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ETHANOL CO-PRODUCTS FROM DRY MILLING IN BEEF CATTLE DIETS

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Presentation Overview

- Current Corn and ethanol situation
- What ethanol co-products are made from corn?
- Why is sulfur a problem with co-products?
- How much co-products can I feed?
- Purchasing -what do I need to know?
- Summary

Current Corn and Ethanol Situation

Corn price = most important factor to determine livestock feeding costs

Reference price for energy sources

Competition for land resources

⇧ corn price = ⇧ soybean meal price

SBM = reference price for proteins

April 2010 → Corn $ ⇧ $2/bu and

SBM $ ⇧ $90/ton (Babcock, ISU, Nov. 2010)

Current Corn and Ethanol Situation

3,360 pounds of corn to produce
500 pounds live weight of beef $/lb.
liveweight beef = ⇧ $.24 (summer 2010)

Impact of ethanol policy on corn $ 2011?
current policy (mandate, tax credit, tariff) = $5.21/bu
mandate only = $4.86/bu
no programs = $3.84/bu

Impact on production cost for beef 2011?
current policy = $ 0.24/lb.
mandate only = $ 0.20/lb.
no programs = $ 0.09/lb .

(Babcock, ISU, Nov. 2010)

Corn Ethanol Co-Products

Corn Wet-Milling Process

Food and Industrial Uses

- 31.5 lb. corn starch or sweetener (alcohol)
- 12.5 lb. corn gluten feed
- 2.5 lb. corn gluten meal
- 1.6 lb. corn oil

Corn Dry-Milling Process

Ethanol Fuel Use

- 2.7 gallons ethanol
- 18 lb. “distillers grains”
- 18 lb. carbon dioxide

→ 3x concentration of energy, protein, P & S vs. corn

Dry milling co-products

Table 1. Nutrient composition of ethanol coproducts.

Nutrient	Dried Distillers Grains	Dried Distillers Grains plus Solubles	Modified Wet Distillers Grains plus Solubles	Wet Distillers Grains plus Solubles	Condensed Distillers Solubles
DM, %	88 to 90	88 to 90	50	25 to 35	23 to 45
			DM Basis		
TDN, %	77 to 88	85 to 90	70 to 110	70 to 110	75 to 120
NEm, Mcal/cwt	89 to 100	98 to 100	90 to 110	90 to 110	100 to 115
NEg, Mcal/cwt	67 to 70	68 to 70	70 to 80	70 to 80	80 to 93
CP, %	25 to 35	25 to 32	30 to 35	30 to 35	20 to 30
DIP, % CP	40 to 50	43 to 53	45 to 53	45 to 53	80.0
UIP, % CP	50 to 60	47 to 57	47 to 57	47 to 57	20.0
Fat, %	8 to 12	8 to 12	12 to 15	10 to 18	9 to 15
Calcium, %	0.11 to 0.20	0.10 to 0.20	0.02 to 0.03	0.02 to 0.03	0.03 to 0.17
Phosphorus, %	0.40 to 1.15	0.40 to 0.80	0.50 to 1.42	0.50 to 0.80	1.30 to 1.45
Potassium, %	0.49 to 1.08	0.87 to 1.33	0.70 to 1.00	0.50 to 1.00	1.75 to 2.25
Sulfur, %	0.46 to 0.65	0.37 to 1.12	0.38 to 1.20	0.40 to 1.20	0.37 to 0.95

Table adapted from:

1) Stock, et al. 1995. Average Composition of Feeds Used in Nebraska. G1048. www.ianr.unl.edu/pubs/beef/G1048.pdf
2) Tjardes and Wright. 2002. Feeding Corn Distiller's Co-Products to Beef Cattle. South Dakota State University. ExEx. 2036.
3) NRC. 2001. Nutrient Requirements of Dairy Cattle.
4) Iowa Renewable Fuels Association. www.iowafa.org/ethanol_coproducts.php. Accessed June 19, 2007.
5) Internal laboratory analysis at NDSU.

The analyses given in this publication are a range of published values and regionally available laboratory analyses. Products vary and this may not represent what a particular plant is producing at any give time.

(Lardy, AS-1242 , 2007)

Why is sulfur a problem?

Ethanol co-products can contain high levels of sulfur (S)

- ✓ corn S content = 0.14 to 0.16%
- ✓ ethanol co-products @ 3X S = 0.45% S
- ✓ form of sulfur amino acids ⇨ ~ 40% rumen degraded

Sulfuric and sulfamic acids used in ethanol fermentation process

- ✓ pH control and cleaning distillation columns

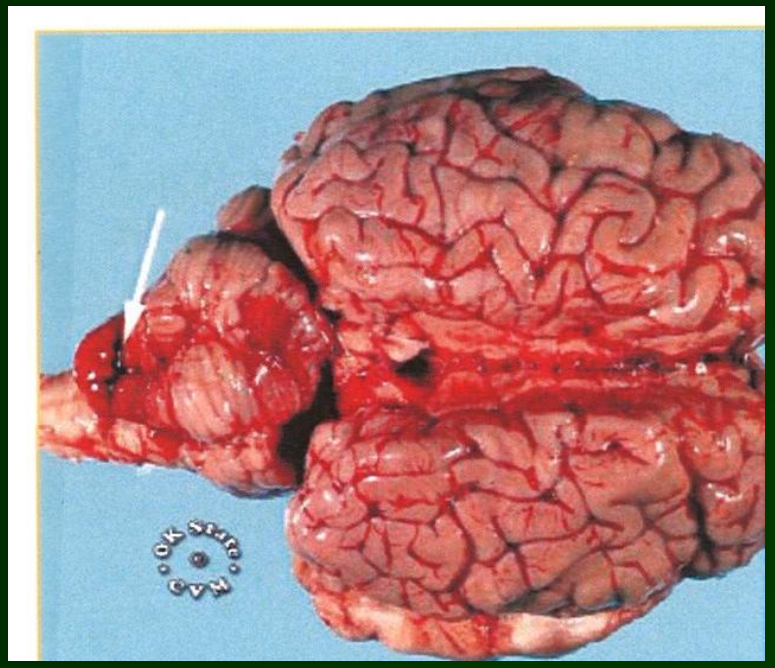
Why is sulfur a problem?

High dietary S has been implicated as a cause of polioencephalomalacia (PEM)

- Rumen S reduced to H_2S + absorption ⇨ H_2S toxicity

Polioencaphalomalacia

- ✓Polio = gray matter
- ✓Encephalo = brain
- ✓Malacia = tissue death



Polioencephalomalacia (PEM)

Signs of PEM

- ✓ Aimless walking
- ✓ Blindness
- ✓ Head-pressing
- ✓ Stumbling
- ✓ Circling
- ✓ Muscle tremors
- ✓ Possible convulsions
- ✓ Star gazing
- ✓ Sometimes referred to as “polio” or “brainers”

Polioencephalomalacia (PEM)

Usually seen one to three weeks after starting high S diet

- ✓Only 10-35% of cattle consuming high S diets develop disease

Current knowledge not complete → other nutritional factors possibly involved

- ✓Thiamin or cobalt deficiency
- ✓Carbohydrate source
- ✓Rumen pH
- ✓Forage level in diet

Why is sulfur a problem?

Other diet sources contain S

✓ Drinking water ⇨ most often overlooked

@ 40° F: 600 lb. stocker = 5 gallons

1, 000 lb. finisher = 9 gallons

Dry cow = 6 gallons

Lactating cow = 13 gallons

(Rankins, Alabama Ext., 2009)

✓ Hays, silages, straws, stalks, other grains

BOTTOM LINE ⇨ TEST water and diet ingredients before feeding ethanol co-products!

How much co-products can I feed?

- ✓ Protein and energy source; high bypass protein (undegraded intake protein, UIP)
- ✓ Fiber - readily fermentable and reduces acidosis
- ✓ Fat - if too much, can reduce feed intake and fiber/forage digestion (fat = 5 to 6% DM basis)
- ✓ Sulfur - if too much, Polio (PEM) or Brainers appear
- ✓ Phosphorus and protein - high feeding levels lead to overfeeding and can have manure management implications
- ✓ Need additional calcium to keep calcium to phosphorus ratios at 2:1

How much co-products can I feed?

Total S intake (feed + water) needs to be considered

General recommendations for dietary S concentration
0.15% total ration dry matter (DM)

- recommended upper S limit < 0.30%
- maximum tolerated intake level = 0.40% S
  (Klopfenstein et al. 2008)
- > 0.40% S DM = polio

High concentrate diets S = 0.30% DM

High roughage diets S = 0.50% DM (NRC, 2005)

Feeding Recommendations (Levels)

Backgrounding and Finishing

- ✓ 10 to 15% diet (DM basis) = protein source; dry or wet, ± solubles

  > 15% diet (DM basis) = energy source ⇨ replace corn or grain source

- ✓ Feed up to 40% diet (DM basis); optimum level < 30%

- ✓ Wet DGS @ 25 to 30% diet (DM basis) in dry rolled corn diets

(Lardy, AS-1242, 2007)

Feeding Recommendations (Levels)

High forage diets: cows, replacement heifers & weaning

- ✓ Source of protein and energy
- ✓ Level depends: forage nutrient content & expected performance
- ✓ Feed up to 4 lb. daily (DM basis)
- ✓ Use to extend forage or improve forage quality
  - ✓ good supplement for cows and replacement heifers on corn stalks (Stalker et al., 2010)

Replacement heifers: program-fed, ADG = 1.5 lb., 60% mature BW @ breeding → AI & PG rate ⇧ compared to 28% CP range cube (Stalker et al., 2010; Klopfenstein et al., 2008)

Creep feed: DDGS used @ up to 50% ⇨ excellent addition
⇨ flavor, aroma + nutrient aspects (Lardy, AS-1242, 2007)

Purchasing – what do I need to know?

75 percent of solubles must be added to the wet grains for the co-product to be officially called distillers grains

American Feed Industry Association (AFIA) updated definition for DDG/S (Feb. 2007)

- ✓ The predominating grain must be declared as a first word in the name: Corn Distillers Dried Grains with Solubles (CDDG/S)

Typical Analysis (as fed basis) : Moisture % 8-12; Ether Extract (fat level) % 6-10; Ash % 4-5; Crude Protein % 25-28; Crude Fiber % 8-10

- ✓SD only state requires a S listing
- ✓maximum only at 0.95% (as fed basis)

Purchasing – what do I need to know?

- ✓ Factors influencing quality - degree of color and/or darkness → higher drying temperatures, mash size differences, residual sugars
- ✓ plant to plant variability

  color: yellow to brown

  odor: sweet and cool; not burnt or musty

  texture: can range from fine/powdery to coarse/gritty - depends on the original fineness of grind of the grain

AFIA standardized the methods of nutrient determination for DDGS vendors (Feb. 2007)

⇨ Wet chemistry methods: DM, crude protein, crude fat, and crude fiber determinations

Purchasing – what do I need to know?

Always get a feed tag and laboratory analysis from ethanol plant

Sample and analyze each load of co-product

⇨ use wet chemistry methods

BEWARE: Distillers grain price is now more closely tied to corn and SBM prices

⇧ corn price = ⇧ SBM price = ⇧ distillers grain price

Best time to purchase: summer months ⇨ decreased feedlot demand

How do I determine if the price is a good buy?

Pricing co-products → compare price per unit of crude protein from other high protein ingredients

DDGS price = $155/ton @ 30% CP

HIPro SBM price = $390/ton @ 47.5% CP

Cost per lb. CP = $155/2000 lb./0.30

Cost per lb. CP = $0.258/lb. DDGS

Cost per lb. CP = $390/2000 lb./.475

Cost per lb. CP = $ 0.41/lb. SBM

⇨ DDGS best buy per unit CP

Other Pricing Methods for co-products

Price from local cash bid for corn

- Best forecaster of future distillers grain values
- Represents the distillers grain price that is 100% price of corn

EX. Local cash bid = $4.50/bu

DDG price = 4.50/.85 /56 X 2000 X 0.90

⇨ DDG price = $170.17/ton (Ives, Hawkeye Gold LLC, 2008)

What about breakeven pricing?

Other Pricing Methods for co-products

Breakeven price based on the price of ground corn grain and SBM:

- ✓ price for SBM is HiPro and all prices (corn, SBM and DDGS) are delivered prices to the farm/ranch

Breakeven of DDGS ($/ton) =

{corn ($/bu) x 17.85} + {SBM ($/ton) x 0.5}

(Weiss et al., OSU Ext., 2007)

EX: ground corn delivered to farm @ $4/bu ($143/ton)

SBM (hipro) delivered to farm @ $210/ton

Breakeven price for DDGS (assuming average nutrient composition ⇨ ($4 x 17.85) + ($210 x 0.5) = $176/ton

Other Pricing Methods for co-products

Value of WDGS calculated from the price of DDGS

- price of DDGS is adjusted for differences in DM concentration, nutrient composition, shrink and storage costs

1. DM adjustment = DM WDGS (35) /DM DDGS (90) = 0.389

2. Nutrient composition adjustment → expected differences in rumen undegradable protein and NE_L between WDGS and DDGS = 0.98

3. Shrink adjustment → estimated from expected spoilage and seepage losses of WDGS = 0.85

4. Storage cost = actual cost of bagging, adding preservatives, etc.

Value of WDGS from the price of DDGS

Example: DDGS delivered to farm @ $176/ton

WDGS is 35% DM

Preservative cost $5/ton

Breakeven for WDGS:

($176 x 0.389 x 0.98 x 0.85) - $5 = $ 52.03/ton delivered

(Weiss et al., OSU Ext., 2007)

Summary

Ethanol co-products are useful feed ingredients for beef producers

Co-products can vary in nutrient content and moisture level

Feeding levels will be determined by:

- prices for other energy and protein ingredients
- nutrient contents of all dietary ingredients and water sources
- production goals

Regular testing of co-products, other feed ingredients and water sources is necessary

Questions?

Thank You!

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