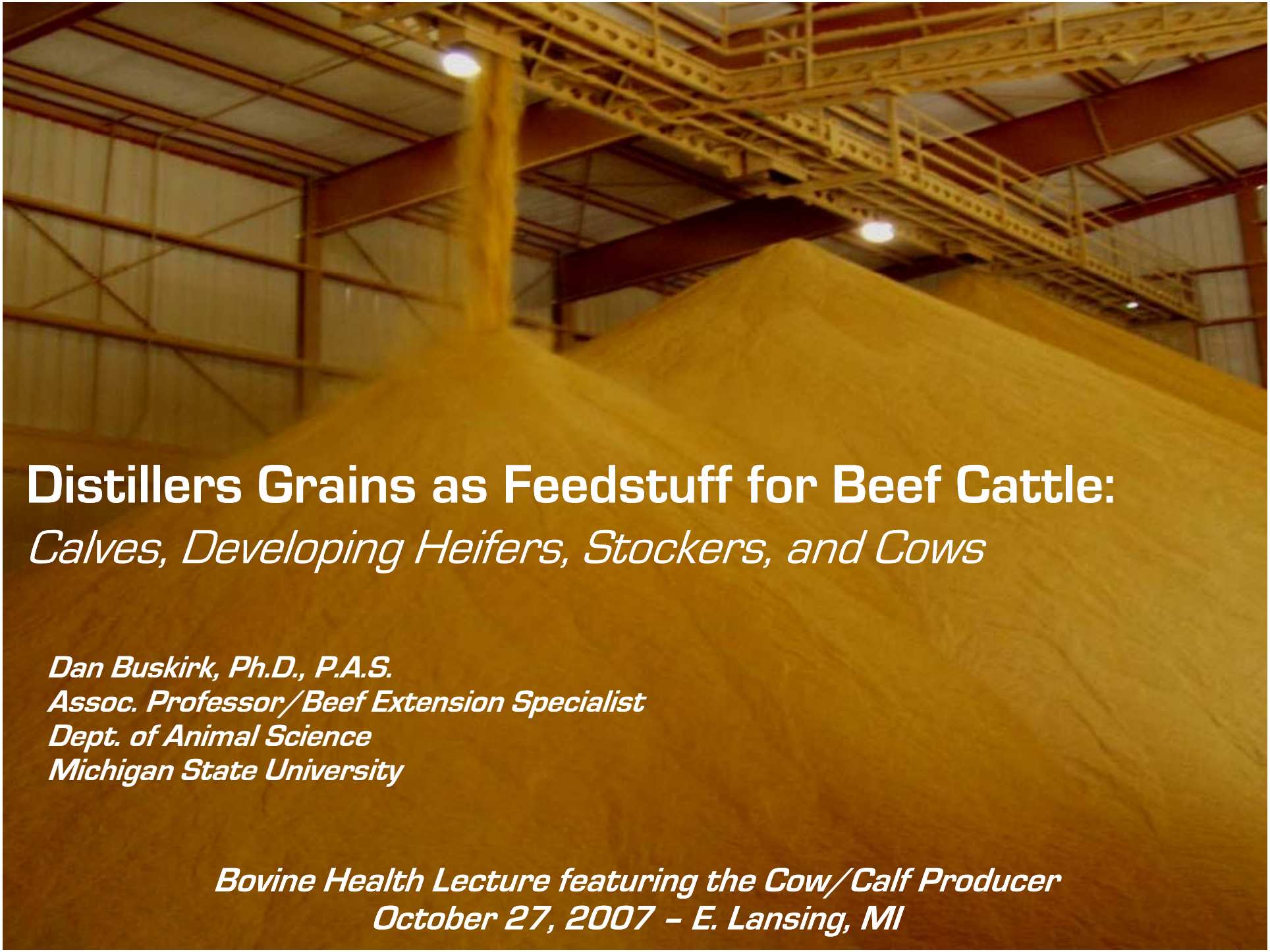

Distillers Grains as Feedstuff for Beef Cattle:

Calves, Developing Heifers, Stockers, and Cows

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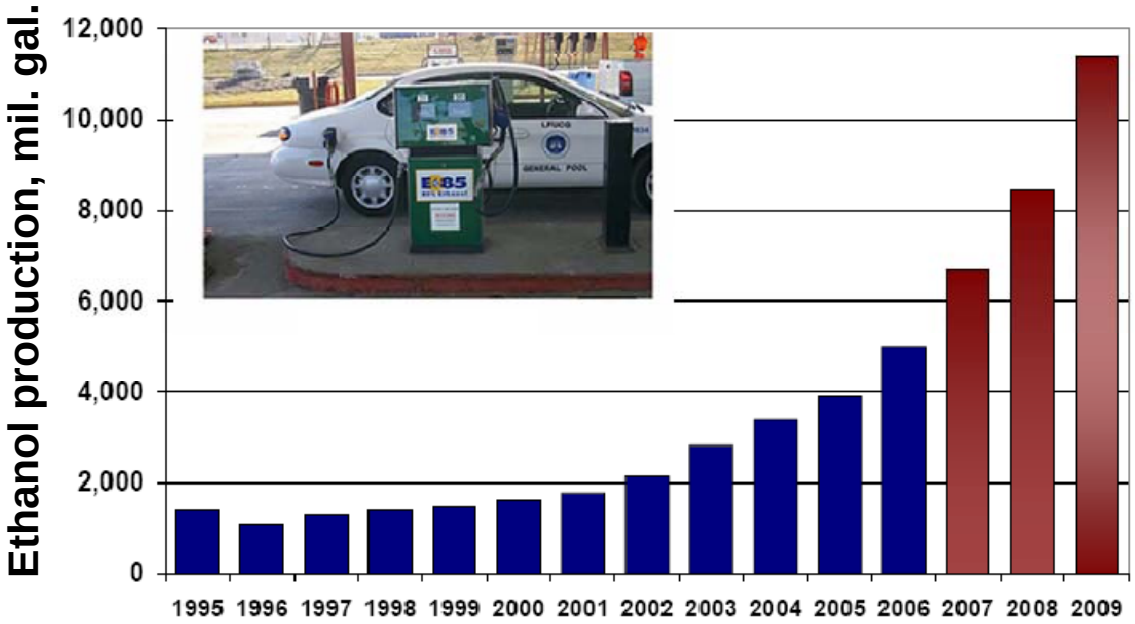
Bovine Health Lecture featuring the Cow/Calf Producer
October 27, 2007 – E. Lansing, MI

Outline

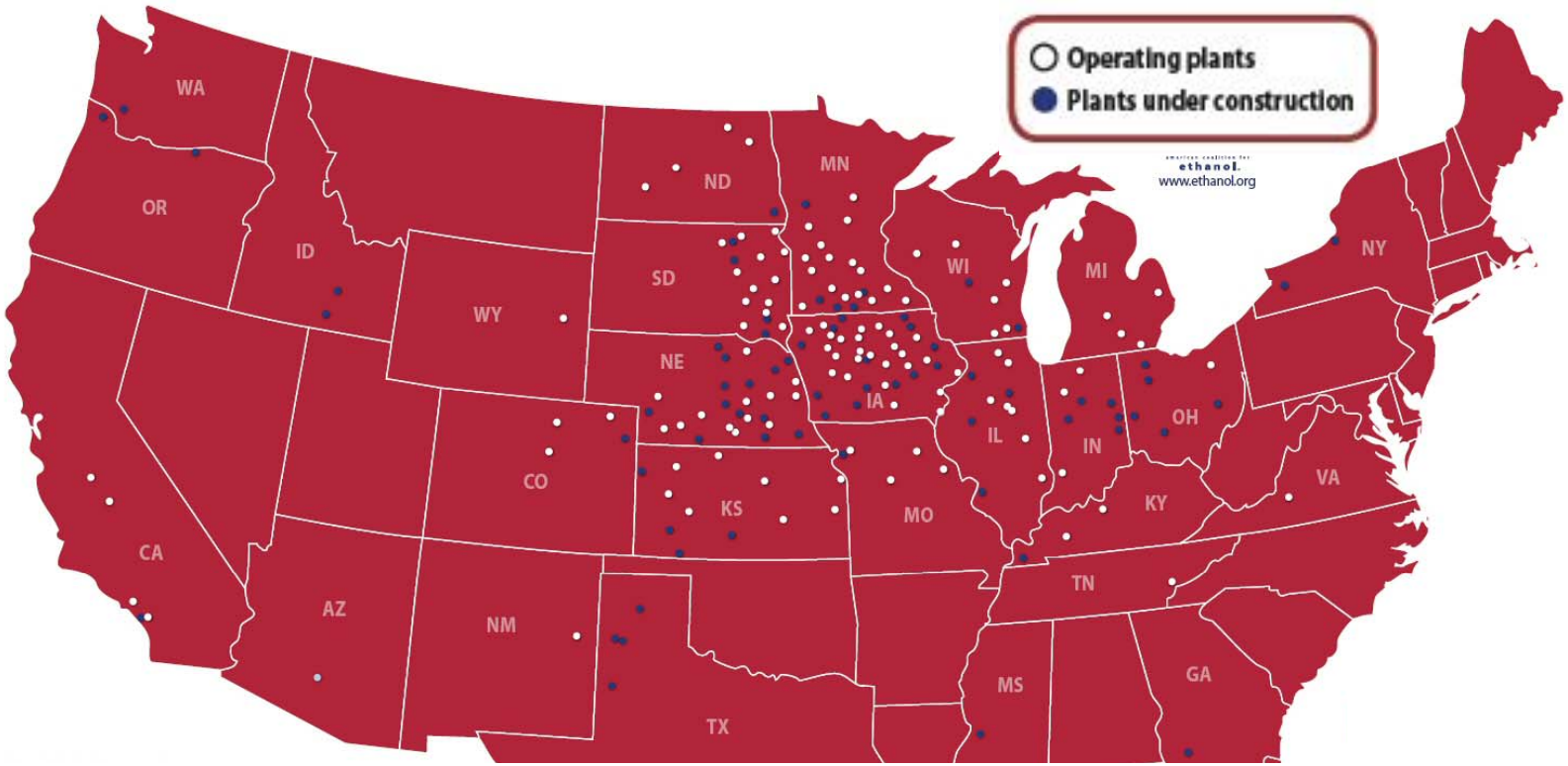
- Status of the ethanol industry
- Overview of distillers grains production
- Research on feeding distillers grains to beef cattle
- Limitations
- Recommendations on feeding & storage

U.S. Ethanol Production, 1995-2009



Source: Renewable Fuels Association (ethanolrfa.org)

U.S. Ethanol Plants



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Total current capacity (131 plants)	**6,923.4 mgy**
Total under construction (73)/expansions (10)	**6,516.9 mgy**

Source: American Coalition for Ethanol (ethanol.org) and Renewable Fuels Association (ethanolrfa.org)

Ethanol plants under construction (1/2007)

Absolute Energy	St. Ansgar, IA	Corn	100
Advanced Bioenergy	Fairmont, NE	Corn	100
ASAlliances Biofuels	Albion, NE	Corn	100
ASAlliances Biofuels	Linden, IN	Corn	100
ASAlliances Biofuels	Bloomingburg, OH	Corn	100
Blue Flint Ethanol	Underwood, ND	Corn	50
Cardinal Ethanol	Harrisville, IN	Corn	100
Cascade Grain Products	Clatskanie, OR	Corn	108
CassCo Amaizing Energy, LLC	Atlantic, IA	Corn	110
Castle Rock Renewable Fuels, LLC	Necedah, WI	Corn	50
Center Ethanol Company, LLC	Sauget, IL	Corn	54
Central Illinois Energy	Canton, IL	Corn	37
Central Indiana Ethanol	Marion, IN	Corn	40
Coshoctan Ethanol (Altra)	Coshoctan, OH	Corn	60
Bonanza Energy, LLC (Conestoga)	Garden City, KS	Corn/milo	55
Arkalon Energy, LLC (Conestoga)	Liberal, KS	corn	110
Dexter Ethanol, LLC	Dexter	Corn	100
E Caruso (Goodland Energy Center)	Goodland, KS	Corn	20
E Energy Adams, LLC	Adams, NE	Corn	50
E3 Biofuels	Mead, NE	Corn	24
Elkhorn Valley Ethanol, LLC	Norfolk, NE	Corn	40
First United Ethanol, LLC (FUEL)	Mitchell Co., GA	Corn	100
Gateway Ethanol	Pratt, KS	Corn	55
Global Ethanol, LLC	Riga, MI	Corn	57
Grand River Distribution (Didion)	Cambria, WI	Corn	40
Green Plains Renewable Energy	Shenandoah, IA	Corn	50
Green Plains Renewable Energy	Superior, IA	Corn	50
Hawkeye Renewables	Menlo, IA	Corn	100
Heron Lake BioEnergy, LLC	Heron Lake, MN	Corn	50
Holt County Ethanol, LLC	O'Neill, NE	Corn	100
Illinois River Energy, LLC	Rochelle, IL	Corn	50
Indiana Bio-Energy, LLC	Bluffton, IN	Corn	101
Iroquois Bio-Energy Company, LLC	Rensselaer, IN	Corn	40
Kansas Ethanol, LLC	Lyons, KS	Corn	55
Levelland/Hockely County Ethanol, LLC	Levelland, TX	Corn	40

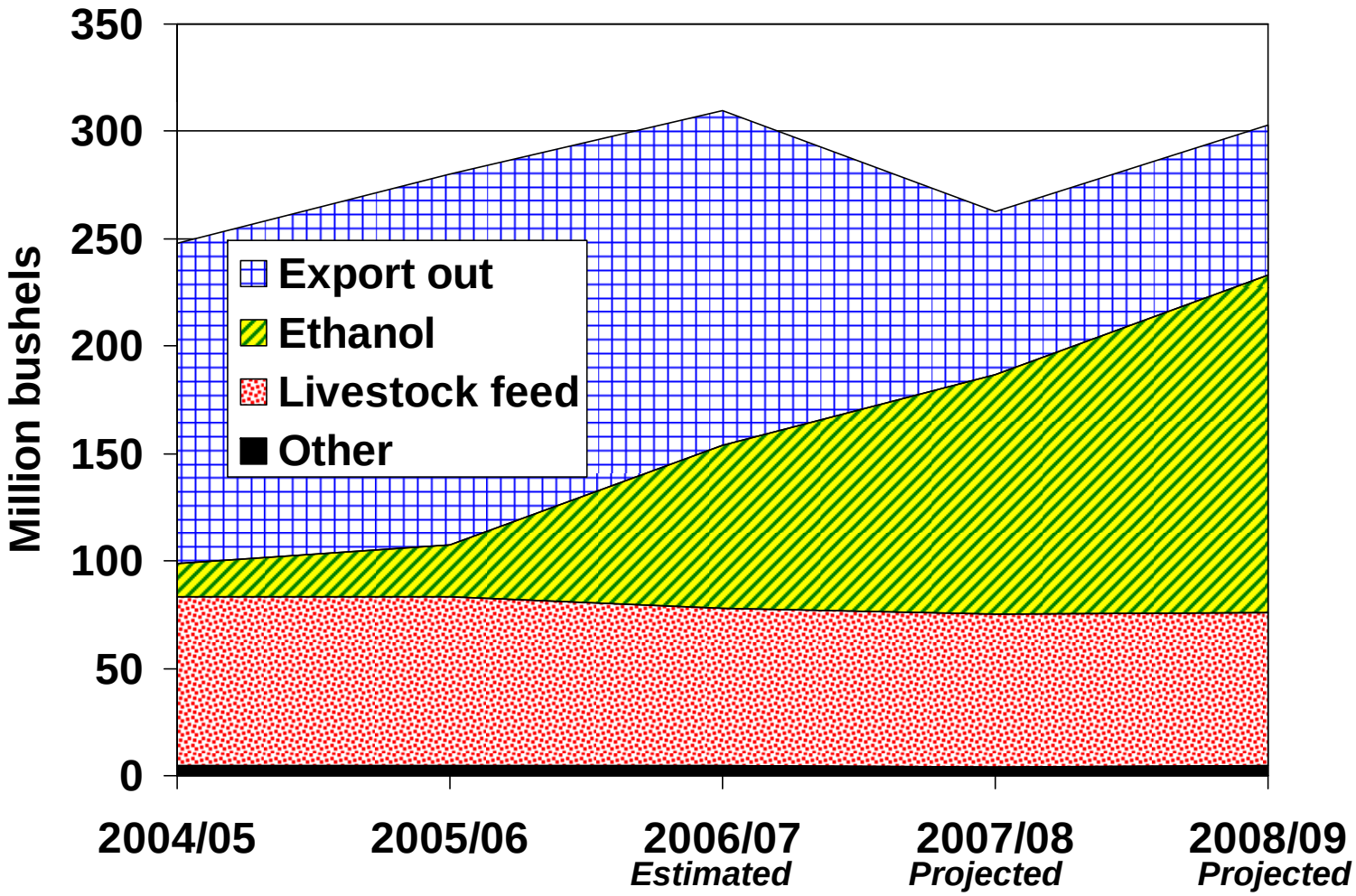
Source: Renewable Fuels Association (ethanolrfa.org)

Michigan Ethanol Plants

Michigan Ethanol, Caro, MI

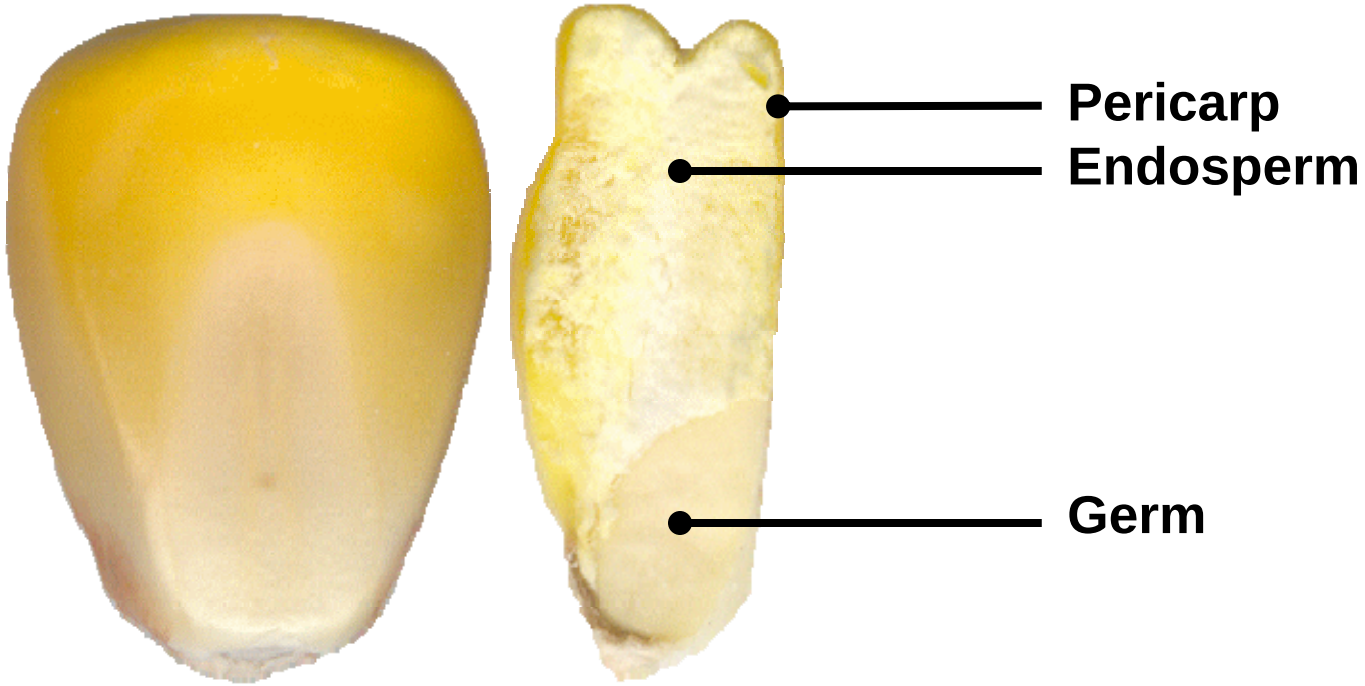
Source: Michigan Dept. of Ag.

Michigan Corn Use

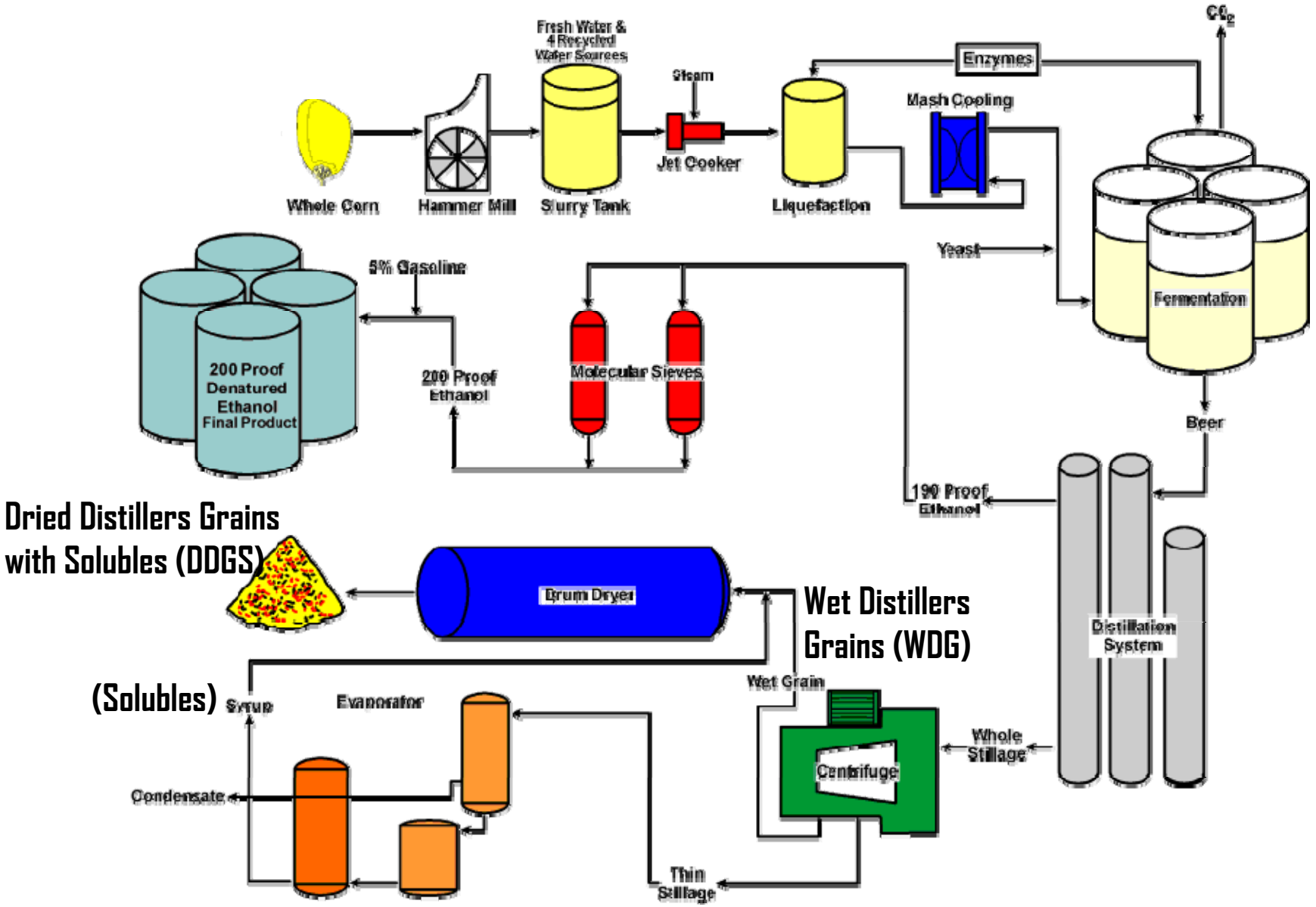


Source: Jim Hilker MSU Ag. Econ.

Corn Kernel



Dry Milling of Corn for Ethanol



Ethanol Co-products

Distillers Grains with or without solubles

Wet

Modified Wet

Dried

Solubles

Ethanol Production from Corn

1 bushel corn

~2.8 gal ethanol

~18 lb CO_2

~17 lb Distillers grains

Nutrient Composition (table values)

	Shelled Corn, (dry)	Dried Distillers Grains with Solubles
Dry matter, %	88	89
TDN, %	88	99
NEm, Mcal/lb	0.98	1.13
NEg, Mcal/lb	0.65	0.75
Crude protein, %	9	30
Crude fiber, %	2	8
Crude fat, %	4.3	11
Calcium, %	0.02	0.05
Phosphorous, %	0.30	0.90
Potassium, %	0.4	1.0
Sulfur, %	0.12	0.90

Nutrient Content of DGS Can Be Variable

- Different ethanol plants may have different processes
- Different moistures marketed
  - Dry (~89% DM)
  - Modified wet (~50% DM)
  - Wet (~47% DM)
- Different amount of solubles returned to distillers grains 0-100%
- Fluctuations in grind, fermentation process, post-fermentation temperatures, etc. can affect final distillers co-product

Distiller's Supplementation

- Distiller's grains with solubles (DGS) can compliment forage diets
  - DGS is low in starch, therefore, little or no negative effect on fiber digestion
  - DGS is high in undegradable (by-pass) protein, therefore, can balance protein supply with forages that are typically high in degradable protein
  - DGS is high in energy (similar to corn), therefore, can increase energy content of forage-based diets (i.e. hay, crop residues)

Research using DGS in cow/calf scenarios is limited...

Creep Feed Ingredient for Calves

- DDGS replaced SBM in corn/soy hull creep feed (14.2% CP) with no difference in ADG or supplemental G:F (n=36)

  (Lancaster et al., 2006, UM)

- DDGS replaced SBM in wheat mid/soy hull creep feed (30% CP) with no difference in ADG, G:F, or carcass

  (n=16) (Reed et al., 2006, NDSU)

Item	Control	CDDGS[1]
CDDGS	—	50.00
Soybean meal	41.00	13.90
Wheat middlings	26.25	14.55
Soybean hulls	26.25	14.55
Beet molasses	5.00	5.00
Limestone	1.50	2.00

[1]CDDGS = corn distillers dried grains with solubles.

Supplement for Bred Heifers

- DDGS (6.6 lb DM, [40% of diet]) fed with grass hay to late gestation crossbred heifers resulted in similar BCS, calf BW, CE, and calf vigor compared to supplementing with soy hulls (40 d, n=96) (Engel et al., 2005, SDSU)

- DDG as 60% of supplement fed at 1 to 5 lb DM, to heifers grazing range resulted in similar ADG, BCS, calf BW, CE, and subsequent calf ADG and pregnancy rate compared to a ranch supplement with dry corn gluten feed (~120 d, n=1353) (Stalker et al., 2006, UNL)

Supplement for Beef Cows

- DDGS (3 lb DM) replaced sunflower meal in ground corn stalk based diet for non-lactating, pregnant or open cows with similar ADG, BCS, and ultrasound fat

  (70 d, n=192) (Doering-Resch et al., 2005, SDSU)

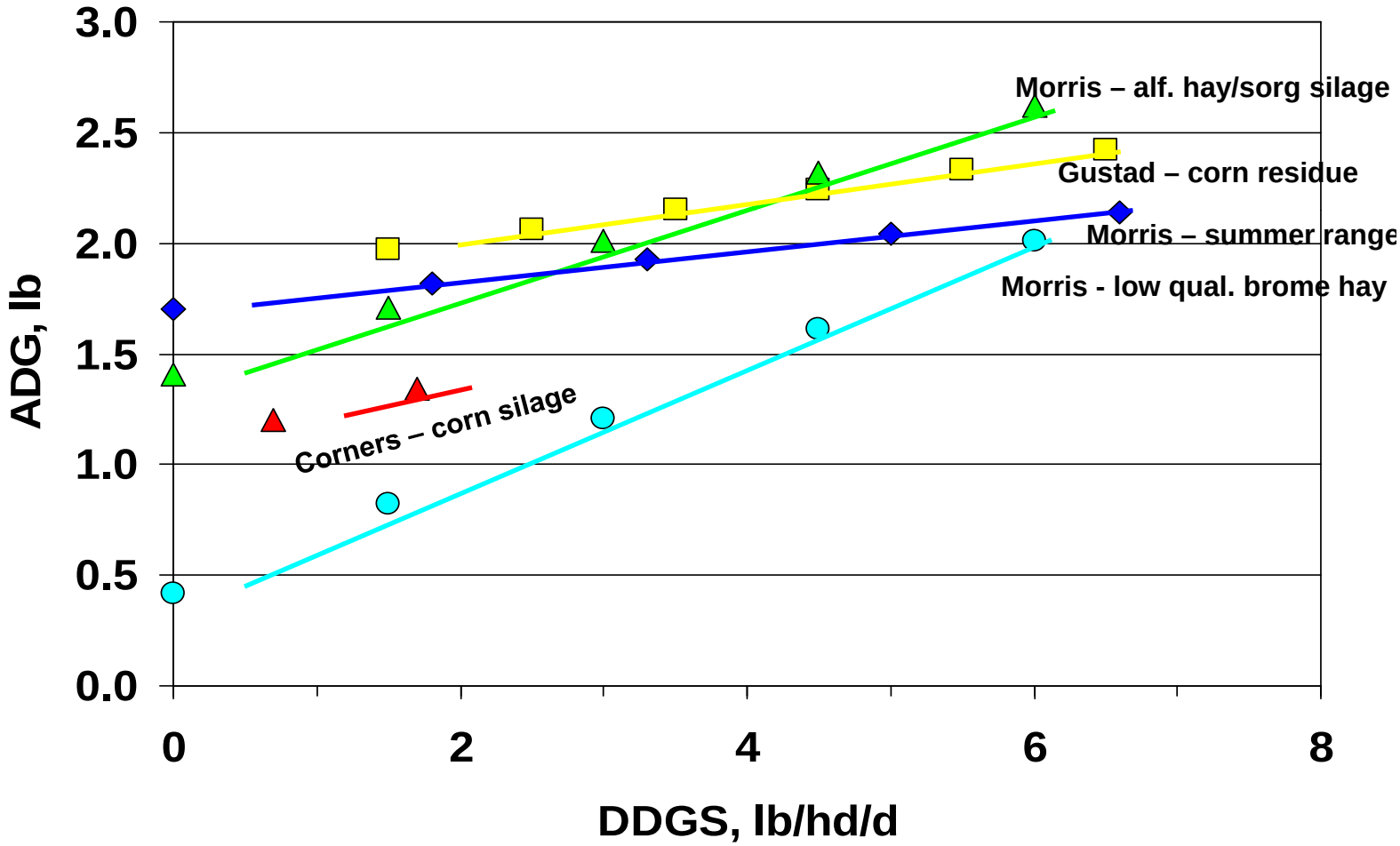
- DDGS (16 lb DM) in ground corn stalk limit-fed diet for lactating Simmental cows resulted in acceptable ADG, milk production, and calf ADG

  (77 d, n=114) (Faulkner, 2005, UI)

- DDGS (10 lb DM) in corn shucklage limit-fed diet for lactating Angus cows resulted in acceptable ADG, milk production, and calf ADG

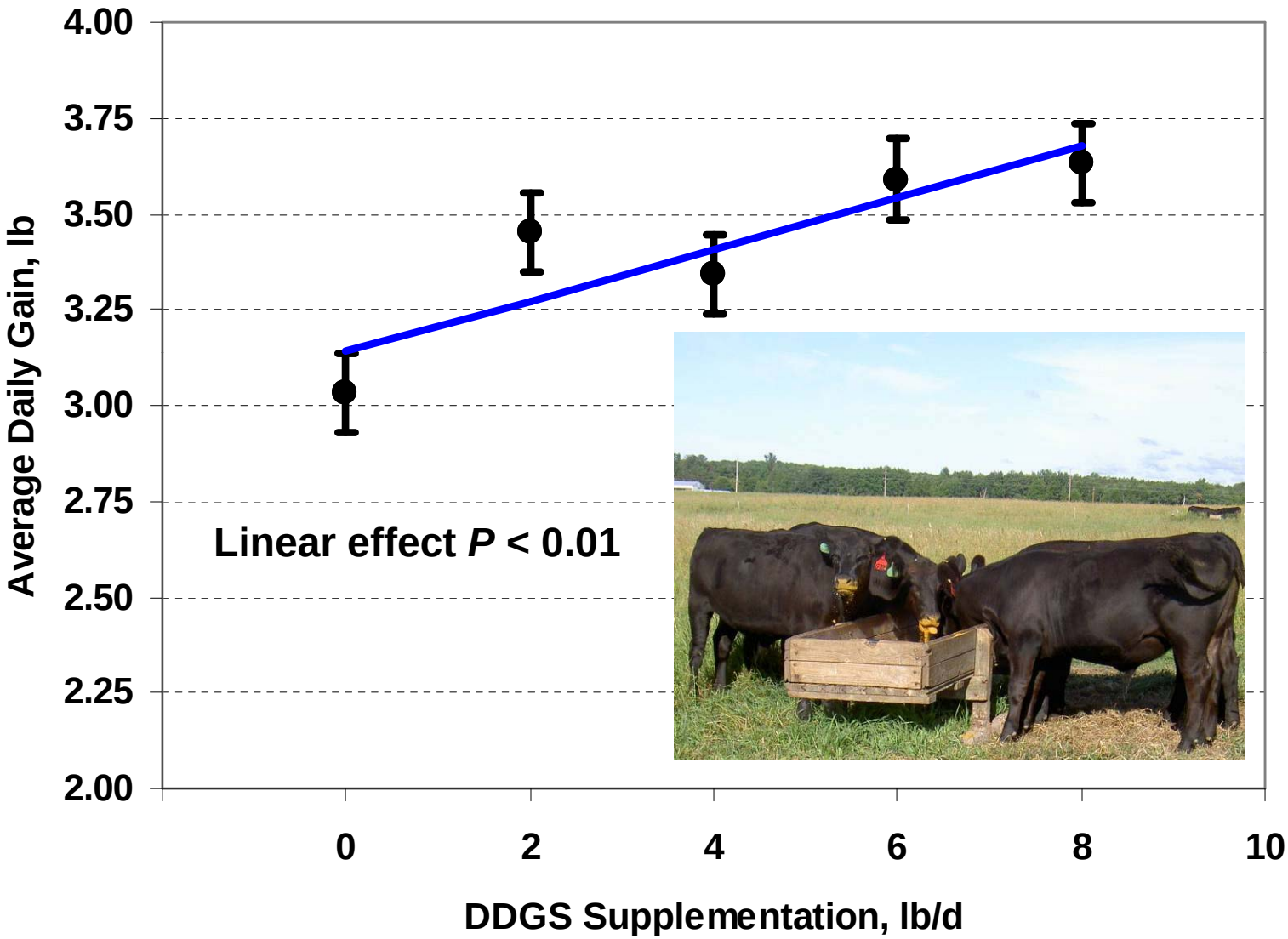
  (68 d, n=88) (Faulkner, 2005, UI)

Stockers/Backgrounders



Effect of DDGS Level on Steer Performance while Grazing

(MSU Lake City Exp. Sta.; 180 steers, 3 replications, 2 years)



Crossbred steers grazed on smooth bromegrass pastures May to Aug (~90d)
Starting wt. = 571 lb, Ending wt. = 874 lb

Subsequent performance (year 1)

- No difference in
  - Feedlot ADG
  - Final live weight
  - Hot carcass weight
  - Dressing %
  - Ribeye area
  - Marbling score
- Difference in
  - Fat thickness
  - Yield grade
  - Percentage of carcass grading Mid Choice

Cattle from 2nd year of project are currently on feed at the MSU Beef Cattle Teaching & Research Center

Sulfur Content Limiting!

- Maximum tolerated level of dietary sulfur <0.4%

  (NRC, 1996)

- High sulfate water (>3000 ppm) compared to low sulfate water (<400 ppm) has:
  - Reduced ADG, DMI, and gain/feed of growing steers
  - Increased risk of polioencephalomalacia (PEM)
  - Reduced milk production, calf gains, and % of cows bred early in the breeding season (84 d exposure to SO_4)

  (Patterson et al. 2002; 2003; 2005)

- Holding to the 0.4% max., if DG is 1% sulfur on DM basis, this would limit its use to no more than ~25% of diet DM in most situations

Relative Value of DG for Beef Cows

Hay price	Value when used as an **energy** supplement, $/T		SBM price	Value when used as a **protein** supplement, $/T	
$/Ton	**DDGS**	**WDGS**	**$/Ton**	**DDGS**	**WDGS**
30	73	29	180	108	43
40	97	39	190	114	45
50	121	48	200	120	48
60	146	58	210	126	50
70	170	68	220	132	53
80	194	77	230	138	55
90	219	87	240	144	57
100	243	97	250	150	60
110	267	106	260	156	62
120	291	116	270	162	64

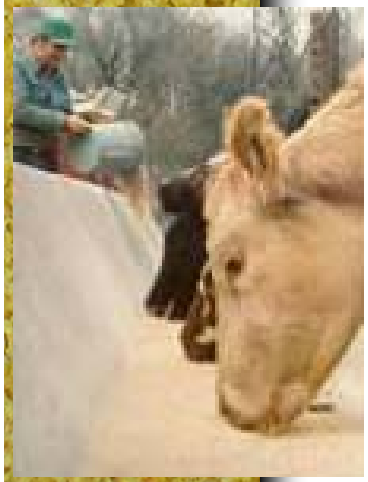
Calculated using Hay - .28 Mcal NEm/lb, 88% DM; DDGS - .68 Mcal NEm/lb, 30% CP, 88% DM; WDGS - .68 Mcal NEm/lb, 30% CP, 35% DM; SBM – 50% CP, 88% DM

Recommendations for Cow/calf & Stocker Beef Cattle

- **Fed as a creep feed ingredient**
  ≤50% DDGS in creep feed diet

- **Fed as a supplement to stocker cattle (~500-800 lb)**
  Based on supplemental cost of gain, ≤ 6 lb/hd/d of DDGS

- **Fed as a supplement to late gestation bred heifers/beef cows**
  Paired with low quality forages (corn stalks, low quality hay, etc.)
  3-5 lb/hd/d DDGS
  or 8-14 lb/hd/d WDGS



- **Fed as a supplement to lactating beef cows**
  Paired with low quality forages (corn stalks, low quality hay, etc.)
  6-8 lb/hd/d DDGS
  or 17-23 lb/hd/d WDGS

- If feeding for long periods, may consider a custom mineral/vitamin mix – minus phosphorous and sulfur

Storage of Wet Distiller's Grains

- Hauling distances may limit use of WDGS
- Cow herds typically not large enough to use load lots quickly
- Storage of WDGS may allow purchase at seasonal price lows
- Material exposed to air spoils in 7-14 days depending on temperature
- Does not ensile by itself, but can be preserved in air-tight storage
- May benefit from use of preservatives (e.g. propionic acid, other organic acids)
- Storage shrinkage should be considered (DDGS ~2-5%, WDGS ~ 10-50%)

WDGS is Difficult to Store Alone in Silage Bags

Although modified wet has been stored successfully this way.

Storage of WDGS - Bunker

- Can be mixed with other feedstuffs and ensiled
  - 70:30 WDGS:Soybean hulls
  - 50:50 WDGS:Corn silage

	Spoilage	Recovery
Covered bunker silo	3-4 in.	91.5%
Uncovered bunker silo	12 in.	90.4%

  Some red and white mold

  Temperature was >100°F at ensiling, decreased thereafter

  Iowa, 2006

- Field report of WDG stored in piles, covered with salt (1 lb/ft^2) and plastic. Kept "very well".

Storage of WDGS - Mixing

- WDG can be stored when packed with dry forages

Minimum level of roughage to mix in WDGS for storage

	Bag[a]	Bunker
Grass hay	15%	30-40%
Wheat straw	12.5%	25-32%
Alfalfa hay	22.5%	45-55%
DDGS	50%	---

[a]300 PSI. Source: Adams et al. - UNL

DGS Sources

The Andersons Ethanol LLC - Albion, Michigan
Albion, Michigan - Phone: 800-537-3370
DGS Contact - **David Stover**: 419-891-2791
Additional Contact - **Rick Hollister**: 517-206-1800

Global Ethanol - Riga, MI
Riga, Michigan - Phone: 612-333-4000
DGS Contact - **Garrett Landel**: 517-486-6190 x103

POET Biorefining - Caro, Michigan
Caro, Michigan - Phone: 989-672-1222
DGS Contact - **David Gloer**: 989-672-1222

US Bio - Woodbury, Michigan
Woodbury, Michigan - Phone: 616-374-3600
DGS Contact - **Drake Stinson**: 616-374-3635
Additional Contact - **Jim Zook**: 616-374-3600

Marysville Ethanol, LLC - Marysville, Michigan
Marysville, MI - Phone: 810-388-2122
DGS Contact - **Al Thrush**: 810-388-2122
Additional Contact - **Aric Metevia**: 810-388-2091

Online Resources

- **Michigan Co-products**
  - Includes distillers feeding recommendations
    - http://miagcoproducts.com/

Coming Soon

- **Iowa Beef Center**
  - Distillers grains for beef cows publication
    - http://www.extension.iastate.edu/Publications/IBC26.pdf

- **UMN Distillers Grains By-products in Livestock and Poultry Feeds**
  - Links to research results on distillers grains
    - http://www.ddgs.umn.edu/info-beef.htm