



# “Healthy Cattle Start With Healthy Forages”



**Star-Gro-Products  
Chilliwack, B.C.  
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*Prepared by Douglas Yungblut, Ph.D., P.Ag.  
Consulting Nutritionist*





# Silo Guard II



# Mold & Yeast Start in the Field







# Mold & Yeast - A Problem!

- Large numbers of spores on plants at harvest.
- When chopped, plant sugars are released and mold and yeast begin to feed on them.
- Mold and yeast are growing in the wagon/truck while being transported to the silo.
- They continue growing until oxygen is depleted.
- The longer it takes to get the oxygen out, the more mold and yeast spores are produced.



# Corn Silage Field Loads

- 16 Corn Silage samples
  - Mold levels (cfu/gm)
    - Range = 4000 to 2,500,000
    - Average = 206,000
  - Yeast (cfu/gm)
    - Range = 26,000 to 160,000,000
    - Average = 2,400,000



# Stresses on Crops Cause Higher Mold and Yeast Counts



- Dry conditions
- Wet conditions
- Insect damage
- Disease damage
- Improper soil fertility
- Improper hybrid selection
- Tillage practices
- Improper plant maturity at harvest
- Improper moisture of plant when harvested
- Damaged plant when chemicals are applied
- Weed infestation

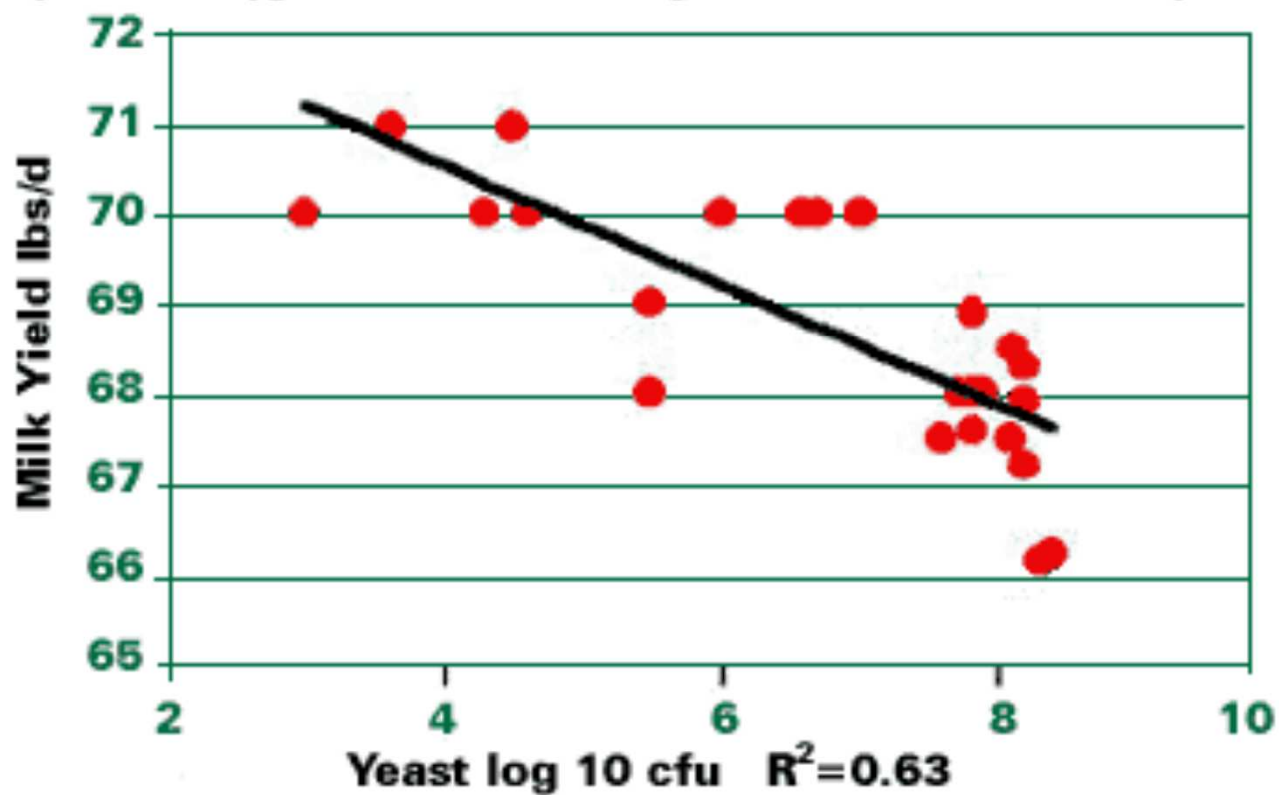


# Most Important Effects of Yeasts and Moulds

- Produce heating during ensiling (silage) or dry down (hay) while using up the most digestible nutrients (sugars and proteins)
  - Possible heat damage
  - Loss of feed value
  - Reduced palatability (dust, off flavours)
- Produce heating during feed-out
  - High levels become active again once oxygen is reintroduced
- Dust when bales are opened (bad for animals and people)
- Production of Toxins?

## MOLDY FEED... NO MYCOTOXINS

- Hoffman et al 1995
- TMR
- Moldy HMC
- Aerobically Unstable
- Exposed to Oxygen
- Fed to Lactating Cows 14d
- No Intake Depression







Producing Healthier Silages

# THE FERMENTATION PROCESS



# Ensiling = Losses of Nutrients at All Phases

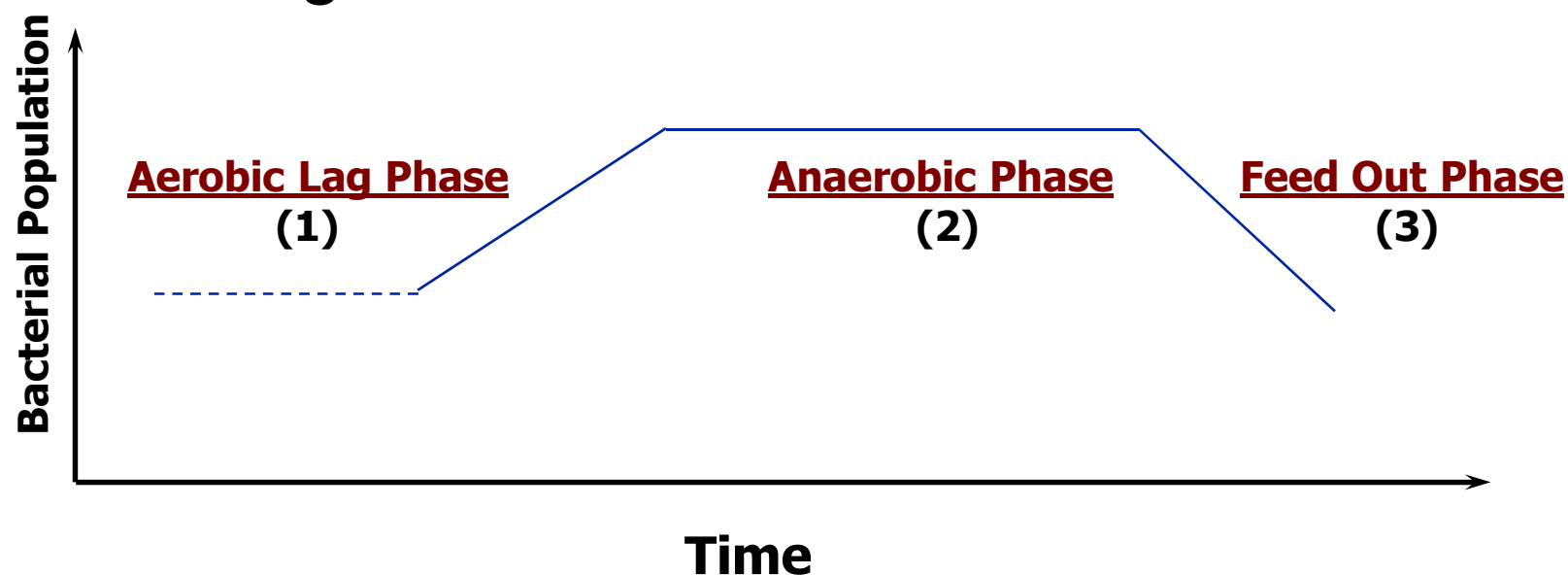


Table 1 – Average of DM losses<sup>1</sup> (% of DM) associated with ensiling systems

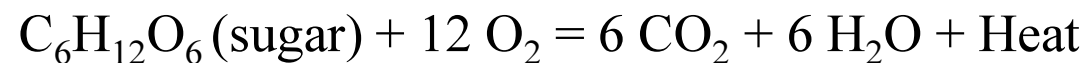
Storage type	Horizontal bunk	Concrete tower	O <sub>2</sub> Limited tower	Bag	Round bale
Total losses	22	17	17	17	30

1 – include respiration, harvesting, storage and feedout losses.

## Phases during the ensiling process

### (1) **Aerobic Phase**

Time from when the silage is chopped until the oxygen in the silage mass is depleted.



### (2) **Anaerobic Phase**

This phase begins when oxygen in the silo is depleted and Lactic Acid Bacteria take control of the fermentation.

### (3) **Feed Out Phase**

This phase begins when silage is taken out of the silo and re-introduced to air.

# Ensiling = Losses

## Nutrient losses at each phase :

- (1) **Aerobic Phase**      Plant respiration, air. Molds, yeast, & good bacteria compete for plant sugars
- (2) **Anaerobic Phase**      a) Natural lactic acid bacteria grow  
   b) pH lowers - sugars are reduced  
   c) Molds, yeasts dormant except in air pockets
- (3) **Feed-Out Phase**      a) Air re-introduced  
   b) Molds & yeasts re-activated & multiply  
   c) Loss of nutrients, heating



See the line? Dry Matter Loss  
to growth of yeast and molds





## FORAGE ADDITIVES PAY!

Forage is the main ingredient in any ruminant diet. *We have to protect that investment.*

It's not a matter to use or not to use an additive for the forages, it's a matter of with which one you feel more comfortable with.





# What is Silo Guard II?



# In A Nutshell.....

## Product Description

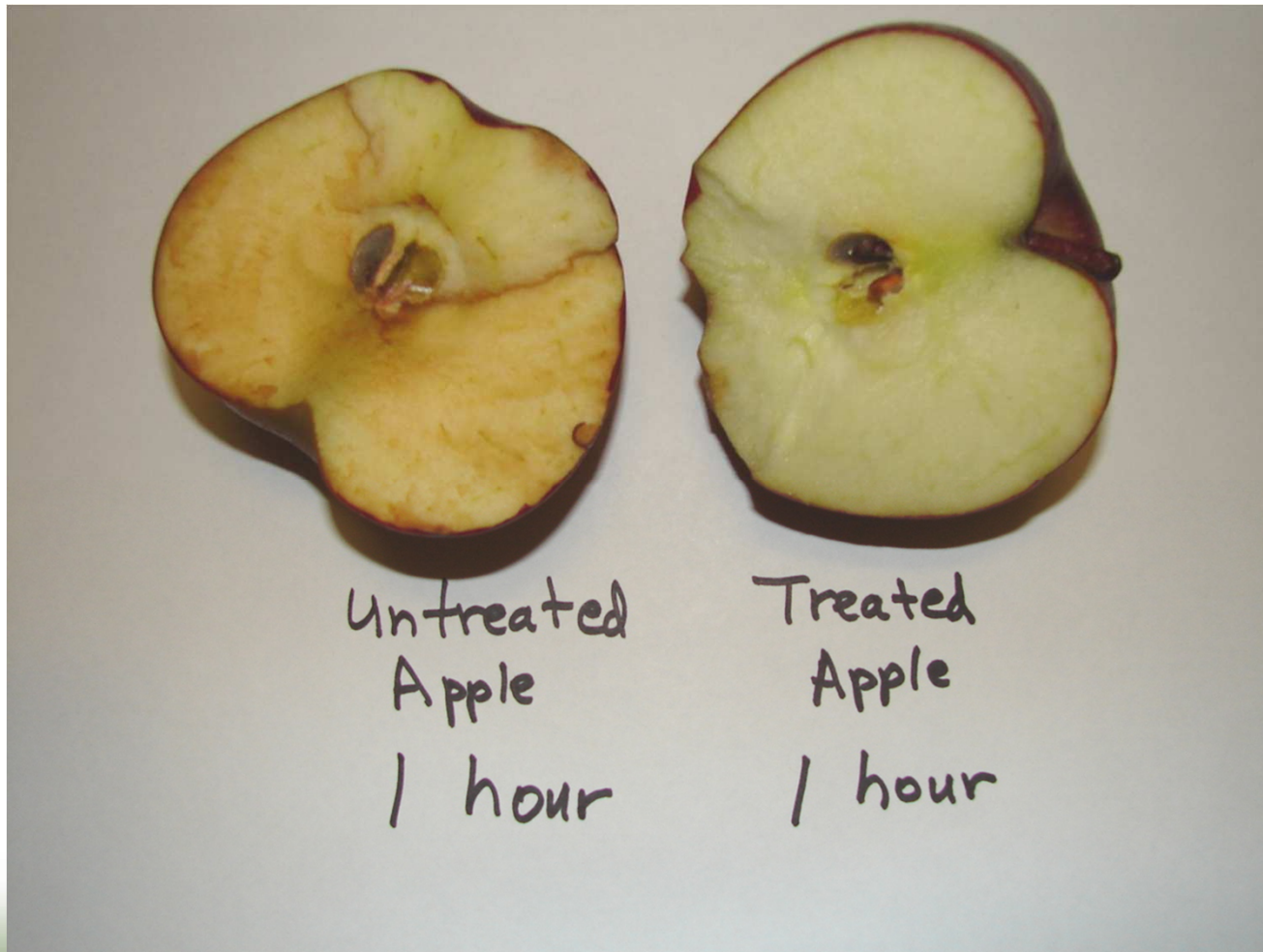


**Silo Guard II is a forage additive including sugars, enzymes and sulfur compounds that act as a fermentation aid and as a yeast and mold inhibitor.**

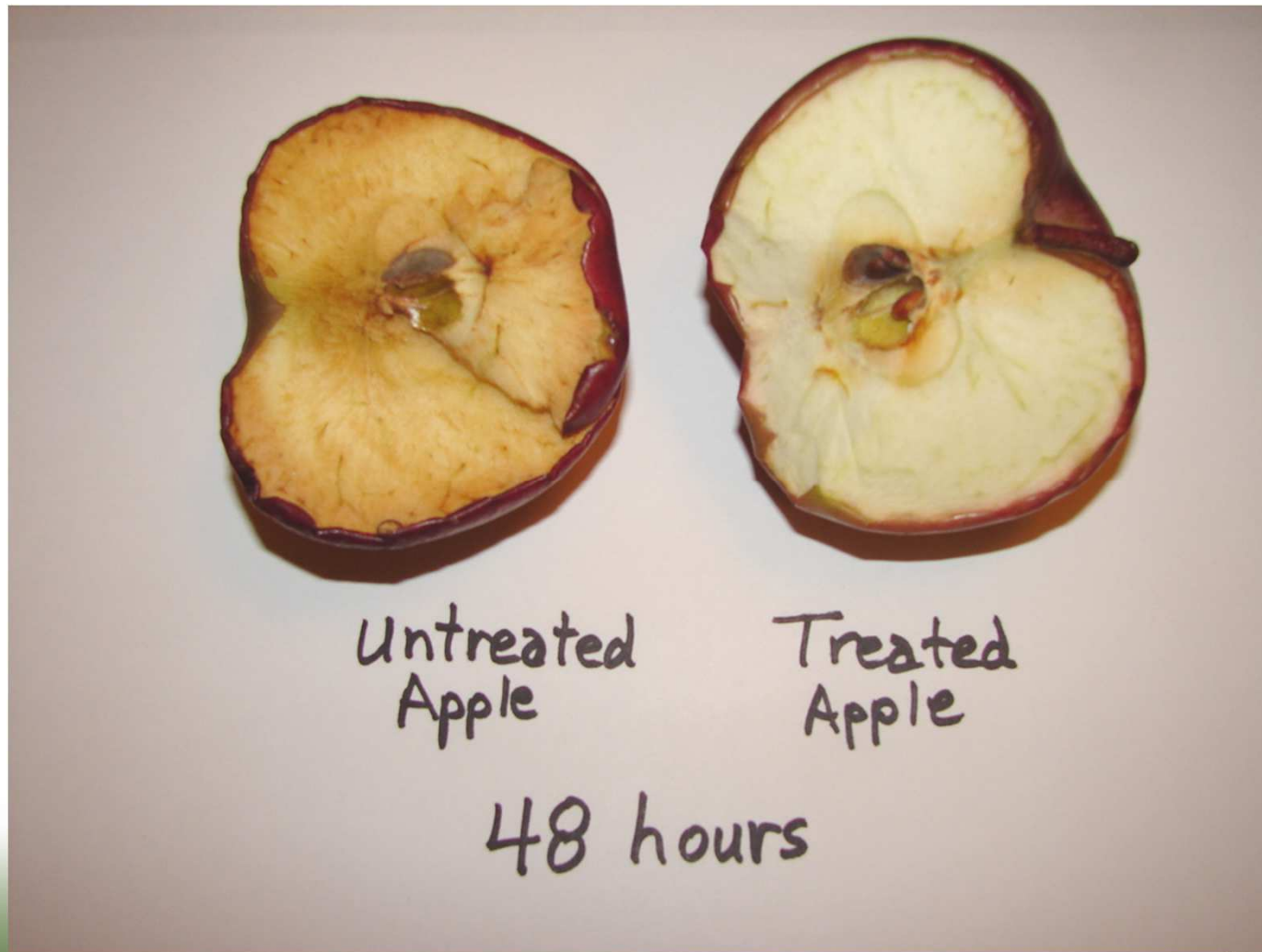
*... treat the apple*



# Action of Silo Guard II



# Still Working at 48 Hours





# Practical Facts

- Contains no bacteria (inoculants)
- All ingredients are CFIA approved
- Contains no acid - base ingredients
- Contains no drugs
- Application - requires no special handling
- Both dry & liquid -- ready-to-use formulas
- Patented formula





# Silo Guard Works with Mother Nature!

- Helps eliminate oxygen quickly
- Helps stop growth of undesirable organisms (yeast and moulds)
- Helps allow naturally occurring bacteria to produce lactic acid
- Does not compete with naturally occurring bacteria





# Silo Guard II Advantages

- Viability is no problem! Since the ingredients in Silo Guard II are of mineral base, sugars and enzymes, the shelf life is 2 years. The only precaution is not to let Silo Guard II liquid freeze.



- Silo Guard II does not contain LAB\* because there are already many billions of colonies on the forage coming in from the field. They are ready to multiply as soon as the pH is low enough and anaerobic conditions are right.

\* Lactic Acid Bacteria



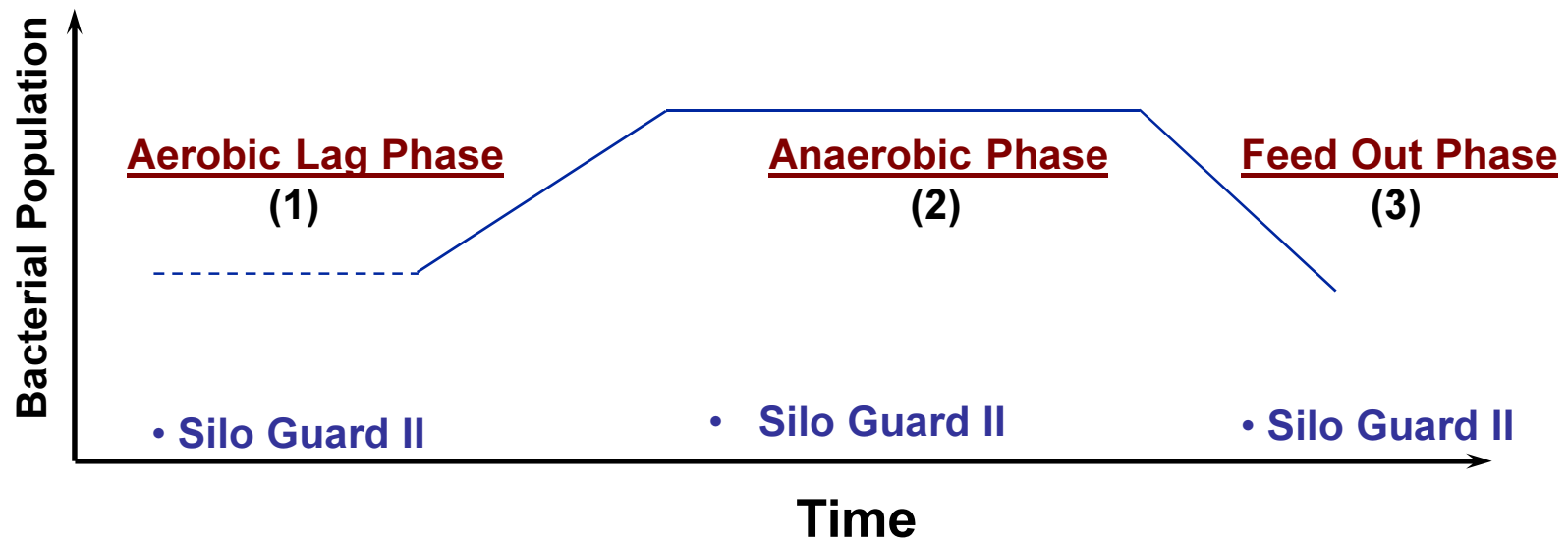
# More Silo Guard Advantages

- Handling Silo Guard II is very easy for the user.
- It is effective for various moisture levels and is made with the same formula every time.
- Silo Guard II is ready to work the minute you receive it and apply it to well cut silage!



**→ A ready-to-use formula!**

# Silo Guard II - Reduces nutrient losses



- |                    |   |   |
|--------------------|---|---|
| (1) Sulfur Salts   | ➡ | Oxygen scavengers help reduce presence of air $\text{SO}_2$<br>reduces yeasts & mold spores       |
| (2) Amylase Enzyme | ➡ | Breaks down starches to sugars for lactic acid bacteria<br>Enhances fermentation, saves nutrients |
| (3) Feed-out Phase | ➡ | Cool silage, reduced mold & yeasts<br>More nutrients - more intake                                |



# **Silo Guard II -**

**Helps reduce Yeast and Mould  
Counts**

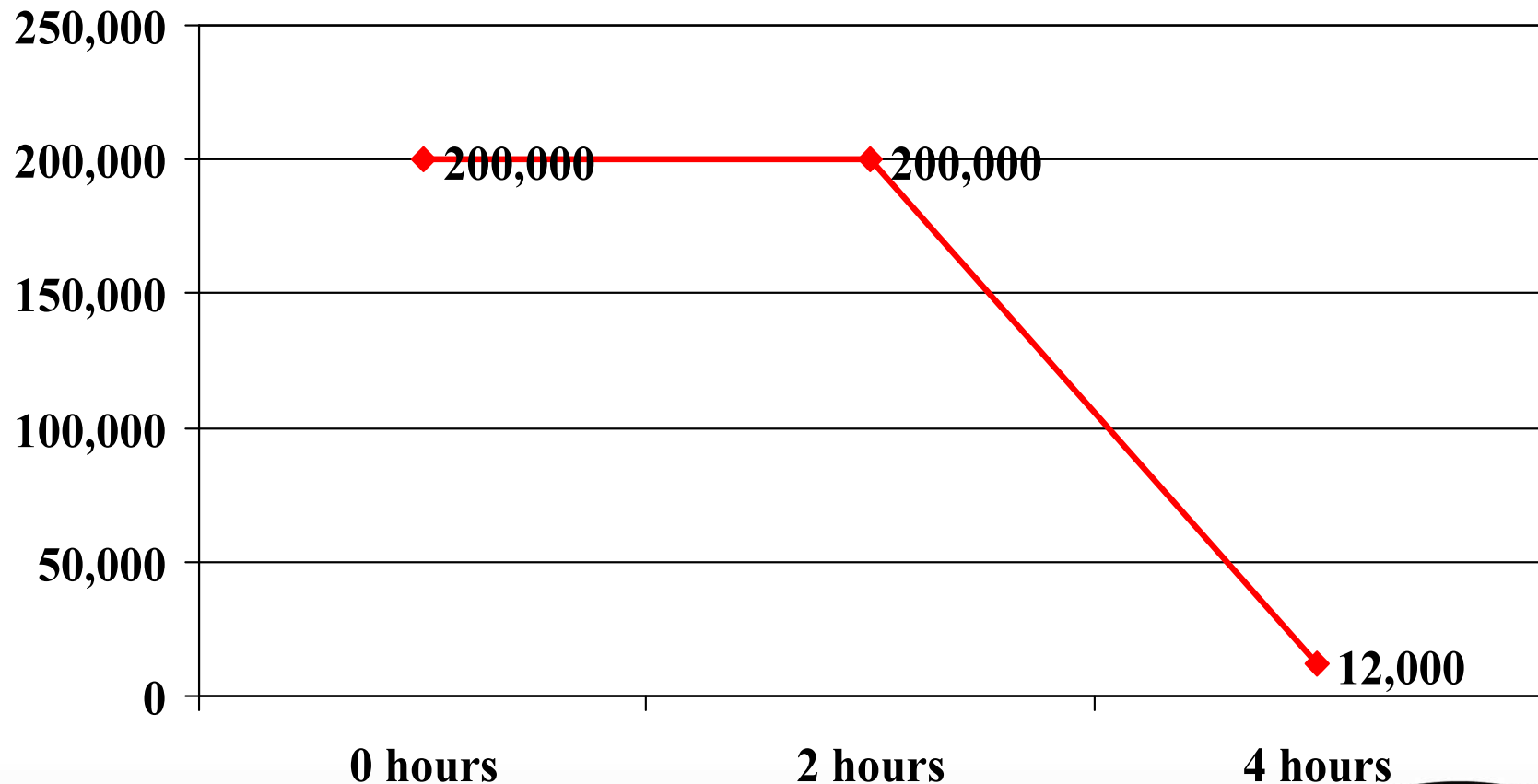
**Equally important in silage and  
hay**





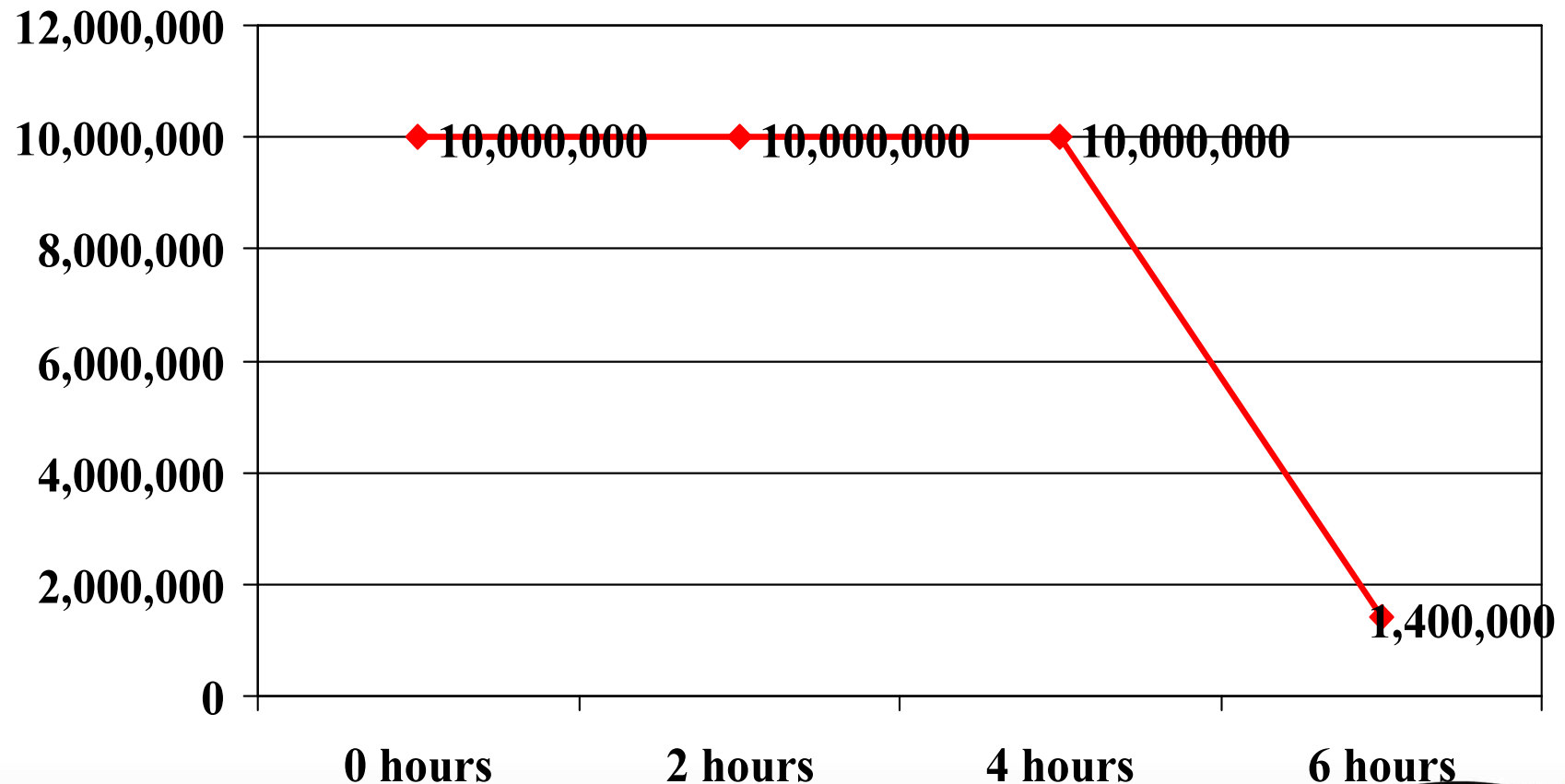


# 2006 – Florida Corn Silage: Mold Before vs. After





# 2006 – Florida Corn Silage: Yeast Before vs. After





# Why is this happening?

- Do you remember the apples?
- Silo Guard does not actually kill the mold and yeast.
- Silo Guard helps eliminate the oxygen, so yeast and mold cannot reproduce.
- Mold and yeast have a short life (usually a few hours).  
When they die naturally, no new mold or yeast are produced, so counts fall.



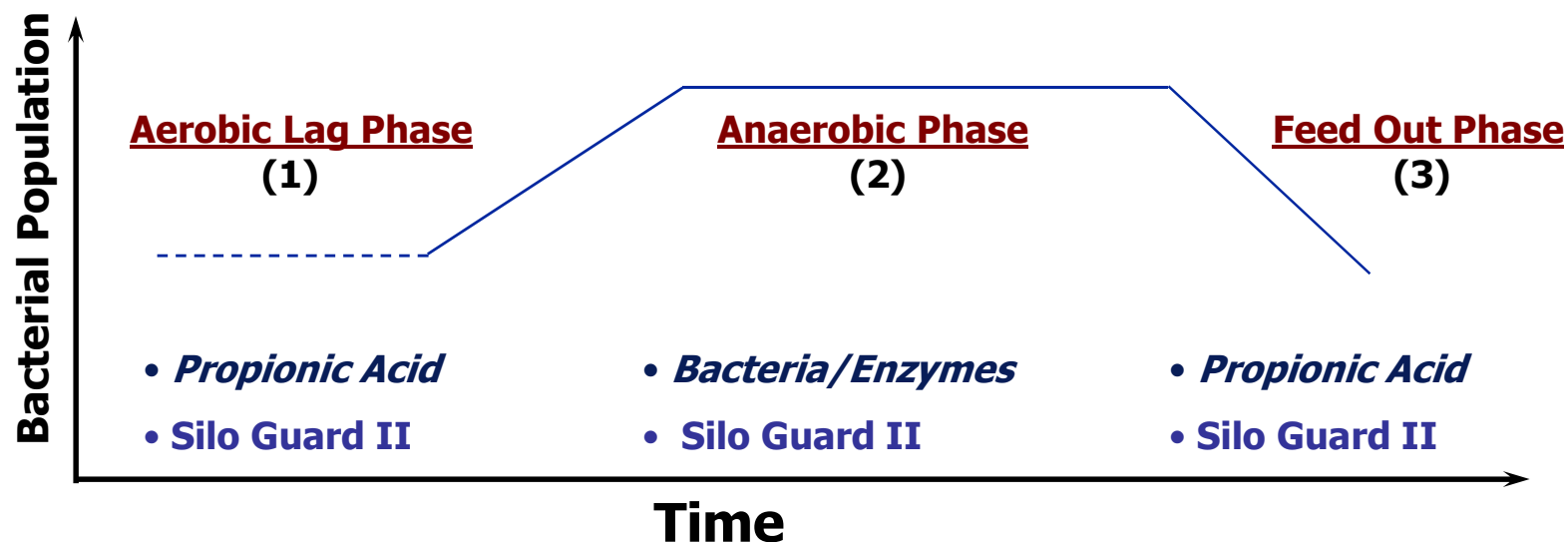
## **Aerobic Stability:** A Major Benefit of Reduced Yeast and Mould Counts at Ensiling *Alfalfa Silage - Winter*

	Number of days until raise in temp.*	Maximum Temperature
Control	9	118 (47.8 °C)
Inoculant	11	117 (47.3 °C)
Silo Guard	<b>14</b>	<b>113 (45.0 °C)</b>

\*A 3°F (1.67 °C) rise or higher

Kansas State University

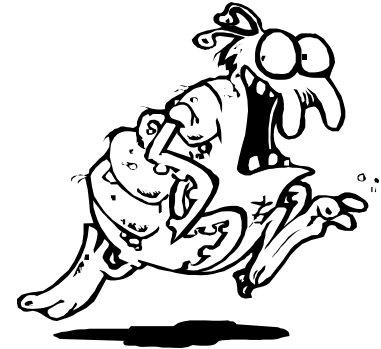
# Compared with Other Additives



- ⌘ **Propionic Acid** . . . Active Phase (1) & (3) Reduces molds & yeasts  
Improves bunk-life
- ⌘ **Bacteria** . . . . . Active Phase (2) -- multiply & lower pH  
Improves dry matter retention
- ⌘ **Enzymes** . . . . . Break down starches to sugars for lactic acid bacteria  
Present in Silo Guard  
Active Phase (2) -- Improves dry matter retention

# Competition

## Bacteria



Often referred  
to as “Bugs”







# The Premise . . . .

- ⌘ pH must be lowered quickly
- ⌘ Lactic acid is the most efficient acid in lowering the pH..... So,
- ⌘ Let's add lactic acid bacteria (LAB) to increase the acid in the silage



**HOWEVER . . . .**

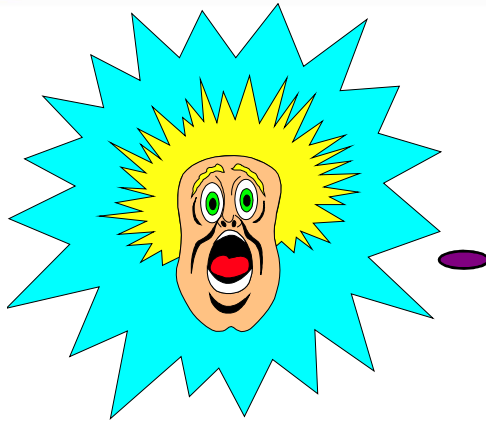
# Conditions



- ⌘ **Must be alive! .... in the bag - and at the Silo**
- ⌘ **Must be numerous and aggressive enough to dominate other organisms coming in from the field**
- ⌘ **Must DOMINATE the lactic acid bacteria (LAB) already on the forage from the field.**
- ⌘ **Sensitive to chlorinated water**



**Dead on Arrival ?!**



**Inoculants - Dead or Alive ??**





# Based on Research

## In the U.K.

- ⌘ 8 out of 10 are D.O.A.
- ⌘ 9 out of 10 fail to supply sufficient population



## In the U.S.

**Kansas State University - Dr. Bolsen's study on viability -**

- ⌘ 8 out of 10 - D.O.A.
- ⌘ Most did not have sufficient bacteria population to be effective



## **Richard Muck's 4 Rules for Silage Inoculants**

(Dairy Herd Mgmt, Feb/08)

- Use products designated for the crop you are ensiling
- Inoculants only work if they are alive going on the crop. Store in a cool dry place and don't use chlorinated water
- Bacteria cannot move around. Spread them uniformly on the crop
- Ask for research data to back up product claims



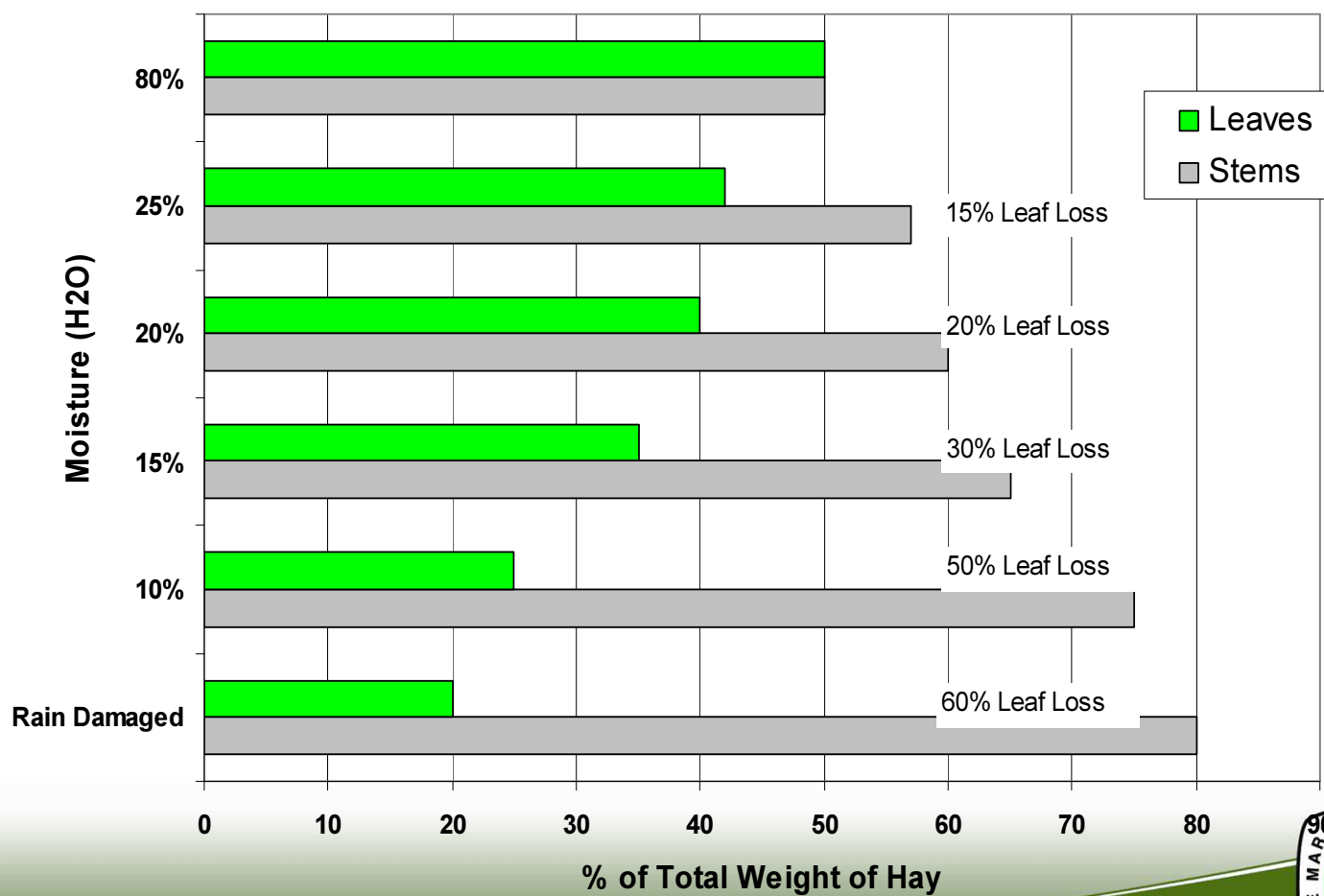


# Making Higher Moisture Baled Hay





# Effect of Moisture on Leaf Loss and Leaf:Stem Ratios



# Save The Leaves!!

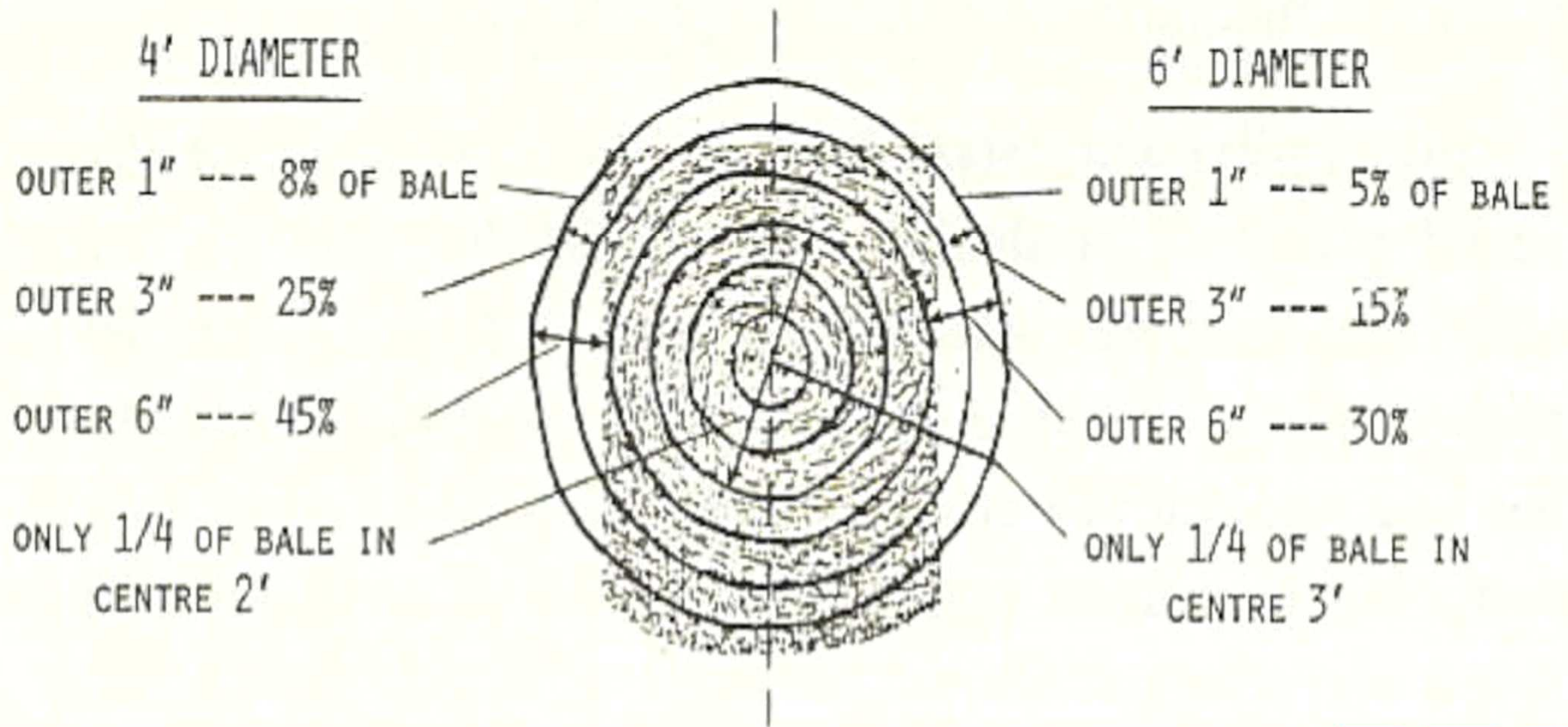
## *Benefits of baling at 20% Moisture*

- **Increases leaf retention dramatically**
- **Leaves - 90% of vitamins  
- 70% of protein**
- **Harvest more hay per acre**
- **Higher quality hay = more \$ \$**

# Hay Management



# A little loss on the outside?



# Get Them Wrapped

Component	<u>Wrapping Time (Hours)</u>		
	2	10	19
pH	5.7	5.6	6.1
ADIN % of N	3.1	3.0	3.7
WSC %	12.1	12.7	9.4
Ammonia N %	4.9	5.0	8.6
Lactic Acid %	1.25	1.7	0.82
ADF %	33.4	32.6	35.0

# Hay Bales - Get Them Under Cover

<u>Storage</u>	<u>Bale Wt. Kg</u>	<u>Storage Loss %</u>	<u>Feeding Loss %</u>	<u>Total Loss</u>	<u>Intake % BW</u>	<u>ADG Kg/d</u>
Inside	480	2.5	12.4	14.8	2.35	0.62
Outside Uncovered	492	15	24.7	39.7	2.11	0.39
2 High Covered	480	5.8	14.5	20.4	2.29	0.46
3 High Covered	502	6.6	13.4	19.7	2.22	0.67





## STACKING WET BALES

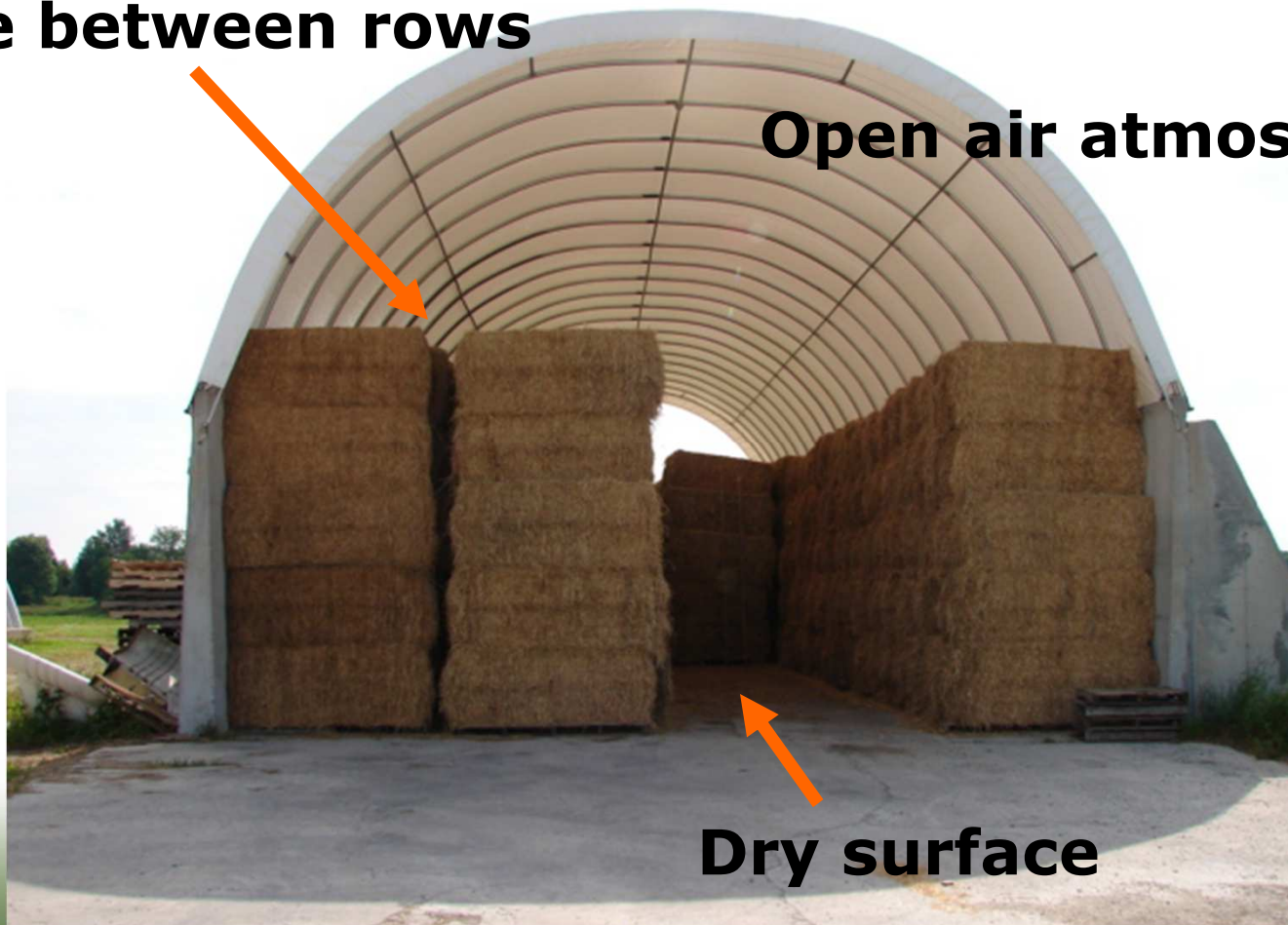
- Stack hay on pallets for better ventilation
- Some experts suggest stacking bales on their narrow side (“on edge”), cut side (edge) up, rather than flat
  - Bales stacked on their side allow some natural air movement between bales
- For additional ventilation, pallets can be used between bales in the stack – once dry they can be removed
- No matter if they are stacked on the side or on the strings, leave a space between the rows of bales
- Place wetter, greener bales at the outside of the storage structure where they have greater exposure to air

# Example of Good Storage Structure



**Space between rows**

**Open air atmosphere**



**Dry surface**



# Silo Guard II in Baled Hay

- Allows baling at higher moistures
- Helps prevent mold and yeast growth
- Helps reduce heating
- Reduces dry matter losses
- Saves more leaves → nutrients



# Silo Guard II vs. Acids

- Lower inclusion rate – **less stopping to fill**
- Lower cost per treated tonne – **higher return on investment**
- Can use on all crops – **less products to inventory**
- User friendly – **no objectionable odor & safe to use**
- Doesn't cause browning – **keeps hay greener**
- Proven to produce more milk/meat per tonne – **more profit**





# Cost Advantage

**On 22% moisture hay**

## Silo Guard II

**1 kg per tonne**

DRY SILO-GUARD II

- Approx. Retail Cost = \$3.98 – 4.31/kg.
- **Cost per treated tonne = \$3.98 – 4.31**

LIQUID SILO-GUARD II

- Approx. Retail Cost = \$6.40 – 6.75/kg.
- **Cost per treated tonne = \$6.40 – 6.75**

## Propionic Acid

- 5 – 10 kg per tonne

Approx. Retail Cost = \$2.35/kg.

**Cost per treated tonne =  
\$11.75 - \$23.50**



# Silo Guard II : Other Uses





# Moving Fermented Feeds

- If silage is sold and must be moved, add Silo Guard II at a rate of 1 kg per tonne.
- Rate will vary due to
  - Time of year
  - Weather
  - Condition of silage



# Prevent Heating on Bunker Face

- Apply Silo Guard II on bunker face after each removal

**Applicator  
mounted  
on facer**





**Silo Guard treated – no losses**



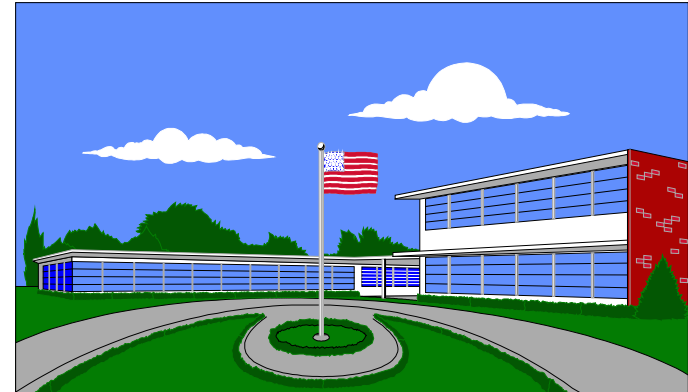
# Proven by University Research

- Research Locations
- Silage
  - Dry Matter Recovery
  - Animal Performance – Beef & Dairy
- Baled Hay
  - Cooler Bales
  - Animal Performance - Beef & Dairy



## University Research

- McGill University, Canada
- Kansas State University
- University of Georgia
- Utah State University
- University of Vermont
- University of Reading, England
- University of Tennessee



## Agricultural Institutes

- Scottish Agricultural College
- Kingshay Farming Trust, England
- German Ministry of Agriculture
- Israeli Ministry of Agriculture, Volcani Center
- Quebec Ministry of Agriculture



# Summary of Research

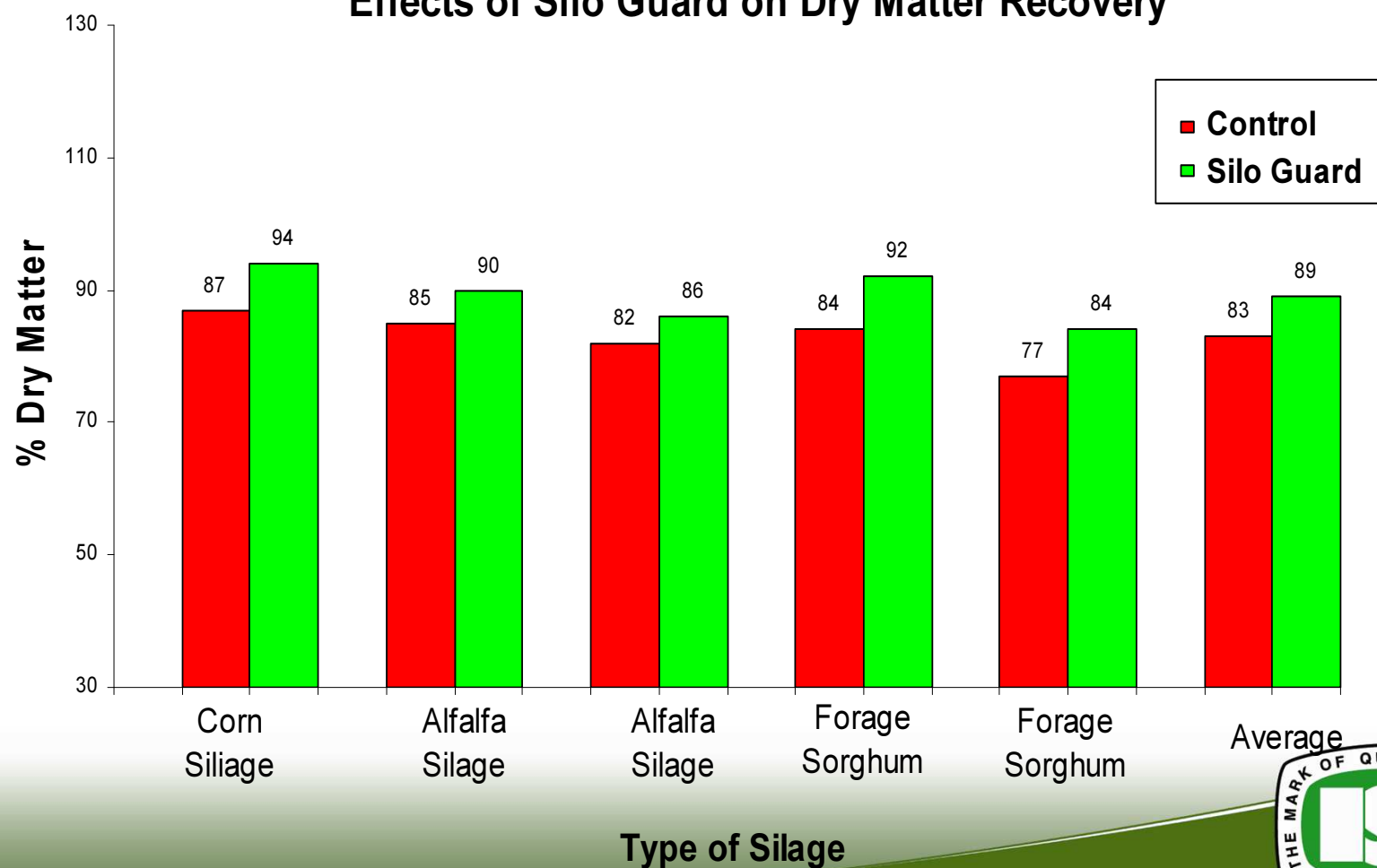
## Silage

- Improved Dry Matter Recovery - *4 Studies*
- Improved Fermentation - *2 Studies*
- Aerobic Stability - *2 Studies*
- Animal Performance, Voluntary Intake - *4 Studies*
- Animal Performance, Feed Efficiency - *3 Studies*
- Animal Performance, Improved Milk Production - *2 Studies*
- Animal Performance, Improved Weight Gain - *3 Studies*



# Silage Dry Matter Kansas State University

## Effects of Silo Guard on Dry Matter Recovery





# Animal Performance - Silage



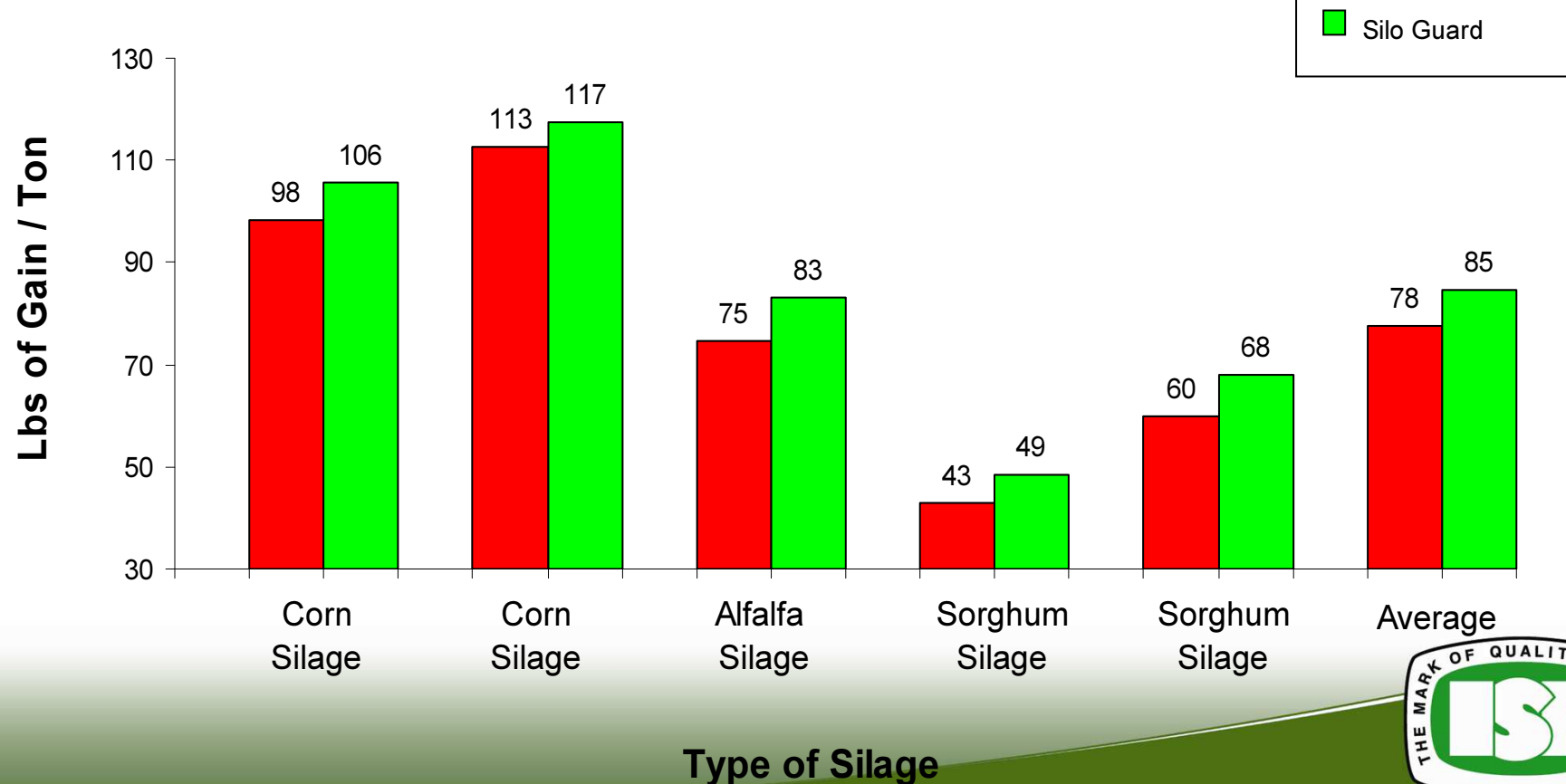
*University Research*





# Kansas State U. Summary

**Beef Cattle**  
**Weight Gain Per Ton of Silo Guard and**  
**Untreated Silages Stored**





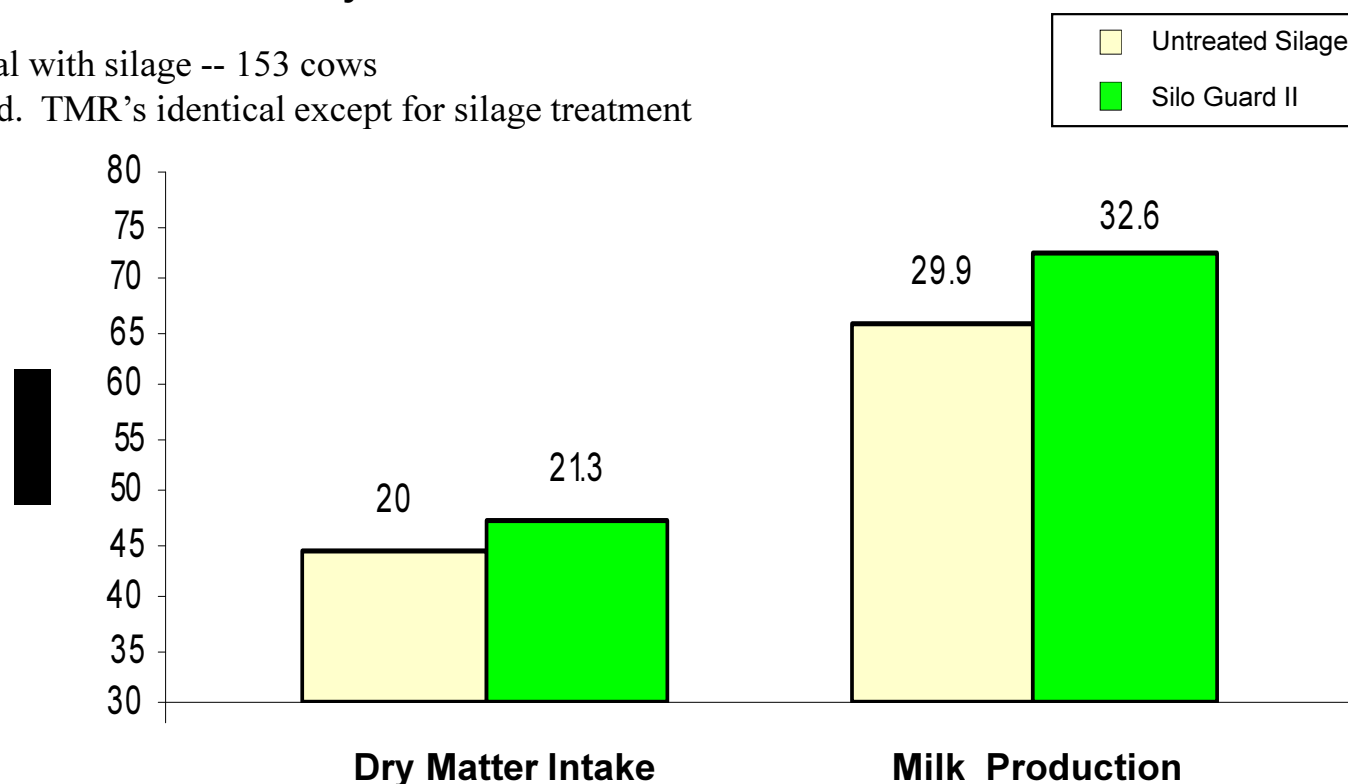
# Milk Trial - Silage

## Silo Guard II Treated or Untreated Silages

### Dry Matter Intake and Milk Production

3 - month milk trial with silage -- 153 cows

Control vs. treated. TMR's identical except for silage treatment



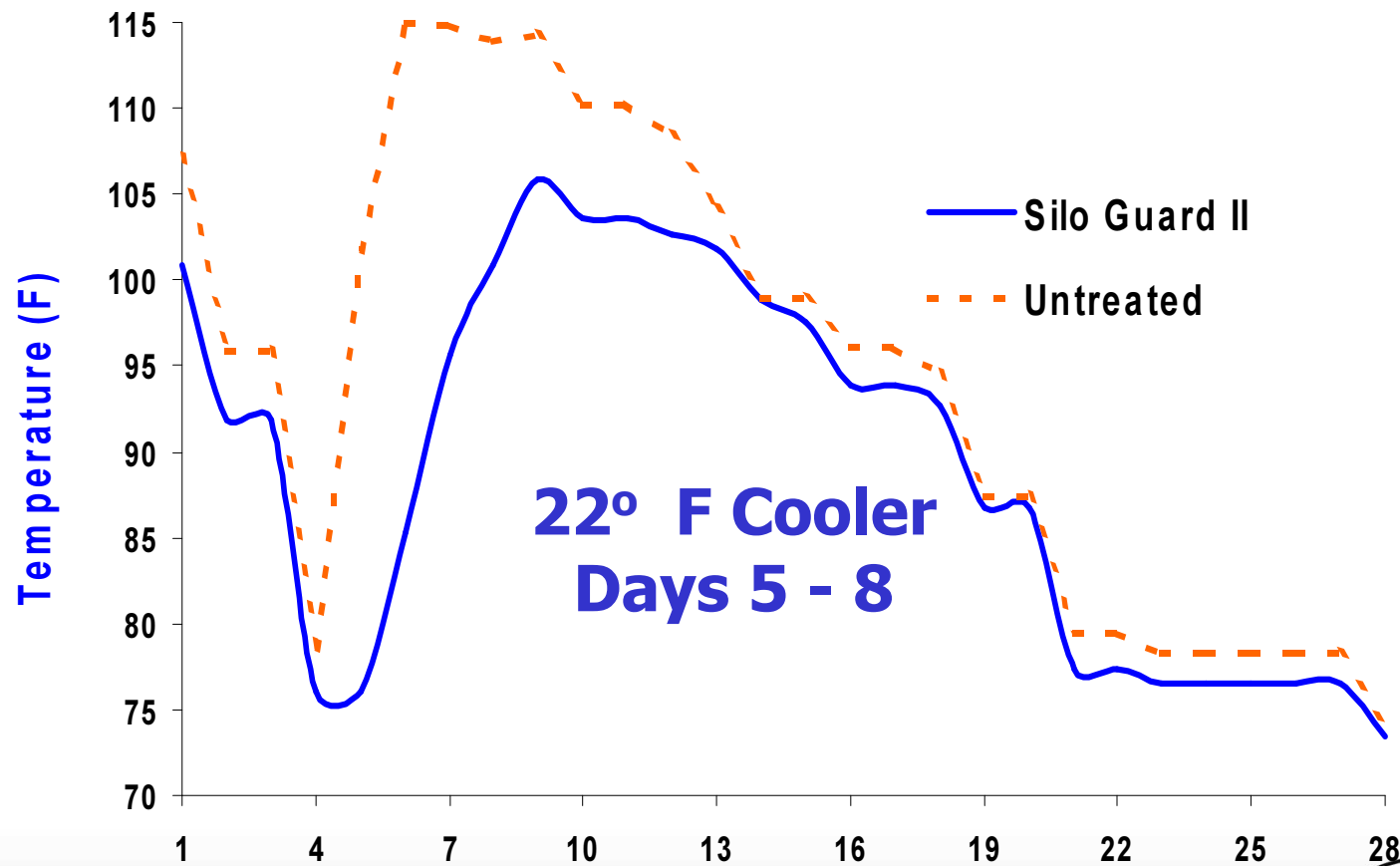
Israeli Ministry of Agriculture



# University Research – Baled Hay



# Produces Cooler Bales



**22° F Cooler  
Days 5 - 8**

Days Post Baling

McGill University, Canada

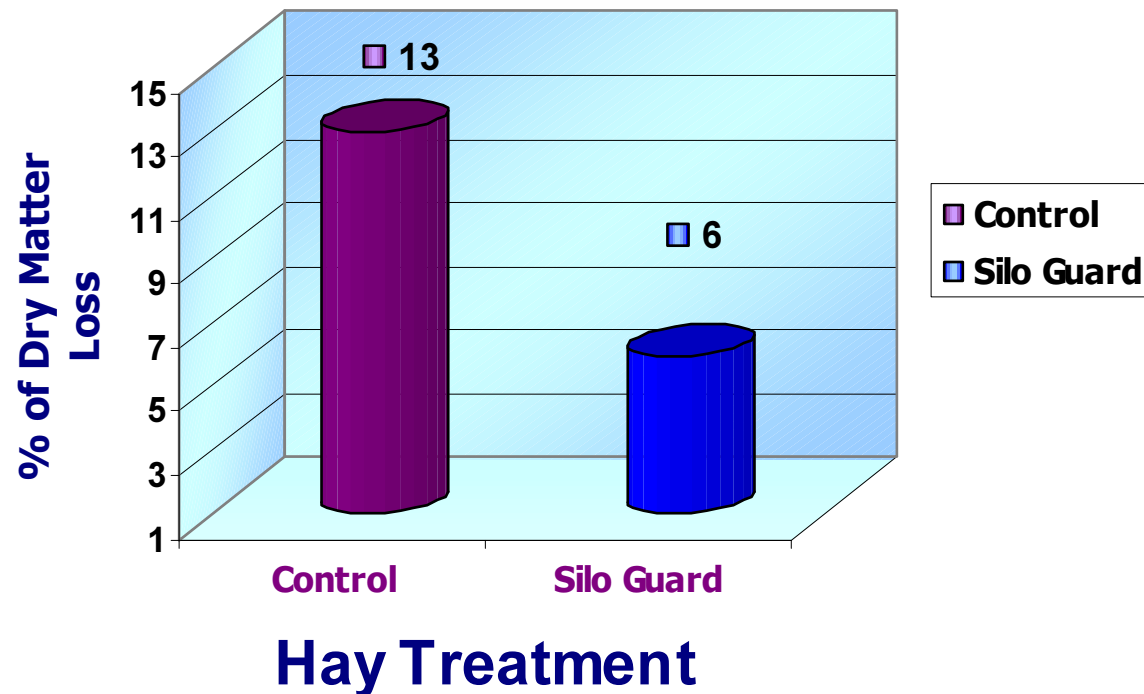




# Baled Hay – Dry Matter

## McGill University - Canada

**Less Dry Matter Loss with Silo Guard II**





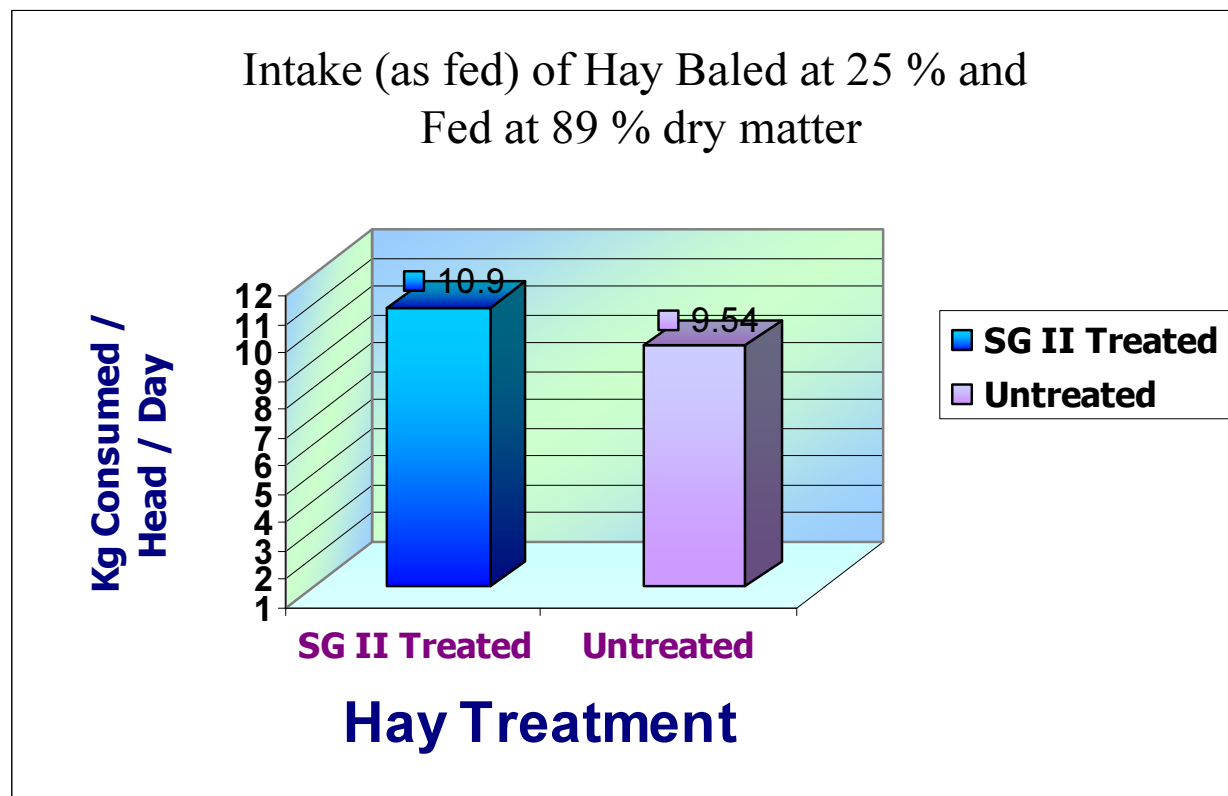
# Animal Performance: High Moisture Baled Hay





# Baled Hay – Intake

## Canadian Study\*



*In a 4-week study:*

***Cattle consumed 1.36 kg per day more with Silo Guard II treated hay compared to untreated hay ( $P < .02$ ).***



\* Quebec Ministry of Agriculture



- First crop alfalfa
- Ensiled 5/25/07
- Same field
- Samples taken for mold & yeast content at filling time – FIELD LOAD
- Haylage weighed before filling
- As used, the haylage will be weighed again
- Compare DM loss, mold, yeast, & nutrition

**Bag #1 - untreated**

**Bag #2 Inoculant E**

**Bag #3 Silo Guard II**

Photo taken  
7/25/07



# Dry Matter Losses

	<u>Silo Guard</u>	<u>Inoculant E</u>	<u>Untreated</u>
DM in, lbs.	148,536	137,813	181,836
DM out, lbs.	146,846	123,683	168,331
DM lost, lbs.	1,690	14,130	13,505
% DM lost	1.14	10.25	7.42





# Treated Corn Silage



## Data from Vermont (Perkins)

- |                        |                            |
|------------------------|----------------------------|
| • <u>Bunker face</u>   | • <u>The pile on floor</u> |
| • pH = 3.68            | • pH = 3.83                |
| • Yeast = 18,000 cfu   | • Yeast = 410,000          |
| • Moulds = 4,000 cfu   | • Moulds = 370,000         |
| • Bacillus = 5,300 cfu | • Bacillus = 730,000       |



# SILO GUARD II COMES IN TWO FORMS: DRY & LIQUID

## Packaging



- Dry: 20 kg bag
- Liquid: 20 liter pail
- Liquid: 200 liter drum
- Liquid: 1200 liter tote



## 20 kg bag units treats

- 20 tonnes of hay
- 20 tonnes of haylage
- 40 tonnes of corn silage

# Application Rate: Baled Hay

- Apply 1 kg/tonne (0.8 L of liquid) of baled hay using an applicator on the baler.
- Stem moisture of hay should be 25% or less.
- Recommended method for measuring moisture is by using a microwave oven.



# Application Rates

**1 kg dry = 0.8 L liquid**

- **Liquid Silo Guard II is 25 %  
heavier than water  
1 litre = 1.25 kg**

# LIQUID SILO-GUARD II

- **Liquid is Ready to Use**
- **DO NOT DILUTE WITH WATER,**  
**this may neutralize the effects**

# HOW TO APPLY SILO GUARD II? **DRY**



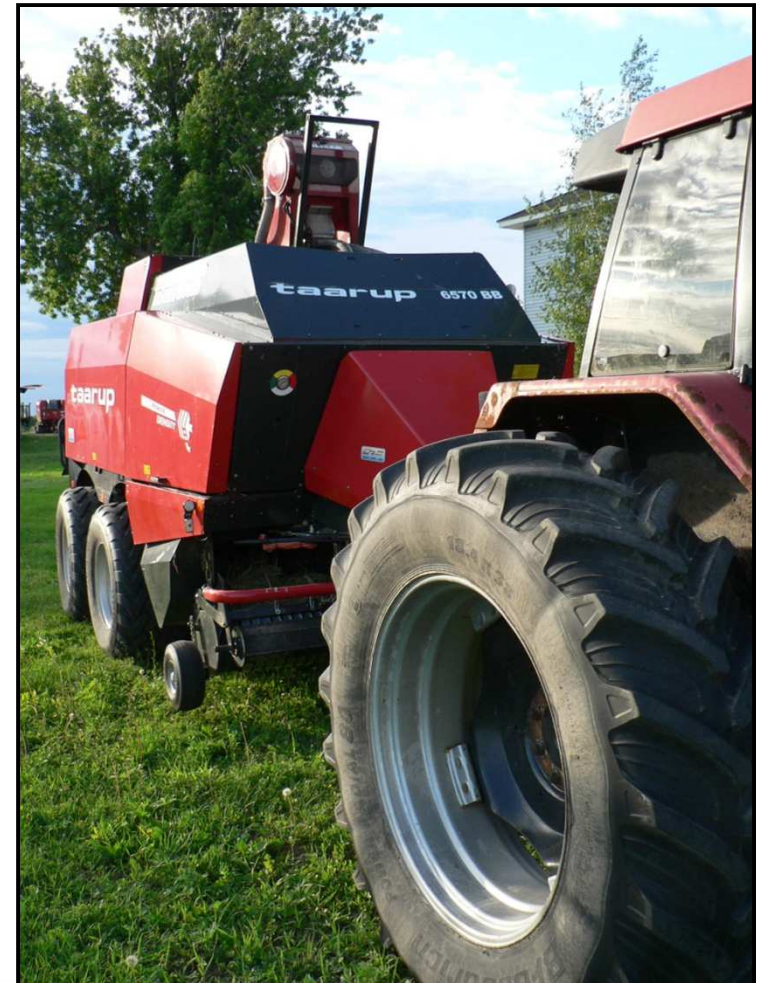


# HOW TO APPLY SILO GUARD II? **DRY**





# HOW TO APPLY SILO GUARD II? **DRY**



## HAY

Calculations / 100 tonnes (DM Basis)

Research results (McGill University, MacDonald College, Canada) show a 7% advantage with the use of Silo Guard II versus no additive on the Dry Matter Recovery of Hay. On any harvesting and curing process there always are losses. Dry Matter Recovery is the amount of Dry Matter that is left after the Hay undergoes this process.

Ontario Zone 1 Pricing	With SG II	Without SG II
Quantity Baled (As Is Basis)	118 tonnes	118 tonnes
Quantity Baled (DM basis)	100 tonnes	100 tonnes
Dry Matter Recovery	94 tonnes	87 tonnes
SG II advantage	94 – 87 = 7 tonnes	
Price of Hay/Tonne of DM	\$156	
SG II advantage (DM Basis) (\$)	7 tonnes x \$156 = \$1092	
Example Cost of SG II / Kg	Dry - \$3.98 (20 kg bag) Liquid - \$6.40 (200 L barrel)	
Amount of SG II to use	Dry – 1 Kg / tonne Liquid – 1 Kg (0.8 L) / tonne	
Example Cost of SG II treatment	Dry – 118 tonne x \$3.98=\$470 Liquid – 118 tonne x \$6.40=\$755	
Silo Guard II Dry Matter Recovery – Cost of Silo Guard II treatment		
Dry: \$1092 - \$470 = \$622		
Liquid: \$1092 - \$755 = \$337		
Based on hay with 15% Moisture and 6¢/lb (\$132/tonne).		

**Silo Guard II application on Hay is quite often paid just by the Dry Matter Recovery. All the other potential benefits – increased milk production, increased animal weight gain, increased voluntary intake, increased feed efficiency – are usually FREE!**



## ALFALFA SILAGE

Calculations / 100 tonnes (DM Basis)

Research results (Kansas State University) shows a 5% advantage with the use of Silo Guard II versus no additive on the Dry Matter Recovery of Alfalfa Silage (45% DM). On any harvesting and fermenting process there always are losses. Dry Matter Recovery is the amount of Dry Matter that is left after the Haylage undergoes this process.

Ontario Zone 1 Pricing	With SG II	Without SG II
Quantity Ensiled (As Is Basis)	222 tonnes	222 tonnes
Quantity Ensiled ( DM Basis)	100 tonnes	100 tonnes
Dry Matter Recovery	90 tonnes	85 tonnes
SG II advantage	90 – 85 = 5 tonnes	
Price of Haylage/Tonne of DM	\$312	
SG II advantage (DM Basis) (\$)	5 tonnes x \$312 = \$1560	
Example Cost of SG II / Kg	Dry - \$3.98 (20 kg bag) Liquid - \$6.40 (200 L barrel)	
Amount of SG II to use (As is Basis 45% DM)	Dry – 1 Kg / tonne Liquid – 1 Kg (0.8 L) / tonne	
Example Cost of SG II treatment	Dry: 222 tonne x \$3.98 = \$884 Liquid: 222 tonne x \$6.40 = \$1421	
Silo Guard II Dry Matter Recovery – Cost of Silo Guard II treatment		
Dry: \$1560 - \$884 = \$676		
Liquid: \$1560 - \$1421 = \$139		
Based on Haylage with 55% Moisture (45% DM) and \$140/tonne.		

**Silo Guard II application on Alfalfa Silage is quite often paid just by the Dry Matter Recovery. All the other potential benefits – Increased milk production, increased animal weight gain, increased voluntary intake, increased feed efficiency– are usually FREE!**

## CORN SILAGE

Calculations / 100 tonnes (DM Basis)

Research results (Kansas State University) shows a 6% advantage with the use of Silo Guard II versus no additive on the Dry Matter Recovery of Corn Silage (35% DM). On any harvesting and fermenting process there always are losses. Dry Matter Recovery is the amount of Dry Matter that is left after the Corn Silage undergoes this process.

Ontario Zone 1 Pricing	With SG II	Without SG II
Quantity Ensiled (As Is Basis)	286 tonnes	286 tonnes
Quantity Ensiled ( DM Basis)	100 tonnes	100 tonnes
Dry Matter Recovery	93 tonnes	87 tonnes
SG II advantage	93 – 87 = 6 tonnes	
Price of Corn Silage/Tonne of DM	\$150	
SG II advantage (DM Basis) (\$)	6 tonnes x \$150 = \$900	
Example Cost of SG II / Kg	Dry - \$3.98 (20 kg bag) Liquid - \$6.40 (200 L barrel)	
Amount of SG II to use	Dry – 0.5 Kg / tonne Liquid – 0.5 Kg (0.4 L) / tonne	
Example Cost of SG II treatment (As Is Basis 35% DM)	Dry: 286 tonne x \$1.99 = \$569 Liquid: 286 tonne x \$3.20 = \$915	
<b>Silo Guard II Advantage – Cost of Silo Guard II treatment</b> Dry: \$900 - \$569 = \$331 Liquid: \$900 - \$915 = (\$-15) Based on Corn Silage with 65% Moisture (35% DM) and \$52.50/tonne.		

**Silo Guard II application on Corn Silage is quite often paid just by the Dry Matter Recovery. All the other potential benefits – increased milk production, increased animal weight gain, increased voluntary intake, increased feed efficiency – are usually FREE!**

# Silage Management Summary

- Choose appropriate hybrids
- Harvest at Proper Stage of Maturity and Moisture
- Consider Processing
- Fill the Silo Fast (Not too fast for packing)
- Pack for Good Density
- Cover Well
- Manage the Feeding Face
- Discard the Spoilage
- Use Silo Guard II preservative





## BOTTOM LINE

### **SILO GUARD II:**

- **Safe to use (not a dangerous good)**
- **Does not reduce palatability of feeds**
- **Easy and ready to use**
- **Long Shelf life (not a bacteria)**



**Today's feed costs dictate to use something on your forages. Silo Guard II is the safest, easiest, most cost effective product of choice.**

