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**Analysis of selected characteristics of the slaughter value
of swine kept on family farms in the Lublin region**

Analiza wybranych cech wartości rzeźnej tuczników utrzymywanych
w gospodarstwach rodzinnych na terenie Lubelszczyzny

Summary. The aim of the study was to evaluate the crossbreeding variants using Pulawska, Landrace, Pietrain, and Duroc swine breeds in terms of their carcass slaughter value. The experiment comprised 45 hybrid pigs of Pulawska × Duroc, Polish Landrace × Duroc, and Duroc × Pietrain breeds. The fattening of barrows and gilts was carried out from about 25 kg to about 110 kg body weight. Pigs were fed *ad libitum* with complete feed according to swine nutrition norms. The animals were slaughtered at a meat processing plant in accordance with the technology applicable in the meat industry. Hot and cold carcass weight was determined. Particular primary elements were dissected for morphological components such as meat, bone, fat, and skin. There was a statistically significant difference in average backfat thickness from 5 measurements between the assessed hybrid groups. The most favorable crossbreeding arrangement was crossbreeding Duroc sows with Pietrain boars, because the meat content in the three most valuable cuts of fatteners as well as loin “eye” area was the highest. Moreover, crossbreeding the Pulawska sows with Duroc boars gave good results referring to the slaughter value of fatteners, hence this crossbreeding system can be successfully used in animal science practice.

Key words: fatteners, linear measurements of carcass, weight of primary cuts, tissue composition of selected primary cuts

INTRODUCTION

Dietary needs and tastes of people have changed along with changing in the ways of works done by replacing a number of activities with machines. This resulted in a greater demand for meat than fat. Thus, the direction of breeding works upon swine has been also altered, as more emphasis was put on the carcass meatiness. However, apart from the degree of muscularity of the slaughter pig carcasses also determines the mass of

meat and percentage of primary cuts. The level of these characteristics determine the nature of the genetic factors and the environment. Nowadays among the European farmers opinion about the need to reduce the intensity of selection for continuous improvement of swine meatability, is more common [Sellier 1989], because high meat content in the carcass is often associated with its worse quality [Kasprzyk 2012]. Improving the quality of meat by increasing the proportion of intramuscular fat is one of the objectives pursued in breeding programs of European countries such as Denmark, the Netherlands, Austria, and France [Blicharski *et al.* 2006]. Finding suitable breeds and lines to be crossbred is a part of the creative work leading to achieve a high production effects and to improve the meat quality [Grześkowiak *et al.* 2010, Węckowicz *et al.* 1986]. It is therefore interesting to find out to what extent the simple crossbreeding of swine with the share of Pulawska, Landrace, and Duroc breeds used in Lublin region affects the slaughter value of fatteners.

The aim of the study was to evaluate the slaughter value of hybrids from family farms located in the Lublin region.

MATERIAL AND METHODS

The experiment comprised 45 hybrid pigs of Puławska × Duroc, Polish Landrace × Duroc, and Duroc × Pietrain breeds. The fattening of barrows and gilts was carried out from about 25 kg to about 110 kg body weight. Pigs were fed *ad libitum* with complete feed according to Swine Nutrition Norms [Normy żywienia świń 1993]. The animals have been slaughtered at meat processing plant in accordance with the technology applicable in the meat industry. After the slaughter, the pig carcass quality class was assessed using IM-03 device. Hot and cold carcass weight was determined. After cooling down, the right half was cut into parts according to PN/86-A-82002 Pork – primal parts. The weight of particular primal element was obtained by weighing it with 0.01 kg precision, then dissecting for morphological components such as meat, bone, fat, and skin. Values of the slaughter traits in different groups of hybrids were verified applying univariate analysis of variance with the help of Statistica version 5.0 software. Significance of differences between means were determined using Duncan's test and adopting two levels of significance: $P \leq 0.01$ and $P \leq 0.05$.

RESULTS AND DISCUSSION

Puławska breed has worse traits of fattening performance and lower slaughter value than modern swine breeds from a mass rearing. They are therefore less attractive material both for farmers and meat processing plants [Florowski *et al.* 2007]. At the same time, pork derived from them is often characterized by very high levels of intramuscular fat, which is not accepted by modern contemporary consumers of pork, attaching much importance to the so-called *healthy lifestyle*. The study upon consumer preferences clearly indicate that today's consumers prefer lean pork. Therefore, the use of Puławska breed in works to improve the quality of domestic carcasses and pork requires its crossbreeding with individuals with a higher slaughter value and lower intramuscular fat content. Com-

mercial crossbreeding of breeds and breeding lines of swine for many years has been the main element of any program of rational fattener production [Węcławicz *et al.* 1986]. A good reproductive performance of Pulawska sows makes they can be crossbred with boars of most paternal breeds and lines held in Poland and a high genetic distinctiveness of this breed pigs causes that effects of such matings are usually very good [Kondracki 1999]. In opinion by Florowski *et al.* [2007], meat of pigs created due to crossbreeding Pulawska with Polish Large White and Landrace breeds was characterized, in comparison with a pure-bred Pulawska pig, by significantly lower intramuscular fat content. Therefore, the main objective of Pulawska swine crossbreeding with other breeds is to obtain a high meatability and good meat quality material.

Selected indicators of the slaughter value of hybrids are given in Table 1. Statistically significant differences of means occurred between groups in relation to the length of the carcass. Among evaluated animals, the shortest carcasses were found for Duroc × Pietrain, while the longest for Pulawska × Landrace and Landrace × Duroc hybrids. Backfat thickness is a key indicator characterizing the carcass adiposity. The average of five measurements performed on the carcass shows a remarkable correlation with the total body fat tissue in the carcass. Statistically significant differences ($P \leq 0.05$ or 0.01) were found referring to the backfat thickness between evaluated hybrid groups. Pulawska × Duroc hybrids had the thickest backfat.

Table 1. Linear measurements of carcass and loin “eye” area
Tabela 1. Pomiary linowe tuszy oraz powierzchnia „oka” połównicy

Specification Wyszczególnienie	Pulawska × Duroc Puławska × Duroc		Landrace × Duroc		Duroc × Pietrain	
	\bar{x}	SD	\bar{x}	SD	\bar{x}	SD
Half weight (kg) Masa półtuszy (kg)	46,49	4,12	44,93	3,84	44,61	4,10
Carcass length (cm) Długość tuszy (cm)	87,54B	3,15	87,53B	2,58	84,27A	3,15
Backfat thickness over shoulder (cm) Grubość słoniny nad łopatką (cm)	3,17C	0,33	2,33B	0,28	1,97A	0,34
Backfat thickness over last rib (cm) Grubość słoniny za ostatnim żebrzem (cm)	2,12Bb	0,44	1,78a	0,52	1,55A	0,55
on back I – na krzyżu I	1,99	0,43	2,38B	0,70	1,73A	0,48
on back II – na krzyżu II	1,72B	0,33	1,92B	0,32	1,39A	0,30
on back III – na krzyżu III	2,14	0,38	2,29B	0,58	1,84A	0,33
Average backfat thickness from 5 measurements (cm) Średnia grubość słoniny z 5 pomiarów (cm)	2,23B	0,38	2,14B	0,55	1,70A	0,42
Loin “eye” area (cm ²) Powierzchnia “oka” połównicy (cm ²)	49,12B	2,98	48,54B	2,68	62,15A	3,54

a, b – values in the rows with different letters differ significantly ($P \leq 0,05$)

a, b – wartości w wierszach oznaczone różnymi literami różnią się istotnie przy ($P \leq 0,05$)

A, B – values in the rows with different letters differ significantly ($P \leq 0,01$)

A, B – wartości w wierszach oznaczone różnymi literami różnią się istotnie przy ($P \leq 0,01$)

Average backfat thickness measured on the shoulder and taking five measurements in these pigs, were 3.17 and 2.23 cm respectively, which was higher as compared with Duroc × Pietrain hybrids by 61% and 31.2% (1.2–0.53 cm) (differences statistically significant at $P \leq 0.01$). These data indicate the existence of trends and relationships that provide a direct transmission of typical breed traits relating to carcass fat content to the offspring. The observed distribution of values can be caused by the influence of additive effects of genes as a result of merging two breeds characterized by higher proportion of fat in the carcass. Mainly factor breed and nutrition level are carriers for significant carcass musculature [Brzóśka *et al.* 2000]. Common meat marbling is typical for Duroc pigs and is often used for crossbreeding with such breeds as Pietrain or Hampshire [Grzeškowiak *et al.* 2006], although according to Michalska [1996], maternal rather than paternal component exerts a greater influence in the transmission of carcass fatness characteristics to the offspring. Pigs being under protection program, as compared to typically meat breeds, are characterized by a higher content of fat and lower proportion of good-quality meat [Szulc *et al.* 2006]. On the other hand, low fat content in swine carcass is accompanied by lowering the fat level in meat, which alters its commercial and consumptive quality [Brzóśka *et al.* 2000]. Analysis of own research reveals that in the case of Landrace × Duroc fatteners, as compared to other hybrids, there was a greater deposition of fat on the back, which resulted in smaller loin “eye” area. Statistically significantly higher “eye” loin area was recorded in Pietrain × Duroc pigs as compared with other hybrid groups. Area of *musculus longissimus dorsi* cross section is the simplest and commonly used indicator of carcass conformation [Michalska 1996]. Meatability and fatness is determined mainly by a pig genotype. The environmental influences on the quantitative slaughter traits, although very important, is somewhat less important [Rekiel 2010]. In opinion by Florowski *et al.* [2007], variant of the commercial crossbreeding along with the slaughter performance traits used for components crossbreeding mostly determine the loin “eye” area at swine.

Table 2 shows data on the weight of particular primal cuts obtained from the carcass dissection. Share of the most important primal cuts that make up the utility and commercial value of carcass was 63.20% for Pulawska × Duroc, 64.75% for Landrace × Duroc, and 67.20% for Duroc × Pietrain swine hybrid groups. Ham and loin are the most valuable materials for domestic meat industry. Loin, then ham and shoulder comprised the largest share of primal cuts. In terms of the 3 cuts weight (ham, loin, and neck), the best results were achieved by Duroc × Pietrain as compared with the other hybrids (statistically significant differences). They had better filled ham, higher loin weight, and more meaty neck. The Landrace × Duroc hybrids were characterized by a larger share of the shoulder. The least valuable cuts of highly fattened carcass are: flank, chop, and bacon. The most padded fatteners were achieved due to crossbreeding the Pulawska sows with Duroc boars; they were distinguished by significantly higher weight of backfat, bacon, fat, and chop (Tab. 2). The final financial result of the meaty fattener production is not only determined by its meatability, but also its carcass weight, which has a considerable impact on the prize obtained for the fattener and yield of valuable cuts [Grzeškowiak 1999, Niemyjski 2007]. In terms of the carcass weight, no significant differences between groups were recorded. The present research shows that along with the increase in carcass weight, the decrease of meat share occurred and an increased deposition of fat was observed. This correlation was also confirmed by Buczyński *et al.* [2000], who car-

ried out the study upon the Złotnicka Pstra, Złotnicka Pstra × Hampshire, and Złotnicka Pstra × Polish Large White finishers. Zybert *et al.* [2005] found that the decrease in the meat percentage in the carcass as well as negative and statistically proven increase in backfat thickness was a consequence of hot carcass weight increase above 90 kg.

Table 2. Weight of primal cuts (kg)
Tabela 2. Masa elementów zasadniczych (kg)

Specification Wyszczególnienie	Puławska × Duroc Puławska × Duroc		Landrace × Duroc		Duroc × Pietrain	
	\bar{x}	SD	\bar{x}	SD	\bar{x}	SD
Ham without backfat Masa szynki bez słoniny	6,41b	1,12	6,17Ba	1,04	7,41A	1,29
Loin without backfat Masa schabu bez słoniny	4,62b	0,87	4,78	0,90	5,39a	1,13
Neck without backfat Masa karkówki bez słoniny	2,69	0,36	2,72	0,40	2,90	0,38
Shoulder without backfat Masa łopatki bez słoniny	4,79	1,05	5,10	1,20	4,58	1,12
Bacon Masa boczku	3,24	0,60	2,87	0,58	3,12	0,56
Ribs Masa żeberka	1,12B	0,19	1,20B	0,21	0,95A	0,20
Hip Masa biodrówki	0,47	0,17	0,50	0,11	0,53	0,08
Tenderloin Masa polędwiczki	0,70Bb	0,14	0,79a	0,12	0,82A	0,12
Front shank Masa golonki przedniej	0,80	0,12	0,86B	0,11	0,72A	0,12
Rear shank Masa golonki tylnej	1,23	0,28	1,30	0,24	1,29	0,18
Front leg Masa nogi przedniej	0,59a	0,02	0,60A	0,03	0,57Bb	0,03
Rear leg Masa nogi tylnej	0,77B	0,13	0,70	0,09	0,63A	0,13
Head Masa głowy	2,28	0,27	2,33A	0,30	2,07B	0,30
Flank Masa pachwiny	2,28A	0,42	1,90B	0,39	1,58C	0,39
Chop Masa podgardla	2,44	0,59	2,40	0,68	2,12	0,58
Backfat Masa słoniny	6,00	2,24	5,18	1,89	4,99	2,13
Lard Masa sadła	1,87A	0,28	1,20B	0,30	0,89C	0,33
Skin Masa skórek	2,30	0,43	2,55	0,38	2,41	0,46

a, b – values in the rows with different letters differ significantly ($P \leq 0.05$).

a, b – wartości w wierszach oznaczone różnymi literami różnią się istotnie przy ($P \leq 0,05$).

A, B – values in the rows with different letters differ significantly ($P \leq 0.01$).

A, B – wartości w wierszach oznaczone różnymi literami różnią się istotnie przy ($P \leq 0,01$).

Analysis of the tissue composition of ham and loin (Tab. 3) showed the impact of genetic group on participation and relative proportions of particular tissues. The meat content in the total weight of ham ranged from 68.2% in Landrace × Duroc hybrids to 73.6% in Duroc × Pietrain fatteners. The fat proportion reached value from 18% (Duroc × Pietrain) to 22.7% (Pulawska × Duroc). Meat accounted from 51.9% (Pulawska × Duroc) to 58.2% (Duroc × Pietrain) in the total weight of neck, while fat tissue varied within the range of 30.85% – 26.95%, respectively.

Table 3. Content of meat, bone and fat in primary cuts selected
Tabela 3. Zawartość mięsa, kości i tłuszczu w wybranych wyrębach podstawowych

Specification Wyszczególnienie	Pulawska × Duroc Puławska × Duroc		Landrace × Duroc		Duroc × Pietrain	
	\bar{x}	SD	\bar{x}	SD	\bar{x}	SD
NECK – KARKÓWKA						
Meat weight (kg) Masa mięsa (kg)	2,02b	0,46	2,07	0,47	2,31a	0,38
Bone weight (kg) Masa kości (kg)	0,67a	0,12	0,65a	0,11	0,59b	0,12
Fat weight (kg) Masa tłuszczu (kg)	1,20	0,31	1,12	0,39	1,07	0,33
SHOULDER – ŁOPATKA						
Meat weight (kg) Masa mięsa (kg)	4,39	0,79	4,55	0,81	4,20	0,70
Bone weight (kg) Masa kości (kg)	0,40B	0,09	0,55A	0,08	0,38B	0,09
Fat weight (kg) Masa tłuszczu (kg)	1,12	0,25	1,23a	0,22	1,05b	0,31
LOIN – SCHAB						
Meat weight (kg) Masa mięsa (kg)	3,37B	0,60	3,48B	0,63	4,19A	0,70
Bone weight (kg) Masa kości (kg)	1,25	0,25	1,30	0,20	1,20	0,28
Fat weight (kg) Masa tłuszczu (kg)	2,30A	0,46	2,12	0,38	1,87B	0,43
HAM – SZYNKA						
Meat weight (kg) Masa mięsa (kg)	5,67	1,05	5,42B	1,04	6,66A	1,31
Bone weight (kg) Masa kości (kg)	0,74	0,11	0,75	0,10	0,75	0,13
Fat weight (kg) Masa tłuszczu (kg)	1,89	0,46	1,78	0,36	1,64	0,70

a, b – values in the rows with different letters differ significantly ($P \leq 0,05$)

a, b – wartości w wierszach oznaczone różnymi literami różnią się istotnie przy ($P \leq 0,05$)

A, B – values in the rows with different letters differ significantly ($P \leq 0,01$)

A, B – wartości w wierszach oznaczone różnymi literami różnią się istotnie przy ($P \leq 0,01$)

It is well known that crossbreeding improves the efficiency of fattening and slaughter value. Polish swine breeds, mainly Polish Large White, Landrace, and disappearing breeds (Pulawska, Żłotnicka) are a good maternal (female) material for commercial

crossbreeding. Duroc breed, exhibiting high intramuscular fat content (determining the juiciness and flavor of culinary meat), is highly recommended as paternal (male) component [Pisula 2010]. In opinion of Stasiak *et al.* [2005], value of the slaughter traits of Pulawska × Landrace and Landrace × Polish Large White hybrid finishers was more favorable in comparison with that of fatteners from pure-breed matings. Crossbreeding the Złotnicka Pstra with Polish Large White and Hampshire pigs resulted in a decrease in the fat thickness, increase in the loin “eye” area, and the proportion of meat in carcasses of hybrids [Szulc *et al.* 2006]. Results achieved in the own research confirm that it is appropriate to mate sows of a particular breed with boars of paternal breed, as indicated also by other studies [Buczyński *et al.* 2000].

CONCLUSIONS

1. The best results regarding the length of the carcass were obtained by Pulawska × Duroc and Landrace × Duroc.
2. There has been a statistically significant difference in average backfat thickness from 5 measurements between the assessed hybrid groups. Results of linear measurements of halves allow for concluding that Duroc × Pietrain pigs had, as compared with Landrace × Duroc and Pulawska × Duroc hybrids, by 0.44 and 0.53 cm thinner backfat thickness from 5 measurements, respectively.
3. In order to obtain a high meatiness, the most favorable crossbreeding arrangement was crossbreeding Duroc sows with Pietrain boars, because meat content in the three most valuable cuts of fatteners as well as loin “eye” area was the highest.
4. Fatteners of Pulawska × Duroc characterized by higher weight bacon, backfat, lard, and chop compared with the other groups.

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Streszczenie. Celem pracy była ocena wariantów krzyżowania z wykorzystaniem ras puławskiej, pbz, pietrain i duroc w odniesieniu do wartości rzeźnej tusz. Doświadczeniem objęto 45 świń mieszańców ras puławska × duroc, polska biała zwiśloucha × duroc i duroc × pietrain. Tucz wieprzków i loszek prowadzono od masy ok. 25 kg do ok. 110 kg. Świnie żywiono do woli mieszanką pełnoporcjową wg norm żywienia świń. Uboju zwierząt dokonano w zakładach mięsnych zgodnie z technologią obowiązującą w przemyśle mięsnym. Określono masy tuszy cieplej i zimnej. Poszczególne elementy zasadnicze poddano rozbirowi na elementy morfologiczne, tj. mięso, kości, tłuszcz i skórę. Zanotowano statystycznie istotne różnice w średniej grubości słoniny z 5 pomiarów pomiędzy ocenianymi grupami mieszańców. Najkorzystniejszym wariantem krzyżowania dla uzyskania wysokiej mięsności było krycie loch rasy duroc knurami rasy pietrain, bowiem zawartość mięsa w trzech najcenniejszych wyrębach tuszy tych tuczników oraz powierzchnia „oka” polędwicy były w tej grupie największe. Również krzyżowanie loch puławskich z knurami rasy duroc dało dobre wyniki w zakresie oceny rzeźnej tuczników i ten system krzyżowania może być zastosowany na szerszą skalę w praktyce zootechnicznej.

Słowa kluczowe: tuczniaki, pomiary linowe tuszy, masa elementów zasadniczych, skład tkankowy wybranych części zasadniczych