



The Value of Midwestern Produced DDGS in Swine Diets

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DDGS Production and Use

- 3.2 to 3.5 million metric tonnes 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
 - ~ 2,580,000 MT (80%) fed to ruminants
 - ~ 45,000 MT fed in MN turkey industry
 - ~ 30,000 MT used in swine diets



The Minnesota Ethanol Industry

- 14 plants:
 - Use 130 million bu. of corn
 - 13% of MN corn production
 - Produce 240 million gallons of ethanol
 - Produce 1 million tons of DDGS
 - 30% of total DDGS in North America
- Plants are:
 - Small - 13 to 34 million gallon capacity/year
 - New - < 10 years old
 - Farmer owned - 8,945 farmer members



Why Hasn't DDGS Been Used in Swine Diets?

- Low protein quality (poor amino acid balance)
- Low amino acid digestibility
- High fiber content
- Nutrient variability among sources
- Cost competitiveness with corn and soybean meal
- Image that DDGS is an inferior ingredient

Why is There Renewed Interest in Feeding DDGS to Swine?

- Rapid growth of the ethanol industry has increased the quantity and local supply
 - 24 million gallons of ethanol produced in 1994
 - 220 million gallons produced in 2000
- New ethanol plants are producing higher quality DDGS
 - Higher nutrient content and digestibility than DDGS values listed in NRC (1998)
- A cost effective partial replacement for corn, SBM and dicalcium phosphate

Why is There Renewed Interest in Feeding DDGS to Swine?



- Use reduces phosphorus content of manure
- Appears to improve gut health of grow-finish pigs



Quality Considerations for Selecting DDGS Sources

- Golden color DDGS is much better suited for swine diets than darker colored DDGS due to higher amino acid digestibility
- DDGS produced by new Midwestern plants is higher in nutrient content and digestibility than DDGS from older plants



Quality Considerations for Selecting DDGS Sources

- Nutrient Specifications
 - Moisture – maximum 12%
 - Protein – minimum 26.5%
 - Fat – minimum 10%
 - Fiber – maximum 7.5%



Quality Considerations for Selecting DDGS Sources

- Physical characteristics
 - Bulk density – 34 to 37 lb/cubic foot
 - Particle size:
 - maximum coarse particles - 10% on 2000 screen
 - maximum fine particles - 15% on 600 screen & in pan
 - Smell – fresh, fermented
 - Color – goldenrod



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

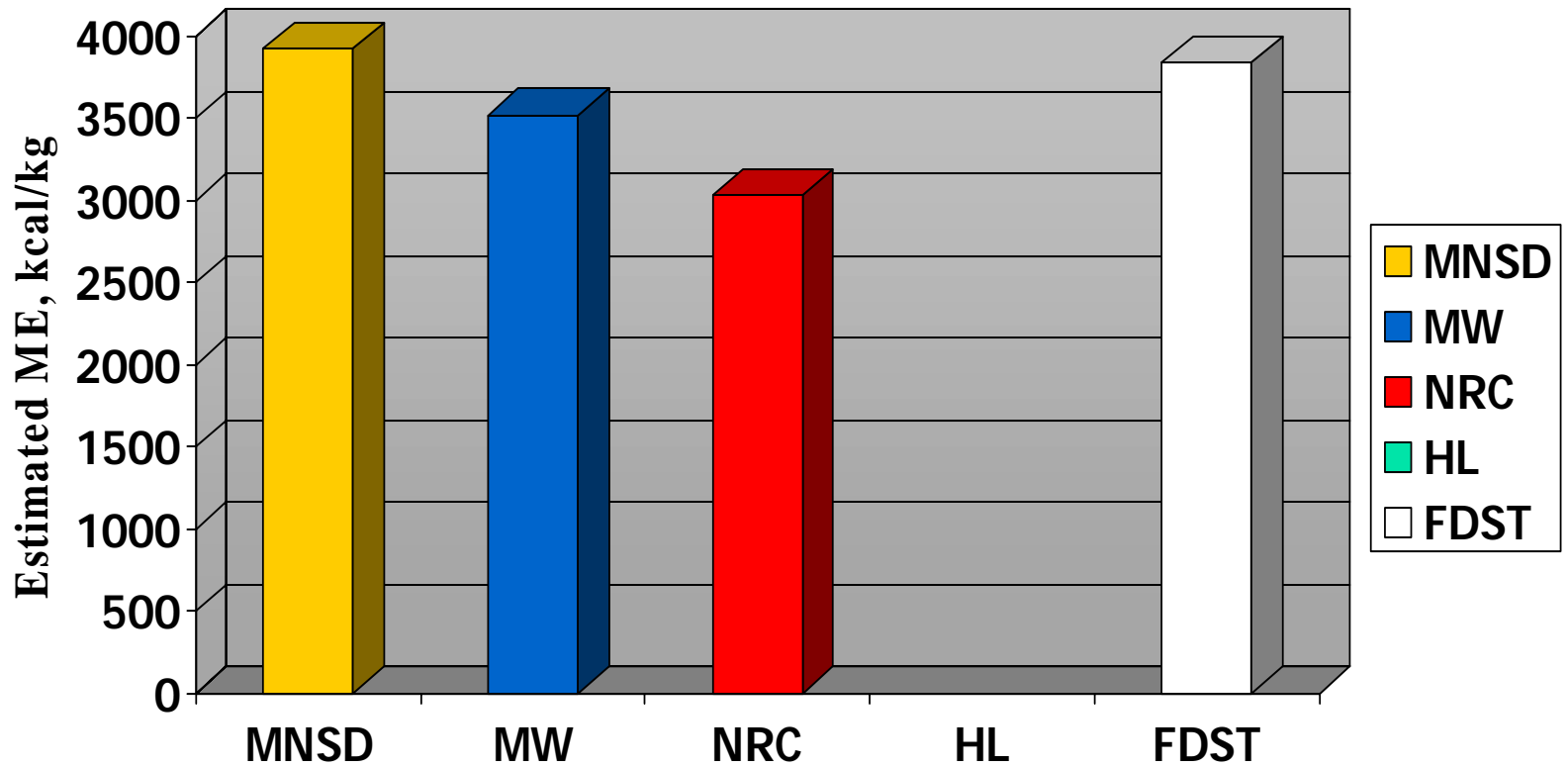


MNSD DDGS Has Higher Nutrient Levels and Digestibility than Other DDGS Sources

- 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%)



Summary of DDGS Nutrient Level Comparisons vs. NRC (1998)

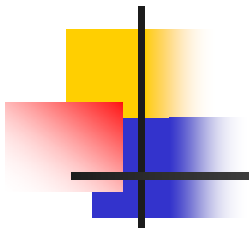
- MNSD DDGS is higher in:
 - crude fat
 - crude fiber
 - DE and ME
 - crude protein
 - total and apparent digestible lysine
 - total and apparent digestible threonine
 - phosphorus
- MNSD DDGS is lower in:
 - dry matter
 - apparent digestible methionine



Comparison of Fiber Characteristics of MNSD DDGS with Other High Fiber Ingredients

| <i>Ingredient</i> | <i>Crude Fiber, %</i> | <i>NDF, %</i> | <i>ADF, %</i> | <i>Soluble Fiber, %</i> | <i>Insoluble Fiber, %</i> |
|----------------------|---------------------------|---------------|---------------|-----------------------------|-------------------------------|
| Corn | 2.6 | 9.0 | 3.0 | 1.7 | 4.7 |
| Soybean meal | 7.0 | 13.3 | 9.4 | 1.6 | 13.2 |
| MNSD DDGS | 9.9 | 44 | 18 | 0.7 | 42.2 |
| Beet pulp | 19.8 | 54 | 33 | 11.7 | 3.9 |
| Soybean hulls | 40.1 | 67 | 50 | 8.4 | 5.5 |

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
- High levels of DDGS may reduce pig performance due to the energy cost of removing excess N
- However, excess N can be minimized by adding synthetic amino acids to diets.



Effects of DDGS on Manure Phosphorus Excretion

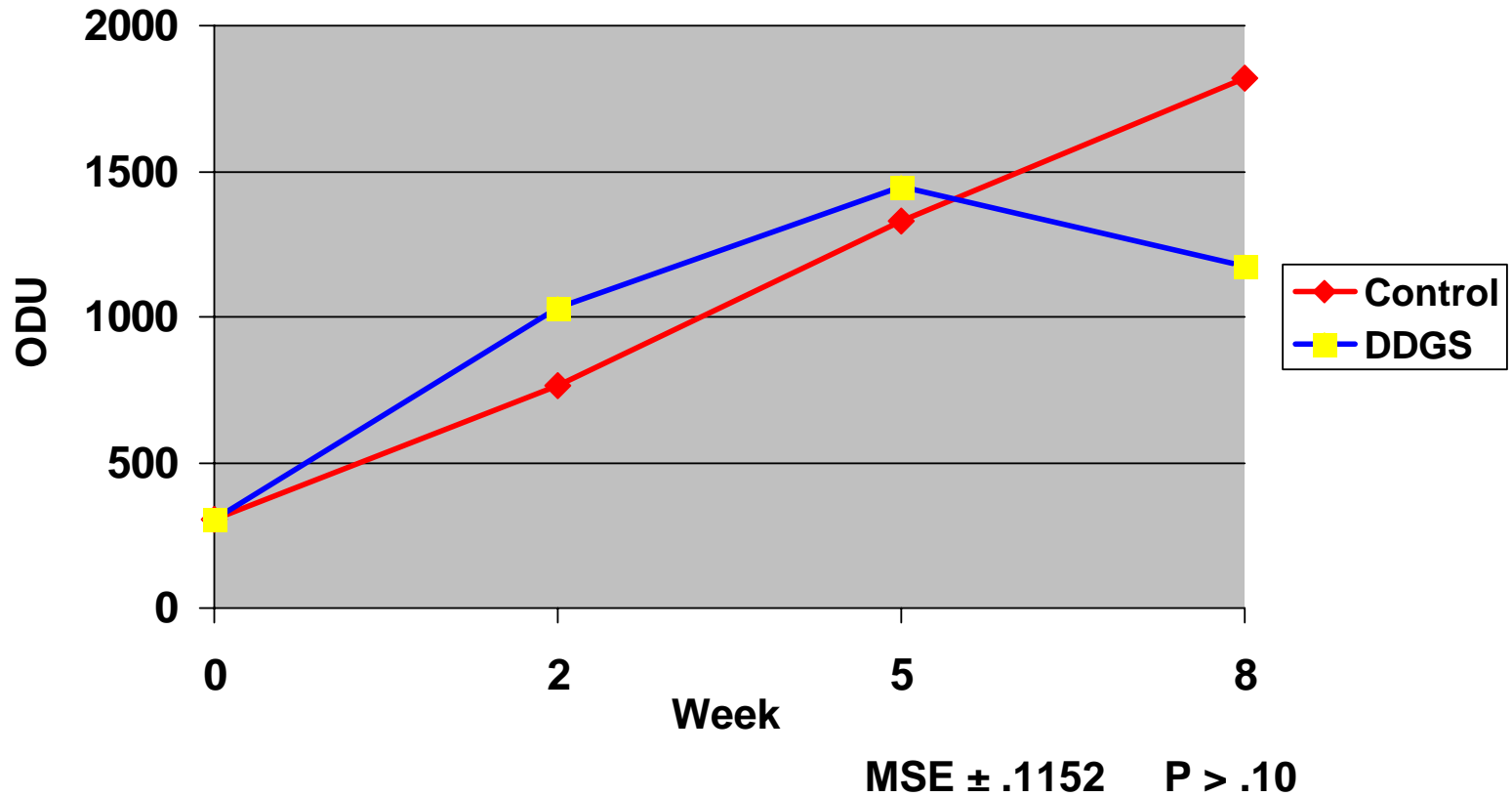
- THE GOOD NEWS
 - Manure P content is reduced due to:
 - DDGS has more available P compared to corn and soybean meal
 - Need for supplemental inorganic P and/or phytase in the diet is decreased
 - Decreases diet cost



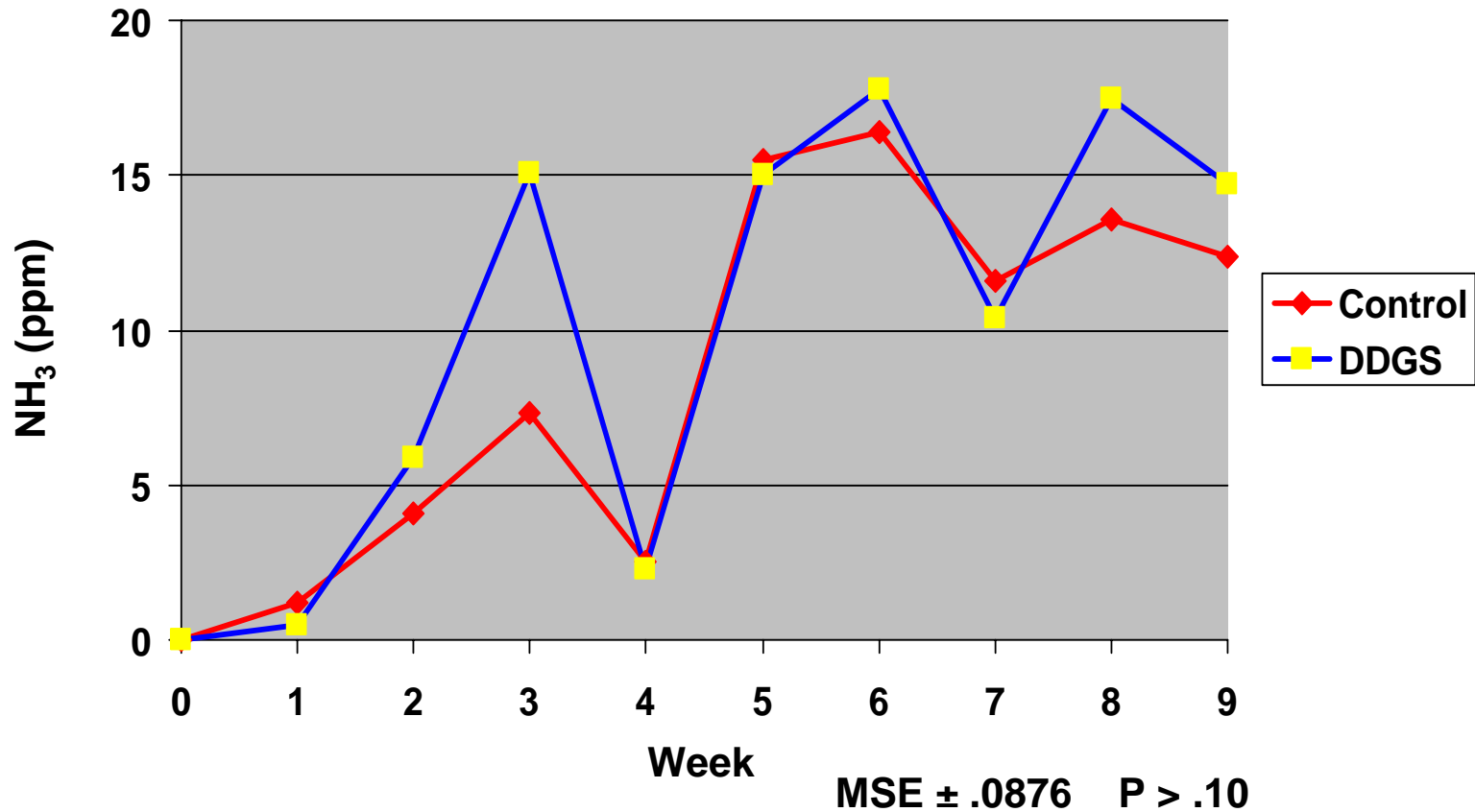
Effects of DDGS on Air Quality

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

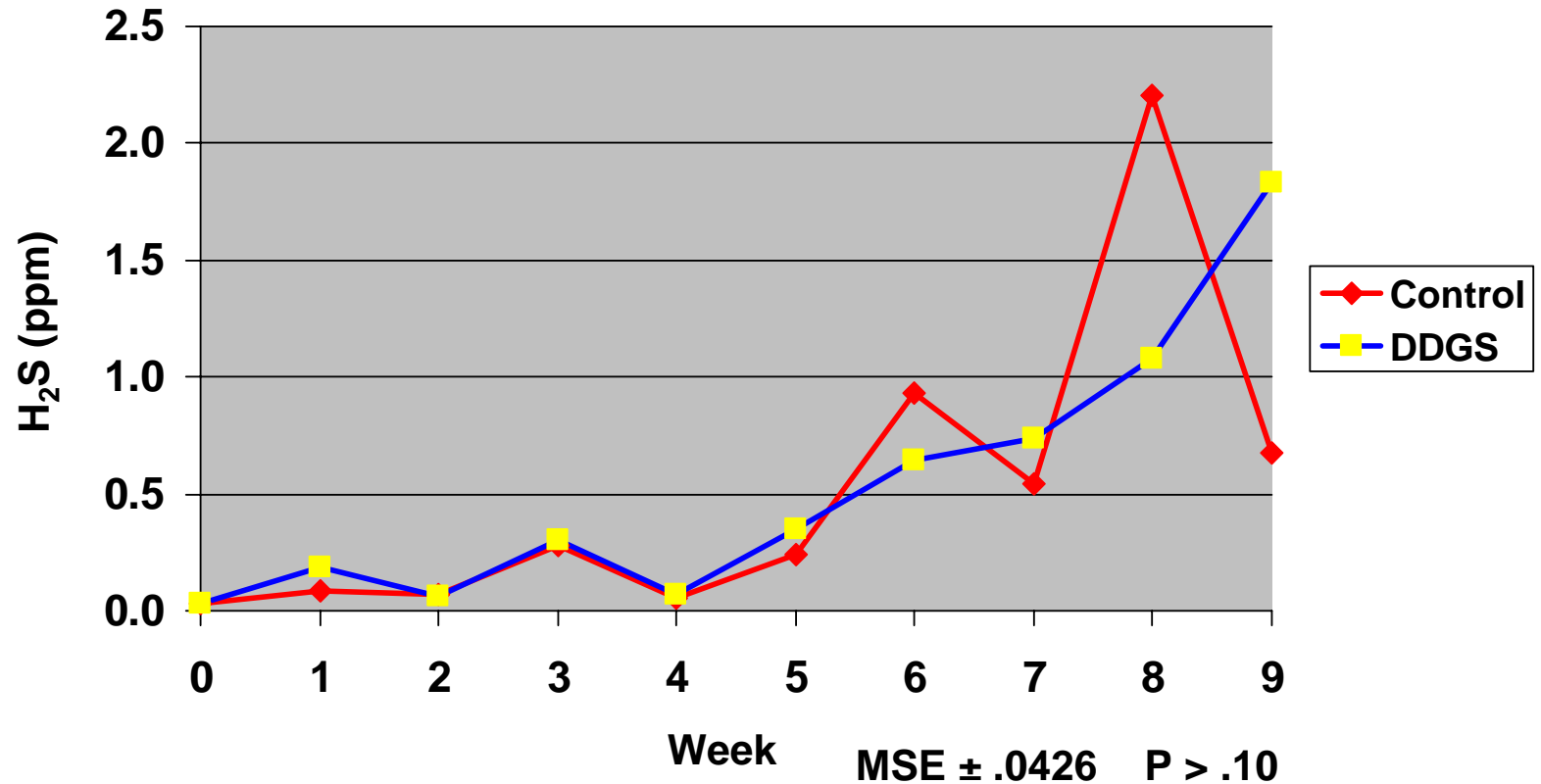
Effect of Dietary Treatment on Manure Odor Detection Threshold



Effect of Dietary Treatment on Ammonia Emission



Effect of Dietary Treatment on Hydrogen Sulfide Emission





Recommended Maximum Inclusion Rates for DDGS

| Production Phase | Feed Co-Products Handbook (1997) | Pork Industry Handbook |
|--------------------------------------|---|-------------------------------|
| <i>Nursery</i> | 5 % | 5 % |
| <i>Growing pigs (18-55 kg)</i> | 7.5 % | 10 % |
| <i>Finishing pigs (55 kg to mkt)</i> | 10 % | 10 % |
| <i>Gestating sows</i> | 50 % | 40 % |
| <i>Lactating sows</i> | 20 % | 10 % |



DDGS in Grow-Finish Diets

- Formulate on a digestible amino acid basis to optimize performance
- No effect on carcass or meat quality when fed up to 30% of the diet.
- Reduces belly thickness, firmness, and increases fat softness
- Appears to help alleviate gut health problems



DDGS is Often an Economical Addition to Swine Diets

- 200 lbs of DDGS and 3 lbs of limestone replaces:
 - 177 lbs of corn
 - 20 lbs of soybean meal (44%)
 - 6 lbs of dicalcium phosphate



Conclusion

- DDGS produced in MN and SD ethanol plants is:
 - higher quality than other sources
 - often a cost effective replacement for corn, soybean meal and dicalcium phosphate
 - abundant quantities are available locally
 - effective in minimizing P excretion in manure
 - may improve gut health of grow-finish pigs



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