

Performances of the Piétrain ReHal, the new stress negative Piétrain line.

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Summary

Piétrain ReHal was created by introgressing the negative stress gene from the LargeWhite into Piétrain (successive back-cross (BC)).

The pigs born in station from Piétrain ReHal boars used as terminal boars are characterised, on average, by a feed efficiency of 2.959, a daily gain during the fattening period of 649 g, a killing out percentage of 82.6 percent with an SKG2 meat percent estimation of 58.55% and a back fat thickness of 2.005 cm.

A total of 5,002 piglets were obtained from commercial sows and boars of different genetic origin, and Piétrain ReHal (Nn) boars were compared to Landrace and Piétrain pure-bred animals. All the animals were born in 2 farms and fattened on 19 farms. Meat% was analysed with a linear fixed model including fattening farm effect, sow line, sex, boar within breed and breed of the boar. Results indicated that Piétrain ReHal heterozygote boars performed quite well (meat%=58.93%) and that the estimated meat% are closed to the pure Piétrain results (59.48%) and better than Landrace boars (57.99%).

In 1997 and 1998, BC5, BC6 and BC7 (=255/256 Piétrain) generations have been produced. More recently, it has been decided to produce the Piétrain ReHal homozygote stress negatives called Piétrain ReHal^{cc}. A large number of Piétrain ReHal^{cc}, with the meat and carcass performance of Piétrain pigs, are produced now in Belgium.

Introduction

The development of a new stress negative Piétrain line was launched at the Faculty of Veterinary Medicine of the University of Liège in the 1980's. Two main objectives of the project were defined.

Firstly, fundamental research was required on the Halothane locus and its impact on meat production and quality, especially in a specific genetic background like the Piétrain which is completely different from other halothane positive lines (Nezer *et al.*, 1999).

Secondly, there was a increasing requirement for pigs that were completely free of the stress gene, both to reduce carcass loss due to unacceptable pH levels and though PSE-PSS syndrome and to meet consumer requirements for a reduction in pre-medication before transport.

The Piétrain ReHal (resistant to halothane anaesthetic gas) was created by Hanset and co-workers (Hanset *et al.*, 1989) by introgressing the negative stress gene (N) from the Large White into the Piétrain. The background Piétrain genome has been recovered by successive backcrossing. The first backcross generation (BC1) were 75% Piétrain, and at the present moment the seventh backcross (BC7 or 255/256 Piétrain) has been reached.

A total of 600 pigs, stress negative animals heterozygotes (Nn) that are 99.6% Piétrain and also homozygotes (NN), born to Nn parents, constitute the foundation sire line of the research station farm at the campus of Sart Tilman (University of Liège). The stress negative animals heterozygotes (Nn) represent 47% and the stress negative animals homozygotes (nn) represent 13% of the total number of pigs born in 1999.

The used of Piétrain ReHal boars in station

Three commercial sow lines were obtained from a private company (Detry SA) and transferred in November 1995 to the University station as part of a project co-financed by Detry SA and the Federal Ministry of Agriculture.

The objective of the study was to estimate growth and carcass performance of Piétrain ReHal (Nn) boars on commercial sows under station conditions.

The 3 sow lines were crossed with Piétrain ReHal boars. All the animals received the same feed composition with the same management conditions.

An integer value (from 11(best) to 17 (worst)), considered as a subjective ranking of the carcass, and an estimated meat percentage (obtained from a camera giving the SKG2 meat percentage estimation) were available from the system currently used by the private slaughterhouse participating in the study.

The growth and carcass performances of the total data set (83 NN, 188 Nn, 72 nn and 37 with unknown halothane genotype) indicate clearly that the reconstruction of the Piétrain breed has been almost attained (table 1). The Europ ranking distribution shows that more than 85% of the pigs are in the S and E highest classes (table 2). The pigs born from Piétrain ReHal boars used as terminal boars are also characterised, on average, by a feed efficiency of 2.959, a daily gain during the fattening period of 649 g, a killing out percentage of 82.6 percent with an SKG2 meat percent estimation of 58.55 and a back fat thickness of 2.005 cm. A linear fixed model including sow line, genotype (NN,Nn,nn) and sex does not explain the differences in weaning weight. The same model including weaning weight as a covariate explains 12.6% of the variation in slaughter weight. The effect of genotype on slaughter weight corrected for weaning weight was not significant. A third fixed linear model including sow line (L, F), genotype (NN,Nn,nn), sex fixed effects and weight at weaning and weight at slaughter as a covariable explained from 6.3 to 18.1 of the variation in carcass traits.

The use of Piétrain ReHal heterozygote (Nn) boars on commercial sow lines in Farm conditions

In parallel with the study of the Piétrain ReHal on station, where Piétrain ReHal animals have been continuously produced from heterozygote Piétrain ReHal (Nn) and new Piétrain (nn) sows, another experiment was set up in order to test the Piétrain ReHal line under commercial conditions. 5,002 piglets were obtained from sows and boars of different genetic origin; Piétrain ReHal (Nn) boars were compared to Landrace and Piétrain pure bred animals. All the animals were born on two farms and fattened on 19 farms.

The data were analysed by a linear fixed model including: fattening farm effect, sow line, sex, boar within breed and breed of the boar. The distribution of the data by origin of boars is given in table 3. The descriptive statistics concerning some growth and carcass traits are given in table 4. The overall results (table 4) are influenced by the frequency of Piétrain boars in comparison with other origins. The percentage of variation explained by the linear model ranged from 10.1% to 21.9% and the relative importance of each effect is illustrated in figure 1. Differences between breed of boars were significant and are given for subjective ranking (11-17) and percentage of meat in table 3.

The results of the subjective ranking and meat percentage indicate that Piétrain ReHal heterozygote boars perform quite well and that the estimated meat percentages are close to the Piétrain results. Piétrain ReHal boars give better results than Landrace boars.

The Piétrain ReHal^{CC}, the Piétrain ReHal homozygote stress negative

In 1997 and 1998 BC5, BC6 and BC7 generations have been produced. For the different years, litter number per year was on average 2.06 and the number of piglets born and weaned per sow per year were respectively 19.02 and 15.45. Better results have been obtained due to improved management conditions on the farm. More recently, it has been decided to produce the Piétrain ReHal homozygote stress negatives that we call Piétrain ReHal^{CC}. These homozygote stress negative pigs are, at the molecular level, CC pigs and they correspond to the NN nomenclature of the previous studies. A large number of Piétrain ReHal^{CC}, with the meat and carcass performance of Piétrain pigs, are produced at the University Station farm and also by Belgian Piétrain breeders..

Table 1. Growth and carcass performance of pigs obtained from Piétrain Piétrain ReHal boars at the Research Station farm of the University of Liège (380 animals).

| Variable | Mean | S |
|----------------------------|--------|-------|
| Birth weight (g) | 1592.2 | 427.8 |
| Weaning weight (Kg) | 7.69 | 1.66 |
| Slaughter weight (Kg) | 114.5 | 14.4 |
| Subjective ranking (11-17) | 14.2 | 1.1 |
| Carcass length (cm) | 83.3 | 3.4 |
| Carcass weight (Kg) | 95.9 | 9.8 |
| Killing out % | 82.6 | 50.8 |
| Meat% | 58.6 | 3.4 |
| Back fat thickness (cm) | 2.0 | 0.6 |
| pH loin after 1 h. | 6.3 | 0.3 |
| pH loin after 24 h. | 5.7 | 0.2 |

Table 2. The use of Piétrain Piétrain ReHal boars on station. Europ carcass ranking of pigs (n=343) born from different commercial sow lines crossed with Piétrain ReHal boars.

| Europ Rank. | N | % |
|-------------|-----|------|
| S | 123 | 35.9 |
| E | 171 | 49.9 |
| U | 48 | 14.0 |
| R | 1 | 0.3 |

Table 3. Frequency distribution of Piétrain ReHal boars used on commercial sow lines and Least square means of subjective ranking and estimated meat % (farm conditions, n=5,008).

| Origin of the boars | Frequency | % | Subject. Rank. | Meat % estim. |
|---------------------|-----------|------|----------------|---------------|
| Piétrain (Belgium) | 3,912 | 3.8 | 13.78 | 59.48 |
| Piétrain (France) | 203 | 2.4 | 13.93 | 58.99 |
| Piétrain ReHal | 582 | 4.1 | 13.99 | 58.93 |
| Landrace (Belgium) | 191 | 78.1 | 14.08 | 57.99 |
| Landrace (France) | 120 | 11.6 | 14.42 | 56.95 |

Table 4. The use of Piétrain ReHal boars (farm conditions). Growth and carcass performances of 5,008 pigs born from commercial sow lines and from different boar type.

| Variable | Mean | S |
|----------------------------|-------|------|
| Age at weaning (days) | 27.7 | 3 |
| Age at slaughter (days) | 213.2 | 18.8 |
| Subjective ranking (11-17) | 13.9 | 1.1 |
| Meat% | 59.4 | 3.5 |
| Carcass weight (Kg) | 92.5 | 10.4 |
| Slaughter weight (Kg) | 112.8 | 12.7 |
| Age at 100 kg (days) | 209.5 | 18.5 |

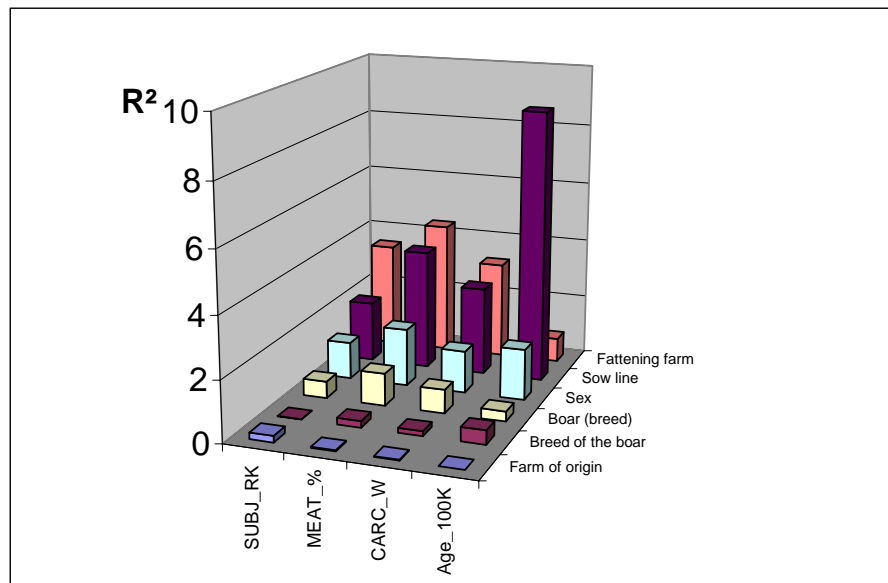


Figure 1. The use of Piétrain ReHal boars (farm conditions). Percentage of the variation ($R^2\%$) of subjective ranking (SUBJ_RK), percentage of meat (MEAT%), carcass weight (CARC_W) and age at 100 kilos (AGE_100K) explained by the different effects included in the linear model.

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