Impact of low energy diets on the bottom line

Miranda Smit, Garrett Rozeboom,
Vicente Zamora, José Landero,
Malachy Young, Denise Beaulieu,
and **Eduardo Beltranena**

Gowans FEED CONSULTING

PRAIRIE SWINE CENTRE INC.

Alberta Agriculture and Rural Development

Feed energy

1. Feed is the largest single cost of pork production.
2. Energy is the most costly component of feed.
3. Hogs consume the most feed in farrow-to-finish.

- Therefore, nothing impacts the profitability of pork producers more than feed energy level.

What are the energy requirements of pigs?

- Feeding diets high in coproducts, we have been wondering if we are feeding enough or too low energy.
- No table for feed energy requirements in NRC 2012.
- Tables show a ‘standard’ **2475 kcal/kg NE**.
- Footnoted ‘*dietary energy content relates to corn-SBM based diets*’.

Dietary energy

- When dietary energy concentration was increased, feed intake was reduced, G:F was improved (Beaulieu et al., 2009).

- As dietary energy decreased, growth was decreased when energy intake or caloric efficiency were reduced (Quiniou and Noblet, 2012).

- If caloric intake is maintained, growth is unaffected when changing dietary energy concentration(Weber et al., 2006).

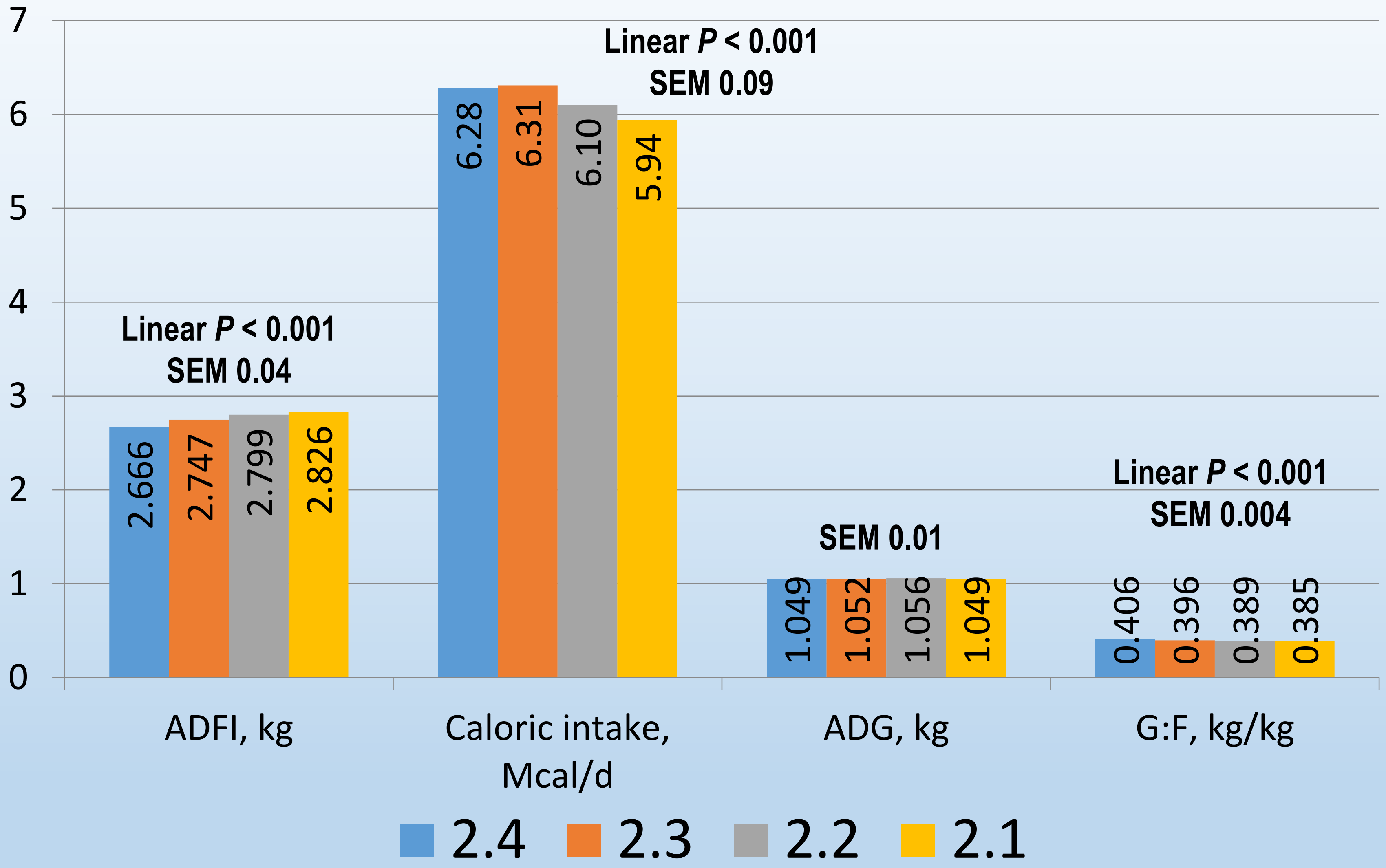
High, enough or low energy?

- The answer is *'it depends…'* largely on feed intake.
- American reports showed that hogs fed corn-SBM diets respond to fat inclusion by growing faster.
- What about diets based on our Prairie grains instead of corn-SBM?
- Share results of 2 commercial trials where we evaluated how our Prairie grain diets stacked to feed energy levels similar to a corn-SBM diets.

Exp 1.‘Constant’ feed NE levels

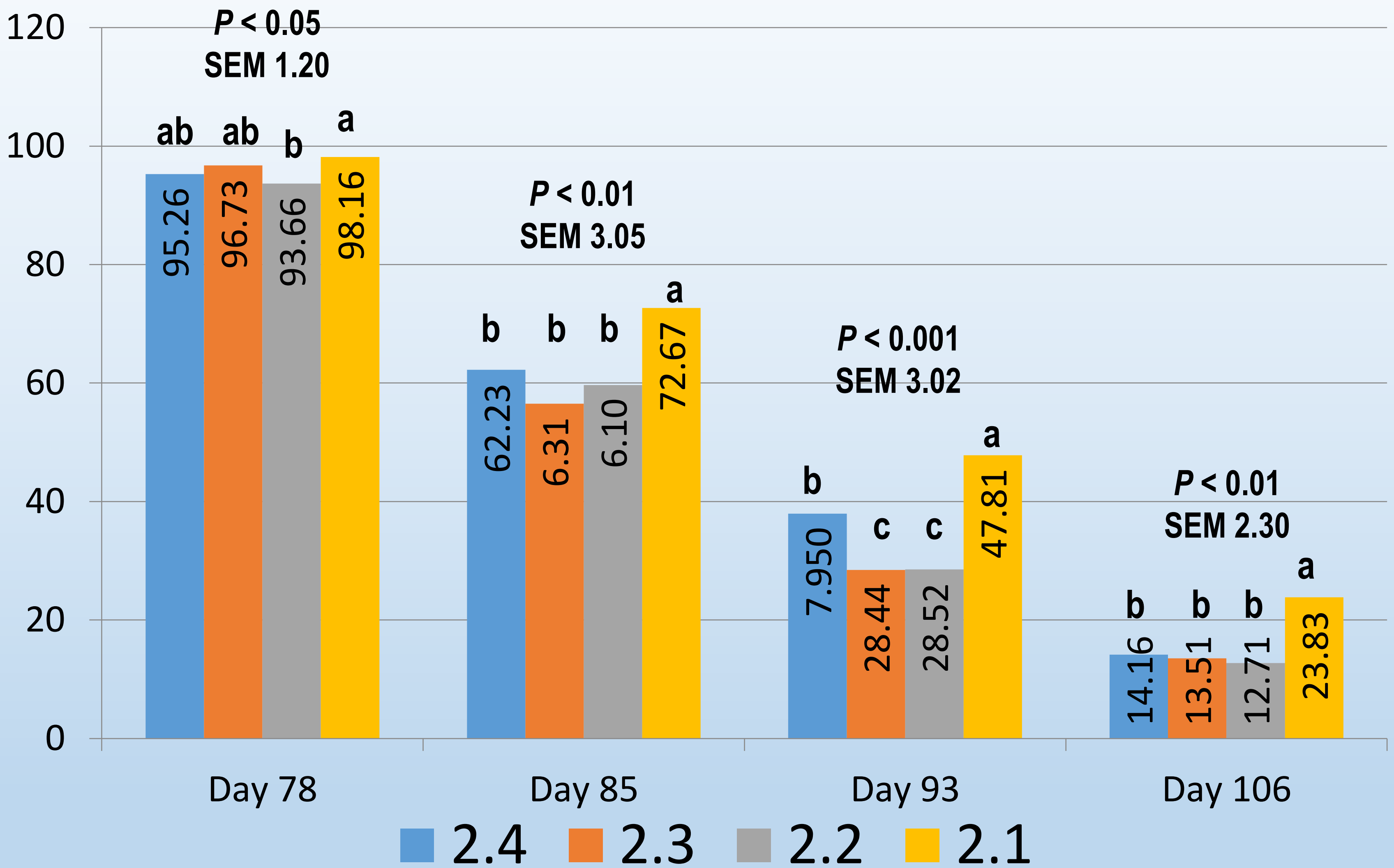
- 1008 (30 kg) housed in 48 pens, 21 barrows or 21 gilts.
- **Fed 2.4, 2.3, 2.2, or 2.1 Mcal NE/kg over 5 phases.**
- Wheat DDGS inclusion decreased from 25 to 16.5% .
- Wheat, field pea, and canola oil included in 2.4 NE diets.
- Barley and oat grain included in 2.1 Mcal NE diets.
- Pen BW and ADFI were measured d0, 21, 42, 56, 70, weekly thereafter, and slaughter weight (120kg).
- Hogs were slaughtered at Maple Leaf, Brandon, MB.

Constant feed NE levels



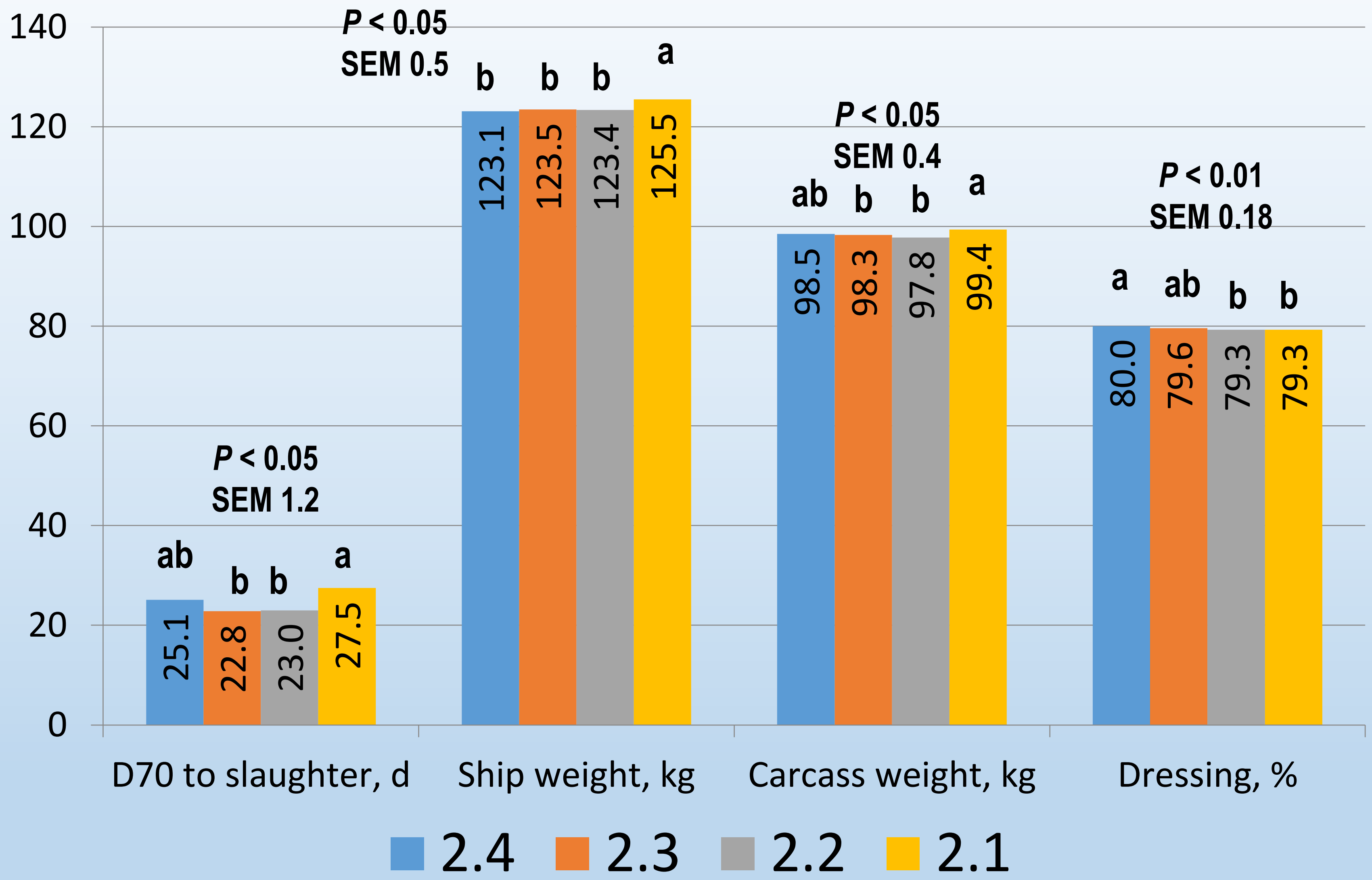
6 barrow + 6 gilt pens/NE level

% hogs remaining in pens



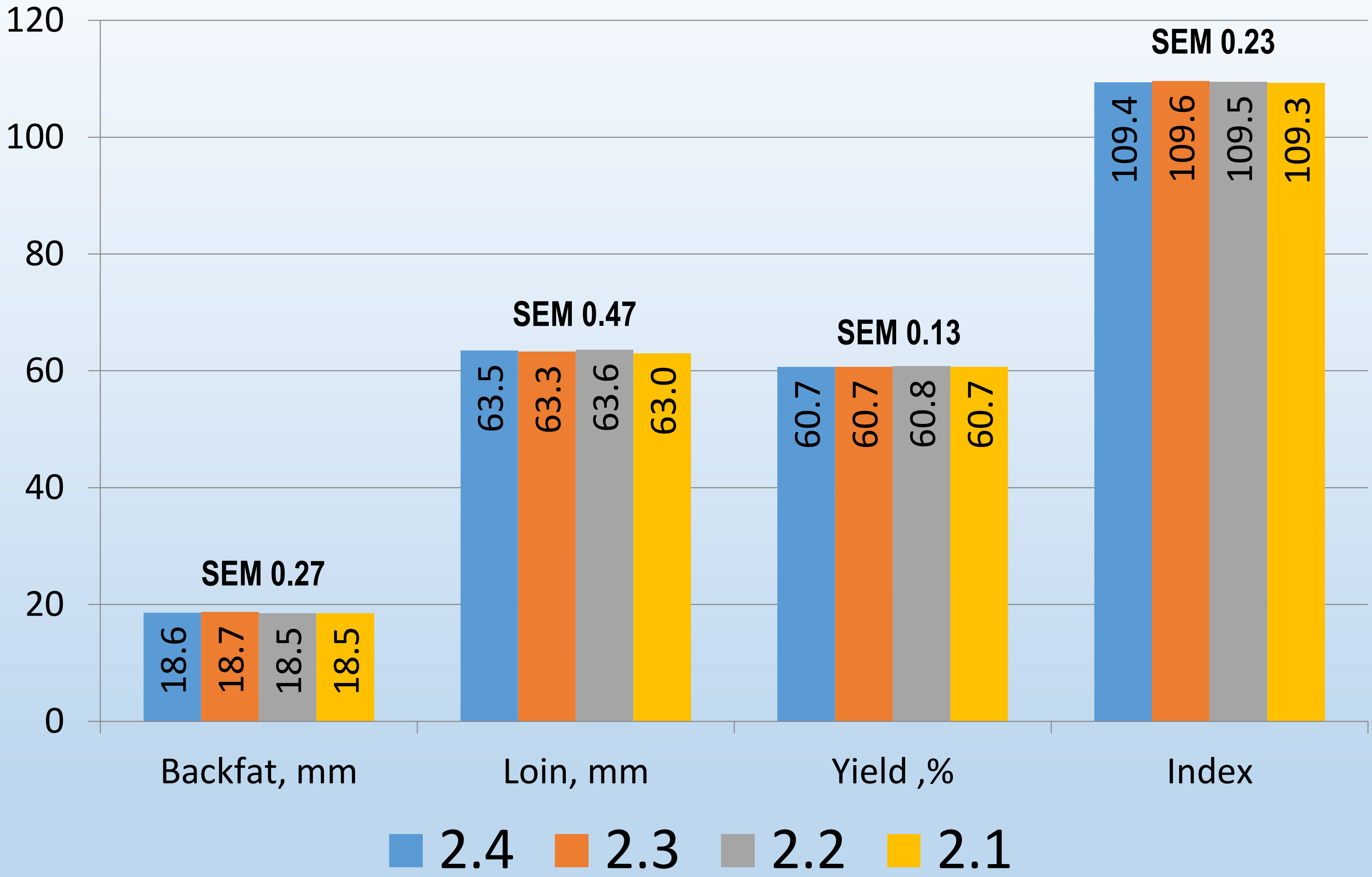
6 barrow + 6 gilt pens/ NE level

Days to slaughter, dressing



6 barrow + 6 gilt pens/NE level

Carcass traits



6 barrow + 6 gilt pens/NE level

Efficiencies

	Constant NE, Mcal/kg					*P* value	
	2.4	2.3	2.2	2.1	SEM	NE	Linear
Lean gain, g /d	468.8	477.5	473.9	465.4	5.12	0.358	0.550
g lean gain/Mcal NE	**76.2b**	**76.2b**	**77.7ab**	**78.9a**	**0.87**	**<0.050**	**<0.010**
g lean gain/g SID Lys	31.8	31.9	32.3	32.4	0.25	0.183	<0.050

6 barrow + 6 gilt pens/NE level

Income over feed cost

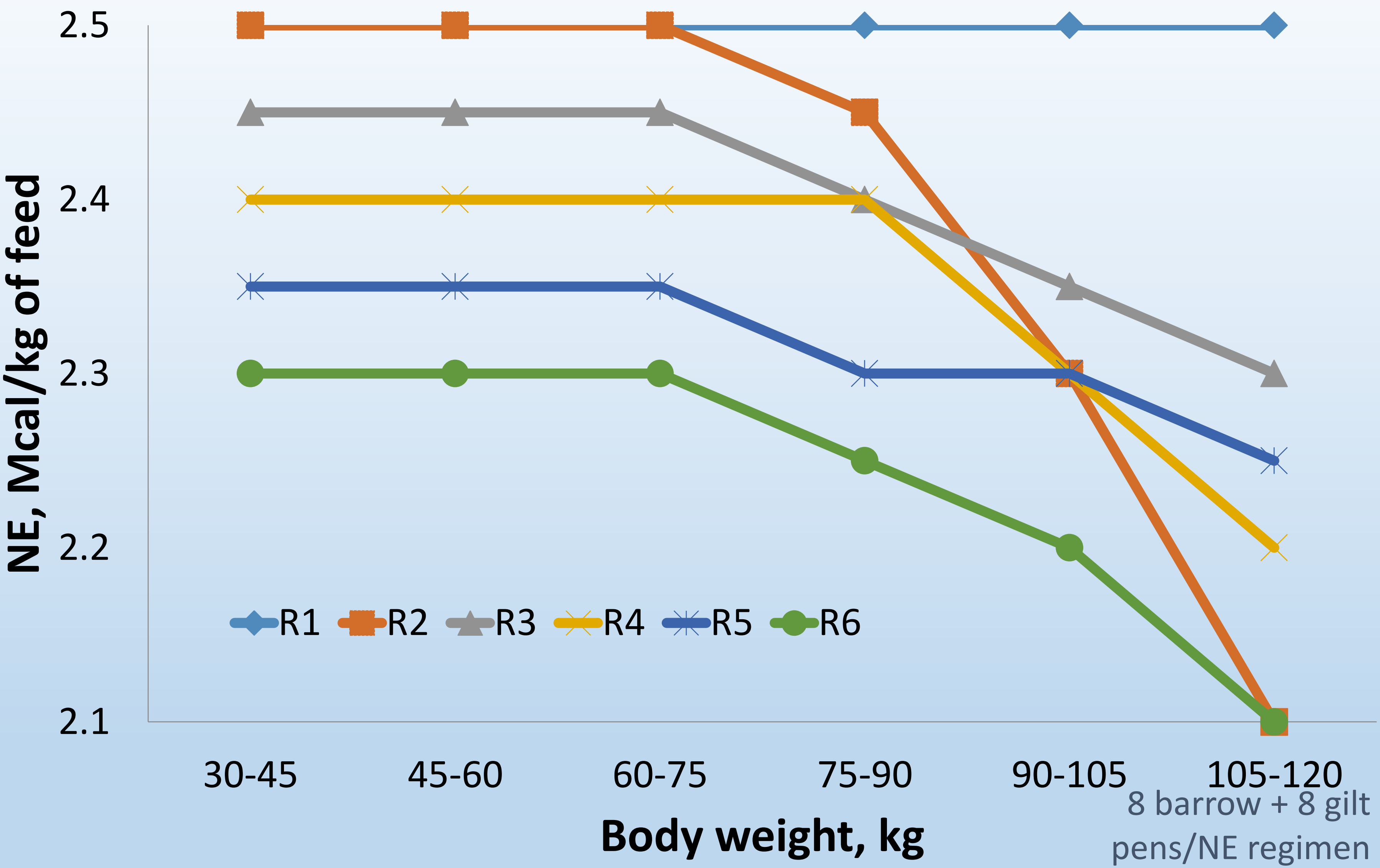
	Constant NE, Mcal/kg					*P* value
	2.4	2.3	2.2	2.1	SEM	Linear
Feed cost per tonne, $	**249.51**a	233.13b	216.22c	**198.81**d	0.354	<0.001
Feed cost per kg BW gain, $	**0.67**a	0.63b	0.60c	**0.57**d	0.006	<0.001
Feed cost per hog, $	**62.50**a	59.58b	56.72c	**54.66**d	0.530	<0.001
IOFC per hog, $	**61.02d**	63.50c	65.93b	**71.43a**	0.853	<0.001

6 barrow + 6 gilt pens/NE level

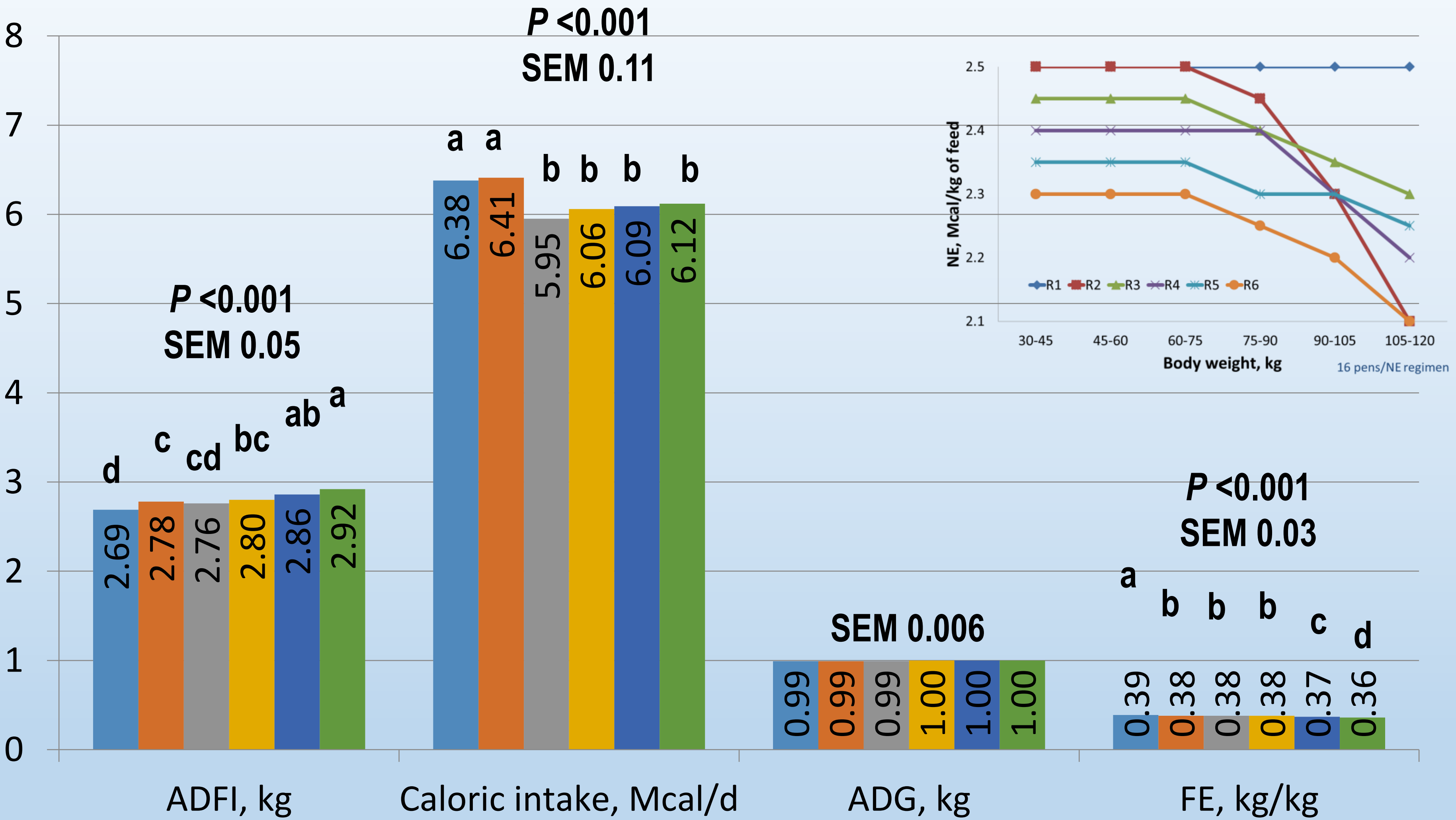
Exp 2. Decreasing feed NE level

- In young pigs, appetite or digestive capacity restricts energy intake limiting protein deposition.
- As pigs grow, they overcome this limitation, but fat deposition then increases progressively faster.
- Dietary energy level could potentially be reduced as pigs grow to mitigate feed cost.
- However, it is not clear…
    1) at what dietary energy level pigs should start,
    2) how long it should be fed for,
    3) if it should drop (curve) down, and if so,
    4) how aggressively feed energy should curve down.

Decreasing feed NE level

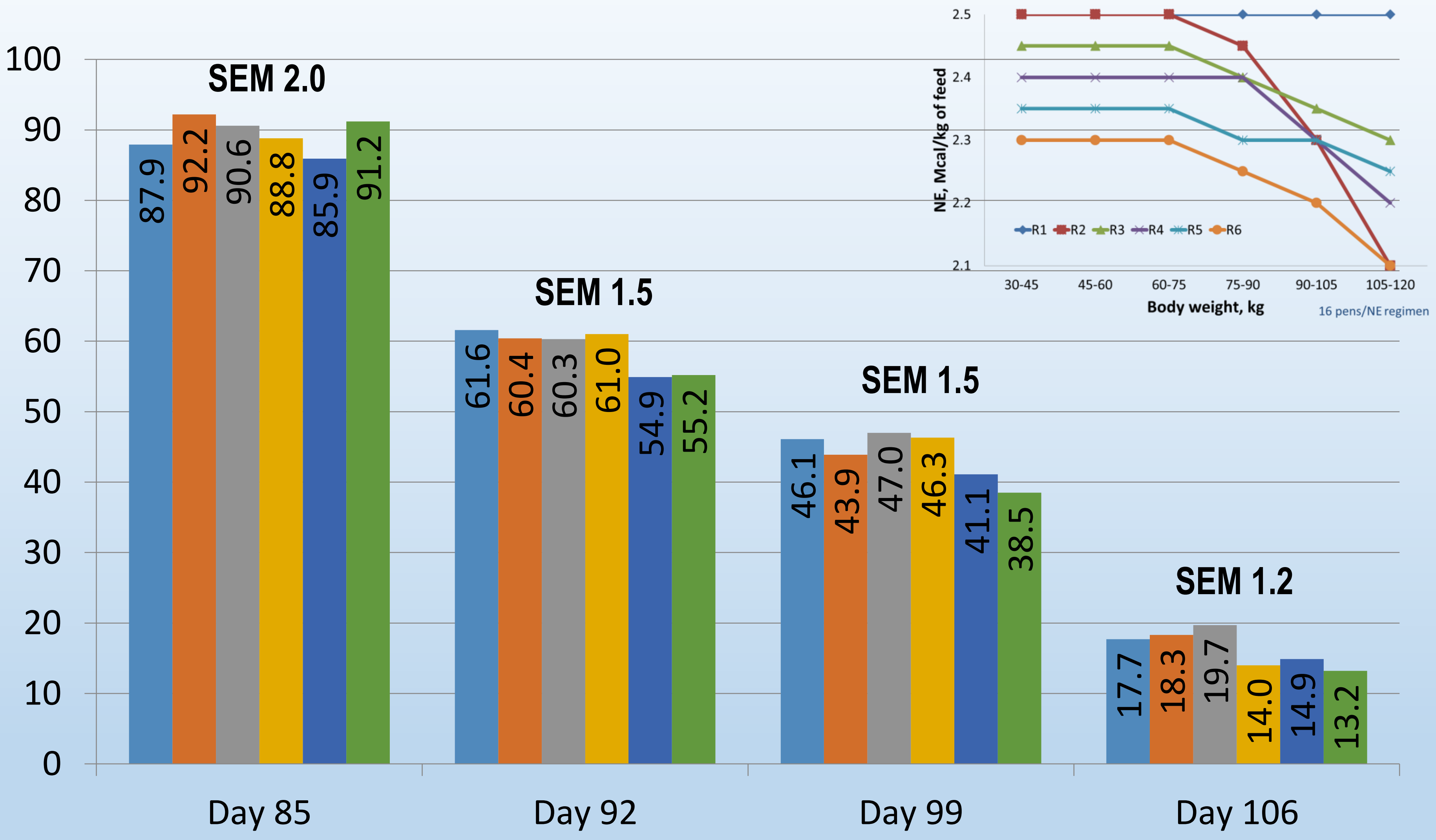


Decreasing feed NE level



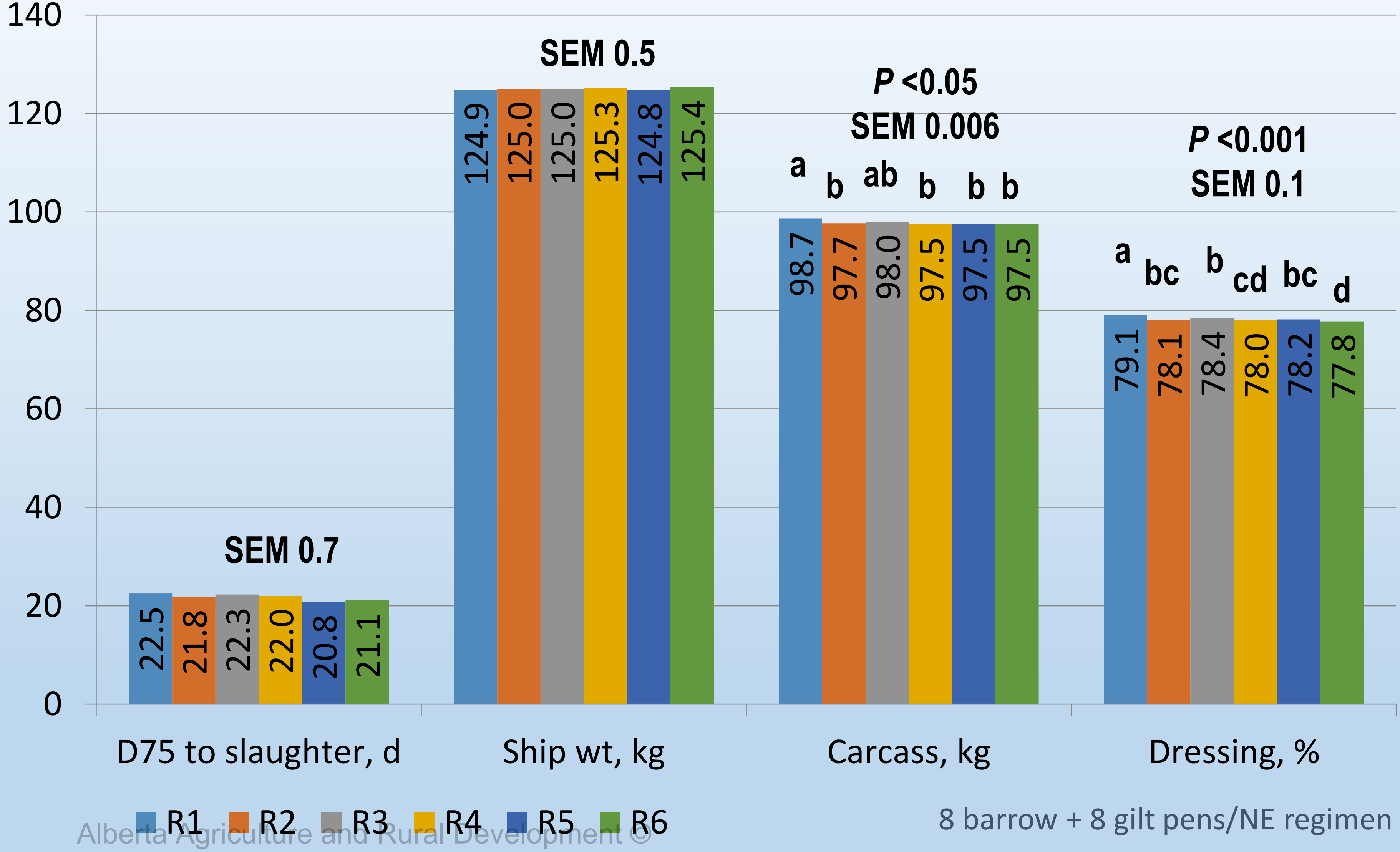
8 barrow + 8 gilt pens/NE regimen

% hogs remaining in pens



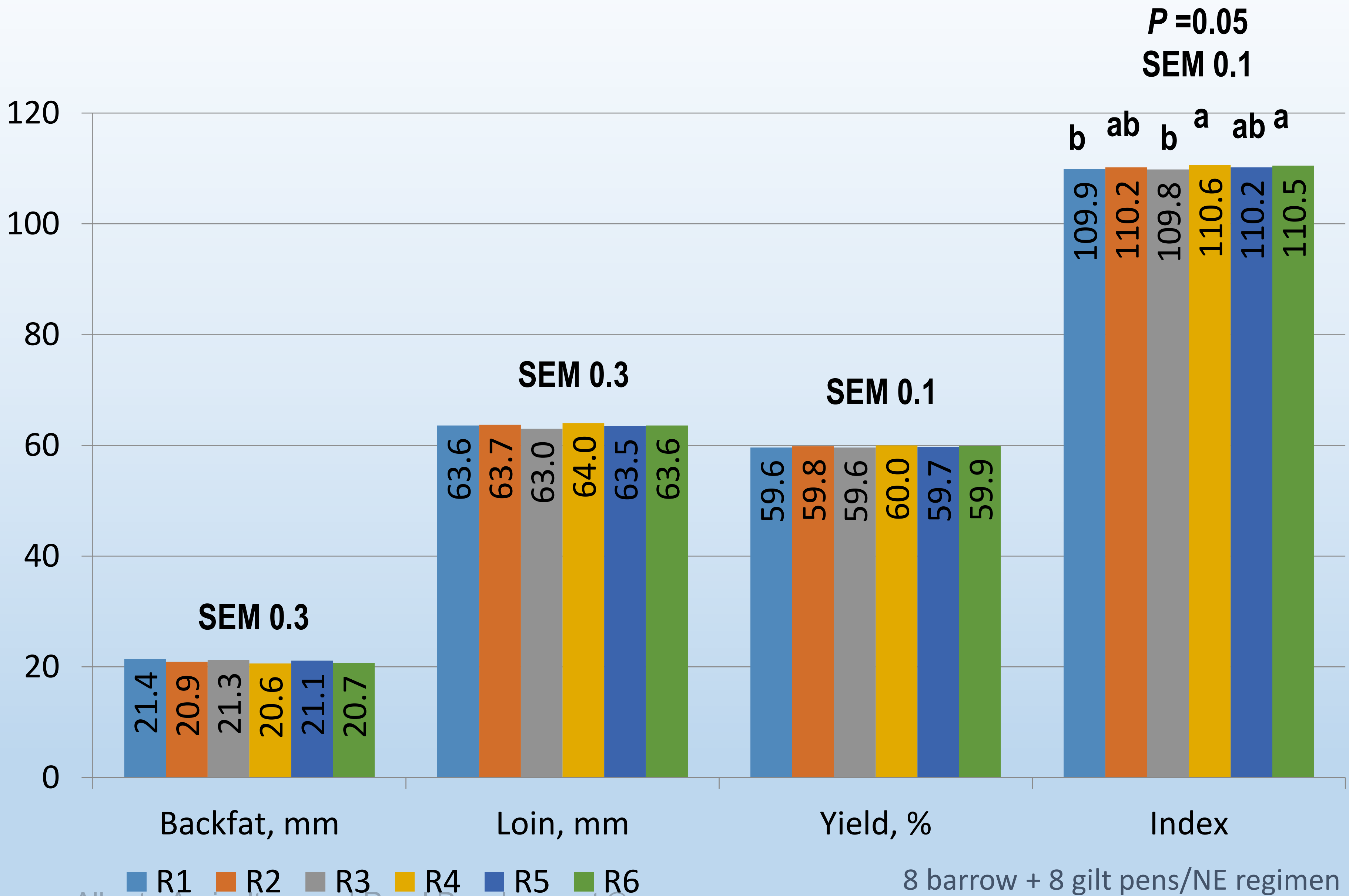
8 barrow + 8 gilt pens/NE regimen

Days to slaughter, dressing %



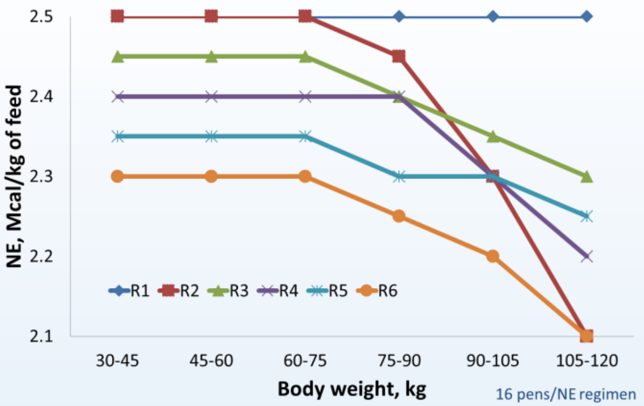
8 barrow + 8 gilt pens/NE regimen

Carcass traits



8 barrow + 8 gilt pens/NE regimen

Efficiencies



	NE Regimen							*P* value
	R1	R2	R3	R4	R5	R6	SEM	NE
Lean gain, g /d	442.1	439.6	436.9	442.3	441.7	441.2	3.0	0.682
g lean gain/Mcal NE	**71.3*c***	**69.7*d***	**74.5*a***	**73.6*ab***	**73.6*ab***	**72.4*bc***	0.9	**<0.001**
g lean gain/g SID Lys	**17.4*b***	**18.0*a***	**18.2*a***	**18.1*a***	**17.5*b***	**18.2*a***	0.2	**<0.001**

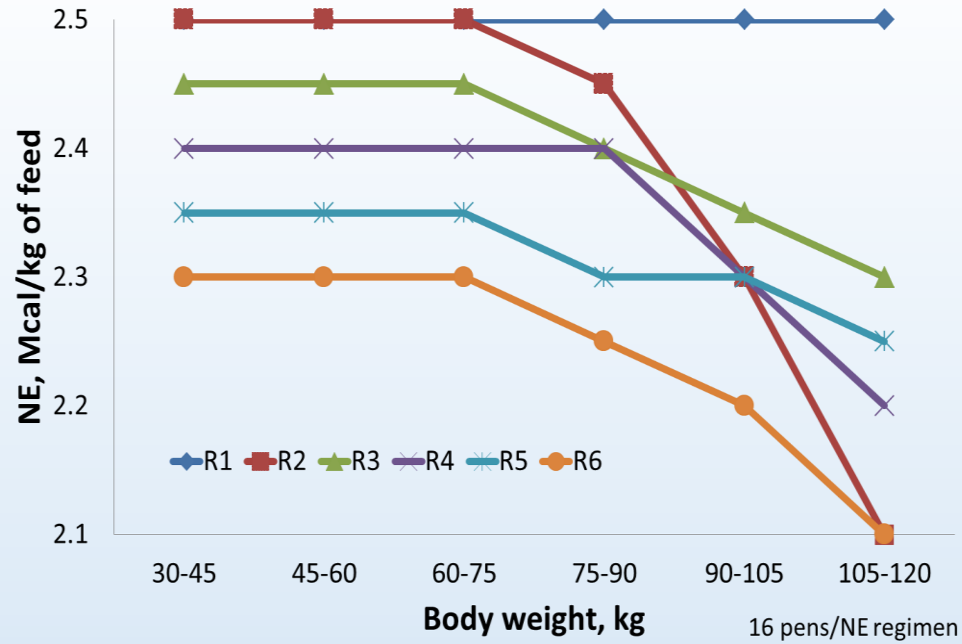
8 barrow + 8 gilt pens/NE regimen

Income over feed cost

	NE Regimen							*P* value
	R1	R2	R3	R4	R5	R6	SEM	NE
Feed cost per tonne, $	261.57*a*	248.49*b*	243.97*c*	238.70*d*	235.07*e*	226.71*f*	0.15	<0.001
Feed cost per kg BW gain, $	0.71*a*	0.70*b*	0.68*c*	0.67*d*	0.67*d*	0.66*d*	0.01	<0.001
Feed cost per kg lean gain, $	1.51*a*	1.51*a*	1.47*b*	1.44*b*	1.45*b*	1.44*b*	0.02	<0.001
IOFC per hog, $	**62.22*b***	**62.50*b***	**63.74*b***	**65.52*a***	**65.46*a***	**65.87*a***	0.90	<0.001

8 barrow + 8 gilt pens/NE regimen

Conclusions



- Not crystal clear whether **abrupt** drops in feed energy level had advantages to **gradual** decreases.

- This trial did show again that hogs perform well feeding lower net energy diets than equivalent corn-SBM NE level resulting in greater profit margin for producers.

Effect of crowding

- Feed intake is reduced because of a restriction in feeder access.

Or

- Crowding reduces growth which decreases feed intake.

Objectives

- The primary objective of this project was to investigate the **interaction** between dietary energy and stocking density on net returns for swine producers.
  - The secondary objective was to determine the interaction of dietary net energy and stocking density on pig welfare and feeding behavior.

Materials and methods

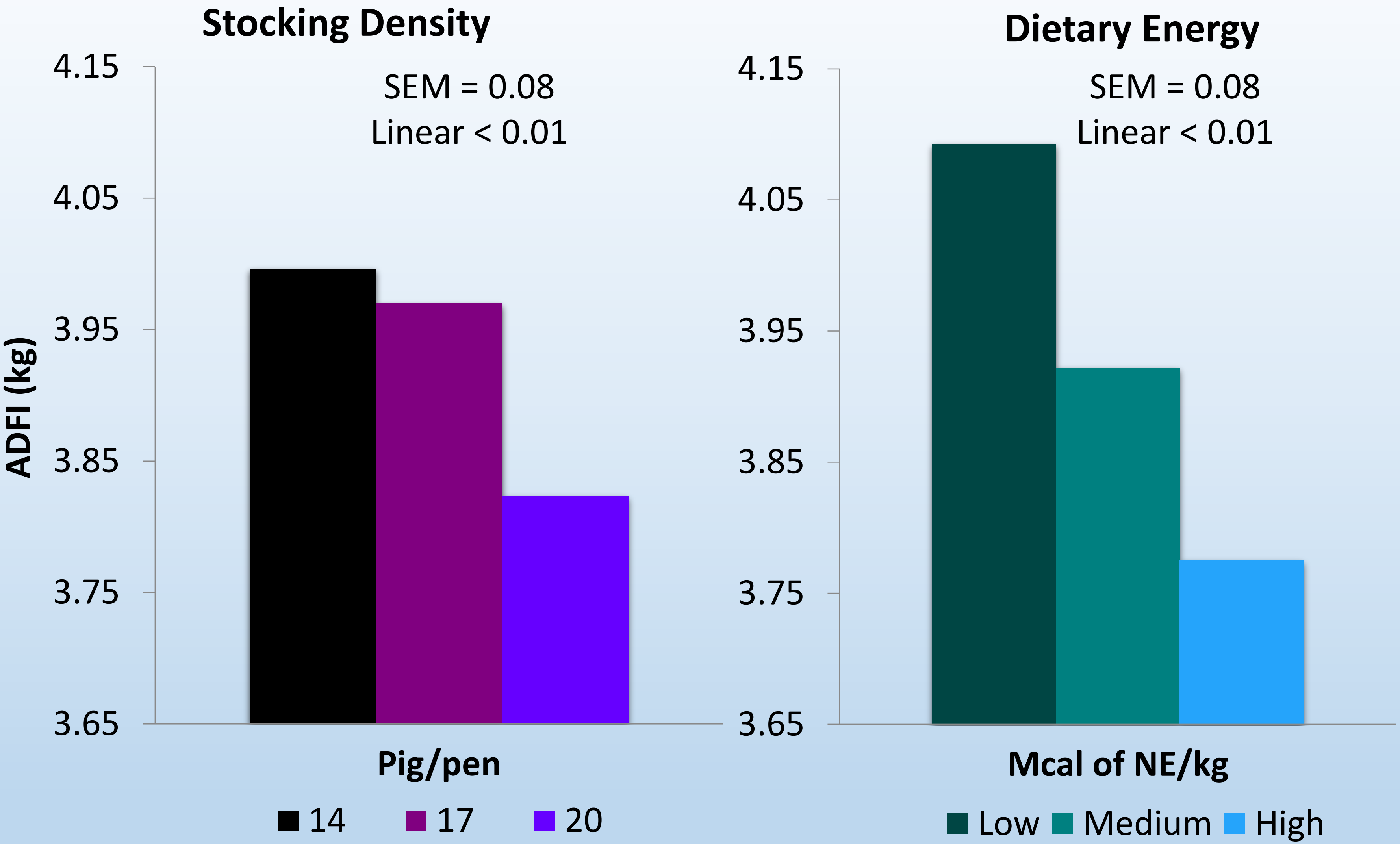
- 932 pigs used in 3 replications of 18 treatments.
  - 3 x 3 x 2 factorial arrangement of treatments
    - 3 dietary energies (**2.15, 2.30, 2.45** Mcal NE/kg)
    - 3 stocking densities (**14, 17, 20 pig**s/pen)
    - 2 sexes (barrows and gilts)
- Pigs were assigned to treatment at 75 ± 15 kg BW.
- Pigs were marketed at 118 kg BW.
- Pigs were slaughtered and graded at Thunder Creek Pork (Moose Jaw, SK).

k-values

- 2014 Code of Practice states a k-value of at least 0.0335.

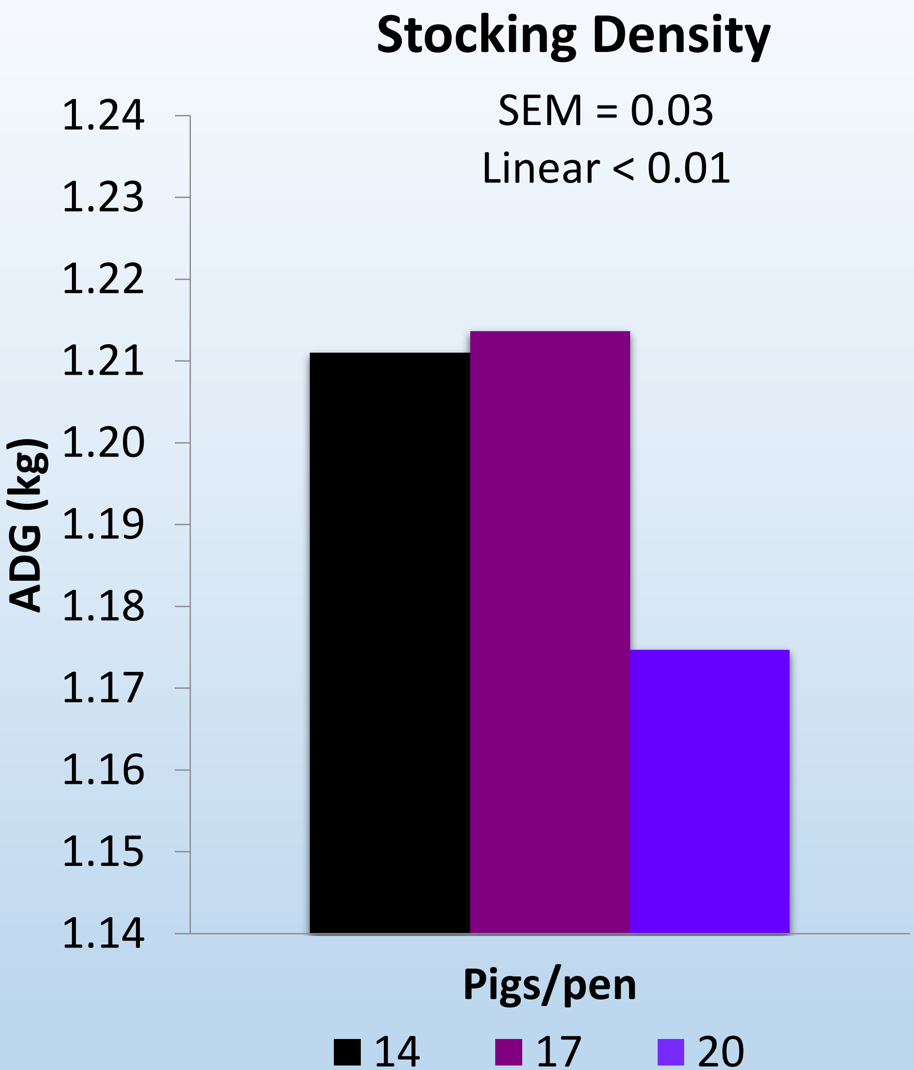
		Stocking Density		
		14	17	20
	Area/pig (m^2)	0.93	0.76	0.65
BW (kg)	75	0.052	0.043	0.036
	80	0.050	0.041	0.035
	100	0.043	0.035	0.030
	120	0.038	0.031	0.027

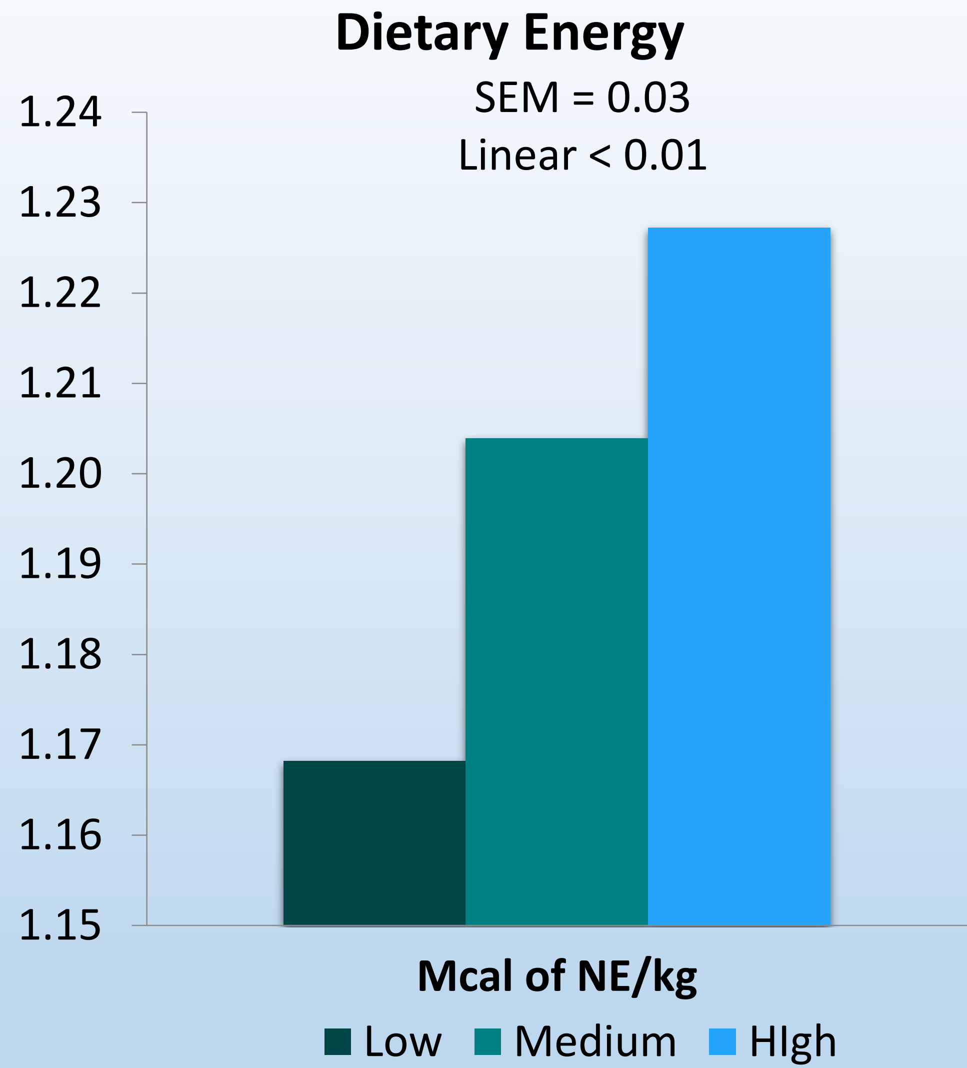
Daily feed intake[1] (75 to 118 kg BW)



[1]Dietary energy x stocking density (*P* > 0.10)

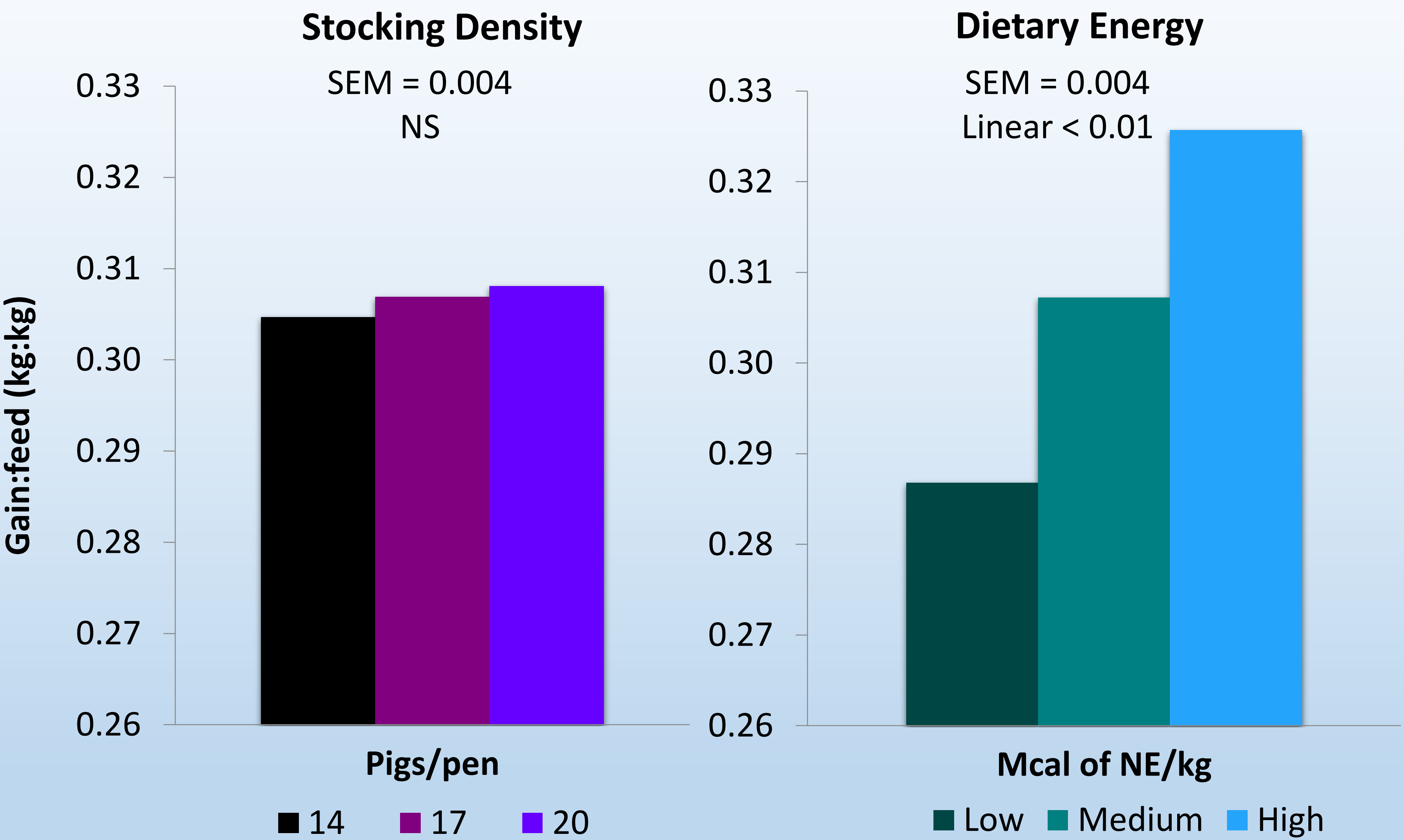
Daily weight gain[1] (75 to 118 kg BW)





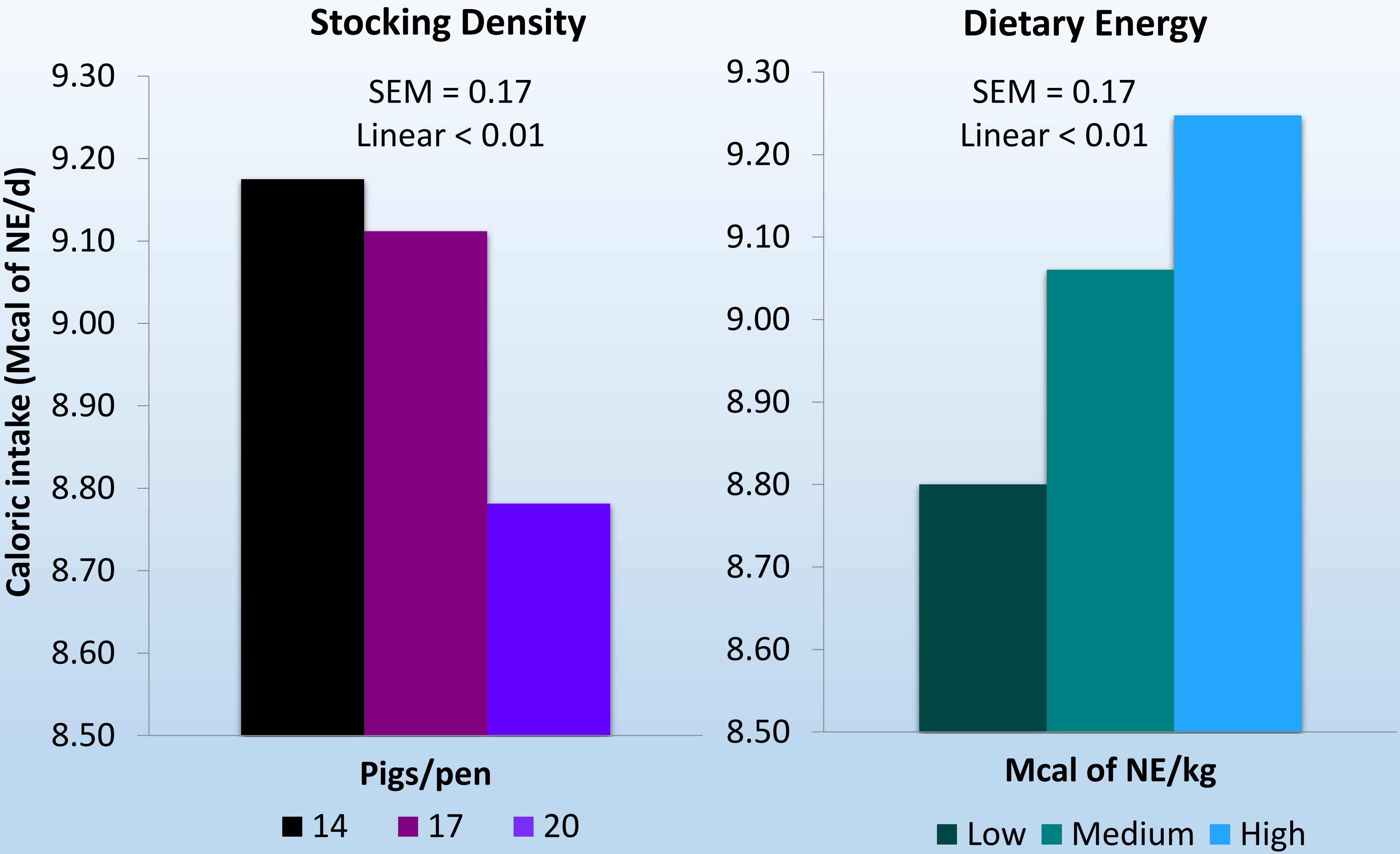
[1]Dietary energy x stocking density ($P > 0.10$)

Gain:feed[1] (75 to 118 kg BW)



[1]Dietary energy x stocking density ($P > 0.10$)

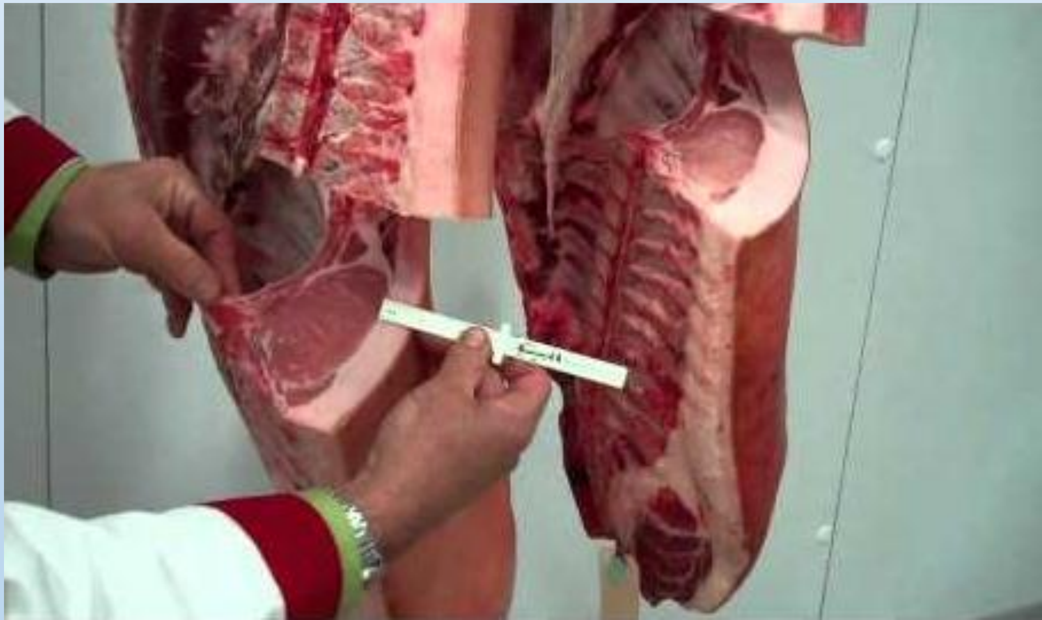
Caloric intake[1] (75 to 118 kg BW)



[1]Dietary energy x stocking density ($P > 0.10$)

Carcass traits

- Neither dietary energy nor stocking density affected:
  - Market weight
  - 10^{th} rib backfat depth
  - 10^{th} rib loin depth
  - Carcass index
  - Yield class
  - Carcass lean yield %.
- Stocking density x dietary energy, *P > 0.10.*



Stocking density effects on economics[1]

Item	Stocking density Pigs per pen 14	17	20	SEM	P-value Linear
Days to market	35.4	36.0	37.0	1.3	0.01
Barn throughput[2]	48.5	58.6	68.3	0.7	<0.01
Carcass revenue/pig, $	134.3	135.4	133.1	1.4	0.70
Ann. carcass revenue/ pen, $	6497	7911	9110	119	<0.01
Feed cost/pig d^{-1}, CDN $	0.87	0.86	0.83	0.02	<0.01
Feed cost/pen, CDN $	429.5	525.5	614.1	16.8	<0.01
Carcass margin/pig CDN $	103.4	104.2	102.9	1.6	0.72

[1] Dietary energy x stocking density ($P > 0.10$)

[2] Barn throughput= finisher rotations x pigs per pen

Dietary energy effects on economics[1]

	Diet regime				P-value
	Dietary NE				
Item	Low	Medium	High	SEM	Linear
Days to market	36.9	36.0	35.5	1.3	0.02
Barn throughput[2]	58.0	58.5	58.9	0.7	<0.01
Carcass revenue/pig, $	133.1	134.4	136.1	1.4	0.03
Ann. carcass revenue/ pen, $	7682	7840	7996	119	<0.01
Feed cost/pig d^{-1}, CDN $	0.81	0.85	0.90	0.02	<0.01
Feed cost/pen, CDN $	508.7	520.3	540.1	16.8	<0.01
Carcass margin/pig CDN $	103.0	103.5	104.0	1.6	0.48

[1] Dietary energy x stocking density (*P* > 0.10)

[2] Barn throughput= finisher rotations x pigs per pen

Summary (performance)

- Increasing dietary energy:
  - ↑ ADG
  - ↓ ADFI
  - ↑ G:F
  - ↑ Caloric intake

- As stocking density increased from 14 to 20 pigs/pen:
  - ↓ ADG
  - ↓ ADFI and caloric intake

- Stocking density x dietary energy $P > 0.10$.

Implications

- We achieved lower feed energy by incorporating lower cost cereal grains like oats and food, bio-industrial co-products.
- Get more pork per tonne of high-energy cereal grains by diluting with food, bioindustrial coproducts.
- We highlighted, again, the ability of the omnivorous pig to convert co-products into human food protein.
- There is a penalty on dressing % that requires increasing live ship weight by 1-2 kg to sustain target carcass weight.
- Heavier ship weights may extend barn utilization by a few days, but lower feed cost per hog likely makes up for it.
- Feeding small cereal Prairie grains likely results in whiter, firmer pork fat, a consumer pork preference advantage.

Some words of caution …

- Experiments were NOT conducted in summer when feeding denser diets may mitigate drops in intake.
- We did not evaluate genetics, disearse, feeder space.
- Feeding fibrous diets increases manure production.
- Feeding fibrous diets complicates feed flow in augers.
- Feed commodities and pork prices vary. Profitability shown here is repeatable, but consistency will vary.
- Consider housing, environmental and economic factors to guide decisions about feeding lower energy levels.

Acknowledgments

ACIDF

Alberta
Agriculture and
Rural Development

Funding for Garrett's project was provided by Gowans Feed Consulting and Agriculture and Agri-Food Canada through the Canadian Agriculture Adaptation Program.

Program funding to Prairie Swine Centre Inc. provided by Saskatchewan Pork Development Board, Saskatchewan Ministry of Agriculture, Manitoba Pork Council, Alberta Pork, and Ontario Pork.