MEAT AND FAT CONTENT OF CROSSBRED GILTS BORN AND KEPT IN POLAND IN BYDGOSZCZ BREEDING DISTRICT IN YEARS 1995-2004

UMIĘŚNIENIE I OTŁUSZCZENIE LOSZEK MIESZAŃCÓW URODZONYCH I ODCHOWYWANYCH W POLSCE W BYDGOSKIM OKRĘGU HODOWLANYM W LATACH 1995-2004

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ABSTRACT

The analysis covers findings of performance (tested in vivo) of fat and meat content of 45286 two-breeds crossbreds gilts tested in ten successive years (1995-2004) according to the same methodology observed in those years. Animals were produced in Poland in the area of Bydgoszcz Breeding District, covering Kujawy-Pomorze province. They came from two crossing variants of breeds Polish Large White (PLW) and Polish Landrace (PL): [PLW x PL] and [PL x PLW]; the sow's breed is given in the first position. Two-factor ANOVA analysis of variance was employed in the research taking into consideration a crossing variant and ten years, i.e. 1995-2004 (referred to as groups 1-10, respectively) when animals' performance was tested (in vivo). Computer program Statistica PL was used in calculations.

Taking into consideration the total results from ten years (1995-2004) it should be noticed that crossbred gilts [PL x PLW] had significantly thinner backfat measured in P_2 and P_4 points, lower height of loin eye and higher carcass meat content ($P \leq 0.01$) compared with animals from [PLW x PL] crossing variant. The analysis of the results from year 1995 and year 2004 shows that in the case of crossbred gilts [PLW x PL] backfat thickness in P_2 and P_4 points decreased by 6.76 and 7.76 mm and meat content increased by 6.65%. Improvement in the mentioned traits occurred also in the case of gilts from the second tested crossing variant, i.e. [PL x PLW], because backfat thickness in P_2 and P_4 points decreased by 5.41 and 6.00 mm and carcass meat content increased by 4.80 %.

Key words: crossbred gilts, performance test, meat content, fat content

ABSTRAKT

Analizowano wyniki dotyczące otłuszczenia i umięśnienia 45286 loszek mieszańców dwurasowych ocenionych przyżyciowo w dziesięciu kolejnych latach (1995-2004) według tej samej obowiązującej w tych latach metodyki. Zwierzęta wyprodukowano w Polsce na terenie bydgoskiego okręgu hodowlanego, obejmującego województwo kujawsko-pomorskie. Pochodziły one z dwóch wariantów krzyżowania ras wielkiej białej polskiej (wbp) i polskiej białej zwisłouchej (pbz): [wbp x pbz] i [pbz x wbp], w których rasę lochy podano w pierwszej pozycji. W pracy zastosowano dwuczynnikową analizę wariancji ANOVA z uwzględnieniem wariantu krzyżowania oraz dziesięciu lat, tj. 1995-2004 (przyjętych odpowiednio jako grupy 1-10), w których zwierzęta zostały poddane ocenie przyżyciowej. Do obliczeń wykorzystano program komputerowy Statistica PL.

Biorąc pod uwagę łączne zestawienie wyników z dziesięciu lat (1995-2004) należy zauważyć, że loszki mieszańce [pbz x wbp] charakteryzowały się istotnie cieńszą słoniną mierzoną w punktach P_2 i P_4, mniejszą wysokością oka polędwicy i większą mięsnością ($P \leq 0,01$) w porównaniu z zwierzętami pochodzącymi z wariantu krzyżowania [wbp x pbz]. Analizując wyniki z 1995 i 2004 r. widać, że u loszek mieszańców [wbp x pbz] grubość słoniny w punktach P_2 i P_4 zmniejszyła się o 6,76 i 7,76 mm a mięsność zwiększyła się o 6,65%. Poprawa w zakresie wymienionych cech nastąpiła również w przypadku loszek pochodzących z drugiego badanego wariantu krzyżowania, tj. [pbz x wbp], bowiem grubość słoniny w punktach P_2 i P_4 zmniejszyła się o 5,41 i 6,00 mm a mięsność wzrosła o 4,80%.

Słowa kluczowe: loszki mieszańce, ocena przyżyciowa, umięśnienie, otłuszczenie

DETAILED ABSTRACT

Współcześni konsumenci poszukują wieprzowiny o wysokiej zawartości chudego mięsa i niskim udziale tłuszczu. Efektywność produkcji mięsa przez pogłowie masowe trzody chlewnej warunkowana jest wieloma czynnikami. Zależy również od mięsności komponentu matecznego stosowanego w krzyżowaniu towarowym. W programach krzyżowania świń w Polsce do komponentów matecznych zalicza się m.in. loszki takich ras czystych jak wielka biała polska i polska biała zwisłoucha oraz mieszańce powstałe z obukierunkowego krzyżowania tych ras.

Celem pracy była analiza wyników dotyczących umięśnienia i otłuszczenia 45286 loszek mieszańców należących do dwóch grup i pochodzących z krzyżowania ras wielkiej białej polskiej (wbp) i polskiej białej zwisłouchej (pbz): [wbp x pbz] i [pbz x wbp], których liczebność wynosiła odpowiednio 25674 i 19612 sztuk. W wymienionych wariantach krzyżowania rasę lochy podano w pierwszej pozycji. Zwierzęta zostały wyprodukowane w Polsce na terenie bydgoskiego okręgu hodowlanego obejmującego woj. kujawsko-pomorskie. Oceniono je przyżyciowo w dziesięciu kolejnych latach, tj. 1995-2004 według tej samej obowiązującej w tych latach metodyki. W pracy zastosowano dwuczynnikową analizę wariancji ANOVA z uwzględnieniem wariantu krzyżowania oraz dziesięciu lat, tj. 1995-2004 (przyjętych odpowiednio jako grupy 1-10), w których zwierzęta zostały poddane ocenie przyżyciowej. Obliczeń dokonano posługując się programem komputerowym Statistica PL.

W łącznym zestawieniu wyników z dziesięciu lat loszki mieszańce pochodzące z wariantu krzyżowania [pbz x wbp] odznaczały się istotnie mniejszym otłuszczeniem określonym na podstawie pomiarów grubości słoniny w punktach P_2 i P_4 i mniejszą wysokością oka polędwicy mierzonej w punkcie P_4 oraz większą mięsnością ($P \leq 0,01$) w porównaniu z mieszańcami [wbp x pbz]. W latach 1995-2004 nastąpiło zmniejszenie grubości słoniny w punktach P_2 i P_4 wynoszące 5,41 i 6,00 mm u mieszańców [pbz x wbp] i 6,76 i 7,76 mm u zwierząt [wbp x pbz]. W analizowanym okresie mięsność wzrosła odpowiednio o 4,80% u loszek mieszańców [pbz x wbp] i o 6,65% u zwierząt [wbp x pbz]. W niektórych analizowanych latach loszki badanych grup mieszańców uzyskały nieco gorsze wyniki od świń ras wyjściowych, tj. wbp i pbz, co stwierdzono również w badaniach innych autorów.

Na podstawie uzyskanych wyników można wyciągnąć wniosek, że loszki mieszańce pochodzące z wariantu krzyżowania [pbz x wbp] odznaczały się mniejszym otłuszczeniem i większym umięśnieniem wobec zwierząt [wbp x pbz]. W okresie dziesięciu analizowanych lat, tj. od 1995 do 2004 r. nastąpiła znaczna poprawa dotycząca wzrostu mięsności i zmniejszenia grubości słoniny u badanych grup loszek mieszańców. Świadczy to o skutecznej pracy hodowlanej (selekcji) prowadzonej w bydgoskim okręgu hodowlanym u loszek mieszańców [wbp x pbz] i [pbz x wbp].

INTRODUCTION

Modern consumers are looking for pork with high lean meat and low fat content [6, 11]. The effectiveness of meat production by mass herds of pigs depends on many factors. It also depends on meat content of maternal component used in commercial crossing. In pig-crossing programmes in Poland maternal components consist of e.g. gilts of pure breeds such as Polish Large White, Polish Landrace and crossbreeds coming from reciprocal crossing of these breeds [2, 3, 4, 7, 9, 10, 13]. They are performance tested (in vivo) which results are one of fundamental criteria in pig selection work and in choosing animals for breeding and meat producing farms [14, 15]. Breeding work aims to improve meat content and decrease fat content of pigs of Polish Large White and Polish Landrace breed and their crossbreds. Results should be regularly analysed because excessive increase in animal productivity may cause disturbance in genetic homeostasis of interrelation between the groups of traits [5]. The aim of the presented paper was evaluation of fat and meat content of two groups of crossbred gilts from a crossing of Polish Large White (PLW) and Polish Landrace (PL), i.e. [PLW x PL] and [PL x PLW] born and kept in Poland in Bydgoszcz Breeding District in years 1995-2004.

MATERIAL AND METHODS

The analysis covers findings of performance of fat and meat content of 45286 two-breeds crossbreds gilts tested in ten successive years (1995-2004) according to the same methodology observed in those years [2, 3]. The animals were born and kept and had their performance tested in the Bydgoszcz Breeding District, covering Kujawy-Pomorze province. They came from two crossing variants of breeds: Polish Large White (PLW) and Polish Landrace (PL): [PLW x PL] and [PL x PLW], the sow's breed is given in the first position. The number of tested pigs in particular years was given in Table 1. The number of crossbred gilts from the tested crossing variants is strictly connected with the structure of pig-breeding in Poland and in Bydgoszcz Breeding District. The age of

Table 1. Number of crossbred gilts coming from tested crossing variants in analysed years 1995-2004
Tabela 1. Liczebność loszek mieszańców pochodzących z badanychwariantów krzyżowania w analizowanych latach 1995-2004

Year / Rok Crossing variant / Wariant krzyżowania	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total / Łącznie
PLW x PL wbp x pbz	26	129	141	597	1110	1338	1773	6843	7932	5785	25674
PL x PLW pbz x wbp	43	42	106	336	511	756	1027	6084	6063	4644	19612

gilts which performance was tested was on average 174 days and their body weight was 97 kg. Measurements of backfat thickness in P_2 and P_4 points and the height of loin eye in P_4M point were taken by ultrasonic PIGLOG 105 apparatus on live animals (the right side of an animal). On this basis the percentage body meat content (BM) was calculated according to the formula:

$$BM = -0.4203\ P_2 - 0.4461\ P_4 + 0.2469\ P_4M + 54.8763$$

The symbols used represent:

P_2 – backfat thickness measured behind last rib (on the border line of pectoral and lumbar vertebras) 3 cm from back medial line (mm),

P_4 - backfat thickness measured behind last rib (on the border line of pectoral and lumbar vertebras) 8 cm from back medial line (mm),

P_4M – measurement of the height of loin eye in P_4 point (mm).

It should be noticed that adhering to the aforementioned methodology of performance tests began from 01.04.1995r. and that year (the first year of the research) not many animals were evaluated. Much more crossbred gilts [PLW x PL] and [PL x PLW] had their performance tested the following years using the same methodology. This methodology was applied till 30.09.2004 r. (the last year of the research). The paper treats about the research that covered all crossbred gilts [PLW x PL] and [PL x PLW], performance tested in Bydgoszcz Breeding District in years 1995-2004, when the same methodology was applied.

The results gathered were statistically interpreted, arithmetical mean ($\bar{x}$) and standard deviation (s) were calculated. Two-factor ANOVA analysis of variance was applied taking into consideration crossing variant and ten successive years, i.e. 1995-2004 (referred to as groups 1-10, respectively), when animals had their performance tested. Calculations were made using formulas given by Ruszczyc [16] and computer program Statistica PL [17].

RESULTS

The paper concerns very numerous animal material (Table 1), performance tested pigs (over 45 thousand crossbred gilts in total) in ten successive years, i.e. 1995-2004, when the same (identical) methodology was applied. Among tested pigs more numerous were crossbred gilts from [PLW x PL] crossing variant which amounted to 57 % in comparison with [PL x PLW] animals, which amounted to 43 %. Number and percentage share of gilts from the tested crossing variant is strictly connected with the structure of pig-breeding in Poland and in Bydgoszcz Breeding District.

Table 2 shows the results of backfat thickness in P_2 point of crossbred gilts [PLW x PL] and [PL x PLW]; and statistically significant differences between the tested crossing variants and years in which performance was tested (referred to as groups 1-10). Crossbred gilts from [PL x PLW] crossing variant had thinner backfat measured in P_2 point expressed as absolute values in all tested years with the exception of the years 1997 and 2001 in comparison with [PLW x PL] animals. The differences in backfat thickness in P_2 point between the tested gilts from two crossing variants were confirmed as statistically highly significant ($P \leq 0.01$) in the following years: 1997, 1998, 2000, 2002 and 2004 and in total results evaluation of ten years (1995-2004). In year 2001 differences within the discussed trait were significant ($P \leq 0.05$). In the case of the results from years 1995, 1996, 1999 and 2003 statistically significant differences of backfat thickness in P_2 point between tested crossbred gilts [PLW x PL] and [PL x PLW] were not stated. Examining the results from 1995 (the first year of the research) and 2004 (the last year of the research) it can be seen that backfat thickness in P_2 point decreased by 6.76 mm in crossbreed gilts of [PLW x PL] and by 5.41 mm in crossbred gilts of [PL x PLW]. It should be stated that many statistically significant differences ($P \leq 0.01$ or $P \leq 0.05$) were revealed when it comes to backfat thickness in P_2 point between results from particular analysed years in both crossbred

gilts [PLW x PL] and [PL x PLW]. Among them there are differences within backfat thickness in P_2 point in gilts [PLW x PL] between the results from two firstly analysed years, i.e. 1995, 1996 and the results from all the other tested years. In the case of crossbred gilts from [PL x PLW] crossing variant statistically highly significant differences were stated between the results from three firstly analysed years, i.e. 1995, 1996 and 1997 and the last tested year, that is 2004 and the results from remaining tested years.

Similar tendencies as in the case of backfat thickness measured in P_2 point occurred also in relation to backfat thickness in P_4 point. The results of backfat thickness in P_4 point and statistically significant differences between tested crossing variants and years of performance test were presented in Table 3. Crossbred gilts from [PL x PLW] crossing variant had statistically highly significant ($P\leq0.01$) thinner backfat in P_4 point in years 1996, 1998, 2000, 2002, 2003 and 2004 and in the overall evaluation of the results of ten years (1995-2004) in comparison with [PLW x PL] animals. The analysis of the results from 1995 and 2004 leads to the conclusion that within the space of ten tested years backfat thickness decreased by 7.76 mm in animals from [PLW x PL] crossing variant and by 6.00 mm in crossbred gilts [PL x PLW] and differences in this range were statistically highly significant. Many statistically significant differences ($P\leq0.01$ or $P\leq0.05$) were revealed relating to backfat thickness in P_4 point between results from particular tested years both in crossbred gilts of [PLW x PL] and [PL x PLW]. It should highlighted that the reason of these favourable changes connected with the decrease in backfat thickness both in points P_2 and P_4, and so the decrease in fat content of crossbred gilts from tested crossing variants within the space of ten analysed years (1995-2004), was conducting a selection work in breeding herds, from where the tested pigs came.

Table 4 shows results of the height of loin eye in P_4 point and gives statistically significant differences between the tested crossing variants and years of conducted evaluation. Crossbred gilts [PLW x PL] had generally more favourable results of this trait (except for year 1995) from [PL x PLW] animals, and differences in years 1998, 1999, 2001, 2002, 2003 and 2004 and in overall evaluation from ten years (1995-2004) were confirmed as statistically highly significant and in year 2000 as significant. In crossbred gilts from [PLW x PL] crossing variant within the space of ten years (1995-2004) the height of loin eye increased by 1.43 mm ($P\leq0.01$). In the case of crossbred gilts [PL x PLW] the improvement of the discussed trait was not stated.

Table 5 presents meat content of the tested crossbred gilts and gives statistically significant differences between the tested crossing variants and years of performance tests. In the ten analysed years (1995-2004) meat content on average amounted to 56.83% in [PLW x PL] crossbred gilts and 56.91% in [PL x PLW] animals; and the differences although small (0.08%) were statistically highly significant. Thus animals from [PL x PLW] crossing variant had higher meat content than [PLW x PL] crossbred gilts, which was statistically confirmed in years: 1996, 2000, 2002 and 2004. Within the space of ten years

Table 2. Backfat thickness in P_2 point (mm)
Tabela 2. Grubość słoniny w punkcie P_2 (mm)

Year (Group) Rok (Grupa)	Crossing variant Wariant krzyżowania		Significance of differences between tested years, shown as groups 1-10 Istotność różnic między badanymi latami przyjętymi jako grupy 1-10			
			PLW x PL wbp x pbz		PL x PLW pbz x wbp	
	PLW x PL wbp x pbz	PL x PLW pbz x wbp	P≤0.05	P≤0.01	P≤0.05	P≤0.01
1995 (1)	17.27±4.00	15.70±4.53	-	1-2,3,4,5,6,7,8,9,10	-	1-2,3,4,5,6,7,8,9,10
1996 (2)	14.75±2.88	13.98±3.35	-	2-1,3,4,5,6,7,8,9,10	-	2-1,3,4,5,6,7,8,9,10
1997 (3)	13.30^{A}±2.60	14.77^{B}±3.47	-	3-1,2,6,7,8,9,10	-	3-1,2,4,5,6,7,8,9,10
1998 (4)	13.47^{A}±2.83	12.88^{B}±3.65	-	4-1,2,6,7,8,9,10	-	4-1,2,3,6,8,9,10
1999 (5)	13.16±2.41	13.04±3.13	-	5-1,2,6,7,8,9,10	-	5-1,2,3,6,7,8,9,10
2000 (6)	12.33^{A}±2.47	11.39^{B}±2.57	6-8	6-1,2,3,4,5,7,9,10	-	6-1,2,3,4,5,7,10
2001 (7)	$12,01^{a}$±2,63	$12,22^{b}$±2,75	-	7-1,2,3,4,5,9,10	-	7-1,2,3,5,6,8,9,10
2002 (8)	11.71^{A}±2.30	11.40^{B}±2.18	8-6	8-1,2,3,4,5,9,10	-	8-1,2,3,4,5,7,10
2003 (9)	11.08±2.17	11.07±2.24	9-10	9-1,2,3,4,5,6,7,8	-	9-1,2,3,4,5,7,10
2004 (10)	10.51^{A}±1.89	10.29^{B}±2.10	10-9	10-1,2,3,4,5,6,7,8	-	10-1,2,3,4,5,6,7,8,9
Average 1995-2004 Średnia 1995-2004	11.43^{A}±2.38	11.18^{B}±2.42				

Average values in rows marked by different letters differ significantly from each other; capital letters - $P\leq0.01$, small letters - $P\leq0.05$
Średnie w rzędach oznaczone różnymi literami istotnie różnią się od siebie; wielkie litery - $P\leq0,01$, małe litery - $P\leq0,05$

Table 3. Backfat thickness in P_4 point (mm)
Tabela 3. Grubość słoniny w punkcie P_4 (mm)

Year (Group) Rok (Grupa)	Crossing variant Wariant krzyżowania		Significance of differences between tested years, shown as groups 1-10 Istotność różnic pomiędzy badanymi latami przyjętymi jako grupy 1-10			
			PLW x PL wbp x pbz		PL x PLW pbz x wbp	
	PLW x PL wbp x pbz	PL x PLW pbz x wbp	P≤0.05	P≤0.01	P≤0.05	P≤0.01
1995 (1)	18.77±6.54	16.26±7.34	-	1-2,3,4,5,6,7,8,9,10	-	1-2,3,4,5,6,7,8,9,10
1996 (2)	15.91^{A}±4.24	12.52^{B}±3.58	-	2-1,3,4,5,6,7,8,9,10	-	2-1,3,6,7,8,9,10
1997 (3)	13.55±3.45	13.50±4.31	3-5	3-1,2,6,7,8,9,10	-	3-1,2,4,5,6,7,8,9,10
1998 (4)	13.20^{A}±3.11	12.60^{B}±3.50	-	4-1,2,6,7,8,9,10	-	4-1,3,6,7,8,9,10
1999 (5)	12.96±2.89	12.56±3.01	5-3	5-1,2,6,7,8,9,10	-	5-1,3,6,7,8,9,10
2000 (6)	11.95^{A}±2.55	11.08^{B}±2.41	6-7	6-1,2,3,4,5,9,10	-	6-1,2,3,4,5,10
2001 (7)	11,43±2,61	11,52±2,91	7-6	7-1,2,3,4,5	-	7-1,2,3,4,5,10
2002 (8)	11.53^{A}±2.35	11.15^{B}±2.27	-	8-1,2,3,4,5	-	8-1,2,3,4,5,10
2003 (9)	11.24^{A}±2.09	11.04^{B}±2.26	-	9-1,2,3,4,5,6	-	9-1,2,3,4,5,10
2004 (10)	11.01^{A}±1.85	10.26^{B}±1.96	-	10-1,2,3,4,5,6	-	10-1,2,3,4,5,6,7,8,9
Average 1995-2004 Średnia 1995-2004	11.48^{A}±2.37	11.01^{B}±2.41				

Average values in rows marked by different letters differ significantly from each other; capital letters - P≤0.01, small letters - P≤0.05
Średnie w rzędach oznaczone różnymi literami istotnie różnią się od siebie; wielkie litery - P≤0,01, małe litery - P≤0,05

(1995-2004) meat content increased by 6.65% in [PLW x PL] crossbred gilts and by 4.80 % in [PL x PLW] animals, and differences between the results from the last year of the research and the results from all other analysed years in both crossing variants were confirmed as statistically highly significant.

It should be noticed that in the case of such traits as backfat thickness in P_2 and P_4 points and meat content the worst results were obtained in 1995, that is in the first year of the research, when appropriate performance test methodology was introduced. In 2004, or in the last year of the research, when the same performance test methodology applied in the case of the above mentioned traits, the most favourable results were stated. It proves efficient breeding work (selection) carried in Bydgoszcz Breeding District in [PLW x PL] and [PL x PLW] crossbred gilts which were a maternal component used in breeding and market crossing.

DISCUSSION

The demand among consumers for meat and its products of low fat content is increasing [6, 11]. Therefore, improvement of meat content and decrease in fat content is one of the main aims for pig breeding and keeping in Poland, where appropriate methods are applied and the results are used in conducted selection [14]. Performance test (in vivo) has a significant role in this process, its results are one of the main criteria for choosing animals to breeding and production herds [15]. Breeding value of paternal and maternal components used in breeding and commercial crossing influences the productivity level of pedigree and mass population of pigs, including the level of meat and fat content. In Poland, including Bydgoszcz Breeding District, performance tested maternal components consist of pigs of such pure breeds: Polish Large White, Polish Landrace, Hampshire, Duroc, Pietrain and line 990 and also crossbreds from reciprocal crossing of Polish Large White (PLW) breed and Polish Landrace (PL), i.e. [PLW x PL] and [PL x PLW]. In Polish bibliography there is a lack of papers dealing with performance traits of crossbred gilts [PLW x PL] and [PL x PLW] that were performance tested. In "Report on Pig Breeding in Poland" [2, 3, 4], an annually published paper by Animal Production Institute in Kraków, there are only overall results of crossbred gilts from two crossing variants, i.e. [PLW x PL] and [PL x PLW]. Therefore, the intention was to compare performance test results connected with meat and fat content of crossbred gilts from the above mentioned crossing variants.

In the presented research [PL x PLW] crossbred gilts, i.e. animals coming from Polish Landrace sows and Polish Large White boars had thinner backfat and higher meat content in comparison with [PLW x PL] crossbred gilts whose mothers were sows of Polish Large White breed and fathers boars of Polish Landrace breed. More favourable results of fat and meat content of [PL x PLW] crossbred gilts in comparison with animals from [PLW x PL] crossing variant were observed in other our research [12]. In some analysed years gilts of tested crossbred groups had slightly worse results of

Table 4. Height of loin eye in P_4M point (mm)
Tabela 4. Wysokość oka polędwicy w punkcie P_4M (mm)

Year (Group) Rok (Grupa)	Crossing variant Wariant krzyżowania		Significance of differences between tested years, shown as groups 1-10 Istotność różnic pomiędzy badanymi latami przyjętymi jako grupy 1-10			
			PLW x PL wbp x pbz		PL x PLW pbz x wbp	
	PLW x PL wbp x pbz	PL x PLW pbz x wbp	P≤0.05	P≤0.01	P≤0.05	P≤0.01
1995 (1)	47.85±5.38	48.58±6.67	1-2,3	1-10	-	1-4,5,7,8
1996 (2)	48.99±5.47	48.33±5.15	2-1	2-5	2-5,8	2-4,7
1997 (3)	49.06±5.38	47.77±5.44	3-1	3-5	3-7	3-4
1998 (4)	48.73^{A}±4.82	46.24^{B}±4.70	4-5,7,8	-	-	4-1,2,3,6,10
1999 (5)	47.63^{A}±4.72	46.91^{B}±4.51	5-4	5-2,3,10	5-2,6,10	5-1
2000 (6)	48.59^{a}±4.47	48.09^{b}±4.82	6-7,8	-	6-5,8	6-4,7
2001 (7)	47.48^{A}±4.50	46.51^{B}±5.06	7-4,6	7-2,3,10	7-3	7-1,2,6,10
2002 (8)	47.44^{A}±4.51	46.82^{B}±4.64	8-4,6	8-2,3,10	8-2,6,10	8-1
2003 (9)	48.44^{A}±4.38	47.41^{B}±4.74	-	-	-	-
2004 (10)	49.28^{A}±4.19	48.23^{B}±4.71	-	10-1,5,7,8	10-5,8	10-4,7
Average 1995-2004 Średnia 1995-2004	48.28^{A}±4.48	47.37^{B}±4.76				

Average values in rows marked by different letters differ significantly from each other; capital letters - P≤0.01, small letters - P≤0.05
Średnie w rzędach oznaczone różnymi literami istotnie różnią się od siebie; wielkie litery - P≤0,01, małe litery - P≤0,05

Table 5. Meat content (%)
Tabela 5. Mięsność (%)

Year (Group) Rok (Grupa)	Crossing variant Wariant krzyżowania		Significance of differences between tested years, shown as groups1-10 Istotność różnic pomiędzy badanymi latami przyjętymi jako grupy 1-10			
			PLW x PL wbp x pbz		PL x PLW pbz x wbp	
	PLW x PL wbp x pbz	PL x PLW pbz x wbp	P≤0.05	P≤0.01	P≤0.05	P≤0.01
1995 (1)	51.03±3.52	52.99±4.24	-	1-2,3,4,5,6,7,8,9,10	-	1-2,3,4,5,6,7,8,9,10
1996 (2)	53.64^{A}±2.70	55.28^{B}±2.88	-	2-1,3,4,5,6,7,8,9,10	-	2-1,3,6,7,8,9,10
1997 (3)	55.32^{a}±2.44	54.40^{b}±3.45	-	3-1,2,6,7,8,9,10	-	3-1,2,4,5,6,7,8,9,10
1998 (4)	55.32±2.51	55.24±3.13	-	4-1,2,6,7,8,9,10	-	4-1,3,6,7,8,9,10
1999 (5)	55.30±2.18	55.34±2.39	-	5-1,2,6,7,8,9,10	-	5-1,3,6,7,8,9,10
2000 (6)	56.33^{A}±2.29	56.98^{B}±2.11	-	6-1,2,3,4,5,9,10	-	6-1,2,3,4,5,7,10
2001 (7)	56.40^{A}±2.45	56.06^{B}±2.39	-	7-1,2,3,4,5,9,10	-	7-1,2,3,4,5,6,8,9,10
2002 (8)	56.49^{A}±1.82	56.63^{B}±1.77	-	8-1,2,3,4,5,9,10	-	8-1,2,3,4,5,7,10
2003 (9)	57.13^{A}±1.64	56.96^{B}±1.65	-	9-1,2,3,4,5,6,7,8,10	-	9-1,2,3,4,5,7,10
2004 (10)	57.68^{A}±1.52	57.79^{B}±1.68	-	10-1,2,3,4,5,6,7,8,9	-	10-1,2,3,4,5,6,7,8,9
Average 1995-2004 Średnia 1995-2004	56.83^{A}±1.96	56.91^{B}±1.95				

Average values in rows marked by different letters differ significantly from each other; capital letters - P≤0.01, small letters - P≤0.05
Średnie w rzędach oznaczone różnymi literami istotnie różnią się od siebie; wielkie litery - P≤0,01, małe litery - P≤0,05

meat and fat content than pigs of pure breed of Polish Large White and Polish Landrace which were parental components (initials) for creating crossbreds [PLW x PL] and [PL x PLW], whose results were published in other papers [1, 2, 3, 4, 8, 9, 10, 13, 15]. In Poland pigs of Polish Landrace breed are in the first place when a total number of pigs is considered, and their share is about 54 % of pigs [9]. The second place take pigs of Polish Large White, their share being about 34% of pigs [8]. In terms of performance, including slaughter value (traits connected with meat and fat content) pigs of Polish Large White and Polish Landrace get similar results [2, 3, 4, 10]. Among all gilts of Polish Large White and Polish Landrace and F_1 crossbreds ([PLW x PL] and [PL x PLW] in total) performance tested in Poland in year 2004 meat content was 58.1%; 57.8% and 57.6% respectively [4]. In the presented research in year 2004 [PLW x PL] and [PL x PLW] crossbred gilts from Bydgoszcz Breeding District had meat content of 57.7% and 57.8%, thus got a slightly better result than the country-average for

crossbreds and a similar result to the one of pure breed gilts of Polish Landrace.

Within the space of ten analysed years (1995-2004) in tested [PLW x PL] and [PL x PLW] crossbred gilts a significant improvement in decrease in fat content and increase in meat content was observed. It shows an efficient improvement of crossbred gilts from [PLW x PL] and [PL x PLW] crossing variants in this region of Poland. It is worth mentioning that Bydgoszcz Breeding District, besides Poznań Breeding District, is at the forefront in the country and pigs produced there impact the degree to which this animal is used in Poland.

CONCLUSIONS

[PL x PLW] crossbred gilts had thinner backfat and higher meat content in comparison with animals coming from [PLW x PL] crossing variant. In years 1995-2004 in tested gilts a significant decrease in fat content and increase in meat content was observed. This shows efficient breeding work (selection) done in Bydgoszcz Breeding District in [PLW x PL] and [PL x PLW] crossbred gilts.

REFERENCES

[1] Buczyński J., Panek A., Szulc K., Fajfer E., Luciński P. Porównanie wyników oceny przyżyciowej loszek różnych ras. Roczniki Naukowe Zootechniki (1999), 3, 87-95

[2] Eckert R., Szyndler M. Ocena przyżyciowa młodych knurów i loszek. W: Stan hodowli i wyniki oceny świń w roku 1995. Instytut Zootechniki Kraków (1996), XIV, 41-68

[3] Eckert R., Żak G. Ocena przyżyciowa loszek. W: Stan hodowli i wyniki oceny świń w roku 2003. Instytut Zootechniki Kraków (2004), XXII, 47-58

[4] Eckert R., Żak G. Ocena przyżyciowa loszek. W: Stan hodowli i wyniki oceny świń w roku 2004. Instytut Zootechniki Kraków (2005), XXIII, 54-70

[5] Falkenberg H., Hammer H., Ritter E. Genetische und phanotypische Beziehungen zwischen Merkmalen der Mast- und Ansatzleistung von Ebern in zentralen Aufzuchtstationen, der Wurfleistung ihrer Schwestern. Archiv für Tierzucht (1989), 32 (2), 163-172

[6] Grześkowiak E. Technologiczna i konsumpcyjna przydatność mięsa krzyżówek towarowych świń polskich ras białych z udziałem knurów ras hampshire i duroc. Akademia Rolnicza w Szczecinie (1999), Rozprawy nr 190, 1-58

[7] Michalska G. Efekt heterozji w zakresie cech użytkowości rozpłodowej, tucznej i rzeźnej w krzyżowaniu dwurasowym prostym świń belgijskiej zwisłouchej z wielką białą polską i duroc. Akademia Techniczno-Rolnicza w Bydgoszczy (1996), Rozprawy nr 76, 1-86

[8] Michalska G., Nowachowicz J., Bucek T., Wasilewski P.D. Changes in range of performance test results of gilts of Polish Large White breed produced in Poland in Bydgoszcz Breeding District. Journal Central European Agriculture (2008), Vol. 9, No. 3, 581-588

[9] Michalska G., Nowachowicz J., Chojnacki Z. The analysis of performance test results of Polish Landrace pigs from Bydgoszcz breeding area. Animal Science Papers and Reports (2006), Vol. 24, Supplement 1, 57-63

[10] Michalska G., Nowachowicz J., Chojnacki. Z. Performance test of body meat content of different breeds gilts. Animal Science Papers and Reports (2006), Vol. 24, Supplement 2, 213-221

[11] Migdał W., Paściak P., Gardzińska A., Barowicz T., Pieszka M., Wojtysiak D. Wpływ czynników genetycznych i środowiskowych na jakość wieprzowiny. Prace i Materiały Zootechniczne, Zeszyt Specjalny (2004), 15, 103-117

[12] Nowachowicz J., Michalska G. Umięśnienie i otłuszczenie loszek mieszańców w zależności od ich tempa wzrostu. Zeszyty Naukowe Akademii Techniczno-Rolniczej w Bydgoszczy, Zootechnika (2004), 34, 79-85

[13] Nowachowicz J., Michalska G., Chojnacki Z., Wasilewski P. D., Bucek T. Analiza wyników oceny przyżyciowej loszek produkowanych w bydgoskim okręgu hodowlanym. Zeszyty Naukowe Przeglądu Hodowlanego (2003), 68, (2), 25-32

[14] Różycki M. Doskonalenie mięsności ras świń hodowanych w Polsce. Roczniki Naukowe Zootechniki (1999), Suplement 3, 55-63

[15] Różycki M. Selected traits of Polish pedigree pigs – progress in the carcass meat deposition and meat quality. Animal Science Papers and Reports (2003), Vol. 21, Supplement 1, 163-171

[16] Ruszczyc Z. Metodyka doświadczeń zootechnicznych. Państwowe Wydawnictwo Rolnicze i Leśne (1981), Warszawa, 1-426

[17] Statistica PL for Windows. Wer. 5.5. StatSoft Polska (2000)