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MEATINESS OF TESTED GILTS IN THREE CONSECUTIVE YEARS

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Abstract: In the present study, the aim was to determine the impact of the following factors: age, farm, and gilt genotype, as well as the regression impact of body weight at the end of the performance test on the following tested properties: age at the end of the test/final age (FA), lifetime daily gain (LDG), the backfat thickness measured in two places (according to the Main Breeding program for Central Serbia), the depth of the long back muscle (BM) and the estimated lean meat content/meatiness (M). The study included two farms of pigs (farm 1 and farm 2), for three consecutive years (year 1, year 2 and year 3). The number of tested heads per year was 974 (year 1), 1311 (year 2) and 757 (year 3). The tested gilts were of Swedish Landrace, Large White and Duroc breeds. The gilts originated from 97 sires, while the number of daughters per sires ranged from 10 to 100. The results show that the Duroc animals were the oldest (245 days), which had the highest values for both measures of backfat thickness, but the lowest values for meatiness. In the third study year, the lowest average values were determined for the properties of the LDG, BM and M. The female animals from the farm 1 showed less growth/gain and had lower values for the estimated meatiness. As a result of the study, it was established that all included factors had a very high statistically significant influence on the variation of the tested properties ($P < 0.001$), only the genotype of gilts showed ahigh statistically significant effect on the BM property ($P < 0.01$).

Key words: factor, performance test of gilts, properties, breed, estimated meatiness/lean meat content

Introduction

Swedish Landrace, Large White and Duroc are the three most numerous pure breeds of pigs in the Republic of Serbia, since they exhibit the most desired levels of production properties and provide economic gain. Pork is the most commonly consumed meat in the world (*Berton et al., 2015*). Many pig breeding programs have been based on estimation and improvement of lean traits (*Kawecka at al., 2009*) for many years, and this intensive work in breeding has led to significant progress in the meat content of pigs (*Rekiel et al., 2015). Różycki (2003)* suggests that the results of the test performance are one of the main criteria in the selection of pigs for further breeding and production. Considering that the productivity of sows in regard to the litter size is one of the key factors for economical and efficient pig production (*Kapelanski et al., 2013; Zapryanova and Malinova, 2018*), special attention should be paid to gilts (*Mijatović et al., 2009*). Also the lifetime daily gain is one of the key traits in the pig production/farming as it contributes to its effectiveness (*Nielsen et al., 2018*). The gain as well as the backfat thickness are also considered to be the most important economic characteristics of pigs (*Zebua et al., 2017*). According to *Gaughan et al. (1995*), selection aimed at increasing lean meat content leads to delaying the onset of sexual maturation. Gilts with a thinner backfat are older at first partus, and after weaning of the piglets, the signs of estrus are delayed (*Ptak et al., 2014*). Also, the increase in lean meat has led to a decrease in the backfat thickness in the growing gilts as well as the lipid reserves (*Rekiel, 2002*). For these reasons, pig breeders often face a risk factor in the sow replacement process. The use of ultrasonic devices has led to a change in the performance testing of pigs (*Kernerova et al., 2006*) and modification of the method for estimating the pig breeding value. Body weight and backfat thickness have an effect on reproduction of gilts (*Flisar et al., 2012).* According to *Gasinski (2013),* certain body weight of gilts is necessary to prevent weight loss during first lactation. Genotype, gender, and genotype and gender interaction are gaining in importance in pig production, since breeding programs depend on the selection of a good genotype and gender to concentrate on in the spreading of new generations (*Morenikeji et al., 2019*). The aim of the paper is to determine whether there is a trait variation in the gilt performance test observed under the influence of the breed, farms and year of birth, as well as how statistically significant are these effects.

Materials and Methods

The trial was carried out on two pig farms, with 1440 gilts tested on farm 1 and 1602 gilts tested on farm 2. Gilts were tested for three consecutive years (1, 2,

and 3). In the first year of testing, 974 gilts were tested, in the second year, 1311 gilts and in the third year 757 gilts. Gilts were following pure breeds: Swedish landrace (2373), Large white (455) and Duroc (214). In total 3042 gilts were tested. During the duration of the test, gilts were kept in group boxes. After reaching the final weight, which was in accordance with the *Main Breeding Program (2014)* for Central Serbia (completion of the test at a body weight of 90 to 120 kg), the backfat thickness and the depth of *Musculus longissimus dorsi* were measured, and the lean meat content evaluated with the aid of the ultrasonic apparatus PigLog 105. The backfat thickness was measured in two places: 1. backfat thickness in the lumbar zone (BFT1, between 3rd and 4th lumbar vertebrae, measured 7 cm laterally from the backline); 2. backfat thickness in the back region (BFT2, 7 cm laterally from the backline between the 3rd and 4th ribs), while the depth of the long back muscle (BM) was measured between the 3rd and the 4th ribs, 7 cm laterally from the backline. The body weight of gilts at the end of the test/final weight represents a linear regression impact and was on average of 111.53 kg. Statistical data processing was performed using the software package "LSBMMW and MIXMDL, PC-2 VERSION" *(Harvey, 1990).* The method of least squares was used to determine the significance ($P < 0.05$) of the factors on the properties of the age at the end of the test, the lifetime daily gain, the backfat thickness in the lumbar zone, the backfat thickness in the back region, the depth of *Musculus longissimus dorsi* and the estimated meatiness (M). The model used included the genotype of gilts (G), the farm (F), the year of birth (S) and the mass at the end of the (direct) test in the form of linear regression influence as factors.

Model

$$Y_{ijkl} = \mu + G_i + F_j + S_k + b_1(x_1 - \bar{x}_1) + \varepsilon_{ijkl}$$

where: Y_{ijkl} – the effect of the trait on animal *l*, of i genotype, j farm, k year of birth, μ = general population average, G_i – the effect of gilt genotype (i=1,2,3), F_j - the effect of farm (j=1,2), S_k – the effect of year of birth (i=1,2,3), ε_{ijkl} – random error (residue).

Results and Discussion

The average values of the tested properties and standard deviation values are shown in Table 1. Data in Table 1 show that the age at the end of the test/final age was 238 days, the lifetime daily gain was 468.57 g/day, the backfat thickness 1 was 12.38 mm, backfat thickness 2 was 11.24 mm, *Musculus longissimus dorsi* depth 49.18 mm, estimated meatiness 58.92%, while the final body weight was 111.53 kg.

Table 1. Average values and standard deviations for the tested properties in the performance test

Trait		$\bar{X}$ ±SD
FA	Age at the end of the test/final age, days	238.02±24.55
LDG	Lifetime daily gain, g/day	468.57±55.60
BFT1	Backfat thickness 1, mm	12.38±2.64
BFT2	Backfat thickness 2, mm	11.24±2.61
BM	Back muscle depth, mm	49.18±6.04
M	Estimated meatiness, %	58.92±2.49
FBW	Final body weight, kg	111.53±7.59

Table 2 shows the variation of the properties studied in the performance test under the influence of the year of birth, farm and genotype. Taking the year of birth as a factor, it can be seen that animals born in the third year ended the test later in relation to the first two years of the trial, and also showed lower daily gain and meatiness, while the values for backfat thickness were higher compared to the first two years. A significant variation of the investigated properties among farms was also established, and it can be concluded that better results in the performance test were achieved by animals from the second farm. Expectedly, the animals of the Duroc breed had the highest values for the backfat thickness and the lowest values for BM and meatiness. The highest values for the trait meatiness were found in the second year of testing (58.63%), on the second farm (58.84%) and in animals of lrge White breed (59.09%). It can be noticed that gilts of Swedish Landrace and Large White (as two fertile breeds) had very similar results in the performance test, unlike the Duroc gilts.

Table 2. Effect of year, farm and genotype on investigated traits (LSMean ± S.E.)

Source of variation		FA[1)], days	LDG, g/day	BFT1, mm	BFT2, mm	BM, mm	M, %
Year	1	235.49±0.83	472.08±1.42	12.71±0.10	11.58±0.09	49.28±024	58.48±0.09
	2	239.59±0.74	463.99±1.26	12.69±0.09	11.62±0.08	49.15±0.21	58.63±0.08
	3	249.00±0.93	449.91±1.59	13.27±0.11	12.32±0.11	48.16±0.26	57.89±0.10
Farm	1	254.39±0.89	437.87±1.52	13.28±0.11	12.80±0.10	50.37±0.25	57.82±0.10
	2	228.33±0.64	486.12±1.08	12.50±0.08	10.87±0.07	47.36±0.18	58.84±0.07
Genotype	SL[2)]	238.79±0.43	467.72±0.73	12.35±0.05	11.22±0.05	49.24±0.12	58.94±0.05
	LW	240.32±1.04	463.82±1.77	12.17±0.12	11.21±0.12	49.40±0.30	59.09±0.12
	D	244.98±1.46	454.45±2.48	14.15±0.17	13.10±0.17	47.95±0.41	56.97±0.16

[1)] FA- final age (age at the end of the test); LDG – lifetime daily gain; BFT1 – backfat thickness-lumbar zone; BFT2 – backfat thickness – back region; BM – deapth of *Musculus longissimus dorsi*; M – evaluated meatiness; [2)] SL – Swedish Landrace; LW – Large White, D – Duroc

Kernerevova et al. (2006) have reported the following results for Large White gilts obtained by using the PigLog105 devices: 1) gilts with the mother's line of Large White, the average values for the gain are 531 g/day, the backfat thicknesses 1 and 2 are 12.96 and 15.08 mm, BM 59.96 mm and lean meat 58.35%; 2) gilts with the father's line of Large White, the average values for gain are 511 g/day, the backfat thicknesses 1 and 2 are 9.96 and 11.16 mm, BM 59.84 mm and lean meat content 61.84%. The reason for the higher lean meat content compared to our research is that the animals tested in the Czech Republic were from the nucleus herd of the Large White breed with above average performance results, and a significantly less animals were tested compared to our research. *Radović et al. (2012)* have obtained following values for gilts of Swedish Landrace breed: gain of 483.71 g/day and backfat thicknesses 1 and 2 of 18.01 mm and 13.46 mm, respectively, with the genotype of the animal (P>0.05) having no statistically significant effect on the variation of properties, which is in contrast with our research. The year of birth had a statistically significant effect as in our study (P<0.001). *Szyndler-Nędza et al. (2016)* have reported significantly higher gains for Large White, Landrace and Duroc gilts than in our research (LW = 625.16; Landrace = 623.47; D = 632.46 g/day), but the animals completed the test significantly earlier (age at end of the test on average 163-165 days). The backfat thickness reported by the same group of authors was measured at identical points as in our research, so that the values for backfat thickness, as expected, were the highest in Duroc breed. Differences in the muscle depth are slight compared to our research, while the values for lean meat content are higher in our research.

Table 3. Statistical significance (level of significance) of the factors included in the model in the analysis of the tested traits

Source of variation	FA[1)]	LDG	BFT1	BFT2	BM	M
Year	***[2)]	***	***	***	***	***
Farm	***	***	***	***	***	***
Genotype	***	***	***	***	**	***
FBW (b)	***	***	***	***	***	***

[1)] FA- final age (age at the end of the test); LDG – lifetime daily gain; BFT1 – backfat thickness-lumbar zone; BFT2 – backfat thickness – back region; BM – deapth of *Musculus longissimus dorsi*; M – evaluated meatiness; FBW – linear regression effect of final body weight; [2)] ** = P <0.01; *** = P <0.001

Table 3 shows the statistical significance of the factors included in the model. It was found that all factors influenced statistically significantly (P<0.001) the variation of all examined gilt traits. Only the effect of genotype on BM showed slightly lower statistical significance (P<0.01).

Gogić et al. (2012) have established in their study of performance tested gilts that genotype and farm have highly significantly (P<0.001) influenced the variability of the properties, except in regard to the depth of the muscle where farm had no effect on the trait while the genotype showed slightly lower effect (P <0.01) on variation of this property. *Nevrkla et al. (2016)* have examined the local breeds in the performance test and established that the meatiness varied highly significantly (P <0.001) between the farms, which is in line with our research.

Conclusion

On the basis of the obtained results, it can be concluded that the animals in the third year of the research were the oldest so they had the lowest values for the traits of gain, meatiness and depth of the muscles; Duroc genotype animals were expected to have the highest values for the BFT1 and BFT2 properties, as well as the lowest values for the BM and M properties; The best value for BM trait was recorded in animals from farm 1, with the highest estimated meatiness in animals of Large White genotype.

Mesnatost testiranih nazimica u tri uzastopne godine

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Rezime

U ovom istraživanju cilj je bio da se utvrdi kakav uticaj su imali sledeći faktori: godina, farma, i genotip nazimica kao i regresijski uticaj telesne mase na kraju performans testa na sledeće ispitivane osobine: uzrast na kraju testa (UKT), životni dnevni prirast (LDG), debljina slanine merena na dva mesta (u skladu sa Glavnim odgajivačkim pogramom), dubina dugog leđnog mišića (BM) i procenjena mesnatost (M). Istraživanjem su obuhvaćene dve farme svinja (farma 1 i farma 2), kroz tri uzastopne godine (godina 1, godina 2 i godina 3). Broj testiranih grla po godinama iznosio je: 974 (godina 1), 1311 (godina 2) i 757 (godina 3). Testirane nazimice su pripadale sledećim čistim rasama švedski landras, veliki jorkšir i Duroc. Nazimice potiču od 97 očeva, dok je broj kćeri po očevima iznosio od 10 do 100. Rezultati pokazuju da su najstarija grla rase Duroc (245 dana), koja imaju i najveće vrednosti za obe mere debljine slanine, ali najmanje vrednosti za mesnatost. U trećoj godini ispitivanja najmanje prosečne vrednosti su utvrđene za osobine LDG, BM i M. Ženska grla sa farme 1 su slabije prirastala i imala manje vrednosti za procenjenu mesnatost. Kao rezultat ispitivanja utvrđeno je da su svi

uključeni faktori veoma visoko statistički značajno uticali na variranje ispitivanih osobina (P <0.001), jedino genotip nazimica pokazuje visok statistički značajan uticaj na osobinu BM (P<0.01).

Ključne reči: faktor, performans test nazimica, osobine, rasa, procenjena mesnatost

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