

# **French qualitative comparison of three Duroc genetics with one Piétrain NN genetic:**

## **Slatted floors or straw's effects on the rearing performance – and the quality of the meat**

This study compares pigs from three Duroc sire lines (Axiom, DanBred and Topigs Norsvin) with those from Piétrain NN Axiom boars. The objective was to evaluate these three lines from birth to slaughter and according to two rearing methods (on slatted floors or on straw). The criteria the offspring were measured on concerned the effects on:

- Pig rearing performance from birth to sale
- Carcass qualities (weight and lean meat percentage)
- The taste quality of the fresh meat

### **What is interesting about the Duroc breed?**

1/ The meat of Duroc pigs is known to be rich in intramuscular fat, which gives it a better sensory (eating) quality. During the 2017 French General Assembly on Food, the Pork Sector Plan announced the ambition of creating a new segmentation of the pork market with "top-of-the-range" products and superior quality criteria.

2/ The use of the Duroc breed as a terminal sire improves the piglet's vigour at birth. Compared to a less competitive Piétrain-cross piglet, the Duroc-cross is quicker to reach the udder at birth – to consume the colostrum essential for its health and survival. The development of free-range maternity pens emphasises the need to raise vigorous piglets to reduce the risk of mortality from crushing.

### **Why three different Duroc lines?**

In 2020, 7 % of the doses marketed by French insemination centres came from different Duroc lines. However, there are major differences in the selection objectives of Duroc lines: some are selected for lean meat, such as Piétrain, while others aim for more marbled meat, associated with a better sensory (eating) quality. Given the diversity of selection criteria for each Duroc line, it is important to phenotype animals from these three lines to assess the specific characteristics of each.

### **Why use the Piétrain NN as a control?**

Since the early 2000s, the male genetics used by French producers have been heavily dominated by the Piétrain breed. The "Halothane NN"-genotype (animals not sensitive to stress) has a positive effect on meat quality. This genetic is widely used in the sectors under an official quality designation.

### **Why two types of rearing methods?**

The way pigs are reared has a well-documented effect on carcass characteristics: pigs reared on straw consume more feed and deposit more back fat, resulting in taste differentiation. Pig rearing in France is dominated by finishing on slatted floors, and there are very few pigs reared on straw. However, the straw rearing method is very common in high-quality approaches and is becoming more widespread as an alternative rearing method. Therefore, it is important to verify the impact of the Duroc lines on the performance of the pigs and their meat quality, according to whether they are reared on slatted floors (SF) or on straw bedding (BED).

**The project partners:**

- Trinottières experimental pig farm (rearing performance)
- Pays de la Loire Chamber of Agriculture (rearing performance)
- IFIP - French Pork and Pig Institute (meat quality measurement)
- Pyragena (sensory analysis, dry ham quality measurements)
- INAPORC (project funding)
- Région des Pays de la Loire (project funding).

## Resources and methods

The trial took place at the Trinottières pig farm between autumn 2019 and spring 2021 on the LW x LRF crossbred sow herd (Axiom Adenia). The piglets were weaned at the age of four weeks.

Each of the three Duroc lines was monitored in a group of sows and their piglets. The sows were divided into two batches of equal sizes, according to their parity and body condition; the first batch was inseminated with Piétrain NN boar semen and the second batch with one of the three Duroc lines. The piglets were weighed at the time of first nursing (24 hours old) and then at weaning. Health problems and mortality were recorded.

Post-weaning, all piglets were raised on slatted floors. At the start of finishing, each group was divided into two batches of pigs to be reared either on slatted floors (SF) or on straw bedding (BED). From weaning to sale, for each Duroc line, one or two groups of pigs were monitored, with regular individual weighing, recording the feed consumption and collecting carcass data.

The animals were slaughtered at around 125 kg live weight at Holvia Porc in Laval. The initial protocol at the slaughterhouse was identical for animals raised on slatted floors and on bedding. At the slaughterhouse, numerous measurements were carried out on:

- Carcass composition: weight of cuts, thickness of fat in hams
- Technological quality of hams and loins: ultimate pH (pHu), visual grading of the colour of the gluteus superficialis (GS) and gluteus profundus (GP) muscles of the ham and of the loin (LD, longissimus dorsi) according to the Japanese scale (grade from 1=very pale to 6=very dark)
- Quality of fresh meat: visual scoring of marbling (intramuscular fat) of the GS muscles of the ham and LD of the loin according to the American NPPC scoring grid (scale of 1=not marbled to 10=very marbled), chemical determination of the intramuscular lipid content (ILC), exudate, cooking losses and shear force after cooking.

Measurements of ham and loin quality were carried out on a sample of ten pigs per genetic type and per rearing method, i.e. 40 animals slaughtered on the same day, selected from carcasses with weight and lean meat percentage values close to the average of the slaughter batch, observing, as far as possible, a balanced sex ratio between females and castrated males.

## DanBred Duroc: the offspring were distinguished by good rearing performance

The DanBred Duroc offspring were characterised by a lower loss rate under the mother, very fast growth, good feeding efficiency and very lean carcasses.

### Maternal and post-weaning performance

The prolificacy criteria (total born or liveborn) did not differ significantly between the two genetics. Similarly, litter size at weaning was comparable. On the other hand, the live birth loss rate was lower for litters from a DanBred Duroc boar (10.5 % compared to 17.5 % for litters from a Piétrain NN boar).

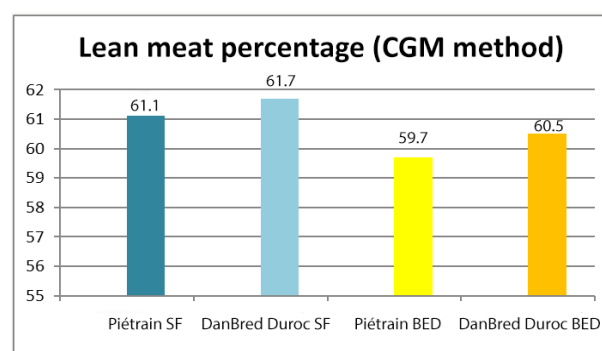
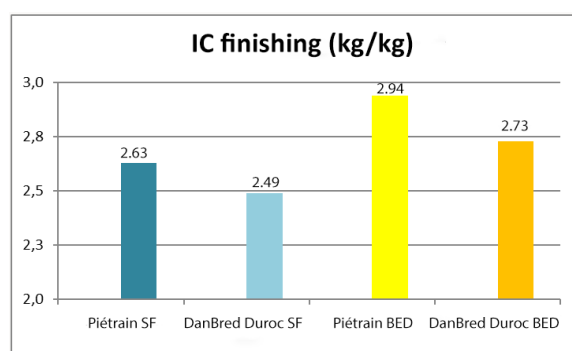
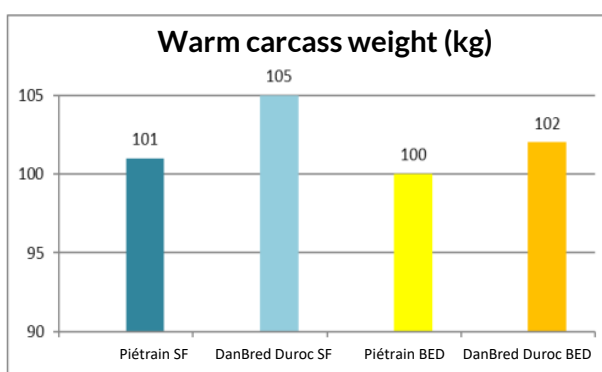
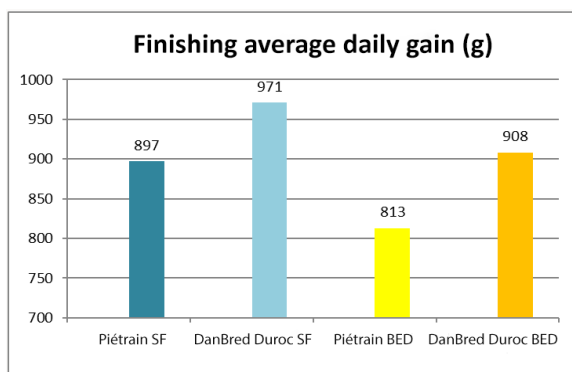
	Piétrain NN boar	DanBred Duroc boar
Total births per litter (1)	17.5	16.8
Live births per litter (1)	16.8	15.9
Weaned per litter (1)	13.2	13.5
Live birth loss rate (1)	17.5 %	10.5 %
Weaning weights (2)	7.7 kg	8.0 kg
Average daily gains post-weaning (2)	528 g	489 g

(1) results on one group - (2) results on two groups

Compared to Piétrain NN offspring, DanBred Duroc offspring showed a lower post-weaning growth rate (489 vs. 528 g), despite their higher weaning weight at day 28 (8.0 vs. 7.7 kg).

### Finishing and slaughter performance

From the age of 12 weeks, pigs bred from DanBred Duroc started to grow faster than those bred from Piétrain NN. The delay in weaning was largely compensated for at 16 weeks of age, and growth continued at a very high rate in the finishing phase due to a liberal feeding curve (bell curve). In finishers, the average daily gain of DanBred Duroc offspring was significantly higher than that of Piétrain NN offspring, both on slatted floors (971 vs. 897 g) and on straw (908 vs. 813 g). These pigs also had a better feed conversion ratio than the Piétrain NN pigs, both on slatted floors (2.49 vs. 2.63) and on straw (2.73 vs. 2.94). When fattened on slatted floors, their carcass weight was, therefore, higher at slaughter: 105 kg of warm carcass weight compared to 101 kg for the Piétrain NN. Despite this higher carcass weight, DanBred Duroc offspring were also less fatty, resulting in a higher lean meat percentage on a slatted floor (61.7 compared to 61.1 for Piétrain NN offspring). On straw bedding, the differences in carcass weight and lean meat percentage between the two genetics were not significant.



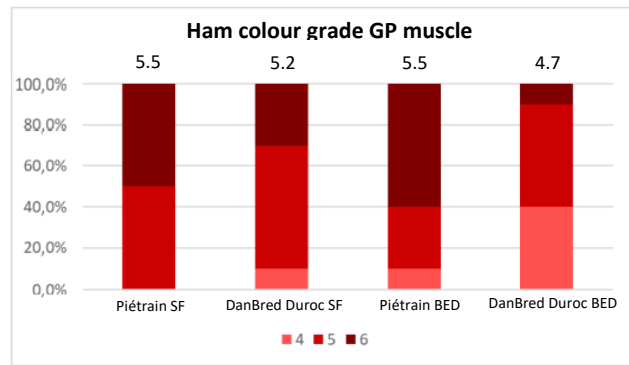
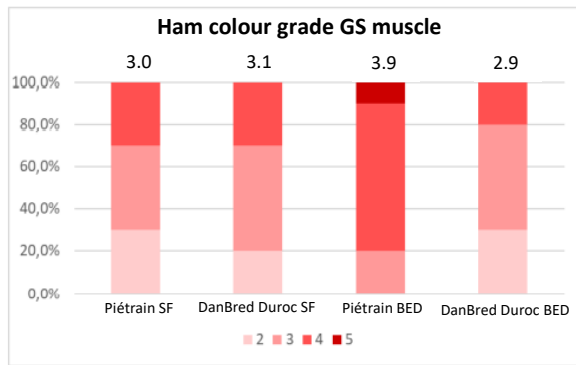
In terms of meat quality, DanBred Duroc offspring showed similar results as Piétrain NN offspring, both in terms of loin and ham – regardless of the rearing method.

### Technological quality of hams

DanBred Duroc offspring differed from Piétrain NN offspring primarily in the way they were reared on straw bedding. The ham muscles were paler in DanBred Duroc offspring (-1.0 point on GS muscle and -0.8 point on GP muscle). DanBred Duroc offspring were also characterised by more fatty hams, both in terms of fat thickness (+2.3 mm on slatted floors and +3.2 mm on straw) and marbling (+0.6 on slatted floors and +0.2 on straw), but the differences were not always significant.

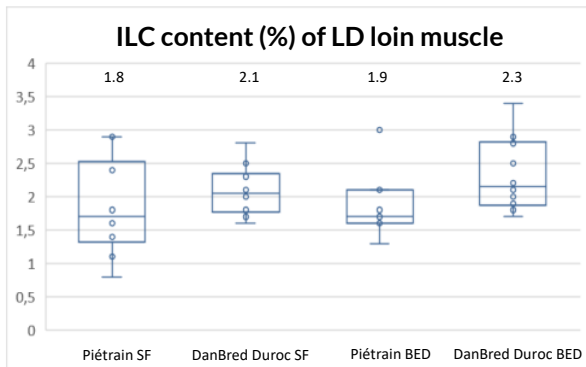
	Slatted floors			Straw bedding		
	Piétrain NN	DanBred Duroc	Deviation Du - Pi	Piétrain NN	DanBred Duroc	Deviation Du - Pi
pHu of ham	5.69	5.70	+0.01 (NS)	5.58	5.57	-0.01 (NS)
GS muscle marbling	1.2	1.8	+0.6 (**)	1.5	1.7	+0.2 (NS)
Fat thickness (mm)	9.3	11.6	+2.3 (NS)	8.9	12.1	+3.2 (*)

NS: non-significant difference; \*: significant difference with a 5 % risk of error; \*\*: significant difference with a 1 % risk of error; \*\*\*: significant difference with a 1 % risk of error



### Quality of the fresh loins

There was not observed any significant difference in the quality of fresh loins between the DanBred Duroc and Piétrain NN genetics for the straw bedding rearing method. Regarding the animals reared on a slatted floor, DanBred Duroc offspring had loins with an average marbling difference of 1.1 points compared to Piétrain NN offspring. The trend was confirmed by chemical analysis, although the difference was not significant. However, the average values of ILC content estimated by dosage were below 2.5 %, considered to be the minimum threshold for producing meat of better sensory quality. Finally, there was less cooking loss on DanBred Duroc loins (-1.4 % compared to Piétrain NN loins).



	Slatted floors			Straw bedding		
	Piétrain NN	DanBred Duroc	Difference Dur - Pié	Piétrain NN	DanBred Duroc	Difference Dur - Pié
Colour of LD muscle	3.4	3.1	-0.3 (NS)	2.7	2.5	-0.2 (NS)
LD muscle marbling	1.5	2.6	+1.1 (***)	1.6	2.2	+0.6 (NS)
% water loss	4.3	2.9	-1.4 (NS)	3.9	4.4	+0.5 (NS)
% cooking loss	19.7	14.6	-5.1 (**)	18.7	17.1	-1.6 (NS)
Shear force (Newton)	26.3	24	-2.3 (NS)	24.6	21.5	-3.1 (NS)

NS: non-significant difference; \*: significant difference with a 5 % risk of error; \*\*: significant difference with a 1 % risk of error; \*\*\* significant difference with a 1 % risk of error

## **Conclusion**

The protocol implemented made it possible to collect numerous data on maternity, finishing, carcass and fresh meat quality, on three Duroc genetics and one Piétrain NN genetic used as a control. The choice of protocol did not allow for a comparison of Duroc genetics with each other, as each group produced contained only one Duroc genetic vs. one Piétrain NN control genetic. This study confirms that the three Duroc lines tested in our project differed from the Piétrain NN control, each with its own specific characteristics. Under the mother, weaning performance remained good regardless of the line, even if differences were observed in the loss rate. It was especially from post-weaning onwards and during finishing that the three Duroc lines gave different results from the Piétrain NN control. In terms of meat quality performance, some Duroc genetics differed more from the Piétrain NN control than others, and overall, the differences between genetics were more marked than those between rearing methods. This study will be completed by sensory analysis data on the loin and dry-cured ham as well as a macro-economic study.