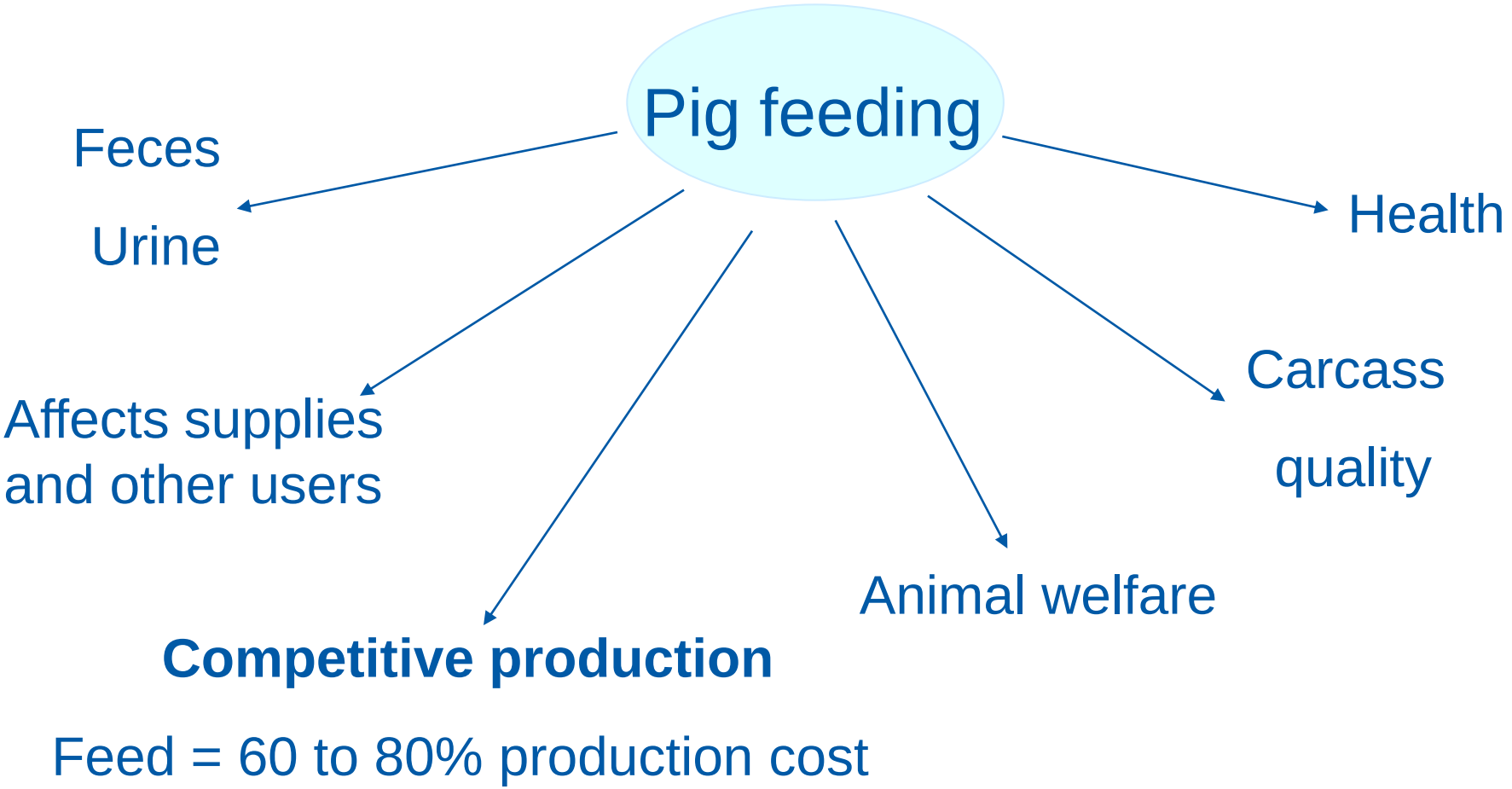
Selection for residual feed intake
in the growing pig

Responses for carcase composition and meat quality traits

Helene Gilbert, INRA, France

Feed intake in the growing pig



Feed = 60 to 80% production cost

What affects feed intake ?

Maintenance requirements ~ **body weight**

+ digestion

+ metabolic utilization of feed **Feed**

+ energy homeostasis

+ activity **Management**

+ stress

+ tissue turn over rates

+ …

+ Production …

Animal

How does production affect feed intake ?

Faster growth correlated to
higher feed intake
but lower feed intake per kg of body weight gain

Growth rate **Body composition**

Lower energy inputs required for protein deposition than for fat deposition

(or milk or egg production, litter growth)

Direct selection for feed efficiency

Feed conversion ratio (FCR)

kg of observed feed intake / kg body weight gain

➔ Lower FCR = more efficient animals

What affects feed intake ?

Maintenance requirements

+ digestion

+ metabolic utilization of feed

+ energy homeostasis

+ activity

+ stress

+ tissue turn over rates

+ …

+ Production

~ **body weight**

Feed

Management

…

Animal

Selection for efficient use of feed

Residual feed intake (RFI)

kg of observed feed intake – kg predicted feed intake

(body weight, growth rate, body composition)

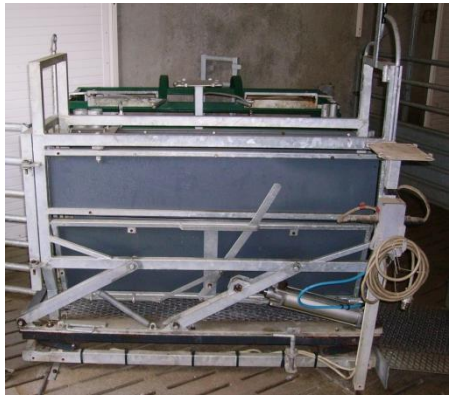
➔Lower RFI = more efficient animals for a given production level

~35% daily feed intake due to RFI

Recording feed efficiency in group housed pigs

Individual feed intake


ACEMO



Individual growth

Individual body composition

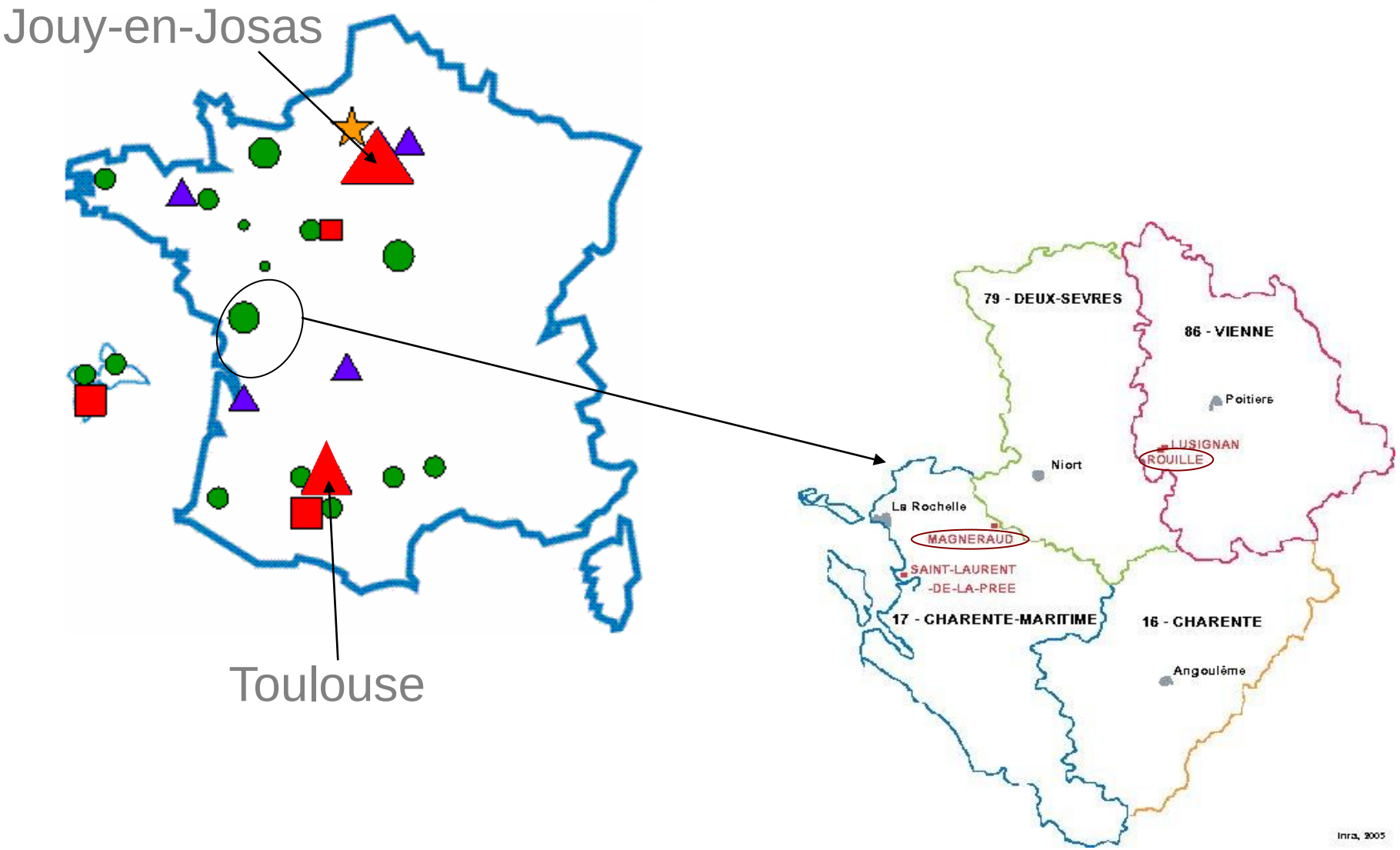
ALOKA

Indirect selection for efficient use of feed

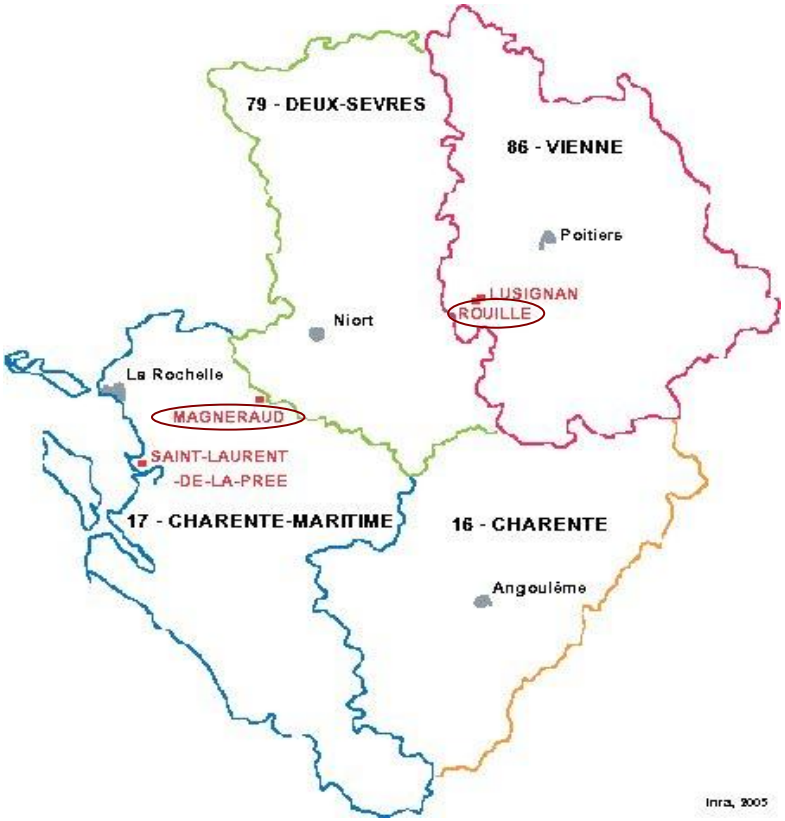
Higher growth rate

Higher leanness

Pig genetics at INRA



Pig genetics facilities at INRA



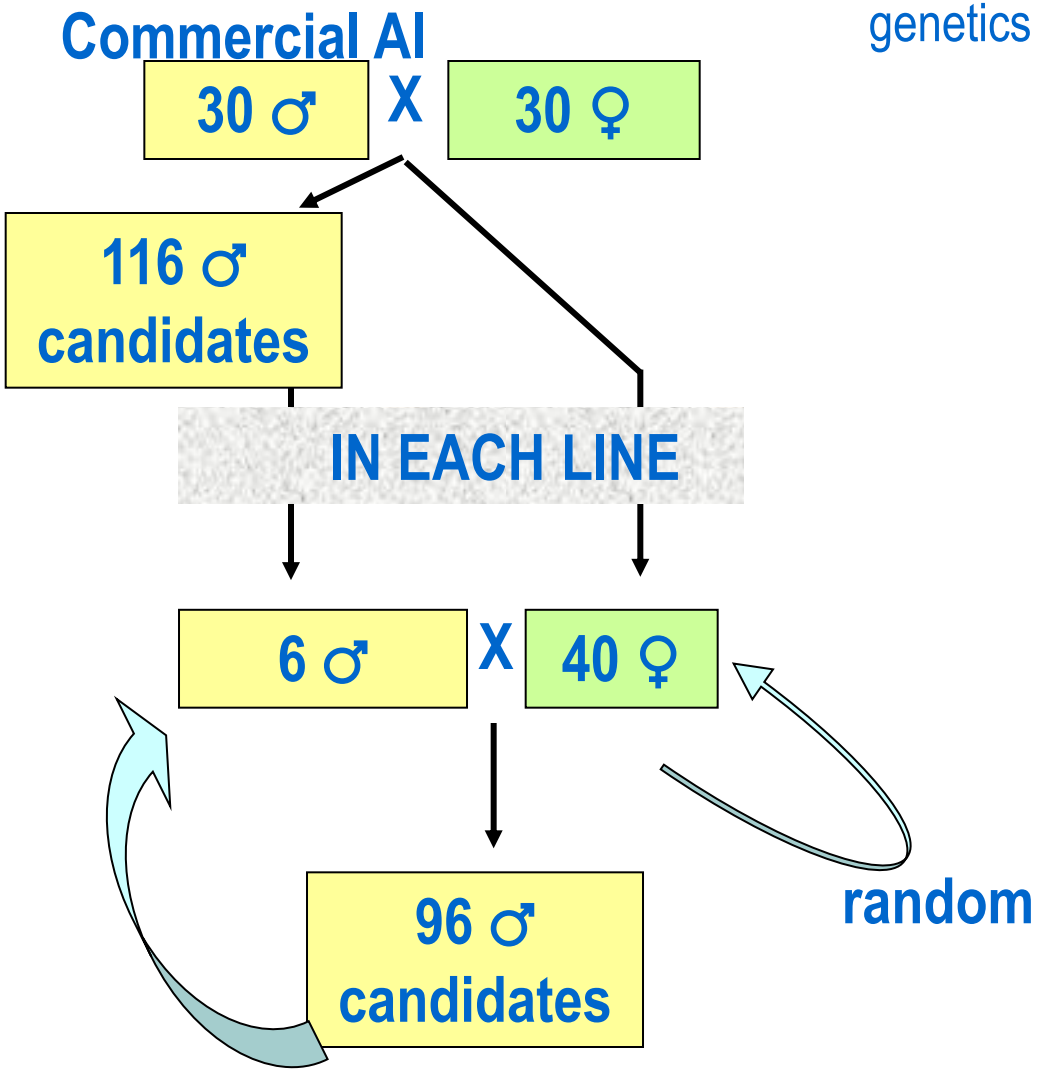
Selection for RFI in Large White pigs

At INRA animal genetics facilities

1999 **Founders**

2000 **G0**

…2006 **G1 to G4**



Selection criterion

RFI computed between 35 - 95 kg live weight

Selection for RFI: records

Two litters / sow

Parity1 (P1)

Candidates for selection (793 males)

Parity2 (P2)

RFI-		RFI+
48 ♂	**Responses to selection (657 females and castrated males)**	48 ♂
48 ♀	**29 - 106 kg**	48 ♀
	Feed intake, growth, body composition	
	Carcase composition, meat quality	

Selection for RFI: RFI estimation in sibs

DFI (g) = Daily Feed Intake

1.48 x ADG (g) Average Daily Gain

- 23.2 x LMC (%) Lean Meat Content

+ 99.1 x metabolic BW (kg) Body Weight

+ RFI_response (g)

Correlated phenotypic changes of RFI_response

RFI_response $h^2 = 0.24$

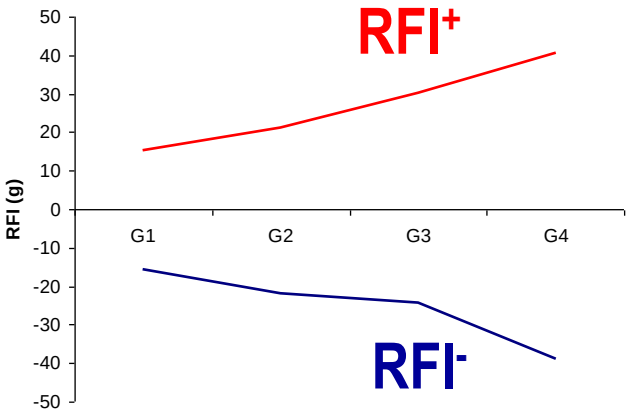
In generation 4, difference between lines :
-79g RFI per day (0.72 SD)
➔45% of the difference for daily feed intake between lines

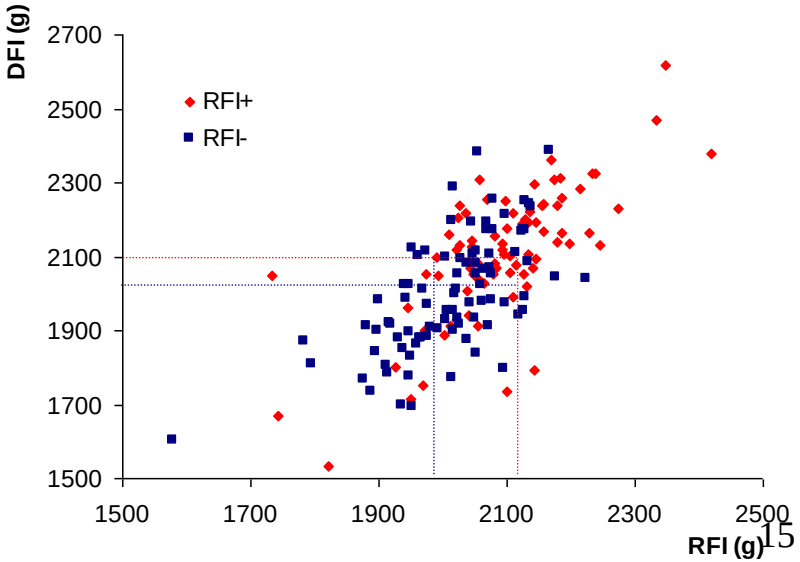
For a given level of performance, lines differ by 79g

➔ difference of A$ 0.49 / pig / generation between lines

After 5 generations, A$ 2.44 / pig

~0.20 phenotypic SD of gain per generation, or 20g of RFI





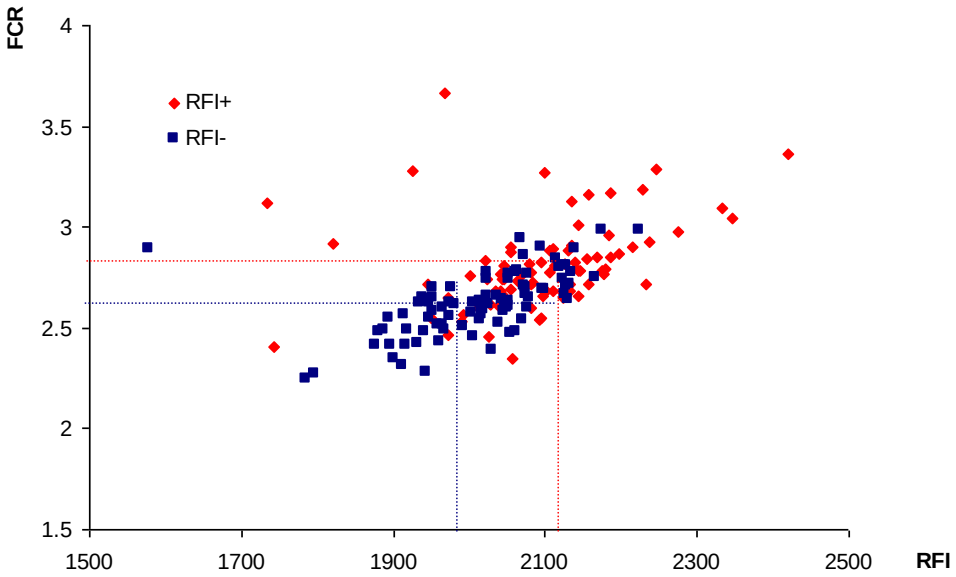
Distribution of feed conversion ratio, generation 4

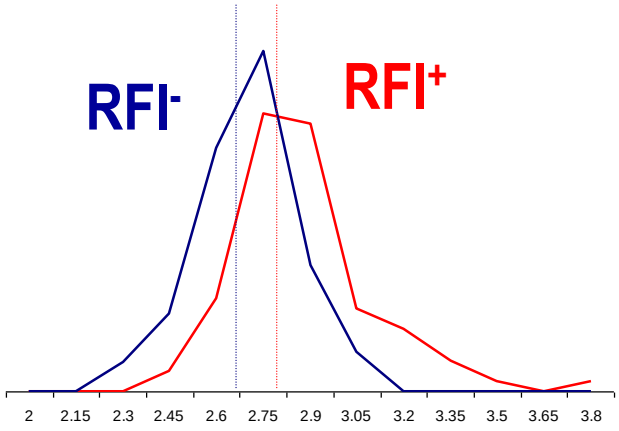
Correlations with RFI_response :

$r_A = 0.71$; $r_P = 0.63$

In generation 4, difference between lines : -180g food per kg body weight gain (0.88 SD)

➔difference of A$ 0.85 / pig / generation between lines





High correlated response in FCR

Average FCR : 2.7 kg food per kg body weight gain

Carcase composition

Body weight / carcase weight at slaughter ➔ dressing %

4 primal cuts : loin, back leg (ham), shoulder, belly
+ weight of the subcutaneous fat above the loin (backfat)

➔ Lean meat content

Distribution of dressing percentage, generation 4

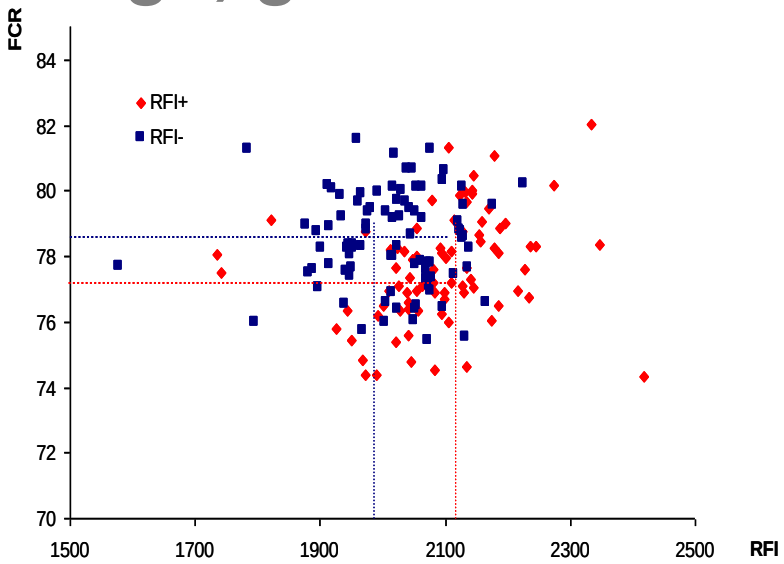
Correlations with RFI :

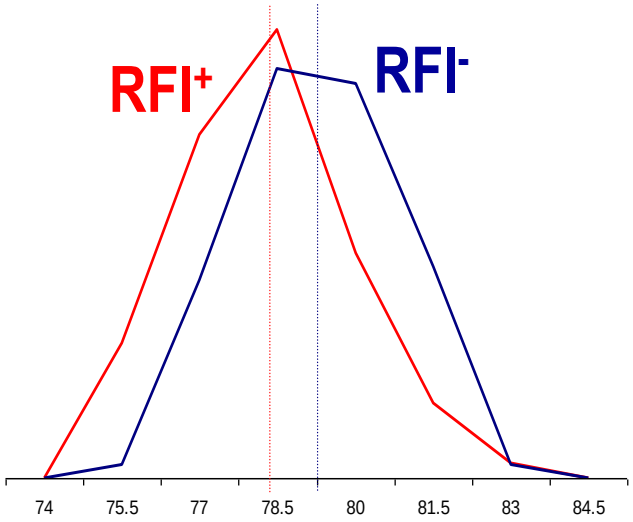
r_A = -0.36 ; r_P = 0.07

In generation 4, difference between lines : 1.58% (0.55 SD)

➔0.9 kg carcass difference for a given body weight at slaughter

➔Difference of A$ 0.56 / pig / generation between lines



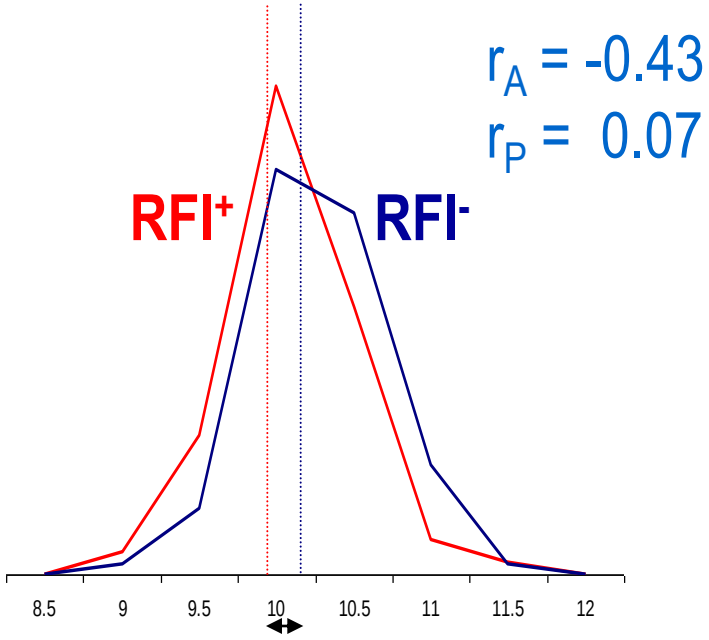


Correlated response in dressing percentage

Average dressing percentage : 78.1%

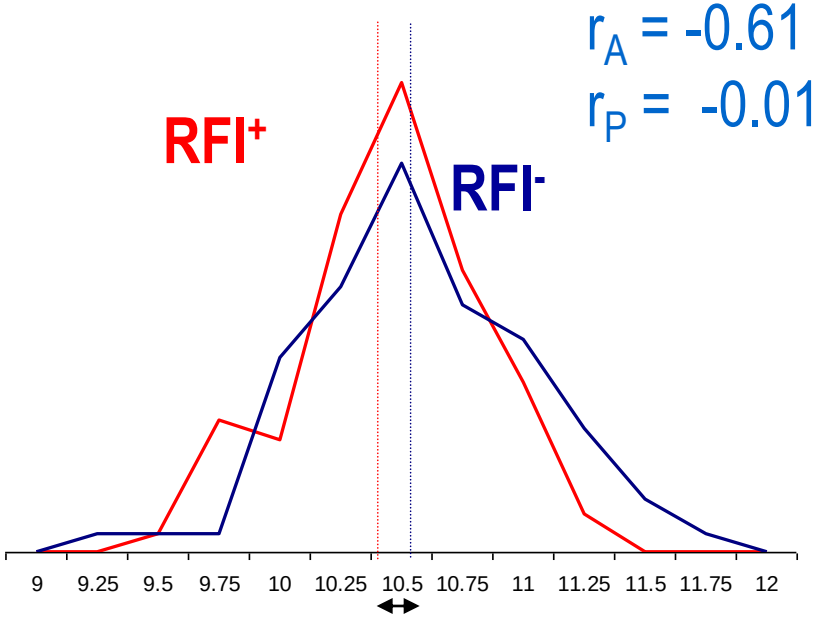
Distribution of loin and ham weights, generation 4

Average loin weight : 9.9kg



Difference between lines :
172g (0.41 SD)
➔Difference of A$ 0.07 between lines

Average ham weight : 10.4kg

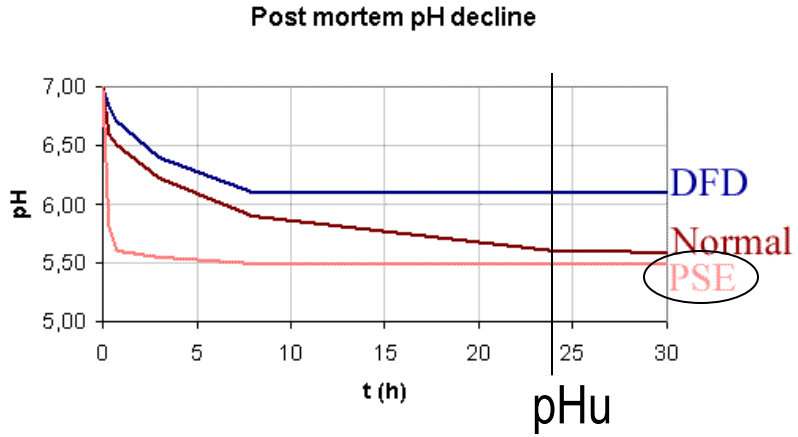


Difference between lines :
129g (0.31 SD)
➔Difference of A$ 0.05 between lines

Meat quality

Ultimate pH (pHu) ; colour (L*) ; Water holding capacity (WHC)

➔ Meat quality index (MQI)

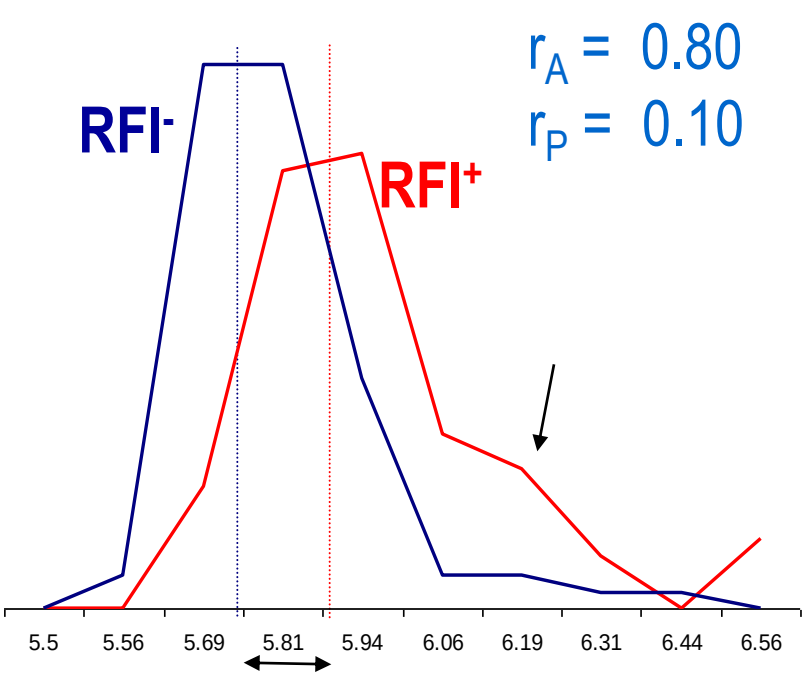


pHu

Poor technological meat quality :
related to low pH, high L*, low WHC
➔ low MQI

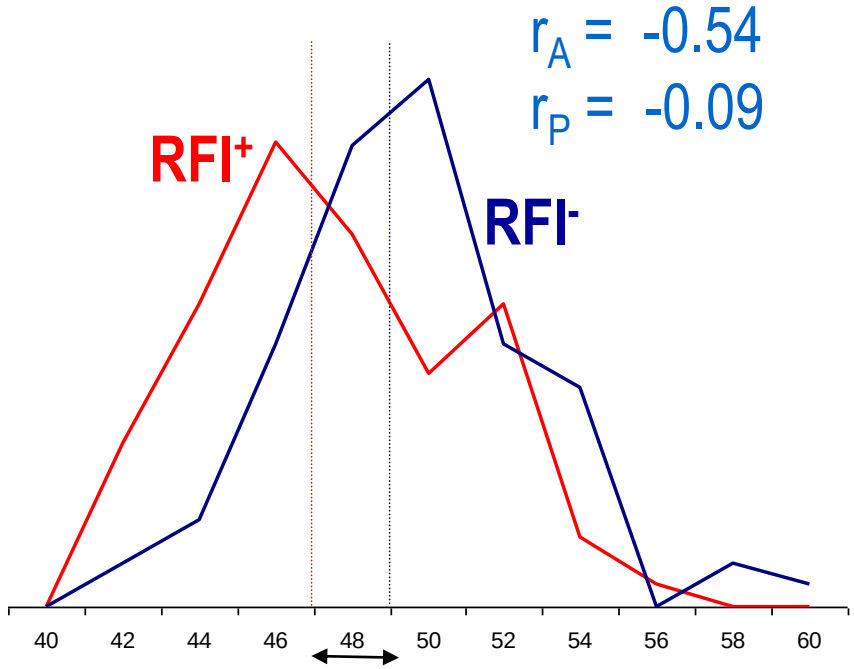
Distribution of ultimate pH *longissimus dorsi* and L* *gluteus superficialis*, generation 4

Average pHu : 5.82points



Difference between lines :
-0.14points (0.78 SD)

Average L* : 47.6points



Difference between lines :
2.1points (0.60 SD)

Lower technological meat quality index

Correlations with RFI :

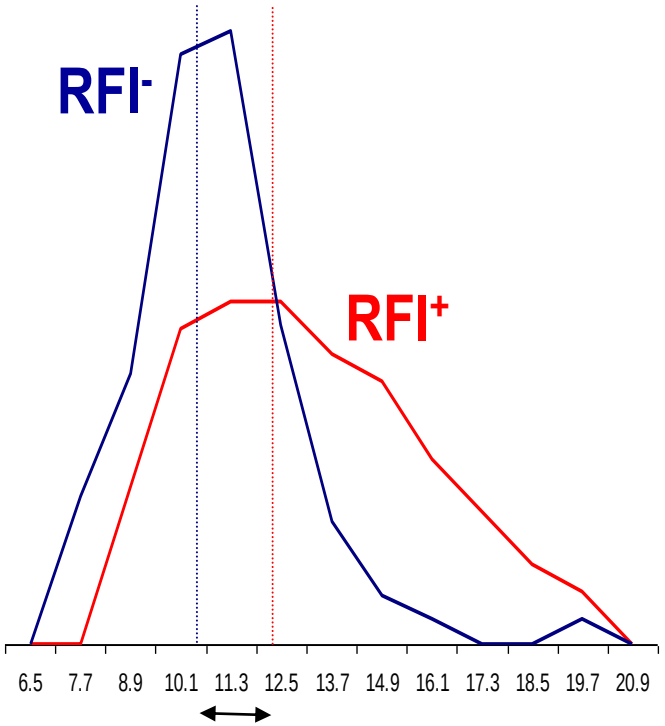
$r_A = 0.77$; $r_P = 0.04$

In generation 4, difference between lines : -2.7points (0.83 SD)

➔ Genetic antagonism between feed efficiency and techological meat quality

High correlated response in technological meat quality

Effect on muscle metabolism



Average MQI : 11.5points

Take home messages

Selection for residual feed intake

(Divergence ~0.20 phenotypic SD/generation)

- **Reduces daily feed intake and feed conversion ratio**
- **Increases lean meat content and affects primal cut weights**
- **Affects technological meat quality**

Based on Gilbert et al, JAS, 2007