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EVALUATION OF FATTENING AND SLAUGHTER PIGS HYBRID (JSR x PLW I JSR x PL)

OCENA UŻYTKOWOŚCI TUCZNEJ I RZEŹNEJ TUCZNIKÓW MIESZAŃCOWYCH (JSR x PLW I JSR x PL)

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Streszczenie. Oceniono parametry mięsności i jakości technologicznej tusz wieprzowych pochodzących z tuczu przemysłowego. Materiał badawczy stanowiło 4648 tusz, poddanych ocenie poubojowej w zakładach mięsnych na terenie Wielkopolski w latach 2006–2009. Tusze pochodziły od tuczników mieszańcowych z krzyżowania loch JSR z knurami ras polskich: wielkiej białej polskiej (wpb) i polskiej białej zwisłouchej (pbz). Obliczenia wg dwóch modeli liniowych wykonano z wykorzystaniem pakietu statystycznego SAS. Stwierdzono, że średnia masa ubijanych tuczników oraz ich mięsność wzrastała z każdym kolejnym rokiem urodzenia zwierząt, a tuczniki ubijane w pierwszej połowie roku charakteryzowały się istotnie lepszymi cechami tucznych.

Key words: fattening, pigs hybrid, slaughter.
Słowa kluczowe: tuczniki mieszańcowe, użytkowość rzeźna, użytkowość tuczna.

INTRODUCTION

For a number of years now, we have witnessed a significant increase of requirements regarding pork carcasses – their meatiness as well as the quality of the acquired raw material, in particular with respect to the content of individual nutrients or restriction of contaminations in the produced food articles (Gajdek and Lechowska 2009). This is associated both with higher consumers' awareness as well as different technological possibilities of meat processing. Moreover, pork meat quality in Poland was further improved by the introduction of the system of classification of swine carcasses with the aim to unify payment criteria to swine producers and to improve market transparency with regard to swine carcass trade within boundaries of the European Union. At the present time, among breeders who settle their accounts with slaughter houses according to the meatiness method, a considerable interest can be observed in issues connected with feeding, genetics as well as, widely understood counselling and advise. However, in Poland the program of meat improvement of swine mass population was introduced fairly late and breeders

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became interested in the program only at the end of 1990s. At that time, the mean meatiness of fatteners in Poland fluctuated from 47 to 49%, while meat content in pork carcasses in Denmark ranged from 58–60%, in France – 55–56.5% and in the Netherlands – from 53–55.5% (Lisiak and Borzuta 2002). Already in the year 2000, the mean swine meatiness in Poland exceeded 50% following a steady improvement of carcass quality assessed in accordance with the EUROP system.

The aim of the study was to analyze changes in conformation and technological quality of porcine carcasses derived from commercial fattening from a certain part of Poland (region of Wielkopolska), over the years 2006–2009.

MATERIAL AND METHODS

The experimental material included 4648 carcasses subjected to after-slaughter evaluation in various meat processing enterprises in Wielkopolska region in years 2006–2009. The carcasses derived from hybrid fatteners from crossings of JSR hybrid sows with the following boars of Polish breeds: Polish Large White (PLW) and Polish Landrace (PL) kept in two piggeries situated in Wielkopolska Voivodeship. The annual production of each of the two piggeries amounted to about 700 piglets and the rearing system employed in the two farms was also similar. Until weaning, sows with piglets were kept on shallow litter, whereas boars were kept on deep litter. Piglet feeding was based on full ration diets, while fatteners were fed farm feeds. JSR hybrid sows were inseminated by either an PLW (2420 fatteners) or PL (2228 fatteners) boars. Fatteners were 6–8 months old and weighed approximately 100 kg when they arrived in the slaughter house. The slaughter year was divided into two seasons: January–June and July–December. The animals were individually weighed at the beginning and end of the fattening period. The following characteristics has been analyzed: days of fattening, daily gains in grams, body weight before slaughter, hot carcass weight, meat content of carcass.

Calculations were carried out using the linear models given below.

Model 1

$$Y_{ijklmn} = \mu + H_i + R_j + B_k + PuSu_l + + Z_m + e_{ijklmn}$$

where:

Y_{ijklmn} – value of the analysed trait (live weight, after-slaughter weight, days of fattening, daily body weight gain, meatiness percentage);

μ – value of the expected trait;

H_i – effect of the i^{-th} piggery;

R_j – effect of the j^{-th} year of birth;

B_k – effect of the k^{-th} breed of boar;

$PuSu_l$ – effect of the l^{-th} year and season of slaughter;

Z_m – effect of the m^{-th} class of the swine price;

e_{ijklmn} – effect of random error.

Model 2

$$Y_{ijklmn} = \mu + W_i + Wz_j + D_k + P_l + E_m + e_{ijklmn}$$

where:

Y_{ijklmn} – value of the analysed trait (pH_1, pH_{24}, wateriness, marbling);
μ – expected value;
W_i – i^{-th} class of after-slaughter weight;
Wz_j – j^{-th} class of live weight;
D_k – k^{-th} class of days of fattening;
P_l – l^{-th} class of daily body weight gains;
E_m – m^{-th} class of EUROP evaluation;
e_{ijklmn} – random error effect.

Calculations were performed using the SAS statistical package and GLM procedure (SAS/STAT 2010).

RESULTS AND DISCUSSION

It was concluded on the basis of the performed analyses that fatteners were slaughtered, on average, following 197-day fattening period at body weight of 104.4 kg. Mean body weight gains of the examined fatteners amounted to 548 g per day during the fattening period, while mean after-slaughter hot carcass weight – 86.3 kg. The mean meatiness of the examined fatteners exceeded slightly 55%.

The comparison of the results regarding fattening and slaughter traits of the PL x JSR and PLW x JSR hybrids showed that the parameters of the PL*JSR hybrids were better. However, differences between the mean values of the discussed traits were not significant statistically (Fig. 1).

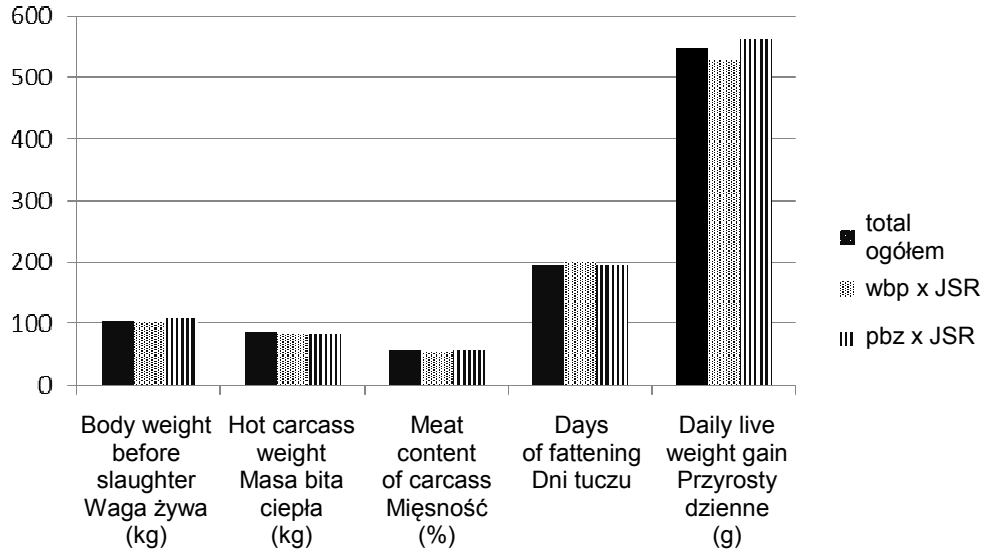

Fig. 1. Comparison of mean values of fattening and slaughter traits for hybrids derived from PLW and PL boars and JSR sows
Rys. 1. Porównanie średnich wartości cech tucznych i rzeźnych mieszańców po knurach wbp i pbz oraz lochach JSR

Similarly, the herd effect failed to be statistically significant. This fact can be attributed to the similar rearing system employed in the two piggeries.

The year of birth of piglets exerted a highly significant impact on fattening and slaughter performance as shown in Fig. 2.

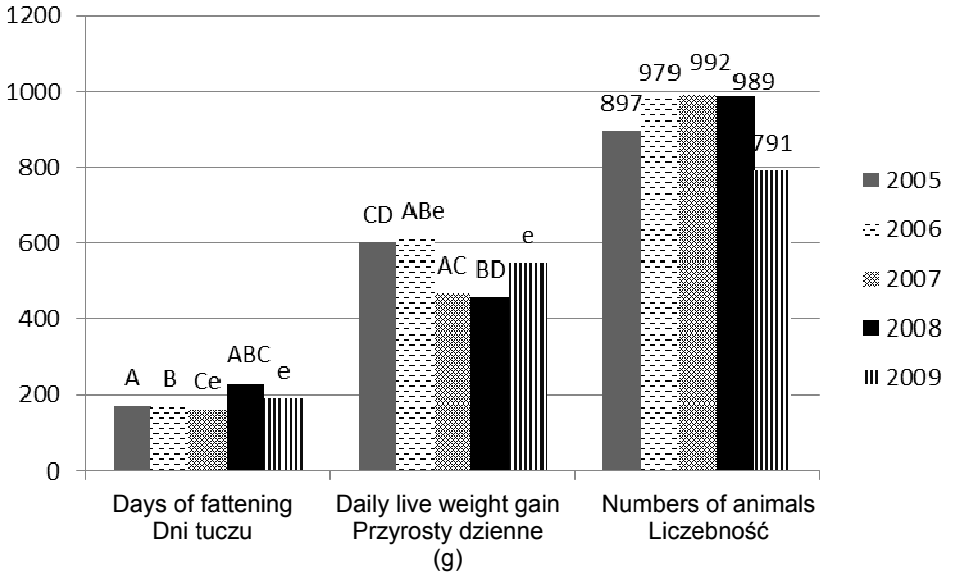

Fig. 2. Effect of the year of birth of piglets on fattening length and daily live weight gains
The means marked with identical letters are not significantly different. Small letters (a, b, c) describe statistically significant differences (P ≤ 0.05) , capital letters (A, B, C) – highly statistically significant differences (P ≤ 0.01).

Rys. 2. Wpływ roku urodzenia prosiąt na długość tuczu i przyrosty dzienne tuczników
Średnie oznaczone takimi samymi literami nie różnią się istotnie statystycznie. Małe litery (a, b, c) oznaczają różnicę statystycznie istotną (P ≤ 0,05), duże litery (A, B, C) – różnicę statystycznie wysokoistotną (P ≤ 0,01).

Animals slaughtered in years 2006–2009 were born in years 2005–2009. Years 2006–2008 were very similar with respect to the numbers of animals, while the smallest numbers of piglets were born in 2009. Significant and highly significant differences in the fattening length and daily live weight gains of animals were observed in animals born during the analysed period of time. Piglets born in 2008 were fattened on average by 65 days longer in comparison with the previous years and by 35 days longer in comparison with the following year.

The highest daily body live gains were recorded in fatteners born in years 2005 and 2006, 604 and 612 g, respectively. Daily body live gains in animals born in years 2007–2008 declined to approximately 460 g and this result should be considered as unsatisfactory. On the other hand, mean daily body live weight gains in animals born in 2009 increased to 550 g.

According to different sources (Chen et al. 2003, Maiorano 2006, Tummaruk et al. 2007, Habier et al. 2009), daily body live weight gains depend on many factors, among others: genetic, environmental as well as rearing techniques. In their experiment, Łyczyński et al. (2002a) demonstrated that differences in daily body live weight gains in three groups of pigs fed identical diets could reach even 159 g and in meatiness – up to 2.6%.

However, it should be taken into account that the length of fattening and levels of daily body live weight gains can also be affected strongly by extragenetic events such as: feed price and purchase price of live fatteners. In general, when the feed price is low, the

slaughter weight of fatteners increases and the fattening period becomes longer, whereas when feed prices are high, fatteners of lower weight are destined for slaughter. The mean weight of fatteners intended for slaughter is closely connected with prices paid by meat processing enterprises. When the price is low, breeders are not interested in a higher weight of fatteners because it is associated with higher food intake per 1 kg of body weight gain.

The year of birth of piglets exerted a statistically significant and highly significant influence on: live weight, hot carcass weight and meatiness. Figure 3 collates significance of differences between mean values of traits for animals born in consecutive years of experiments.

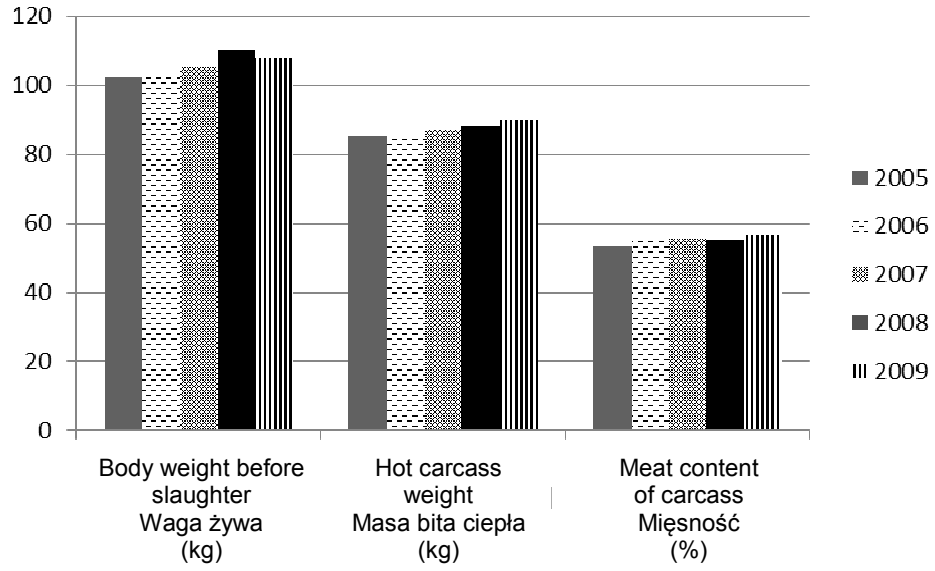

Fig. 3. Impact of the year of birth of piglets on live body weight, hot carcass weight and carcass meat content
The means marked with identical letters are not significantly different. Small letters (a, b, c) describe statistically significant differences (P ≤ 0.05) , capital letters (A, B, C) – highly statistically significant differences (P ≤ 0.01).

Rys. 3. Wpływ roku urodzenia prosiąt na wagę żywą, masę bitą ciepłą oraz mięsność tusz
Średnie oznaczone takimi samymi literami nie różnią się istotnie statystycznie. Małe litery (a, b, c) oznaczają różnicę statystycznie istotną (P ≤ 0,05), duże litery (A, B, C) – różnicę statystycznie wysokoistotną (P ≤ 0,01).

The recorded body live weight of fatteners ranged in the interval from 102.2 kg – in animals born in 2005 to 109.9 kg – in those from 2008. The mean live weight of fatteners slaughtered in Poland in years 2005 to 2009 amounted, respectively, to: 104 kg, 106,5 kg, 109 kg and 117 kg (Średnie wyniki oceny przeżyciowej loszek i knurów wg linii i ras, w poszczególnych latach, http://trzoda.izoo.krakow.pl/przyzyciowa/raporty). It can be said that live weight of fatteners from the region of Wielkopolska was slightly smaller in comparison with the mean live body weight of animals from the entire country. In the course of the examined years, it was possible to notice a trend for the increase in slaughter weight. The tendency for increased slaughter weight can be observed in many countries with Germany as one of the examples where, during the past 16 years, the mean weight of slaughtered fatteners in Bavaria increased from 106 kg to 118 kg. However, it is assumed that the increase of body weight by each 10 kg above 105 kg results in meatiness decrease by about 1%.

This negative dependence between live body weight and its meatiness was reported in many studies (Karamucki et al. 2001, Zybert et al. 2005a). It is also worth emphasising that together with the increase of the slaughter weight, backfat thickness in many different pig breeds was also found to increase (Łyczyński et al. 2000, Tummaruk et al. 2007).

Also Maiorano (2006) reported that in Italy, in comparison with other countries, swine production differs by high slaughter weight. Pigs are slaughtered at the age of 10–12 months at the body weight of 150–170 kg and, consequently, the weight of carcasses ranges from 125 to 140 kg. This, however, is closely connected with the requirements of the meat industry.

On the other hand, Grześkowiak et al. (2010) demonstrated significantly – by 2.35% – higher meat content in carcasses of hybrids with 25% share of Pietrain and Duroc breeds in comparison with the fatteners of white breeds – PLW and PL. In other experiments, meatiness of hybrid carcasses (PLW x PL) x (D x P) weighing about 80 kg was by 2.8% lower (Grześkowiak et al. 2006a).

Hot carcass weight (HCW kg) in fatteners increased in consecutive years of birth (from 85.2 kg in 2005 to 89.8 kg in 2009) with the exception of 2006 (84.9 kg). Until the end of 1990s, hot carcass weight of fatteners remained on a constant level of approximately 79–80 kg. Beginning with the year 2001, a growing trend of this trait was observed by 1.9 kg in relation to the previous year (2003 – with its 5.2 kg increase – was an exception) so that in 2012 HCW reached 89.3 kg. Therefore, it can be said that hot carcass weight of fatteners derived from the region of Wielkopolska born in years 2005–2009 did not differ from the country average and showed a trend for growth in successive years of birth.

Lisiak et al. (2011) carried out quality investigations of fattener carcasses slaughtered in the same region and in the same slaughter enterprise and found that the mean hot carcass weight reached already 89.95 kg which confirmed that the tendency for the increase of body weight of slaughtered pigs remained unchanged.

Already in 1990s, Cisneros et al. (1996) and Zybert et al. (2005 b) provided evidence that higher slaughter weight exerted a favourable influence on changes in basic porcine carcass cuts. Numerous experiments are conducted with the aim to increase slaughter weight of fatteners in such a way as to obtain heavier fatteners and, at the same time, maintain their high meatiness and also to increase proportions of the most valuable kinds of meat as well as cuts in the carcass.

The highest mean value of meatiness was recorded for animals born in 2009 – 57%. It should be stressed here that the mean meatiness of fatteners slaughtered in Poland in years 2005–2009, depending on the region, ranged from 52.6% to 55.5%. Lower meatiness percentage was reported by Gajdek and Lechowska (2009) for fatteners slaughtered during the same period of time in eastern Poland. These values fluctuated between 49.01 to 49,58% depending on the applied measuring instrument.

A statistically significant difference concerning meatiness was also determined between animals born in 2005 and 2009 as well as a clear trend for the growth in meatiness percentage in successive years of birth of the animals. The observed meatiness increase in mass populations seems to be closely correlated with a considerable meatiness increase in maternal and paternal breeds. For example, in 2008, in PLW, meat content in the carcass increased to 59.6% in young boars and to 58.1% in gilts, whereas in the case of the PL breed – to 59.3% in young boars and 57.8% in gilt (Średnie wyniki oceny przeżyciowej loszek i knurów wg linii i ras, w poszczególnych latach, http://trzoda.izoo.krakow.pl/przyzyciowa/raporty).

Fatteners slaughtered in the period from January to June showed significantly better values of fattening traits – they reached slaughter weight by 12 days earlier than fatteners brought to the slaughter-house in the second half of the year. During their experiments conducted on Duroc gilts, Tereszkiewicz et al. (2006) demonstrated that carcasses of pigs reared in winter were by 0.41 kg heavier and their dressing percentage was by 1.39% significantly higher in comparison with gilts reared in summer. It was also found that the fattening and slaughter season failed to exert a significant effect on levels of meatiness and subcutaneous fat. However, it was noticed that fatteners from the winter period had thinner backfat, their carcasses were shorter and hams were characterised by greater circumference.

Differences between values of the analysed traits for fatteners in individual EUROP meatiness classes (Fig. 4 and 5) revealed that animals from the meatiness class R were characterised by the highest live weight, the highest live body weight gains and the highest weight before slaughter and the meatiness percentage increased together with the lengthening of the fattening period of animals. Statistical inference was affected negatively by a high discrepancy in the number of meatiness classes (Fig. 4).

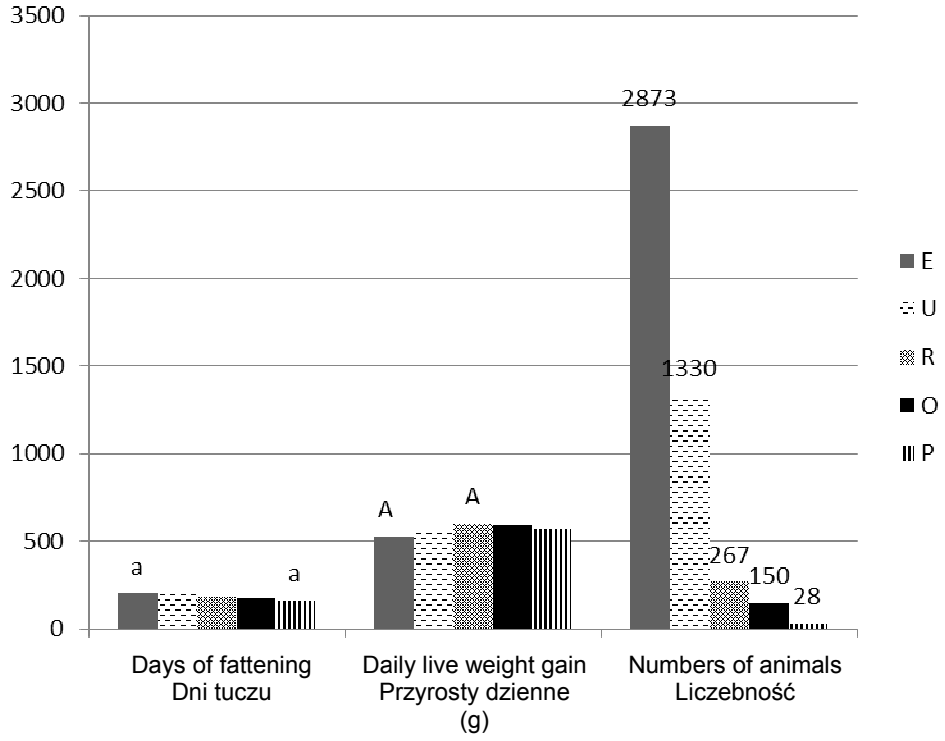

Fig. 4. Days of fattening and daily gains taking into account meatiness classes
The means marked with identical letters are not significantly different. Small letters (a, b, c) describe statistically significant differences (P ≤ 0.05) , capital letters (A, B, C) – highly statistically significant differences (P ≤ 0.01).

Rys. 4. Dni tuczu oraz przyrosty dzienne, z uwzględnieniem klasy mięsności
Średnie oznaczone takimi samymi literami nie różnią się istotnie statystycznie. Małe litery (a, b, c) oznaczają różnicę statystycznie istotną (P ≤ 0,05), duże litery (A, B, C) – różnicę statystycznie wysokoistotną (P ≤ 0,01).

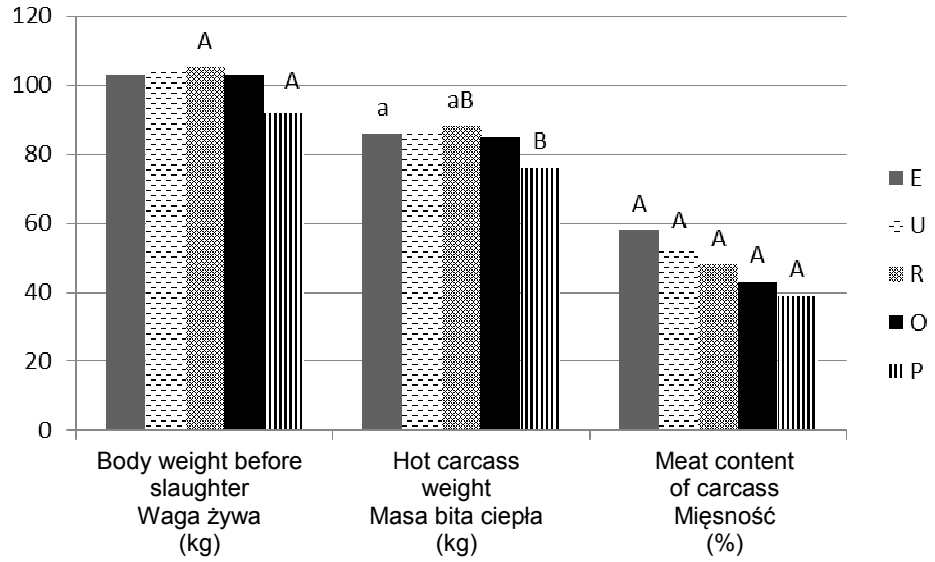

Fig. 5. Live weight, hot carcass weight and meat content of carcass taking into account meatiness classes
The means marked with identical letters are not significantly different. Small letters (a, b, c) describe statistically significant differences (P ≤ 0.05), capital letters (A, B, C) – highly statistically significant differences (P ≤ 0.01).

Rys. 5. Waga żywa, masa bita ciepła tusz oraz zawartość mięsa w tuszy, z uwzględnieniem klasy mięsności
Średnie oznaczone takimi samymi literami nie różnią się istotnie statystycznie. Małe litery (a, b, c) oznaczają różnicę statystycznie istotną (P ≤ 0,05), duże litery (A, B, C) – różnicę statystycznie wysokoistotną (P ≤ 0.01).

In their investigations Zybert et al. (2005a, b) demonstrated the effect of the extent of musculature on total mass yield and percentage proportions in the carcass of meat and fat tissue. The yield of meat weight from carcasses of the E class exceeded statistically significantly the value of the yield successively in R, O and P classes. Carcasses of E and U classes constituted a uniform group with respect to the meat weight yield as well as the total carcass. E class carcasses, in comparison with those from class P, were characterised by up to 10% higher proportion of meat weight in the carcass at simultaneous lower by 12.5% weight of fat tissue.

With the assistance of a linear model comprising yield classes, the impact of slaughter and fattening traits on such meat quality attributes as: acidity, wateriness and marbling was examined because the above-mentioned traits exhibit important correlations with some sensory meat quality parameters (Czarniecka-Skubina et al. 2007).

During the first hour after slaughter, mean meat acidity was determined at 6.3 (at standard deviation of 0.22) and decreased slightly to 6.12 during the second hour after slaughter (at standard deviation of 0.12). No statistically significant differences with respect to meat acidity within subclasses of fattening and slaughter yield were recorded in the course of the first and second hour after slaughter. Similar results were reported by Grześkowiak et al. (2004, 2006b). Moreover, in the case of muscle evaluation of pure breeds as well as hybrids carried out by other researchers (Kapelański et al. 2002, Gajewczyk 2005), generally speaking, pH values did not differ from those observed in this study. Different results were reported by Litwińczuk et al. (2005) who, in their investigations, determined significantly lowest pH value in carcass muscles of the P class (5.57) and significantly highest – in carcasses of the O class (6.16).

Meat wateriness is determined by natural drip during 48 hours. Meat wateriness in this study fluctuated from 4.75% to 6.15%, with standard deviation of 2.5. As in the case of acidity, no statistically significant differences were found inside the analysed subclasses of yield traits. Generally speaking, no PSE meat was found to occur among the analysed carcasses. Similar results were reported by Litwińczuk et al. (2005) who failed to record significant differences with respect to muscle wateriness of fatteners among EUROP commercial classes.

On the other hand, statistically significant differences were determined for intramuscular fat (from 1.15% to 3.22%, at standard deviation of 1.2). Marbling – a character sought-after by processing enterprises and consumers alike – was affected by: breed (PLW were characterised by 1.2% higher content of intramuscular fat), live weight class (fatteners slaughtered at 90–110 kg turned out best) and slightly increased number of days of fattening.

Grześkowiak et al. (2010) compared in their experiments fat content in the muscles of PLW x PL and Duroc x Pietrain fatteners and found a significant influence of the Duroc breed on higher levels of intramuscular fat which reached the level of 2.05% in hybrids obtained from Duroc boars.

According to Wood et al. (1994), the level of intramuscular fat optimal to maintain desirable sensory traits ranges from 2 to 3%. There is no doubt that meat quality and marbling connected with it depends strongly on genetic predisposition of animals.

Exceptional meat quality is obtained in large white pigs and in breeds derived from Yorkshire (Koćwin-Podsiadła et al. 2004, Krzęcio et al. 2004).

CONCLUSIONS

1. Mean weight of the examined slaughtered animals as well as their meatiness increased with every consecutive year of birth of animals.
2. Fatteners slaughtered in the first half of the year exhibited significantly better values of fattening traits.
3. Animals from the R meatiness class were characterised by the highest live body weight, after-slaughter weight and the highest body weight gains.

REFERENCES

Czarniecka-Skubina E., Przybylski W., Jaworska D., Wachowicz I., Urbańska I., Niemyjski S. 2007. Charakterystyka jakości mięsa wieprzowego o zróżnicowanej zawartości tłuszczu śródmięśniowego [Quality profile of pork meat with varying contents of intramuscular fat]. Żywn. Nauka Technol. Jakość 6(55), 285–294. [in Polish]

Chen P., Baas T.J., Mabry J.W., Koehler K.J. 2003. Genetic correlations between lean growth and litter traits in U.S. Yorkshire, Duroc, Hampshire and Landrace pigs. J. Anim. Sci. 81, 1700–1705.

Cisneros F., Ellis M., McKeith F.K., McCaw J., Fernando R.L. 1996. Influence of slaughter weight on growth and carcass charakteristics, commercial cutting and curing yields, and meat quality of barrows and gilts from two genotypes. J. Anim. Sci.74, 925–933.

Fortin, A., Robertson, W.M., & Tong, A.K.W. 2005. The eating quality of Canadian pork and its relationship with intramuscular fat. Meat Sci. 69(2), 297–305.

Gajdek G., Lechowska J. 2009. Appraisal of pork carcass leanness using two survey device measurements. Zesz. Nauk. Płd-Wsch. Oddz. Pol. Tow. Inż. Ekol. 54–60.

Gajewczyk P. 2005. Influence of crossbreeding on some characteristics of longissimus dorsi muscle and backfat of fatteners. Ann. Anim. Sci. 1, Suppl., 17–22.

Grześkowiak E., Borzuta K. 2005. Results of meat quality and technological stability assessment of fatteners obtained from mating Naima sows with P-76 Boards. Pol. J. Food Nutr. Sci. 13/54(2), 199–202.

Grześkowiak E., Borzuta K., Borys A., Strzelecki J., Lisiak D. 2006 a. Research on meat quality of pigs of selected breeds and crossbreeds from the mass population. Ann. Anim. Sci. 2(2), Suppl., 327–330.

Grześkowiak E., Borzuta K., Strzelecki J., Lisiak D. 2006 b. Results of assessment of meat quality in fat-meat type pigs currently fattened on small farms. Anim. Sci. Pap. Rep. 24(1), Suppl., 113–118.

Grześkowiak E., Borzuta K., Lisiak D., Strzelecki J. 2010. Physical-chemical and sensory properties, as well as composition of fatty acids in longissimus dorsi muscle of pl x plw and pl x (d x p) pig cross breeds. Żywn. Nauka Technol. Jakość 6(73), 189–198.

Habier D., Götz K. U., Dempfle L. 2009. Genetic parameters for performance and meat quality traits of crossbred pigs housed in two test environments. Livestock Sci. 121, 275–280.

Kapelański W., Żurawski H., Bocian M., Grajewska S., Hammermeister A. 2002. Meat quality of Polish landrace, duroc and Torhyb crossbreds in relation to carcass lean content. Ann. Anim. Sci. 2, Suppl., 301–304.

Karamucki T., Kortz J., Rybarczyk A., Gardzielewska J., Jakubowska M., Natalczyk-Szymkowska W. 2001. Zależność między mięsnością tuszy, a udziałem w niej elementów zasadniczych o największej zawartości mięsa z uwzględnieniem stopnia ich otłuszczenia [w: III Międzynarodowa Konferencja Naukowa nt. „Optymalizacja systemu i metod klasyfikacji poubojowej tusz wieprzowych], Puszczykowo k. Poznania 4–5 grudnia 2001. [b.w.], 68–72. [in Polish]

Koćwin-Podsiadła M., Zybert A., Sieczkowska H., Krzęcio E., Antosik K., Włodawiec P. 2004. Muscling and carcass composition in fatteners obtained from F0 generation imported from Denmark. Anim. Sci. Pap. Rep. 22, Suppl. 3, 147–15.

Krzęcio E., Antosik K., Koćwin-Podsiadła M, Zybert A., Sieczkowska H., Kuryl A., Łyczyński A. 2004. Quality and technological value of meat from porkers of six genetic groups as related to RYR1 gene. Anim. Sci. Pap. Rep. 22, Suppl. 3, 19–30.

Lisiak D., Borzuta K. 2002. Zmiany wartości rzeźnej tuczników pogłowia masowego w latach 1998–2001 [Changes in the value of slaughter mass of fattening in 1998–2001]. Gosp. Mięs. 4, 20–22. [in Polish]

Lisiak D., Grześkowiek E., Borys A., Borzuta K., Strzelecki J., Fabian M., Lisiak B., Powałows K. 2011. Wpływ mięsności tusz wieprzowych na wydajność mięsa i tłuszczu [The effect of porcine carcass meatiness on yield of meat and fat processing]. Nauka Przyr. Technol. 6(5), 1–13. [in Polish]

Litwińczuk A., Florek M., Skałecki P., Grodzicki T. 2005. Meat quality of fatteners classified under indyvidual classes of the europ system. Żywność 3(44), Suppl., 140–146.

Łyczyński A., Pospiech E., Urbaniak M., Rzosińska E., Bartkowiak Z., Mikołajczak B., Grześ, B. 2002a. Meat quality depending on pig genotype. Ann. Anim. Sci. 2, Suppl., 53–56.

Łyczyński A., Pospiech E., Urbaniak M., Bartkowiak K., Mikołajczak B. 2002 b. Pork carcass classification depending on meatiness range. Ann. Anim. Sci. 2, Suppl., 335–338.

Łyczyński A., Pospiech E., Urbaniak M., Frankiewicz A., Rzosińska E., Bartkowiak Z. 2000. Cechy rzeźne świń ubijanych przy różnej masie ciała [Fattening and slaughter traits of pigs slaughtered at different weights]. Rocz. Nauk Zootech. 6, Suppl., 181–185. [in Polish]

Maiorano G. 2006. Swine production in Italy: new opportunities for the local breeds [w: Zastosowanie osiągnięć naukowych z zakresu genetyki, rozrodu, żywienia oraz jakości tusz i mięsa w nowoczesnej produkcji świń]. Materiały III Międzynarodowej Konferencji,Bydgoszcz–Ciechocinek, 29–30 czerwca 2006, [b.w.], 32–36.

SAS Institute Inc. 2010. SAS/STAT 9.2 user's guide. Cary, NC: SAS Institute Inc.

Średnie wyniki oceny pożyciowej loszek I knurów wg linii i ras, w poszczególnych latach, http://trzoda.izoo.krakow.pl/przyzyciowa/raporty, dostęp: czerwiec 2013 r. [in Polish]

Tereszkiewicz K., Molenda P., Ruda M. 2006. Wpływ sezonu tuczu na wartość rzeźną tuczników rasy duroc ocenianych w SKURTC [The influence of the season of feeding on the slaughter value]. [in: LXXI Zjazd Polskiego Towarzystwa Zootechnicznego w Bydgoszczy. Sekcja Chowu i Hodowli Trzody Chlewnej. Komunikaty naukowe, zesz. 5]. Bydgoszcz, PTZ, 16. [in Polish]

Tummaruk P., Tantasuparuk W., Techakumphu M., Kunavongkrit A. 2007. Age, body, weight and backfat thickness at first observed oestrus in crossbred Landrace x Yorkshire gilts, seasonal variations and their influence on subsequent reproductive performance. Anim. Reprod. Sci. 99, 167–181.

Wood J.D., Wiseman J., Cole D.J.A. 1994. Control and manipulation of meat quality. Principles of pig science. Nottingham, Nottingham University Press, 433–456.

Zybert A., KoćwinPodsiadłA M., Krzęcio E., Sieczkowska H., Antosik K. 2005a. Uzysk i procentowy udział masy mięsa i tłuszczu ogółem w półtuszy pozyskanych z rozbioru i wykrawania tusz wieprzowych zróżnicowanych masą oraz klasą mięsności według systemu klasyfikacji EUROP [The gain and percent content of the meat weight and fat in total, in half-carcasses produced by cutting and trimming pork carcasses differentiated by hot carcass weight and class of leanness under the europ carcass grading system]. Żywność 3(44), Suppl., 254–264. [in Polish]

Zybert A., KoćwinPodsiadłA M., Krzęcio E., Sieczkowska H., Antosik K. 2005b. Jakość mięsa tuczników zróżnicowanych masą tuszy ciepłej oraz klasą mięsności według systemu klasyfikacji EUROP [Meat quality of fatteners differentiated by hot carcass weight and leanness class according to the europ carcass grading system]. Żywność 3(44), Suppl., 221–231. [in Polish]

Abstract. Meatiness parameters and technological quality of swine carcasses derived from commercial fattening were evaluated. The experimental material comprised 4648 carcasses subjected to after-slaughter evaluation in various meat-processing plants in Wielkopolska region in years 2006–2009. The assessed carcasses derived from hybrid fatteners from the crossing of JSR sows with boars of the following Polish breeds: Polish Large White (PLW) and Polish Landrace (PL). It was found that the mean weight of slaughtered fatteners as well as their meatiness increased in each successive year of birth of animals and fatteners slaughtered in the first half of the year exhibited significantly better values of their fattening traits. The highest live weight, after-slaughter weight as well as the highest live body weight gains were recorded in animals from the R meatiness class.