

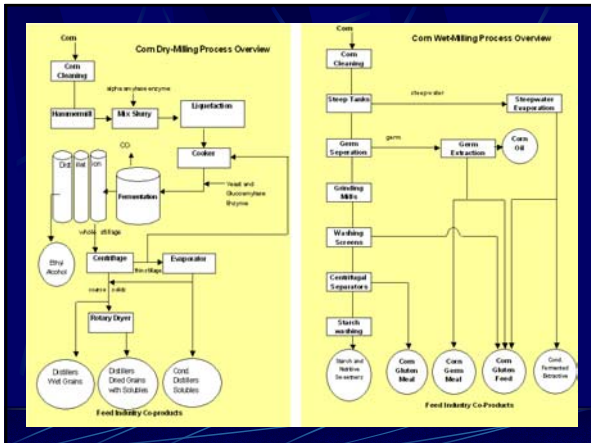
## Distillers Dried Grains with Solubles for Swine Diets



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## Production of DDGS

- Co-product from the dry-milling of corn for production of ethanol
- 1 bu of corn yields:
  - 2.7 gallons of ethanol
  - 18 lbs of DDGS
  - 18 lbs of CO<sub>2</sub>
- Other grains can be used
  - Sorghum
- Level of production has increased recently:
  - Increased number and capacity of ethanol plants
  - ↑ supply and ↓ cost of DDGS in Midwest



### ETHANOL PLANTS IN MINNESOTA

Updated February 2002

-Currently 14 ethanol plants in Minnesota  
 -Ethanol production can ↑ value of corn by \$0.30/bu  
 -Government support has encouraged increase in # of plants in MN  
 -May change with economic conditions currently  
 -Ability to derive income from DDGS and CO<sub>2</sub> produced becomes more important

## Historical Use of DDGS

- Used in ruminant diets primarily
- Not used in swine or poultry diets:
  - Lack of nutritional information
  - Variability of nutrient content
  - Viewed as having low energy density
  - Poor amino acid profile
  - Digestibility of amino acids
  - Cost and supply



## DDGS Swine Research Conducted at Univ. of MN

- 12 experiments conducted so far:
  - DDGS Database
  - Determine DE and ME Values for DDGS (2)
  - Nutrient Balance and Gas/Odor Emission
  - Apparent Ileal Amino Acid Digestibility
  - P Availability Study
  - Grow-Finish Performance/Carcass Quality
  - Sow Reproductive Performance
  - Nursery Performance
  - Gut Health / Ileitis (3)

## DDGS Nutrient Database

Nutrient	MN-SD*	OMP	NRC(1998)
DM	88.9	88.3	93.0
Crude fat	10.9	8.2	9.0
Crude fiber	8.8	7.1	4.8
DE*	3965	3874	3449
Crude protein	30.2	28.1	29.8
Lys	0.85	0.53	0.67
Met	0.55	0.50	0.54
Thr	1.13	0.98	1.01
Trp	0.25	0.19	0.27

\* Number of samples = 120 (10 plants, 12 samples each), DM basis

## DDGS Nutrient Database

- Higher nutrient content compared to
  - NRC (1998)
  - Sample from "old generation" plant (OMP)
- Variation within and among plants
  - Less than in the past
  - Lysine most variable (CV = 17%)
  - Color differences
- Some year-to-year differences

## Energy Balance Studies

- ME and DE values obtained were significantly higher than NRC 1998 but were highly variable
  - 3380 to 5905 kcal DE/kg (3963 kcal DE/kg)
  - 3315 to 5930 kcal ME/kg (3917 kcal ME/kg)
- Calculated DE and ME values:
  - DE kcal/kg = 3965 (CV=2.2%) Range: 3883 to 4020 kcal/kg
  - ME kcal/kg = 3592 (CV=2.4%) Range: 3510 to 3654 kcal/kg



## DDGS Apparent Ileal Amino Acid Digestibility Comparison

AA	"New Generation" DDGS	"Old Generation" DDGS	NRC(1998)
Lys	0.83 (53) 0.44	0.68 ( 0 ) 0.00	0.67 (46) 0.31
Met	0.55 (58) 0.32	0.49 (49) 0.24	0.54 (72) 0.39
Thr	1.13 (55) 0.62	1.01 (36) 0.36	1.11 (50) 0.56
Trp	0.24 (63) 0.15	0.27 (56) 0.15	0.20 (70) 0.14

## DDGS P Availability Study

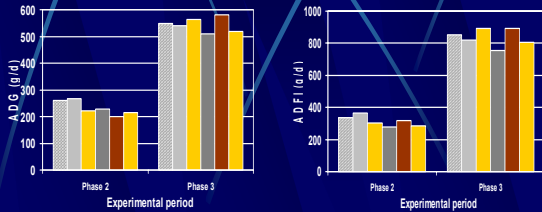
- Phosphorus balance study
- Regression analysis of P excretion & retention
  - Relative to P intake for DDGS and Dical Phosphate
  - Excretion 87.5% availability of P ( $r^2 = .47$ )
  - Retention 92.2% availability of P ( $r^2 = .72$ )
  - DDGS = 0.89% total P x 90% avail = 0.80% avail P
- Corn = 0.28% total P x 14% avail = 0.04% avail P
- SBM (44% CP) = 0.65% total P x 31% avail = 0.20% avail P

## DDGS Nursery Performance Studies

- 2 experiments
  - 19 and 17 days of age (15.6 vs 11.6 lbs)
  - Commercial pelleted diet first 4 days
  - 0, 5, 10, 15, 20, or 25% DDGS
  - Formulated on App III Dig AA basis
  - Phase 2 (2 weeks), Phase 3 (3 weeks)
- Similar growth, feed intake, and G/F
  - Slight lag during Phase 2 for younger pigs, but they caught up by end of nursery period



## DDGS Nursery Performance Studies



## DDGS Grow-Finish Performance and Carcass Composition Study

- Diets formulated to contain same total lysine, phosphorus, and ME
  - 240 crossbred pigs (24 pens), 60 – 250 lbs
  - Diets contained 0, 10, 20, or 30% DDGS
  - 5-phase feeding program
    - Diet switches based on average pen weight
  - At slaughter, carcass/meat/fat quality measurements conducted by Shanks/Wulf (SDSU)

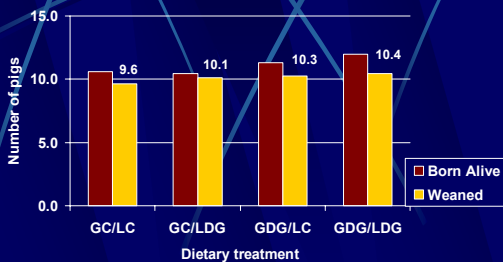
## DDGS Grow-Finish Performance and Carcass Composition Study

- Performance
  - Growth rate similar at 0 and 10% DDGS levels
    - Drop at 20 & 30% levels
  - No difference in feed intakes
  - Decrease in G/F at 30% DDGS inclusion level
- Carcass composition
  - % lean and backfat depth unaffected
- Importance of using available vs. total amino acid levels when formulating and using DDGS

## DDGS Sow Gestation/Lactation

- Study just completed
- 2 x 2 factorial arrangement of treatments:
  - Gestation: 0 or 50% DDGS
  - Lactation: 0 or 20% DDGS
- Followed through 2 parities (mixed parity sows)
  - 93 sows initially, 49 sows second cycle
- Initial results suggest an increase of  $\approx 0.75$  pig weaned for the 2<sup>nd</sup> litter with DDGS feeding
  - Insoluble fiber effect?

## DDGS Sow Gestation/Lactation

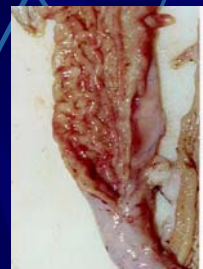


## Ileitis

Healthy Ileum



PIA Ileum



## Ileitis



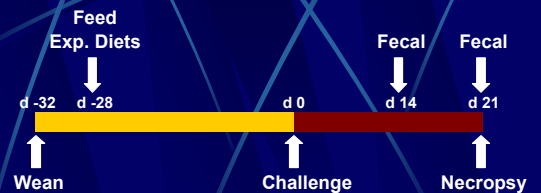
## DDGS Ileitis Challenge Studies

- Field reports:
  - Beneficial effect of adding 5 to 10% DDGS in grow-finish diets
- DDGS contains low levels of soluble (0.7 %) and high levels of insoluble (42.2 %) fiber (Shurson et al., 2000)
  - Low soluble fiber diets may reduce the proliferation of pathogenic organisms in the GI tract (Hampson, 1999).
- DDGS contains yeast cells
  - May have nutraceutical properties

## DDGS Ileitis Challenge Studies

- Experiment 1:
  - NC: Negative control, corn-soybean meal diet
  - PC: Positive control, corn-soybean meal diet\*
  - D10: 10% DDGS diet\*
  - D20: 20% DDGS diet\*
- Experiment 2:
  - NC, PC, and D10 same as Experiment 1
  - PC+AR: Corn-soybean meal diet with antimicrobial regimen\*
  - D10+AR: 10% DDGS diet with antimicrobial regimen\*
- Experiment 3:
  - NC, PC, and D10 same as Experiment 1
  - SH: 5% Soy Hulls diet\*
  - PA: Polyclonal antibody product with soy hulls

## DDGS Ileitis Challenge Studies



## DDGS Ileitis Challenge Studies

- Just completed 3<sup>rd</sup> challenge study:
  - Variable results with DDGS in diet
    - 1 study – positive effect on lesion prevalence, length, and severity in ileum and colon
      - 10% inclusion rate
      - Similar to effect of an antimicrobial/antibiotic treatment (BMD/CTC)
    - 2 studies – no beneficial effect of DDGS inclusion
  - Dosage rate very high in one study
    - Probably higher in all studies than would occur in field
  - Other potential nutritional strategies:
    - Soybean hulls, polyclonal antibody product

## Quality Criteria

- Establish relationship with supplier
  - Quality control measures in place
    - Nutrient specs, mycotoxins, handling characteristics
  - Consistency of product
    - Proportion of solubles standardized
    - Grading system in place?
- Color: generally, lighter is better
  - Indicates higher amino acid digestibility
- Smell: shouldn't have burnt smell
  - May affect palatability
  - Can indicate protein damage

## Quality Criteria



## Univ. of MN DDGS Web Site

We have developed a DDGS web site featuring:

- \* research summaries
  - swine, poultry, dairy, & beef
  - DDGS quality
- \* presentations given
- \* links to other DDGS related web sites
- \* international audiences

[www.ddgs.umn.edu](http://www.ddgs.umn.edu)