The Value of DDGS in Swine Feeding Programs

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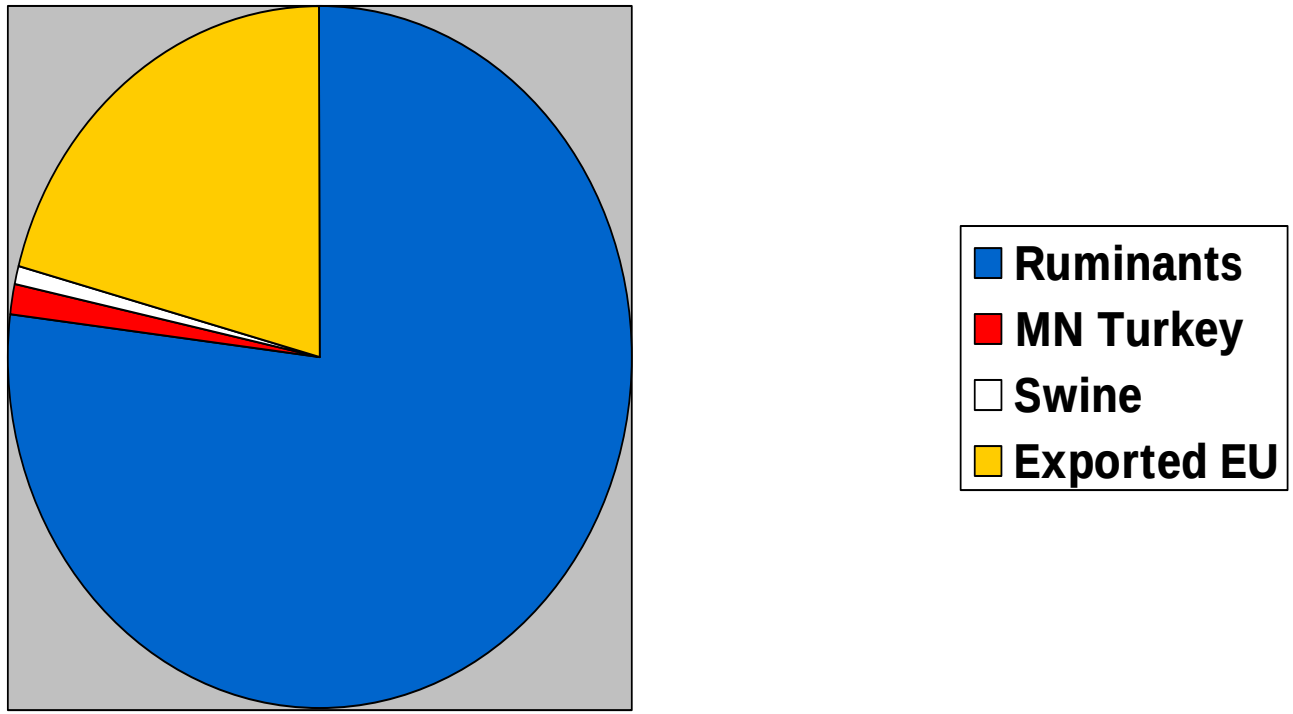
DDGS Production and Use

- 3.2 to 3.5 million metric tonnes (MT) of DDGS are produced in North America/year
  - ~ 900,000 MT produced in MN-Dakota region
  - ~ 700,000 MT exported to the EU
  - ~ 2.65 million MT fed in U.S. and Canada
    - ~ 2.58 million MT (80%) fed to ruminants
    - ~ 45,000 MT fed in MN turkey industry
    - < 27,000 MT used in swine diets

Distribution of Use of DDGS Produced in North America



Why Hasn't DDGS Been Used in Swine Diets?

- Variability of nutrient levels
  - type of grain used
  - variability of corn quality
  - amount of solubles added
- Low amino acid digestibility
  - variable heating and drying temperatures
  - excessive heating = dark color
- High crude fiber
  - low and variable DE and ME estimates

Why Hasn't DDGS Been Used in Swine Diets?

- Amino Acid Profile
  - amino acid balance not well suited to the pig
    - low lysine
  - amino acid imbalance is amplified 3 fold in DDGS vs corn
- Limited recent information on use of DDGS in swine diets
- Cost competitiveness relative to commonly used energy and amino acid ingredients

Why is There Renewed Interest in Feeding DDGS to Swine?

- Increasing quantities of DDGS
  - increased ethanol production to meet oxygenated fuel demand
- New ethanol plants
  - improved fermentation technology and processing = higher feeding value?
- Reduced nutrient variability?
  - corn supply from smaller geographic regions
- Higher P availability = reduced P excretion in manure
- Reduced odor emissions?

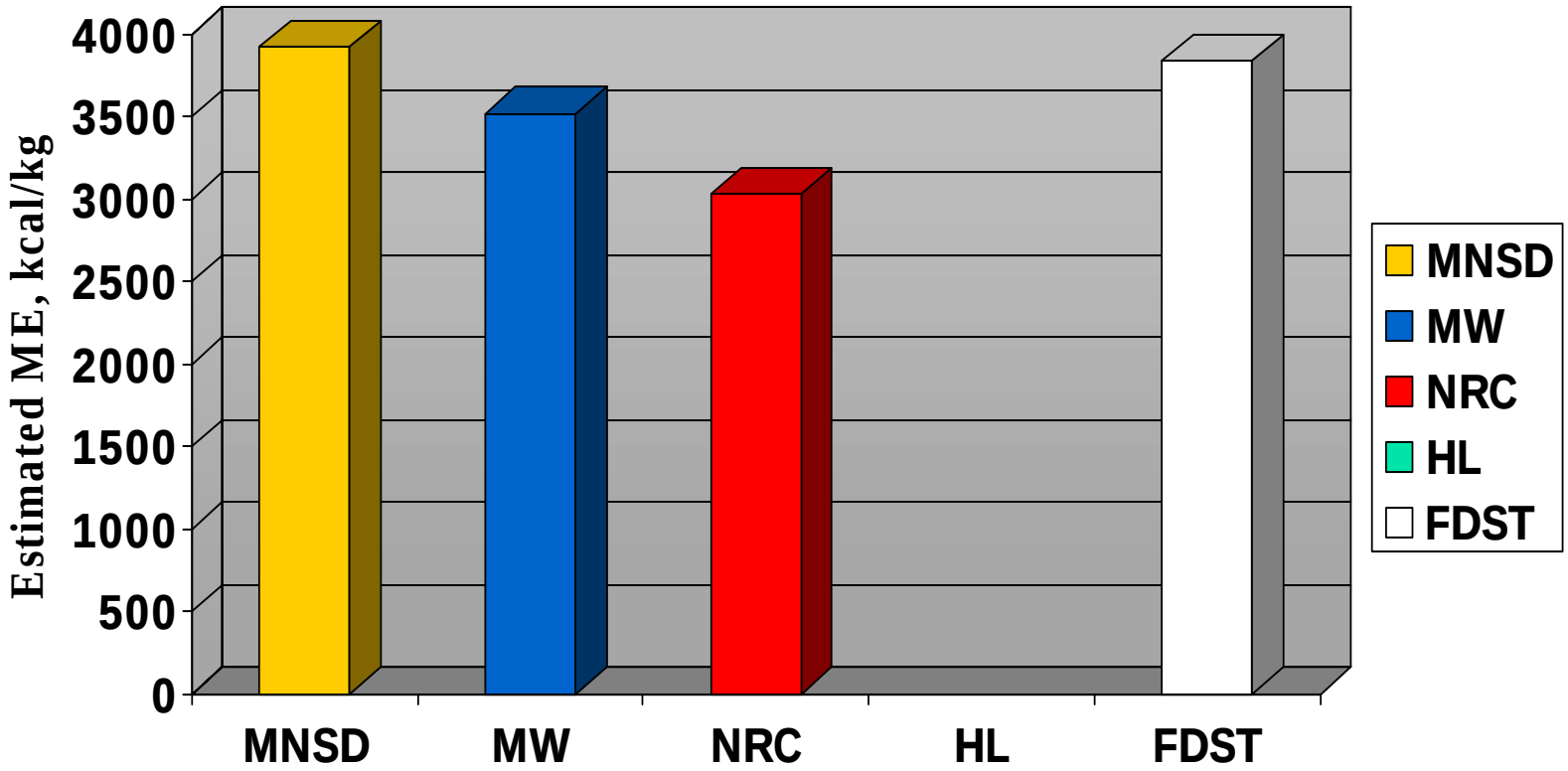
How Do Nutrient Levels of MNSD DDGS Compare to Published Values?

MNSD DDGS has Higher Nutrient Levels and Digestibility than Other DDGS Sources

- Energy
  - Digestible energy (DE) and metabolizable energy (ME) > corn
  - Increase in fiber content is offset with increase in fat content
- Amino acids
  - Poor amino acid balance
  - Higher digestible amino acids levels

MNSD DDGS Metabolizable Energy (kcal/kg) vs. DDGS from an Older Midwestern Plant and Published Values

C.V. = 34.0



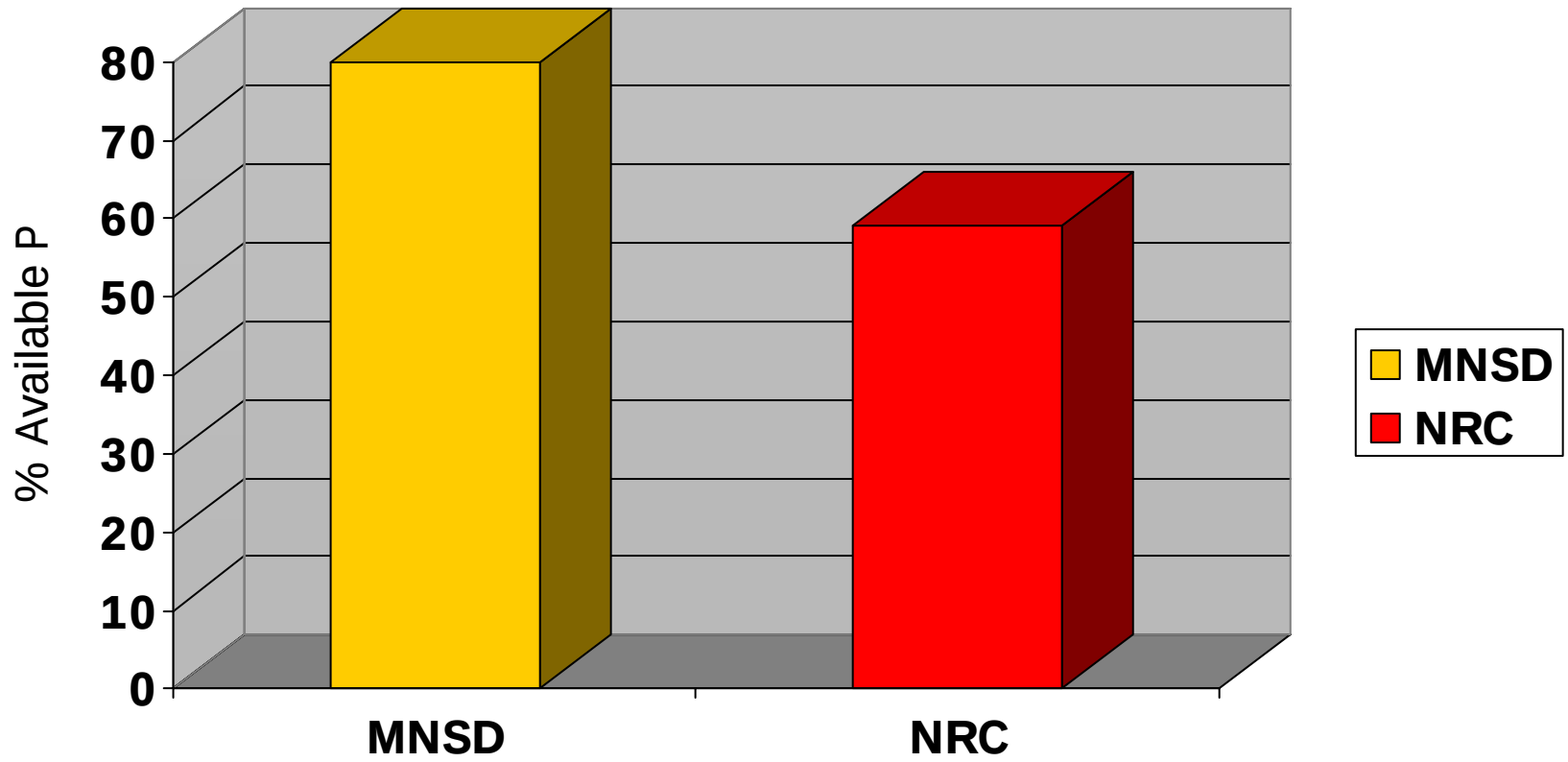
MNSD DDGS Apparent Digestible Amino Acid Levels vs. DDGS from an Older Midwestern Plant and Published Values

App. Dig. AA	MNSD	MW	NRC (1998)
Lysine, %	.44	.00	.31
Methionine, %	.32	.24	.39
Threonine, %	.62	.36	.56
Tryptophan, %	.15	.15	.14
Valine, %	.92	.51	.88

MNSD DDGS is Higher in Phosphorus Availability Compared to Corn and Published Values

- Available P in DDGS is dramatically improved compared to corn (0.80% vs 0.04%).
- Available P in MNSD DDGS is higher than published values (0.80% vs. 0.59%)

MNSD DDGS Available Phosphorus Levels vs. Published Values



DDGS is Often an Economical Addition to Swine Diets

- Replaces a portion of:
  - Corn
  - Soybean meal
  - Dicalcium phosphate

What Are the Effects of DDGS on Manure Nutrient Management and Air Quality?

Effects of DDGS on Manure Nitrogen Excretion

- THE BAD NEWS
  - Manure N content increases due to:
    - high crude protein:lysine ratio
    - reduced a.a. digestibility compared to corn & SBM
  - Excess N minimized by adding synthetic amino acids to diets
  - High levels of DDGS may reduce pig performance due to the energy cost of removing excess N
  - May increase ammonia emissions?

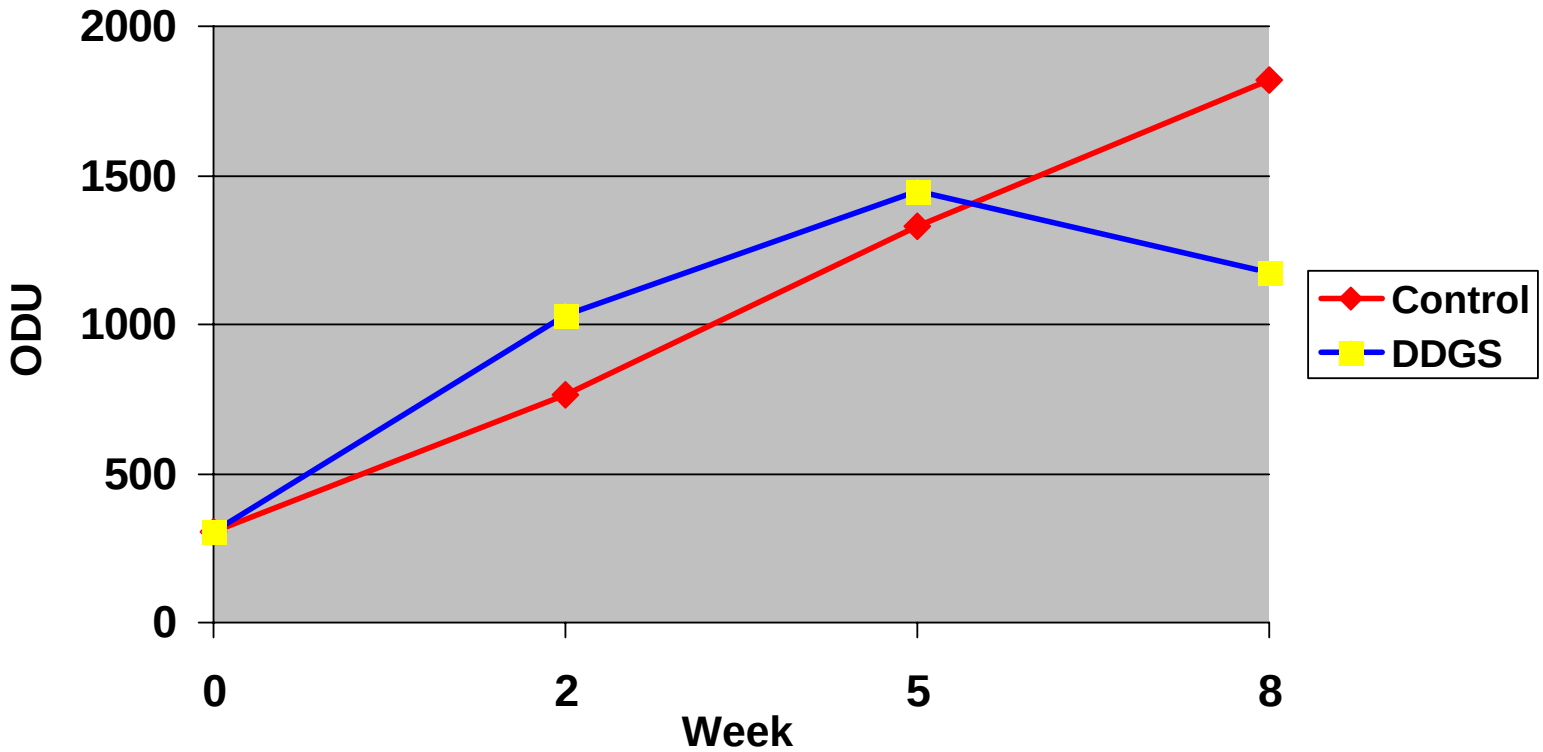
Effects of DDGS on Manure Phosphorus Excretion

- THE GOOD NEWS
  - Manure P content is reduced due to:
    - DDGS has more available P compared to corn and soybean meal
  - Amount of supplemental inorganic P or phytase in the diet is decreased.
    - Decreased diet cost

Effects of DDGS on Air Quality

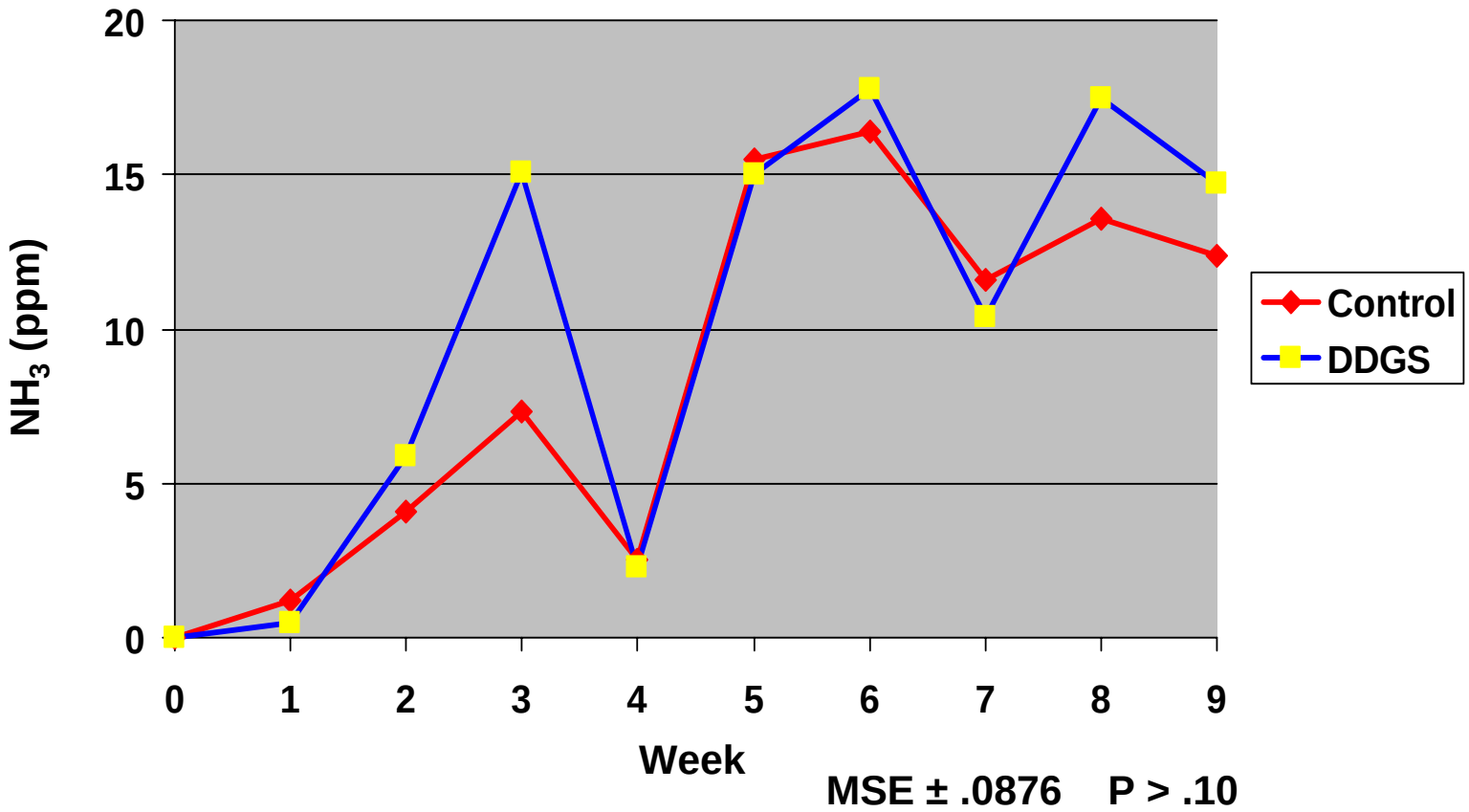
- Feeding DDGS has no positive or negative effects on gas and odor emissions.

Effect of Dietary Treatment on Manure Odor Detection Threshold

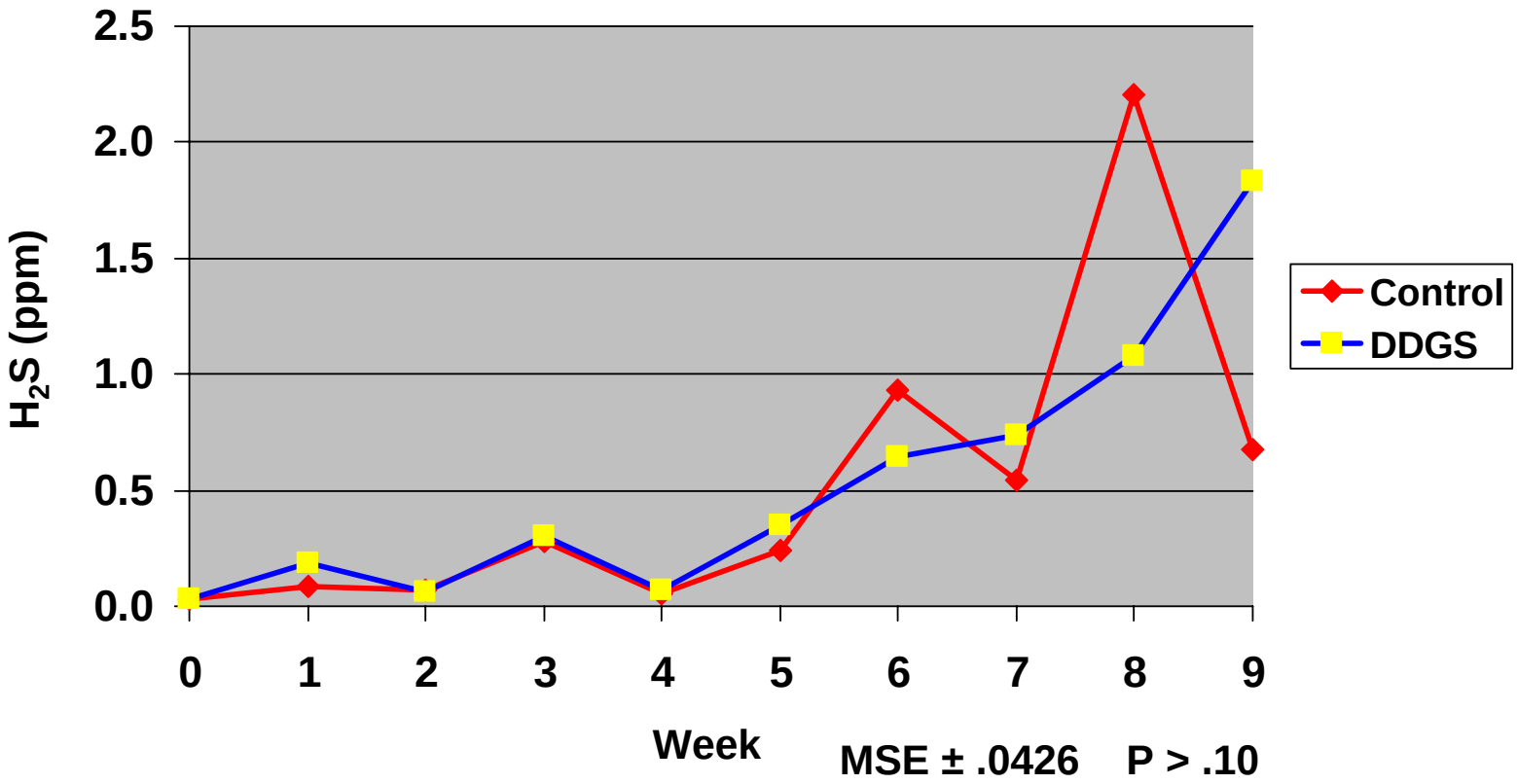


MSE ± .1152 P > .10

Effect of Dietary Treatment on Ammonia Emission



Effect of Dietary Treatment on Hydrogen Sulfide Emission



Recommended Usage Rates of DDGS in Swine Diets

- Nursery pigs – up to 5%
- Grow-finish pigs – up to 20%
- Gestating sows – up to 50%
- Lactating sows – up to 20%

Summary

- MNSD DDGS:
  - has higher levels and digestibility of most key nutrients
  - has less variability in nutrient levels
  - does not reduce or improve air quality
  - will reduce P excretion
  - is often can be an economical addition to swine diets

Evaluation of the Feeding Value of MNSD DDGS

- Ethanol plants participating in DDGS evaluation:

Aberdeen, SD
Bingham Lake, MN
Luverne, MN
Preston, MN
Winnebago, MN
Benson, MN
Claremont, MN
Morris, MN
Scotland, SD
Winthrop, MN

U.S. Approved GMO Crop Species

- Canola
- Chicory
- Cotton
- Papaya
- Radichio
- Soybean
- Sugar beet
- Cantaloupe
- Corn
- Flax
- Potato
- Rice
- Squash
- Tomato

U.S. Production of GMO Grains

- > 30 genetically engineered plants are permitted for sale by law world-wide.
- > 40% of corn produced is genetically modified
- > 50% of soybeans are genetically modified
- 3 agencies regulate GMO crops and foods:
  - Environmental Protection Agency
  - Food and Drug Administration
  - U.S. Department of Agriculture

GMO Grains Produced

- Insect protection – Bt corn
  - Increased quality
  - Less pesticide use
  - Improved yields
  - Increased profits
  - Reduced mycotoxins
  - Increased number of beneficial insects

GMO Grains Produced

- Herbicide protection – glyphosate-tolerant soybeans
  - Increased seed quality (6 to 20%)
  - Less herbicide use (improves weed control by 9%)
  - Improved yields (+5%)
  - More efficient use of fertilizers
  - Increased profits (10 to 20%)
  - Reduced foreign material in grain (- 33%)
  - Reduces erosion (- 90%)

GMO Grains Produced

- Disease resistance – *Fusarium graminearium*
  - Corn
  - Wheat

GMO Grains Produced

- Enhance protein quality
- Increase protein conc. (decrease amino acid suppl.)
- Modify amino acid composition (lysine and methionine)
- Modify starch and oil composition
- Increase oil content
- Reduce oligosaccharides
- Increase oligofructans (decrease antibiotic use)
- Increase phosphorus bioavailability

Added Value of 6 genetic Modifications of Corn in Swine/Poultry Diets ($/kg)

Modification	Baby pigs	Finisher hogs	Broilers
High protein	1.16	0.61	2.26
Enlarged germ	0.00	0.41	1.89
High starch dig.	-----	-----	1.57
High methionine	-----	-----	0.29
High lysine	0.00	0.20	-----
High avail. phos.	0.07	0.07	-----

Pig Performance When Fed Genetically Enhanced Soybean Meal

- Low saturates = low linolenic = high oleic
- Low Kunitz inhibitor > uncooked soybeans
- Lectin free > uncooked soybeans
- Low oligosaccharide > soybean meal
- Low phytate soybeans > soybean meal