Beyond Grandfather's Grasses: Next Generation Highly Digestible Forages 8<sup>th</sup> Annual CFGA Conference November 14-16<sup>th</sup> Guelph, ON

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# **BARENBRUG**





We can't feed TODAY'S world without ruminant animal agriculture, let alone the world of 2050.



We must improve efficiency & productivity of ruminant animal agriculture.



#### The challenge ahead



- UN projects world population will reach 9+ billion by mid-century
- UN has called for a 100 percent increase in world food production by 2050
- FAO predicts a 66% increase in demand for animal protein by 2050
- Must come from virtually the same land area as today.



#### Percent of food calories and protein from plant products



FAOSTAT (Food and Agriculture Organization of the United Nations, FAOSTAT database). 1997. <u>https://goo.gl/mkjnwQ</u> Cited In: Delgado, C. L., C. C. B. Courbois, and M. L. Rosegrant. 1998. Global food demand and the contribution of livestock as we enter the new millennium. <u>https://goo.gl/CbjDKQ</u>

#### BARENBRUG

#### Malnourishment in today's world

# 795 million suffer from chronic undernourishment<sup>1</sup> 2.2 billion overweight & obese<sup>2</sup>

FAO <u>https://goo.gl/Ta47sg</u> Lancet https://goo.gl/bThgFx



I dream of the day when the public understands that their consumption of the products in the background ...

... lessens their need for the products in the foreground.



#### Happily, THAT day is fast approaching!



### In the United States

2.1 million principal farm operators\*,1



2.2 million prisoners (State, Local, & Federal)<sup>2</sup>



\* - But for more than 70% of these, less than 25% of their household income from farming.<sup>3</sup>

- 1. US Census of Agriculture. 2012. http://goo.gl/UUv8Fi
- 2. Bureau of Justice Statistics. 2013. http://goo.gl/O0NdGo
- 3. US Census of Agriculture. 2012. https://goo.gl/0hVu1K



#### True health food comes from ruminants!



Beef (cattle)



Lamb (sheep)



Chevon or cabrito (goats)



Venison (deer)

#### Different kinds of fermented plant products



#### I can turn grass into heavy whipping cream.





#### Lower your carbon footprint! Eating MORE fat lowers your personal CO<sub>2</sub> emissions.



Dr. Ted Naiman - 'Insulin Resistance' at 2017 Low Carb Breckenridge Low Carb Down Under <u>https://goo.gl/I09pDq</u>

#### 





#### Production or profit?

"Production is vanity, profit is sanity!" Graham Kerr, New Zealand Agriseeds				
agriseed Pasture Seed Sector				
Parameter (annual, per cow)	US <sup>1</sup>	NZ <sup>2</sup>	NZ vs. US (% of US)	
Production (lb milk)	21,355	11,322	53	
Income (USD)	\$4,300	\$2,337	54	
Cost (USD)	\$3,640	\$1,429	38	
Profit (USD)	\$660	\$908	138	

1 US average, 2011, USDA ERS 2 2011 data, Lincoln University Dairy Farm



# **Breeding Improved Forage Grasses**

Factors affecting selection for both cutting and grazing systems

- Persistency
- Stress tolerance to heat, drought, freeze
- Disease (Rust, Xanthomonas)
- Effluent water / Salt tolerance
- Forage quality





## **Breeding Improved Forage Grasses**





# Varietal differences

"Greater differences exist among grass varieties than among corn hybrids and soybean varieties"

Dr. Dan Undersander, Univ. WI





#### Grandfather's Grasses



#### There's nothing so expensive as cheap seed!





#### What is your forage made of?

	ALFALFA	GRASS
Protein	27%	16%
NDF	35%	43% to 70%
ASH	8%	8%
FAT	3%	3%
NFC	27%	18% to 30%
	100%	100%
NDFd	25-45%	25-60%



# **Relative Forage Quality of Grasses**

All Grasses harvested at Boot Stage

				NDF	NDFd	
		Heading Date P	PROTEIN (%)	(%)	(%)	IVTD (%)
Perennial Ryegrass	BAR 1M	16-May	16.9	55.5	83.5	90.9
Perennial Ryegrass	Remington	25-May	14.0	57.0	81.0	89.2
Meadow Fescue	Pradel	16-May	16.8	55.5	83.7	90.9
Meadow Fescue	Barvital	14-May	17.7	51.9	89.0	94.3
Tall Fescue	Retu	21-May	15.5	57.2	75.4	85.9
Tall Fescue	Barcel	18-May	16.8	54.7	79.3	88.7
Orchard grass	Potomac	14-May	16.7	64.2	75.4	84.2
Orchard grass	Baridana	14-May	17.6	62.6	79.7	87.3

Grass Trial in Ithaca, NY, Forage quality predictions by NIRS; NDF: neutral detergent fiber NDFd: NDF digestibility (48 hour digestion)



#### Carbohydrate Digestibility Affects Health & Production

Dairy rations contain carbohydrates (NFC and NDF)



Properly balancing NFC and NDF is critical for health and production in high producing dairy cows.

Variations in fiber digestibility affect production more than variations in starch digestibility Starch digestibility => 3-5 lb/day Fiber digestibility => 6-7 lb/day



### Assessing fiber digestion not easy





# Stand-alone *in vitro* NDFD30 or iNDF values are poor predictors of in vivo fiber digestion



Arndt C, Armentano LE, Hall MB. J. Dairy Sci. 2009;92 (E-Suppl. 1):94.

Ferraretto L. F., A. C. Fonseca, C. J. Sniffen, A. Formigoni, and R. D. Shaver. 2014. Submitted to ADSA meeting 2014.

Fredin SM, Bertics SJ, Shaver RD. 2013 J. Dairy Sci. 2013;96(E-Suppl. 1):149.

Fredin SM, Ferraretto LF, Akins MS, Shaver RD. 2013 J. Dairy Sci. 2013;96(E-Suppl. 1):34.

Lopes, F., D. E. Cook, R. W. Bender and D. K. Combs. 2013a. J. Dairy Sci. 96( E-Suppl 1): 523..

Lopes. F., D. E. Cook and R. W. Bender and D. K. Combs. 2013b.. J. Dairy Sci. 96( E-Suppl 1): 16..

Verbeten, W. D., D. K. Combs and D. J. Undersander. 2011. J. Dairy Sci. 94 (E-Suppl 1): 556.

# **Reasons why NDFD**<sub>30</sub> or NDFD<sub>48</sub> values are poor predictors of fiber digestibility:

- 1. Single time point values do not differentiate between indigestible and undigested potentially digestible fiber.
- 2. Single time point in vitro values to not necessarily reflect rate of fiber digestion.

To evaluate forage fiber utilization you need to know pdNDF, kd and kp!

Fiber digestibility = 
$$pdNDF$$
 x kd  
(kd + kp)

# TTNDFD: The Take Home Message

1. Fiber digestibility has a big impact on milk yield.

A 2-3 unit change in ration TTNDFD corresponds to a 1 pound change in milk yield.

# 2. The TTNDFD test was developed to predict fiber digestibility in high producing dairy cattle

Can be used across forage types and byproduct feeds Can be used in ration balancing and evaluation

#### TTNDFD combines *in vitro* <u>rate</u> of NDF digestion with *iNDF* to improve the prediction of *in vivo* fiber digestion



# Fiber Digestibility Varies in Grasses

NutriFiber grasses are higher in fiber digestibility than other grasses with similar NDF content\*

Item	Ν	NDF Range % of DM	TTNDFd % of NDF
Green Spirit <sup>®</sup>	13	46 to 56	59.5
Other Grass Forage	448	46 to 56	48.3

\* Forage samples submitted to Rock River Labs, Watertown, WI in 2012







Soft Leaf Fescues Bardoux Traditional Rough Leaf Tall Fescues Kora



#### All Cuts Tall Fescue Varieties in Michigan 2015





#### Endophytic Fungi in Plants





#### Endophytes & Plants A mutualistic relationship

- Plants provide the endophyte with nutrients, protection, reproduction and dissemination.
- Endophytes improve plant's tolerance to drought, insects, diseases and nematodes.
- Plants with endophytes have greater resistance to drought stress.
- Endophytes improve persistence under stressful environments and close grazing.
- Endophytes improve tillering.
- Endophytes improve utilization of soil nitrogen.



#### Recommendations

- Soft leaf fescue varieties provide high quality and yield; Beneficial endophyte
- Newer perennial ryegrass varieties developed from continental germplasm have better winter hardiness; Beneficial endophyte
- Choose orchardgrass varieties that have late heading, and high leaf to stem ratio.
- TRUE Italian ryegrass is suitable for short-term pastures for dairy but especially for finishing grass-fed beef; Haylege.
- Meadow fescue provides an excellent opportunity to increase milk production and weight gains, especially in mixtures with other grasses. Beneficial endophyte.





Champion in Quality Counts Hay/Haylage 1<sup>st</sup> place in the Haylage and Baleage Divisions 2<sup>nd</sup> place in the Grass Hay Division



# Prize winning, 2015



#### **Green Spirit**

1<sup>st</sup>, 2<sup>nd</sup>, 13<sup>th</sup>, and 18<sup>th</sup> in the Haylage Division
42% dry matter
15.5% crude protein
24.3% ADF
39.5% NDF.
RFQ 254, 4,040 lbs of milk predicted per ton

Also won the Quality Counts award for the Hay/Haylage category, surpassing all other entries in the Baleage, Commercial Hay, Dairy Hay, Grass Hay and Haylage Divisions







#### **Barenbrug soft leaf fescues**

1<sup>st</sup> and 2<sup>nd</sup> in the Baleage Division

- 56.6% Dry Matter
- 15% Crude Protein
- 22.2% ADF
- 37.4% NDF
- 245 RFQ

2<sup>nd</sup> in Grass Hay Division with BarOptima PLUS E34<sup>®</sup>



# Prize winning, 2016



World's Forage Grand Champion (over all categories including corn silage) Tom Leubke, Mayer, MN Green Spirit - Alfalfa Mix From Grass Hay Category

- 81.4% Dry Matter
- 19.6% Crude Protein
- 19.9% ADF
- 28.8% NDF
- 77.0% NDFd 30hr IV
- 216 RFQ, 4,086 lbs of milk predicted per ton

Barenbrug represented in 5 of the top 10 finalist in the grass hay division



# Thank you!





#### **Questions?**



