Distillers Grains-Potential Toxicity Issues

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Ethanol By-Products

Health issues include:
- Sulfur toxicity in ruminants
- Mycotoxins in grain prior to fermentation
- Mycotoxins in post storage feeds
- Antibiotic residues
Ethanol By-Products

- Health issues include
  - Atypical interstitial pneumonia
  - Copper depletion
  - Zinc depletion
Ethanol By-Products

Health issues include

- Calcium/Phosphorus imbalance
- Bone osteodystrophy
- High nitrogen feed and kidney damage
- Salt concentration
DDGS

- Very safe
- Produced by the new dry mill plants
- Less variation
- Most is shipped out of Iowa
Wet Mill Products

- Can’t economically transport water
- Short time period to get used up
- Moisture content can vary widely
- Corn condensed distillers solubles
- The majority of the issues I see are involved with wet mill products.
Flattened Gyri & Cerebellar Coning
Cation Anion difference

\[(\text{Na} + \text{K}) - (\text{Cl} + \text{S})\]

Balancing the DCAD may reduce the probability of developing sulfur toxicity.
Sulfur toxicity

- Adult Cattle seem to tolerate high sulfate diets.

- Cows have been fed free choice CCDS without problems.
Mycotoxins

- Secondary metabolites of fungi.

Concentrated 3 fold during fermentation.
Mycotoxins

- Metabolites of fungi, recognized as toxic to other life forms
- More than 300 recognized "mycotoxins" based on experimental or field conditions.
- Relatively stable once formed.
High Moisture Effects

- Main concern is post-production infection

- Wet DDG’s – a good substrate for molds
Mycotoxins in corn

- Aflatoxins - Aspergillus kernel rot
  - Potent liver toxin
  - Immunosuppression
  - Carcinogenic, milk contamination
Aflatoxin – clinical effects

- **Acute** - depression, anorexia, reduced gain/milk, hypothermia.

- **Chronic** - unthrifty, decreased growth rate, anorexia, icterus, mild anemia, ascites, immunosuppression
Aflatoxin

Public health:
- FDA action level in milk = 0.5 ppb (from > 20 ppb AF in feed)
- Carcinogen in laboratory animals
Fumonisins

- First recognized as a cause of esophageal cancer in South Africa.
- Fumonisin mycotoxins in traditional Xhosa Maize Beer in South Africa.
Fumonisins

- Fusarium ear rot
- Fatal diseases in horses & pigs
- Affects brain, heart, liver, lungs, kidneys
- Carcinogenic; birth defects?

Fumonisins B1

Fumonisins B2
Mycotoxins in corn

- Deoxynivalenol (DON) - Gibberella ear rot
  - Feed refusal, vomiting, poor weight gain in swine

- Zearalenone, Other *Fusarium* toxins
Molds

WDGS
Zearalenone/Zearalenol

- Estrogenic mycotoxin
- Lush early season legumes
- Estrogenic implants
- Analogous to endocrine disruptors that can be found in the environment
Fusarium
ANTI BIOTICS

- Used during fermentation
- May have residues in the feed
- **LACTROL**®
  (virginiamycin and dextrose)
  ☒ 0.25 ppm to 2.0 ppm added to yeast propagators
FDA/CVM authorized the distiller’s grains industry to use virginiamycin with dextrose when the antibiotic:

1) is added during the fermentation phase

2) is used at a rate of 2 to 6 parts per million (ppm.)

3) has a maximum residue level of 0.2 to 0.5 ppm. in the resulting co-product, with the maximum value dependent upon the addition rate.

FDA/CVM based the letter on a safety assessment that assumed a 20 percent maximum inclusion rate of distiller’s dried grains with solubles (DDGS) in an animal’s diet.
FDA/CVM is revisiting antibiotic residue issues in corn co-products
More concern than reality
AIP and Corn Co-Products
AIP (Acute Interstitial Pneumonia)

- 4 ipomeanol production from a mold growing in wet DDG products

- Similar to what occurs when sweet potato’s are infected with *Fusarium solani*. 
AIP (Acute Interstitial Pneumonia)

Alternate theory is high hydrogen sulfide levels in the rumen

- Eructated gas
  - Damage respiratory cilia
  - Damage lung
  - Normally goes through rumen wall
Atypical Interstitial Pneumonia

- Cases of AIP have been associated with feeding of wet DDG
- Usually when wet DDG’s are fed so are other highly fermentable feeds
- Is it real or not?
Copper depletion occurs with high sulfate diets.

1. (Response of Cow-calf Pairs to Water High in Sulfates, Hubert Patterson, Pat Johnson, George Perry, Roger Gates, and Ron Haigh, BEEF 2005 – 05.)

2. (Effect of High-sulfate Water on Trace Mineral Status of Beef Steers, Cody L. Wright and Hubert H. Patterson, BEEF 2005 – 17.)
Pasture

Cu levels ppm

Animal I.D.

25-100
Liver copper means

- Pasture-90
- Pasture & syrup-66
- Feedlot-69
- Feedlot & syrup-61
Tox is staffed during the break and is doing samples during the break.
Zinc

- High sulfur diets may interfere with zinc absorption and affect hoof quality.
- Many field reports of associated lameness and/or a splay hoof.
Calcium/Phosphorus

- Elevated concentration and bioavailability of phosphorus in corn co-products.
- Increased incidence of milk fever observed in old pregnant cows on diets > 30% inclusion.
Calcium/Phosphorus

- High-grain diets with roughly a 1:1 calcium to phosphorus ratio.
- Urinary calculi in steers on high inclusion rates.
- Ca:P needs to be closer to 2:1
Ringbone

- New bone growth on the proximal, middle, or distal phalanx often with degeneration of the joint surface.
- Observation of joint damage with subsequent fibrous exudate in the joint and subque in the area.
High Nitrogen Feed

- Damage to kidneys
Salt

Salt concentration has previously been observed to vary widely.
Questions?