

# **Distiller's Dried Grains with Solubles for Swine and Poultry**

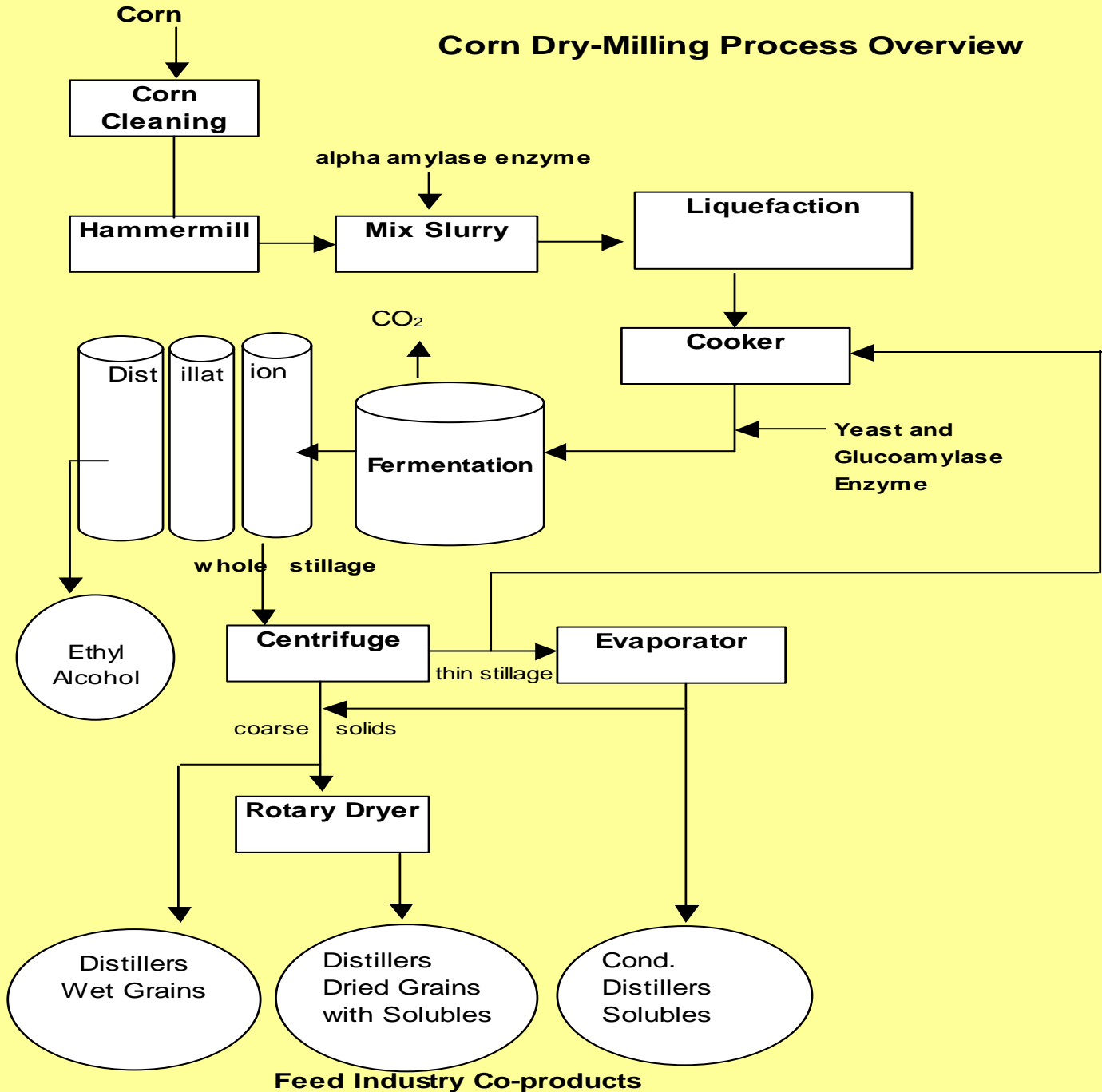
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# What is DDGS?

- ◆ Co-product of the dry-milling ethanol industry
  - Corn (maize) DDGS - Midwestern US
  - Wheat DDGS - Canada
  - Sorghum (milo) DDGS - Great Plains US
  - Barley DDGS
  - Rye DDGS



# Corn Dry-Milling Process Overview



**Feed Industry Co-products**



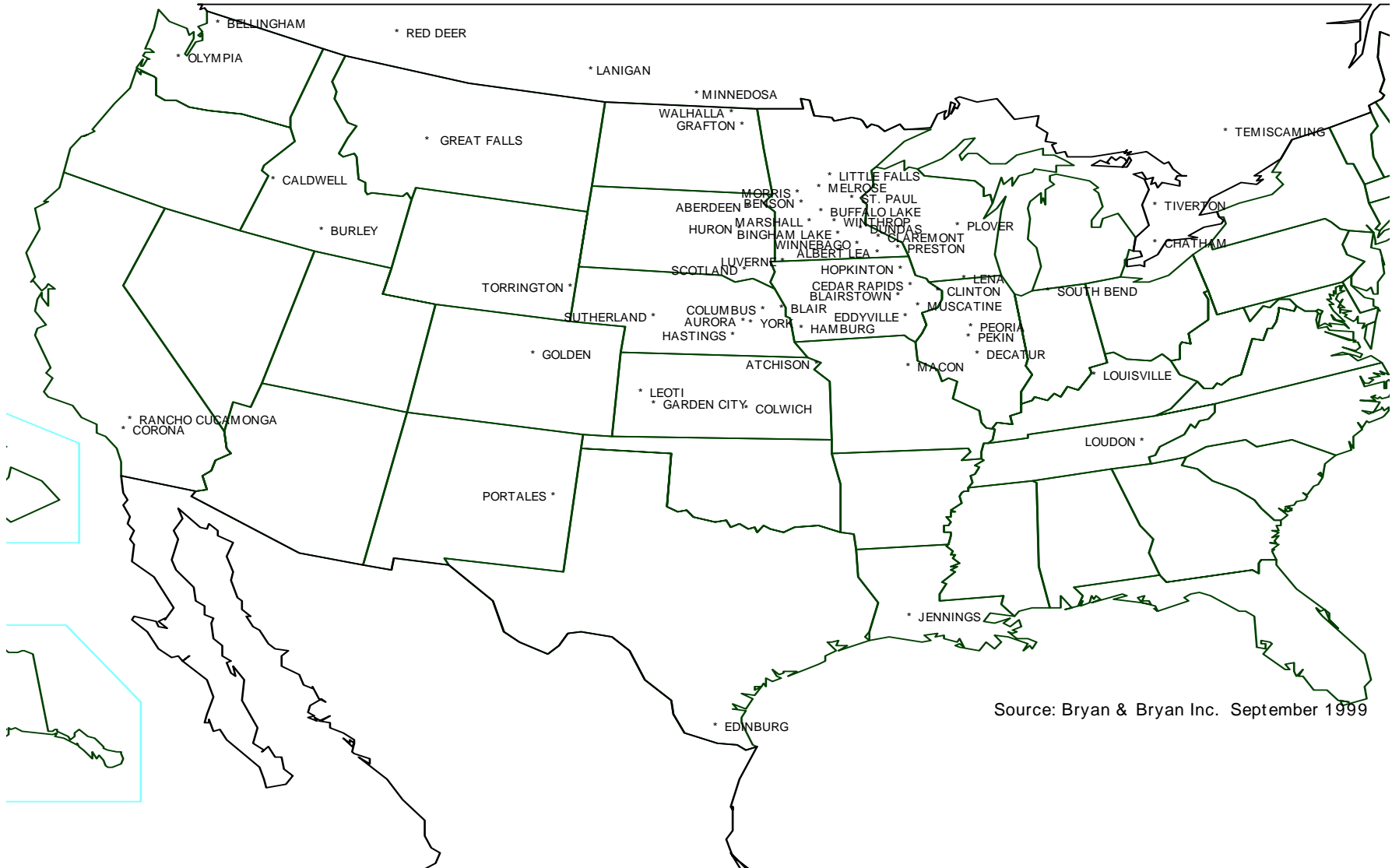
# Dry-Milling Average Ethanol Yield Per Bushel (25.4 kg) of Corn



- ◆ Ethanol 2.7 gallons (10.2 liters)
- ◆ DDGS 18 lbs (8.2 kg)
- ◆ CO<sub>2</sub> 18 lbs (8.2 kg)

Slide courtesy of Ms. Kelly Davis, CVEC, Benson, MN

# Map of U.S. Ethanol Plants



Source: Bryan & Bryan Inc. September 1999

# “New Generation” vs. “Old Generation” DDGS



**Lower Quality,  
Less Digestible  
DDGS**



**High Quality,  
Highly Digestible  
DDGS**





# **Use of Corn DDGS in Swine Diets**

# Comparison of Energy Values of DDGS for Swine (88% DM Basis)

	“New” DDGS Calculated	“New” DDGS Trial avg.	“Old” DDGS Calculated	DDGS NRC (1998)
DE, kcal/lb	1582 Range 1550-1604	1600 Range 1349-1853	1546	1564
ME, kcal/lb	1434 Range 1400-1458	1527 Range 1279-1776	1405	1212

Corn (NRC, 1998):

DE (kcal/lb) = 1580

ME (kcal/lb) = 1534

# Comparison of Amino Acid Composition of DDGS (88% dry matter basis)

	“New” DDGS	“Old” DDGS	DDGS (NRC, 1998)
Lysine, %	0.75 (17.3)	0.47 (26.5)	0.59
Methionine, %	0.63 (13.6)	0.44 (4.5)	0.48
Threonine, %	0.99 (6.4)	0.86 (7.3)	0.89
Tryptophan, %	0.22 (6.7)	0.17 (19.8)	0.24
Valine, %	1.32 (7.2)	1.22 (2.3)	1.23
Arginine, %	1.06 (9.1)	0.81 (18.7)	1.07
Histidine, %	0.67 (7.8)	0.54 (15.2)	0.65
Leucine, %	3.12 (6.4)	2.61 (12.4)	2.43
Isoleucine, %	0.99 (8.7)	0.88 (9.1)	0.98
Phenylalanine, %	1.29 (6.6)	1.12 (8.1)	1.27

Values in ( ) are CV's among plants

## Comparison of Apparent Ileal Digestible Amino Acid Composition of DDGS for Swine (88% dry matter basis)

	“New” DDGS	“Old” DDGS	DDGS (NRC, 1998)
Lysine, %	0.39	0.00	0.27
Methionine, %	0.28	0.21	0.34
Threonine, %	0.55	0.32	0.49
Tryptophan, %	0.13	0.13	0.12
Valine, %	0.81	0.45	0.77
Arginine, %	0.79	0.53	0.77
Histidine, %	0.45	0.26	0.40
Leucine, %	2.26	1.62	1.85
Isoleucine, %	0.63	0.37	0.64
Phenylalanine, %	0.78	0.60	0.96

## Comparison of Phosphorus Level and Relative Availability of DDGS for Swine (88% dry matter basis)

	“New” DDGS	“Old” DDGS	DDGS NRC (1998)	Corn NRC (1998)
Total P, %	0.78 Range 0.62-0.87	0.79	0.73	0.25
P Availability, %	90 Range 88-92	No data	77	14
Available P, %	0.70	No data	0.56	0.03

# Why is there so much interest in feeding DDGS to swine?

- ◆ “New Generation” DDGS is high in digestible nutrients
- ◆ Economical partial replacement for:
  - corn
  - soybean meal
  - dicalcium phosphate
- ◆ Increasing production and supply
- ◆ Unique properties
  - reduce P excretion in manure
  - increase litter size weaned/sow
  - gut health benefits?

# Maximum Inclusion Rates of “New Generation” DDGS in Swine Diets

(Based Upon University of Minnesota Performance Trials)

- ◆ Nursery pigs (> 7 kg)
  - Up to 25 %
- ◆ Grow-finish pigs
  - Up to 20% (higher levels may reduce pork fat quality)
- ◆ Gestating sows
  - Up to 50%
- ◆ Lactating sows
  - Up to 20%

Assumptions: no mycotoxins

formulate on a digestible amino acid and available phosphorus basis

# DDGS and Phytase are a Key Part of Manure Phosphorus Management

- ◆ Adding 20% DDGS to a corn-soy diet and formulating on an available P basis
  - can reduce manure P by > 12%
- ◆ Adding phytase to a corn-soy diet
  - increases P bioavailability from 15% to > 45%
- ◆ Lowering dietary P, adding 20% DDGS & phytase
  - can reduce manure P excretion by 40 to 50%



# Diet Compositions and Cost Comparison from Adding 18.8% DDGS and Phytase

Ingredient	Corn-SBM-1.5 kg Lysine	18.8% DDGS + Phytase
Corn, kg	798.3	636.3
Soybean meal 44%, kg	176.9	159.4
DDGS, kg	0.0	188
Dicalcium phosphate, kg	11.6	0.0
Limestone, kg	7.2	9.8
Salt, kg	3.0	3.0
L-lysine HCl, kg	1.5	1.5
VTM premix, kg	1.5	1.5
Phytase, 500 FTU/kg	0.0	0.5
TOTAL, kg	1000.0	1000.0
Total Cost, \$	96.25	96.36
<b>Difference, \$</b>	<b>-</b>	<b>+ 0.11</b>



# Does Feeding DDGS Improve Gut Health?





**Healthy**



**Ileitis**





# **Use of Corn DDGS in Poultry Diets**

# Unidentified Growth or Hatchability Factors

- ◆ Growth response (Couch et al., 1957)
  - 5% DDGS in turkey diets
  - 17-32% improvement in gain
- ◆ Feed preference (Alenier & Combs, 1981)
  - 10% DDGS in chicken layer diets
- ◆ Reproduction improvement (Manley, 1978)
  - 3% DDGS in turkey breeder hen diets
  - improvement in egg numbers and hatch (late lay)

# Nutrient Content of Corn DDGS for Poultry (5 Sources)

<b>Nutrient</b>	<b>Range</b>	<b>Average</b>	<b>NRC, 1994</b>
Protein, %	25.5 - 30.7	27.5	27.4
Fat, %	8.9 - 11.4	10.0	9.0
Fiber, %	5.4 - 6.5	5.7	9.1
Ca, %	0.02 - 0.05	0.05	0.17
P, %	0.62 – 0.78	0.73	0.72
Na, %	0.05 – 0.17	0.11	0.48
Cl, %	0.13 – 0.19	0.17	0.17
K, %	0.79 – 1.05	0.95	0.65
TME (kcal/kg)	2650 – 3082	2850	3097
AME (kcal/kg)	2090 – 2418	2260	2480

Source: Noll and Parsons. 2003. Unpublished data.

# Amino Acid Content of Corn DDGS (5 Sources)

Amino acid	Range	Average	NRC, 1994
Methionine, %	0.44 – 0.56	0.49	0.60
Cystine, %	0.45 – 0.60	0.52	0.40
Lysine, %	0.64 – 0.83	0.74	0.75
Arginine, %	1.02 – 1.23	1.08	0.98
Tryptophan, %	0.19 – 0.23	0.22	0.19
Threonine, %	0.94 – 1.05	0.98	0.92

Source: Noll and Parsons. 2003. Unpublished data.



# True Digestible Amino Acid Levels of Corn DDGS for Poultry (5 Sources)

<b>Amino acid</b>	<b>True Dig. Amino Acid, %</b>	<b>Average</b>	<b>Digestibility Coefficient, %</b>	<b>Average</b>
Methionine	0.35 – 0.53	0.43	86 - 90	88
Cystine	0.28 – 0.57	0.40	66 - 85	76
Lysine	0.37 – 0.74	0.53	59 - 83	71
Arginine	0.73 – 1.18	0.93	80 - 90	86
Tryptophan	0.14 – 0.21	0.18	76 - 87	82
Threonine	0.61 – 0.92	0.74	67 - 81	75

Source: Noll and Parsons. 2003. Unpublished data.

## Correlation Between DDGS Color and Amino Acid Digestibility ( $r^2$ )

Amino acid	L*	a*	b*
Lys	.67	NS	.77
Cys	.67	NS	.74
Thr	.51	NS	.58

# Summary of Corn DDGS Source Characteristics for Poultry

- ◆ Nutrient profile is consistent within source
- ◆ Na, P, K, S are most variable among minerals
- ◆ Higher protein and fat content than NRC, 1994
- ◆ High amino acid digestibility
- ◆ DDGS with high lysine content tended to have high amino acid digestibility
- ◆ DDGS color is a fairly reliable predictor of amino acid digestibility

# Recommended Inclusion Rates of DDGS for Poultry

## ◆ Broilers and Turkeys

- 5-10% inclusion rates (Starter/Finisher)
  - Without energy adjustments
- > 10%
  - With adjustments for lys, met, thr, trp, and energy

## ◆ Chicken Egg Layers

- 10% inclusion rate

# U of M DDGS Web Site

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

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

