

# Wheat-based DDGS as a protein source in poultry feeding

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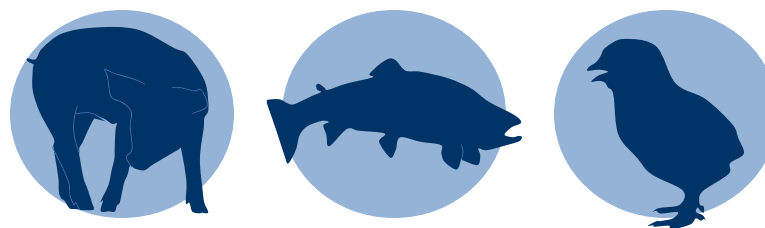
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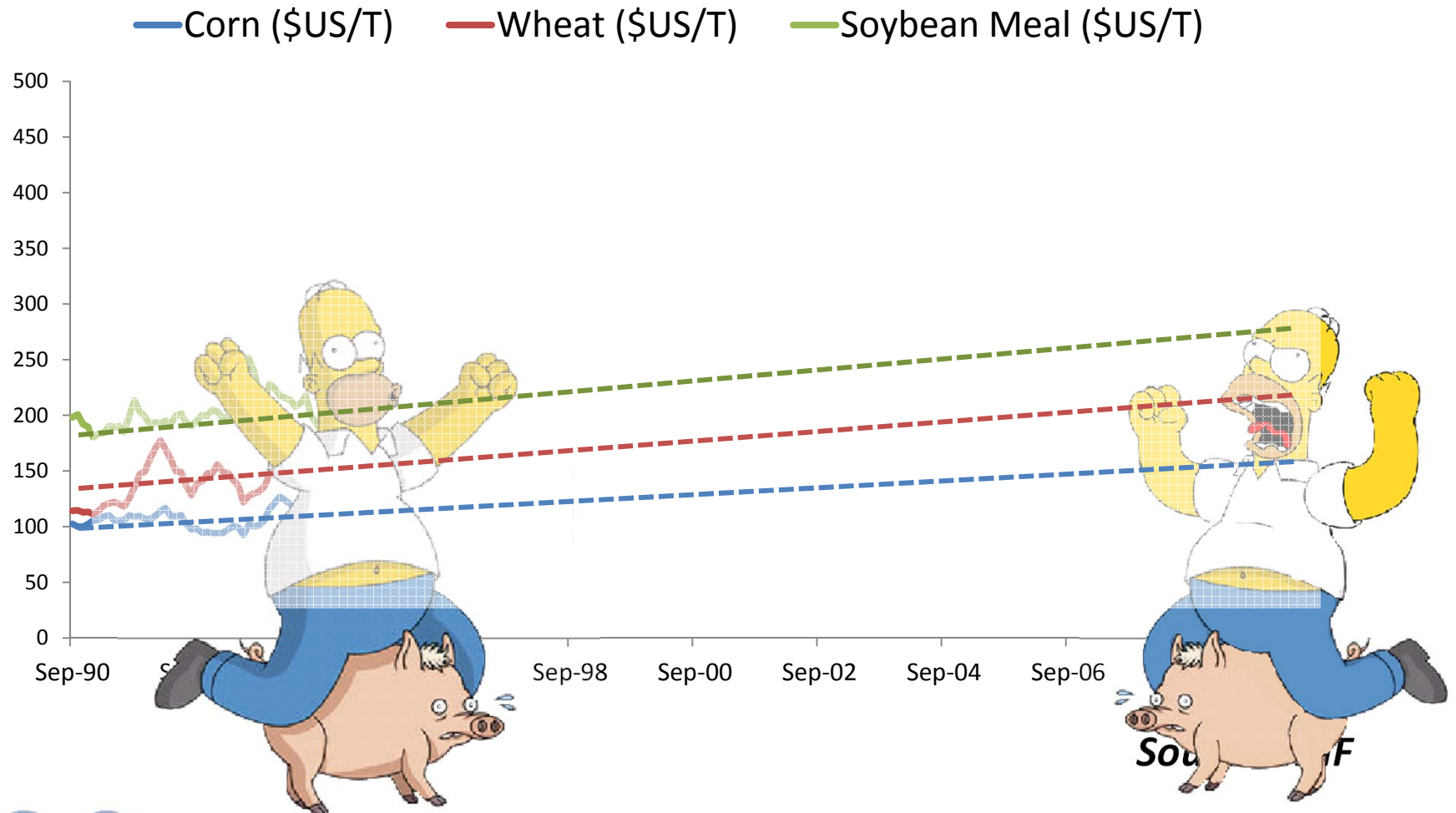
Utilization of DDGS in Livestock Feeding  
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# Monogastric Feed Research Group (AARD)

- **Research currently focuses on:**
  1. Novel or currently underutilized grains, legumes, oilseeds and their fractions/co-products
  2. Mitigating potential adverse effects of including these on performance and product quality
  3. Processing methods that improve the feeding value



# Trends in feed costs (1990-2010)





# Disposition of Canadian wheat (excluding durum), 2005-2010

	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Total Production	19,834	21,919	16,373	23,092	21,115	20,200
Total Exports	11,426	14,949	12,682	14,966	14,300	13,500
Total Domestic Use	7,441	7,811	5,732	7,078	7,274	7,050
<i>Food</i>	2,742	2,703	2,628	2,509	2,550	2,600
<i>Industrial</i>	178	411	394	571	750	800
<i>Seed</i>	824	683	782	773	780	800
<i>Feed, waste, dockage and handling loss</i>	3,697	4,014	1,928	3,225	3,194	2,850





# Opportunities and challenges with feeding wheat DDGS to poultry

## Opportunities

- Cost
- Local availability
- Protein content
- Minerals highly digestible



## Challenges

- Fiber content
- AA balance & digestibility
- Handling issues
- Contamination
- Variation
- Maximum inclusion level(?)



# Questions guiding our research

- **Can we improve AA digestibility in DDGS?**
- **What are the 'limits' to DDGS inclusion in broiler diets?**
- **Can we increase nutrient density in DDGS?**



# PROJECT 1.

## Effect of enzymes and single screw extrusion on nutrient digestibility of triticale DDGS for broilers





# Project overview

- **Assay diets with 15 or 30% inclusion triticale DDGS with or without an enzyme complex**
  - Balance of diet was a complex basal
  - Enzyme complex (Canadian Bio-Systems) had XYL, GLU, FAA, HUT and INV activity
- **Ileal digesta collected at 28d of age**
  - 5 replicate pens of 12 birds/pen
  - Digesta pooled by pen





# Table 1. Effect of enzyme supplementation on AID coefficients in diets containing 15 or 30% triticale DDGS

	15%			30%		
	(-)	(+)		(-)	(+)	
DM	62.8	65.2	*	59.5	61.5	*
GE	71.0	73.1	*	67.3	69.0	*
CP	78.7	79.6	NS	77.5	77.6	NS
Lysine	82.7	83.9	NS	81.0	80.0	NS
Methionine	84.4	85.4	NS	81.8	81.5	NS
Threonine	73.9	75.3	NS	73.6	74.1	NS
Arginine	83.3	84.7	NS	84.2	84.7	NS

\*  $P < 0.05$ , NS =  $P > 0.10$



## Table 2. Effect of single screw extrusion on AID of AA from triticale DDGS

Amino Acid			
GE	50.2	55.8	**
CP	60.0	62.9	NS
Lysine	62.3	65.4	NS
Methionine	72.2	78.6	***
Threonine	60.0	62.9	NS
Arginine	75.0	80.8	T
Valine	68.9	75.7	***
Isoleucine	69.2	75.5	***
Leucine	71.8	77.9	***

\*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ ,  $T = P < 0.1$ , NS =  $P > 0.10$



# Findings

- **Enzyme complex improved AID of DM and GE, but not eAA**
  - Suggests reduction in antinutritive influence of fibre
- **SS extrusion improved AID of GE and selected AA**





# PROJECT 2:

## **Effect of twin screw extrusion on nutrient digestibility of wheat and corn DDGS for broilers**







# Project overview

- **Assay diets containing 15 or 30% inclusion of TS extruded or regular wheat or corn DDGS**
  - Extrudate produced from same DDGS stock
- **Ileal digesta collected at 28d of age**
  - 5 replicate pens of 12 birds/pen
  - Digesta pooled by pen



# Table 3. Effect of DDGS type and twin screw extrusion on AID coefficients of AA from DDGS

Amino Acid						
Lysine	73.1	65.9	**	59.8	79.2	***
Methionine	86.4	85.4	NS	81.6	90.2	***
Threonine	70.8	70.1	NS	63.8	77.1	***
Arginine	83.2	81.3	NS	75.6	88.9	***
Valine	79.5	78.0	NS	72.0	85.4	***
Isoleucine	79.2	77.2	NS	71.9	84.4	***
Leucine	85.9	81.9	**	79.5	88.4	***

\*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ , NS =  $P > 0.10$




# Findings

- **AID coefficients for AA similar between corn and wheat DDGS**
  - Coefficients currently used for corn DDGS proxy for wheat DDGS when formulating diets
- **Sizeable improvements in AA digestibility achieved through TS extrusion**
  - E.g. AID of Lys improved nearly 35%





## Table 4. Comparison of AID coefficients for AA from wheat DDGS from our study with published values

Amino Acid		Low	High	Mean (n=5)
Lysine	56.3	24.4	45.7	35.6
Methionine	82.2	69.3	76.4	73.7
Threonine	64.9	48.2	60.9	54.8
Arginine	75.6	63.3	68.8	68.2
Valine	72.3	58.6	69.7	64.7
Isoleucine	71.1	63.5	72.4	68.8
Leucine	77.3	72.7	77.0	73.4

Source: Poultry Science 88:2592-2599



# PROJECT 3:

## Effect of graded inclusions of wheat, corn and triticales DDGS on broiler performance and breast yield



# Project overview

- **Diets containing 0, 5 or 10% wheat, corn or triticale DDGS fed in 42-d performance study**
  - 4 replicate pens of 55 birds of each sex/treatment
  - ADG, ADFI, G:F calculated for each 14-d period
- **Breast muscle weight and yield (as % of BW) determined on d 37**
  - Based on sampling 5 birds per pen



**Table 5. Overall performance (d0 - 42) of broilers fed 0, 5 or 10% wheat, corn or triticale DDGS**

	<b>0%</b>			<b>5%</b>			<b>10%</b>			
	<b>Control</b>	<b>WDDGS</b>	<b>CDDGS</b>	<b>TDDGS</b>	<b>WDDGS</b>	<b>CDDGS</b>	<b>TDDGS</b>	<b>WDDGS</b>	<b>CDDGS</b>	<b>TDDGS</b>
<b>ADG, g/d</b>	62.44	61.25	61.39	60.62	61.78	60.69	61.33			
<b>ADFI, g/d</b>	91.54 <sup>cd</sup>	90.24 <sup>cde</sup>	92.64 <sup>c</sup>	100.60 <sup>b</sup>	89.56 <sup>de</sup>	88.32 <sup>e</sup>	104.48 <sup>a</sup>			
<b>G:F</b>	0.704 <sup>a</sup>	0.716 <sup>a</sup>	0.712 <sup>a</sup>	0.643 <sup>b</sup>	0.716 <sup>a</sup>	0.706 <sup>a</sup>	0.635 <sup>b</sup>			
<b>Breast Wt, g</b>	407.7	403.6	410.7	404.6	414.5	406.5	396.3			
<b>Breast Yield, %</b>	19.1	18.9	19.2	18.8	19.4	18.9	18.5			

*Different superscripts in rows denote significantly different means (P < 0.05)*





# Findings

- **Up to 10% inclusion of corn or wheat DDGS did not affect performance or breast muscle yield**
  - 5 or 10% triticale DDGS increased ADFI but similar ADG to other DDGS types
- **Diets containing 10% DDGS in each phase were at least \$5/T cheaper than the control**
  - For average AB producer this could amount to \$3,000 in feed savings per year, based on G:F from our study

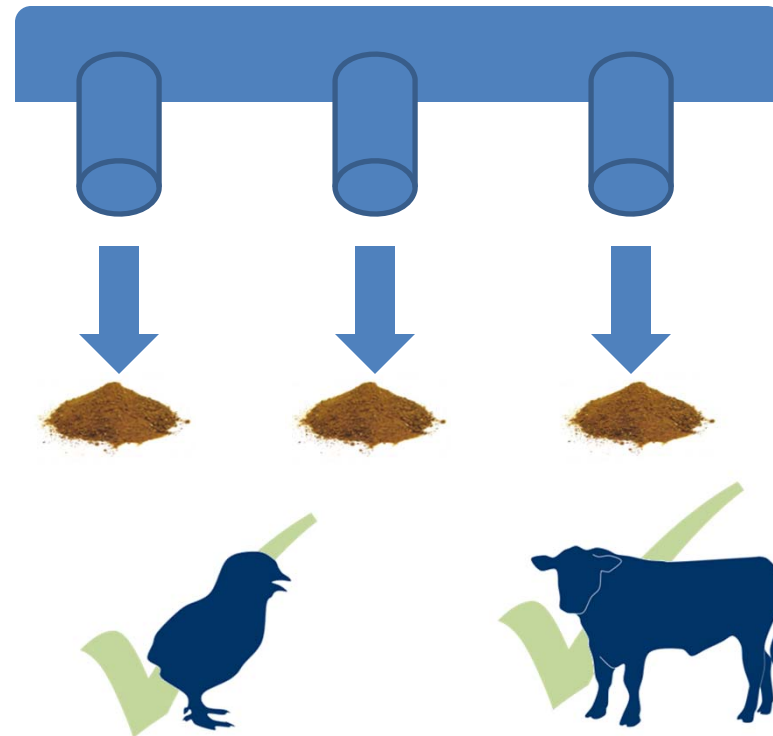
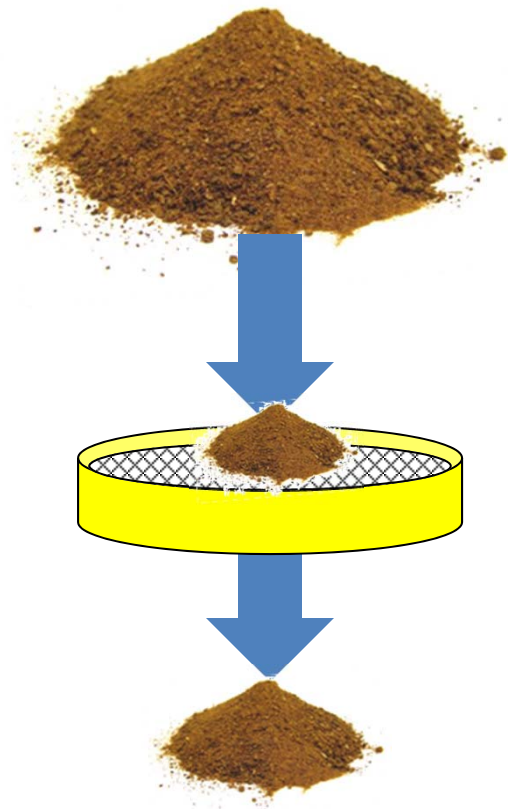


# PROJECT 4:

## **Effect of fractionation of wheat DDGS by particle size and weight on nutrient digestibility for broilers**



# The concept



# Equipment used to fractionate DDGS for this study





# Project overview

- **Wheat DDGS fractions (3) produced first by 2-step process**
- **Fed along side parent stock wheat DDGS in 21-d broiler digestibility trial**
  - Ileal digesta and excreta collected after 7d on test diets
  - 6 replicate cages of 12-13 male broilers/treatment



## Table 6. Analyzed composition of wheat DDGS fractions

	Fraction 'A'	Fraction 'B'	Fraction 'C'	Fraction 'D'
Yield, %	26.69	21.75	22.48	28.11
Crude protein	48.51	39.86	34.95	29.34
Lysine	0.96	0.85	0.76	0.58
Threonine	1.28	1.07	0.90	0.69
Methionine	0.69	0.54	0.46	0.33
TSAA	1.69	1.36	1.20	0.87
Tryptophan	0.36	0.30	0.28	0.22
Crude fat	2.66	3.29	3.00	2.73



## Table 6. Analyzed composition of wheat DDGS fractions

	Fraction 'A'	Fraction 'B'	Fraction 'C'	Fraction 'D'
Crude fibre	4.79	7.38	9.72	12.13
ADF	10.14	11.42	13.00	15.38
NDF	25.35	29.36	39.92	40.68
Total dietary fibre	17.55	26.55	31.84	37.36



# Findings (very preliminary)

- **AID coefficients for AA do not appear to be different between fractions and parent stock DDGS**
  - Suggests that fibre content may not be the major factor affecting AA digestibility in DDGS??
- **Benefit of fractionation seems to be confined to increasing density of digestible AA**



# Putting it all together

- **Extrusion or air classification could increase the value of wheat DDGS to chicken producers**
  - Value added potential for ethanol producers???
- **AID AA coefficients for wheat DDGS  $\approx$  corn DDGS**
- **Only thing Wheat DDGS inclusion up to 10% seems to reduce is feed cost**
  - No apparent impact on performance or product yield



# Putting it all together

- **DDGS fractionation???** (stay tuned)
  - Has the ability to concentrate AA and fibre
  - Do fractions differ in AID / ATTD coefficients???





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