

## THE INFLUENCE OF LITTER'S ORIGIN ON TRAITS CONNECTED WITH REPRODUCTION PERFORMANCE OF SOWS AND SLAUGHTER PERFORMANCE OF THEIR OFFSPRING

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### ABSTRACT

Experimental material comprised 47 Złotnicka Spotted sows, coming from 2 piggeries keeping Złotnicka pigs within conservative breeding. Slaughter performance was evaluated on carcasses coming from their offspring (112 carcasses – Złotnicka Spotted×Duroc) and 16 carcasses coming from purebred animals. The following reproduction performance traits of sows were investigated: the number of piglets born in the litter and the number of piglets reared 21st day, and the following slaughter performance traits of their offspring were analyzed: weight of carcass (kg), mean backfat thickness (mm), height of loin eye of the longissimus dorsi muscle (mm) and meat percentage in the carcass (%). The most numerous litters, both at day 1 (10.16 head) and on 21st day of life (9.99 head), were those sired by Duroc boars. Recorded differences turned out to be statistically high significant. The breed of the sire also had a significantly high effect on meatiness of fatteners.

**Key words:** Złotnicka Spotted sow, ZŁP, Złotnicka Spotted×Duroc, maternal nursing of piglets, slaughter value

### INTRODUCTION

One of the potential opportunities to improve yield and quality of slaughter animals is to apply for commercial crossing. However, in crossing it is important to select appropriate breeds and use an adequate crossing method [Szulc et al. 2006, Buczyński et al. 2011, Szulc et al. 2011]. Thanks to commercial crossing we may obtain the heterosis effect, manifested in increased fertility of sows, viability and growth rate of young animals. It also brings desirable effects at further stages of production of slaughter pigs [Wojciechowski et al. 2002, Buczyński et al. 2011]. The aim of this study was to determine the effect of litter's origin on traits connected with reproduction performance of sows and slaughter performance of their offspring.

### MATERIAL AND METHODS

Experimental material comprised 47 Złotnicka Spotted sows, coming from 2 piggeries, keeping Złotnicka

Spotted pigs within conservative breeding. Slaughter performance was evaluated on carcasses of their offspring (112 carcasses, Złotnicka Spotted×Duroc) and 16 purebred Złotnicka Spotted offspring.

Reproduction performance of sows was characterized by the following traits:

- the number of piglets born in the litter,
- the number of piglets reared to 21st day of life.

Data were collected from breeding documentation: litter records and pedigree certificates (for the period from 2007 to 2009).

The data base contained information referring to successive litters (from 1 to 9). Due to the small number of data from litters ranking from 3 to 9 they were combined to form one class (litters 3–9).

The following post-slaughter testing traits were analyzed:

- post slaughter carcass weight, kg,

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- mean backfat thickness, mm,
- height of loin eye of the longissimus dorsi muscle, mm,
- meat percentage in the carcass, %.

A statistical package SAS with the MEANS, GLM and LSD procedures (analysis of variance with least significant difference test) was used in order to characterize data. Dependencies between slaughter and reproduction performance traits were determined by analyzing Pearson's correlation coefficients, with the use of the CORR procedure [SAS, 2010].

The significance of the effect of experimental factors on traits connected with reproduction performance was determined by analysis of variance for multiple factors using the linear model:

$$Y_{ijkl} = \mu + S_i + HB_j + L_k + e_{ijkl},$$

where:

$Y_{ijkl}$  – value of analyzed trait (the number of live born piglets and the number of reared piglets),

$\mu$  – expected value,

$S_i$  – fixed effect of sire,

$HB_j$  – accumulated fixed effect of piggery and supplier,

$L_k$  – fixed effect of litter rank,

$e_{ijkl}$  – random residual.

The effect of rank of litter of origin on slaughter performance traits was estimated using a one-way model of the analysis of variance with the LSD test.

$$Y_{ij} = \mu + M_i + e_{ij},$$

where:

$Y_{ij}$  – value of analyzed trait,

$\mu$  – expected value,

$M_i$  – fixed effect of litter rank,

$e_{ij}$  – random residual.

## RESULTS

Table 1 presents statistical characteristics of reproduction and slaughter performance traits in the analyzed population.

Table 2 presents statistical characteristics and a comparison of analyzed traits depending on the sex of animals.

Boar piglets differed from gilts statistically significant in terms of meat content and they had a highly significantly smaller backfat thickness.

The breed of the sire had a highly significant effect on meatiness of analyzed fatteners (Table 3).

Animals sired by Duroc boars were characterized by a higher meatiness, irrespective of their sex, piggery, supplier or the year of birth. Backfat thickness was significantly higher in the group of crosses sired by Złotnicka boars.

Significance test LSD showed the effect of the breed of the sire on reproduction performance results. Sows mated with Duroc boars gave birth and reared almost 2 more piglets in the litter.

Table 4 presents basic statistics and a comparison of reproduction performance traits of sows and slaughter performance traits of their offspring in terms of the litter of origin.

When analyzing traits connected with reproduction we may observe an upward trend for the number of piglets born in the litter and the number of piglets reared to the 21st day in successive litters, with the first litter being highly significantly less numerous than litters 3–9.

In terms of traits connected with slaughter performance animals coming from the second litter were characterized by lower values of these traits. Highly significant differences between the first three litters were recorded in terms of thickness of the longissimus dorsi muscle. Meat content in the carcass and weight after slaughter were significantly lower in crossbred animals coming from the second litter.

Coefficients of correlation were determined between variables of breeding performance of sows determining the number of piglets in the litter and the number of piglets on the 21st day (Table 5).

For traits connecting with fattening and carcass performance (weight after slaughter, backfat thickness and thickness of the longissimus dorsi muscle, meat content in the carcass) correlation coefficients were estimated (Table 6).

## DISCUSSION

On the one hand, the number of piglets in the litter is economically important, since it significantly affects financial results of farms, but on the other hand, this parameter is also important from the breeding point of view, since it determines the potential intensification of selection conducted in breeding herds [Buczyński et al. 1999, Hermes 2001].

In this study concerning reproduction performance of Złotnicka Spotted sows variation in fertility of sows and the number of piglets reared the 21st day were presented in terms of litter rank. As it could have been expected, reproduction performance traits of sows change considerably with successive reproduction cycles. Similar results of analyses on Złotnicka pigs were presented in studies

**Table 1.** Statistical characteristics of reproduction performance traits of 47 Zlotnicka spotted sows and slaughter performance traits of their offspring (n = 128)

**Tabela 1.** Charakterystyka statystyczna cech użytkowości rozplodowej loch oraz rzeźnej ich potomstwa (n = 128)

Trait Cecha	Min. Min.	Max. Max.	Mean Średnia	SD Odchylenie standardowe
Number of piglets born, n Liczba prosiąt urodzonych, osobniki	3	14	9.96	2.24
Number of piglets on 21st day, n Liczba prosiąt w 21 dniu życia, osobniki	3	14	9.77	2.34
Body weight after slaughter, kg Masa poubojowa tuszy, kg	80.50	124.40	101.52	7.63
Backfat thickness, mm Grubość słoniny, mm	13.00	50.00	33.37	16.46
Height of loin eye, mm Mięsień najdłuższy grzbietu, mm	24.00	73.00	58.16	11.74
Meat content of carcass, % Mięśność, %	33.20	59.20	44.98	9.52

**Table 2.** Statistical characteristics and a comparison of reproduction performance traits of sows and slaughter performance traits of their offspring in terms of sex

**Tabela 2.** Charakterystyki statystyczne i porównanie cech użytkowości rozplodowej loch oraz rzeźnej ich potomstwa w zależności od płci

Trait Cecha	Mean Średnia		SD Odchylenie standardowe	
	boar piglets knurki	gilts loszki	boar piglets knurki	gilts loszki
Number of piglets born in head litter, n Liczba prosiąt urodzonych, osobniki	9.92	10.00	2.23	2.12
Number of piglets on 21st day, n Liczba prosiąt w 21 dniu życia, osobniki	9.71	9.83	2.14	2.34
Body weight after slaughter, kg Masa poubojowa tuszy, kg	102.12	100.96	7.15	7.68
Backfat thickness, mm Grubość słoniny, mm	32.40 <sup>A</sup>	34.27 <sup>A</sup>	17.85	16.67
Height of loin eye, mm Mięsień najdłuższy grzbietu, mm	58.84	57.53	11.62	14.80
Meat content of carcass, % Mięśność, %	45.76 <sup>c</sup>	43.25 <sup>c</sup>	10.17	9.62

A–F at  $P \leq 0.01$  significant difference; a–d at  $P \leq 0.05$  significant difference.

A–F przy  $P \leq 0,01$ ; różnice istotne statystycznie; a–d przy  $P \leq 0,05$  różnice istotne statystycznie.

[Buczyński et al. 2003a, 2003b]. It results from observations [Buczyński et al. 1999] conducted on Polish White Landrace sows kept in a closed herd that litters 2, 3 and 4 were the most numerous. The first litters turned out to be least numerous. A similar trend was also observed in this study, which was confirmed statistically.

In the analyzed herd Zlotnicka Spotted sows mated with boars of the same breed had on average 8.56 piglets in the litter and reared 8.25 piglets to 21st day of life. Litters sired by Duroc boars were much more numerous both on 1st day (10.16 head) and on 21st day of life (9.99 animals). Reported differences turned out to be statistically high significant. Szulc et al. [2011] conducted ana-

lyses on fattening and slaughter testing of F1 gilts produced as a result of crossing Large White Polish sows with boars of different breeds, including Duroc. Recorded data indicate a distinct heterosis in crosses sired by Duroc boars in comparison to crosses of other breeds and Large White Polish pigs.

In this study mean carcass leanness was 44.98%. A higher leanness was found in fatteners sired by Duroc boars (45.33). Shown differences were confirmed statistically. Fatteners sired by Duroc boars were characterized by thinner backfat (33 mm) in contrast to purebred Zlotnicka Spotted fatteners (35.94 mm). These differences were statistically significant. In many studies conduc-

**Table 3.** Basic statistics of analyzed reproduction performance traits of sows and slaughter performance traits of their offspring in terms of genotype of sire

**Tabela 3.** Charakterystyki statystyczne i porównanie cech użytkowości rozplodowej loch i rzeźnej ich potomstwa w zależności od genotypu ojca

Cecha Trait	Średnia Mean		SD Odchylenie standardowe	
	Duroc		Złotnicka Spotted Złotnicka Pstra	
Number of piglets born, n Liczba prosiąt urodzonych, osobniki	10.16 <sup>E</sup>	8.56 <sup>E</sup>	2.70	28.28
Number of piglets on 21st day, n Liczba prosiąt w 21 dniu życia, osobniki	9.99 <sup>F</sup>	8.25 <sup>F</sup>	2.26	29.86
Body weight after slaughter, kg Masa poubojowa tuszy, kg	101.75	99.95	7.25	9.30
Backfat thickness, mm Grubość słoniny, mm	33.00 <sup>d</sup>	35.94 <sup>d</sup>	19.37	18.16
Height of loin eye, mm Mięsień najdłuższy grzbietu, mm	58.62	55.00	13.02	14.64
Meat content of carcass, % Mięśność, %	45.33	42.53	9.69	11.17

A–F at  $P \leq 0.01$  significant difference; a–d at  $P \leq 0.05$  significant difference.

A–F przy  $P \leq 0.01$ ; różnice istotne statystycznie; a–d przy  $P \leq 0.05$  różnice istotne statystycznie.

**Table 4.** Statistical characteristics and a comparison of reproduction performance traits of sows and slaughter performance traits of their offspring in terms of litter of origin

**Tabela 4.** Charakterystyki statystyczne i porównanie cech użytkowości rozplodowej loch i rzeźnej ich potomstwa w zależności od miotu pochodzenia

Cecha Trait	Średnia Mean			SD Odchylenie standardowe		
	litter 1 miot 1	litter 2 miot 2	litter 3 miot 3	litter 1 miot 1	litter 2 miot 2	litter 3 miot 3
Number of piglets born, n Liczba prosiąt urodzonych, osobniki	9.33 <sup>A</sup>	10.00	11.54 <sup>A</sup>	2.23	2.23	1.79
Number of piglets on 21st day, n Liczba prosiąt w 21 dniu życia, osobniki	9.16 <sup>B</sup>	9.69	11.54 <sup>B</sup>	2.24	1.12	1.80
Body weight after slaughter, kg Masa poubojowa tuszy, kg	102.15 <sup>C</sup>	99.64 <sup>e</sup>	101.40	7.67	8.04	8.37
Backfat thickness, mm Grubość słoniny, mm	33.53	33.25	33.38	5.59	8.59	7.04
Height of loin eye, mm Mięsień najdłuższy grzbietu, mm	59.23 <sup>D</sup>	44.28 <sup>DE</sup>	59.54 <sup>E</sup>	6.70	11.30	5.99
Meat content of carcass, % Mięśność, %	45.18 <sup>f</sup>	44.28 <sup>fg</sup>	45.96 <sup>g</sup>	4.30	9.33	5.16

A–F at  $P \leq 0.01$  significant difference; a–d at  $P \leq 0.05$  significant difference.

A–F przy  $P \leq 0,01$ ; różnice istotne statystycznie; a–d przy  $P \leq 0,05$  różnice istotne statystycznie.

ted in different countries it was shown that Duroc is one of the very few breeds which mated with other breeds has been given a clear effect of heterosis in key parameters of production [Wojciechowski et al. 2002, Szulc et al. 2006, Buczyński et al. 2011]. In a study [Florowski et al. 2006] processability of meat was evaluated for different pig breeds kept in Poland. Experimental material comprised a section of the longissimus dorsi muscle collected from Duroc, Pietrain, Polish White Landrace, Large

White Polish and line 990. In their study the authors stated that the breed of pigs is a factor significantly differentiating meat quality. Among analyzed populations more advantageous quality attributes were found for meat of Duroc fatteners, while inferior attributes were found for Pietrain pigs. The authors were of the opinion that collected results indicate that the quality of pork produced in domestic breeding may be improved by a bigger uti-

**Table 5.** Table of Spearman's correlation between interval type traits

**Tabela 5.** Tabela korelacji Spearmana pomiędzy zmiennymi typu skokowego

Trait Cecha	Number of piglets born, n Liczba prosiąt urodzonych, osobniki	Number of piglets on 21st day, n Liczba prosiąt w 21 dniu życia, osobniki	Number of left mammary glands of dam Gruczoły sutkowe lewe matki	Number of right mammary glands of dam Gruczoły sutkowe prawe matki	Subsequent litter Kolejny miot
Number of piglets born, n Liczba prosiąt urodzonych, osob.	1	0.973**	-0.165*	-0.166*	0.257**
Number of piglets on 21 st day, n Liczba prosiąt w 21 dniu życia, szt.		1	-0.137*	-0.141*	0.259**
Number of left mammary glands of dam Gruczoły sutkowe lewe matki			1	0.540**	0.050
Number of right mammary glands of dam Gruczoły sutkowe prawe matki				1	0.090
Subsequent litter Kolejny miot					1

Significant difference: \*\*  $P \leq 0.01$ ; \*  $P \leq 0.05$ .

Różnice istotne statystycznie: \*\*  $P \leq 0.01$ ; \*  $P \leq 0.05$ .

**Table 6.** Table of Pearson's correlations between interval type traits

**Tabela 6.** Tabela korelacji Pearsona pomiędzy zmiennymi typu ciągłego

Trait Cecha	Body weight after slaughter, kg Masa poubojowa tuszy, kg	Backfat thickness, mm Grubość słoniny, mm	Height of loin eye, mm Mięsień najdłuższy grzbietu, mm	Meat content of carcass, % Mięśność, %
Body weight after slaughter, kg Masa poubojowa tuszy, kg	1	0.150*	0.198*	-0.043
Backfat thickness, mm Grubość słoniny, mm		1	0.014	-0.886**
Height of loin eye, mm Mięsień najdłuższy grzbietu, mm			1	0.452**
Meat content of carcass, % Mięśność, %				1

Significant difference: \*\*  $P \leq 0.01$ ; \*  $P \leq 0.05$ .

Różnice istotne statystycznie: \*\*  $P \leq 0.01$ ; \*  $P \leq 0.05$ .

lization of the Duroc breed and a reduced utilization of Pietrain pigs.

In this study positive correlations were recorded between weight post slaughter and backfat thickness (0.15\*). Similar results were reported by Buczyński et al. [1999], who observed that with meat content in the carcass decreases an increase in body weight. Young fatteners with body weight below 100 kg have less fattened carcasses than it was observed in case of heavier carcasses.

## CONCLUSIONS

Recorded dependencies may suggest that in order to minimize production costs when selecting animals for fattening other criteria need to be considered, e.g. rank of litter of origin and the number of piglets in this litter.

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## WPŁYW MIOTU POCHODZENIA NA CECHY ZWIĄZANE Z UŻYTKOWOŚCIĄ ROZPŁODOWĄ I RZEŻNĄ

### STRESZCZENIE

Materiał badawczy stanowiło 47 loch rasy Złotnickiej Pstrej, pochodzących z 2 chlewni, utrzymujących świnie złotnickie w ramach hodowli zachowawczej. Użytkowość rzeźną oceniono na tuszach pochodzących od ich potomstwa (112 tusz, Złotnicka Pstra×Duroc) oraz 16 tusz pochodzących od osobników czystorasowych. Uwzględniono następujące cechy użytkowości rozplodowej loch: liczba prosiąt urodzonych w miocie, liczba prosiąt odchowanych do 21. dnia życia oraz cechy użytkowości rzeźnej potomstwa: masa tuszy (kg), średnia grubość słoniny (mm), wysokość mięśnia najdłuższego grzbietu (mm), procentową zawartość mięsa w tuszy (%). Najliczniejsze zarówno w 1. (10,16 osob.) jak i w 21. dniu życia (9,99 osob.) okazały się mioty pochodzące po knurach rasy Duroc. Wykazane różnice okazały się statystycznie wysoko istotne. Rasa ojca wpływała również statystycznie wysoko istotnie na mięsnosć tuczników.

**Słowa kluczowe:** Złotnicka Pstra, zlp, Złotnicka Pstra×Duroc, odchów prosiąt, wartość rzeźna