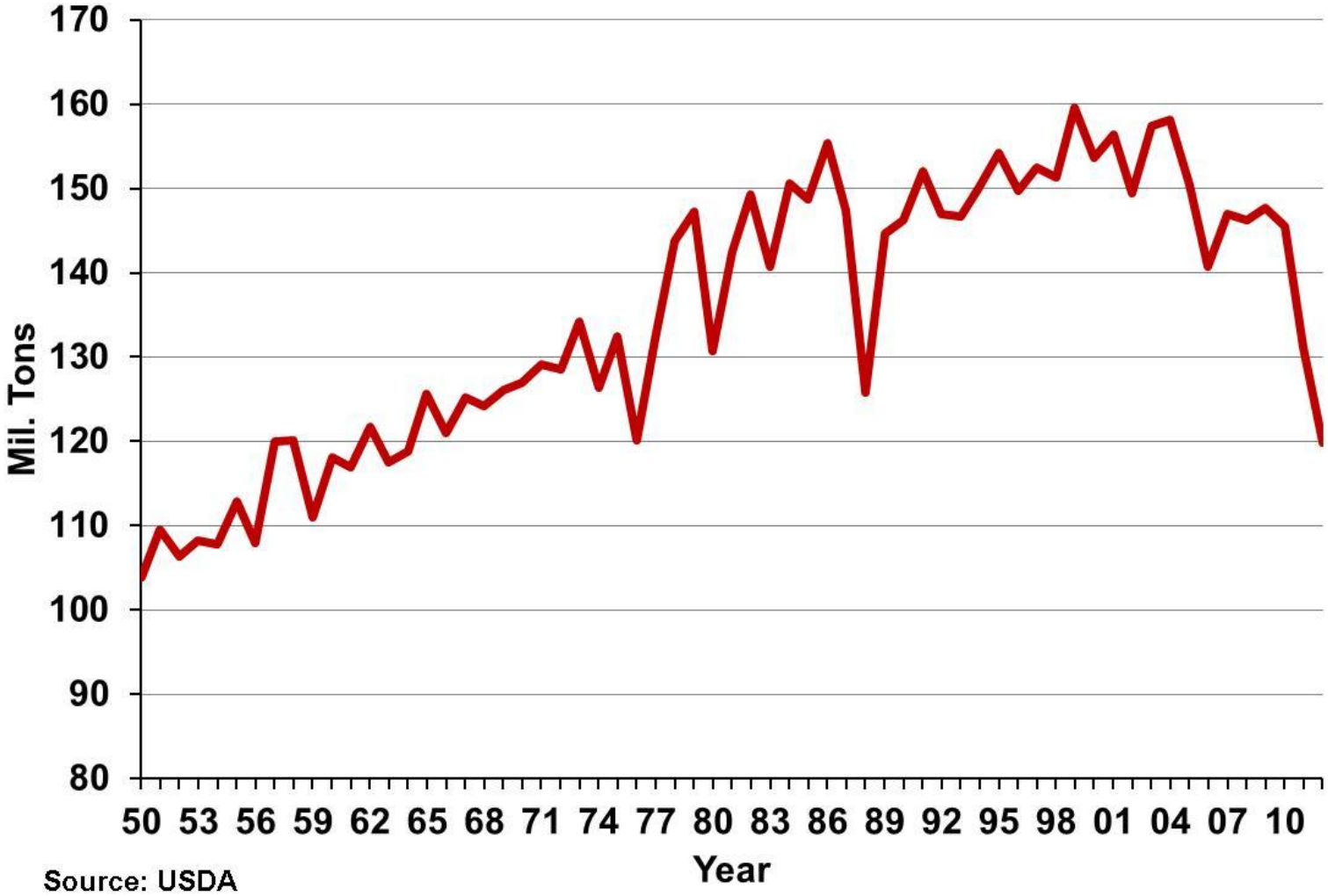
Changing Forage Attributes and Storage

Rick Rasby – Beef Specialist

U.S. Hay Production



Source: USDA

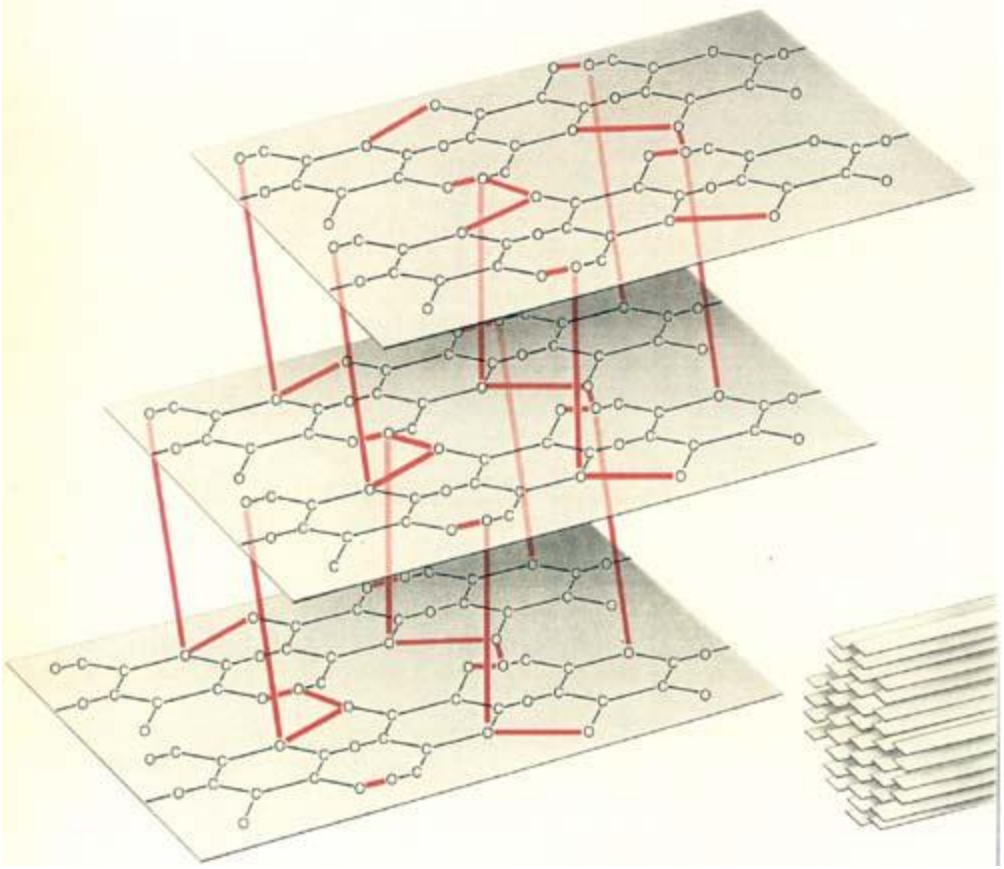
Introduction

- Cost of Energy in beef cow rations
- Availability of residues
  - Corn
  - Wheat
  - Soybean stubble

Daily Feed/Forage Capacity of Beef Cows: Thumb Rules

Forage Type	Class of Cattle[1]	Dry Matter Capacity[2],%	Dry Matter Capcaity[3] Pounds/hd/da
Low quality forages (<53% TDN; dormant native range, straw, stalks bales)	Dry cow Lactating cow	1.8% 2.0%	20-22 lb/hd/da 22-24 lb/hd/da
Average quality forages (53% to 59% TDN native hay, bromegrass hay, alfalfa)	Dry cow Lactating cow	2.0% 2.3%	22-24 lb/hd/da 25-28 lb/hd/da
High quality forages (>59% TDN; alfalfa, boot-stage hay)	Dry cow Lactating cow	2.5% 2.7%	28-30 lb/hd/da 30-33 lb/hd/da
Green pasture	Dry cow Lactating cow	2.5% 2.7%	28-30 lb/hd/da 30-33 lb/hd/da
Silages	Dry cow Lactating cow	2.5% 2.7%	28-30 lb/hd/da 30-33 lb/hd/da

[1]1100 to 1200 lb cow
[2]Capacity as a percent of body weight
[3]Total daily intake (dry basis)



- Crystallinity is a highly ordered 3-dimensional structure which may impair digestibility.

- For example, crop residues cell wall fiber is highly crystalline cellulose and digests slowly.

- When soaked in NaOH, the cell wall fiber swells and becomes amorphous. Hydrogen bonding is reduced and rate and extent of cellulose digestion increase.

History

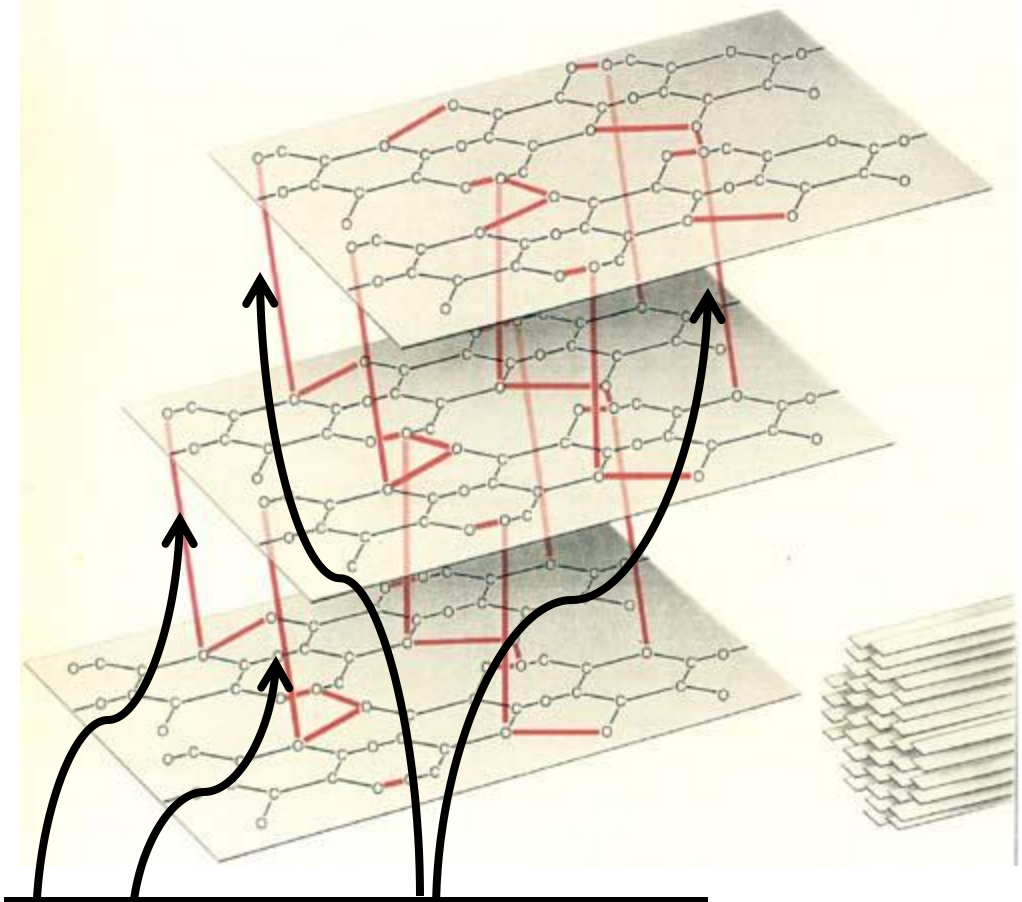
- Chemical treatment began in 1880's
  - Started with paper making
  - Observation of increased cellulose digestibility

- Alkali
- Peroxides
- Ammonia

Hydrolytic

1. Partial solubilization of hemicellulose
2. Above 5% NaOH some lignin and silica solubilized
3. Disruption of intermolecular hydrogen bonding of cellulose
4. Increased rate of fiber hydration
5. Increased rate of bacterial colonization

Van Soest, Berger



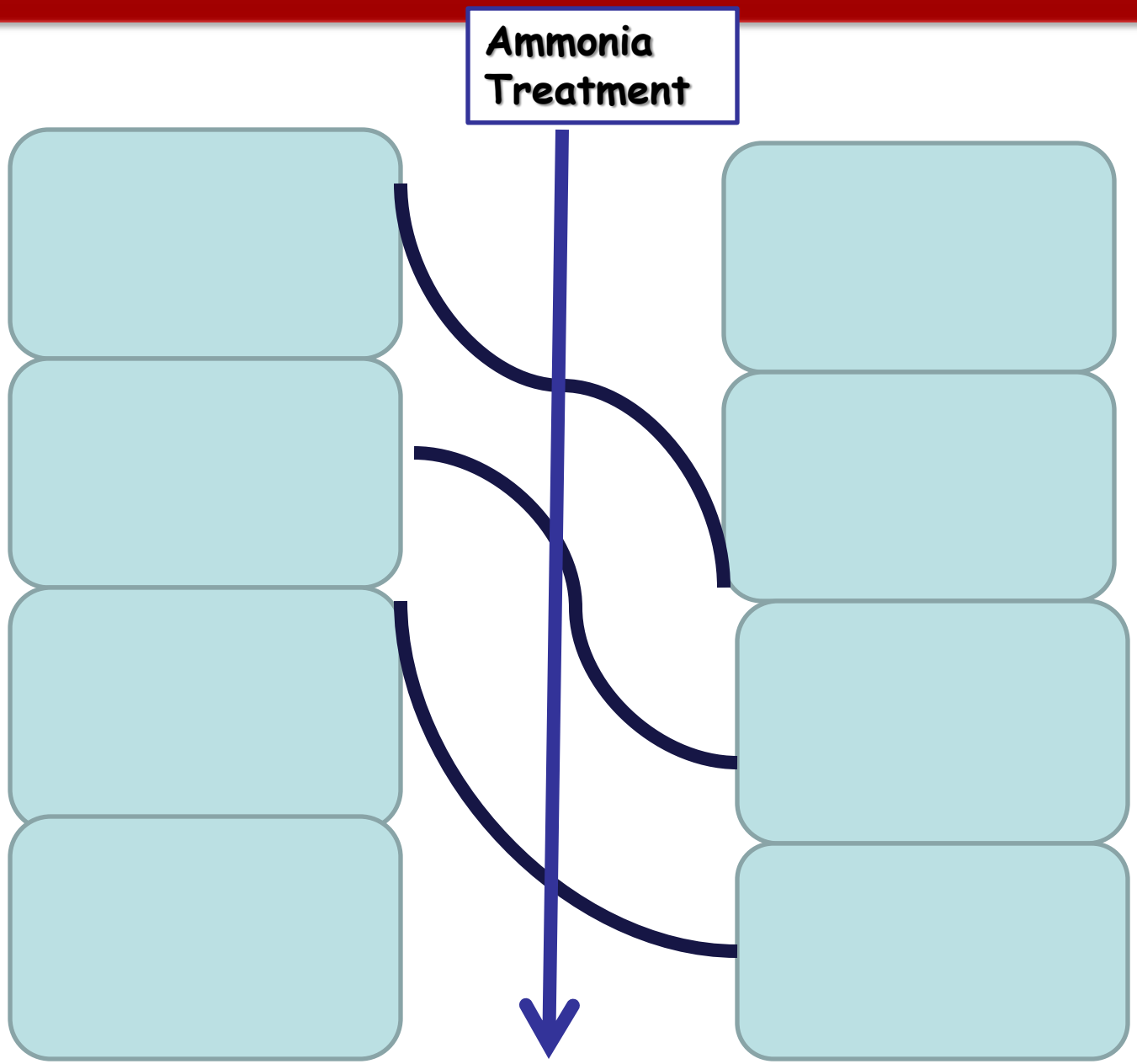
- Crystallinity is a highly ordered 3-dimensional structure which may impair digestibility.
- For example, raw cotton fiber is highly crystalline cellulose and digests slowly.
- When soaked in NaOH, the cotton fiber swells and becomes amorphous. Hydrogen bonding is reduced and rate and extent of cellulose digestion increase.

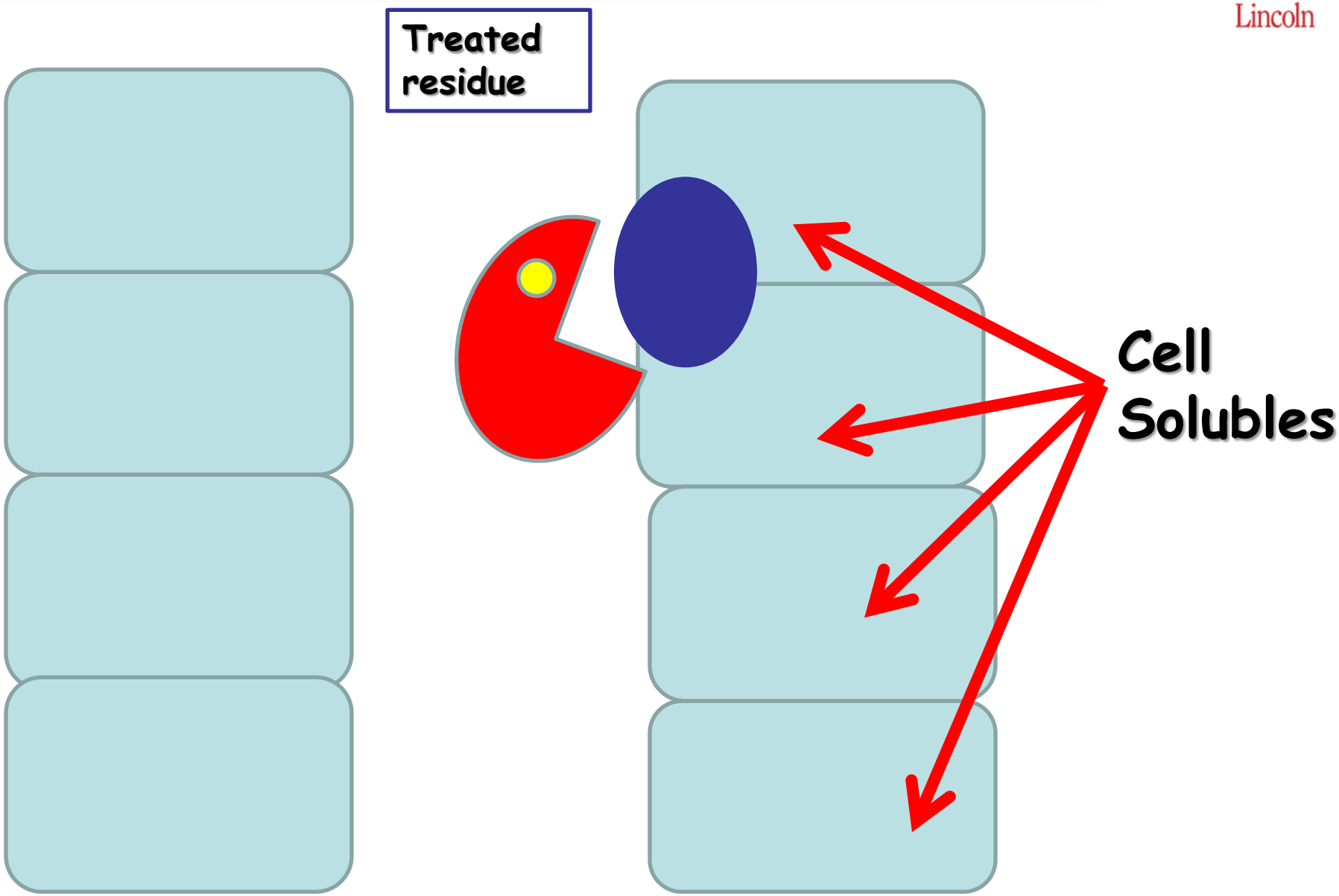
$NH_3 + H_2O$

H-Bonding

Enzyme accessible space

Digestibility


Ammonia Treatment


Treated residue
Cell Solubles

Ammoniation of Low Quality Forages

1. Reaction is temperature dependent.
   - Temperature above 86°- 1 week
   - Temperature: 59° to 86° - 1 to 4 weeks
   - Temperature: below 59° - 4 to 8 weeks
2. Forage must be covered/sealed until reaction is complete.
3. Leave 3 to 4 inches between bales
4. In summer – bale residue when a dew is on it.

Anhydrous Treatment

- DM intake increased 22% averaged over 21 treated crop residues
- DM digestibility increased 15% averaged over 32 studies
- Usually ~ 33% of the NH_3 is retained.
- Temperature, water content, length of reaction time influences effectiveness.

University of Nebraska Lincoln

Effect of Treatment of Straw on Intake and Performance of Gestating Beef Cows

Treatment	Daily Straw Intake, lb	Daily Weight Change, lb
Straw + 7 pounds of alfalfa	14.8	(-)0.27
Treated Straw + 7 pounds of alfalfa	19.7	0.40
Treated straw	26.1	0.1

If fed without supplementation - best use for beef cows before calving.

Ward, et al., 1982 NE Beef Cattle Report

2013 Budget for Ammoniating Wheat Straw

Item	Cost per unit	Total costs
Wheat straw, $/t	0.00	0.00
Baling, $/bale	13.00	1,092.00
Labor (blade, move,stack bales) 6 hrs	10.00	60.00
Machine time and repair, 6 hours	12.00	72.00
Plastic sheeting, 40' by 100' 6 mil	280.00	280.00
Labor (cover, seal, application), 4 hrs	10.00	40.00
Anhydrous ammonia, 3% rate, $/t	770.00	971.00
Miscellaneous	15.00	10.00
Total cost, $/stack		2,525.00
Cost, $/t		60.12
Cost per pound of Energy (TDN)	(56% TDN, 90% DM)	$0.06

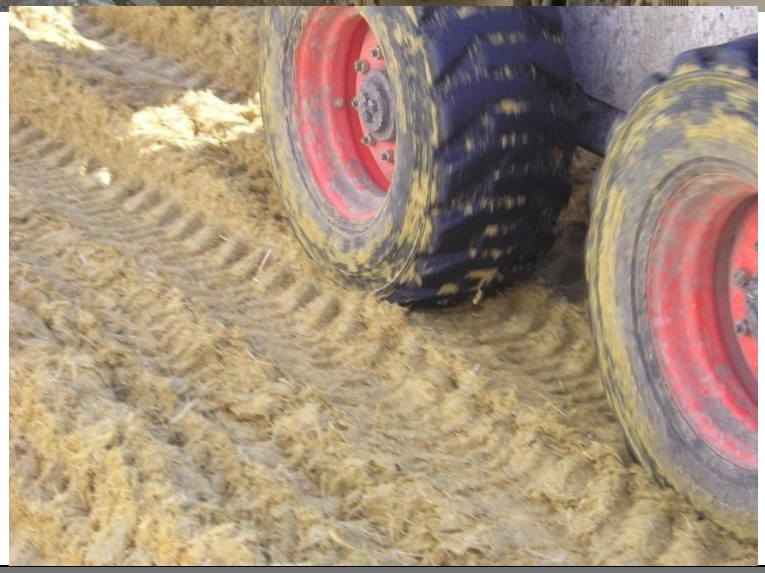
Ammoniating one stack of straw containing 84, 1,000 bales
Arranged 14 bales long, 3 bale base, 2 bales second level, one on top

Summary of Ammoniation

1. Process used on low quality forages – ONLY!
2. Bale forage with a dew on it: exp.-Straw summer.
3. Increases digestibility by 15%.
4. Increases dry matter intake by 22%.
5. Increase nitrogen/protein:3 and 4 most important.
6. Open bag 3 to 4 days before feeding.
7. Handle anhydrous with care.
8. Feed w/o supplementation – cows before calving
   - TDN: 54 to 56 percent
   - Crude Protein – 7.5 to 9 percent
9. Feed w/ supplementation
   - 1st calf heifers – pre and post calving
   - Cows after calving

Storage of WDGS in Silo Bags

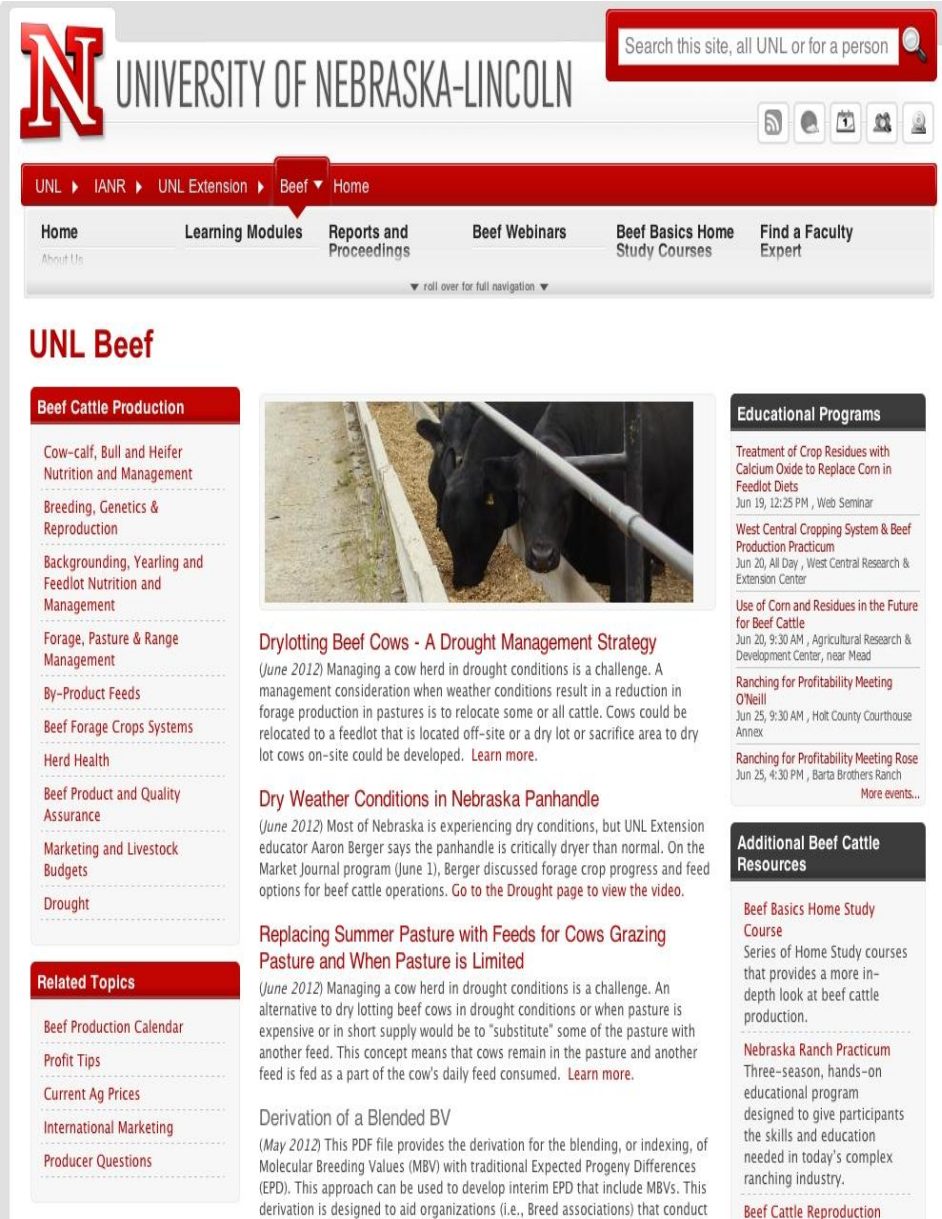
Storage of WDGS in a Bunker



- Distillers Solubles Bunker
  - 41:59 ratio of Solubles and Corn Stalks (DM basis)

Beef Extension Page

http://beef.unl.edu



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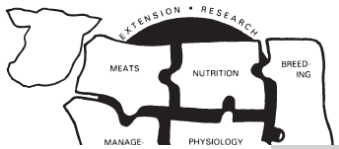

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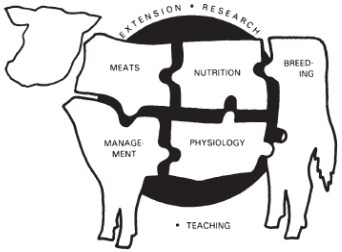

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2013 Beef Cattle Report

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