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Effect of fattening and slaughter value of Puławska gilts on their lifetime piglet production

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SUMMARY

The aim of this study was to determine the influence of performance test traits of young gilts on the number of piglets born and reared during their reproductive life. The material for the study consisted of the entire population of Puławska sows, kept in breeding herds and included in a genetic resources conservation programme, in the years 2001–2019. A dataset was created for 2722 Puławska gilts with complete information from live fattening and slaughter evaluation and reproductive performance results. Fattening and slaughter traits were evaluated using the Piglog 105 ultrasonic device. To determine the influence of selected factors on sow production performance, four groups of factors were established (for parity, body weight, daily gain, and meatiness). Young gilts evaluated at a body weight of up to 95.9 kg and with daily gains of up to 519 g/day were found to have statistically significantly the poorest production parameters in the first and subsequent parities. Excessive meatiness in the carcass of sows (≥60%, class S) caused a reduction in the number of piglets born and reared, mainly in the first parity. In the second and third parity, a high meatiness value reduced the number of piglets reared.

KEY WORDS: pigs, native breed, gilts, fattening and slaughter traits, fertility

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INTRODUCTION

The Puławska breed, one of the oldest pig breeds kept in Poland, is included in a genetic resources conservation programme supervised by the National Research Institute of Animal Production. The most important objectives of the pig genetic resources conservation programme, apart from increasing the number of animals, is to maintain the existing genetic distinctiveness, intra-breed variability, and valuable characteristics of the breed at a constant level. This is achieved through individual selection of animals for mating while adhering to the principles of limiting inbreeding and moderate selection based on performance traits (Hammermeister et al. 2021). Under the conservation programme, changes in the performance traits of young boars, gilts and sows have been monitored over the last few years (Szyndler-Nędza et al. 2020). The results of this monitoring indicate that the carcass meat percentage in gilts increased continuously from 2007 to 2020 (except for the years 2009 and 2010). In 2020, this parameter reached a value of 56.2% and was comparable to the percentage meat content of boar carcasses. The backfat thickness of gilts gradually decreased during this period, to 12.7 mm in 2020. Analysis of the reproductive performance of Puławska sows revealed that until 2015, the number of piglets born alive and reared to 21 days of age remained at a similar level. However, from 2016 to 2020, a decrease was observed in the values of both traits. Analysis of additional traits, i.e. purebred piglet and litter weight at birth and on the last day of rearing, indicated some fluctuations in these parameters, but no adverse trends were observed. The Puławska sows included in the programme are characterized by good maternal care, including milk yield (piglets weighing 5 kg on average at weaning). The reduction in the number of piglets of this breed born in the last five years is concerning.

The above-mentioned results of monitoring of the performance traits of Puławska sows between 2007 and 2020 indicate a gradual reduction in fat content and an increase in muscularity. Therefore we decided to verify whether the changes observed in the fattening and slaughter traits of young Puławska gilts significantly reduce the number of piglets born. The influence of fattening and slaughter traits of sows on their reproduction has been analysed by many authors. Results pertaining to the influence of the carcass meat percentage of gilts determined on the day of selection on their reproductive performance are not conclusive. Kawęcka et al. (2009) reported a statistically significant negative effect of high meat content in the carcass of young gilts of the paternal line 990 on the number of piglets to which they gave birth, in three consecutive litters. Contrasting results were obtained by Grzyb et al. (2007), who demonstrated no effect of carcass meat percentage (ranging from 52.61% to 59.67% on average) of Polish Landrace (PL) gilts on the number of piglets produced. The results of these studies indicate that meatiness determined on the performance test day is a breed-specific parameter, and its use to assess the reproductive capacity of females should be determined individually for each breed. Knecht et al (2020), on the other hand, analysing changes in the muscling of sows of maternal breeds (PL, Polish Large White (PLW), and PL×PLW) in three successive reproductive cycles, showed that lower muscling levels and increased fatness of sows on the day of insemination improved indicators of their reproductive performance.

The aim of this study was to determine the influence of performance test traits of young Puławska gilts on the number of piglets born and reared during their reproductive life.

MATERIAL AND METHODS

This study did not require the approval of the local ethics committee.

Research material

The material for the study consisted of the entire population of Puławska sows, kept in breeding herds and included in a genetic resources conservation programme, in the years 2001–2019. In accordance with current methodology (Szyndler-Nędza 2022), the animals were subjected to live fattening and slaughter value evaluation (using the Piglog 105 ultrasonic device) and reproductive evaluation. A database containing the results of individual performance evaluations was made available by the Polish Pig Breeders and Producers Association (POLSUS). On its basis, a dataset was created for 2722 Puławska gilts, with complete information from fattening and slaughter evaluation and reproductive performance results. The data collected from the fattening and slaughter evaluation were body weight on test day (Body weight) [kg], daily gain standardized to 180 days of age (GAIN) [g/day], backfat thickness measured at points P2 and P4 [mm] standardized to 110 kg of body weight, average backfat thickness (BACKFAT) [mm] ((P2+P)/2), loin 'eye' height measured at point P4 (EYE) [mm] standardized to 110 kg of body weight, and carcass meat percentage (MEAT) [%] standardized to 180 days of age. The performance test data were accompanied by information indicating how many purebred piglets the sows had given birth to and reared in successive litters. In total, the collection contained data for 12,665 purebred litters (number of piglets born alive (NPB) [head] and number of piglets at day 21 (NPR21) [head]). These data came from 71 breeding herds, from parities 1 to 15.

Statistical analysis

The population was characterized based on arithmetic means, standard deviation and minimum and maximum values. For the traits that are discrete random variables (number of piglets at birth and at day 21), these variables were transformed into continuous random variables according to the following formula:

$$Y = \log_{10}(X+1)$$

where:

Y – value of the variable after transformation,

X – value of the variable before transformation.

The normality of distribution was determined using the Kolmogorov-Smirnov test. Pearson's correlations between fattening and slaughter performance of young gilts and their reproductive evaluation results were estimated. To determine the influence of selected factors on sow production performance, four groups of factors were established – for parity, body weight, daily gain, and meatiness.

Parity was divided into three groups: 1 – first parity, 2 – second and third parity, 3 – fourth and subsequent parities.

Body weight and daily gain groups were based on the mean and standard deviation of the individual traits.

The ranges for the body weight groups were as follows: group 1 – up to 95.9 kg (1986 animals), group 2 – from 96 kg to 115.9 kg (8947 animals), group 3 – from 116 kg to 135.9 kg (1682 animals), and group 4 – from 136 kg (50 animals).

The ranges for the daily gain groups were as follows: group 1 – up to 519 g/day (1952 animals), group 2 – from 520 g/day to 659 g/day (8728 animals), group 3 – from 660 g/day to 799 g/day (1922 animals), and group 4 – from 800 g/day (63 animals).

Meatiness groups were created according to the ranges used in the SEUROP classification of pork carcasses: group S – 60% and above (904 animals), group E – 55% to 59.9% (6191 animals), group U – 50% to 54.9% (4829 animals), group R – 45% to 49.9% (684 animals), and group O – <44.9% (57 animals).

The effect of selected factors on reproductive performance and fattening and slaughter performance was analysed using analysis of variance according to the mixed model procedure, where the fixed effects were body weight group (1–4), daily gain group (1–4), and meatiness group (1–5), and the random effects were parity group (1–3), herd (71), and sow birth year (2001–2019). Differences between means for traits were estimated using the NIR test ($P < 0.05$). Statistical analyses were performed using the STATISTICA v 12. statistics package (StatSoft, Inc. (2014), www.statsoft.com).

RESULTS

Characteristics of the population

Table 1 shows the characteristics of the analysed population in the form of means, SD and minimum and maximum values for the traits analysed in the study. The levels of traits – carcass fatness, meat content and number of piglets born and reared – in the population were typical for the breed.

Table 1.
Characteristics of the performance traits of Puławska pigs

	N	Mean	Min	Max	SD
Number of litters	12665	3.52	1.00	15.00	2.32
NPB [head]	12665	10.58	1.00	22.00	2.16
NPR21 [head]	12665	9.46	1.00	17.00	1.94
Body weight [kg]	12665	105.80	71.00	152.00	10.08
P2 [mm]	12665	13.27	6.00	27.00	2.65
P4 [mm]	12665	12.64	5.90	26.30	2.63
BACKFAT [mm]	12665	12.96	6.00	24.00	2.41
EYE [mm]	12665	52.39	35.40	74.40	5.72
GAIN [g/d]	12665	589.93	400.00	862.00	69.74
MEAT [%]	12665	55.31	39.50	66.20	3.30

NPB – number of piglets born, NPR21 – number of piglets reared, P2 – P2 backfat thickness, P4 – P4 backfat thickness, BACKFAT – average backfat thickness from P2 and P4 measurements, EYE – loin 'eye' height measured at P4, GAIN – standardized daily gain, MEAT – carcass meat percentage

Correlation coefficients

Table 2 shows the values of Pearson's correlation coefficients between the analysed traits from the fattening and slaughter performance evaluation and the lifetime number of piglets born alive and reared to 21 days of age. All values of the correlation coefficients for lifetime gilt production were statistically significant ($P < 0.05$). The number of piglets born and reared was positively correlated with body weight, average backfat thickness and daily gain of gilts. Negative correlation coefficients were found for the other traits (loin eye height and carcass meat percentage). In addition, correlation coefficients were estimated for these traits in individual parity groups (Table 2). Most of the correlation coefficients were statistically significant ($P < 0.05$) in these groups, except between mean backfat thickness and the number of piglets born and reared in the second and subsequent parities ($P \geq 0.05$). The correlation coefficients between the number of piglets born alive and reared and the analysed performance traits were found to be highest in the first parity group.

Table 2.
Correlations between fattening and slaughter performance of young gilts and their reproductive evaluation results

	Body weight	**BACKFAT**	**EYE**	**GAIN**	**MEAT**
Lifetime number of piglets					
NPB [head]	**0.1070**	**0.0200**	**-0.1041**	**0.0919**	**-0.0764**
NPR21 [head]	**0.0756**	**0.0534**	**-0.0888**	**0.0604**	**-0.0884**
Parity 1					
NPB [head]	**0.1561**	**0.0663**	**-0.1537**	**0.1302**	**-0.1315**
NPR21 [head]	**0.1075**	**0.0952**	**-0.1444**	**0.0901**	**-0.1490**
Parity 2 and 3					
NPB [head]	**0.1213**	-0.0110	**-0.0853**	**0.0906**	**-0.0423**
NPR21 [head]	**0.0802**	0.0274	**-0.0667**	**0.0575**	**-0.0562**
Parity ≥4					
NPB [head]	**0.0704**	-0.0170	**-0.0715**	**0.0551**	**-0.0275**
NPR21 [head	0.0528	0.0201	**-0.0571**	**0.0277**	**-0.0407**

Abbreviations are given under Table 1. **Bold font** denotes significant correlation at $P < 0.05$.

Effects of body weight, daily gain and meatiness of gilts on the number of piglets born and reared

Tables 3–5 show the effects of body weight, daily gain and meatiness of gilts on the lifetime number of piglets born alive and reared and on the number of piglets in each parity group. Other fattening and slaughter traits of gilts in the groups distinguished according to the factors analysed are presented as well. The gilts with the lowest body weight on the performance test day (up to 95.9 kg) gave birth and reared statistically significantly ($P < 0.05$) the fewest piglets during their life compared to gilts with higher body weights (Table 3). This relationship was noted in all parity groups. However, the gilts with the highest body weight on the test day (136 kg or more) had the most favourable results for reproductive traits. These gilts gave birth to statistically significantly more piglets in the first parity and in the second and third parity. Analysis of the fattening and slaughter performance results

of the sows in different body weight groups revealed that the sows in the lightest and heaviest groups had similar average backfat thickness and loin eye height (P ≥ 0.05). Statistically significant differences between the two groups were found for daily gain (group 1< group 4 by 178.1 g/day) and carcass meat percentage (group 1< group 4 by 1.4%).

Table 3.
Effect of gilt body weight on the number of piglets born and reared and on their fattening and slaughter parameters on test day (mean ±SD)

	Body weight groups			
	up to 95.9 [kg]	**96 to 115.9 [kg]**	**116 to 135.9 [kg]**	**136 + [kg]**
n	1986	8947	1682	50
Parity number	3.3±2.1[a]	3.6±2.4[b]	3.4±2.3[c]	3.0±2.0[a]
Lifetime NPB [head]	**10.0±2.3[a]**	**10.7±2.1[b]**	**10.7±2.1[b]**	**11.7±1.5[c]**
NPB in parity 1	8.9±2.3[a]	9.8±2.1[b]	10.0±2.2[c]	11.8±1.8[d]
NPB in parity 2 and 3	10.0±2.2[a]	10.6±2.0[b]	10.8±2.0[c]	11.8±1.2[d]
NPB in parity ≥4	10.8±2.2[a]	11.2±2.0[b]	11.1±2.0[b]	11.4±1.7
Lifetime NPR21 [head]	**9.1±2.2[a]**	**9.5±1.9[b]**	**9.6±1.9[b]**	**10.2±1.0[c]**
NPR21 in parity 1	8.0±2.5[a]	8.8±2.0[b]	8.8±2.1[b]	9.8±1.1[b]
NPR21 in parity 2 and 3	9.1±2.1[a]	9.5±1.9[b]	9.6±1.8[b]	10.3±0.8[b]
NPR21 in parity ≥4	9.7±1.9[a]	9.8±1.8	9.9±1.7[b]	10.6±1.2
Characteristics of sows on test day				
Body weight [kg]	89.7±4.8	106.3±5.1	121.2 ± 4.2	141.0±4.5
BACKFAT [mm]	12.8±2.0[a]	13.0±2.4[b]	13.0 ± 2.7[b]	13.0±2.3[ab]
EYE [mm]	53.9±5.0[a]	52.0±5.8[b]	52.6 ± 5.8[b]	54.1±4.6[a]
GAIN [g/d]	550.5±62.6[a]	592.1±68.1[b]	621.0 ± 62.3[c]	729.6±50.2[d]
MEAT [%]	55.1±2.5[a]	55.2±3.3[b]	56.3 ± 3.8[c]	56.5±2.9[cd]

Abbreviations are given under Table 1. Values in rows marked with different letters a b c d are statistically significantly different at P < 0.05.

Analysis of the effect of daily gains of gilts on their lifetime production performance (Table 4) showed that in the first parity group gilts with daily gains of 660 g/day or more (groups 3 and 4) gave birth to statistically significantly the most piglets, with the greatest difference noted in comparison to the group of gilts with the lowest gain (group 1). In later parity groups (2–3, 4 and higher), gilts from daily gain group 3 gave birth to statistically significantly more piglets than gilts from groups 1 and 2. The number of piglets reared was statistically significantly the highest in daily gain groups 2 and 3 compared to group 1. This relationship was noted in all groups of litters. The gilts in group 3, with the highest number of piglets born and reared, had statistically significantly the highest average backfat thickness on the performance test day, while the meat percentage in the carcass was intermediate with respect to the other groups.

Table 4.
Effect of daily gain of gilts on the number of piglets born and reared and on their fattening and slaughter parameters on test day (mean ±SD)

	Daily gain groups			
	up to 519 [g/d]	**520 to 659 [g/d]**	**660 to 799 [g/d]**	**800 + [g/d]**
n	1952	8728	1922	63
Parity number	3.3±2.0^{a}	3.5±2.4^{b}	3.7±2.4^{c}	3.7±2.3^{bc}
Lifetime NPB [head]	**10.3±2.4^{a}**	**10.6±2.1^{b}**	**10.8±2.1^{c}**	**10.9±2.2^{bc}**
NPB in parity 1	9.2±2.4^{a}	9.7±2.1^{b}	10.0±2.1^{c}	11.5±2.5^{d}
NPB in parity 2 and 3	10.3±2.2^{a}	10.5±2.1^{b}	10.7±1.9^{c}	10.0±1.9
NPB in parity ≥4	10.9±2.4^{a}	11.1±2.0^{b}	11.3±2.1^{c}	11.0±2.0
Lifetime NPR21 [head]	**9.2±2.1^{a}**	**9.5±1.9^{b}**	**9.6±1.8^{c}**	**9.4±2.0^{abc}**
NPR21 in parity 1	8.3±2.4^{a}	8.7±2.0^{b}	8.9±1.9^{b}	10.1±1.9^{c}
NPR21 in parity 2 and 3	9.3±2.0^{a}	9.5±1.9^{b}	9.6±1.8^{b}	8.9±2.2
NPR21 in parity ≥4	9.6±1.9^{a}	9.9±1.7^{b}	9.9±1.8^{b}	9.5±1.9
Characteristics of sows on test day				
Body weight [kg]	99.7±9.0^{a}	106.2±9.8^{b}	110.0±9.4^{c}	116.1±5.0^{d}
BACKFAT [mm]	12.8±2.4^{a}	12.9±2.4^{a}	13.5±2.5^{b}	12.3±2.0^{c}
EYE [mm]	51.7±5.4^{a}	52.5±5.6^{b}	52.5±6.4^{b}	49.3±5.5^{c}
GAIN [g/d]	493.2±25.8	585.5±37.7	700.7±36.1	821.2±20.9
MEAT [%]	56.4±2.9^{a}	55.5±3.2^{b}	53.6±3.5^{c}	52.9±2.7^{d}

Abbreviations are given under Table 1. Values in rows marked with different letters a b c d are statistically significantly different at $P < 0.05$.

Analysis of the effect of carcass meat percentage in gilts on the number of piglets they gave birth to and reared (Table 5) showed that these values were statistically significantly the highest for the gilts with the lowest carcass meat percentage (group O). Gilts from group O gave birth to and reared significantly more piglets in their first parity compared to gilts from groups E and S, with the highest meat content, and in their fourth and subsequent parities compared to all other groups. The poorest reproductive performance parameters were noted for gilts from group S, with the highest meatiness. Analysis of the fattening and slaughter performance of gilts with the most (group O) and fewest (group S) piglets born and reared in their lifetime showed that gilts from both groups had similar body weights on the test day, but gilts from group O had statistically significantly higher backfat thickness, by 10.2 mm, and higher daily gains, by 116.4 g/day.

Table 5.
Effect of gilt carcass meat content on the lifetime number of piglets born and reared and on their fattening and slaughter parameters on test day (mean ±SD)

	Classes of carcass meat percentage				
	S	**E**	**U**	**R**	**O**
n	904	6191	4829	684	57
Parity number	2.97±1.9^{c}	3.4±2.2^{b}	3.8±2.4^{a}	3.8±2.3^{a}	3.7±2.7^{a}
Lifetime NPB [head]	**10.3±2.5^{d}**	**10.5±2.2^{c}**	**10.7±2.0^{b}**	**10.8±1.9^{b}**	**11.4±1.9^{a}**
NPB in parity 1	9.3±2.6^{a}	9.5±2.3^{ac}	9.9±1.9^{b}	10.2±1.8^{b}	10.6±0.9^{bc}
NPB in parity 2 and 3	10.3±2.4^{a}	10.5±2.1	10.6±1.9^{b}	10.6±2.0	10.6±1.8
NPB in parity ≥4	11.2±2.4^{b}	11.1±2.1^{b}	11.1±2.0^{b}	11.2±1.9^{b}	12.2±2.0^{a}
Lifetime NPR21 [head]	**9.1±2.3^{d}**	**9.4±2.0^{c}**	**9.6±1.8^{b}**	**9.7±1.7^{b}**	**10.3±1.6^{a}**
NPR21 in parity 1	8.1±2.5^{a}	8.6±2.2^{b}	9.0±1.8^{c}	9.3±1.9^{c}	9.9±1.1^{c}
NPR21 in parity 2 and 3	9.3±2.1^{b}	9.4±2.0^{a}	9.6±1.8^{c}	9.5±1.8	9.5±1.6
NPR21 in parity ≥4	9.6±2.1^{b}	9.8±1.8^{b}	9.8±1.6^{b}	9.9±1.5^{b}	11.0±1.5^{a}
Characteristics of sows on test day					
Body weight [kg]	111.0± 9.8^{a}	105.7±10.0^{d}	104.6±10.1^{c}	107.9± 8.2^{b}	110.8± 7.5^{a}
BACKFAT [mm]	10.2± 1.3^{e}	11.9± 1.6^{d}	14.1± 1.9^{c}	17.2± .0^{b}	20.4± 2.2^{a}
EYE [mm]	58.7± 4.5^{e}	54.2± 4.7^{d}	50.0± 5.0^{c}	45.6± 4.7^{b}	41.6± 3.8^{a}
GAIN [g/d]	557.5±54.5^{e}	577.7±65.6^{d}	605.0±71.0^{c}	629.9±67.7^{b}	673.9±79.5^{a}
MEAT [%]	61.3± 1.1	57.1± 1.3	53.0± 1.3	48.5± 1.2	43.6± 1.0

Abbreviations are given under Table 1. Values in rows marked with different letters a b c d are statistically significantly different at $P < 0.05$.

DISCUSSION

The number of piglets born per litter is influenced by several genetic and environmental factors. Genetic factors include breed as well as the sow's line within the breed, which is distinguished by a specific pattern of single mutations in the genes (single nucleotide polymorphisms – SNPs), which under favourable environmental conditions predispose the sow to give birth to more piglets per litter (Terman and Kumalska 2012, Szyndler-Nędza et al. 2016, Babicz et al. 2020). The most important environmental factor is adequate feeding of sows during the reproductive cycle to ensure their good condition, including adequate carcass fatness and preparation for colostrum and milk production (Jittakhot et al. 2012, Hansen et al. 2012, Loisel et al. 2014, De Rensis et al. 2005, Tummaruk et al. 2007, Szyndler-Nędza et al. 2017). An alarming reduction in the number of Puławska piglets born has been reported by Szyndler-Nędza et al. (2020) and by Babicz et al. (2020). Babicz et al. (2020) attempted to explain these changes by the higher proportion of primiparous sows (first litters being less numerous) in the total number of sows evaluated during the period analysed. In our study, analysis of the relationship between the lifetime number of piglets born and reared and fattening traits (body weight, backfat thickness, and daily gain) and slaughter traits (meatiness and loin eye height)

showed that a decrease in the body weight and daily gain of gilts and an increase in their meatiness caused a decrease in the lifetime number of piglets born and reared from these sows, which was particularly evident in the first parity (Table 2). The effect of fattening and slaughter traits on the reproductive performance of sows has also been shown in other studies (Tummaruk et al. 2001, Holm et al. 2004, Grzyb et al. 2007, Matysiak et al. 2010, Knecht et al. 2020). The authors of these studies were inclined to conclude that selection aimed solely at improving fattening and slaughter traits contributed to the deterioration of reproductive performance parameters.

Effect of body weight, daily gain, and meatiness of gilts on the number of piglets born and reared in first parity

Detailed analysis of data from first parities (Table 2) revealed that of the two reproductive parameters analysed, higher correlation coefficients with the fattening and slaughter traits of sows were obtained for the number of piglets born. Furthermore, gilts subjected to the performance test too early, i.e. with a body weight of up to 95.9 kg (Table 3) and daily gains of up to 519 g/h (Table 4), were shown to have poorer reproductive performance in first parity (they gave birth to and reared the fewest piglets compared to the other groups of gilts). Gilts with high meat content on the test day (above 55%; groups E and S; Table 5) gave birth to significantly fewer piglets compared to the other gilts. However, the most favourable production results in the first parity were noted for the gilts with the highest body weight on the test day (group 4, body weight 136 kg and above), the highest daily gains (group 4, 800 g/day and above) and meatiness up to 55% (classes O, R, and U). These results are in line with studies by other authors which found that gilts with faster gains (above 700 g/day) mature earlier and, at 135–150 kg body weight, give birth to more piglets in their first parity. In addition, fast-growing sows also have an increased risk of giving birth to more stillborn piglets in the first parity (Tummaruk et al. 2009, Bortolozzo et al. 2009, Szulc et al. 2015). Grzyb et al. (2007) also demonstrated that gilts with poor growth rates (< 509 g/day) give birth to fewer piglets in both the first and subsequent parities. Matysiak et al. (2007) found that the body weight of sows on the day of mating and at 30 days of gestation was statistically significantly positively correlated with rearing performance and the number of piglets born per litter. In the case of backfat thickness and carcass meatiness, Matysiak et al. (2010) found that gilts with higher meatiness had significantly lower body weight at first mating and significantly lower reproductive rates than less meaty sows. The results cited above indicate that one of the effects of improving pigs to increase meatiness is that younger gilts with lower body fat and therefore lower body energy reserves are allowed to breed, which may adversely affect their reproductive performance (Bortolozzo et al. 2009, Rekiel et al. 2011).

Effect of body weight, daily gain and meatiness of gilts on the number of piglets born and reared in successive litters

Of the fattening and slaughter performance traits analysed, the highest positive correlation coefficient with the number of piglets born and reared in the second and subsequent parities was found for gilt body weight. Gilts with a body weight of up to 95.9 kg on the test day (Group 1) gave birth to and reared the fewest piglets, compared to sows with higher body weight. The heaviest gilts (136 kg and over) were also shown to give birth to significantly the highest number of piglets only in the second and third parity. These results are consistent with those of other authors, who showed that higher sow weight at first insemination (above 139 kg) increased the number of piglets born to these sows in their second and subsequent parities (Lesskiu et al. 2015, Roongsitthichai et al. 2013). The poorer reproductive performance of sows with low body weight on the day of first mating is

probably due to the fact that these sows have not accumulated adequate protein and fat reserves for reproduction (Rekiel et al. 2011, Lesskiu et al. 2015).

Interesting results were obtained for the daily gain of gilts. Gilts with the lowest daily gain (< 519 g/day) gave birth to and reared statistically significantly the fewest piglets in the second and subsequent parities, while the best reproductive parameters were recorded for gilts from group 3, with daily gains of 660 to 799 g. These gilts also had the thickest backfat. In another study on the Puławska breed, Walkiewicz et al. (2004) also reported that sows with daily gains above 500 g/day gave birth to the most piglets. These results indicate that, in the Puławska breed, slow weight gain in young gilts (up to 500 g/day) can negatively affect their lifetime piglet production. Similar trends have been noted in sows of other breeds. Grzyb et al. (2007) and Roongsitthichai et al. (2013) showed that sows with daily gains of more than 650 g/day achieve better breeding performance in successive litters than slower-growing sows (< 509 g/day).

Carcass meatiness was shown to have no effect on the number of piglets born in the second and third parity, but high meatiness significantly reduced the number of piglets reared relative to sows with meatiness of 50–55% (S, E<U). Breeding females with meatiness of up to 45% (class O) gave birth to and reared similar numbers of piglets in their second and third parity to sows of class U, but in their fourth and subsequent parities they gave birth to and reared the most piglets. Animals in this group, compared to the other meatiness groups, had the highest average backfat thickness and the highest daily gains on the test day. These results are consistent with those of Kawęcka et al. (2009) and Knecht et al. (2020) and may indicate that proper preparation of gilts for reproduction, i.e. accumulation of sufficient subcutaneous fat, enables adequate energy metabolism during lactation and keeps the animals in good reproductive condition during successive reproductive cycles, which in turn ensures their longevity. Higher meatiness in gilts is indicative of high slaughter value, but at the same time poses a potential threat to the sow's condition during successive lactations and may result in earlier culling.

CONCLUSIONS

It can be concluded from the results of the study that in the Puławska breed, the values of fattening and slaughter traits of gilts determined on the performance test day significantly reduced the lifetime number of piglets born and reared. Young gilts evaluated at a body weight of up to 95.9 kg and with daily gains of up to 519 g/day had statistically significantly the poorest production parameters in the first and subsequent parities. Excessive meat content in the carcass of females (≥60%, class S) caused a reduction in the number of piglets born and reared, mainly in the first parity. In the second and third parity, a high value of this trait reduced the number of piglets reared. Due to the statistically significant effect of these traits on the lifetime production of sows, selection of females for breeding should take all of these traits into account. However, to clarify exactly which gilts are predisposed to give birth to and rear more piglets, a multivariate statistical analysis including all the above factors is necessary.

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