A COMPARATIVE STUDY OF GROWTH PERFORMANCE AND CARCASS TRAITS OF UPTON-MEISHAN AND LARGE WHITE PIGS.

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Background

The Meishan breed of pigs has generated considerable interest over recent years both in Europe and North America because of its extreme prolificacy and early onset of puberty compared to conventional commercial genotypes. However, this breed suffers from the disadvantages of slow growth, poor feed efficiency and high carcass fat (Legault *et al.*, 1985; Suzuki *et al.*, 1991; Lan *et al.*, 1993). In the late 80's, the implementation of several crossbreeding schemes, where graded proportion of Meishan genes were used, did not result in any improvement in growth and carcass traits (Bidanel *et al.*, 1993). On the other hand, Lan *et al.* (1993) reported carcass quality from Meishan x Yorkshire crossbred to be intermediate between that of the Yorkshire and Meishan purebreds. Given its exceptional reproductive performance, high genetic gains may have been achieved in the last decade leading to a more performing composite Meishan line.

Objective

The objective of this study was to assess growth performance and carcass quality traits of the Upton-Meishan crossbred compared with purebred Large White pigs.

Methods

Forty Large White purebred (LW) and 40 Upton-Meishan crossbred (UM, 50% LW x 50% Chinese Meishan) pigs, equally divided according to sex within each breed (20 castrates and 20 females), were reared from 56 days of age (20.62 ± 3.28 kg) until slaughter at the Agriculture and Agri-Food Canada Research Centre in Lennoxville (QC). During growing-fattening, average daily gain (ADG, g/day) was recorded weekly and ultrasound backfat thickness (mm) at the 3/4 last rib (3/4 LR) and at the 3/4 last lumbar vertebra (3/4 LLV) was recorded at 2 week intervals. Feed intake was recorded daily and feed efficiency (FE, kg/kg body weight) was calculated. At slaughter weight (108.18 ± 2.52 kg), pigs were fasted, weighed and shipped to a commercial abattoir where they were killed by standard slaughter procedures. After slaughter, hot carcass weight (kg) was obtained during the first hour *post mortem* and used to calculate the slaughter yield (%). After overnight chilling, measures of fat (3/4 LR and ham covering fat, mm) and loin depth (3/4 last rib, mm) as well as carcass length (cm) were taken by caliper on the left carcass side. Carcass conformation was evaluated by visual assessment of the shape from 1 (very good) to 4 (very poor). The carcass side was dissected into loin, ham and belly, which were deboned, and their distribution (%) in the carcass was calculated as weight of boneless individual joint (g)/half carcass weight (kg). Loin area (cm^2) was obtained by computer image analysis (Pomar *et al.*, 2000) on the scanned surface of a loin chop taken at the 3/4 last rib. Breed and sex effects were tested using the GLM Procedure of the SAS System (SAS, 1999).

Results and discussion

A significant effect of breed ($P<0.001$) was found for both growth and carcass quality traits. Differently from Bidanel *et al.* (1993) who did find apparent sex differences in F1 crosses from LW x Meishan (M) for both variables, no significant effects of sex within the breed was observed in this study, thus data were pooled across sex within each breed.

French studies showed that the introduction of M genes into a LW population led to a deterioration of growth rate (ranging form -52 to –71 g/d) and feed conversion rate (ranging from 0.10 to 0.46) (Legault *et al.*, 1985; Gueblez *et al.*, 1987; Bidanel *et al.*, 1993). The detrimental effect of M genes on growth parameters are confirmed in this study (Table 1). Indeed, compared to LW pigs, average daily gain (ADG, g/d) of UM was decreased (-107 g/d) and feed efficiency (FE) was poorer (+ 0.53 kg/kg body weight). In vivo measurements of the backfat thickness carried out both at the 3/4 LR and at the 3/4 LLV level indicated that the growth of UM pigs is more in terms of fat deposition than muscle development. Indeed, compared to LW pigs UM pigs deposited more fat both at the mid-loin (approx. + 4 mm) and at the end loin level (approx. + 15 mm) from 20 to 108 kg. This finding is in agreement with Kanis *et al.* (1990) who concluded that in M pigs a large part of the feed is mainly converted into fat.

The results presented in Table 2 confirm those previously reported from studies of the Asian (Suzuki *et al.*, 1991), European (Serra *et al.*, 1992; Bidanel *et al.*, 1993) and North American (Lan *et al.*, 1993) populations of M crossbred pigs. Except slaughter yield (%), a significant breed difference ($P<0.001$) was observed for all carcass quality traits. The lack of difference in slaughter yield (%) can be taken as an improvement if one considers the 2% better yield in LW carcasses compared to M crosses which was reported by Lan *et al.* (1993). However, when compared to LW carcasses, the UM carcasses had 1.9 and 1.8 times deeper fat both at the 3/4 LR and on the ham, respectively, and consequently had smaller loin muscle development as showed by the 1.2 times lower depth and 1.3 times smaller area of the loin muscle. These findings are supported by the 0.41 points lower score in carcass shape for the UM compared to LW and confirm the conclusion by Suzuki *et al.* (1991) about the existence of a linear relationship between high fat percentage and reduced leanness in carcasses of M crosses. This is corroborated by the higher proportion of boneless belly in the UM carcasses. Moreover, UM carcasses had lower proportions of valuable commercial lean cuts, namely boneless loin and ham, being the percent of each cut approximately 1.2 % lower than LW carcasses. These results are consistent with data presented by Lan *et al.* (1993). In agreement with Serra *et al.* (1992), UM carcasses, and consequently the loins, were also shorter than LW carcasses and loins, but the differences were even larger (- 1 *vs* -4 cm) than those reported in their study.

Conclusions

This study confirms the existence of large differences between Meishan crossbred and Large White purebred pigs for growth performance and carcass traits. Upton-Meishan pigs have lower growth performances (lower daily weight gain and poorer feed efficiency) and inferior carcass quality (less muscle and more fat) indicating the still existing disadvantage of introducing Meishan genes into the current selection schemes.

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Table 1. Means and standard deviation (SD) of growth parameters for LW and UM pigs

	Breed		
	LW	UM	P
Growth traits[1]			
ADG (g/d)	931±0.78	824±0.79	***
FE (kg/kg body weight)	2.35±0.16	2.82±0.21	***
Ultrasound backfat thickness (mm)[2]			
UBF_{56} (3/4 LR)[a]	4.17±1.06	7.16±2.37	***
UBF_{56} (3/4 LLV)[a]	4.82±1.03	7.74±2.12	***
$UBF_{slaughter}$(3/4 LR)[b]	15.49±3.45	28.82±5.99	***
$UBF_{slaughter}$ (3/4 LLV)[b]	22.51±3.82	34.55±5.49	***

[1] ADG = average daily gain; FE = feed efficiency. [2] UBF = ultrasound backfat measurements; LR = last rib; LLV = last lumbar vertebra.
[a] Evaluated at 56 days of age; [b] Evaluated at the end of the finishing period.
*** (P<0.001)

Table 2. Means and standard deviation (SD) of carcass quality traits for LW and UM pigs

	Breed		
	LW	UM	P
Carcass measurements[1]			
Slaughter yield (%)	82.62±1.06	83.02±1.11	NS
LD fat depth (3/4 LR, mm)	17.46±4.95	33.75±7.26	***
LD lean depth (3/4 LR, mm)	63.46±4.53	53.85±4.78	***
Ham fat depth (mm)	17.85±4.99	32.15±6.52	***
Conformation score[+]	2.28±0.32	2.69±0.37	***
Carcass length (cm)	79.32±1.82	75.66±1.70	***
Loin length (cm)	63.01±1.85	59.02±2.17	***
Loin area (cm^2)	51.52±4.47	38.98±4.10	***
Weight distribution of deboned joints (%)			
Loin	20.54±1.15	17.03±1.09	***
Ham	21.23±0.81	19.85±0.93	***
Belly	10.83±1.45	12.25±0.80	***

[1] LD = *longissimus dorsi*; LR = last rib; [+]Evaluated by a 4-point scale (1= very good to 4= very poor conformation)
*** (P<0.001); NS: not significant