Performance, carcass and ham quality in crossbreds combinations of three sow lines and two Belgian Piétrain lines

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Introduction

Economic return in contemporary pig fattening is strongly determined by high growth rate, low feed conversion ratio and high carcass quality (Ollivier et al., 1990). The latter is reflected by a high lean meat content and good conformation. Meat quality is currently not valorized at slaughter, and not included in most breeding programs. Consequently, the expression of meat quality traits is determined by genetic correlations with traits in the breeding goal. There are indications that selection for fast growth rate, conformation and low fat deposition has resulted in increasing glycolytic muscle fiber type proportions and decreasing intramuscular fat content (IMF), thereby impairing meat quality in terms of taste, juiciness and occurrence of PSE-like (pale, soft and exudative) meat (Hugenschmidt et al., 2010; O'Neill et al., 2003). However, breeding goals evolve. The Belgian Piétrain is the predominant sire line in Flanders and is now commercially differentiated (Personal comm. VPF). In addition, of several sow lines used nowadays, the effect on meat quality traits is not known. The aim of this study was therefore to explore the differences in 3 common sow lines and 2 types of Belgian Pietrain sire lines.

Material & Methods

The animals were crossbreds of one out of 3 hybrid sow lines (Topigs20, TN70 (both Topigs Norsvin), Mira (RA-SE genetics) and one out of 2 types of Belgian Piétrain sire lines, with Optimal sires (n=6 boars) selection based on higher breeding values for growth rate (87.3 vs 8.0 (Premium)) and Premium sires (n=7) selection based on a higher breeding values for carcass quality (20.4 vs. -6.3 (Optimal)). Across three weaning rounds, 270 piglets were selected and divided per crossbred into 45 pens in the nursery with at least 6 pen replicates per crossbred. The animals were raised mixed sex (3 gilts and 3 immunocastrates) and the same pen grouping was retained in the fattening barn. The male pigs were immunocastrated using two vaccinations of Improvac® (Zoetis, Belgium), carried out at 15 and 20 weeks of age. The pigs had free access to water and were fed with the same three phase diet *ad libitum* (changed at 15 and 20 weeks. All animals were weighed individually and feed consumption was measured at pen level to calculate average daily gain (DG), average daily feed intake (DFI) and feed conversion ratio (FCR). Pigs were slaughtered at 2 slaughter events per round by exsanguination after carbon dioxide stunning. Hot carcass weight was recorded and used for calculation of dressing yield and lean tissue growth. The 'AutoFOM III' system (Frontmatec A/S, Denmark) was used to determine carcass lean meat content and Meat Building Index (MBI). MBI is an index representing carcass quality, with a lower score representing a better carcass quality. The initial pH of *m. semimembranosus* (MS) was measured 35 min. after slaughter at the right side of the carcass. A total of 216 pigs (18 pigs/cross/sex) were selected to evaluate meat quality based on final live weight to ensure a weight of the fresh ham with bone between 10.5-12 kg. The next day, the right ham of these animals was collected and deboned. The pH_u was evaluated by 3 repeated measurements in MS. Drip loss was evaluated after 48 hours (Christensen, 2003), on 2 samples taken from the inner surface of MS (close to the area with where PSE-like zone could appear). Cooked hams were produced in a commercial setting (Breydel, Gavere, Belgium) according to a recipe for artisanal cooked ham ("zadelham ambachtelijk"). The fresh hams were weighed before injection with a brine solution and after cooking to calculate the cooking yield. Seven days after cooking, the hams were sliced and trimmed for intermuscular and subcutaneous fat before determination of IMF (data shown for 108 animals) (ISO 1444:1973, n.d.) by Soxhlet method. All statistical analyses were performed with R 3.5.1 (Team, 2018), with pen considered as experimental unit. For performance parameters, sow and sire line and initial weight were included as fixed effects and round as random effect for repeated measurements. For carcass/meat quality: sow and sire line and weight (carcass/fresh ham) were included as fixed effects and round, slaughter date and pen as random effect to account for repeated measurements within the pen.

Results & Discussion

No interaction between sire and sow line was observed. Topigs20 offspring had a trend to have a lower DG compared to the other 2 sow lines and Premium offspring had a lower DG compared to the Optimal. For DFI, only Optimal offspring had a significant higher DFI. In line with differences for DG and DFI, a higher feed conversion ratio was found for Topigs20 and Mira offspring compared to the other two sow lines. No differences regarding FCR was found for the sire lines. A difference in carcass quality was only found between the sow lines. The dressing yield was significant higher for Mira and TN70 offspring instead of Topigs20. The lean meat content was the highest for the TN70 offspring, lowest for Topigs20 and Mira intermediary. In line with the lean meat content, the highest lean tissue growth was calculated for TN70 and Mira offspring and lowest for Topigs20. The lower lean meat content and lean tissue growth could be explained by the linear effect of feed intake on lean meat growth until the maximum protein deposition capacity is reached, after which almost only lipids will be deposited. Considering the higher need of energy per unit of fat gain, higher FCR can be anticipated. This could explain the higher FCR for Topigs20 offspring (Patience et al., 2015). Regarding the conformation and lean meat content, TN70 offspring had the lowest MBI (highest carcass quality) and Topigs20 the highest (lowest carcass quality), while it was not possible to differentiate MIRA offspring. However, in the present study, meat quality traits did not differ significantly between crossbred types, except for cooking yield for the sow lines, with a trend for a lower cooking yield for the TN70 offspring compared to the other 2 lines. Similarly, in the study of Correa et al. (2006), the meat quality of the loin was not affected by differences in growth rate. In this study a negative correlation between lean meat content and cooking yield could also be observed (-0.33, $p<0.001$). A reason why numeric differences between treatments were not significantly different (e.g. IMF, drip loss) might be the high variation between individual sires and sows within a line.

Table 1: Effect of sow and sire line on performance, carcass and meat quality

	Sow lines			**Sire lines**		**P-value**	
	Mira	TN70	Topigs20	Optimal	Premium	Sow	Sire
Daily gain (g/day)	952	953	911	967	897	0.053	0.013
Daily feed intake (g/day)	2219	2095	2217	2287	2069	0.174	0.004
Feed conversion ratio (g/g)	2.33^{b}	2.20^{a}	2.44^{b}	2.37	2.31	<0.001	0.311
Dressing yield (%)	78.4^{a}	79.1^{b}	78.4^{a}	78.6	78.6	<0.001	0.832
Lean meat content (%)	64.7^{ab}	65.5^{b}	64.0^{a}	64.4	64.9	0.003	0.875
Lean tissue growth (g/day)	0.476^{b}	0.490^{b}	0.451^{a}	0.481	0.454	<0.001	0.916
MBI	3.27^{ab}	3.06^{a}	3.41^{b}	3.30	3.25	0.003	0.748
pH_1	6.60	6.54	6.61	6.59	6.58	0.809	0.885
pH_u	5.58	5.58	5.62	5.59	5.60	0.138	0.932
Drip loss (%)	6.09	5.82	5.33	5.80	5.70	0.189	0.766
IMF (%)	4.13	4.04	4.50	4.06	4.39	0.310	0.187
Cooking yield (%)	105.6	102.7	105.6	105.3	104.0	0.067	0.153

^{ab} Different letters indicate difference between the groups ($p < 0.05$)

Conclusions

Present results show that the investigated crossbred combinations of sow and sire lines had the largest effect on performance and carcass quality, and hardly an effect on meat quality. In general, there was a lower feed conversion ratio in TN70 offspring. Topigs20 had the lowest carcass quality (e.g. lean meat content, dressing yield, MBI) and TN70 the highest and Mira intermediate. Regarding meat quality, only a trend to a lower cooking yield of the TN70 offspring compared to the other two sow lines was observed. Further investigation in the individual variation of sires within a line could increase the meat quality.

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