Does selection for feed efficiency in pigs improve robustness to heat stress?

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Introduction

U.S. swine industry loses at least $300 million/year to heat stress (HS)

☞ (~$900 million annually)

= costliest issues in US pork industry

☞ Climate change

Reduced revenue:

- Slower growth rates
- Reduced feed efficiency
- Inconsistent market weights
- Altered carcass traits
- Increased health care costs
- Mortality

Introduction

High lean tissue growth rate

- More heat production
- Faster growing pigs may be more susceptible to HS

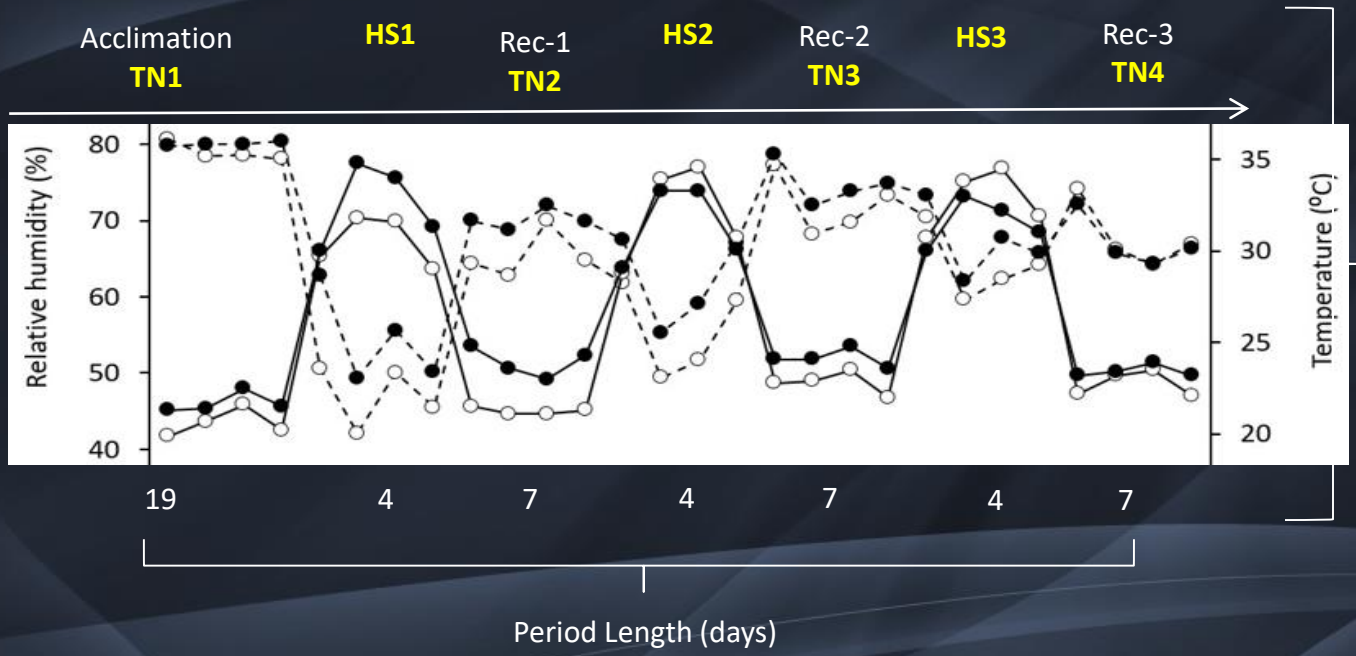
High feed efficiency

- Less heat production
- More efficient pigs may be less susceptible to HS

Aim of this study: Determine the effect of genetic potential for high growth rate and feed efficiency

Material and methods

TN: Thermal Neutral
HS: Heat Stress



Market at Weight of ~125 kg

Total length = 19 + 4 + 7 + 4 + 7 + 4 + 7 = 52 days, Slaughter at 55

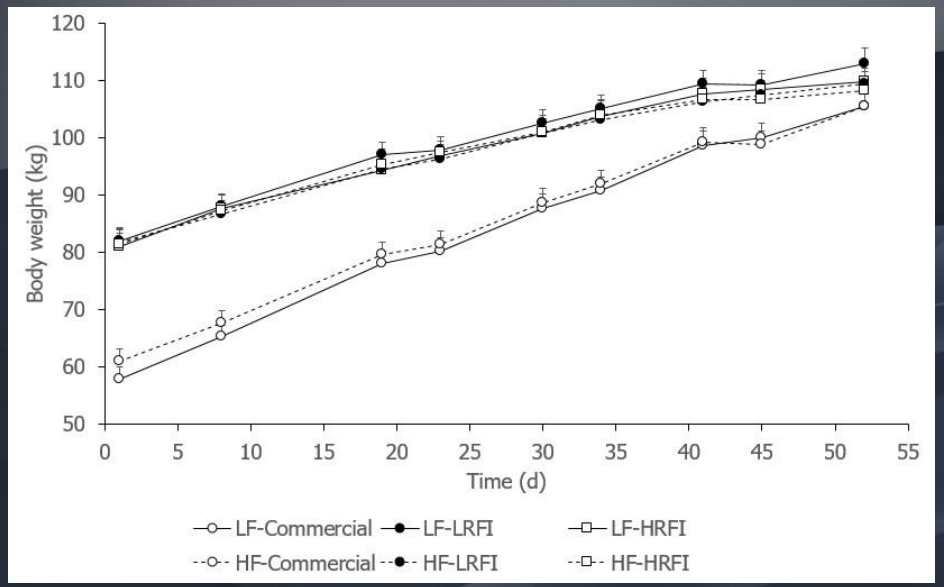
Daily Samples/Measurements
Feed Intake

Body Weights and Ultrasound Obtained
Beginning and end of each period

Material and methods

97 animals, 3 genetic lines:

31 Commercial, 35 Low RFI (efficient), 31 High RFI (inefficient)



☞ reach slaughter weight at same time

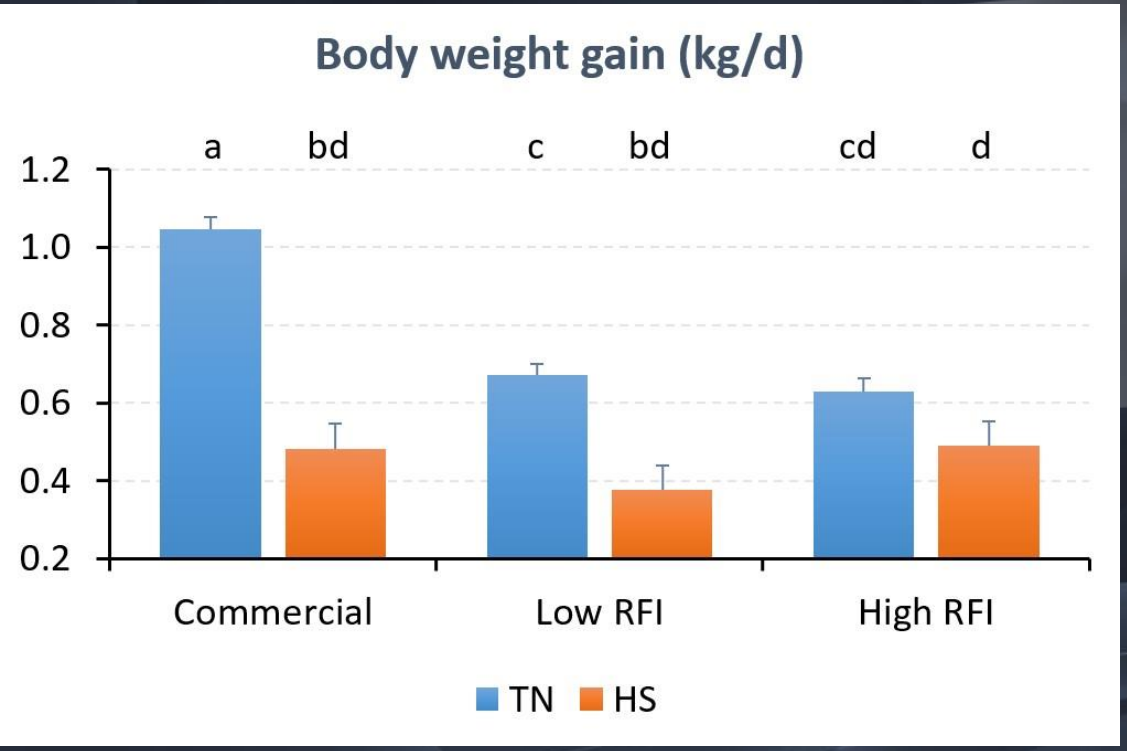
Material and methods

Periods: TN1 HS1 TN2 HS2 TN3 HS3 TN4

- FI per period (kg/d) (7 ×)
- Drop in FI between HS and TN: FI_{HS}-FI_{TN} (3 ×)
- BWG per period (kg/d) (7 ×)
- Drop in BWG between HS and TN: BWG_{HS}-BWG_{TN} (3 ×)

FCE = Feed conversion efficiency = BWG/FI (BWG ≤ 0!)

Results: BWG



HS < TN

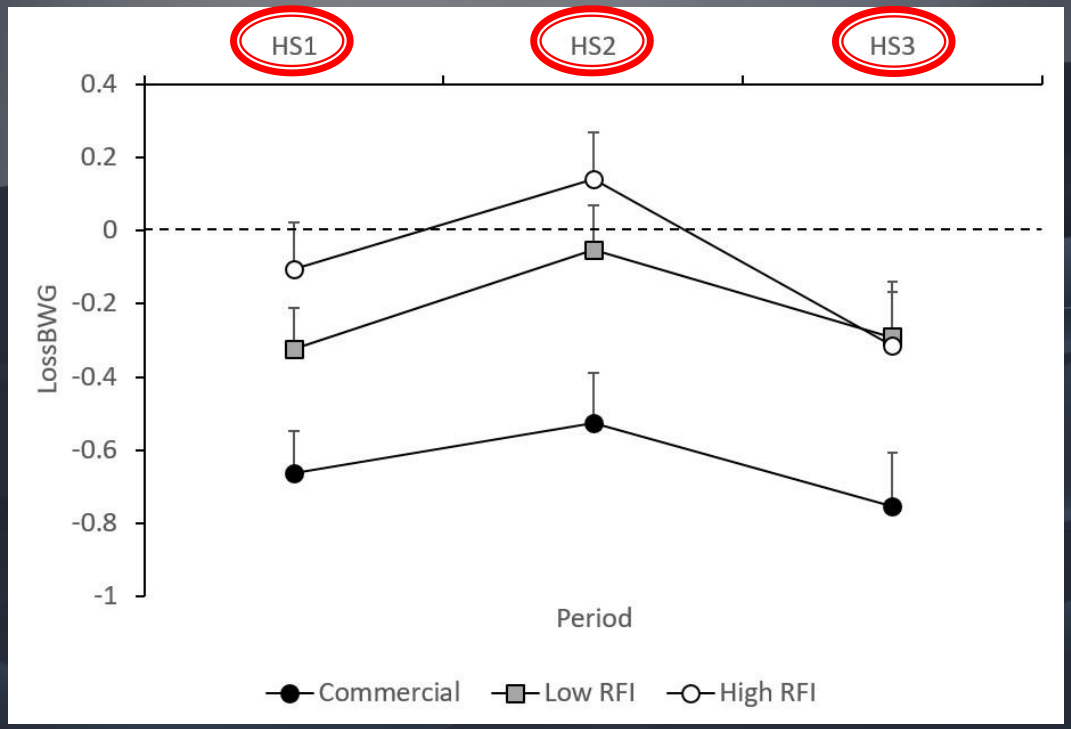
TN:
Commercial > Low RFI and high RFI

HS:
similar

Drop in BWG = BWG_{HS}-BWG_{TN}

Lower drop in BWG in HS2

Largest drop in BWG in Commercial &
Tended to be larger in low RFI than high RFI

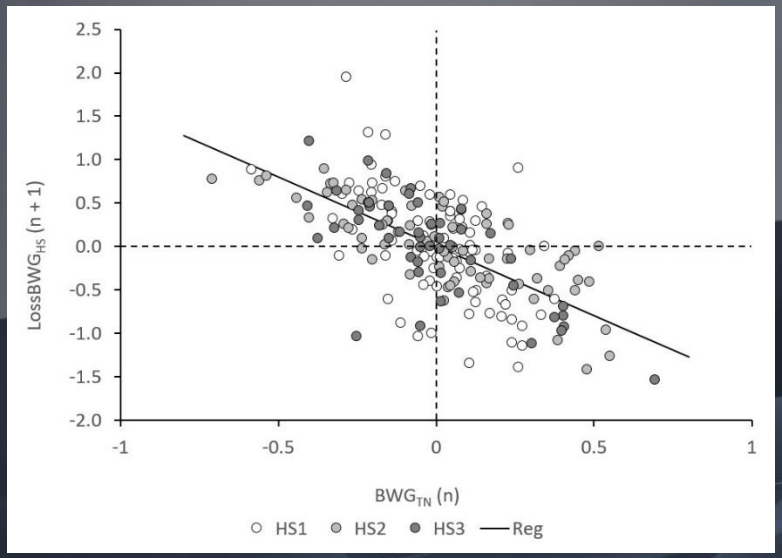


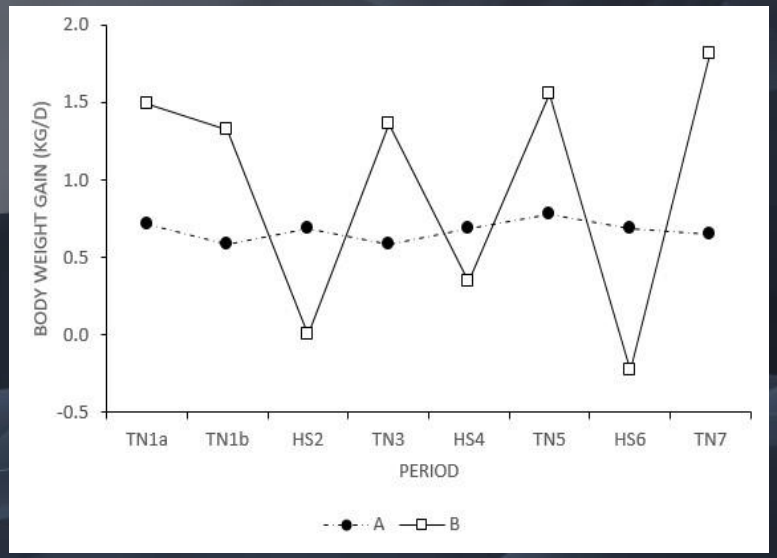
Larger HS1, larger HS2 †
Larger HS2, larger HS3 **
☞ repeatable

3. Results: BWG, loss BWG

Higher BWG in period TN = larger loss in HS

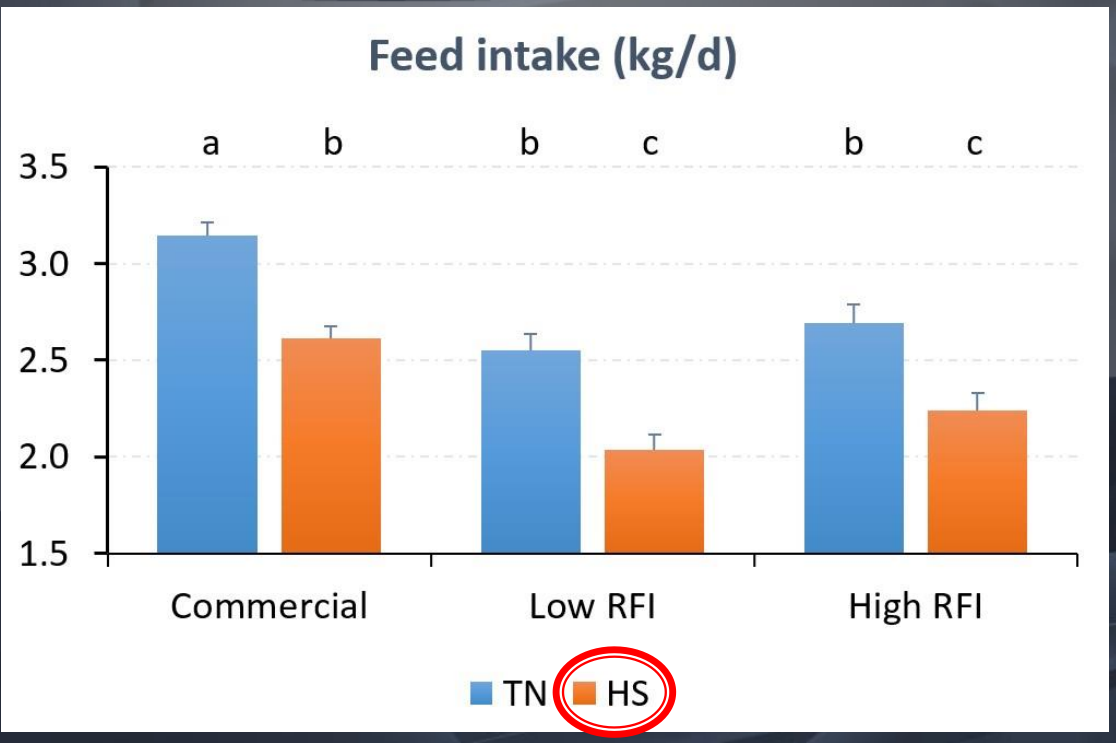
r = -0.65 (P < 0.0001)





☞ Higher production TN = lower robustness to HS

3. Results: FI



HS < TN

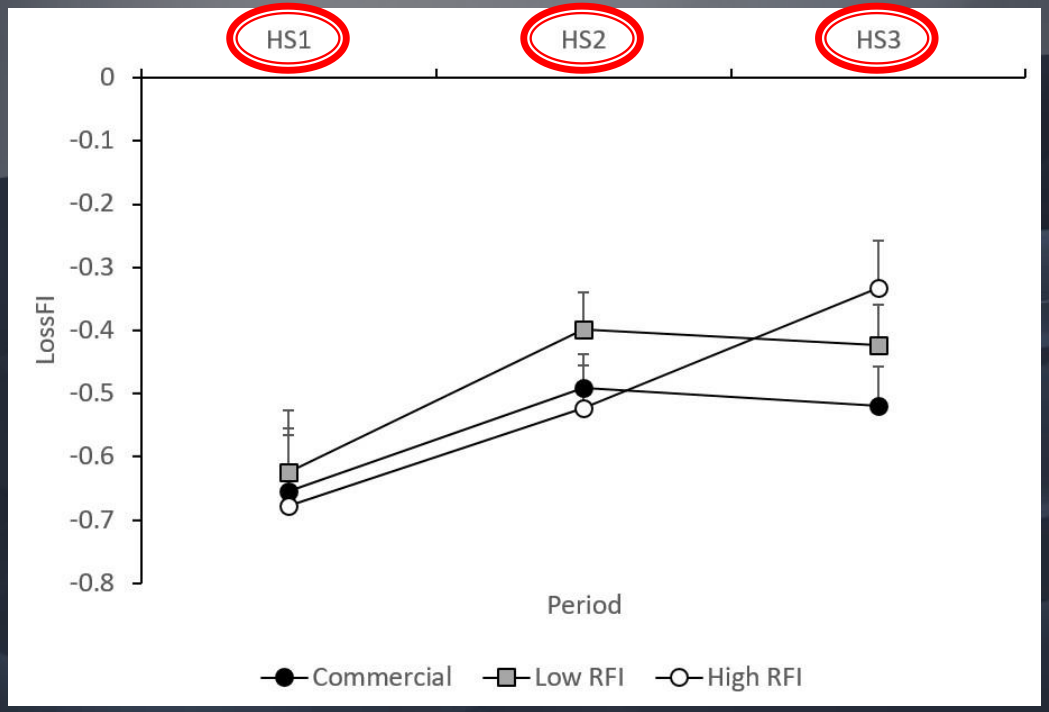
TN:
Commercial > Low RFI and high RFI

HS: similar

3. Results: Loss FI = FI_{HS}-FI_{TN}

Larger drop in FI in HS1

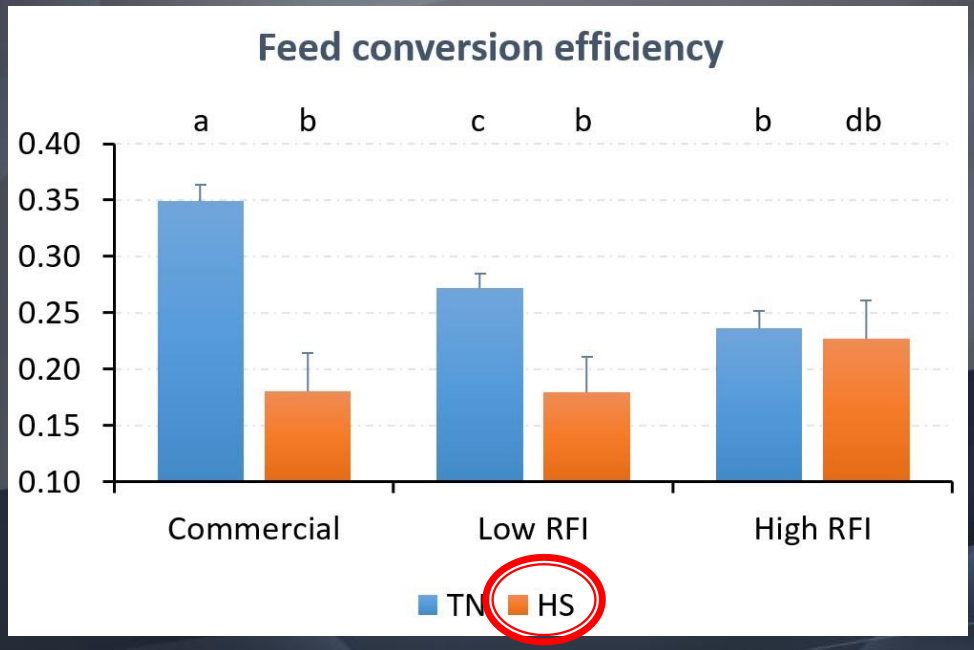
No line effect



Larger HS1, larger HS3 **

☞ repeatable

3. Results: FCE



Less efficient in HS than TN

In TN: Commercial > Low RFI > High RFI

In HS: differences <u>disappeared</u>

Conclusions: Effect of heat stress on feed intake and growth

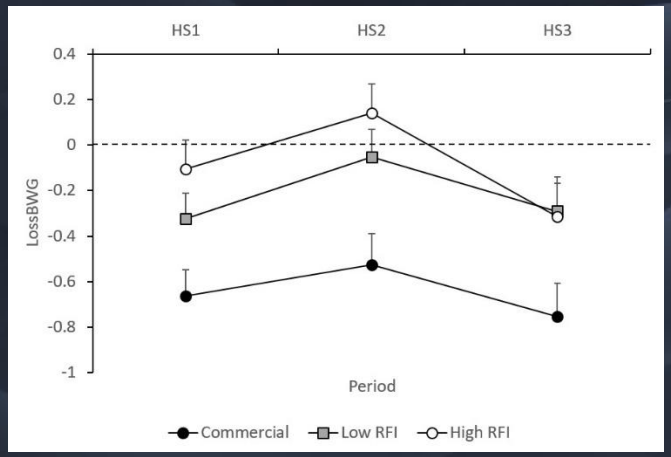
Profound depression in FI and BWG

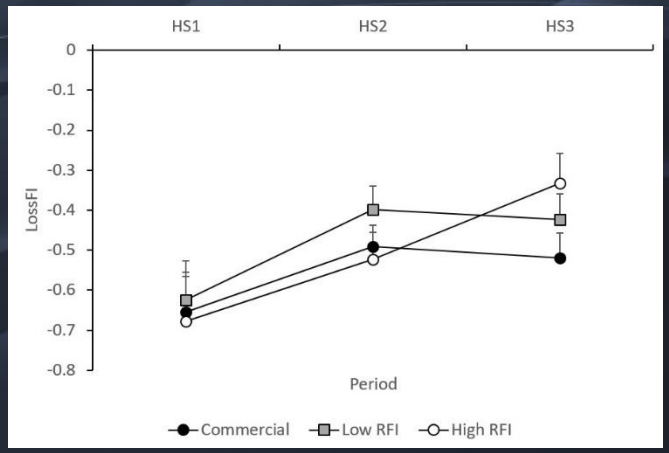
FI: Postprandial response = 25-50% increase in metabolic rate

So ☞ reduce FI ☞ also reduced BWG = heat production ⇩

Better producer in TN = Less robust to HS

Efficiency: variation in response in BWG, not in FI ☞ variation in efficiency





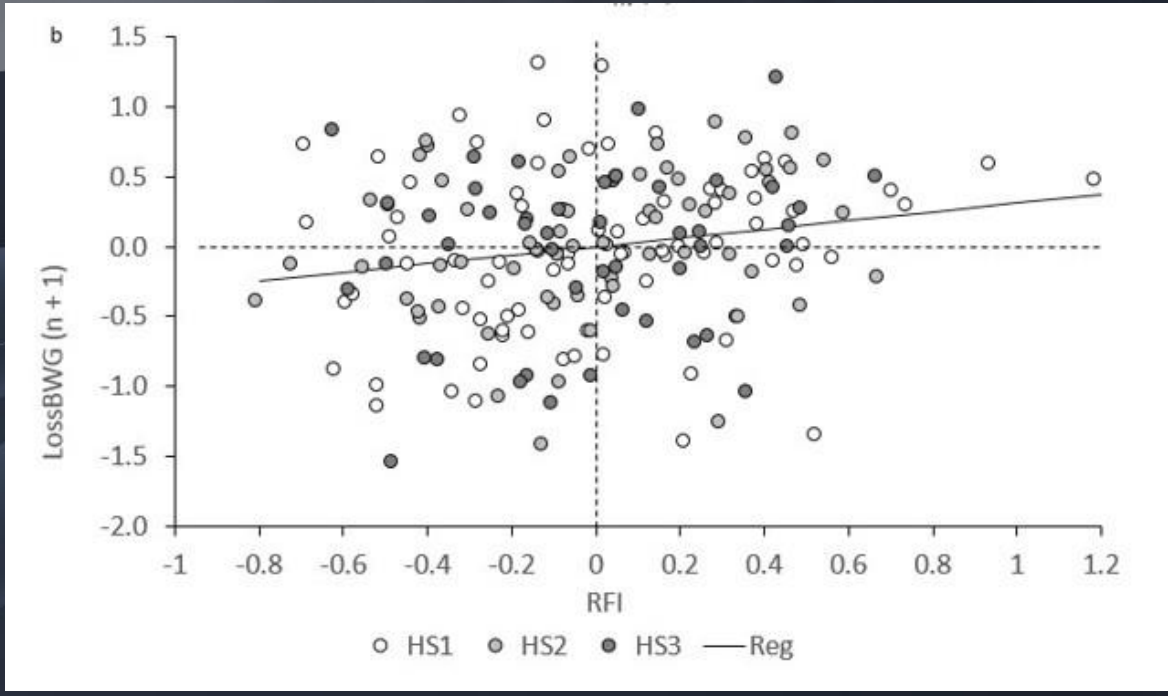
Conclusions: Effect of improved efficiency

Higher efficiency = reduced basal metabolic rate ☞ better adaptation?

But: Drop in BWG was largest in commercial line,
& larger (but non-significant) in efficient line than inefficient line
= Loss superiority in FCR

Independent of line:
$r = 0.19$, $P < 0.01$, but…

Studies: high RFI may have higher capacity for heat Dissipation (water intake)



SUMMARY:

1. Heat stress reduced BWG (variable) and FI (fixed)
   ☞ Variation in feed efficiency through BWG, not FI
2. Heat stress reduces FCE, particularly in high growth/feed efficient pigs
3. High growth rate reduces robustness to HS
4. Improved RFI did not appear to improve robustness to HS

Best animal = not too high level of lean tissue growth

☞ Choose those that maintain BWG on reduced FI

Reduction in commercial pigs ☞ still as good as other lines in HS

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JOHN PATIENCE, NICK GABLER,
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pork checkoff

Thanks!