

# Burning issues in biodiversity 2: *Fitter livestock farms* from **better gene banks**

A **Feed-a-Gene** contribution:



Identify (selection) criteria and populations  
related to a better feed efficiency  
in pigs and chickens fed alternative feedstuffs



Burning issues in biodiversity 2:  
*Fitter livestock farms from **better gene banks***

# Responses of **pigs divergently selected** for *cortisol level* or *feed efficiency* to a low energy/low AA diet during growth

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Many thanks to farm staffs for animal raising, sampling and data collection



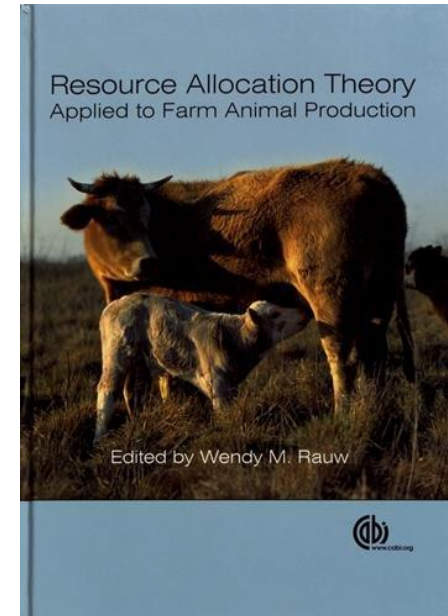


*Fitter livestock farms:  
Is joint *improvement of feed efficiency  
and responses to stress* a challenge?*

By reducing the feed intake  
compartment dedicated to non  
productive functions

selection for more productivity  
might impair the ability of animals  
to deal with stressors

→ Can we combine these traits  
to improve animal fitness?



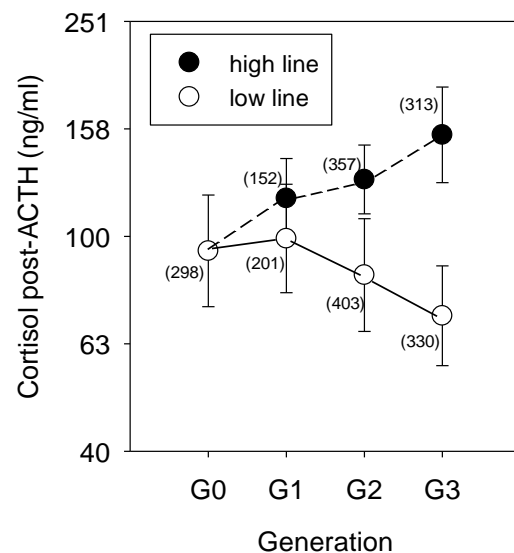


# Better gene banks:

## Is joint improvement of feed efficiency and responses to stress a challenge?

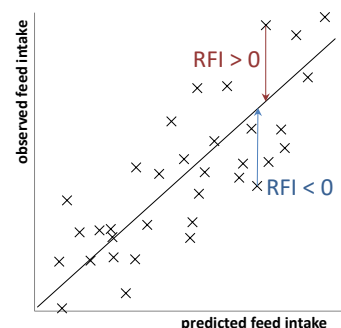
Response of the HPA axis to an ACTH injection via plasma **cortisol** measure

$h^2=0.68$  (Larzul et al, 2015)

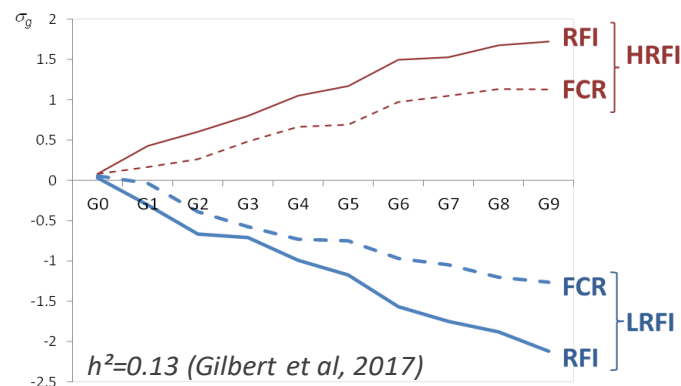


➔ Pig lines selected for divergent cortisol levels after ACTH injection at 6 weeks of age (G3)

**RFI** = net feed efficiency



➔ Pig lines selected for divergent RFI during growth (G9)



$h^2=0.13$  (Gilbert et al, 2017)

HPA: hypothalamo-pituitary-adrenal; ACTH: adenocorticotrophic hormone

# Objectives

- ▶ Did selection for RFI impair the HPA axis activity?
- ▶ Did selection for high cortisol impair performance?
  - ▶ How does a low energy/low protein diet affect performance during growth?
  - ▶ Control conventional European diet
    - ▶ Cereals, corn, rapeseed, soya meal
    - ▶ 16% crude protein, 1.82% crude fat
  - ▶ Test diet
    - ▶ Cereals, rapeseed, wheat bran, sunflower meal
    - ▶ 14.4% crude protein, 1.61% crude fat



-10% NE  
Same digAA/NE

# Data and analyses

192 pigs tested: 24 pigs x 4 lines x 2 diets

To each pair of lines: linear model with

start BW as covariate

sex (2 levels)

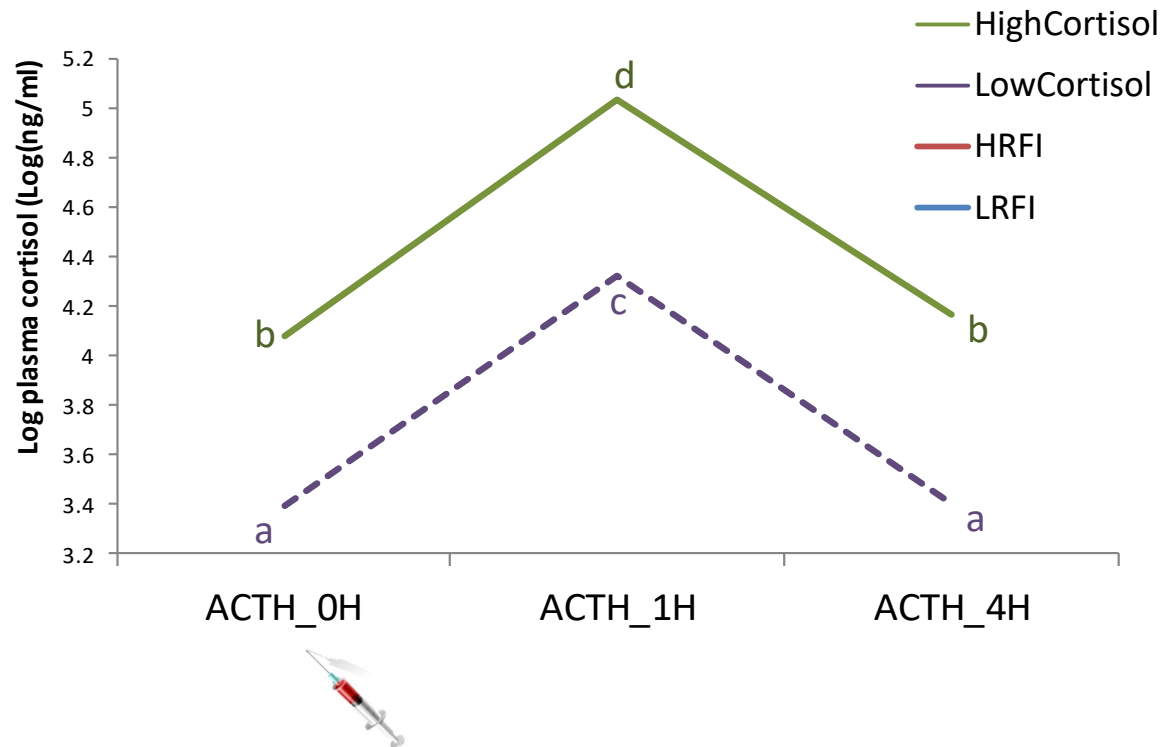
batch (4 levels)

Time or **Diet** (2 or **3** levels)

**Line** (2 levels)

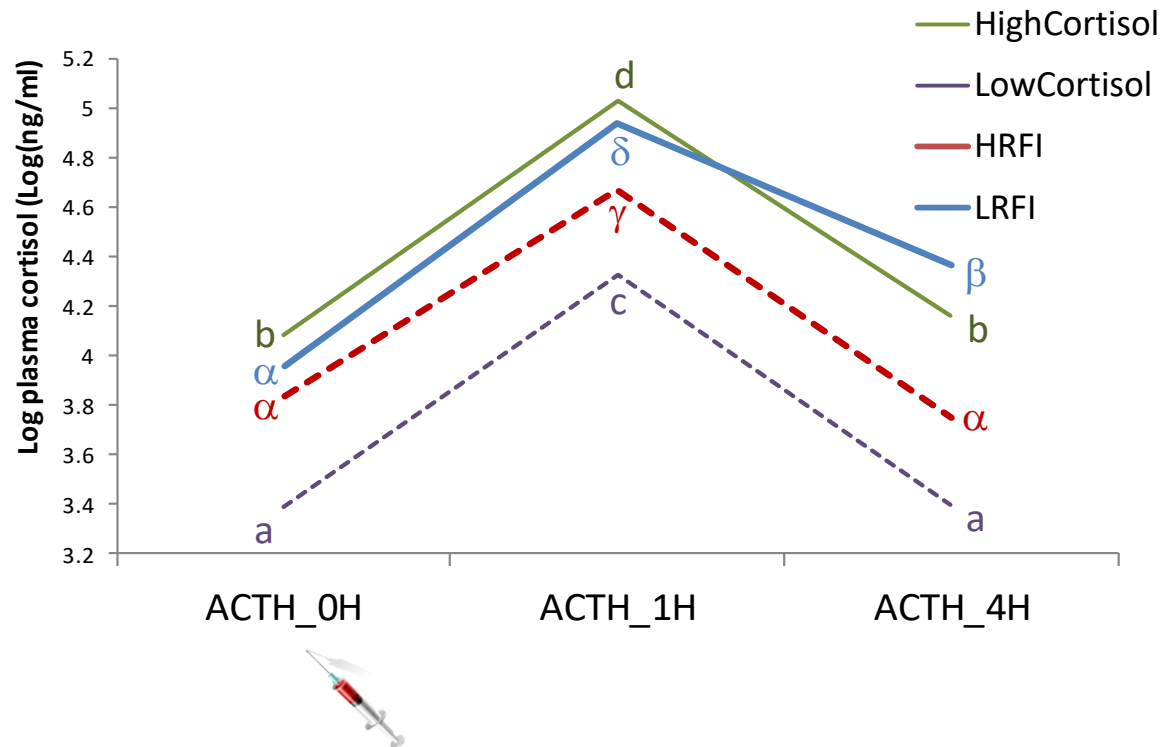
L x T or **L x D** interaction

# Did selection for RFI impair the HPA axis activity?



→ Expected responses of the cortisol lines

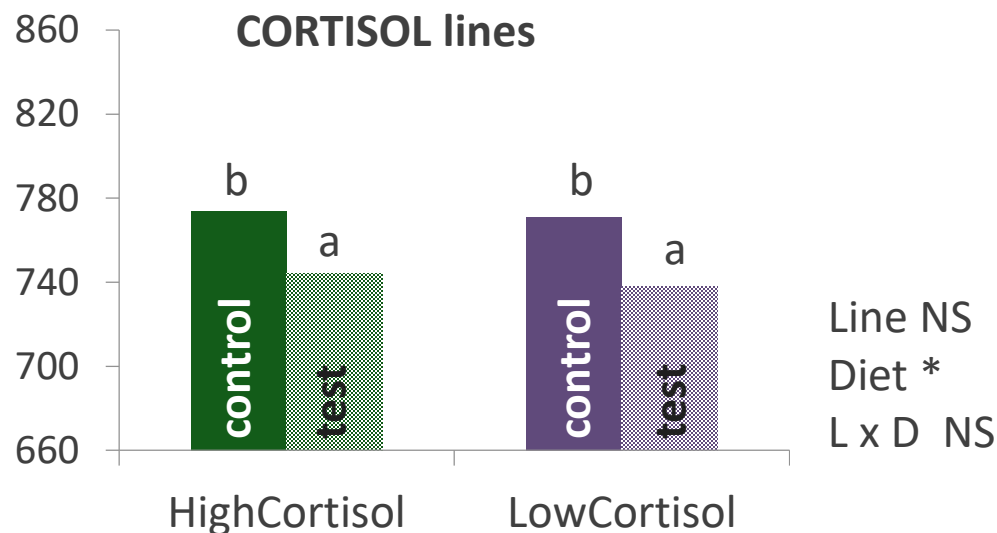
# Did selection for RFI impair the HPA axis activity?



HPA axis is more reactive in LRFI than HRFI  
→ Hypothesis 1 not valid

# Did selection for high cortisol impair performance?

## ADG (g/d) 13 weeks of age to slaughter



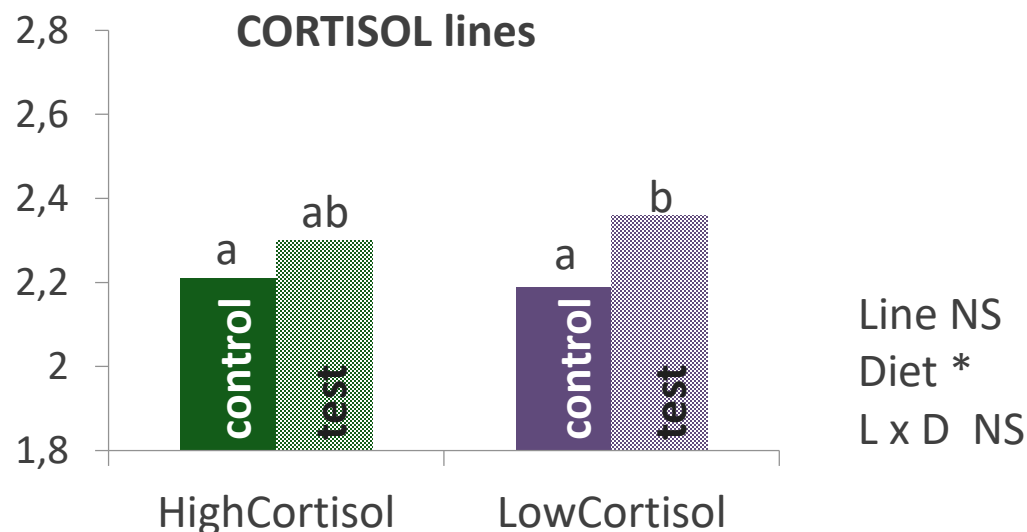
→ Cortisol lines had same ADG with the control diet

→ The Test diet decreased ADG to the same extent in both lines (-5%)

Start of test (10 weeks of age) = same BW ( $\mu$  = 26 kg)

# Did selection for high cortisol impair performance?

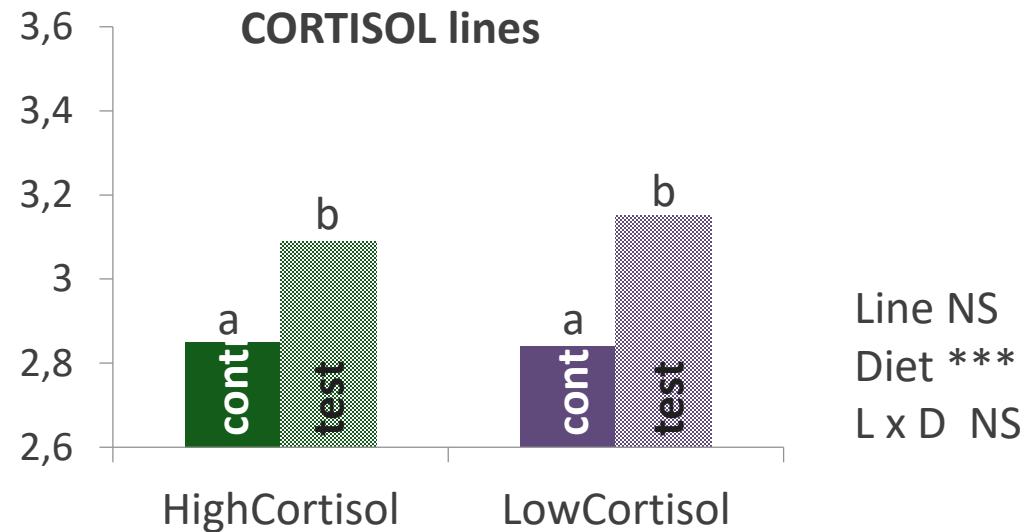
## Daily feed intake (kg/d) 13 weeks of age to slaughter



- With the Test diet lines increased their feed intake
- Cortisol lines had same feed intake and same response to diet

# Did selection for high cortisol impair performance?

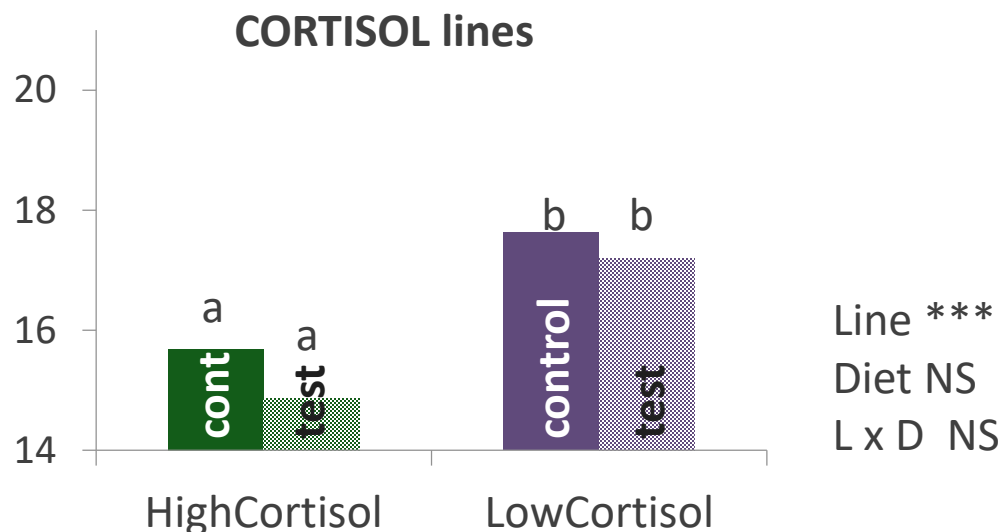
## Feed conversion ratio 13 weeks of age to slaughter



→ Test diet increased FCR

→ No Cortisol lines difference

# Did selection for high cortisol impair performance? Backfat thickness (mm) at slaughter (23 weeks)



- Test diet had no effect on BFT  
but lower body weights at 23 weeks of age
- High cortisol pigs were leaner than Low cortisol pigs

# Summary, effects of selection

## ■ Selection for high cortisol response

- Did not affect growth, feed intake and feed efficiency
- Increased leanness
- Did not affect response to the Test diet

➔ Breeding for high cortisol **does not necessarily impair performance traits** (Mormède et al, Larzul et al, WCGALP 2018)

## ■ Selection for low residual feed intake

- Did not impair the HPA axis activity

➔ Breeding for better feed efficiency **does not systematically impair fitness indicators**

(Gilbert et al, Animal 2017; Dunkelberger et al, 2015)



# Can we combine traits to improve animal fitness?

- ▶ Yes, we can
- ▶ Study of (selected) extreme genotypes in production populations helps understanding the links between traits of interest
- ▶ Identification of (combination of) criteria for fitness, and their measure in production situations, is needed to know which populations and individuals can contribute to *fitter livestock farms*