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INFLUENCE OF SOME FACTORS ON THE FERTILITY OF HYBRID SOWS

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Abstract: The purpose of this study was to establish the influence of the boar and the age category of sows as factors for the fertility of hybrid sows ((Tai Zumu x Landrace) x Large White). The mother is a reliable source of variation on the number of the alive pigs ($p<0.05$) and the total number of the delivered ones in a farrow ($p<0.01$). The difference between the gilts and the sows is significant in the number of the alive and the total number of pigs in a farrow ($p<0.05$). The total number of delivered pigs from the sows are within the range of 10.6±0.4 to 11.4±1.2, while with the gilts ones they are from 8.9±0.6 to 11±1.8. High positive correlation was established between the live-born pigs and the total number of pigs born by gilts (rp= 0.858 $p<0.01$), as well as with the next parity (rp= from 0.702 to 0.861, $p<0.01$). The connection between the stillborn and the total number of born pigs, we reported a moderate and reliable correlation, both with the gilts (rp= 0.381, $p<0.01$) and the sows (rp = from 0.408 to 0.584, $p<0.01$)

Key words: litter size, alive and stillborn piglets, correlation, reproduction, prolificacy, gilts, sows

Introduction

The size of the farrow is one of the basic factors characteristic for the fertility of pigs and has a priority significance for pig farming. The increased number of delivered pigs by sow per year leads to reduction of production costs which results in the increased efficiency of pig farming.

A number of conditions like fertilization season, age, and sequence of farrowing of the mothers, etc., have influence both on the total number of delivered pigs and on the alive and stillborn pigs. The size of the farrow can increase in generation F1 as a result from the heterosis effect of crossing breeds and lines *(Pusic et al., 2014).*

The significance of male breeders in pig farming, especially after the widely-spread introduction of artificial insemination, is undeniable. However, the efficiency of production is significantly influenced by the reproduction ability of

the breeders because not all boars and their ejaculates have identical fertilizing abilities. Regardless of the mass application of analyses for defining the quality of semen, they usually turn out to be insufficient for the prediction of the relative fertility of male breeders *(Flowers 1997; Alm et al. 2006).*

The purpose of this study was to follow the influence of some factors on the fertility of gilts and sows, as well as to establish the relation between the basic indicators of the litter of hybrid sows.

Materials and Methods

The study included a total of 843 litters of the hybrid 'Y' ((Tai Zumu x Landrace) x Large White), for the period of 2010-2017, and bred in a pig farm located in the region around the town of Plovdiv, Bulgaria, under extensive conditions of breeding.

The stock was inseminated twice during the estrus, with sperm of imported terminal boars 'D' (Large White x Pietrain). The first insemination was not done earlier than the time of the first registered estrus after reaching sexual maturity.

The following indicators were studied: the average total number pigs (LS±SE); the average number of live pigs (LS±SE), and the average number of stillborn pigs (LS±SE), with both age categories – gilts and sows, depending on the boars.

During the course of the study, the influence of the father and mother as factors, influencing the fertility of pigs was analyzed, as well as that of the age category of female breeders (gilts and main sows) on the studied indicators.

When processing the data and establishment of the influence of some factors on the studied traits we used univariate (Model 1,2..5) and multivariate dispersion analysis (Model 6 and 7) as the linear model had the following statistical type:

$$Yijk=\mu+Si+Aj+eijk$$

$$Yijk=\mu+Si+Aj+CSij+eijk,$$

where: Yijk – observation vector; μ- overall average constant; Si, Aj are fixed effects corresponding to the boar (i=7); age class (j=2); CSij is random effect of interaction boar* age class; eijk..- residual variance.

In data processing, we used a multi-factor dispersion analysis and Pearson's coefficient of correlation was used for bivariate correlation analysis, and were performed with SPSS software product version 24.

Results and Discussion

Table 1 shows that the mother is a reliable source of variation between the number of live ($p<0.05$) and the total number of pigs in a farrow ($p<0.01$). The difference between gilts and sows is significant only in the number of stillborn and the total number of pigs in a farrow ($p<0.05$).

The season of fertilization of pigs does not have any influence on the number of dead ($p<0.001$), and the live ($p<0.01$) pigs, while the year – on the number of the dead pigs in a farrow ($p<0.05$).

A number of indicators characterizing the reproduction ability of pigs depend on environmental factors. The season, the temperature, and the duration of daytime, have influence not only on the sexual cycle and the estrus, but also on the fertilization of pigs *(Nikolova, 2012)*. In her studies with pigs of Danube White and Landrace breed, the author established reliably better reproduction indicators with the animals fertilized and farrowed during the winter compared to the summer months of the year.

In our previous research, we established that the month and season of insemination influences reliably the number of the pigs born ($p<0.01$ and $p<0.001$, respectively) and the farrowing interval ($p<0.01$ and $p<0.05$, respectively). The smallest number of pigs are born after insemination in the summer – June, July, August, and the pigs inseminated in the winter have the most numerous farrowings *(Zapryanova, 2017)*

Table 1. The effect of some factors on the number of piglets at birth

F-criterion and degree of reliability				
Model	Factors	Traits		
		Alive piglets	Stillborn piglets	Total number of piglets
1	Boar	1.156	0.905	0.683
2	Mother	1.272*	0.840	1.465**
3	Season of fertilization	4.125**	6.457***	1.897
4	Year of fertilization	1.592	2.316*	1.479
5	Age category of sows	3.54*	2.16	7.05**
6	Boar	1.067	0.913	0.578
	Age category of sows	2.963*	2.189	6.298*
7	Boar	1.049	0.759	0.79
	Age category of sows	1.079	2.204	4.06*
	Boar*Age category of sows	0.519	1.044	0.58
***P<0,05, **P<0,01, ***P<0,001**				

One of the main goals of selection of pigs is achieving of more numerous farrows. However, there is a negative dependency between the number and the live mass of the animals, especially those, bred in less favourable conditions *(Nogaj et al., 2006)*. At the same time, *Rydhmer (1992)* established that the weight at birth influences the survival rate of the pigs in the first weeks of their life.

The number of alive born pigs in a litter determines significantly the number of animals for slaughtering, which is why this indication has too big economic significance. According to *Dimitrov (2015)* gilts and the ones after the sixth farrow, as a rule, have smaller plurality farrows. *Legault (1983)* defines the capacity of the uterus, which is not large enough for the early pregnancies, as a reason for the smaller values of the examined indicators at the beginning of the reproductive life. In experiments with Swedish Landrace, Duroc sows and their crossbreeds *Pusic et al. (2014)* establish reliable increase of the number of the live-born pigs until the fifth farrow. In the same experiment, the authors find out that the sequence of farrowing has a significant effect on the indications of fertility, with the exception of the number of stillborn pigs in the farrow.

In the conditions of the conducted experiment, the smallest number of animals is born by the gilts, fertilized by father No. 985 – 8.8±1.3 pigs, and the highest is from father No. 995 – 11±1.8 pigs, who is with the highest fertility among the main sows (11.4±1.2) (Fig.1). We report the biggest difference (2.1 pigs) between the two categories of sows at their fertilization with boar No. 985, and the smallest one – with fathers No. 943 and No. 982. The highest number of live born pigs are in the farrows of the sows, inseminated by boar 982- 10.5±0.7 piglets, and the smallest number in the farrows with father No. 995 (8.9±0.9).

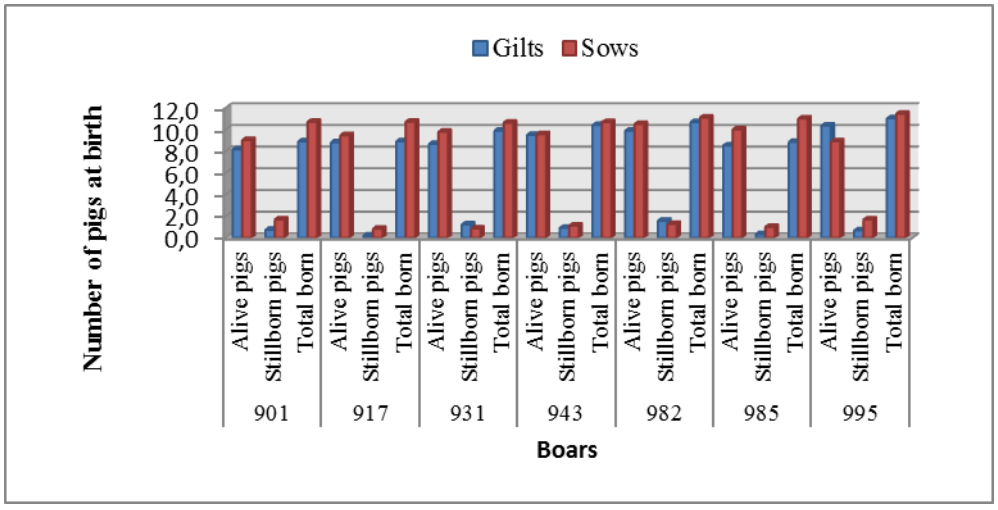

Figure 1. Litter size of gilts and sows depending on the boar

The effectiveness of pig-farming production depends on a number of factors, some of which refer to the reproduction ability of the male breeders, because not all boars and their ejaculates have the same fertilizing ability, and also on the number of live-born, stillborn and total number of pigs in a farrow

Figure 2 shows the distribution of the pigs in categories depending on their father. Highest total fertility is displayed by father No. 995 (11.3±0.9), but the level of stillborn pigs is too high as well (1.4±0.5 pigs). The difference between it and the boar with the lowest total number of piglets (No.917) is 1.6 pigs, and in the category of the stillborn ones the difference is almost 1 pig. The highest number of live pigs is in the litter of boar No. 982 (10.3±0.6), followed by the fathers with numbers 985 and 943- 9.7±0.5 and 9.5±0.3 pigs, respectively.

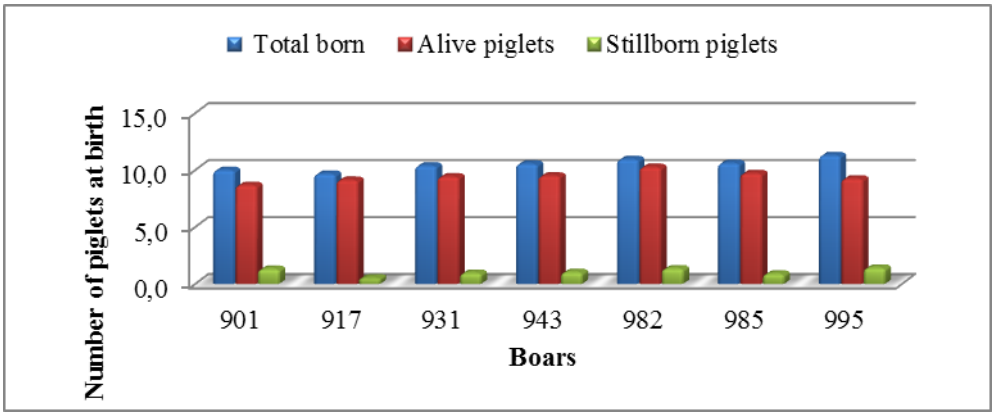

Figure 2. Distribution of pigs by category according to the boars

Table 2. Phenotypic correlation between the traits of litter size depending on the parity number

Parity number	Traits	Alive piglets	Stillborn piglets
First parity (n=166)	Stillborn piglets	-0.148	-
	Total number of piglets	0.858**	0.381**
Second parity (n=169)	Stillborn piglets	-0.233**	-
	Total number of piglets	0.790**	0.412**
Third parity (n=154)	Stillborn piglets	-0.114	-
	Total number of piglets	0.861**	0.408**
Fourth parity (n=204)	Stillborn piglets	-0.130	-
	Total number of piglets	0.822**	0.457**
Fifth parity (n=116)	Stillborn piglets	-0.005	-
	Total number of piglets	0.809**	0.584**
Sixth parity (n=34)	Stillborn piglets	-0.219	-
	Total number of piglets	0.702**	0.584**

**p<0.01

Without a doubt, the reproductive process is the most important process for continuation and refinement of species. The improvement of the reproduction abilities of the pigs is essential because it affects the number of the delivered pigs and their productive potential *(Miclea et al. 2007, 2009).* Pig fertility is a main characteristic of this type of animals, which, together with the high growth intensity, defines the effectiveness of pig-farming production. According to *Radović et al. (2016)* the fertility of the pigs depends on a number of indicators, which can be divided to reproductive indicators and indicators, related to the farrow. The authors assign the age of the first oestrus and insemination to the first group, as well as the age of the first farrow, and to the second group – size and mass of the farrow at birth and at weaning.

Table 2 shows the phenotype correlations between the traits of the litter size at the first and the following parity. There is a high positive correlation between the live-born pigs and the total number of pigs born by gilts (rp= 0.858 $p<0.01$), as well as with the next parity (rp= from 0.702 to 0.861, $p<0.01$). The values of the phenotype correlation between the total number of born ones and the number of live-born pigs in the conditions of our experiment are lower, but in a unison with what *Lukač et al. (2016); Radović et al. (2016),* and others found.

Regarding the connection between the stillborn and the total number of born pigs, we reported a moderate and reliable correlation, both with the gilts (rp= 0.381, $p<0.01$) and the sows (rp = from 0.408 to 0.584, $p<0.01$). The correlation between stillborn and piglets born alive is negative and not reliable, with the exception of the significant value between these traits on second parity (rp= -0.233, $p<0.01$).

Conclusion

The mother is a reliable source of variation on the number of the live pigs ($p<0.05$) and the total number of the delivered ones in a farrow ($p<0.01$).

The difference between the gilts and the sows is significant in the number of the live and the total number of pigs in a farrow ($p<0.05$). The total number of delivered pigs from the sows are within the range of 10.6±0.4 to 11.4±1.2, while with the gilt ones they are from 8.9±0.6 to 11±1.8.

High positive correlation was established between the live-born pigs and the total number of pigs born by gilts (rp= 0.858 $p<0.01$), as well as with the next parity (rp= from 0.702 to 0.861, $p<0.01$). The connection between the stillborn and the total number of born pigs, we reported a moderate and reliable correlation, both with the gilts (rp= 0.381, $p<0.01$) and the sows (rp = from 0.408 to 0.584, $p<0.01$).

Uticaj nekih faktora na plodnost hibridnih krmača

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Rezime

Cilj ovog istraživanja bio je utvrđivanje uticaja nerasta i starosne kategorije krmača kao faktora plodnosti hibridnih krmača (Tai Zumu x landras) x jorkšir). Majka je pouzdan izvor varijacije na broj živorođene prasadi ($p < 0,05$) i ukupan broj u leglu ($p < 0,01$). Razlika između nazimica i krmača je značajna u broju živorođenih i ukupnom broju svinja u leglu ($p < 0,05$). Ukupan broj prasadi od krmača je u opsegu od 10,6 ± 0,4 do 11,4 ± 1,2, a kod nazimica od 8,9 ± 0,6 do 11 ± 1,8. Uspostavljena je visoka pozitivna korelacija između živorođene prasadi i ukupnog broja prasadi nazimica ($rp = 0,858$ $r < 0,01$), kao i sa sledećim paritetom ($rp =$ od 0,702 do 0,861, $p < 0,01$). Između broja mrtvorođenih i ukupnog broja prasadi, zabeležili smo umerenu i pouzdanu korelaciju, kao i kod nazimica ($rp = 0.381$, $r < 0.01$) i krmača ($rp =$ od 0.408 do 0.584, $p < 0.01$)

Ključne reči: veličina legla, živo i mrtvo rođena prasad, korelacija, reprodukcija, plodnost, nazimice, krmače

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