

## EFFICIENCY OF IMPROVEMENT OF LITHUANIAN WHITE PIGS BREED BY USING ENGLISH LARGE WHITES

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**Summary.** 120 pigs of old type Lithuanian White breed and 494 pigs of improved Lithuanian White with different part of English Large White blood were evaluated by the methodology of control fattening and slaughtering. Boars of English Large White breed had significant influence on the some fattening traits and especially meatiness of improved genotypes. Metabolizable energy per kg gain (feed conversion) of improved Lithuanian Whites with  $\frac{1}{2}$ ,  $\frac{3}{4}$  and  $\frac{5}{8}$  part of English Large White immigration was, respectively, on 4.29, 3.88 and 6.23 MJ lower, and leanness – on 4.0%, 4.3% and 4.1 % higher compared to old type Lithuanian White pigs ( $P < 0.001$ ). From all groups the lowest feed consumption were of progeny with  $\frac{5}{8}$  part of English Large White blood ( $P < 0.01-0.001$ ). Backfat thickness, loin lean area, ham weight and lean meat percentage of improved progeny with  $\frac{3}{4}$  and  $\frac{5}{8}$  part of English Large White blood were not significantly different. According to investigation data, higher than 75% infusion of blood of English Large Whites is inexpedient. Improved gilts and boars of Lithuanian White breed, having 50–75% of English Large White immigration, will be raised *inter se*. Received offsprings of  $\frac{5}{8}$  genotype by their leanness (56.0 %) were intermediate between  $\frac{1}{2}$  and  $\frac{3}{4}$  genotypes. At the end of 2010, the highest percentage in the genealogical structure of improved Lithuanian Whites consisted boars belonging to the lines of Imperatorius 1 and Jauris 1 and sows belonging to the families of Drašulė and Dobilė.

**Keywords:** pig breeds, genotype, growth rate, carcass, genealogical structure.

## LIETUVOS BALŲŲ VEISLĖS KIAULIŲ GERINIMAS ANGLIJOS DIDŽIOSIOMIS BALTOSIOMIS

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**Santrauka.** Pagal kontrolinio penėjimo ir skerdimo metodiką įvertintos 120 senojo tipo Lietuvos baltųjų ir 494 pagerintų Lietuvos baltųjų, turinčių skirtingą Anglijos didžiųjų baltųjų veislės kraujo dalį, kiaulių. Anglijos didžiųjų baltųjų veislės kuiliai turėjo esminės įtakos pagerinto įvairaus genotipo prieauglio kai kurioms penėjimosi, o ypač – mėsinėms savybėms. Lietuvos baltųjų, turinčių  $\frac{1}{2}$ ,  $\frac{3}{4}$  ir  $\frac{5}{8}$  dalies Anglijos didžiųjų baltųjų veislės kraujo, pašarų sąnaudos (išreikštos apykaitos energija) kilogramui priesvorio buvo atitinkamai 4,29; 3,88 ir 6,23 MJ mažesnės, o raumeningumas – 4,0; 4,3 ir 4,1 proc. didesnis negu senojo tipo kontrolinės grupės Lietuvos baltųjų kiaulių ( $p < 0,001$ ). Iš visų grupių mažiausiomis pašarų sąnaudomis išsiskyrė prieauglis, turintis  $\frac{5}{8}$  dalies Anglijos didžiųjų baltųjų kraujo ( $p < 0,01-0,001$ ). Pagerinto prieauglio, turinčio  $\frac{3}{4}$  ir  $\frac{5}{8}$  dalies Anglijos didžiųjų baltųjų kraujo, lašinių storis, ilgiausiojo nugaros raumens skerspjūvio plotas, kumpio masė bei raumeningumas yra panašūs. Skirtumai statistiškai nepatikimi.

Tyrimo duomenimis, įlieti daugiau kaip 75 proc. Anglijos didžiųjų baltųjų veislės kraujo netikslinga. Pagerintų Lietuvos baltųjų veislės kiaulaitės (paršavedės) ir kuiliai, turintys 50–75 proc. Anglijos didžiųjų baltųjų kraujo, turi būti veisiami tarpusavyje. Gautas  $\frac{5}{8}$  dalies genotipo prieauglis pagal raumeningumą (56,0 proc.) užima tarpinę padėtį tarp  $\frac{1}{2}$  ir  $\frac{3}{4}$  dalių genotipų. Pagerintų Lietuvos baltųjų genealoginėje struktūroje 2010 m. pabaigoje didžiausią dalį sudarė Imperatorius 1 ir Jaurio 1 linijų kuiliai bei Drašulės ir Dobilės šeimų paršavedės.

**Raktažodžiai:** kiaulių veislės, genotipas, penėjimasis, skerdena, genealoginė struktūra.

**Introduction.** Each breed has its own structure composed of individual lines and families. The number of lines and families indicates the level of genetic diversity in the breed (Webb, 1994; Nicholas, 1996). At the beginning of 1998, purebred (old type) Lithuanian Whites consisted of 8 boars lines and 20 sow families and at the beginning of 2003, - 8 boar lines and 14 sow families (Klimas and Klimienė, 1999; Klimas et al., 2003). The necessity for culling low producing pigs directly influences decrease of the number of lines and families or their complete extinction. The average leanness of progeny old type Lithuanian White breed, being raised in breeding centres

at the beginning of the year 2003, reached 51.9 %; when that of progeny, kept in the stables of control fattening of the State Pig Breeding Station – 50.1% (Klimas et al., 2003). Namely because of that reason, rapid decrease in their numerousness were underway, as they are not withstanding the competition with imported pig breeds. Having a purpose to improve of Lithuanian White pigs, it was a case necessary to increase their muscularity no less than by 3-5 %. This became especially relevant after introducing EUROP standard in the Lithuania in year 2005 for slaughtered pigs.

The cultural breed of Lithuanian White pigs (old type)

was recognized as an individual one on 29 April 1967 (Makoveckas, 1986). For more rapid improvement of genetic potential of the population of purebred Lithuanian Whites the most purposeful is to use the boars of English Large White breed. Whereas namely English Large Whites had the biggest influence on nurture of Lithuanian Whites (Makoveckas, 1986), therefore additional infusion of blood of the above-mentioned imported breed may be considered as pure breeding. Besides, favourable situation appeared, because in March 2000 the one breeding centre were brought from Ireland 5-7 months gilts of 9 families and boars of 4 lines, belonging to new type English Large White breed. According to prepared programme, in 2002 this work has been started in nine breeding centres of old type purebred Lithuanian White pigs (Klimas et al., 2003). Lithuanian Association of Pig Producers also approved this decision.

It was indicated (Klimas and Klimienė, 2004), that English Large Whites had no significant influence on the litter size and milk yield of Lithuanian White pigs, since reproductive performance of these breeds are similar

(Razmaitė et al., 2005; Rimkevičius et al., 2009). The new type English Large Whites had less influence on the meat physicochemical parameters of improved Lithuanian White pigs too (Jukna et al., 2005; Jukna et al., 2010).

**The purpose** of this study was to determine the fattening and carcass traits of old type Lithuanian Whites and of improved Lithuanian White pigs, having  $\frac{1}{2}$  (50 %),  $\frac{3}{4}$  (75 %) and  $\frac{5}{8}$  (62.5 %) part of English Large White blood, and to analyse the genealogical structure of improved genotypes.

**Material and methods.** All procedures of animal experiments were approved by the Lithuanian animal care, management and use legislation No. 8-500 (State news, 28 November 1997, no. 108).

Breeding of investigated pigs has been carried out at the "Berka" (Kelmė district) breeding centre. It is one of the largest breeding centre wherein the improvement of Lithuanian White by using boars of English Large White breed was started at the end of 2002. Breeding scheme for pigs at the "Berka" breeding centre presented in Table 1.

Table 1. **Breeding scheme for pigs at the breeding centre "Berka"** (Kelmė distr.)

Dobilė x Bikas (ELW) – Imperatorius 1*	Rūta x Vikingas (ELW) – Jauris 1*	Drąsuolė x Baras (ELW) – Baravykas 1*	Razeta x Fildmaršalas (ELW) – Maršalas 1*
Dobilė x Jauris 1	Rūta x Baravykas 1	Drąsuolė x Maršalas 1	Razeta x Imperatorius 1
Dobilė x Baravykas 1	Rūta x Maršalas 1	Drąsuolė x Imperatorius 1	Razeta x Jauris 1
Dobilė x Maršalas 1	Rūta x Imperatorius 1	Drąsuolė x Jauris 1	Razeta x Baravykas 1

Note: \* - number "1" show that this is improved Lithuanian White breed line. Boars from these English Large White (ELW) breed lines were used: Bikas was used to improve Imperatorius line, Vikingas – to Jauris, Baras – to Baravykas and Fildmaršalas was used to improve Maršalas line.

Four groups of pigs were formed in this breeding centre. Group 1 was formed of old type Lithuanian Whites (LW), Group 2 – of improved Lithuanian Whites with  $\frac{1}{2}$  (50 %) part of English Large White blood ( $\frac{1}{2}$  LW  $\frac{1}{2}$  ELW), Group 3 – of improved Lithuanian Whites with  $\frac{3}{4}$  (75 %) part of English Large White blood ( $\frac{1}{4}$  LW  $\frac{3}{4}$  ELW) and Group 4 - of improved Lithuanian Whites with  $\frac{5}{8}$  (62.5 %) part of English Large White blood ( $\frac{3}{8}$  LW  $\frac{5}{8}$  ELW).

Analogous by parentage, weight and age 120 pigs of control group (LW) and 494 pigs of improved Lithuanian White with different part of English Large White blood selected from the mentioned breeding centre, were evaluated by the methodology of control fattening and slaughtering (Saikevičius, 2003). Pigs were tested in stables of control fattening of the State Pig Breeding Station. During the control fattening (from 30 to approx. 95 kg weight), conditions of housing and feeding were equal for all groups of pigs. Pigs were fed with special dry compound feed KRET-KOM58-1404, containing 1.1 feed units, 13.84 MJ of metabolizable energy and 16 % of proteins per kilogram. After finishing control fattening of pigs, their average daily gain and feed consumption per kg gain (during the fattening period from 30 kg to approx. 95 kg weight) was calculated. Before realization (slaughtering), lean meat percentage was determined for live pigs accord-

ing to accepted methods (*Piglog 105 User's Guide*, 1991). Half carcass length, backfat thickness at the last rib, loin lean area and ham weight of cooled carcasses (at 0...+4°C in 24-hours period) were recalculated at 100 kg of weight, using accepted coefficients of regression (Saikevičius, 2003).

The number of improved boars and sows belonging to separate lines and families at the breeding centre "Berka" by 1<sup>st</sup> November 2010 was used as a basis for estimation of the genealogical structure.

The investigation data, except genealogical structure, were processed using statistical package Statistica for Windows version 6.0 (StatSoft, 2001) and following the basic guide to the statistical analysis of biological data by Tucker (2003). The difference was considered significant when  $P < 0.05$ .

**Results and Discussion.** The results of control fattening and slaughtering presented in Tables 2 and 3. As in the beginning of the investigation (Klimas et al., 2005), it was indicated that boars of English Large White breed have positive influence on the some fattening traits and especially meatiness of improved progeny. Comparing with control pigs (LW), Lithuanian Whites with  $\frac{1}{2}$ ,  $\frac{3}{4}$  and  $\frac{5}{8}$  part of English Large White immigration gained daily, respectively, by 10, 2 and 9 g more (differences were not significant), and consumed, respectively, by 4.29, 3.88

and 6.23 MJ of metabolizable energy per kg gain less ( $P < 0.001$ ). Thus, from all groups feed consumption were least of progeny with  $\frac{5}{8}$  part of English Large White blood (Group 4,  $P < 0.01 - 0.001$ ). Backfat at the last rib of improved progeny Groups 2, 3 and 4 was, respectively, on 7.1, 7.4 and 7.0 mm thinner, loin lean area, ham weight and leanness – 5.2, 7.8 and 7.1 cm<sup>2</sup>, 0.5, 0.6 and 0.6 kg, 4.0, 4.3 and 4.1 % higher than of old type (Group 1) Lithuanian White pigs ( $P < 0.001$ ). The following results are in concert with findings of other authors. In addition, the Yorkshires and the Landraces were used to improve Lithuanian White pigs. During period 2001-2006, namely

the Large White boars made the highest influence on the decreasing of the backfat thickness and on the increasing of the lean meat percentage of Lithuanian White. The Landraces and Yorkshires made the greatest influence on the growth rate of improved progeny (Rekštys, 2007). In comparing with old type, Lithuanian White with only 25 % of English Large White breed blood already distinguished by lower feed consumption and better meat characteristics (Jukna et al., 2010). However, no author had made separate research for productivity of Lithuanian White with 62.5 % of English Large White immigration.

Table 2. Control fattening performance data

Item	Group				Comparison ( $\pm$ )						
	I LW	II $\frac{1}{2}$ LW $\frac{1}{2}$ ELW	III $\frac{1}{4}$ LW $\frac{3}{4}$ ELW	IV $\frac{3}{8}$ LW $\frac{5}{8}$ ELW	II/I	III/I	III/II	IV/I	IV/II	IV/III	
No. of pigs	120	183	179	132	x	x	x	x	x	x	
Daily gain, g	782 $\pm$ 6	792 $\pm$ 6	784 $\pm$ 5	791 $\pm$ 4	+10	+2	-8	+9	-1	+7	
Conversion per kg gain:	Compound feed, kg	3.19 $\pm$ 0.02	2.88 $\pm$ 0.03	2.91 $\pm$ 0.03	2.74 $\pm$ 0.02	-0.31 <sup>c</sup>	-0.28 <sup>c</sup>	+0.03	-0.45 <sup>c</sup>	-0.14 <sup>b</sup>	-0.17 <sup>c</sup>
	Metabolizable energy, MJ	44.15 $\pm$ 0.28	39.86 $\pm$ 0.41	40.27 $\pm$ 0.41	37.92 $\pm$ 0.28	-4.29 <sup>c</sup>	-3.88 <sup>c</sup>	+0.41	-6.23 <sup>c</sup>	-1.94 <sup>b</sup>	-2.35 <sup>c</sup>

Note : <sup>b</sup>  $P < 0.01$ ; <sup>c</sup>  $P < 0.001$ .

Table 3. Meatiness traits

Item	Group				Comparison ( $\pm$ )					
	I LW	II $\frac{1}{2}$ LW $\frac{1}{2}$ ELW	III $\frac{1}{4}$ LW $\frac{3}{4}$ ELW	IV $\frac{3}{8}$ LW $\frac{5}{8}$ ELW	II/I	III/I	III/II	IV/I	IV/II	IV/III
No. of pigs	120	183	179	132	x	x	x	x	x	x
Half carcass length, cm	95.6 $\pm$ 0.2	95.4 $\pm$ 0.2	97.0 $\pm$ 0.2	97.9 $\pm$ 0.1	-0.2	+1.4 <sup>c</sup>	+1.6 <sup>c</sup>	+2.3 <sup>c</sup>	+2.5 <sup>c</sup>	+0.9 <sup>c</sup>
Backfat thickness at last rib, mm	24.0 $\pm$ 0.4	16.9 $\pm$ 0.3	16.6 $\pm$ 0.2	17.0 $\pm$ 0.2	-7.1 <sup>c</sup>	-7.4 <sup>c</sup>	-0.3	-7.0 <sup>c</sup>	+0.1	+0.4
Loin lean area, cm <sup>2</sup>	32.1 $\pm$ 0.3	37.3 $\pm$ 0.2	39.9 $\pm$ 0.3	39.2 $\pm$ 0.2	+5.2 <sup>c</sup>	+7.8 <sup>c</sup>	+2.6 <sup>c</sup>	+7.1 <sup>c</sup>	+1.9 <sup>b</sup>	-0.7
Ham weight, kg	11.0 $\pm$ 0.1	11.5 $\pm$ 0.1	11.6 $\pm$ 0.1	11.6 $\pm$ 0.0	+0.5 <sup>c</sup>	+0.6 <sup>c</sup>	+0.1 <sup>a</sup>	+0.6 <sup>c</sup>	+0.1 <sup>a</sup>	0
Lean meat % (Piglog 105 data)	51.9 $\pm$ 0.3	55.9 $\pm$ 0.2	56.2 $\pm$ 0.2	56.0 $\pm$ 0.2	+4.0 <sup>c</sup>	+4.3 <sup>c</sup>	+0.3	+4.1 <sup>c</sup>	+0.1	-0.2

Note : <sup>a</sup>  $P < 0.05$ ; <sup>b</sup>  $P < 0.01$ ; <sup>c</sup>  $P < 0.001$ .

Consequently (Table 3), carcass traits, except the half carcass length, of improved progeny with  $\frac{3}{4}$  and  $\frac{5}{8}$  part of English Large White immigration are comparable (differences were not statistically significant). However, in up-to-date pig selection in Europe less attention is paid on the half carcass length. Main indicator of evaluation of carcasses is their lean meat percentage, which is closely related to the backfat thickness and loin lean area (Newcom et al., 2002; Orzechowska, 2005).

The improvement of Lithuanian White pigs breed by using Large Whites, from 2002 has been started in nine breeding centres (Klimas et al., 2003). However, concerning the objective reasons only one breeding centre

“Berka” have remained. By 1<sup>st</sup> November 2010, the structure of improved Lithuanian White pigs in this breeding centre comprised 4 boar lines (Table 4) and 4 sow families (Table 5). The highest percentage in the genealogical structure constituted boars belonging to Imperatorius 1 (33.3 %), Jauris 1 (33.3 %) and Maršalas 1 (25.0%) lines and sows belonging to the families of Drašulė (31.5 %), Dobilė (29.1 %) and Rūta (25.3 %). Since all the gilts (sows) in the breeding centre are inseminated, less boars are kept. As in the beginning of 2003 (Klimas et al., 2003), the lowest percentage in the genealogical structure consisted sows belonging to the family of Razeta. By the data of other research (Webb, 1994; Nicholas, 1996), the per-

formance traits of pigs belonging to different lines and families is not the same. That makes influence to the number of animals in some lines especially in families. It can be suggested that genealogical structure show higher or lower demand of particular lines or families.

Table 4. Genealogical structure of improved Lithuanian White boars by November 1<sup>st</sup>, 2010, at the breeding centre "Berka"

No.	Line name	No. of boars	Genealogical structure, %
1.	Imperatorius 1	4	33.3
2.	Jauris 1	4	33.3
3.	Maršalas 1	3	25.0
4.	Baravykas 1	1	8.4
Total		12	100.0

Table 5. Genealogical structure of improved Lithuanian White sows by November 1<sup>st</sup>, 2010, at the breeding centre "Berka"

No.	Family name	No. of sows	Genealogical structure, %
1.	Drašuolė	482	31.5
2.	Dobilė	446	29.1
3.	Rūta	388	25.3
4.	Razeta	216	14.1
Total		1532	100.0

At the beginning of 2009 at Lithuanian breeding centres about 21 % of all purebred pigs were Lithuanian White open population (with repeatedly infusion of the blood of English Large White breed). Improved Lithuanian Whites by their lean meat percentage are becoming comparable to Large Whites, bred in the country (Rimkevičius et al., 2009; Klimienė et al., 2010). Leanness of Lithuanian Whites open population lately corresponds to dictated market condition, therefore keeping of them should be expanded.

According to investigation data, higher than 75 % infusion of blood of English Large Whites is inexpedient. Improved gilts and boars of Lithuanian White breed, having 50 – 75 % of English Large White immigration, will be raised *inter se*. Received offsprings of  $\frac{5}{8}$  genotype by their leanness (56.0 %) were intermediate between  $\frac{1}{2}$  and  $\frac{3}{4}$  genotypes.

#### Conclusions

1. Boars of English Large White breed had significant influence on the some fattening traits and especially meatiness of improved genotypes:

- Metabolizable energy per kg gain (feed conversion) of improved Lithuanian Whites with  $\frac{1}{2}$ ,

$\frac{3}{4}$  and  $\frac{5}{8}$  part of English Large White immigration was, respectively, by 4.29, 3.88 and 6.23 MJ lower and leanness – 4.0, 4.3 and 4.1 % higher compared to old type Lithuanian White pigs ( $P < 0.001$ ).

- From all groups the lowest feed consumption were of offsprings with  $\frac{5}{8}$  part of English Large White blood

( $P < 0.01 - 0.001$ ).

- Backfat thickness, loin lean area, ham weight and lean meat percentage of improved progeny with  $\frac{3}{4}$  and  $\frac{5}{8}$  part of English Large White blood were not significantly different.

- Received offsprings of  $\frac{5}{8}$  genotype by their leanness (56.0 %) were intermediate between  $\frac{1}{2}$  and  $\frac{3}{4}$  genotypes.

2. At the end of 2010, the highest percentage in the genealogical structure of improved Lithuanian Whites consisted boars belonging to the lines of Imperatorius 1 and Jauris 1 and sows belonging to the families of Drašuolė and Dobilė. Determined proportions show the demand of particular lines and families.

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