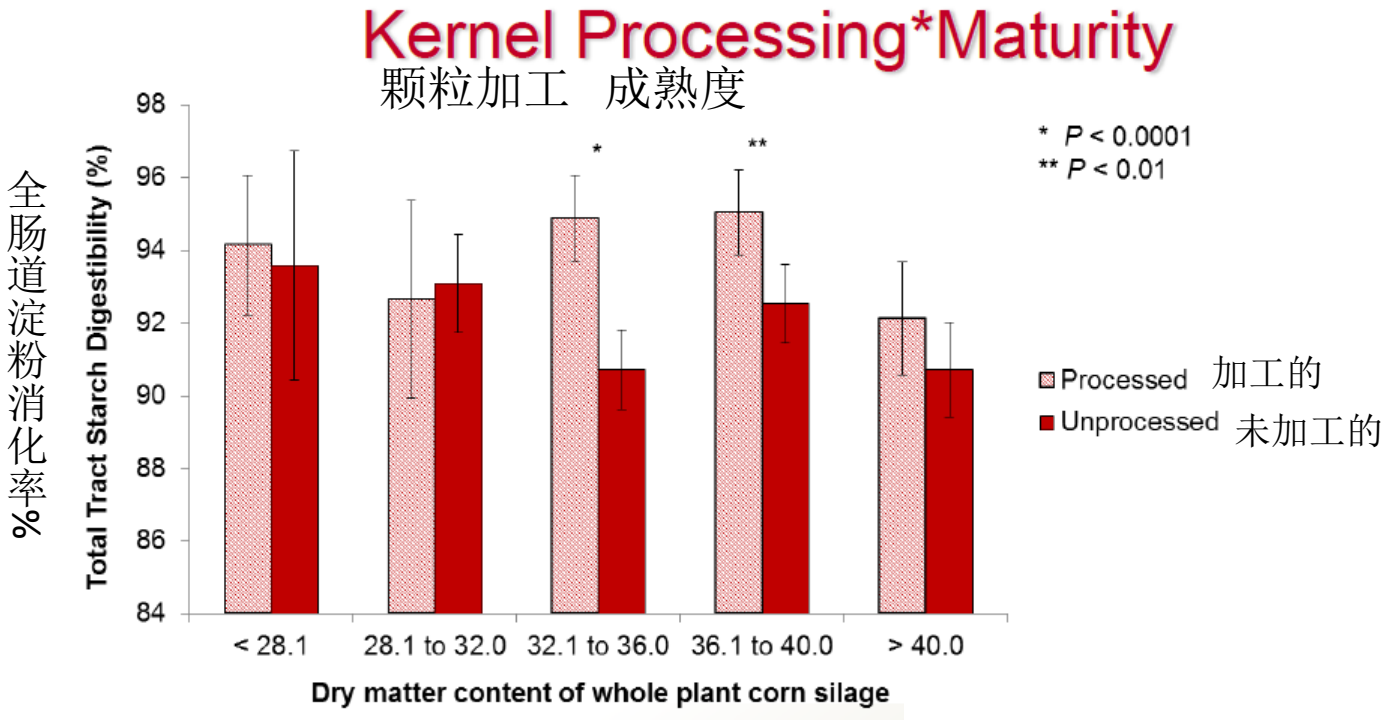
Distribution 分布图



In 2014 there were close to 600 units working, harvesting more than 7% of the U.S. corn silage.

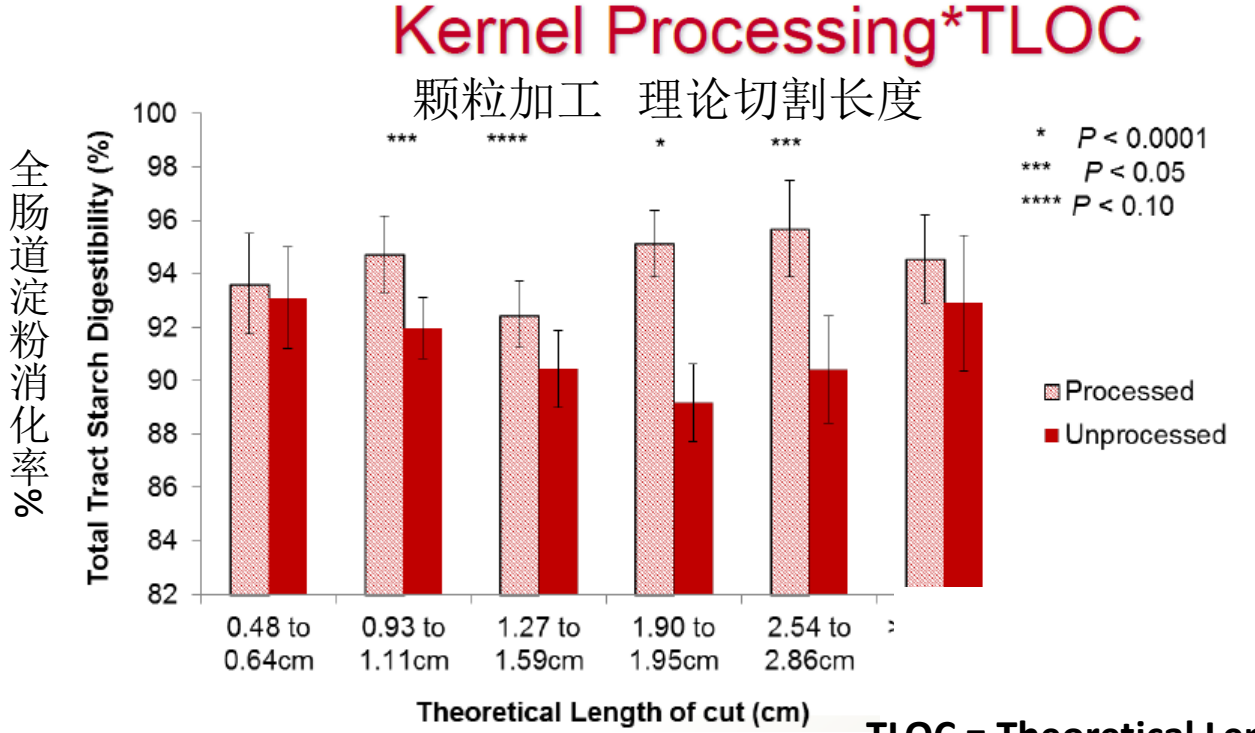
2014年，有近600家在使用，收割比例超过了美国玉米青贮的7%

Processing and Starch Digestibility
加工和淀粉的消化率



Ferrareto and Shaver 2012

Processing, TLOC, and Starch Digestibility
加工、理论切割长度和淀粉消化率



TLOC = Theoretical Length of Cut
TLOC=理论的切割长度

Ferrareto and Shaver 2012

Processing compared 加工对比

Kernel processor 籽粒加工

Shredlage® 揉丝青贮

Advantages of Shredlage®

揉丝青贮的优势

- Improves rumen function
- 改善瘤胃功能
- Increases effective fiber and its digestibility
- 增加有效纤维及其消化率

Digestible fiber replaces straw, hay, etc.
可消化纤维替代稻草、干草等。

- Reduces the need for other forage reserves
- 减少其他粗料储备的必要性

Demostrations 示范

(Several contractors, States and conditions, different moistures)
（一些生产商，州和条件，水分不同）

- One chopped close to 60% moisture by accident
- 偶然地，一个制作揉丝青贮的实例中水分接近60%
- Diets with less than 70% shredlage 日粮中揉丝青贮小于70%
  - Seems 21 mm TLOC is enough (30 mm before)看上去21毫米的理论切割长度是足够的（之前是30毫米）
- Accepted among contractors.不同的产商之间都认可

Modified Kernel Processors (KP)
改良籽粒加工

- Do not work 没有作用
- Reduced forage particles but did not process grain enough 粗料颗粒度降低，但是籽粒的加工不够
- Damaged KP at longer forage particles
- 粗料较长时，籽粒加工被破坏
- They did not result in Shredlage® 这些不会在揉丝青贮中出现

Shredlage® 30mm and 64% moisture

揉丝青贮：30毫米，64%水分

Results of the PS particle separator: 35:45:19:1

滨州筛结果：: 35:45:19:1

Cow performance
奶牛性能

PS Particle Separator
滨州颗粒分离筛

Silage samples from a bag at feed-out
青贮取样于袋装青贮

Sieve, mm 筛孔，毫米	Shredlage® 揉丝青贮	KP 籽粒加工
19	31.5%	5.6%
8	41.5%	75.6%
1.18	26.2%	18.4%
pan	0.8%	0.4%

Grain Processing Score 籽粒加工评分

	Shredlage®	KP
Starch (%) through a 4.75 mm sieve **淀粉（%）通过一个4.75毫米筛孔**	**75.0% ± 3.3**	**60.3%± 3.9**

Ferrareto and Shaver 2012

Experimental diets (dry basis)
试验日粮（以干物质为基础）

	Shredlage®	KP
Shredlage® 揉丝青贮	50%	---
Silage + KP 青贮+籽粒加工	---	50%
Alfalfa haylage 苜蓿干草青贮	10%	10%
Ground dry corn 干玉米粉	10.3%	10.3%
Gluten feed 麸质饲料	7.4%	7.4%
Soybean meal 48% 豆粕48%	6.9%	6.9%
Soy expeller 大豆皮	9.3%	9.3%
Bypass fat 过瘤胃脂肪	1.9%	1.9%
Min y vit. 矿物质 维生素	4.2%	4.2%

Ferrareto and Shaver 2012

PS Particle Separator 滨州颗粒分离筛

TMR samples TMR 取样

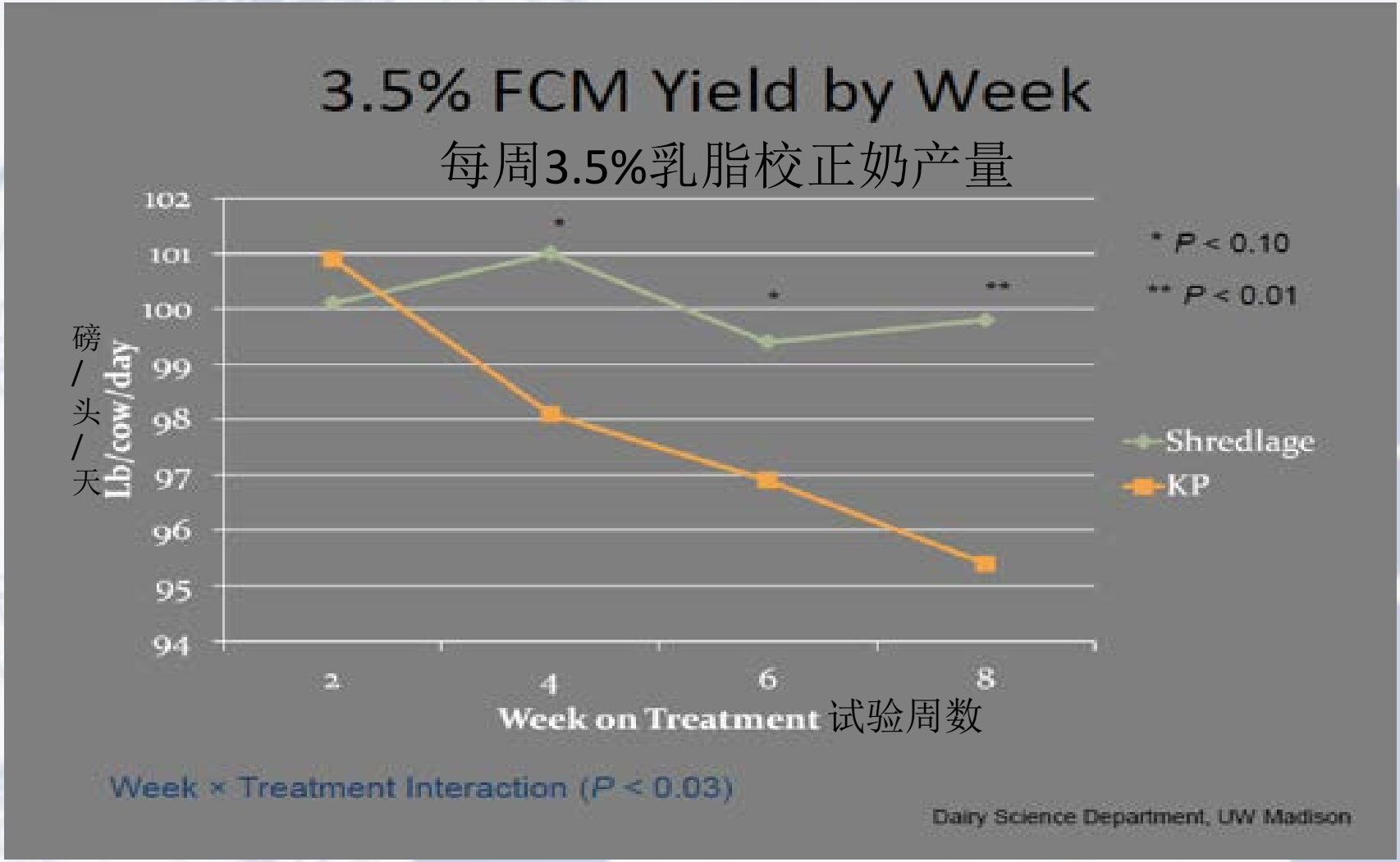
Sieve 筛孔	shredlage®	KP
19	15.6%	3.5%
8	38.2%	52.9%
1.18	38.9%	35.8%
Pan	7.3%	7.8%

Ferrareto and Shaver 2012

Cow Behavior and Digestibility
奶牛行为和消化率

- Agressive intake 采食量增加
- With 40-50mm sorting; little when < 30mm
- 当长度为40-50毫米时，奶牛挑料；当长度小于30毫米时，奶牛挑料很少
- Significantly increased effective fiber
- 极大的增加了有效纤维
  - No need for straw, hay, etc. (Shaver 2012-2013)
  - 不需要稻草和干草等
- Apparently increases NDFd NDF消化率明显增加
  - Based on fecal particles and production response
  - 根据粪便颗粒和产量的反馈

Milk Production 产奶量



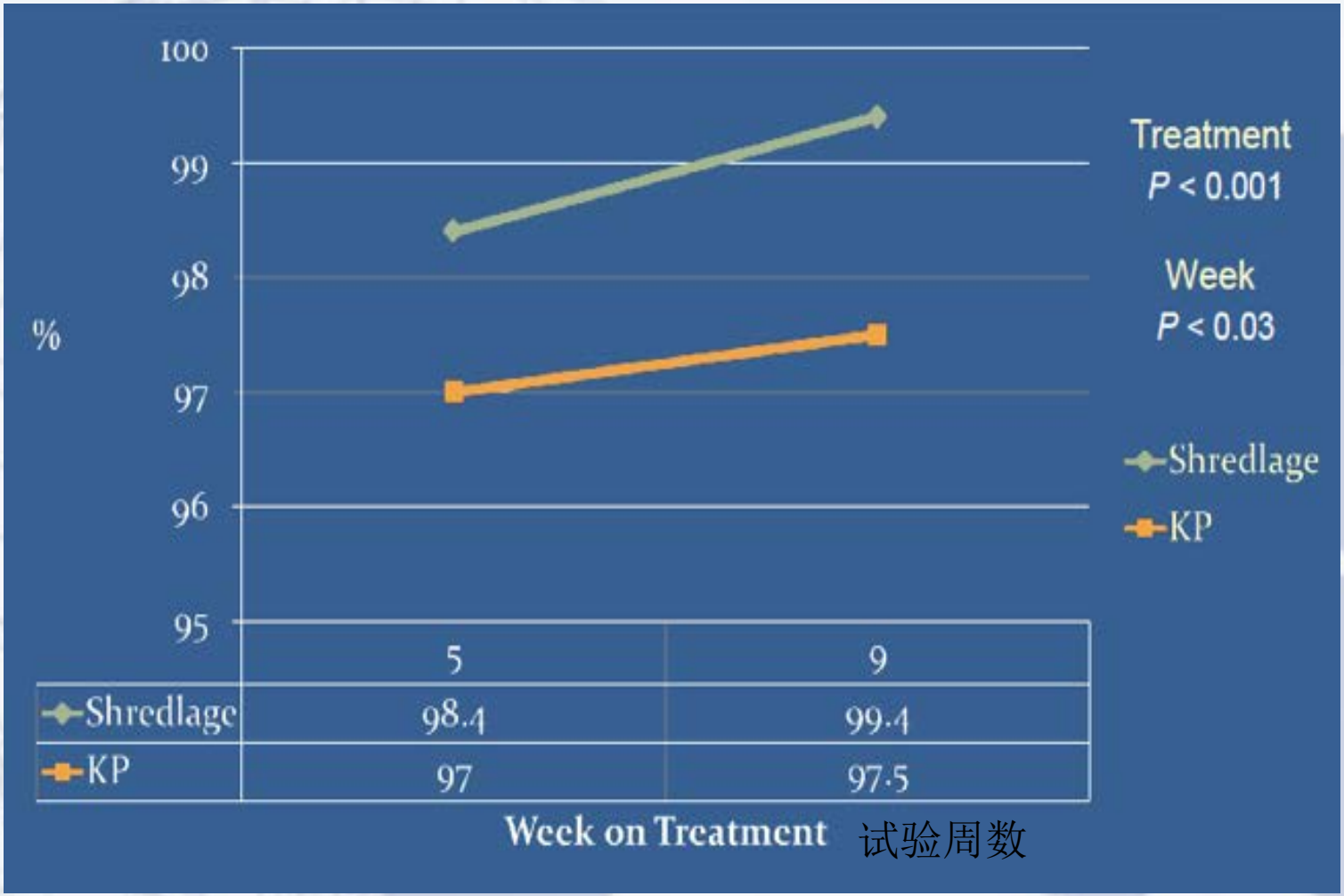
Ferrareto and Shaver 2012

Intake and production (kg/d)
采食量和产量（公斤/天）

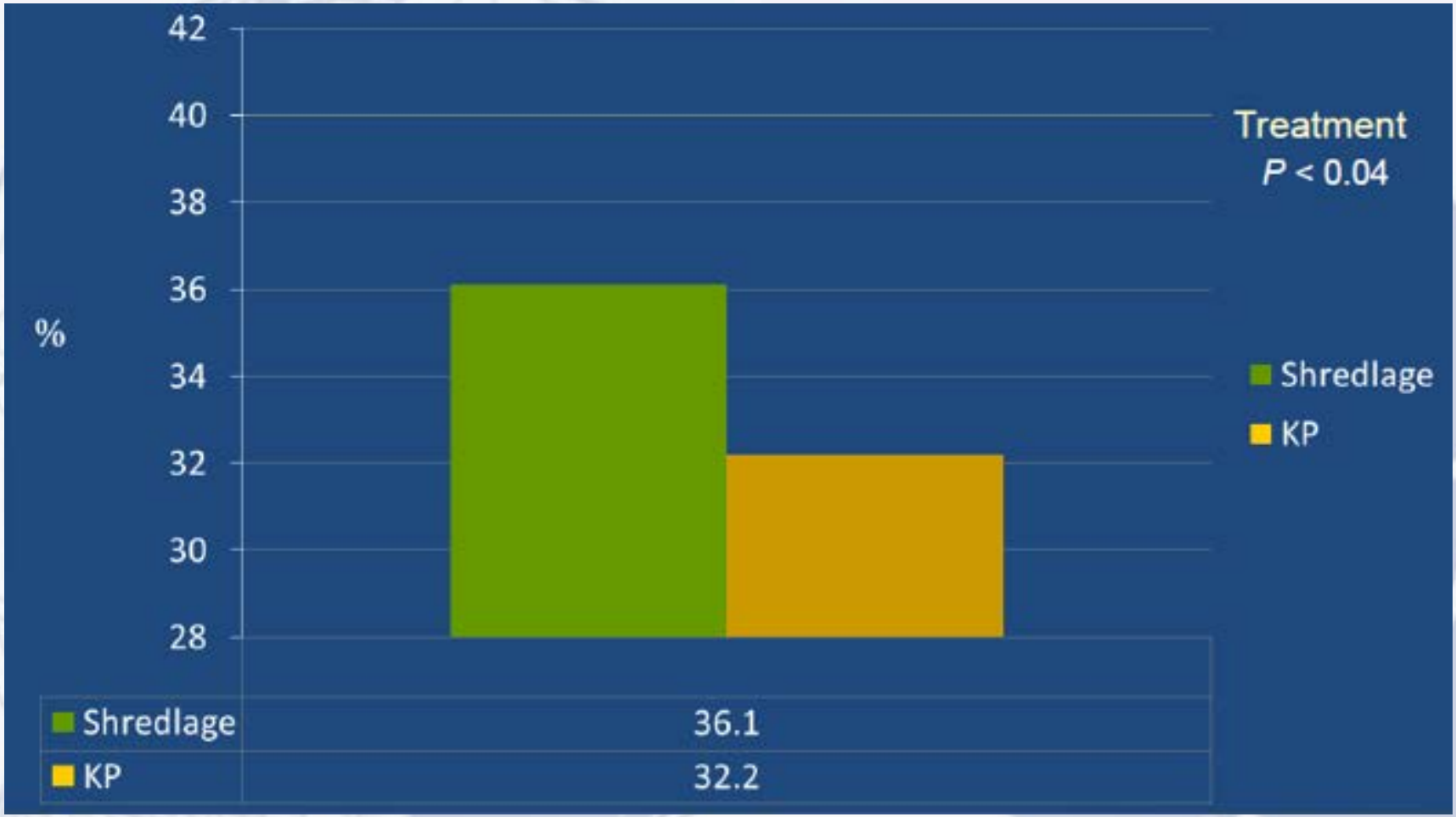
	Shredlage®	KP	P <
DMI 干物质采食量	25.3	24.7	0.08
Milk 产奶量	43.6	42.8	0.14
Milk/DMI 奶产量：干物质采食量	1.72	1.73	0.74

No effects on milk components

Total Starch Digestibility 总淀粉消化率



Total NDF Digestibility总NDF消化率



Conclusions 结论

- More Shredlage® in the top sieve of the PS
- 更多的揉丝青贮在滨洲筛的上层筛
- No feed sorting 没有挑料
- Intake tended to be greater with Shredlage®
- 饲喂揉丝青贮日粮的奶牛，采食量更高
- FCM increased towards the end of the experiment
- 在试验末，乳脂校正奶增加
- Grain processing and starch D higher with Shredlage®
- 揉丝青贮的籽粒加工和淀粉消化率更高
- More total NDFd in the diet with Shredlage®
- 揉丝青贮日粮中总中性洗涤纤维消化率更高

Added advantages of Shredlage®
揉丝青贮的更多优势

Better nutritional value; Greater harvest window
更多的营养价值

- Older silages less digestible (more “cigar butts”)
- 过去的青贮，消化率较低（很多的“雪茄屁股”
- Processes well; particles ripped completely
- 加工得更好，颗粒完全破碎
- Late, drought-tolerant hybrids

  digestibility remains higher

晚熟、耐旱品种的消化率仍然很高

Possibilities of Shredlage®
揉丝青贮的可能性

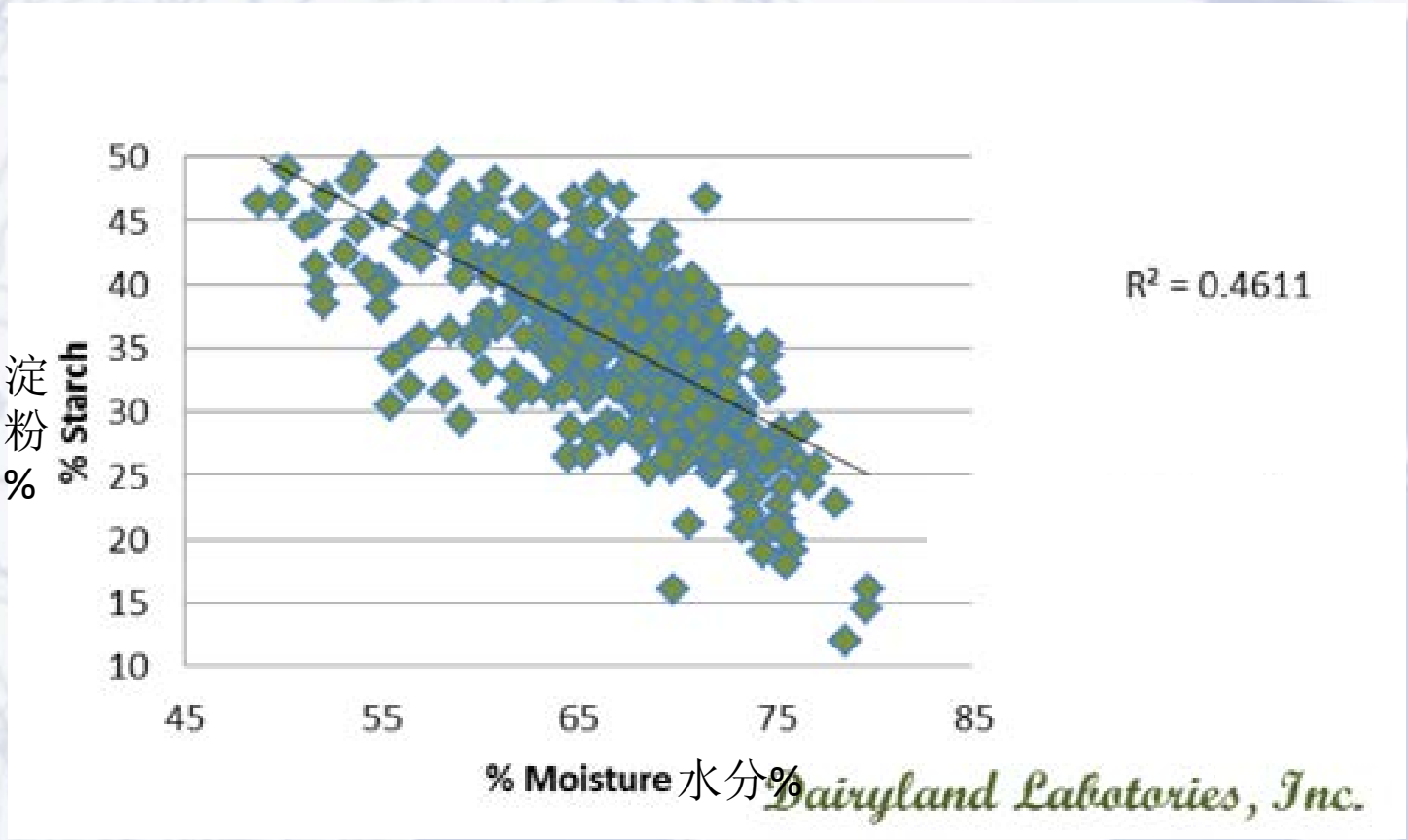
- Silage needs 63-64% moisture at high dietary inclusions.
- 在高产日粮中，青贮需要63-64%的水分
- Maximum Shredlage® inclusion 85% of the forage
- 揉丝青贮在粗料中最高可占比85%
  - Due to % starch and NFC degradability
  - 由于淀粉比例和非纤维性碳水化合物降解率
  - Same silage: Well processed in the fall; not so much later on
  - 相同的青贮：在秋季时很好加工，过些时候就没有那么好加工
- Less corn grain needed in the diet (use dry corn!)
- 日粮中需要的玉米颗粒降低（使用干玉米）
- Shredlage® and drought diets: 揉丝青贮
  - 26mm seem to be enough TLOC to use with most byproducts.
    与大部分副产品一起使用时，理论切割长度26毫米已足够

Increasing Starch in the Silage
增加青贮中的淀粉
Harvest at 1/4 vs. 2/3 milk line
在乳线1/4收获 vs.乳线2/3收获

- 1/4 milk line = 29% starch
- ¼乳线=29%淀粉
- 2/3 milk line = 37% starch
- 2/3乳线=29%淀粉

Shaver. 2013

Starch vs. Moisture: 2011 Silages
淀粉vs.水分 2011年青贮



Highly Digestible Hybrids
高消化率品种

- Maximum D, high yield and milk production
- 消化率最大化，作物高产和产奶量
- Brown midrib (BMR; bm3) —natural mutation
- BMR —自然的变化
- < lignin in stalks; > D and > DMI > milk production
- <秸秆中的木质素； > 消化率并且大于干物质采食量 > 牛奶产量
- Greater standability compared to the past
- 与过去相比，稳定性增加
- Greater herbicide resistance 抗杂草性更强

BM3 (Mycogen) Shredlage®
BM3揉丝青贮

- To be put up a little drier than conventional

  将比传统的更干燥
- 65-67% moisture　65-67% 水分
- At least ½ milk line　至少½ 乳线
- Field sequence dependent on milk line
- 田间的收割顺序取决于乳线
- Adjust cylinders at least ½ mm closer 调节滚筒至少接近½ 毫米

Shredlage® 揉丝青贮

30mm TLOC and 2 mm separation

30毫米的理论切割长度和2毫米的间隔

Great retention in top sieve; Excellent grain processing

上层筛留存率增加；良好的籽粒加工

Compaction 压实

- Same or better than conventional silage in trench silos
- 与地下青贮窖（沟式青贮窖）的常规青贮一致或更好
- UWI research showed better compaction in silo bags
- 威斯康辛大学研究表明压实比袋装青贮更好

- Available since 2013 for:
  - Class 494's (930-960) HPS and HPMS
  - Class 494's (970-980) HPS and HPMS
  - Class 492's & 493's (900-830) HDS

Characteristics

» 1 year full warrantee 一年全部质保
» 5 years warrantee on the frame 5年车身质保
» Cabin monitor for bearing temp. and air pressure 车内监控器耐温和耐气压

Shredlage™ LLC

HPS and HPMS Processo

HPS fits 494 Model years 2008-2011
HPMS fits 494 Models 2012 and Newer

Requirements

494 Series (930-980)

24-KNIFE DRUM • 20-KNIFE DRUM • 36-KNIFE DRUM

*APPROPRIATE DRIVE SYSTEM

HDS Processor Requirements

Fits All 492 and 493 Models

492 and 493 Series (830-900)

24-KNIFE DRUM • 20-KNIFE DRUM • HALF-SECTION KNIVES

*SOME MACHINE MODIFICATION REQUIRED

Requirements 需求

Half-Section Knives

Incorporated to other choppers

-2013-

LOREN CUT™ Cylinders

John Deere	New Holland	Krone
Narrow and Wide Body 7000 Series	FR 9000 Series	All Models

Installed unit

Oil sprayer

Cabin monitoring of bearing temp. and air pressure


Thank you! 谢谢！