The impact of growth rate on the results of growth and slaughter traits of young crossbred boars in Poland in Bydgoszcz Breeding Region

Wpływ tempa wzrostu na wyniki cech tucznych i rzeźnych knurków mieszańców ocenionych przyŜyciowo w Polsce w bydgoskim okręgu hodowlanym

Jerzy NOWACHOWICZ, GraŜyna MICHALSKA Przemysław Dariusz WASILEWSKI, Tomasz BUCEK

University of Technology and Life Sciences in Bydgoszcz, Faculty of Animal Breeding and Biology, Department of Animal Products Evaluation, Kordeckiego 20, 85-225 Bydgoszcz, Poland, E-mail: surzwierz@utp.edu.pl

ABSTRACT

There was analysed the impact of growth rate on the results of growth and slaughter traits of 3917 young crossbred boars performance tested in years 2004-2008 in Poland in The Bydgoszcz Breeding Region. They came from 8 following crossing variants, where sow's breed was given in a first position and boar's breed in a second position: Hampshire x Belgian Landrace (H x BL), Hampshire x Duroc (H x D), Hampshire x Pietrain (H x P), Duroc x Hampshire (D x H), Duroc x Pietrain (D x P), Pietrain x Hampshire (P x H), Pietrain x Duroc (P x D) and Line 990 x Pietrain (990 x P). The impact of growth rate on the results' formation in the range of tested traits noted in different degrees. It was the most visible in the growth traits (age and body weight) and the performance test selection index and less visible in the slaughter traits, among which the most visible in case of the backfat thickness measured in P2 and P4 points and then in the meat content and the height of loin eye. In the analyzed years tested young crossbred boars of the high growth rate, i.e. of high daily gain of body weight standardized on the 180th day of life were younger and generally obtained higher body weight and higher performance test selection index and in the majority of cases, where the statistically significant differences were proved, had thinner backfat in the P2 and P4 points and had lower meat content and the higher height of loin eye as compared to the animals of low growth rate.

Keywords: daily gain of body weight, backfat thickness, meat content, performance test selection index, young crossbred boars

ABSTRAKT

Analizowano wpływ tempa wzrostu na wyniki cech tucznych i rzeźnych 3917 knurków mieszańców ocenionych przyŜyciowo w latach 2004-2008 w Polsce w bydgoskim okręgu hodowlanym. Pochodziły one z następujących 8 wariantów krzyŜowania, w

których rasę lochy podano w pierwszej pozycji a knura w drugiej: hampshire x belgijska zwisłoucha (h x bz), hampshire x duroc (h x d), hampshire x pietrain (h x p), duroc x hampshire (d x h), duroc x pietrain (d x p), pietrain x hampshire (p x h), pietrain x duroc (p x d) i linia 990 x pietrain (990 x p). Wpływ tempa wzrostu na kształtowanie się wyników w zakresie badanych cech zaznaczył się w róŜnym stopniu. Najbardziej był widoczny w cechach tucznych (wiek i masa ciała) oraz indeksie selekcyjnym oceny przyŜyciowej a w mniejszym stopniu w cechach rzeźnych, spośród których najbardziej w przypadku grubości słoniny mierzonej w punktach P2 i P4 a następnie w zawartości mięsa i wysokości oka polędwicy. W analizowanych latach badane knurki mieszańce o wysokim tempie wzrostu, tj. wysokim przyroście dobowym masy ciała standaryzowanym na 180. dzień Życia były młodsze oraz osiągnęły na ogół większą masę ciała i wyŜszy indeks selekcyjny oceny przyŜyciowej oraz w większości przypadków, w których udowodniono statystycznie istotne róŜnice charakteryzowały się cieńszą słoniną w punktach P2 i P4 oraz mniejszą mięsnością i większą wysokością oka polędwicy w porównaniu ze zwierzętami o niskim tempie wzrostu.

Słowa kluczowe: przyrost dobowy masy ciała, grubość słoniny, mięsność, indeks selekcyjny oceny przyŜyciowej, knurki mieszańce

DETAILED ABSTRACT

Wieloletnie intensywne prace hodowlane nad trzodą chlewną przyczyniły się do bardziej efektywnego wykorzystania paszy, zwiększenia przyrostu dobowego masy ciała prowadzącego do wzrostu odkładania białka w ciele i w konsekwencji do większego umięśnienia zwierząt. Jednak wyniki badań niektórych autorów sugerują, Że zbyt wysokie tempo wzrostu moŜe niekorzystnie wpływać na wartość rzeźną świń szczególnie przy Żywieniu ad libitum, prowadząc do obniŜenia mięsności i zwiększenia otłuszczenia.

Celem pracy było określenie wpływu tempa wzrostu na wyniki cech tucznych i rzeźnych 3917 knurków mieszańców pochodzących z następujących wariantów krzyŜowania, w których rasę lochy podano w pierwszej pozycji a knura w drugiej: hampshire x belgijska zwisłoucha (h x bz), hampshire x duroc (h x d), hampshire x pietrain (h x p), duroc x hampshire (d x h), duroc x pietrain (d x p), pietrain x hampshire (p x h), pietrain x duroc (p x d) i linia 990 x pietrain (990 x p) ocenionych przyŜyciowo w Polsce w bydgoskim okręgu hodowlanym w latach 2004-2008 zgodnie z obowiązującą metodyką. W zaleŜności od tempa wzrostu knurki pochodzące z poszczególnych wariantów krzyŜowania podzielono na dwie grupy o zróŜnicowanym tempie wzrostu a więc charakteryzujące się niskim i wysokim przyrostem dobowym masy ciała według określonego schematu. Statystyczne opracowanie wyników przeprowadzono stosując jednoczynnikową analizę wariancji. Istotność róŜnic między grupami o zróŜnicowanym tempie wzrostu w obrębie kaŜdego wariantu krzyŜowania w danym roku weryfikowano testem t-Studenta. Do obliczeń wykorzystano program komputerowy Statistica 8.0 PL (2008). Wpływ tempa wzrostu na kształtowanie się wyników w zakresie badanych cech zaznaczył się w

róŜnym stopniu. Najbardziej był widoczny w cechach tucznych (wiek i masa ciała) oraz indeksie selekcyjnym oceny przyŜyciowej a w mniejszym stopniu w cechach rzeźnych, spośród których najbardziej w przypadku grubości słoniny mierzonej w punktach P2 i P4 a następnie w zawartości mięsa i wysokości oka polędwicy. W analizowanych latach badane knurki mieszańce o wysokim tempie wzrostu, tj. wysokim przyroście dobowym masy ciała standaryzowanym na 180. dzień Życia były młodsze oraz osiągnęły na ogół większą masę ciała i wyŜszy indeks selekcyjny oceny przyŜyciowej oraz w większości przypadków, w których udowodniono statystycznie istotne róŜnice (P≤0,01 lub P≤0,05) charakteryzowały się cieńszą słoniną w punktach P2 i P4 oraz mniejszą mięsnością i większą wysokością oka polędwicy w porównaniu ze zwierzętami o niskim tempie wzrostu.

INTRODUCTION

Many years of intensive work on the pigs has contributed to more efficient use of feed, increase of the daily gain of body weight leading to raise of the body protein deposition and consequently to higher meat content of the animals (Cameron and Curran, 1995a, 1995b; Fuller et al., 1995). However, the results of some authors suggest that too high growth rate may unfavourable impact on the slaughter value of the pigs, especially with ad libitum feeding, leading to decrease of the meat content and increase of the fat content (Buczyński et al., 2001; Kanis, 1988; Kapelański et al., 2002; Knap, 1987; Michalska et al., 2002, 2003; Milewska and Falkowski 2001; Urbańczyk et al., 1999). However, the studies of Gy, et al. (1992) and Cameron, et al. (1999) indicate that high growth rate of the pigs of high genetical capacity to the protein deposition does not impact on increase of the fat content.

In a modern breeding and rearing of the pigs crossbred boars are increasingly used, which as compared to the purebred animals are characterized by earlier puberty, higher testicular weight, higher volume of semen of better quality, higher breeding performance regarding to higher libido, higher insemination efficiency and the possibility to their longer use (Czarnecki et al., 1998; Fent et al., 1980; Kapelański, 1995; Koczanowski et al., 2001; Michalski and Polańska, 1983; Neely and Robison, 1983; Nowachowicz, 2004; Rak et al., 1993).

The results of performance test are one of the main criteria in selection-work when animals are chosen to breeding and producing herds (RóŜycki, 2003). The breeding value of performance tested pigs depends on their growth rate and the body meat content. The performance test has a special role in conducted selection, especially the male individuals, because of their breeding value depends largely on the level of productivity of breeding and mass livestock of the pigs. In the recent years, among the paternal components of pigs performance tested in Poland beside young purebred boars such as Belgian Landrace, Hampshire, Duroc, Pietrain and synthetic Line 990 there are also two-breed crossbred young boars came from their crossing. The aim of presented paper was to determine the impact of growth rate on the results of growth and slaughter traits of young crossbred boars in Poland in Bydgoszcz Breeding Region.

MATERIALS AND METHODS

The impact of growth rate on the results of growth and slaughter traits of 3917 young crossbred boars intended for further breeding has been examined. The animals were produced and performance tested in years 2004-2008 in Poland within The Bydgoszcz Breeding Region (Kujawy-Pomorze Province) according to the obligatory methodology (Eckert and Szyndler-Nędza, 2005). The body meat content of young crossbred boars was estimated on the base of ultrasound measurements of the backfat thickness in the P2 and P4 points and the height of loin eye in the P4 measurement point, carried out using PIGLOG 105 apparatus.

Performance test selection index was calculated according to the formula (Eckert and Szyndler-Nędza, 2005):

$I_O = 0,1364\ X_1 + 4,7820X_2 – 275,5944$ where:

I_O - paternal lines selection index

X_1 – daily gain standardized on 180th day of life

X_2 – percentage body meat content.

The young crossbred boars came from 8 following crossing variants, where sow's breed was given in a first position and boar's breed in a second position: Hampshire x Belgian Landrace (H x BL), Hampshire x Duroc (H x D), Hampshire x Pietrain (H x P), Duroc x Hampshire (D x H), Duroc x Pietrain (D x P), Pietrain x Hampshire (P x H), Pietrain x Duroc (P x D) and Line 990 x Pietrain (990 x P). Depending on the growth rate, i.e. the height of daily gain of body weight standardized on the 180th day of life young crossbred boars came from different crossing variants were divided into two groups of different growth rate, thus of low and high daily gain of body weight according to the scheme given in Table 1. The number of tested animals was given in Tables 2-6.

The results were statistically elaborated using the one-way variance analysis.The significance of differences between the groups of different growth rate within each crossing variant in a particular year was verified by t-Student's test. The calculations were made using computer program Statistica 8.0 PL (2008).

RESULTS

The number of animals and the results of growth and slaughter traits were given in the tables 2-6. The animal material was very numerous and covered almost 4000 young two-breed crossbred boars came from 8 crossing variants, performance tested in Poland in The Bydgoszcz Breeding Region in the 5 following years (2004-2008). The animals of high daily gain of body weight were younger and obtained generally higher body weight on the performance test day (except crossbreds: H x BL in 2004

and 2005, H x P in 2005, 990 x P in 2006 and H x D in 2007) as compared to the pigs of low growth rate (tables 2-6). The data regarding the daily gain of body weight standardized on 180th day of life (tables 2-6) clearly results that in the tested years in case of all crossing variants the differences between the groups of young boars of the low and high growth rate were high and statistically high significant.

The growth rate generally impacted on the standardized backfat thickness in the point P2 (tables 2-6). Detailed analysis of the results of the groups of pigs of low and high growth rate on 26 tested cases (regarding to particular year and the crossing variant) in 17 cases statistically high significant or statistically significant differences stated, among them in the majority of cases (12) young crossbred boars of the high growth rate had thinner backfat measured in the P2 point. It was observed in the following years in the animals from the groups: 2004 H x D; 2005 H x D, D x P; 2006 H x D, D x P; 2007 D x P, P x H, P x D; 2008 H x P, D x P, P x H, P x D. In 5 following cases the inverse relationship was observed: 2004 H x BL; 2005 H x BL, H x P, P x D; 2006 990 x P. Regarding to the backfat thickness in the P4 point (tables 2-6) it was also stated similar trends as in the backfat thickness measured in the point P2. It was observed that in case of 15 indicated significances of differences in the 11 cases young crossbred boars of the high growth rate had thinner backfat (2004 H x D; 2005 H x D; 2006 H x D, D x P; 2007 D x H, D x P, P x H, P x D; 2008 H x P, D x P, P x D). In the 4 cases opposite trend was observed, thus the animals of the high growth rate had thicker backfat (2004 D x P, P x H; 2005 H x P, P x D).

The impact of the growth rate on the results of the standardized height of loin eye in the P4 point was lower than on the fat content of pigs characterized on the base of the backfat thickness measurements in the P2 and P4 points (tables 2-6). In analyzed years in the pigs from some crossing variants 10 significances of differences were proved between the groups of low and high daily gain of the body weight (the 26 cases under consideration taking into account tested years and the crossing variants). All of them show the same trend - young crossbred boars of the high growth rate had more favourable result of the standardized height of loin eye in the P4 point as compared to the pigs of low daily gains of the body weight. They concerned following years and crossing variants: 2004 D x P, P x H; 2005 H x D, H x P, D x P; 2006 D x P, 990 x P; 2007 D x P, P x H; 2008 D x P. It should be noticed, that the impact of the growth rate on standardized body meat content of young crossbred boars in analyzed years (tables 2-6) was proved in the half of cases (according to years and the crossing variants). Among 13 statistically high significant or significant differences which were stated between the groups of different growth rate, majority of them (8) concerned the trend that young crossbred boars of the high growth rate had unfortunately lower meat content. It was observed in the following years in the pigs from such crossing variants as: 2004 D x P; 2005 H x BL, H x P, D x P, P x H, P x D; 2006 990 x P; 2007 H x P. However, in 5 cases the animals of high

daily gains of the body weight had higher body meat content: 2004 H x D; 2007 P x H; 2008 H x P, D x P, P x D.

In the analyzed period among tested crossing variants young boars of the high growth rate obtained higher value of the performance test selection index as compared to the animals of low daily gains of the body weight (tables 2-6). The differences in this range between the groups of pigs of different growth rate were high and in the majority statistically high significant or significant.

DISCUSSION

In Poland and other countries conducted selection based on i.e. performance test results of pigs in the direction to increase the growth rate through the control of the daily gain of body weight and increase the meat content conducted on the base of the backfat thickness measurements and the height of loin eye caused a significant progress of the genetic value of animals (Bobček et al., 2002; Cameron and Curran, 1995b; Chen et al., 2003; McKay, 1990; RóŜycki, 2003). However, the obtained results should be analyzed currently, because too intensive increase of the performance of pigs may cause disorders and changes in the genetic homeostasis of the relations between the groups of traits (Falkenberg et al., 1989). The results of performance test of tested young boars were presented in other publication (Michalska et al., 2010). There was observed, that regarding to the best results of growth and slaughter traits Hampshire x Pietrain crossing variant should be recommended to young crossbred boars production and used as paternal component in crossing programs of the pigs.

In the presented paper in tested young crossbred boars in analyzed years more statistically significant differences were proved between tested groups of pigs of a different growth rate in case when young boars of the high growth rate had thinner backfat in points P2 and P4, the higher height of loin eye and the lower body meat content. The obtained results show an unfavourable impact of the high growth rate on the meat content of young crossbred boars came from some crossing variants in particular years. This is consistent with the previous own results concerning the pure breed pigs (Michalska et al., 2002, 2003). In the research of other authors similar trends were observed, suggesting that the high daily gains of the body weight may impact on decrease of the meat content of pigs (Buczyński et al., 2001; Kanis, 1988; Kapelański et al., 2002; Knap, 1987; Milewska and Falkowski, 2001; Urbańczyk et al., 1999). The modern breeds and lines of the pigs and their crossbreds, including these from tested crossing variants have a different level of the production traits i.e. the daily gains of the body weight (Czarnecki et al., 1998; Eckert and Szyndler-Nędza, 2005; Fandrejewski et al.; 2001; Fischer et al., 2002; Glodek et al., 2004; Kapelański et al., 2002; Kawęcka et al., 2008; Michalska et al., 2002, 2003, 2010; Milewska and Falkowski, 2001; Nowachowicz, 2004). Fandrejewski, et al. (2001) observed, that among the growing pigs from the paternal lines there is a significant diversity in the amount of the intaken fodder, what impacts on their growth rate, the body composition and the meat production costs. According to Buczyński, et al.

(2001) forcing too high growth rate may cause decrease of the production pigs profitability.

CONCLUSIONS

Summarizing the obtained results it should be stated, that the impact of the growth rate on formation of the results in range of tested traits noted in the different degree. It was the most visible in the growth traits (age and body weight) and the performance test selection index and the less visible in the slaughter traits, among them the most visible in case of the backfat thickness measured in the P2 and P4 points, than in the meat content and the height of loin eye. In the analyzed years tested young boars of the high growth rate, i.e. the high daily gain of the body weight standardized on the 180th day of life were younger and obtained generally higher body weight and higher performance test selection index and in the most cases where the statistically significant differences (P 0.01 or P 0.05) were proved, had thinner backfat in the points P2 and P4 and lower meat content and higher height of the loin eye as compared to the animals of low growth rate.

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Table 1. The division of young crossbred boars into groups of different growth rate
Tabela 1. Podział knurków mieszańców na grupy o zróżnicowanym tempie wzrostu

Crossing variant Wariant krzyżowania	Daily gain of body weight (g) standardized on 180th day of life Przyrost dobowy masy ciała knurków (g) standaryzowany na 180. dzień życia	
	low - niski	high - wysoki
2004		
Hampshire x Belgian Landrace hampshire x belgijska zwisłoucha	up to 631 do 631	from 632 od 632
Hampshire x Duroc hampshire x duroc	up to 637 do 637	from 638 od 638
Hampshire x Pietrain hampshire x pietrain	up to 649 do 649	from 650 od 650
Duroc x Hampshire duroc x hampshire	-	-
Duroc x Pietrain duroc x pietrain	up to 649 do 649	from 650 od 650
Pietrain x Hampshire pietrain x hampshire	up to 674 do 674	from 675 od 675
Pietrain x Duroc pietrain x duroc	up to 679 do 679	from 680 od 680
Line 990 x Pietrain linia 990 x pietrain	-	-
2005		
Hampshire x Belgian Landrace hampshire x belgijska zwisłoucha	up to 627 do 627	from 628 od 628
Hampshire x Duroc hampshire x duroc	up to 662 do 662	from 663 od 663
Hampshire x Pietrain hampshire x pietrain	up to 668 do 668	from 669 od 669
Duroc x Hampshire duroc x hampshire	-	-
Duroc x Pietrain duroc x pietrain	up to 657 do 657	from 658 od 658
Pietrain x Hampshire pietrain x hampshire	up to 624 do 624	from 625 od 625
Pietrain x Duroc pietrain x duroc	up to 667 do 667	from 668 od 668
Line 990 x Pietrain linia 990 x pietrain	-	-

2006		
Hampshire x Belgian Landrace hampshire x belgijska zwisłoucha	-	-
Hampshire x Duroc hampshire x duroc	up to 637 do 637	from 638 od 638
Hampshire x Pietrain hampshire x pietrain	up to 667 do 667	from 668 od 668
Duroc x Hampshire duroc x hampshire	-	-
Duroc x Pietrain duroc x pietrain	up to 650 do 650	from 651 od 651
Pietrain x Hampshire pietrain x hampshire	-	-
Pietrain x Duroc pietrain x duroc	-	-
Line 990 x Pietrain linia 990 x pietrain	up to 614 do 614	from 615 od 615
2007		
Hampshire x Belgian Landrace hampshire x belgijska zwisłoucha	-	-
Hampshire x Duroc hampshire x duroc	up to 759 do 759	from 760 od 760
Hampshire x Pietrain hampshire x pietrain	up to 730 do 730	from 731 od 731
Duroc x Hampshire duroc x hampshire	up to 797 do 797	from 798 od 798
Duroc x Pietrain duroc x pietrain	up to 664 do 664	from 665 od 665
Pietrain x Hampshire pietrain x hampshire	up to 605 do 605	from 606 od 606
Pietrain x Duroc pietrain x duroc	up to 626 do 626	from 627 od 627
Line 990 x Pietrain linia 990 x pietrain	-	-
2008		
Hampshire x Belgian Landrace hampshire x belgijska zwisłoucha	-	-
Hampshire x Duroc hampshire x duroc	-	-

Hampshire x Pietrain hampshire x pietrain	up to 731 do 731	from 732 od 732
Duroc x Hampshire duroc x hampshire	-	-
Duroc x Pietrain duroc x pietrain	up to 688 do 688	from 689 od 689
Pietrain x Hampshire pietrain x hampshire	up to 610 do 610	from 611 od 611
Pietrain x Duroc pietrain x duroc	up to 608 do 608	from 609 od 609
Line 990 x Pietrain linia 990 x pietrain	-	-

Table 2. The results of growth and slaughter traits of tested young crossbred boars performance tested in year 2004
Tabela 2. Wyniki cech tucznych i rzeźnych badanych knurków mieszańców poddanych ocenie przyżyciowej w 2004 roku

Traits Cechy		The daily gain of body weight of young boars standardized on 180th day of life (g) Przyrost dobowy masy ciała knurków standaryzowany na 180. dzień życia (g)																	
		H x BL h x bz			H x D h x d			H x P h x p			D x P d x p			P x H p x h			P x D p x d		
		low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie
Number, n Liczebność, szt.		9	9	18	16	18	34	16	14	30	46	46	92	31	27	58	42	40	82
Age on test day Wiek w dniu oceny	$\bar{x}$	172.33a	166.11b	169.22	161.19	158.72	159.88	181.13a	170.00b	175.93	183.65A	164.39B	174.02	171.26A	164.15B	167.95	177.98A	167.90B	173.06
	s	0.50	7.70	6.19	4.69	9.81	7.82	11.59	13.18	13.39	13.72	10.81	15.64	8.79	8.41	9.26	12.49	10.44	12.54
Body weight on test day Masa ciała w dniu oceny	$\bar{x}$	105.56	104.11	104.83	92.06A	101.06B	96.82	108.56	111.64	110.00	106.24A	112.02B	109.13	105.48	108.19	106.74	108.98A	116.08B	112.44
	s	0.88	4.43	3.19	5.62	9.21	8.88	7.91	13.48	10.78	8.69	8.92	9.23	10.75	8.91	9.95	9.23	11.02	10.69
Daily gain of body weight standardized on 180th day of life Przyrost dobowy masy ciała standaryzowany na 180. dzień życia	$\bar{x}$	626.44A	655.67B	641.06	607.13A	684.83B	648.26	600.19A	677.50B	636.27	577.15A	719.76B	648.46	632.10A	693.37B	660.62	619.48A	719.13B	668.09
	s	4.82	20.95	21.06	14.93	40.80	50.09	36.80	15.96	48.51	49.05	57.78	89.34	33.02	11.75	39.84	48.49	43.90	68.04
Standardized backfat thickness in P2 point Standaryzowana grubość słoniny w punkcie P2	$\bar{x}$	7.78a	8.67b	8.22	10.69A	8.83B	9.71	8.81	8.43	8.63	9.59	9.63	9.61	9.45	8.89	9.19	8.88	9.05	8.96
	s	0.67	0.87	0.88	1.74	0.79	1.61	1.22	1.34	1.27	1.68	1.48	1.58	1.65	1.60	1.64	1.55	1.30	1.43
Standardized backfat thickness in P4 point Standaryzowana grubość słoniny w punkcie P4,	$\bar{x}$	9.67	10.44	10.06	12.31a	11.22b	11.74	10.38	10.21	10.30	9.33A	10.48B	9.90	9.97a	11.11b	10.50	9.83	9.60	9.72
	s	1.32	1.01	1.21	1.82	0.73	1.44	1.02	1.42	1.21	1.59	1.85	1.81	2.14	1.74	2.03	1.81	1.61	1.71
Standardized height of loin eye in P4 point Standaryzowana wysokość oka polędwicy w punkcie P4	$\bar{x}$	50.89	52.67	51.78	55.69	57.22	56.50	52.81	53.86	53.30	52.04A	54.39B	53.22	54.06a	56.59b	55.24	52.60	54.10	53.33
	s	3.06	1.41	2.49	2.68	2.96	2.89	2.97	2.48	2.76	4.41	4.17	4.42	3.90	4.10	4.16	4.31	3.02	3.79
Standardized body meat content Standaryzowana zawartość mięsa w ciele	$\bar{x}$	57.59	57.33	57.46	56.15A	57.96B	57.11	58.64	58.36	58.51	58.74A	57.33B	58.03	58.10	58.11	58.10	58.51	58.22	58.37
	s	0.83	1.06	0.93	1.49	1.15	1.59	1.68	1.63	1.64	1.86	1.44	1.80	1.78	1.30	1.56	2.28	1.58	1.96
Performance test selection index Indeks selekcyjny oceny przyżyciowej	$\bar{x}$	85.33	88.11	86.72	75.75A	94.94B	85.91	86.63A	95.79B	90.90	84.04A	96.72B	90.38	88.39A	96.96B	92.38	90.19A	100.88B	95.40
	s	3.74	3.76	3.91	7.82	6.66	12.05	9.22	8.07	9.73	6.86	10.70	10.98	10.61	6.20	9.77	13.96	7.89	12.55

Averages in rows within particular breed marked by different letters significantly differ each other; capital letters - P≤0.01; small letters - P≤0.05
Średnie w rzędach w obrębie danej rasy oznaczone różnymi literami istotnie różnią się od siebie; wielkie liter - P≤0,01; małe litery - P≤0,05

Table 3. The results of growth and slaughter traits of tested young crossbred boars performance tested in year 2005
Tabela 3. Wyniki cech tucznych i rzeźnych badanych knurków mieszańców poddanych ocenie przyżyciowej w 2005 roku

Traits Cechy		The daily gain of body weight of young boars standardized on 180th day of life (g) Przyrost dobowy masy ciała knurków standaryzowany na 180. dzień życia (g)																	
		H x BL h x bz			H x D h x d			H x P h x p			D x P d x p			P x H p x h			P x D p x d		
		low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie
Number, n Liczebność, szt.		20	17	37	39	39	78	69	65	134	190	192	382	104	103	207	191	194	385
Age on test day Wiek w dniu oceny	$\bar{x}$	183.75A	169.53B	177.22	187.87A	175.31B	181.59	182.81A	165.49B	174.41	181.82A	169.85B	175.80	191.13A	173.55B	182.39	180.70A	167.64B	174.12
	s	7.03	8.28	10.40	11.47	9.03	12.05	12.05	11.14	14.47	11.94	12.00	13.37	12.33	10.91	14.58	15.22	14.20	16.08
Body weight on test day Masa ciała w dniu oceny	$\bar{x}$	111.30A	107.24B	109.43	118.44	121.26	119.85	113.19	111.91	112.57	108.22A	118.70B	113.48	111.25A	115.52B	113.38	106.93A	115.76B	111.38
	s	2.77	5.66	4.75	8.71	8.55	8.69	7.49	11.59	9.68	9.27	13.64	12.79	10.16	9.70	10.14	11.20	16.26	14.64
Daily gain of body weight standardized on 180th day of life Przyrost dobowy masy ciała standaryzowany na 18. dzień życia	$\bar{x}$	601.00A	654.41B	625.54	619.87A	702.62B	661.24	617.57A	709.06B	661.95	594.99A	722.41B	659.04	568.03A	680.07B	623.78	594.73A	718.12B	656.91
	s	22.15	23.14	35.00	32.09	32.84	52.67	35.47	39.56	59.19	42.53	55.76	80.78	37.16	30.64	65.64	47.23	41.49	76.06
Standardized backfat thickness in P2 point Standaryzowana grubość słoniny w punkcie P2	$\bar{x}$	8.13a	8.70b	8.39	8.79a	7.98b	8.39	8.27a	8.85b	8.55	9.36a	9.13b	9.25	9.12	8.89	9.01	8.65A	9.05B	8.85
	s	0.77	0.87	0.86	1.92	1.27	1.67	1.36	1.35	1.38	1.48	1.67	1.58	1.54	1.41	1.48	1.30	1.70	1.53
Standardized backfat thickness in P4 point Standaryzowana grubość słoniny w punkcie P4	$\bar{x}$	9.73	9.94	9.82	10.30a	9.56b	9.93	9.77a	10.29b	10.02	9.56	9.39	9.47	9.61	9.51	9.56	8.96A	9.62B	9.29
	s	1.00	0.92	0.96	1.70	1.43	1.61	1.14	1.59	1.39	1.50	1.82	1.67	1.79	1.79	1.79	1.51	1.68	1.63
Standardized height of loin eye in P4 point Standaryzowana wysokość oka polędwicy w punkcie P4	$\bar{x}$	53.80	53.45	53.64	53.45A	54.97B	54.21	54.09a	55.53b	54.79	53.22a	54.21b	53.71	53.50	54.29	54.29	53.78	53.96	53.87
	s	1.78	3.06	2.42	2.47	2.24	2.47	3.27	3.70	3.54	3.79	4.45	4.16	3.81	3.17	3.17	3.85	3.66	3.75
Standardized body meat content Standaryzowana zawartość mięsa w ciele	$\bar{x}$	59.77A	57.98B	58.95	59.48	59.56	59.52	59.76A	58.24B	59.03	58.92a	58.44b	58.68	60.08A	58.82B	58.82	59.69A	58.15B	58.91
	s	0.83	1.51	1.48	2.31	1.49	1.93	1.83	1.37	1.79	2.13	2.53	2.35	1.91	1.83	1.83	1.96	2.09	2.16
Performance test selection index Indeks selekcyjny oceny przyżyciowej	$\bar{x}$	92.20	90.88	91.59	93.41A	105.03B	99.22	94.45A	99.63B	96.96	87.32A	102.36B	94.88	89.13A	98.44B	98.44	91.01A	100.44B	95.76
	s	3.97	6.48	5.24	11.62	9.37	12.01	8.25	8.50	8.73	11.75	13.47	14.71	8.90	8.83	8.83	9.21	11.24	11.30

Averages in rows within particular breed marked by different letters significantly differ each other; capital letters - P≤0.01; small letters - P≤0.05
Średnie w rzedach w obrebie danej rasy oznaczone różnymi literami istotnie różnia sie od siebie; wielkie liter - P≤0.01; małe litery - P≤0.05

Table 4. The results of growth and slaughter traits of tested young crossbred boars performance tested in year 2006
Tabela 4. Wyniki cech tucznych i rzeźnych badanych knurków mieszańców poddanych ocenie przyżyciowej w 2006 roku

Traits Cechy		The daily gain of body weight of young boars standardized on 180th day of life (g) Przyrost dobowy masy ciała knurków standaryzowany na 180. dzień życia (g)											
		H x D h x d			H x P h x p			D x P d x p			990 x P 990 x p		
		low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie
Number, n Liczebność, szt.		37	39	76	36	32	68	241	246	487	13	11	24
Age on test day Wiek w dniu oceny	$\bar{x}$	189.95A	183.18B	186.47	188.81a	182.25b	185.72	186.05A	174.79B	180.36	197.62A	174.64B	187.08
	s	6.48	6.22	7.17	10.41	10.14	10.76	13.14	12.32	13.92	7.04	7.09	13.58
Body weight on test day Masa ciała w dniu oceny	$\bar{x}$	119.95A	126.03B	123.07	118.92A	129.91B	124.09	111.95A	123.61B	117.84	117.69	114.36	116.17
	s	5.86	6.62	6.93	11.61	12.58	13.20	11.84	13.26	13.86	6.40	4.48	5.74
Daily gain of body weight standardized on 180th day of life Przyrost dobowy masy ciała standaryzowany na 180. dzień życia	$\bar{x}$	616.03A	682.97B	650.38	616.64A	708.72B	659.97	594.63A	720.07B	658.00	572.08A	667.18B	615.67
	s	13.76	32.35	41.90	39.16	32.95	58.72	45.27	51.00	79.15	27.77	40.91	58.93
Standardized backfat thickness in P2 point Standaryzowana grubość słoniny w punkcie P2	$\bar{x}$	8.11A	7.55B	7.82	8.02	7.84	7.93	9.41A	8.56B	8.98	8.15a	9.07b	8.57
	s	0.82	0.87	0.89	1.02	0.85	0.94	1.61	1.77	1.75	1.26	0.75	1.14
Standardized backfat thickness in P4 point Standaryzowana grubość słoniny w punkcie P4	$\bar{x}$	9.70A	8.38B	9.02	8.89	8.78	8.84	9.51A	9.09B	9.30	10.05	9.99	10.02
	s	0.90	1.31	1.30	1.59	1.35	1.47	1.29	1.50	1.41	1.61	1.45	1.50
Standardized height of loin eye in P4 point Standaryzowana wysokość oka polędwicy w punkcie P4	$\bar{x}$	54.79	55.54	55.18	56.23	56.17	56.20	54.77A	56.13B	55.46	53.75a	57.95b	55.67
	s	2.65	3.03	2.86	5.42	4.24	4.87	3.79	3.99	3.94	4.04	5.44	5.09
Standardized body meat content Standaryzowana zawartość mięsa w ciele	$\bar{x}$	60.74	61.22	60.98	61.60	61.06	61.35	59.89	59.91	59.90	61.02a	59.80b	60.46
	s	1.13	1.42	1.30	1.44	1.33	1.40	2.35	2.36	2.35	1.49	1.29	1.51
Performance test selection index Indeks selekcyjny oceny przyżyciowej	$\bar{x}$	98.81A	110.26B	104.68	103.11A	113.09B	107.81	91.90A	109.13B	100.60	94.31a	101.27b	97.50
	s	6.16	8.90	9.57	8.60	7.14	9.35	12.42	12.79	15.26	8.79	6.40	8.41

Averages in rows within particular breed marked by different letters significantly differ each other; capital letters - P≤0.01; small letters - P≤0.05
Średnie w rzędach w obrębie danej rasy oznaczone różnymi literami istotnie różnią się od siebie; wielkie liter - P≤0,01; małe litery - P≤0,05

Table 5. The results of growth and slaughter traits of tested young crossbred boars performance tested in year 2007
Tabela 5. Wyniki cech tucznych i rzeźnych badanych knurków mieszańców poddanych ocenie przyżyciowej w 2007 roku

Traits Cechy		The daily gain of body weight of young boars standardized on 180th day of life (g) Przyrost dobowy masy ciała knurków standaryzowany na 180. dzień życia (g)																	
		H x D h x d			H x P h x p			D x H d x h			D x P d x p			P x H p x h			P x D p x d		
		low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie
Number, n Liczebność, szt.		13	13	26	29	25	54	8	9	17	268	247	515	48	49	97	93	92	185
Age on test day Wiek w dniu oceny	$\bar{x}$	189.00A	169.69B	179.35	187.03A	177.00B	182.39	181.00	178.56	179.71	185.57A	176.17B	181.06	192.60A	177.86B	185.15	191.65A	181.79B	186.75
	s	7.27	6.58	11.96	5.68	11.80	10.28	3.51	3.09	3.42	11.86	10.20	12.04	9.18	11.50	12.74	14.10	13.62	14.68
Body weight on test day Masa ciała w dniu oceny	$\bar{x}$	138.69A	135.62B	137.15	125.52	138.56	131.56	138.88A	149.89B	144.71	113.85A	126.66B	119.99	109.15A	125.86B	117.59	108.80A	132.65B	120.66
	s	11.18	10.47	10.72	13.73	11.60	14.27	3.14	10.23	9.42	12.10	11.53	13.44	6.62	15.68	14.66	16.01	15.98	19.94
Daily gain of body weight standardized on 180th day of life Przyrost dobowy masy ciała standaryzowany na 180. dzień życia	$\bar{x}$	717.69A	824.46B	771.08	658.21A	792.16B	720.22	765.88A	842.56B	806.47	606.12A	728.70B	664.91	550.58A	712.39B	632.32	551.84A	728.55B	639.72
	s	45.68	34.70	67.41	56.89	40.02	83.55	27.18	45.41	53.95	44.68	49.03	77.10	27.61	61.24	94.13	51.62	66.94	106.76
Standardized backfat thickness in P2 point Standaryzowana grubość słoniny w punkcie P2	$\bar{x}$	7.02	6.95	6.98	7.26	6.79	7.04	7.00	6.62	6.80	9.02A	8.14B	8.60	9.60A	7.60B	8.59	9.27A	7.68B	8.48
	s	1.25	1.09	1.15	1.05	0.92	1.01	0.95	1.03	0.98	1.52	1.70	1.66	1.41	1.29	1.68	1.66	1.47	1.76
Standardized backfat thickness in P4 point Standaryzowana grubość słoniny w punkcie P4	$\bar{x}$	7.98	7.02	7.50	8.16	8.02	8.09	8.34a	7.41b	7.85	9.08A	8.71B	8.90	9.49A	8.44B	8.96	8.83A	8.07B	8.45
	s	1.55	1.36	1.51	1.25	1.64	1.43	0.48	0.99	0.91	1.36	1.55	1.46	1.45	1.45	1.54	1.49	1.42	1.50
Standardized height of loin eye in P4 point Standaryzowana wysokość oka polędwicy w punkcie P4	$\bar{x}$	57.31	57.26	57.28	57.58	57.91	57.73	58.55	56.64	57.54	55.45A	56.79B	56.09	54.83A	56.76B	55.81	54.93	56.00	55.46
	s	4.08	2.60	3.35	4.75	3.88	4.33	2.32	2.84	2.71	4.04	4.15	4.14	2.75	2.89	2.97	3.49	3.98	3.77
Standardized body meat content Standaryzowana zawartość mięsa w ciele	$\bar{x}$	62.89	61.50	62.20	62.55a	62.04b	62.31	62.34	62.04	62.18	60.46	60.61	60.53	60.45a	61.15b	60.80	60.92	61.41	61.16
	s	1.84	1.13	1.66	1.79	1.51	1.67	0.95	0.76	0.84	2.22	2.12	2.18	1.59	1.86	1.76	1.90	2.05	1.99
Performance test selection index Indeks selekcyjny oceny przyżyciowej	$\bar{x}$	122.85A	131.08B	126.96	113.38	129.20	120.70	127.00a	135.89b	131.71	96.17A	113.62B	104.54	88.54A	114.02B	101.41	91.01A	117.46B	104.16
	s	13.03	7.65	11.28	11.35	8.30	12.75	5.18	7.46	7.78	12.81	12.00	15.18	7.11	12.95	16.51	12.70	15.06	19.20

Averages in rows within particular breed marked by different letters significantly differ each other; capital letters - P≤0.01; small letters - P≤0.05
Średnie w rzędach w obrębie danej rasy oznaczone różnymi literami istotnie różnią się od siebie; wielkie liter - P≤0,01; małe litery - P≤0,05

Table 6. The results of growth and slaughter traits of tested young crossbred boars performance tested in year 2008
Tabela 6. Wyniki cech tucznych i rzeźnych badanych knurków mieszańców poddanych ocenie przyżyciowej w 2008 roku

Traits Cechy		The daily gain of body weight of young boars standardized on 180th day of life (g) Przyrost dobowy masy ciała knurków standaryzowany na 180. dzień życia (g)											
		H x P h x p			D x P d x p			P x H p x h			P x D p x d		
		low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie	low niski	high wysoki	total łącznie
Number, n Liczebność, szt.		36	35	71	201	203	404	63	63	126	115	115	230
Age on test day Wiek w dniu oceny	$\bar{x}$	178.22A	171.06B	174.69	185.23A	166.00B	175.57	177.70A	168.43B	173.06	187.71A	181.50B	184.61
	s	8.80	9.62	9.83	12.32	10.24	14.85	14.62	11.32	13.83	15.72	14.66	15.49
Body weight on test day Masa ciała w dniu oceny	$\bar{x}$	115.94A	135.14B	125.41	113.78A	127.44B	120.64	102.44a	107.11b	104.78	106.11A	124.59B	115.35
	s	10.22	7.95	13.28	12.19	11.78	13.79	11.88	13.25	12.75	14.72	14.86	17.42
Daily gain of body weight standardized on 180th day of life Przyrost dobowy masy ciała standaryzowany na 180. dzień życia	$\bar{x}$	654.56A	814.97B	733.63	607.81A	806.54B	707.67	581.73A	658.52B	620.13	554.74A	688.18B	621.72
	s	41.14	54.55	93.89	51.45	83.17	121.16	19.90	34.32	47.61	31.02	76.59	88.72
Standardized backfat thickness in P2 point Standaryzowana grubość słoniny w punkcie P2	$\bar{x}$	9.05A	6.88B	7.98	9.13A	7.74B	8.43	10.19A	9.58B	9.88	9.59A	8.13B	8.86
	s	1.74	1.15	1.83	1.68	1.75	1.85	1.26	1.37	1.35	1.77	1.69	1.88
Standardized backfat thickness in P4 point Standaryzowana grubość słoniny w punkcie P4	$\bar{x}$	9.68A	7.51B	8.61	9.17A	8.18B	8.67	9.63	9.32	9.47	9.03A	8.01B	8.52
	s	1.57	1.65	1.94	1.49	1.52	1.58	1.29	1.23	1.27	1.51	1.63	1.65
Standardized height of loin eye in P4 point Standaryzowana wysokość oka polędwicy w punkcie P4	$\bar{x}$	58.58	58.72	58.65	55.15A	58.16B	56.66	57.17	57.57	57.37	55.34	55.36	55.35
	s	4.01	3.47	3.73	3.79	3.52	3.95	2.19	2.85	2.54	2.80	3.92	3.40
Standardized body meat content Standaryzowana zawartość mięsa w ciele	$\bar{x}$	60.50A	61.96B	61.22	60.23a	60.65b	60.44	59.53	59.29	59.41	60.44a	60.99b	60.72
	s	1.53	1.24	1.56	2.29	1.90	2.11	1.50	1.22	1.37	2.17	2.05	2.12
Performance test selection index Indeks selekcyjny oceny przyżyciowej	$\bar{x}$	103.03A	131.89B	117.25	95.34A	124.41B	109.95	88.48A	97.73B	93.10	89.13A	109.93B	99.53
	s	10.12	7.90	17.11	12.88	14.98	20.17	6.93	8.35	8.94	12.04	15.05	17.13

Averages in rows within particular breed marked by different letters significantly differ each other; capital letters - P≤0.01; small letters - P≤0.05
Średnie w rzędach w obrębie danej rasy oznaczone różnymi literami istotnie różnią się od siebie; wielkie liter - P≤0,01; małe litery - P≤0,05