

# Butyric Acid In Silage: Why It Happens

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# The Problem

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When butyric acid is in silage, be prepared for:

- Reduced intake
- Potential health problems - ketosis
- And for problems to get worse with time



# How Does The Butyric Acid Get There?

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- Produced by clostridia - bacteria on the crop at ensiling
  - Anaerobic bacteria: grow only when there is no oxygen
  - Spores, not active cells



# How Is Butyric Acid Produced By Clostridia?

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Fermentation of sugars or lactic acid:



- Dry matter loss - 51%
- Energy loss - 18%
- Raises pH if lactic acid is fermented



# What Else Can Clostridia Produce?

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- Some ferment amino acids, producing various compounds:
  - Amines
  - Ammonia
  - Acetic, propionic and other acids
  - Carbon dioxide
- Some of the amines & other compounds may be responsible for reduced intake



# How Do The Clostridia Get On The Crop?

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## Two Key Sources:

- Soil

- Rain splash during wilting
- Lodged forages

- Manure

- If applying manure to alfalfa or grass, apply right after taking a cutting



# When And Where Will Clostridia Grow In The Silo?

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- Butyric acid will not occur just because there are clostridial spores on the crop.
- Lactic acid bacteria (LAB) are faster than clostridia.
- Generally the LAB produce sufficient acid and lower pH enough to keep clostridia from growing.



# When And Where Will Clostridia Grow In The Silo?

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So we typically find clostridia and butyric acid:

- Where pH from LAB fermentation has not gotten low enough to keep clostridia from growing
- In spoiled areas where pH has risen





# When And Where Will Clostridia Grow In The Silo?

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- In both cases, generally it takes at least several months before you see much butyric acid.
- When butyric acid becomes noticeable, the amount of butyric acid will keep increasing with time.



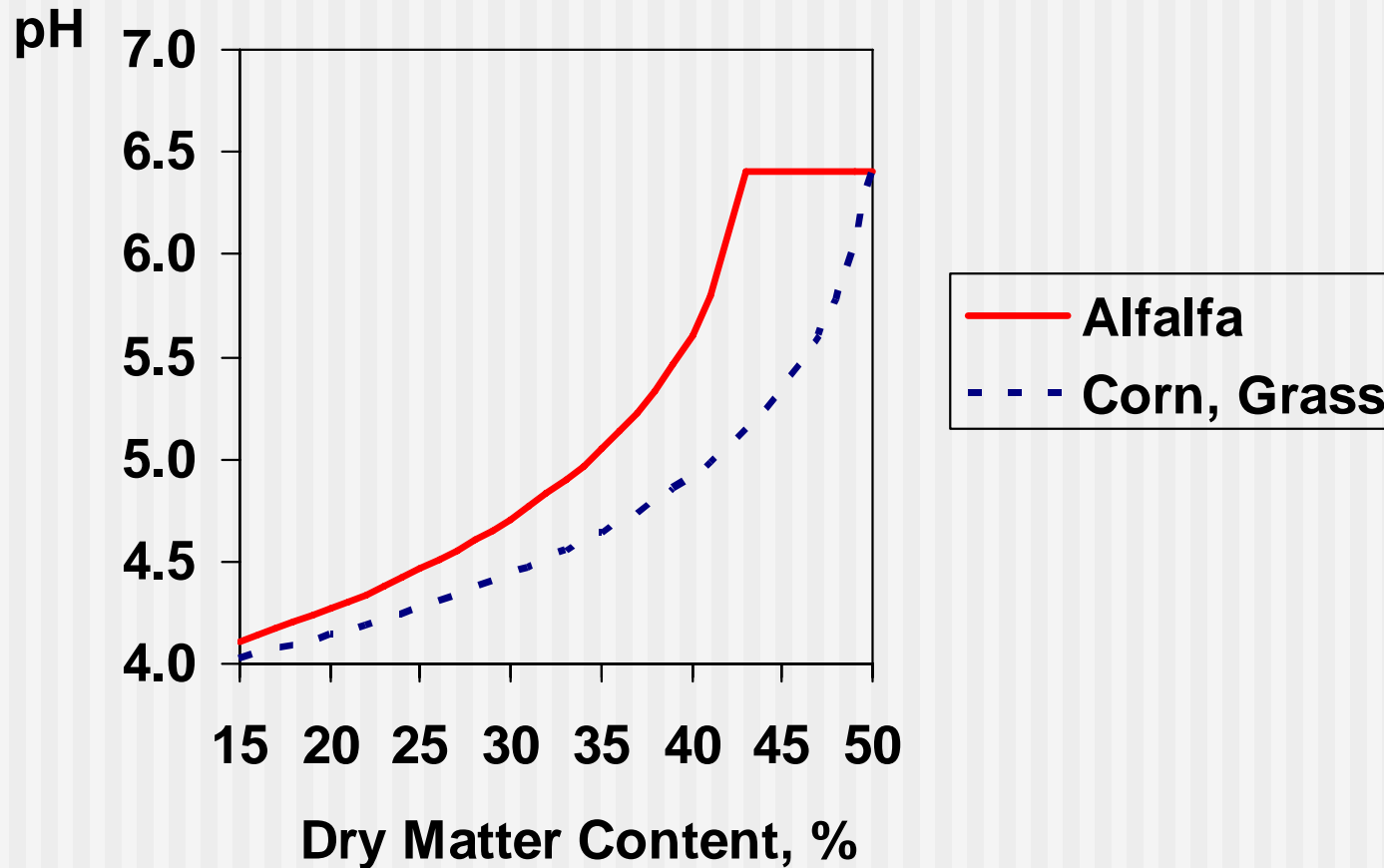
# How Do You Keep Clostridia From Growing In The Silo?

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- Get the pH sufficiently low and keep it that way.
- However, the critical pH is affected by dry matter content and crop.



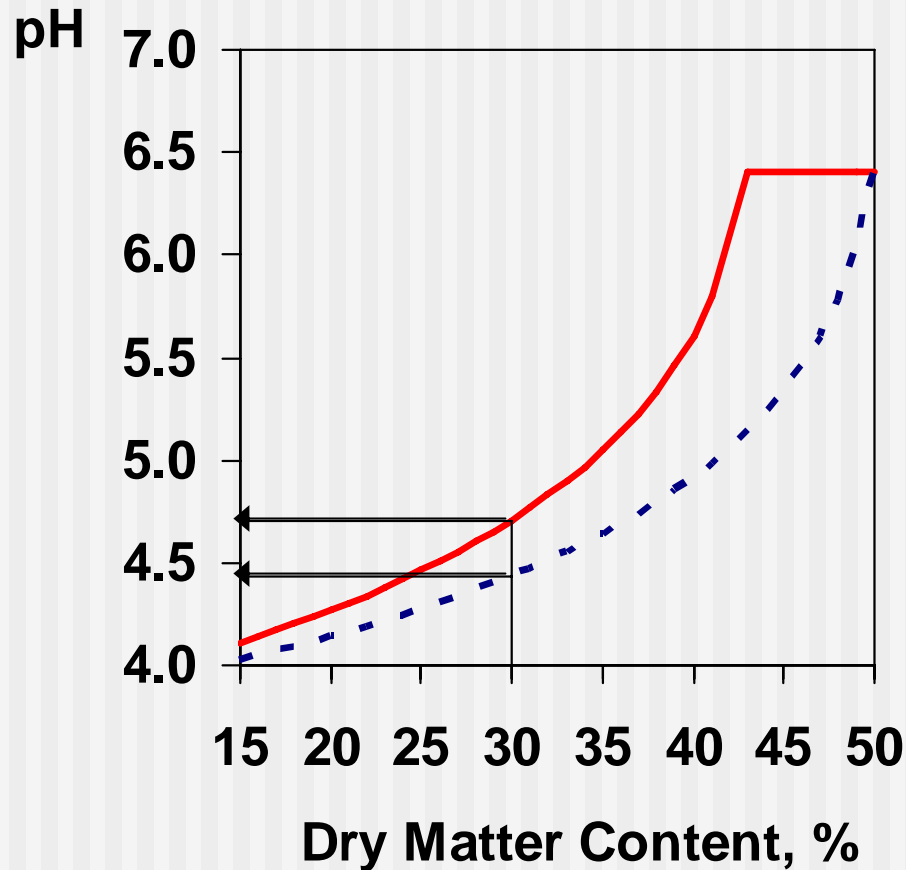
# Critical pH to Stop Clostridia



Based on Leibensperger and Pitt, 1987



# Critical pH to Stop Clostridia



— Alfalfa  
- - - Corn, Grass

At 30% DM, need a pH of 4.7 in alfalfa and 4.4 in grass or corn to keep clostridia in check.



# Silage Management Keys To Minimizing Clostridia

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- Minimize soil, manure contamination
- Corn Silage:
  - Seldom seen except in spoiled areas or from over-application of ammonia or urea
- Alfalfa or Grass Silage:
  - Wilt sufficiently (30+% DM)
  - If rained on during wilting, needs to be drier
  - If wrapped bales, 40+% DM for alfalfa



# Silage Management Keys To Minimizing Clostridia

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- What if you need to ensile on the wet side?
  - Start feeding out as soon as you can after active fermentation is over (~ two weeks).



# *Butyric Acid in Silage: How to Deal with It?*

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# Butyric Acid Silage – Increased Risk for Ketosis!

- Adds to other risk factors for ketosis:
  - ◆ fat cows
  - ◆ pen moves before or after calving
  - ◆ over-crowding
  - ◆ low energy intake
  - ◆ high protein diet
  - ◆ high fat diet

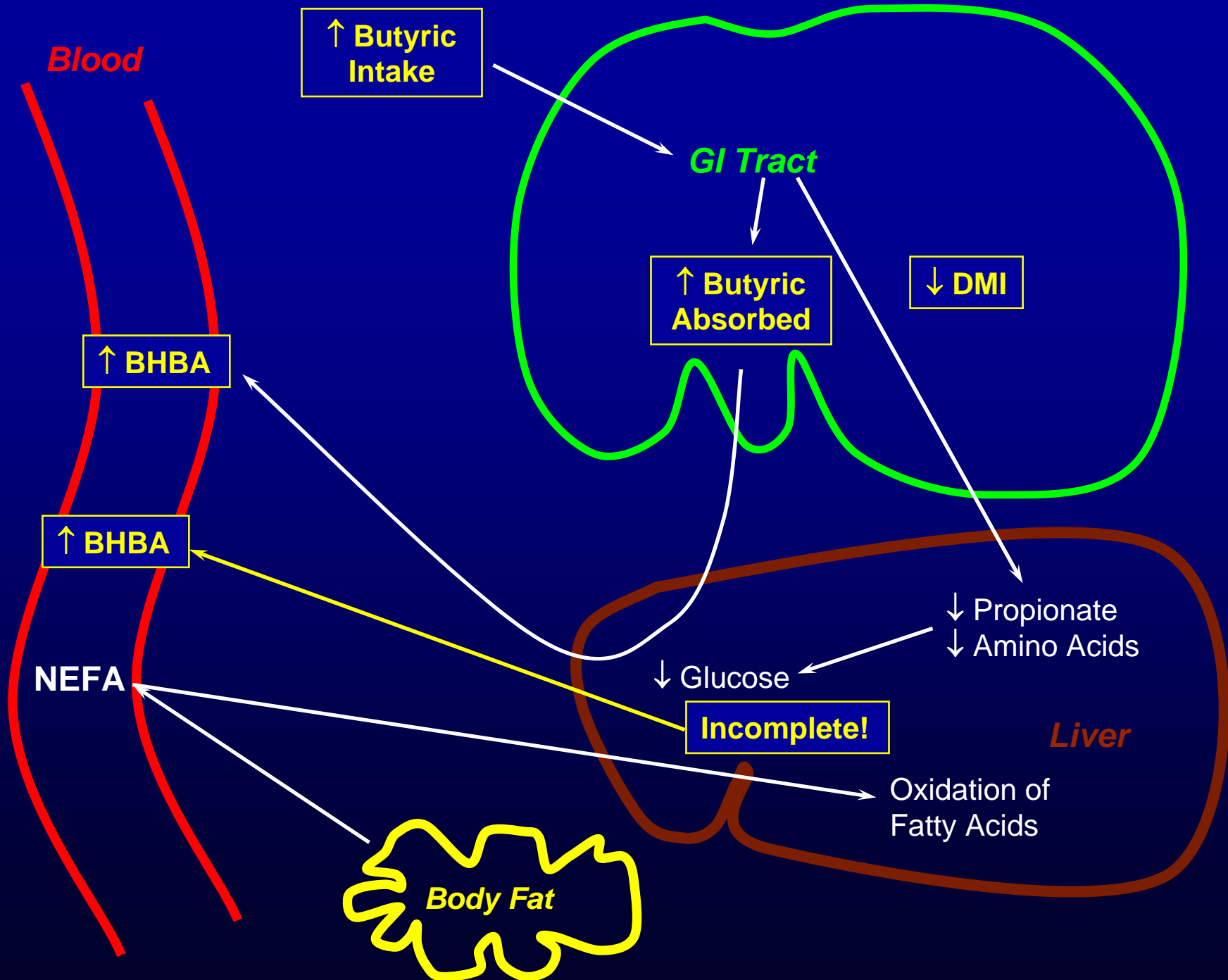




# Mechanism for Increased Ketosis Risk

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- Cow converts excessive butyric acid from the silage to a ketone body
  - ◆  $\beta$ -hydroxybutyric acid (BHB or BHBA)
  - ◆ one enzymatic step in the liver
  - ◆ source of the BHBA does not matter (off-feed, DA, fatty liver, or silage)



# Other Problems with Clostridial Silages

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- Amines (protein breakdown)
  - ◆ putrescine, cadaverine
  - ◆ may be toxic and/or depress intake
- $\text{NH}_3$  (high protein solubility)
  - ◆ requires calories to convert to urea
  - ◆ may depress intake

# Other Problems with Clostridial Silages

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- Ingestion of clostridial organisms
  - ◆ silage clostridia are usually not pathogens (e.g., *C. perfringens*)
  - ◆ clostridial spores are already plentiful in the environment and in feed
- *Might* increase risk for hemorrhagic bowel syndrome (HBS), sudden deaths

# Action Plan – Clostridial Silages

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1. *Diagnosis* - confirm the presence and amount of butyric acid in the silage
  - ◆ smell (especially if bring indoors)
  - ◆ pH (expect  $>4.8$  pH)
  - ◆ laboratory organic acid analysis (gives exact amount of butyric acid)



# Action Plan – Clostridial Silages

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## 2. *Daily Intake* – calculate butyric acid intake from silage

- ◆ lab analysis result x silage DM intake
- ◆ example:
  - 1.84% butyric acid in silage DM
  - 10 lbs (4.5 kg) silage DM intake
  - total butyric intake = 83.5 grams/day



# Action Plan – Clostridial Silages

3. *Divert* the butyric acid silage away from pre- and post-fresh cows
  - ◆ zero tolerance for butyric acid in these groups of cattle
  - ◆ buying hay is cheaper than dead cows, DA's, open cows, etc.



# Action Plan – Clostridial Silages

## 4. Dilute the butyric acid silage for the remaining cattle

- ◆ less than 50 grams of butyric acid per day
- ◆ example:
  - 1.84% butyric acid in silage DM
  - total butyric intake <50 grams/day
  - silage intake < 6.0 lbs DM/day





# Action Plan – Clostridial Silages

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## 5. *Decay* the butyric acid

- ◆ knock down and spread out for a few days before feeding
- ◆ some butyric will volatilize
- ◆ the silage won't spoil - butyric acid makes silage very aerobically stable
- ◆ resample to check for loss of butyric acid



# Action Plan – Clostridial Silages

6. *Dispose* of silage with very high (>2%) butyric acid content
- ◆ if >2.0% butyric acid the maximal feeding rate is 5.5 lbs DM
  - ◆ bad silage can be good fertilizer



# What to Do for the Cows?

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- Monitor for ketosis more intensively
- Treat ketotic cows promptly
- Limit other risk factors for ketosis



# Other Silages on the Farm?

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- If other silages might have clostridial fermentation:
  - ◆ feed sooner, not later!



# Questions?

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