Managing Feed Costs

March 28, 2011

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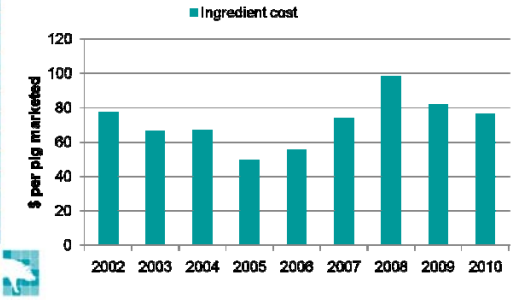
Research Scientist – Nutrition

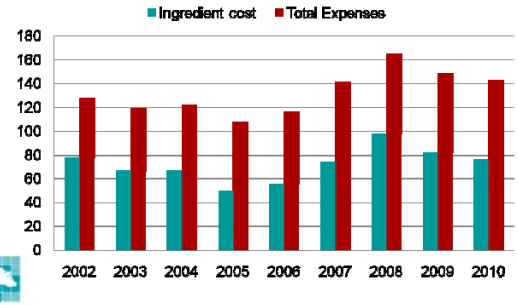
What has happened to feed costs??

$ per pig marketed



Source: M. Ferguson, SaskPork

$ per pig marketed



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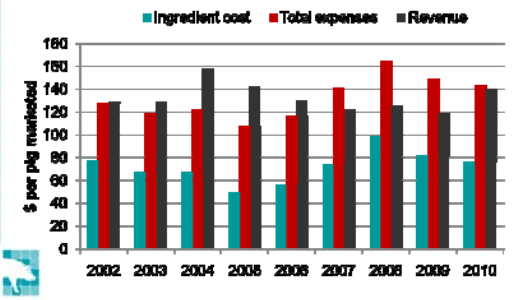
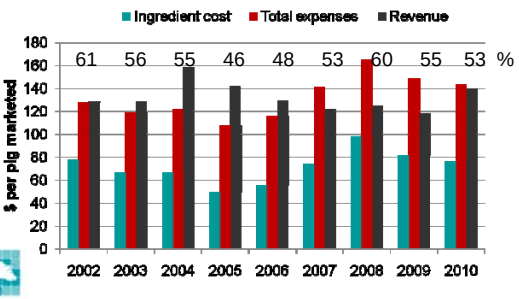
$ per pig marketed



Source: M. Ferguson, SaskPork

$ per pig marketed
Feed ingredient as a % of total cost



Source: M. Ferguson, SaskPork

Dietary Energy

- **Supplying energy to the growing pig is the most significant cost in pork production**
- Examining
  - NE values of ingredients
  - Efficiency of energy utilization
  - Source of energy

Energy systems

- **DE vs NE (s)**
  - Estimated that **$2 to $3 per pig saved** by switching to the NE system
  - Provides a system to accurately price and rank ingredients according to the energy content
  - The NE system is "better" at predicting outcome
  - But we still need good inputs!!

Experimental diets, weanling

Ingredient	Formulated NE, Mcal/kg 2.21	2.32	2.42
Wheat	51.9	57.5	63.2
SBM	27.0	19.3	11.5
Fish Meal	8.50	8.50	8.50
Soy protein conc	2.25	2.25	2.50
Skim milk	2.50	2.50	2.50
Lactose	5.00	5.00	5.00
Canola oil	0.50	1.75	3.00
DE, Mcal/kg	3.26	3.32	3.37
NE, Mcal/kg	2.15	2.26	2.37
TID Lys, %	1.47	1.51	1.67
CP, %	29.0	26.7	24.7

Experimental diets - Growers

Ingredient	Formulated NE, Mcal/kg 2.18	2.29	2.40
Barley	55.45	31.33	6.80
SBM	24.00	22.20	20.40
Wheat	15.00	39.55	64.51
Canola oil	1.00	2.25	3.50
Lysine	0.190	0.270	0.350
L-Threonine	0.060	0.093	0.125
DL-Methionine	0.045	0.058	0.070
L-Tryptophan	0.005	0.005	0.000
DE, Mcal/kg	2.93	3.13	3.21
NE, Mcal/kg (Retained energy)	2.12	2.22	2.28
NE, Mcal/kg (Calorimetry)	2.23	2.27	2.40

RE – FHP assumed to be 170 kcal/kg $BW^{0.60}$ (van Milgen and Noblet, 2003)
Calorimetry – application of Brouwer's equations (1965)

Correlations (barrows) 9 and 25 30 to 60 kg kg fed diets with increasing NE concentrations and at 3 feeding levels

DE intake, and		
ADG	0.9157	0.57
ADFI	0.9862	0.97
G:F	-0.1350	-0.08
Empty body CP content	-0.2347	-0.19
Empty body lipid content	0.6005	0.43
NE intake, and		
ADG	0.8982	0.55
ADFI	0.9636	0.96
G:F	-0.1219	-0.05
Empty body CP content	-0.2858	-0.23
Empty body lipid content	0.6592	0.47

Correlations (barrows) 9 and 25 (30 to 60 kg) fed diets with increasing NE concentrations and at 3 feeding levels

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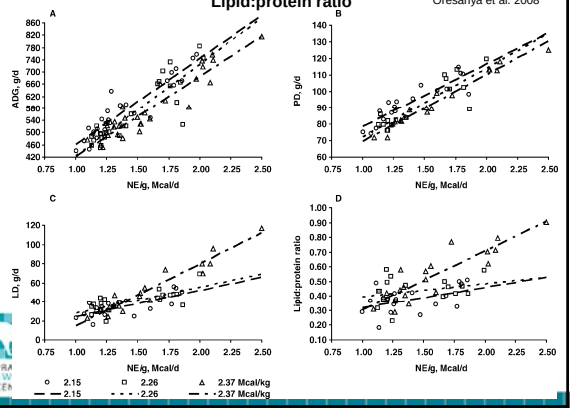
Relationship of NE available for growth and ADG, PD, LD and the Lipid:protein ratio

Oresanya et al. 2008



Efficiency of energy utilization, for protein or lipid deposition (g/Mcal), 30 to 60 kg BW

	NE, Mcal/kg			Feeding level, % ad lib		
	2.18	2.29	2.40	80	90	100
Protein deposition,						
DE	43.0	42.9	39.7	44.7	41.4	39.6
NE[a]	69.7	72.0	66.3	76.3	68.1	63.8
Lipid deposition,*						
DE	34.0	36.2	39.0	33.0	31.3	45.1
NE[a]	54.8	60.9	65.0	56.4	51.4	47.4

[a]Calculated using retained energy + fasting heat production (FHP assumed to be 170 kcal/kg $BW^{0.60}$;van Milgen and Noblet, 2003).

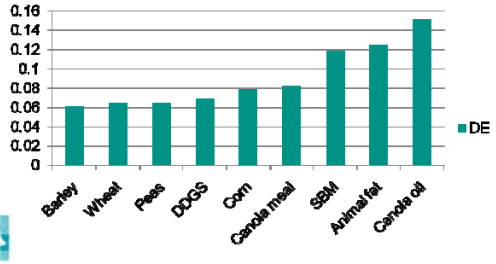
*Effect of Feeding level, P < 0.001, all other treatments, P > 0.05

Feeding level x NE, P > 0.05

Conclusions

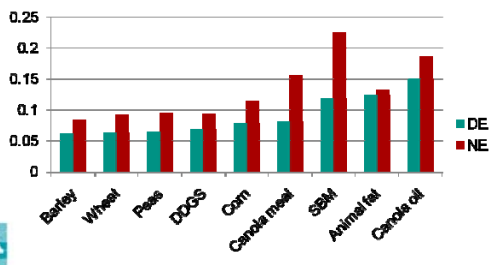
- Changes in dietary energy concentration or intake alter the composition of gain without necessarily changing overall BW gain
- **NE is a better predictor of composition of gain than DE**
  - **Bottom line**
- **We still don't fully understand the utilization and partitioning of energy in the growing, finishing pig**

Ingredient selection, $ per Mcal DE



SK Feb 2011 prices

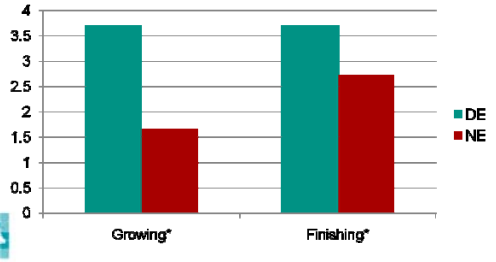
Ingredient selection, $ per Mcal



SK Feb 2011 prices

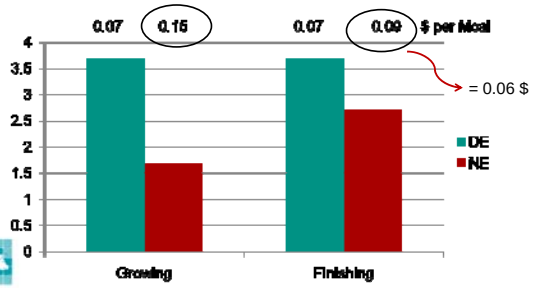
Value of NE for ingredients

Corn DDGS, Mcal/kg



*NE - Stein, 2009

Corn DDGS, Mcal/kg*



*Stein, 2009

Dietary Energy

- **A growing pig, assume:**
  - 2. 5 kg/day intake
  - NE content = 2300 kcal/kg
  - Consumes 5.8 Mcal NE/day
  - If 30 % DDGS x difference of 0.06 $ /Mcal x 5.8 Mcal/d = 0.10 $ per pig /d
  - Or 0.10 $ per kg of gain

Need accurate values for the NE contents of ingredients!!

Energy values for corn DDGS

as fed, Mcal/kg

Reference	DE	NE	
		Grow	Finish
NRC 1998	3.1	1.17	1.17
Sauvant 2004	2.7	1.67	1.94
Stein (2009)		1.67	2.72
Stein and Shurson 2009, n=11			
Minimum	3.48		
Maximum	4.04	(chemically similar to Stein 2009)	
Average	3.64		

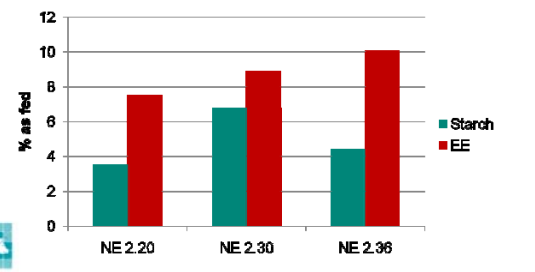
- Note: conventional corn DDGS has 10 to 11 % fat, however, some is now available with only 6 to 8 % fat, worth only 85 to 90 % of price of conventional,
- Sauvant 2004, 3.9 % EE

Energy values for wheat DDGS

(as fed, Mcal/kg)

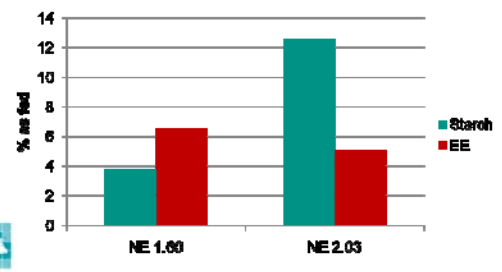
	DE		NE	
Reference	Grow	Finish	Grow	Finish
Sauvant 2004, < 7 % starch	2.70	2.94	1.60	1.72
Sauvant, 2004 > 7 % starch	3.27	3.42	2.03	2.13
Nyachoti et al 2005	3.20			
Widyaratne and Zijlstra 2007	3.62		2.14	
Zijlstra and Beltranena 2007	3.86		2.47	

Energy in corn DDGS



Shurson 2010

Energy in wheat DDGS



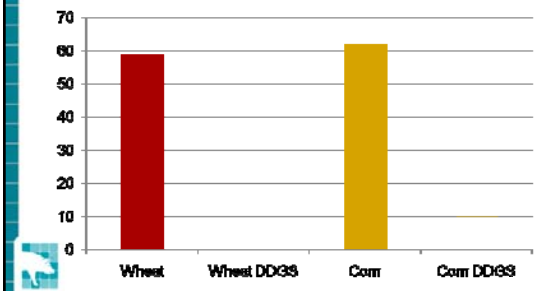
Source of energy

•All nutrients, (carbohydrates, lipid, protein) except water and ash provide the pig with energy

•The pig has an obligatory requirement for glucose
•Glucose can be obtained from, - diet (starch)
• - endogenous synthesis
•The pig has a dietary requirement for glucose?

Does dietary starch impact protein deposition in the growing pig?

The main difference between DDGS and the source grain is the removal of starch



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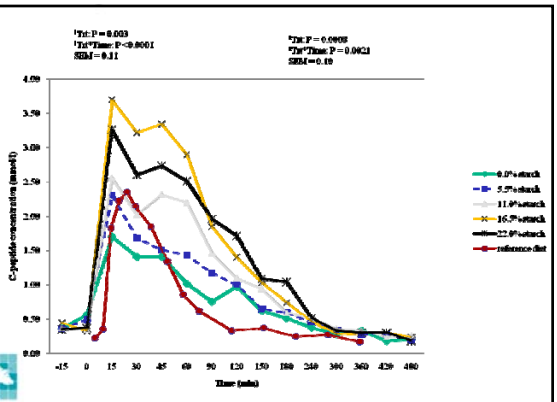
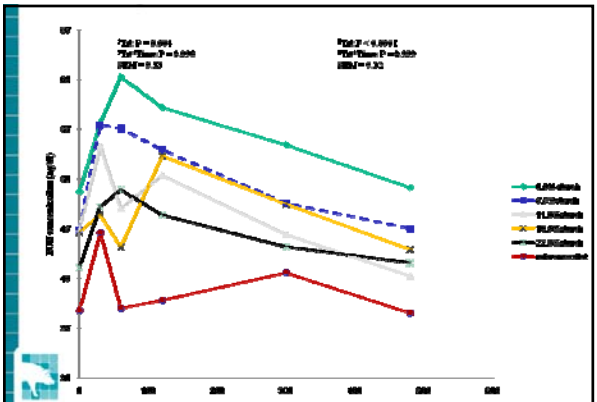
Does dietary starch impact protein deposition in the growing pig?

Response of growing pigs to increasing starch content of the diet

Added starch, %

Nutrient gain, kg	0	5.5	11	16.5	22	SEM	P = linear
Crude protein	3.20	3.09	3.65	3.84	4.02	0.22	<0.001
Crude fat	0.52	0.42	0.45	0.76	0.81	0.14	<0.001
Water	13.23	13.22	14.63	15.73	15.68	0.65	<0.001
CP_{gain} /CP_{intake}	.329	.316	.362	.349	.365	.017	<0.001
CP_{gain} /DE_{intake}, g /kcal	1.15	1.14	1.28	1.25	1.27	0.16	0.034





Corn vs wheat DDGS

- Corn DDGS
  - Extensively researched
  - Product has (or should have) reduced variability
- Wheat DDGS
  - Research lacking
  - Variability – ie. How much wheat in wheat DDGS?

Pricing need to also consider

- Corn DDGS
  - 30 % inclusion reduced dressing % by 1.2 %
  - Withdrawal strategies required to mitigate concerns with fat quality
- Wheat DDGS
  - Dressing percent reduced, 0.45 % for every 7.5 % added (1.2% for 20% inclusion)

Labelling of DDGS, CFIA Table IV

- 5.5.21
- *Wheat distillers grains dehydrated* (IFN 5-05-193) is the product obtained after the removal of ethyl alcohol by distillation from the yeast fermentation **of a wheat or a grain mixture** in which **wheat predominates** by separating the resultant coarse grain fraction of the whole stillage and drying it by methods employed in the grain distilling industry. It shall be labelled with guarantees for **minimum crude protein, maximum moisture and maximum crude fibre**.

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Take home message

- Substantial savings can be realized by proper usage of by-products from the ethanol industry
- However, variability is still a very great concern..
- ...and regardless of whether we use NE, or DE, etc. adequate characterization of these ingredients is essential

Energy systems

- **DE vs NE (s)**
  - Estimated that **$2 to $3 per pig saved** by switching to the NE system
  - Provides a system to accurately price and rank ingredients according to the energy content
  - The NE system is "better" at predicting outcome
  - But we still need good inputs!!

Net energy value of canola meal and full-fat canola seeds

Saskatchewan Canola Development Commission

CANOLA CANADA

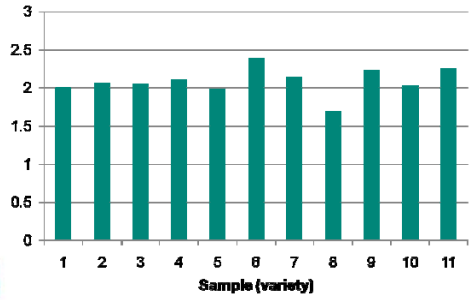
Net energy value of canola meal and full-fat canola seeds

	DE	NE
	Mcal/kg as fed	
CM	3.12	2.14
FFCS	4.73	3.35

Growth trial indicated NE was slightly underestimated for the FFCS

Field Peas, 11 varieties

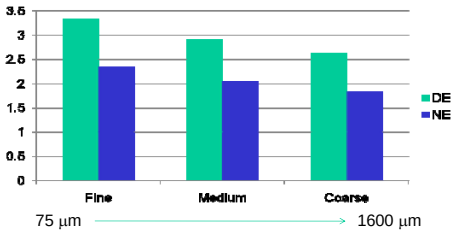
NE Mcal/kg as fed



Field Peas, 11 varieties

Mcal/kg as fed

Effect of grind



75 μm → 1600 μm

Fine, 1/64 (0.74 mm) screen
Medium, 8/64 (3.28) screen
Coarse, 13/64 (5.4 mm)

Montoya and Leterme, 2010

Barley and wheat and fineness of grind

- Barley-SBM diets, wheat-SBM diets
- HM (sieve size 3 or 5), crimping RM (0.5 to 0.8 mm gap), flattening RM (0.15 to 0.35 mm gap), triple RM
- Fine vs coarse
- **Results**
- ADFI decreased with fineness of grind
- Overall mill type had no effect on DE content of barley or wheat, performance was maintained if ADFI was maintained

Laurinen et al. 2000

Conclusions

- Canola meal and full-fat canola seed contain about 2.14 and 3.35 kcal NE/kg
- Growing pigs (30 kg) can tolerate up to 22 % CM or 10 % FFCS

- Field peas contain 1.85 to 2.3 kcal NE/kg, depending on fineness of grind

Development of diets for low birth-weight piglets which optimize net returns to the producer

- Introduction
  - Light-weight piglets
    - always “lag behind”
    - contribute to variability in grow-out
    - Some piglets do not eat for at least 24 hours post-weaning
  - Should a diet be formulated specifically for the light weight piglet?
  - Is the problem nutrients? or access to feed?

Materials and Methods

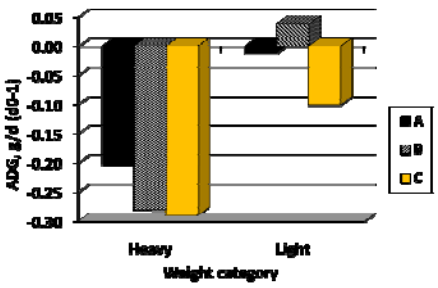
- 2 diets, complex ($720) and simple ($340)
- 3 feeding regimes a) complex 0 to 1, b) complex 0 to 4, c) simple 0 to 14
- Two body weights at weaning
- Creep or no creep

		Dietary regime					
Kg/d		A	B	C		SEM	P value
ADG	d 0-1	-0.11	-0.12	-0.20		0.02	0.002
	d 2-4	0.03	0.14	0.06		0.01	<0.001
	d 5-7	0.14	0.13	0.15		0.01	0.21
	d 8 - 14	0.31	0.30	0.33		0.01	0.05

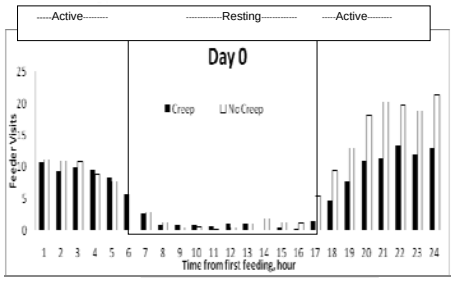
A- Complex 0 – 1
B- Complex 0 – 4
C – Simple 0 - 14

		Weaning weight				
Kg/d		Heavy	Light		SEM	P <
ADG	D0-1	-0.26	-0.02		0.02	<0.001
	D 2-4	0.07	0.08		0.00	0.04
	D 5 – 7	0.12	0.15		0.01	0.001
	D 8 – 14	0.29	0.34		0.01	<0.001

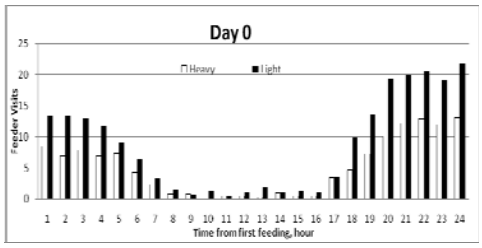
		Creep feed				
Kg/d		No	Yes		SEM	P <
ADG	D 0 – 1	-0.12	-0.16		0.02	0.36
	D 2 -4	0.08	0.07		0.01	0.43
	D 5 – 7	0.16	0.12		0.02	0.20
	D 8 – 14	0.33	0.30		0.02	0.20



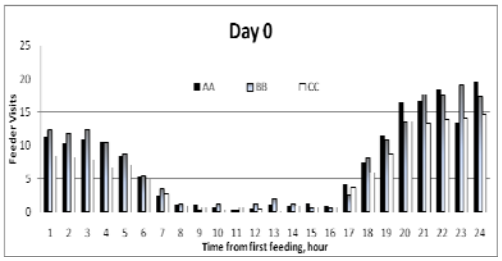
Diet by BW, P < 0.01



	Creep	No creep	SEM	P =
Day 0	6.3	8.6	0.45	0.02
Day 1	7.0	9.1	0.32	0.04
Day 4	7.4	8.0	0.29	0.12



	Heavy	Light	SEM	P =
Day 0	5.61	9.34	0.44	0.08
Day 1	6.83	9.28	0.32	0.07
Day 4	7.37	8.00	0.27	0.007



	A	B	C	SEM	P =
Day 0	12.55	12.60	9.98	0.52	0.20
Day 1	11.94	14.33	11.65	0.60	0.007
Day 4	12.37	14.08	11.00	0.59	0.06

Conclusions

- In a “non-competitive” environment light-weight piglets performed equal to their heavier littermates
- Benefits of creep feeding were not maintained
- “Complex” diet didn’t improve performance, --in these conditions

Managing Feed Costs

Checklist

•What are you feeding for? Benchmark?
- •Growth rate
- •Feed efficiency
- •Return over feed cost
- •Net return

•Cost of ingredients
- •Risk management, contracts
- •Availability
- •Variability

Managing Feed Costs

Checklist

•Energy content of ration
- •Increase DE, add fat, improve feed efficiency
- •But ↑↑ $$$!!

•Feed Budgets

•Phase feeding
•Split-sex feeding

•Manure production

Managing Feed Costs

Checklist

•Mill capacity
•Feed form
- •Pellet quality
- •Equipment maintenance, efficiency and cost

•Flow
•Feeders, wet/dry
- •Reduce dust
- •Improve palatability

•Packer constraints and contract

Managing Feed Costs

Checklist

- Out of feed events
- Water availability and flow
- Wastage
  - Feeder adjustment
  - Cleanliness
  - Rodents
- Seasonal effects on performance

Acknowledgements

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