

## THE EFFECT OF GENOTYPE AND THE NUMBER OF FARROWING ON SOW FERTILITY TRAITS

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### Abstract

The goal of this paper was to investigate the effect of genotype and the number of farrowing on the number of piglets and variability of the fertility traits of the pigs from the farm “PKB Vizelj“ in Padinska Skela (Belgrade), in the period 2007-2012. The paper investigated the following pig genotypes: Swedish Landrace (SL), Large White (LW), Duroc (D) and crosses SL x LW and (SL x LW) x D. The paper shows the variability in the total number of piglets, the number of live born and weaned piglets, determined on the sample of 3,909 litters. The results show that the SL sows averaged 10.81 piglets per litter (n=1,532), while the LW sows averaged 10.04 piglets per litter (n=379). The SL sows farrowed 0.78 more piglets per litter than the crosses of F1 generation (SL x LW). On average, 11.51 more piglets per litter (n=859) were produced by three-breed crossing of the sows of F1 generation (SL x LW) with Duroc boars than by pure breeding and two-breed crossing. The authors came to conclusion that genotype and the number of farrowing had a significant effect on fertility traits, and no significant effect on the number of stillborn piglets.

**Key words:** *Pigs, genotype, number of farrowing, fertility traits*

### Introduction

Litter size is one of the most important factors of pig fertility and it is one of the main breeding and production goals. Production costs can be reduced by increasing the number of piglets per farrowed sow per year, and good fertility is therefore one of the basic conditions for successful pig production. In the prenatal stage, litter size mostly depends on the number of ovulated egg cells, the survival capability of the embryo and the uterine capacity, while in the postnatal stage, litter size is mostly presented as the total number of born piglets, and the number of live born, stillborn and weaned piglets per litter.

*Kosovac et al.* (2005) recorded the average number of live born, stillborn and weaned piglets ranged 8.50-10.37, 0.30-0.79, and 6.75-8.44, respectively. In the research of *Radojković et al.* (2007), the average number of live born piglets, born piglets, stillborn and weaned piglets in the first three farrowings of purebred sows was 9.19, 9.78, 0.51 and 8.42, respectively. Litter size can be increased by crossing of pig breeds and lines, and manifesting the heterosis effect in the crosses of F1 generation. The number of farrowing and the age of sows can affect the litter size. It is common that the number of live born piglets increases to the fifth farrowing, and then decreases. Most important reason for this decrease in litter size that comes along with the aging of sows is high embryonic mortality. Primiparous sows have smaller litters than multiparous sows, which can be explained by fewer ovulated eggs in gilts. *Vinček* (2005) concluded in his research that the size of Large White litters increased to the third farrowing, while other genotypes had a tendency to increase to the fifth farrowing.

### Materials and methods

This research on fertility traits comprised 3.909 litters produced in eight farrowings by five sow genotypes: Swedish Landrace (SL), Large White (LW), Duroc (D), and two groups of

crosses (SL x LW and (SL x LW) x D). The authors recorded data on live born and stillborn piglets, total number of piglets born and data on 21-day-old weaned piglets. The data were processed and analysed with a method of mono-factorial analysis of variance for unequal sample size. The authors observed isolated effects of genotype and the number of farrowing on the number of live born, stillborn and 21-day-old weaned piglets. Multiple comparisons of the sample pairs were conducted using the Tukey-Kramer method. Other measures of variation observed in this paper comprised the analysis of the standard variation and coefficients of variation.

### Results and discussion

The results (Table 1) show that the average number of live born piglets of the Swedish Landrace was 10.49, which is 0.21 more than *Kosovac et al.* (2005) obtained in their research. At the same time, the number of stillborn piglets was lower by 0.11, when compared to the results of the aforementioned authors. In the research of *Luković and Škorput* (2012) on the sample of 2,035 litters, Swedish Landrace sows averaged 11.19 piglets, 10.27 of which were live born piglets, i.e. 8.45 weaned piglets. In our research, the sows of the Swedish Landrace in the first farrowing (n=193) had on average 9.25 live born piglets, and 0.39 stillborn piglets per litter (Table 2). These values are higher than those recorded by *Radojković et al.* (2007). Examining the phenotypic variability of fertility of Swedish Landrace sows from a herd in Serbia those authors determined that in the first farrowing the average number of live born and stillborn piglets was 8.31 and 0.56; while the total number of born piglets was 8.87.

Most studies show that Large White sows have good maternal traits and give high milk yields, farrowing on average 10-14 live born piglets. In this research, the sows of the Large White breed farrowed on average 1.07 live born, 1.39 stillborn, and 1.59 weaned piglets less than in the research of *Vidović et al.* (2012), where Large White sows farrowed on average 10.6 live born, 1.9 stillborn, and 10.2 weaned piglets. Within this breed, there are some hyper fertile lines, comprising a small percentage of animals with fertility far above average for this breed.

Table 1. Number of piglets per litter, by genotype

Genotype	Live born	Stillborn	Total	21-day-old weaned
SL	10.49	0.32	10.81	8.81
LW	9.53	0.51	10.04	8.61
D	8.91	0.34	9.25	8.27
SL x LW	9.70	0.32	10.03	8.73
(SL x LW) x D	11.22	0.29	11.51	8.94

The average number of born purebred piglets (SL and LW) is higher than the average number of crosses (SL x LW). It can be explained by the fact that sows and boars from nucleus herds are used for the production of purebreds, and sows from production herds (that are less fertile) are used for the production of F1 crosses. This is also supported by the results of *Uremović et al.* (2003), who determined that the average number of live born piglets of F1 generation (SL x LW) kept in an outdoor system was 9.8, while the average number of weaned piglets was 8.03.

When it comes to the Duroc, it is a breed of good maternal traits, but of slightly more variable fertility. Duroc sows farrow on average 8-12 piglets per litter. This breed has pronounced fattening and slaughter traits, so “PKB Vizelj“ uses it for pure breeding (nucleus herd) as well as for three-breed crossing, where Duroc boars are used as a terminal breed. Sire-boars of the

Duroc breed (D) caused an increase in the number of piglets per litter in three-breed crossing. In all farrowings, some significant differences were recorded in the number of live born piglets of two- and three-breed crossing. The highest number of live born piglets (12.35) was recorded in the fifth farrowing of the sows mated with Duroc boars, about 2.49 piglets more than in the case of SL x LW crosses produced in the same farrowing. The lowest number of live born piglets (7.44) in the first farrowing was recorded for the Duroc sows. The results show that the number of live born piglets of F1 generation (SL x LW) was 9.70, which is lower than recorded by *Kosovac et al.* (2005), where the highest number of live born piglets (10.87) was obtained in third and lowest (9.21) in the first farrowing. It is in line with our results, where the highest number of live born piglets (11.49) was also recorded in third and lowest (7.44) in the first farrowing.

The best fertility traits were expressed in the three-breed crosses ((SW x LW) x D), with 11.22 live born piglets, and the total number of 11.51 born piglets, which was a result of the heterosis effect of both the dam and the sire-boar. *Petrović et al.* (2002) recorded that on farms in Vojvodina the number of live born and stillborn piglets was 9.51 and 0.72, and the total number of piglets born was 10.23; on farms in Serbia, the number of live born piglets and stillborn piglets was 9.41 and 0.58, while the total number of piglets born was 9.99.

Table 2. Number of live born piglets, by genotype and farrowing

Number of farrowing	Swedish Landrace			Large White			Duroc			SL x LW			(SL x LW) x D		
	Swedish	SD	CV	Large	SD	CV	Duroc	SD	CV	SL	SD	CV	(SL x LW)	SD	CV
1	9.25	2.95	31.84	8.91	2.66	29.86	7.44	2.83	38.09	7.44	2.72	36.55	9.74	3.10	31.88
2	9.99	3.44	34.47	9.16	4.02	43.89	8.60	3.12	36.34	9.33	3.24	34.71	10.68	3.02	28.30
3	9.22	2.91	31.62	9.54	3.49	36.59	9.11	3.11	34.21	11.49	2.91	25.35	11.59	3.07	26.46
4	9.83	3.15	32.05	10.06	3.40	33.82	9.55	2.89	30.23	10.25	3.23	31.49	11.83	2.77	23.42
5	11.32	2.65	23.42	10.11	3.19	31.50	9.54	3.57	37.40	9.41	3.24	34.41	12.35	3.07	24.88
6	10.64	3.24	30.43	9.92	3.96	39.94	10.27	2.67	26.03	10.54	2.87	27.25	11.35	3.53	31.07
7	9.98	3.43	34.39	9.82	3.01	30.61	9.77	2.73	27.92	10.35	2.98	28.77	10.62	3.96	37.28
8	9.94	3.06	30.76	8.91	3.14	35.30	8.47	3.56	41.97	9.48	3.54	37.30	10.70	4.01	37.49

When observed by genotype, the average number of farrowing is shown in Chart 1. The highest number of farrowing was recorded for the Swedish Landrace sows and the lowest for the Duroc and Large White sows.

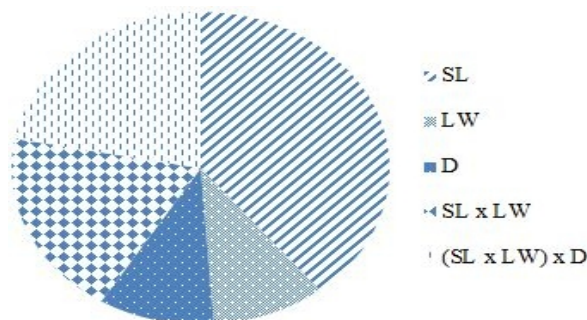


Chart 1. Average number of farrowing, by genotype

The average number of stillborn piglets did not exceed 5% of the total number of piglets born. The number of stillborn piglets per litter is shown in Chart 2.

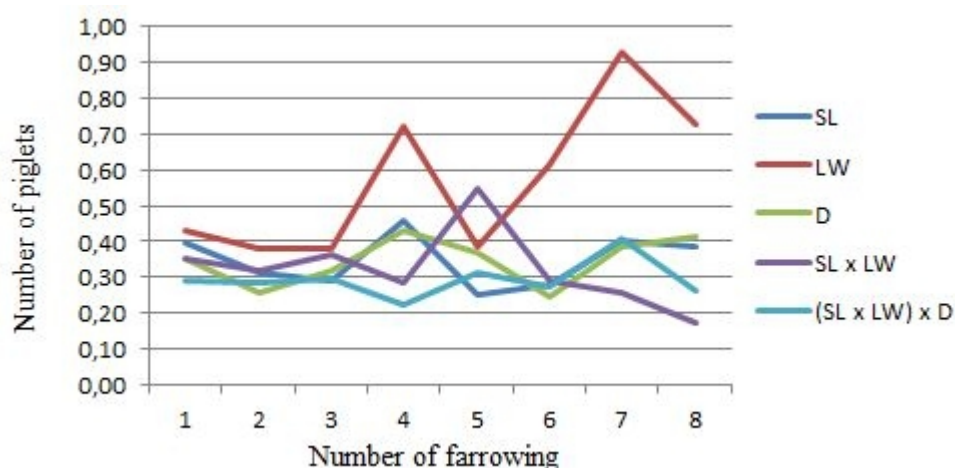


Chart 2. Number of stillborn piglets per litter, by genotype and farrowing

Table 3. Number of weaned piglets per litter, by genotype and farrowing

Number of farrowing	Swedish Landrace			Large White			Duroc			SL x LW			(SL x LW) x D		
	Mean	SD	CV	Mean	SD	CV	Mean	SD	CV	Mean	SD	CV	Mean	SD	CV
1	8.50	2.29	26.97	8.86	1.00	11.25	7.77	2.23	28.70	7.77	1.97	25.40	8.46	2.30	27.20
2	8.90	2.30	25.90	8.74	2.74	31.31	8.49	2.28	26.83	8.78	2.22	25.29	8.93	2.25	25.19
3	8.07	2.49	30.80	8.75	2.61	29.76	8.51	2.35	27.66	8.79	2.38	27.10	9.02	2.03	22.49
4	8.69	2.61	30.08	8.83	2.28	25.81	8.35	2.64	31.57	9.21	2.83	30.72	8.94	2.25	25.20
5	9.37	1.93	20.59	8.55	2.65	30.96	8.26	2.72	32.92	8.86	2.46	27.70	9.62	1.14	11.86
6	8.72	2.75	31.59	8.62	2.75	31.91	8.84	1.85	20.92	9.22	2.39	25.93	8.92	2.57	28.82
7	8.52	2.84	33.32	6.89	4.18	60.70	7.87	2.99	37.94	9.00	3.31	36.73	8.75	2.72	31.11
8	8.55	2.63	30.73	8.91	3.02	33.84	8.35	3.30	39.47	9.00	1.33	14.81	8.39	3.40	40.53

The results shown in Table 4 make the authors conclude that genotype significantly affects the variability of live born, stillborn and weaned piglets. The number of farrowing significantly affects the number of live born and weaned piglets, but not the number of stillborn piglets per litter. Some statistically highly significant differences were determined in the dynamics of the number of live born and weaned piglets, when observing each following farrowing. At the same time, no statistical significance was detected for the effect of the number of farrowing on the average number of stillborn piglets. When observing the effect of genotype on the number of live born piglets, there were highly significant differences in all the genotypes, with the exception of Large White and Duroc, and Large White and the crosses of F1 generation (SL x LW) where no statistical significance was recorded. Highly significant difference in the number of stillborn piglets was recorded only for the Large White, since its mortality rate was higher than the mortality rate of the other breeds. Significant and highly significant differences in the average number of weaned piglets were recorded after comparing the sows of the Duroc and the Large White breed, and Duroc and SL x LW crosses, i.e. (SL x LW) x D.

Table 4. Effect of genotype and farrowing on the variability in the number of 21-day-old weaned piglets

Factor	Number of live born piglets	Number of stillborn piglets	Number of 21-day-old weaned piglets
Genotype	48.59**	5.48**	5.88**
Number of farrowing	29.74**	0.98 <sup>NS</sup>	4.99**

\*\*P<0.01; \*P<0.05; <sup>NS</sup>P>0.05

### Conclusions

The results show that genotype and the number of farrowing significantly affect fertility traits, except for the number of stillborn piglets, where no clear consistency was determined. A significant difference in the litter size of the purebred sows was determined. On average, the highest number of piglets was farrowed by the Swedish Landrace sows and the lowest by the Duroc sows. Two-breed crossing did not show a consistent effect on the increase in the average number of live born piglets. This increase was a result of three-breed crossing (SL x LW) x D in all eight farrowings. The authors can conclude that the average number of live born piglets of all genotypes increases from first to the fifth farrowing, and then decreases, showing significant differences between the farrowings. With the exception of the first farrowing, the sows of the three-breed crosses show better results to the fifth farrowing, after which they achieve poorer results than two-breed crosses and purebreds. Observed by genotype, no consistencies in the variations of the number of 21-day-old weaned piglets can be found.

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