GENETIC BUT NOT LEAN GRADE IMPACT ON GROWTH, CARCASS TRAITS AND PORK QUALITY UNDER ORGANIC HUSBANDRY

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I. INTRODUCTION

The Duroc breed has been used as sire line with improved maternal crossbreds (Landrace x Large-White) to produce dry-cured pork products, since accumulates greater intramuscular fat than other sire breeds as Pietrain [1]. However, local breeds (either in maternal or sire lines) may be preferred under organic production. In addition, pork prices in the European Union are based on lean content, which may condition the target farming decision. The aim of this study was to evaluate the effects of genetic type and lean grade on growth performance, carcass traits and pork quality under organic husbandry.

II. MATERIALS AND METHODS

A total of 48 pigs from two genetic types raised from 12 sows: 26 animals were Pietrain x (Landrace x Large White) (Pi x (LD x LW) and 22 animals were Duroc x (Gascon x Duroc) (Du x (Gc x Du). Half of the animals were females, the other half were castrates. The Pi genetic types derived from Pi line of Selección Batallé (Riudarenes, Girona, Spain) and the Du genetic types derived from Du line of German Genetic (Stuttgart-Plieningen, Germany). In total, 32 pig carcasses (around 3 pigs/litter) and loin meat from 24 pigs (2 pigs/litter) were sampled. The individual body-weight (BW) was determined at the start of the growing phase (initial age 68±15 days) and prior to slaughter (after 20 hours of fasting) to calculate the average dairy gain (ADG). The BW at slaughter was set at 105 kg (Pi-sired) or 90 kg (Du-sired) to reach a similar lean content between genetic types (around 60% lean). All pigs had the same feed *ad libitum* (14% of crude protein, 3.7% ether extract, 0.65% lysine and 12.7 MJ/kg of metabolizable energy). Pigs from both genotypes were housed together in three concrete floor pens with a space allowance ≥2.3 m^2/pig. Slaughtering was performed on five batch days. Pigs were brought to the abattoir (68 km away) and they were allowed to rest 3-4 h. Pigs were stunned by CO_2 (concentration 87%). The carcasses were graded with an automated image analysis system (VCS 2000) and classified in two classes (<=60% and >60% lean). Backfat thickness was measured at 3^{rd}-4^{th} last rib. Hot carcass weight was individually recorded before the carcasses were refrigerated in line processing at 2º C. At ~45 min *post-mortem*, the loins were excised from the carcass. The *longissimus lumborum* was sampled (~600 g, 12 cm caudal), packaged and stored at 4ºC in darkness overnight. At 45-min and 24-h *post-mortem*, the meat pH was measured.
Colour measurements were taken in 2 cm-thick loin slices after 30 min blooming by determining the CiELab colour coordinates with a Minolta spectrophotometer (Konica Minolta Sensing Inc., Japan). These values are L* (lightness), a* (redness) and b* (yellowness). Meat samples were vacuum packaged and stored at -20ºC until Warner-Bratzler shear force (WBSF) measurement. Samples were thawed at 4ºC during 24 h for texture analysis. Loin slices were cooked by placing the vacuum bags in a water bath (95ºC) with automatic temperature control to internal temperature of 70ºC, controlled by thermocouples connected to a data logger. After cooking, samples were cooled at room temperature overnight and the percentage of cooking loss was recorded. Samples were then cut parallel to the long axis of the muscle fibers into rectangular cross-section slices of 10 × 10 mm and 30 mm length. Pieces (8/slice) were sheared perpendicular to the fiber orientation, with a WBSF device attached to a PC (Instron Ltd., UK), and equipped with a 500 N load cell and a crosshead speed of 150 mm/min. The data were analyzed with the Jmp Pro 11 statistical software (SAS Institute, Cary, NC, USA), with a standard model including genetic type, lean grade, sex and batch as fixed effects, and their single interactions. Differences ($P<0.05$) between least square means were assessed with the Tukey test.

III. RESULTS AND DISCUSSION

The initial and final BW was affected by genotype (Table 1), being higher in Pi x (LD x LW) than in Du x (Gc x Du) pigs ($P<0.01$), but final BW was not affected by lean grade ($P>0.05$). The ADG was affected by genetics, Pi x (LD x LW) growing faster than Du x (Gc x Du) pigs (P<0.01). Carcass weight and dressing out were higher in Pi x (LD x LW) than in Du x (Gc x Du) (P<0.001). Genotype did not affect backfat thickness or lean content (P>0.05). The pigs classed as leaner had been heavier at the start of the growing period (P<0.05) and tended to grow slower during the fattening period (P=0.06) than fattier pigs, but both groups had no differences in carcass weight or dressing out (P>0.05).

Table 1. Growth performance and carcass traits of organic pigs as affected by genetic type and lean grade.

	Genetic type		Lean grade		P-value[1]	
	Pi x (LD x LW)	Du x (Gc x Du)	<60%lean	>60%lean	Genetic type	Lean grade
Initial age, days	69.0±2.8	71.2±3.0	68.1±4.1	72.1±2.7	0.61	0.47
Initial body weight, kg	16.9±0.6	14.3±0.7	14.1±0.9	17.1±0.6	*0.007*	*0.02*
Final body weight, kg	104.4±1.9	90.7±2.2	100.1±2.8	95.1±1.8	*0.001*	0.18
Age at slaughter, day	202±3	204±3	201±3	205±3	0.60	0.47
Average daily gain, g	663±14	593±17	654±21	602±14	*0.003*	0.06
N carcasses	*13*	*19*	*18*	*14*	-	-
Carcass weight, kg	78.1±1.4	62.6±1.5	71.7±2.0	69.0±1.3	*<0.001*	0.33
Dressing out (%)	75.1±0.7	70.3±0.8	72.3±1.0	73.1±0.6	*<0.001*	0.56
Backfat thickness (mm)	25.4±1.5	25.4±1.6	26.7±2.1	24.2±1.4	0.98	0.37
Lean content (%)	59.3±0.9	59.2±0.9	56.4±1.2	62.2±0.8	0.95	*0.002*

[1]Interaction genetic type x lean grade non-significant in any variable (P>0.05).

The loin pH at 45 min and 24 h *post-mortem* was not affected by genetics or lean grade (Table 2; P>0.05). None of the CIELab colour attributes differed significantly between carcass lean groups (P>0.05). However, the redness was greater in Pi x (LD x LW) than in Du x (Gc x Du) pigs (P<0.05), whereas lightness and yellowness did not differ between genetic types (P>0.05). Cooking losses were not affected by genotype or lean content (P>0.05). Likewise, the WBSF was lower in Pi x (LD x LW) than in Du x (Gc x Du) pigs (P<0.05) but no differences were observed between lean grades (P>0.05).

Table 2. pH, colour, cooking loss and tenderness of pork as affected by genetic type and lean grade.

	Genetic type		Lean grade		P-value[1]	
	Pi x (L x LW)	Du x (Gc x Du)	<60% lean	>60% lean	Genetic type	Lean grade
N meat samples	*8*	*16*	*15*	*9*	-	-
pH 45 min	6.20±0.13	6.38±0.12	6.27±0.17	6.30±0.11	0.32	0.89
pH 24 h	5.64±0.04	5.68±0.04	5.67±0.06	5.66±0.04	0.50	0.89
Lightness (L*)	51.87±1.05	52.56±1.04	53.88±1.49	50.85±0.95	0.65	0.20
Redness (a*)	2.96±0.27	2.12±0.27	2.57±0.38	2.51±0.24	*0.04*	0.90
Yellowness (b*)	6.51±0.46	6.85±0.46	6.64±0.66	6.71±0.42	0.61	0.94
Cooking loss, %	21.7±2.2	23.7±2.4	21.6±2.9	23.7±2.3	0.54	0.62
Shear force, kg	4.29±0.38	5.43±0.36	4.44±0.42	5.29±0.41	*0.05*	0.22

[1]Interaction genetic type x lean grade non-significant in any variable (P>0.05).

IV. CONCLUSION

The crossbred finishing pig including 75% Duroc genes showed lower growth performance, carcass weight and dressing out than the Pietrain sired crossbreds. In addition, the pork loin from Duroc genetic type had lower redness (a*) and it was tougher than their Pietrain counterparts. Lean grade was not associated with earlier differences in growth or carcass performance or technological meat characteristics.

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