Impact of Distiller's Grains on Indirect Land Use Change

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What is the Issue?

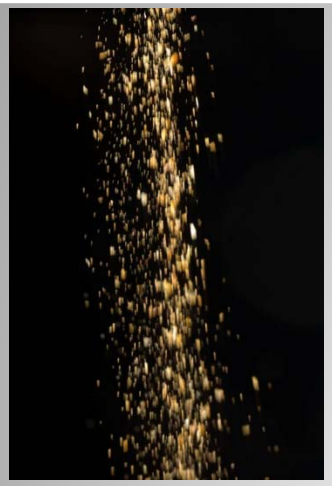
- A KEY determinant for the net impact of U.S. ethanol production on "Indirect Land Use Change" is the amount of Distiller's Grains (DGS) used in animal feeds

One bushel of corn produces …

- 2.7 gallons of ethanol (1/3)
- 18 lbs of CO_2 (1/3)
- 18 lbs of DGS (1/3)
  - 3x concentration of energy, protein, & P vs. corn

DGS is a life-cycle carbon credit for corn ethanol…

- When added to livestock and poultry feeds it displaces traditional feed ingredients
  - corn
  - soybean meal
  - others
- Significantly contributes to reduced green house gas emissions



DGS displacement ratios are controversial

- Argonne National Laboratory (2008)
  - 1 lb DGS replaces 1.28 lbs of other ingredients
- California Air Resource Board (2008)
  - 1:1 displacement ratio
- FASOM Model (Texas A&M, 2008)
  - 1:1 displacement ratio
- CARD/FAPRI Model (Iowa State Univ., 2008)
  - 1:1 displacement ratio

Impact of DGS displacement ratios on land use credits

- 1:1 displacement = 0.33 land use credit (CARB, 2008)
  - one-third of every acre of corn dedicated to ethanol actually should be credited to livestock feed
- 1.28:1 displacement = ~ 0.70 land use credit (Argonne, 2008)
- This assumption significantly affects indirect land use change!

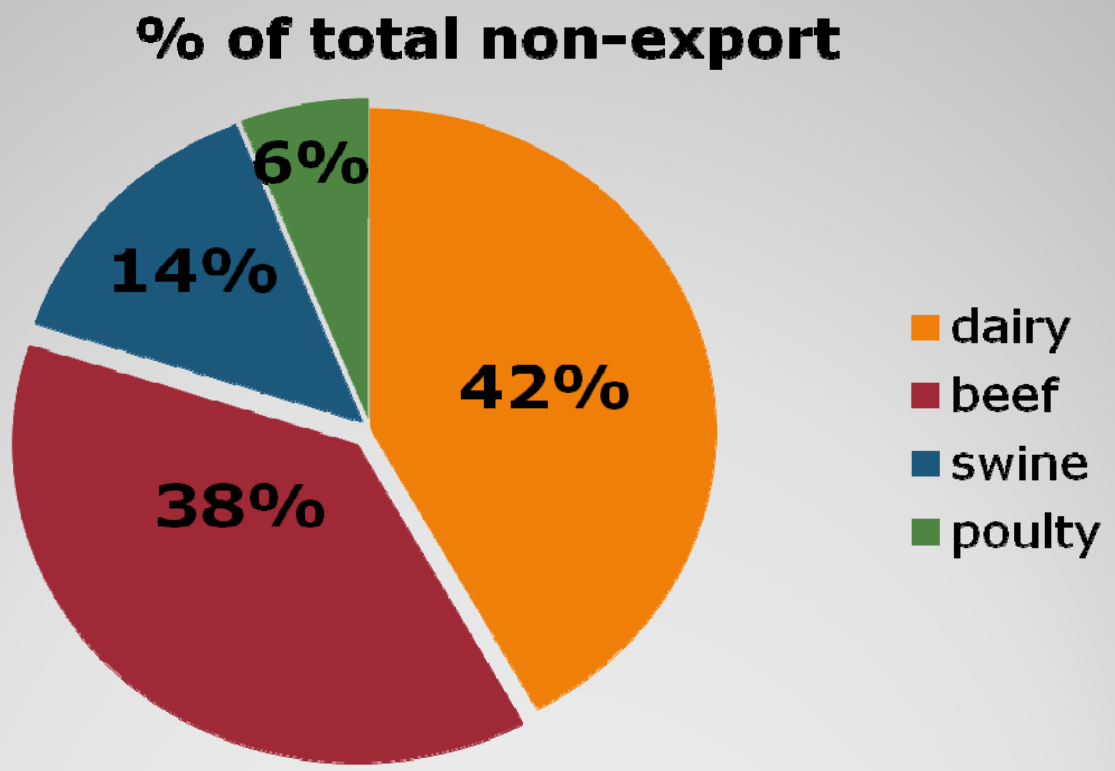
DGS impact on land use credits must account for…

- Estimated DGS market share of:
  - Dairy
  - Beef
  - Swine
  - Poultry
- Actual dietary usage rates
- Changes in animal performance
- Amounts (+/-) of all ingredients its use affects

Estimated DGS market share by species

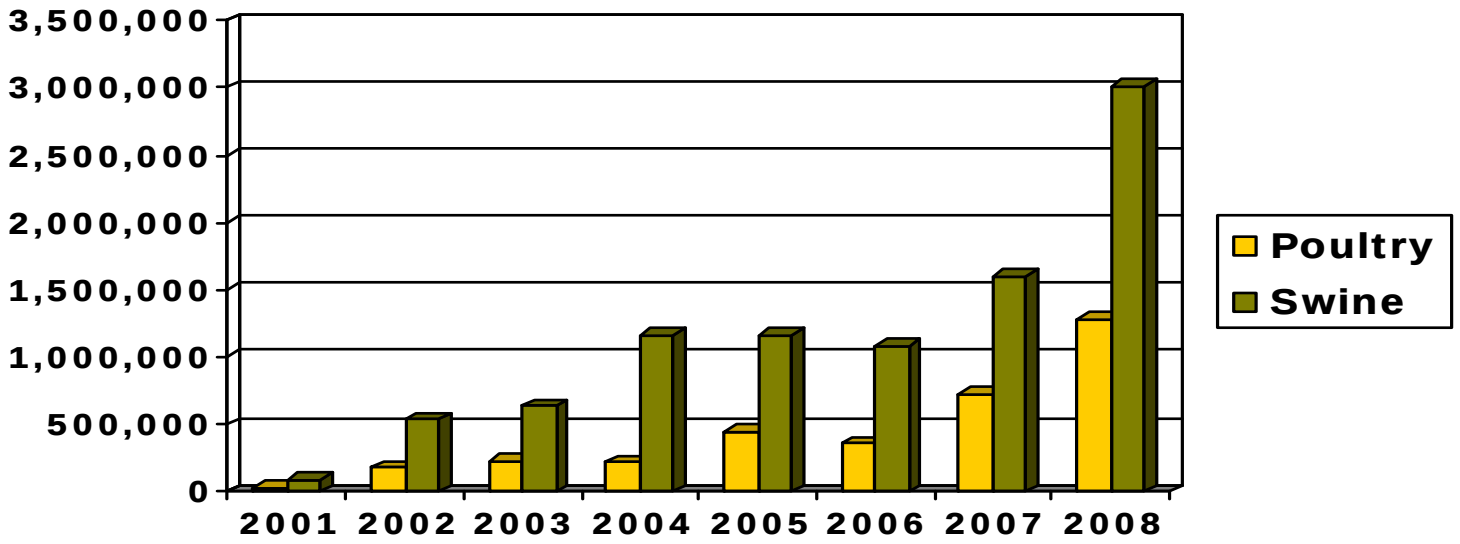
- Dairy and beef cattle are the predominant consumers (80%) of DGS in animal agriculture

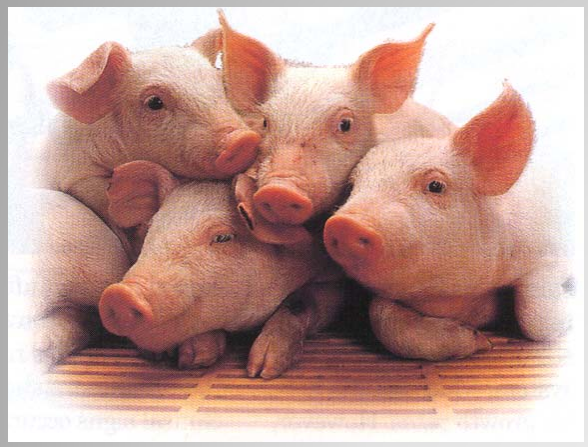
Estimated North American DGS Usage Rates (2008)



Estimated Use of DGS in U.S. Poultry and Swine Diets (2001-2008)

(Metric Tonnes)





Opportunity for increased DGS use

- Swine DGS use has increased 30%
  - 35% of potential use
- Poultry DGS use has increased 27%
  - 22% of potential use

Factors affecting future market penetration

- Price relationship between DGS and displaced ingredients in livestock and poultry diets
- Availability of DGS supply
- Research to develop solutions for overcoming barriers for increased DGS use

Maximum dietary DGS inclusion rates

(based on university research)

- Lactating dairy cattle – up to 30% (Kalscheur et al., 2006)
- Beef feedlot cattle – up to 40% (Klopfenstein et al. 2008)
- Swine grower-finisher – up to 30% (Stein and Shurson, 2008)
- Poultry – up to 15% (Noll, 2008)

Current dietary DGS inclusion rates

- Lactating dairy cattle – 10 to 20%
- Beef feedlot cattle – 20 to 40%
- Swine grower-finisher – 10 to 40%
- Poultry – 5 to 30%

Characterizing DGS consumption by animal type

- Dietary inclusion rates must be based on:
  - current usage
    - record high 2008 corn and soybean meal prices increased usage rates
  - include all animals (poultry)

Nutritionists formulate diets to improve or maintain animal performance

- Lactating dairy cattle
  - Equal or greater milk production
- Beef feedlot cattle
  - Improved weight gain and feed conversion
- Swine grower-finisher
  - Generally equal wt. gain and may improve feed conversion
- Poultry
  - Generally equal wt.gain and feed conversion

DGS displacement ratios need to be adjusted based on differences in animal performance

- Beef and Dairy Cattle
  - improved growth performance and milk production requires displacement ratio adjustments
- Swine and Poultry
  - unchanged growth performance does not require displacement ratio adjustments

Example of variable performance responses from feeding up to 30% DGS in diets for G-F pigs

Item	N	Response to dietary corn DGS		
		Increased	Reduced	Not changed
ADG	25	1	6	18
ADFI	23	2	6	15
G:F	25	4	5	16

Data calculated from experiments by Gralapp et al. (2002), Fu et al. (2004), Cook et al. (2005), DeDecker et al. (2005), Whitney et al. (2006), McEwen (2006, 2008), Gaines et al. (2007ab); Gowans et al.(2007), Hinson et al. (2007), Jenkin et al. (2007), White et al. (2007), Widyaratne and Zijlstra (2007), Xu et al. (2007ab, 2008ab), Augspurger et al. (2008), Drescher et al. (2008), Duttlinger et al. (2008), Hill et al. (2008), Linneen et al. (2008), Stender and Honeyman (2008), Weimer et al. (2008), and Widmer et al. (2008).

Example of determining partial replacement amounts of ingredients with 20% DGS in swine grower diets

Ingredient, %	0% DGS	20% DGS	Difference
Corn	81.30	67.32	-13.98
Soybean meal, 46% CP	16.50	10.60	-5.90
DGS	0.00	20.00	+20.00
Dicalcium phosphate	0.82	0.24	-0.58
Calcium carbonate	0.68	1.00	+0.32
Salt	0.30	0.30	0.00
Synthetic amino acids	0.15	0.29	+0.14
Vitamins & trace minerals	0.25	0.25	0.00
TOTAL	100.00	100.00	

20% DGS inclusion rate in swine grower diets

400 lbs DGS
6.4 lb calcium carbonate
2.8 lbs synthetic amino acids

REPLACES

279.6 lbs corn
118 lbs soybean meal
11.6 lbs dicalcium phosphate/ton (2000 lbs)

Comparison of displacement ratios for 20 & 30% DGS inclusion rates in swine grower diets

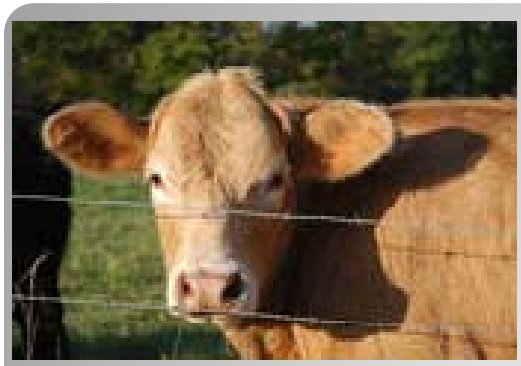
Dietary DGS Inclusion Rate	Corn	Soybean meal	Dicalcium phosphate
20%	0.699	0.295	0.029
30%	0.688	0.307	0.027

Overall DGS displacement ratio

Calculated as a sum of displacement ratios by species weighted over the market fraction for each specie

DGS displacement ratio for dairy cattle

Parameter	Dairy
Market share, %	42
Corn	0.731
Soybean meal	0.633
Total	**1.364**



DGS displacement ratio for beef cattle

Parameter	Beef
Market share, %	38
Corn	1.196
Urea	0.056
Total	**1.252**

DGS displacement ratio for swine

Parameter	Swine (20%)
Market share, %	14
Corn	0.699
Soybean meal	0.295
Synthetic amino acids	+0.007
Inorganic phosphate	0.029
Calcium carbonate	+0.016
Total	**1.000**

DGS displacement ratio for poultry

Parameter	Avg. for Broilers, Layers, and Turkeys
Market share, %	6
Corn	0.589
Soybean meal	0.446
Synthetic amino acids	+0.009
Fat	+0.036
Inorganic phosphate	0.022
Calcium carbonate	+0.018
Salt	0.003
Total	**0.997**

Calculation of Overall DGS Displacement Ratio

Parameter	Overall Ratio (lb/lb DGS)
Market share, %	100
Corn	0.895
Soybean meal	0.334
Urea	0.021
Synthetic amino acids	(0.001)
Fat	(0.002)
Inorganic phosphate	0.005
Calcium carbonate	(0.003)
Salt	0.0002
Total	**1.249**

Composite DGS displacement ratio

1 lb of DGS = 1.249 lbs of competing dietary ingredients

= 0.895 lbs corn + 0.334 lbs SBM + 0.02 lbs other ingredients

What about fractionated corn co-products?

High protein DGS
De-oiled DGS
Corn germ
Corn bran
Others?

Conclusions

- DGS has > 1:1 displacement value
- DGS displaces more soybean meal than used in most models to estimate indirect land use change
- Displacement value may change in the future depending on
  - Quantity
  - Nutritional value of fractionated co-products produced

Acknowledgements

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