

**NPG meeting – PPILOW  
Workshop on Pig Castration**

**Research studies on intact boars:  
Strategies to prevent undesired  
behaviours in intact male pigs and to  
avoid boar taint in the end-products**

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## PPILOW project - Task 4.3

### Objectives

- Develop strategies to **prevent undesired behaviours** (mounting, aggressions) in intact male pigs and to **avoid boar taint** (androstenone, skatole) in the end-products
- Allow **ending of surgical castration in good conditions** for animals, producers and consumers

## INRAE experiment: objectives

- Welfare, boar taint, carcass and quality of meat from entire male pigs in organic system according to genotype: Duroc (x Large White) vs Piétrain (x Large White) crossbreeds

- Prediction of boar taint risk at lower live weight (85 or 105 vs 125 kg)

*Piétrain: standard genotype, highly used in conventional and organic pig production, low risk for boar taint*

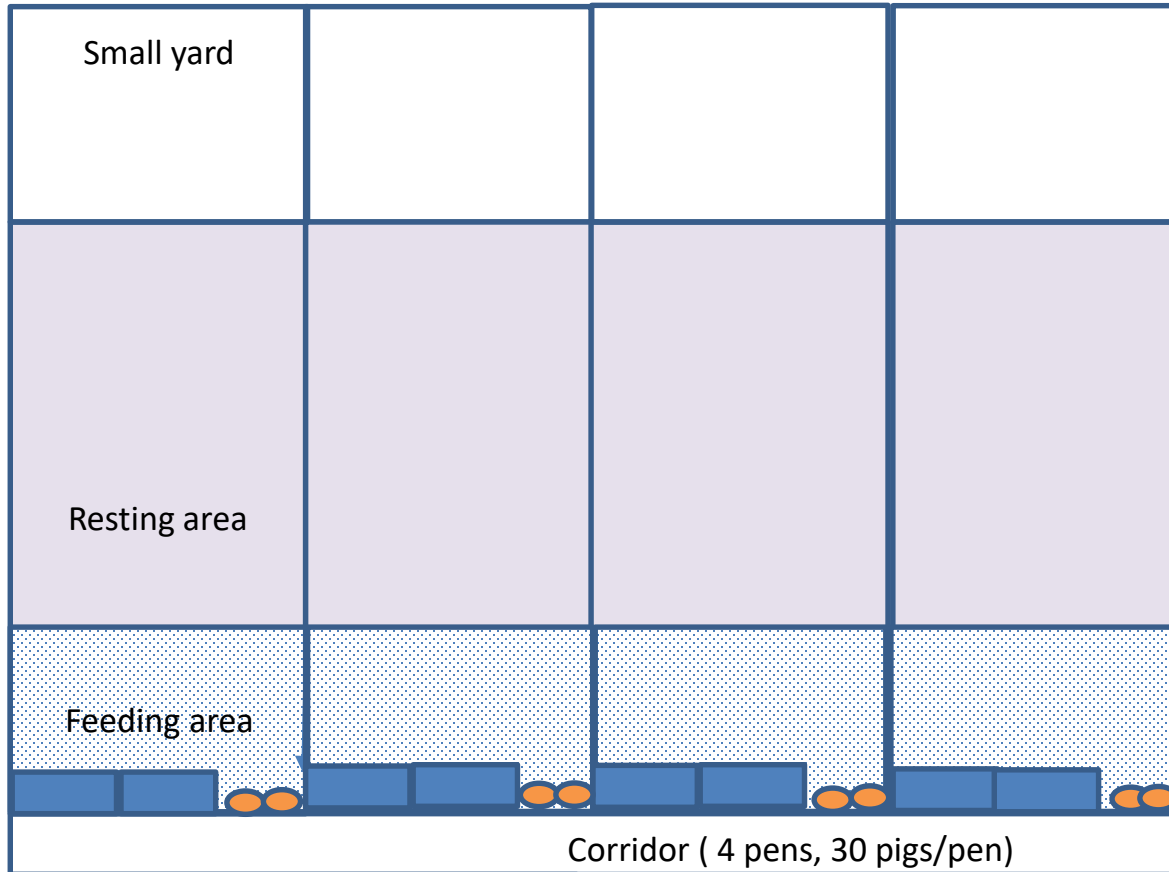
*Duroc: improved meat tenderness, juiciness and technological quality but higher risk for boar taint (Lebret & Candek-Potokar, 2022)*

*Differences in animal behaviour between Duroc and Piétrain crossbreeds (Terlouw et al.)*

### Animal experiment: INRAE Porganic experimental facilities

- ✓ *Partners: IFIP (animal welfare), Nucleus (genetic selection), Cooperl (slaughterhouse)*

# INRAE Porganic experimental facilities

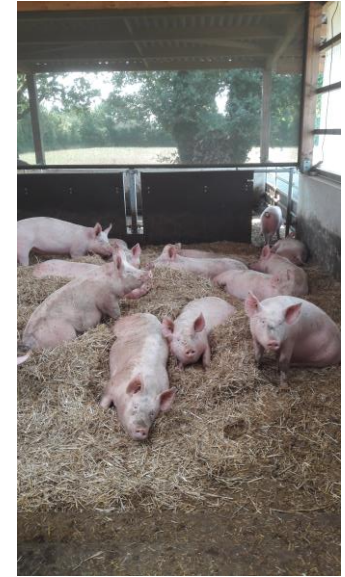


2 pens filled every 6 weeks  
 1 pen LWxPietrain, the other LWxDuroc

## Animal experiment

### INRAE “Porganic” , October 2021 – March 2022

- ✓ *2 experimental replicates, each including one group of entire males per genotype*
  - => 47 DuxLW and 34 PixLW in total*
- ✓ *Feeding: growing and finishing organic diets (ad libitum) and hay in a rack*
- ✓ *2 slaughtering sessions per replicate, with similar number of pigs from each genotype*
  
- ✓ *Observations of health and welfare during rearing*
- ✓ *Blood sampling during fattening (2 to 4 samples/pig)*
- ✓ *Growth performance and carcass traits*
- ✓ *Meat quality traits and boar taint components*



## Indicators of health and welfare

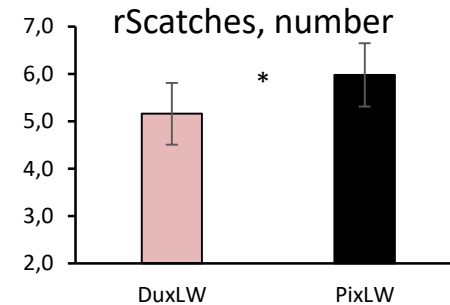
Health indicators	Duroc x LW	Pietrain x LW
Mortality rate	0 %	5.6 %
Bad general state (% pigs)	0.7	0
Pigs with lameness, score of severity (% pigs)		
- 0: no sign of lameness	100	97.1
- 1	0	1.0
- 2	0	0
- 3 = severely lame, impossible to walk	0	1.9



- *First descriptive analysis: lower mortality rate and lameness for Duroc vs Pietrain crossbred males*

## Indicators of health and welfare

Welfare indicators on farm	Duroc x LW	Pietrain x LW
Pigs with skin wounds larger than 5 cm (% pigs)	1.4	2.9
Pigs with at least 15 scratches on one side (% pigs)	0	24
Pigs with tail lesions, score of severity (% pigs)		
- 0: no sign of lesion	95.2	96.5
- 1	4.8	3.5
- 2	0	0
- 3 = severe lesion	0	0



**Carcass scratches at slaughterhouse**  
(square root values)

- *Lower skin wounds and scratches scores for Duroc vs Pietrain crossbred males (due to lower aggressive or mounting behaviours – or lower sensitivity of skin of Duroc to scratches? )*
- *Improvement of health and welfare of entire males with Duroc vs Pietrain crossbred pigs, to be confirmed with complementary statistical analyses*

## Growth performance and carcass traits

	Duroc x LW	Pietrain x LW	Significance
Number of pigs	47	34	
Final live weight, kg	124.2	125.4	
Average growth rate (27-125kg), g/d	952	966	
Carcass weight, kg	96.5	98.4	G*
Lean meat content, %	58.9	60.8	G***

(mixed model, fixed effects of genotype: **G** and replicate: **R**; \*\*\*: P<0.001, \*: P<0.05)

- *Similar growth performance*
- *Lower lean content for Duroc carcasses (higher fat and lower muscle thickness)*





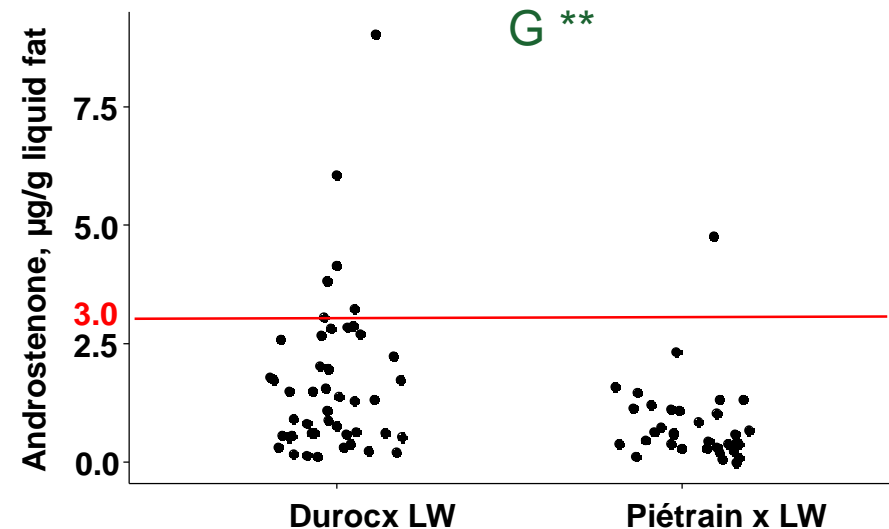
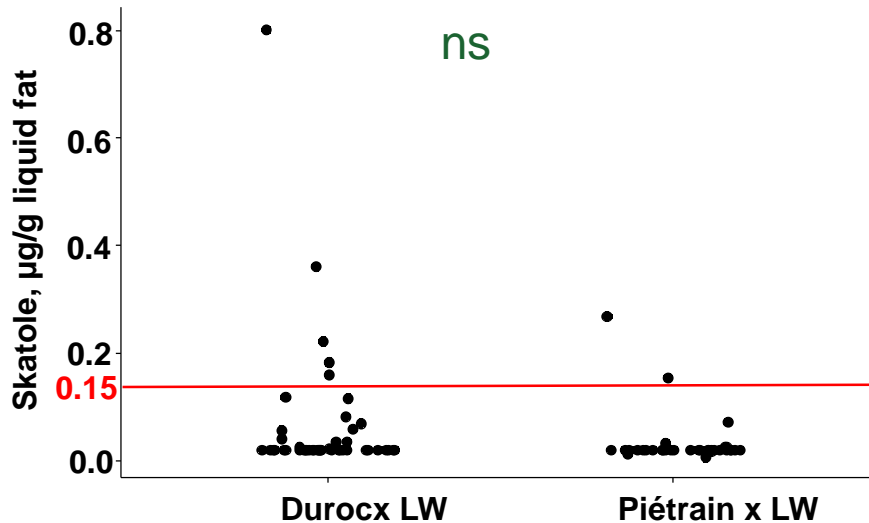
## Meat quality traits of the loin (longissimus)

	Duroc x LW	Pietrain x LW	Sign.
pH 24 h	5.51	5.50	
Drip loss,%	4.70	5.66	G*
Colour: lightness (L*)	48.9	50.0	G*
Colour: redness (a*)	9.97	9.22	G*
Intramuscular fat content, %	2.50	1.90	G***
Shear force of cooked meat, N	33.2	35.0	G <sup>t</sup>

(mixed model, G and R fixed effects, slaughter day(replicate) as random, \*\*\*: P<0.001, \*: P<0.05, t: P<0.10)

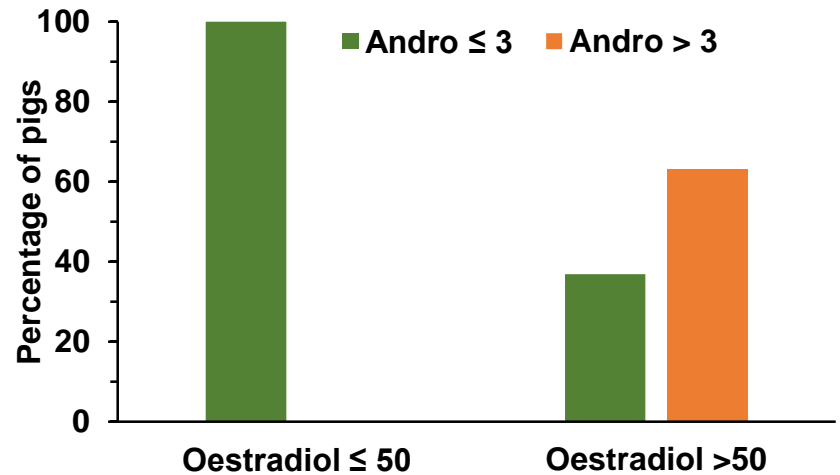
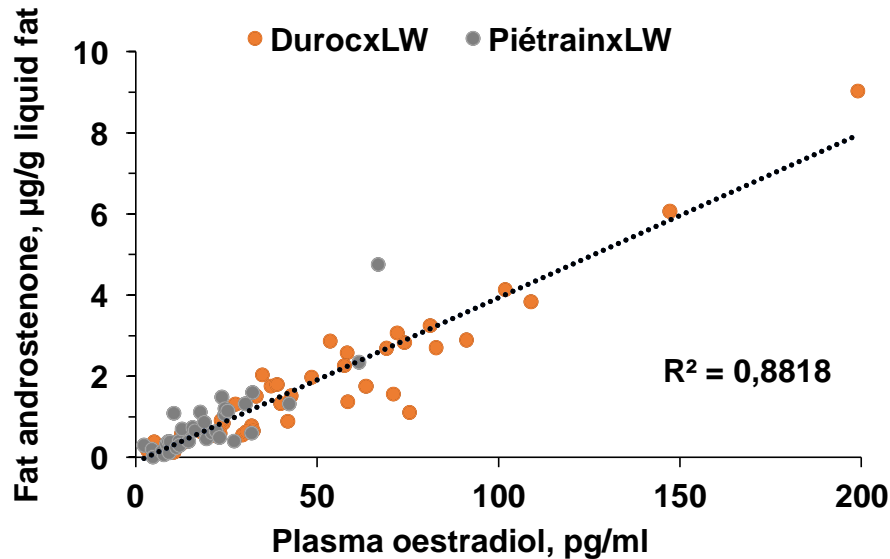
- *Similar ultimate pH (also in ham muscles)*
- *Overall: higher water-holding capacity, redness and IMF, lower lightness and toughness of pork in **Duroc pigs** => **higher technological and sensory quality***

## Boar taint components in backfat



- Similar average skatole content in both genotypes
- Higher average fat androstenone content in Duroc than Pietrain crossbreeds
- Only 1 Duroc carcass detected as odorant at slaughterhouse (highest skatole content)
- Considering **limits of “perception”** (rejection) by consumers to be **0.15  $\mu\text{g/g}$  for skatole and 3.0  $\mu\text{g/g}$  for androstenone**, more carcasses from Duroc (17.4%) than Pietrain (8.8%) crossbreeds would be rejected

# Plasma oestradiol and relationships with androstenone in backfat



- Higher plasma oestradiol for Du vs Pi pigs
- Very high correlation between plasma oestradiol and fat androstenone  
=> **plasma oestradiol can be used to predict fat androstenone**

## Estimation of risk for boar taint related to androstenone

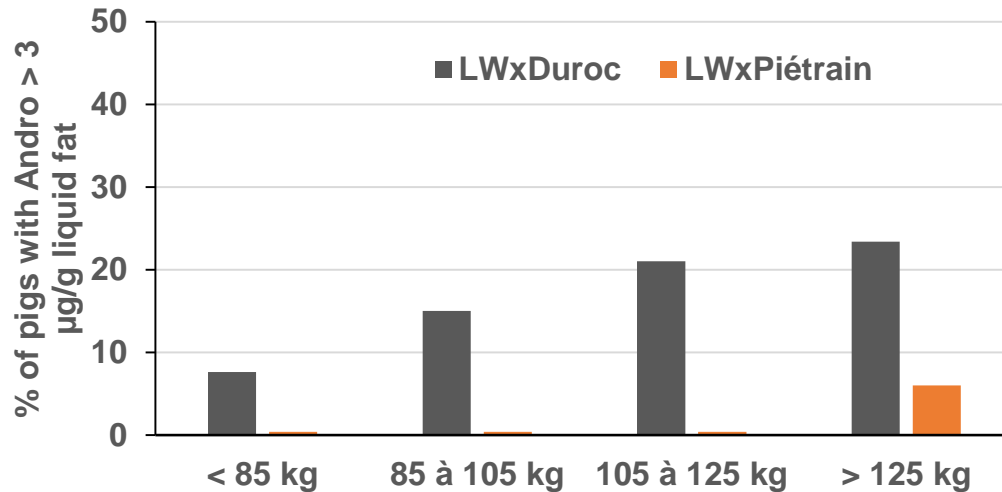
- ≤ 50 pg oestr./ml plasma: close to 0
- > 50 pg oestr./ml plasma: close to 60 %

## Influence of genotype and reduction of live weight at slaughter on the risk for boar taint

*On each pig: 2 to 4 blood samples during fattening*

*Calculation of boar taint risk due to androstenone at given slaughter weight, considering:*

- Risk = 0 for plasma oestradiol  $\leq$  50 pg/ml and risk = 63% for oestradiol > 50 pg/ml
- Risk due to skatole: very low if environmental conditions are good



- *Pietrain : very low risk below 125 kg, close to 6% above 125 kg live weight*
- *Duroc : **gradual increase of risk** from  $\approx$  8% below 85 kg to  $\approx$  23% above 125 kg live weight*
- ***Risk due to skatole:** probably independent of live weight, low in both genotypes if good environmental conditions: clean animals (clean bedding) and good air renewal*

## Effects of Duroc vs Pietrain genotype

### Health and welfare

- Improved health and welfare for entire males from Duroc vs Pietrain crossbreeds, to be confirmed with complementary analyses

### Growth performance and carcass traits

- Similar growth performance between both genotypes
- **Lower carcass leanness** (-> lower commercial value) for Duroc vs Pietrain

### Meat quality

- Higher technological quality (i.e. ability for processing) of Duroc vs Pietrain
- Indicators (intramuscular fat, shear force) suggest **higher meat tenderness**,
- **But higher risk for boar taint** (androstenone) for Duroc than Pietrain crossbreeds

# Conclusions

## Risk for boar taint

### Reduction of live weight at slaughter

- Decreases the risk for androstenone, especially for Duroc crossbreeds
- For both genotypes, **avoid live weight above 125 kg**

### Pig rearing conditions

- Diet (fibers) and pig environment: cleanliness of pens/pigs, air renewal should decrease the risk due to skatole (-> IFIP complementary experiment, PPILOW project)

Thank you for your attention!

Questions?