

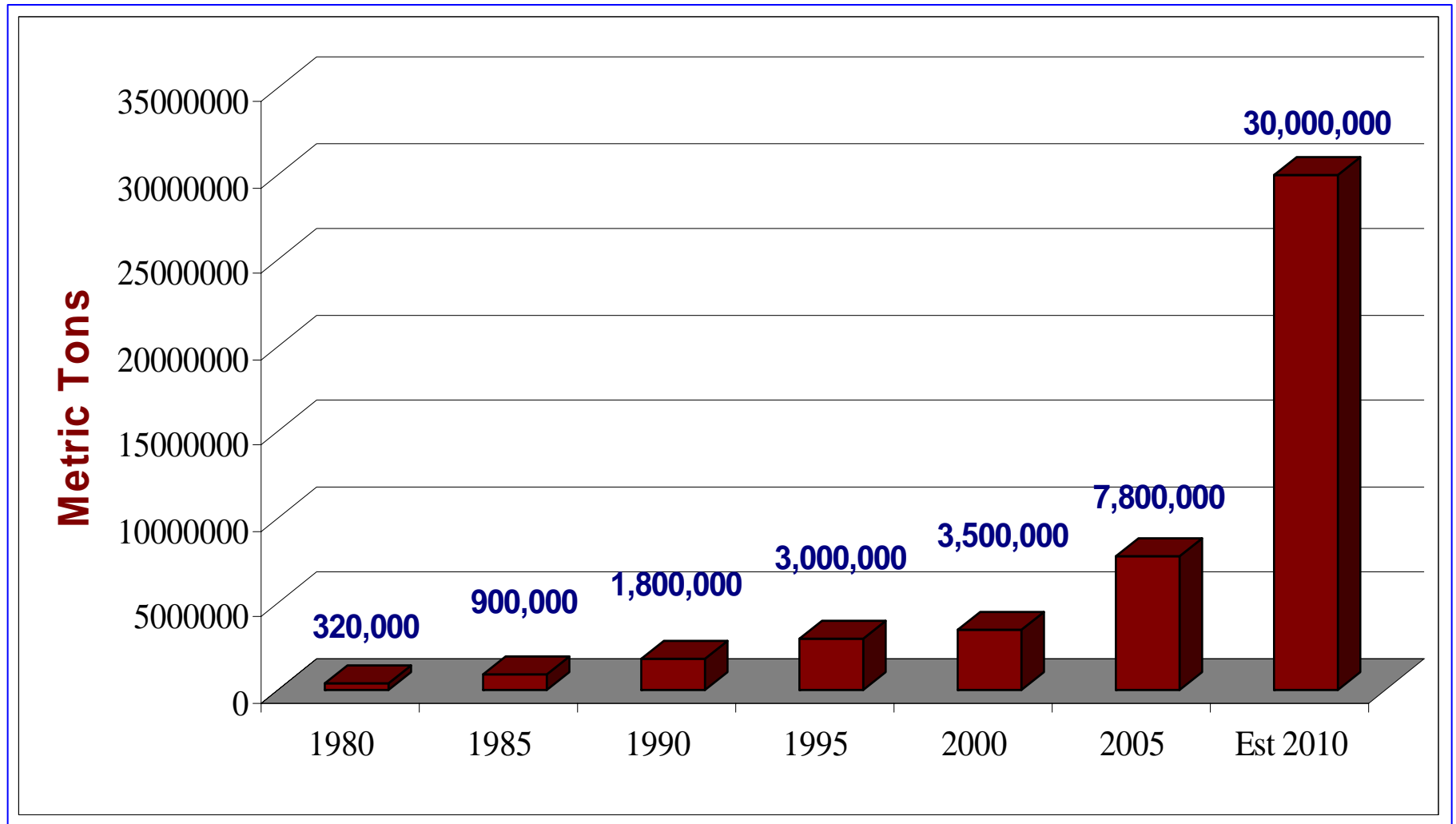
Using Distiller's Grains in Livestock and Poultry Feeds

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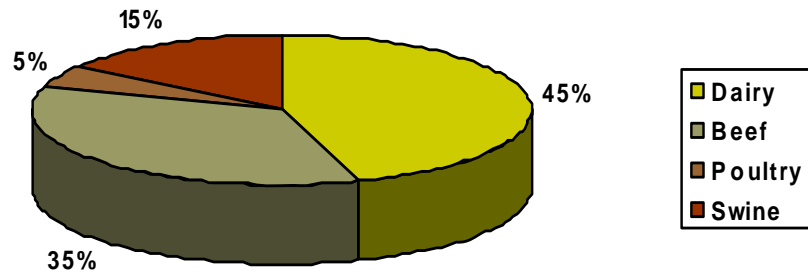
North American DDGS Production



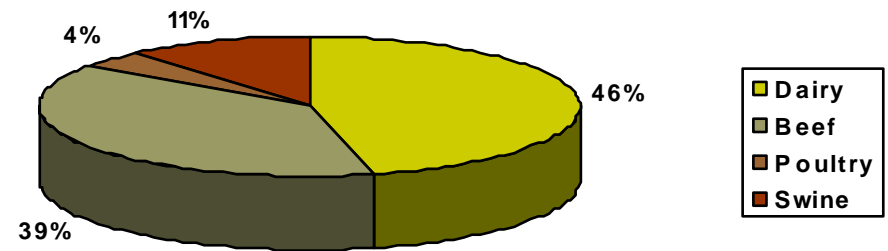
Source: Sean Broderick, Commodity Specialists Company

North American DDGS Consumption

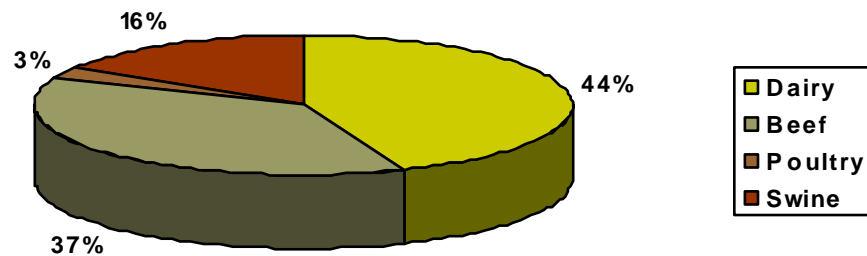
Estimate 2002



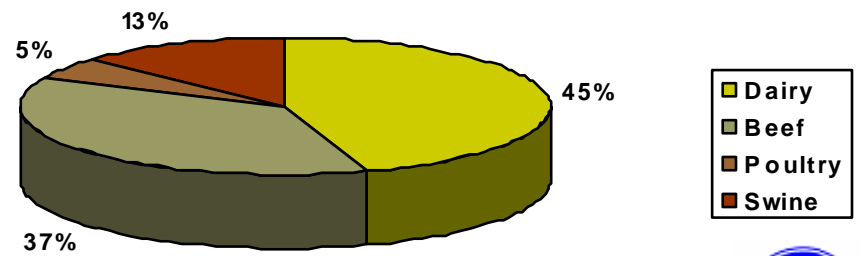
Estimate 2003



Estimate 2004

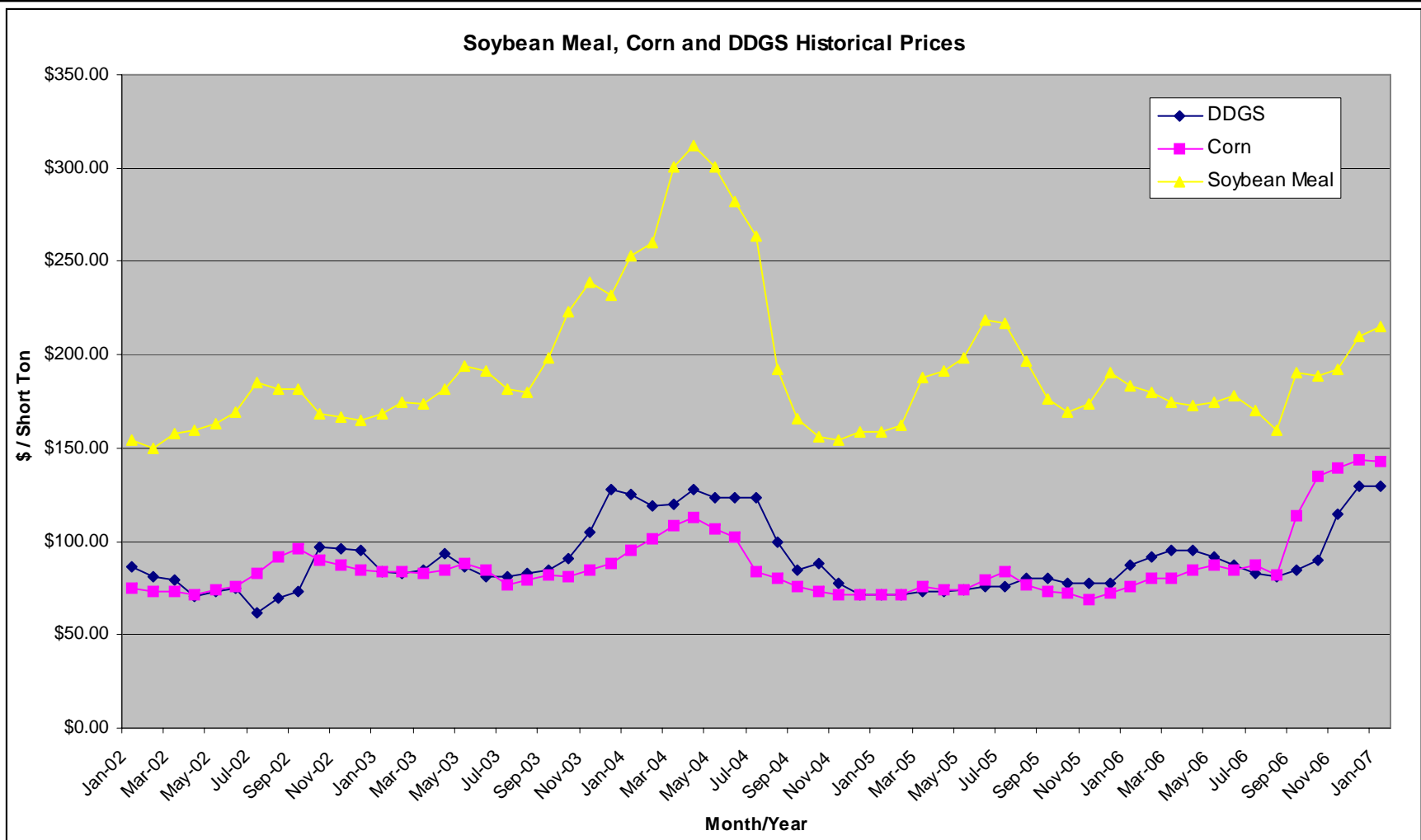


Estimate 2005



CSC 2006

USDA historical wholesale prices for DDGS (\$/short ton) compared to monthly average closing prices of near-month corn and soybean meal futures from the CBT.





Types of Distiller's By-Products from Dry-Grind Ethanol Plants

- Wet distiller's grains
 - Primarily beef, some dairy
- Dry distiller's grains
 - Beef and dairy
- Wet distiller's grains with solubles
 - Beef and dairy
- Dried distiller's grains with solubles
 - Dairy, swine, poultry, some beef
- Modified wet cake (blend of wet and dry distiller's grains)
 - Primarily beef, some dairy
- Condensed distiller's solubles
 - Beef and dairy
 - Ontario, Canada - swine liquid feeding systems

Wet Distillers' Grains



Dried Distiller's Grains with Solubles (DDGS)





DDGS Nutrition

- DDGS is a “package of nutrients”
 - Mid-protein ingredient
 - Like corn, has poor protein quality (amino acid balance) for swine and poultry
 - High fat
 - High available P
 - important for monogastrics

Averages, Coefficients of Variation, and Ranges of Selected Nutrients Among 32 U.S. DDGS Sources (100% Dry Matter Basis)

Nutrient	Average	Range
Dry matter, %	89.3	87.3 – 92.4
Crude protein, %	30.9 (4.7)	28.7 – 32.9
Crude fat, %	10.7 (16.4)	8.8 – 12.4
Crude fiber, %	7.2 (18.0)	5.4 – 10.4
Ash, %	6.0 (26.6)	3.0 – 9.8
Swine ME, kcal/kg	3810 (3.5)	3504 – 4048
Lysine, %	0.90 (11.4)	0.61 – 1.06
Phosphorus, %	0.75 (19.4)	0.42 – 0.99

DDGS Varies in Nutrient Content and Digestibility, Color, and Particle Size Among U.S. Sources



Nutritionists make the decisions on feed ingredient use

- Decisions are based on:
 - Price relative to competing ingredients
 - Corn
 - Soybean meal
 - Dicalcium phosphate
 - Consistency of supply
 - Ability to source and manage quality
 - Physical characteristics
 - Particle size and flowability
 - Bulk density
 - Ability to pellet
 - Risk of mycotoxins
 - Product consistency/variability



DDGS Nutrition

- Nutrients are evaluated and valued differently depending on target species.
 - Cattle
 - Protein and energy source
 - Fiber – readily fermentable and reduces acidosis
 - Fat – if too much, milk fat is depressed in lactating dairy cows
 - Sulfur - polioencephalomalacia
 - Phosphorus – high feeding levels leads to overfeeding P
 - Swine
 - Energy source equal to corn
 - Poor amino acid balance
 - Limiting in lysine, tryptophan, and threonine
 - Amino acid digestibility varies among sources
 - Good source of available P
 - Poultry
 - Same as swine but lower energy (85% the value of corn) and available phosphorus value
 - Limiting in lysine, tryptophan, and arginine
 - Xanthophyll content - skin and egg yolk color
 - Sodium - layers

Relative Value of DDGS Differs Depending on Species

Assumptions:

- Corn \$2.00 / bu
- SBM \$175.00 / ton
- Urea \$360.00 / ton
- Non-ruminant diets corn/SBM
- Ruminant diets typical diets with competing by-products.

Feed

Dollars/ ton

Dairy Lactation	\$114.24
Poultry Finisher	\$100.09
Layer Diet	\$104.66
Swine G-F Diet	\$96.34
Beef Feedlot	\$108.00

Source: Tilstra, Land O' Lakes

Feeding Distillers' Grains to Beef Cows



Source: Dr. Alfredo DiCostanzo, University of Minnesota

Bagged WDGS

(Univ. of Nebraska)

WDGS no forage



**WDGS and
7.5% or 10% grass hay (DM basis)**



WDGS in a Bunker Silo

(Univ. of Nebraska)



WDGS and 40% grass hay (DM basis)

Consider Supplementing Distiller's Grains (Spring Calvers)

- ❑ Energy on low-quality forage diets
 - corn stalks
 - hay
- ❑ Gestating diet needs:
 - 55% TDN
 - 8% CP
- ❑ Lactating diet needs:
 - 60% TDN
 - 12% CP



Source: Dr. Alfredo DiCostanzo, University of Minnesota

Consider Supplementing Distiller's Grains (Fall Calvers)



- In drought years
 - Late-gestating cows
 - 55% TDN
 - 8% CP
- Every winter
 - Lactating cows
 - 60% TDN
 - 12% CP

Source: Dr. Alfredo DiCostanzo, University of Minnesota

Example Rations (WDGS)

□ Lactating cow

- Hay 21 lb
- WDGS 22 lb

□ Dry cow

- Hay 16 lb
- WDGS 21 lb

□ Growing heifer

- Hay 18 lb
- WDGS 24 lb

□ Lactating cow

- Corn silage 41 lb
- WDGS 16 lb

□ Growing heifer

- Corn silage 49 lb
- WDGS 7 lb

Source: Dr. Alfredo DiCostanzo, University of Minnesota

Example Rations (DDGS)

□ Lactating cow

- Hay 23 lb
- DDGS 7 lb

□ Lactating cow

- Corn silage 44 lb
- DDGS 5 lb

□ Dry cow

- Hay 18 lb
- DDGS 7 lb

□ Growing heifer

- Corn silage 48 lb
- DDGS 3 lb

□ Growing heifer

- Hay 16 lb
- Corn 4 lb
- DDGS 6 lb

Source: Dr. Alfredo DiCostanzo, University of Minnesota



Other Important Considerations

- ❑ Excess supply in summer and fall lead to attractive distillers' grains pricing for contracting
- ❑ Storage, shrink and wastage must be managed
- ❑ Approximately 5 to 7 lb dry distillers' grains (or wet distillers' equivalent) needed to balance corn silage and hay diets
- ❑ At 6 lb DM, dry distillers' grains can interact with sulfate concentrations and lead to intake of toxic levels of sulfate
- ❑ Make sure water sulfate concentrations are less than 2,000 ppm when using distillers' grains

The Use of DDGS in Beef Feedlot Rations



Benefits and Limitations for Finishing Feedlot Cattle

Benefits

- More protein and energy than corn
- Feed up to 40% of ration dry matter to replace corn
 - Feed excess protein and P
- Highly digestible fiber source
 - Fewer digestive upsets
- “Golden” DDGS gives best performance
- No effect on carcass yield, quality, or eating characteristics of beef

Limitations

- Need to supplement calcium to achieve proper Ca:P ratio
 - Avoid urinary calculi
- Manure N and P excretion increases at high feeding levels
- Monitor sulfur level of water and diet (< 0.4% ration DM)
 - Avoid polioencephalomalacia

Value of Nutrients in DDGS for Finishing Cattle

- Energy
 - Wet distiller's grains – 110 to 125% energy of corn (DM basis)
 - DDGS – 100% of corn (DM basis)
- Protein
 - By-pass > soybean meal
 - Wet = Dry if properly dried
- Fiber
 - High fiber and low starch reduces fermentation rate
 - Safe ingredient to start cattle on finishing diets
 - Reduces subacute acidosis
- Fat
 - Oil content limits the quantity fed (<40%)
- Phosphorus
 - No value in corn-based finishing diets
 - Value as a supplement to low P forages

How Much Distiller's By-Products Can Be Fed to Beef Feedlot Cattle?

- DDGS (90% DM)
 - Feed to supply protein to meet requirement
 - < 20 % ration dry matter
- Wet DGS (30% DM)
 - Feed to supply protein and energy
 - Commonly fed at < 25% of ration dry matter
 - Greatest value at 15 to 20% of ration dry matter
 - Can feed up to 40% of ration dry matter
 - Overfeed protein and phosphorus
- Wet Condensed Distiller's Solubles (30% DM)
 - Feed to supply protein and energy
 - Limit to < 10% of ration dry matter

The Use of DDGS in Dairy Rations



Benefits and Limitations for Lactating Dairy Cows

Benefits

- More protein and energy than corn
- Feed at up to 20% of ration dry matter
- Highly digestible fiber source
 - Fewer digestive upsets
 - Can be a partial forage replacement
- “Golden” DDGS gives best performance
- Highly palatable

Limitations

- Low protein (lysine) quality
 - add other supplements high in lysine
- Manure P excretion increases at high feeding levels
- No effect on milk fat if adequate forage in the ration



Wet vs. Dried Distiller's Grains

- ❑ On a DM Basis, nutrient content is the same
- ❑ Considerations for Wet Distiller's Grains:
 - Can usually store only 5-7 days
 - May need preservatives (e.g. propionic acid or other organic acids, etc.)
 - Limited economical hauling distances
 - Rations may be too wet
 - May limit total DM intake, especially if ensiled forages are also fed



Milk Production Response of Dairy Cows When Fed Distiller's Grains

- ❑ The same or greater than when fed SBM
- ❑ Increased or no change when supplemented with protected lysine and methionine
- ❑ Similar to when fed a blend of protein supplements
 - Soybean Meal, Fish Meal, Distiller's Grains

How Much Distiller's Grains Can be Fed to Dairy Cows?

- Recommend a maximum of ~ 20% of ration DM
 - 10-13 lb/d of dried
 - 30-40 lb/d of wet
- Usually no palatability problems
- At 30% of ration DM
 - May decrease DMI, especially if wet CDG
 - May feed excess protein



Example Ration Considerations for Dairy Cattle

- Diets containing 50:50 forage:concentrate
 - If equal proportions of alfalfa & corn silage
 - DG can replace most or all protein supplement
 - If mostly corn silage
 - More DG can be fed but may need some other protein supplement (check lysine and P levels)
 - If mostly alfalfa
 - Less DG likely needed to supply diet CP

Feeding Value of DDGS for Swine



Benefits and Limitations of Feeding DDGS Diets to Swine

Benefits

- ❑ Energy value = corn
- ❑ High available P
 - Reduce diet P supplementation
 - May reduce manure P excretion
- ❑ Partially replaces some corn, soybean meal, and dicalcium phosphate and reduces diet cost
- ❑ Commonly fed at 10% of diet
 - Higher levels can be used if amino acids are supplemented
- ❑ Only “golden” DDGS should be used
 - High amino acid digestibility
- ❑ Appears to reduce gut health problems due to ileitis
- ❑ May increase litter size weaned when fed at high levels to sows
- ❑ Increases pig weight gain when fed to sows during lactation

Limitations

- ❑ Low protein (lysine) quality
 - add other supplements high in lysine and tryptophan
- ❑ Variability in nutrient content and digestibility among sources
- ❑ Manure N excretion increases
- ❑ Belly firmness and pork fat quality may be reduced when > 20% in the diet
- ❑ Fine particle size causes flowability problems in bins and feeders
- ❑ Difficult to pellet and maintain throughput of pellet mills
- ❑ Mycotoxin free grain should be used to produce ethanol and DDGS
- ❑ Short-term feed intake may be reduced when feeding high DDGS diets to sows



Maximum Inclusion Rates of Golden, High Quality DDGS in Swine Diets

(Based Upon University of Minnesota Performance Trials)

- Nursery pigs (> 7 kg)
 - Up to 25 %
- Grow-finish pigs
 - Up to 30%
- Gestating sows
 - Up to 50%
- Lactating sows
 - Up to 30%

Assumptions: no mycotoxins

formulate on a digestible amino acid and available phosphorus basis

Use of Corn DDGS in Poultry Diets





Benefits and Limitations for Poultry

Benefits

- ❑ Good energy and amino acid source when limited to < 15% of the diet
- ❑ Source of highly available P
 - Reduce manure P
- ❑ May improve egg yolk and skin color (xanthophyll)
- ❑ Source of “unidentified growth factors”?
- ❑ “Golden” DDGS gives best performance
- ❑ Highly palatable

Limitations

- ❑ Energy value ~ 84% of corn
- ❑ Low protein quality
 - add other supplements high in lys, arg, trp
- ❑ Sources high in sodium may increase litter moisture if adjustments to dietary salt levels are not made



Recommended Inclusion Rates of DDGS for Poultry

□ Broilers and Turkeys

- 10% inclusion rates (Starter/Finisher)

- Without energy adjustments

- > 10%

- With adjustments for lys, met, thr, trp, and energy

□ Chicken Egg Layers

- 10% inclusion rate

- > 10%

- With adjustments for lys, met, thr, trp, and energy



U of M DDGS Web Site

www.ddgs.umn.edu

We have developed a DDGS web site featuring:

- * nutrient profiles and photos of DDGS samples
- * research summaries
 - swine, poultry, dairy, & beef
 - DDGS quality
- * presentations given
- * links to other DDGS related web sites
- * international audiences