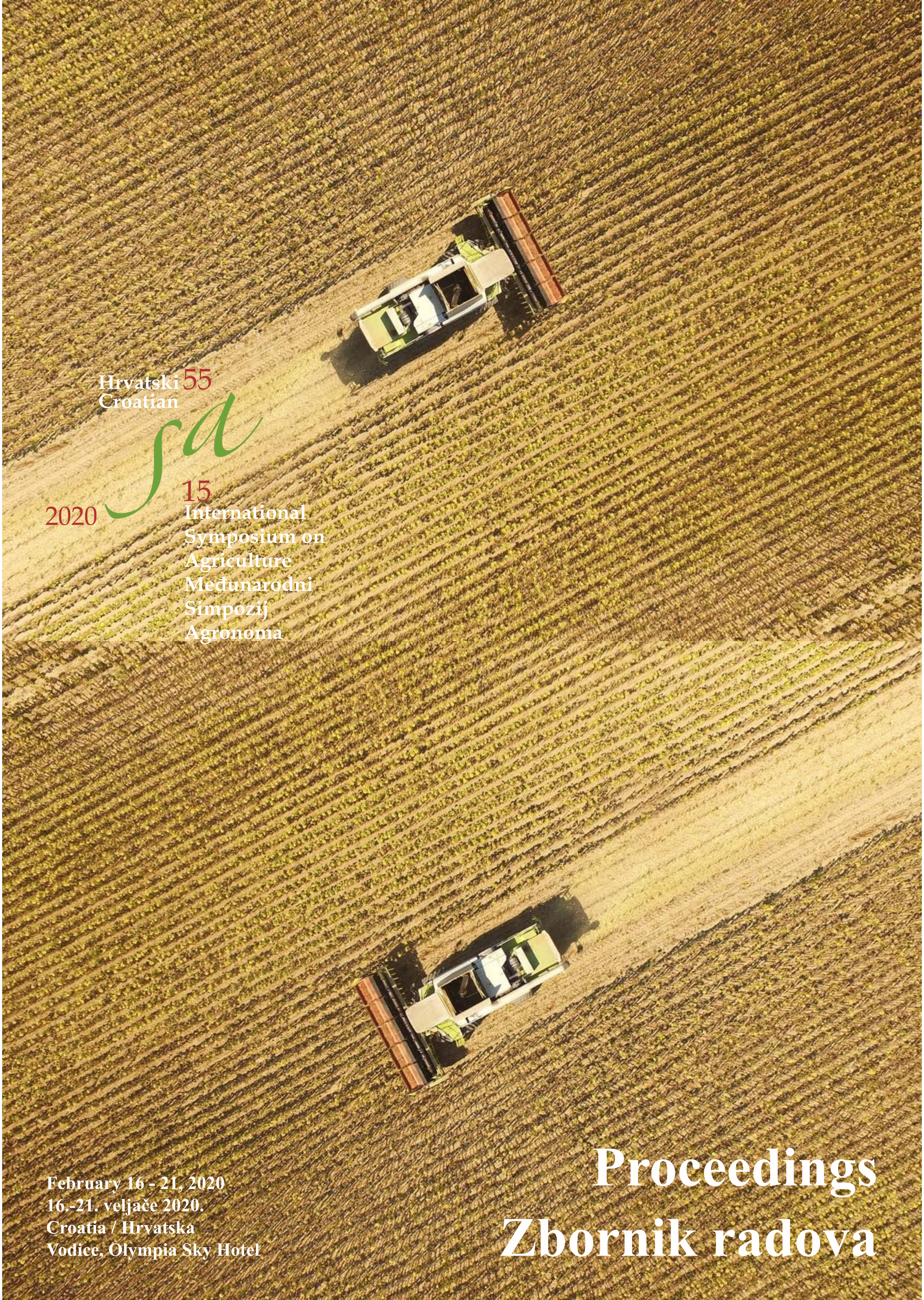

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# Proceedings
# Zbornik radova

February 16 - 21, 2020
16.-21. veljače 2020.
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2020 SA 15

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# Proceedings

55 Hrvatski

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# Influence of genotype, farm, and test year on the variability of traits monitored in the performance test of gilts

Nenad Stojiljković[1], Dragan Radojković[2], Radomir Savić[2], Marija Gogić[1], Vladimir Živković[1], Miloš Marinković[1], Krstina Zeljić[2]

[1]*Institute for Animal husbandry, Autoput 16, P.Fax 23, 11080, Belgrade, Serbia (e-mail: zake9103@gmail.com)*
[2] *University of Belgrade, Faculty of agriculture, Nemanjina 6, 11080, Belgrade, Serbia*

**Abstract**

The production traits of gilts were examined in two pig herds for three consecutive years. The study included 3,610 gilts of 3 genotypes, originating from 84 boar sires. The test included only those boar sires who had 10 or more daughters. At the end of the test, the weight and thickness of the fat (FT1 and FT2) and depth were measured by an back musle depth-ultrasound apparatus. The aim of this study was to determine the phenotypic and genotypic variability of the observed traits in the performance test of gilts: age at the end of the test (FA – final age), lifetime daily gain (LDG), fat thickness 1 and 2 (FT1 and FT2) and back muscle depth (BMD). In the first herd there were 1228 gilts and in the second 2382 gilts tested. Within the Landrace (L) breed there were 1962 gilts, Large white (LW) 1324 and Duroc (D) 319 gilts. In the first year, 885 gilts were tested, in the second 1145 and in the third 1580 gilts. Based on the results obtained, the genotype of gilts was found to have a statistically significant effect ($P<0.001$) on FT1, FT2, and BMD, while LDG was unaffected ($P>0.05$). Considering the farm as a source of variation in gilt traits, it was concluded that the farm had a highly significant statistical effect on the traits tested ($P<0.001$). The year of testing of gilts as a source of variation in their traits showed a high statistical influence ($P<0.001$) on all traits examined. Observed traits - fat thickness 1, 2 and BMD were highly statistically dependent ($P<0.001$) on the weight at the end of the test.

Keywords: pigs, boars, genotype, gilts

## Introduction

The performance test represents a significant measure in pig selection. The aim of on-farm selection is to improve the performance of the herd by increasing the frequency of desirable genes. Selection based on performance test results brings the improvement of economically important traits (life gain, backfat thickness, back muscle depth), by 2-3% per year (Schinkel, 1999).Szyndler-Nędza et al. (2010) have concluded that the differences between the studied genotypes of performance tested gilts (LW, L, D, and P) were statistically very significant ($P\leq0.01$) for all traits tested except for the BMD ($P\leq0.05$). Brkić et al. (2001) have found statistically highly significant ($P<0.01$) differences between breeds for all traits studied except for FT1 and BMD where the results obtained were not statistically significant ($P>0.05$). While Radović et al. (2011) and Petrović et al. (1999) cited gilt genotype as a statistically highly significant ($P<0.01$) source of variation of all analysed traits of tested gilts (FA, FT1, and FT2).The effect of year on fat thickness and muscle depth of the performance tested F1 gilts of Large White and Landrace breeds (PLW × PL and PL × PLW) was investigated by Nowachowicz et al. (2009). In these studies, a significant and highly significant influence of the year on the fat thickness P2 (measured behind the last rib 3 cm from the medial plane) was found. Petrović et al. (2009) have found in their study that the average weight of gilts at the end of the test varied significantly between herds ($P<0.01$) at all years. Also, the same author states that the year of testing has a statistically significant influence on the manifestation of all traits tested. The gilts studied were of the Swedish Landrace and Large White sires (Petrović et al., 1999). Brkić et al. (2001) have examined the carcass quality of gilts on two farms at an average age of 209.25 days, weighing 103.81 kg (with an average daily gain of 0.491 kg), at the end of the test, on live animals with an ultrasonic apparatus (Piglog 105). The average thickness of the loin fat (FA1) was 20.09 mm, of the back fat (FT2) 15.25 mm, the average depth of the long back muscle (BMD) was 45.25 mm and the average lean meat content was 53.64%.

## Material and methods

The production traits of gilts were examined in two pig herds in three consecutive years. The study included 3,610 gilts from 3 genotypes, originating from 84 boar sires. The test included only those sires who had 10 or more daughters. At the end of the test, the weight and thickness of the fat (FT1 and FT2) and depth were measured with a MLD ultrasound apparatus. In the first herd, there were 1228 gilts and in the second 2382 gilts tested. Within the Landrace (L) breed there were 1962 gilts, Large White (LW) 1324 and Duroc (D) 319 gilts. In the first year, 885 gilts were tested, in the second 1145 and in the third 1580 gilts.The study included the following traits: age at end of test (FA – final age), fat tissue thickness between 3rd and 4th lumbar vertebra, 7 cm lateral to dorsal line (FT1), fat tissue thickness between 3rd and 4th rib, 7 cm lateral from dorsal line (FT2) and back muscle depth (BMD).The values of statistical indicators for the phenotypic expression of the traits tested were calculated using the least squares method and applying the GLM procedure using the software package "SAS/STAT" (SAS Inst. Inc., 2010) using the following models:

Model1: $Y_{ijklm} = \mu + F_i + G_j + R_k + b_1 (X_1 - \overline{x}_1) + \varepsilon_{ijklm}$

Model 1 was used to determine the significance (P<0.05) of systematic influences on the fat thicknesses 1 and 2 and back muscle depth of the performance tested gilts, where: Yijklm = observation i.e. the manifestation of the trait of the m individual, the i farm, thej year of testing, k =genotype, μ = general population average, F = farm, G = year of testing, R = animal genotype, b1 = linear regression effect of body weight at the end of the test, ε = random error, i = farm subscript (i = 1, 2), j = test-year subscript (j = 1, 2, 3), k = animal genotype subscript (l = 1, 2 , 3), m = offspring subscript.

Model 2: $Y_{ijklm} = \mu + F_i + G_j + R_k + \varepsilon_{ijklm}$

Like the previous one, model 2 was used to determine the significance (P<0.05) of systematic effects on trait age at the end of the test of the performance tested gilts, where: Yijklm = observation i.e. manifestation of the trait of the m individual, the i farm, the j year of testing, k = genotype, μ = general population average, F = farm, G = year of testing, R = animal genotype, ε = random error, i = farm subscript (i = 1, 2), j = subscript for the test year (j = 1, 2, 3), k = subscript for the animalgenotype (l = 1, 2, 3), m = subscript for the offspring.

The fixed part of the model for the age at the end of the gilt test (FA) did not include a linear regression effect of the weight on the variability of age at the end of the test, since a previous correction of this trait for age at a weight of 100 kg was performed. The correction was made using the following expression:

Corrected age at end of test = (Actual age x 100kg)/Weight achieved

## Results and Discussion

Table 1 presents descriptive statistical indicators for the studied growth and carcass quality traits determined at the end of the gilt performance test.

Table 1. Average values and variability of tested traits

| Variable | N | $\bar{x}$ | SD | Min | Max |
|---|---|---|---|---|---|
| FA (day) | 3610 | 180.75 | 19.17 | 122.22 | 273.81 |
| FT1(mm) | | 9.83 | 2.32 | 5.20 | 23.00 |
| FT2(mm) | | 8.92 | 1.97 | 4.70 | 24.00 |
| BMD(mm) | | 53.40 | 5.13 | 34.00 | 72.00 |

*FA- final age, FT1- fat tissue thickness 1; FT2- fat tissue thickness2; BMD-back muscle depth;*

Gills at a body weight of 100 kg achieved an average age of 180.75 days. The result presented for FA is better than the results presented by Petrović et al. (2009), Gogić et al. (2012) and Popovac (2016), the cited authors have found higher values of this trait. On the basis of the results shown in Table 1, it can be seen that the average fat tissue thickness 1 and 2 was 9.83 and 8.92 mm, respectively. In terms of the average value of the fat tissue thickness, the result obtained in the present study is similar to the results presented by Szyndler-Nędza et al. (2010) and Gogić et al. (2012). The BMD at the end of the test averaged 53.40 mm, making this result close to the results of Szyndler-Nędza et al. (2010), while lower than the results presented by Gogić et al. (2012).

Table 2 shows the LSM (Least Squares Average) ± SE values of the traits tested across the effects of the farm, year of testing and animal genotype factors.

Table 2. LSM ± S.E. Values of tested traits for the farm, test year and genotype

| Source of variation | | FA[2] (day) | FT1(mm) | FT2(mm) | BMD(mm) |
|---|---|---|---|---|---|
| Farm | 1 | 200.83±0.42 | 10.09±0.05 | 8.97±0.05 | 49.61±0.15 |
| | 2 | 171.50±0.34 | 8.01±0.04 | 7.55±0.04 | 54.79±0,12 |
| Year | 1 | 190.46±0.46 | 9.43±0.06 | 8.53±0.06 | 50.58±0.17 |
| | 2 | 184.69±0.93 | 8.97±0.04 | 8.23±0.04 | 51.66±0.12 |
| | 3 | 183.35±0.41 | 8.75±0.05 | 8.01±0.05 | 53.36±0.15 |
| Genotype | 1[1] | 186.10±0.21 | 8.65±0.02 | 7.86±0.02 | 52.78±0.08 |
| | 2 | 185.84±0.27 | 8.57±0.03 | 7.80±0.03 | 52.77±0.10 |
| | 3 | 186.56±0.53 | 9.92±0.07 | 9.11±0.07 | 50.04±0.20 |

*[1]) 1-L, 2- LW, 3-D,[2]) FA- final age, FT1- fat tissue thickness 1; FT2- fat tissue thickness 2; BMD-back muscle depth;*

When the farm was observed as a source of variation, the following results were obtained: 1) The animals on farm 1 completed the test with an average of 200.83 days and were older than the animals on farm 2 which completed the test with an average age of 171.50 days, the difference between them being 29.33 days; 2) The thickness of fat tissue 1 is greater on farm 1 by 2.08mm compared to farm 2, as is the thickness of fat 2 on farm 1 compared to farm 2 by 1.42mm; 3) Farm 1 animals had less back muscle depth than animalson farm 2 by 5.18 mm.

The youngest animals were examined in the third year and the oldest in the first year. Fat tissue thickness 1 wasthe highest in the first year and the lowest in the third. The thickness of fat tissue 2, as well as 1, were the highest in the first and the lowest in the third year. Back muscle depth was the lowest in the first year and the highest in the third test year.

When the genotype of gilts is observed as a source of variation, it was found that: 1) Durocanimals were the oldest, while the youngest was the Large White (the difference between them was 0.72 days); 2) The lowest value for the thicknesses of dorsal fat tissue 1 and 2 was recorded in animals of Large White breed, and the highest in animals of Duroc breed; 3) The highest value for the depth of the back muscle was recorded in Landrace animals, and the lowest in Duroc.

Table 3 shows the statistical significance of the fixed and regression influences included in the models for the analysis of the variability of the growth and carcass quality traits of gilts and the coefficient of determination.

Tabela 3.Statistical significance of fixed and regression effects on FA, FT1, FT2, and BMD

| Studied traits | Farm | Year | Genotype | FW | | $R^2$ |
|---|---|---|---|---|---|---|
| | | | | B | **p** | |
| FA (day) | <0,0001*** | <0,0001*** | 0.2255 NS | - | - | 0,56 |
| FT1(mm) | <0,0001*** | <0,0001*** | <0,0001*** | 0,08565 | <0,0001*** | 0,57 |
| FT2(mm) | <0,0001*** | <0,0001*** | <0,0001*** | 0,07869 | <0,0001*** | 0,44 |
| BMD(mm) | <0,0001*** | <0,0001*** | <0,0001*** | 0,07123 | <0,0001*** | 0,52 |

*FW-final weight, B-regression coefficient, $R^2$-determination coefficient, FA- final age, FT1- fat tissue thickness 1; FT2- fat tissue thickness 2; BMD-back muscle depth; NS=P>0,05; *=P<0,05; **=P<0,01; ***=P<0,001*

Using the model, the following results were obtained:

1) The farm had statistically significant (P <0.001) effect on the manifestation of tested traits;

2) The year also had statistically significant (P <0.001) effect on all studiedgilt traits;

3) The gilt genotype had statistically significant effect (P<0.001) on FT1, FT2, BMD, while FAwas unaffected (P> 0.05).7

The effect of year on fat tissue thickness and muscle depth of the performance tested gilts is consistent with the results obtained by Nowachowicz et al. (2009). In these studies, a significant and highly significant influence of the year on the thickness of P2 fat tissue (measured behind the last rib 3 cm from the medial plane) is found. Petrović et al. (1999)have found that gilt genotype and age have a statistically significant effect on the manifestation of traits in performance tested gilts, which was inconsistent with the results obtained in the present study. Also Petrović et al. (2009)have found in their study that the average weight of gilts at the end of the test varies significantly between herds (P <0.01) in all years, which is consistent with the results obtained in the present study.

The regression effect of the final weight at the end of the test on the tested properties showed the following: by increasing the mass by 1 kg, FT1 increased by 0.085 mm and FT2 by 0.078 mm; the back muscle increased by 0.071 mm. Also, weight at the end of the test had a statistically significant effect on the properties of FT1, FT2 and BMD (P <0.001). The coefficients of determination of $R^2$ indicated that the effects included in the model (farm, year, and genotype) explained from 0.44 to 0.57% the variability of the traits tested in the performance tested gilts.

## Conclusion

The objective of this paper was to determine the phenotypic and genotypic variability of the observed traits in the performance test of gilts. Based on the test results, the following conclusions can be drawn: The gilt genotype was found to have a statistically significant (P<0.001) effect on FT1, FT2and BMD, but no effect on FA was recorded (P>0.05). Considering the farm as a source of variation of gilt traits, it can be concluded that the farm had a very significant statistical effect on the traits tested (P<0.001). The year of testing of gilts as a source of variation showed high statistical effect (P<0.001) on all traits examined. Observed traits of fat tissue thickness 1, 2 and BMD were highly statistically dependent (P <0.001) on the weight at the end of the test.

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