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EFFECT OF GENOTYPE AND SEX OF PIGLETS ON THEIR LOSSES BEFORE WEANING

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Abstract

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The aim of the experiment was to analyze selected reproductive characteristics in sows and losses of piglets according to their age and to evaluate the effect of sex on survivability of piglets before weaning. The experimental observation involved 80 sows with their second litters (40 sows of genotye I and 40 sows of genotype II). The sows were mated with a boar of Danish Duroc. No significant difference was found between the evaluated genotypes of sows in numbers of live-born piglets and reared piglets, however it is evident that better results were reached by the sows of the genotype II. Also the losses of piglets per litter were lower, by 0.65 piece ($P \le 0.05$). In sows of the genotype I a high correlation ($P \le 0.01$) was confirmed between the number of live-born piglets and the number of reared piglets per litter ($r = 0.750$). Another correlation was found between the number of live-born piglets and their losses before weaning ($r = 0.716$). Similar trend was observed in the genotype II, however without significant correlation between the number of live-born piglets and the losses of piglets before weaning. The results also revealed that the piglets died mostly before the 14th day of age, while the losses of male piglets were more frequent than of female piglets. Losses of female piglets of the genotype I before the 14th day of age were 6.82 %, in the genotype II they were 3.01 %. In this period, the losses of male piglets reached 9.56 % in the genotype I and 4.49 % in the genotype II. From the 14th day to weaning the losses of female piglets counted 2.39 % vs. 0.75 %, the losses of male piglets 1.37 % vs. 2.88 %. The total losses from birth to weaning were 9.22 % vs. 3.76 % in female piglets and 10.92 % vs. 7.37 % in male piglets.

Keywords: sex of piglets, losses, reproduction, sows, genotype

INTRODUCTION

Production of healthy and viable piglets is a basis for successful pig breeding, therefore breeding of sows is considered a key factor. Breeding of sows is aimed to production of quality piglets for direct rearing or sale. A certain prerequisite for effective breeding of sows is ensuring a high performance characterized by numbers of weaned piglets per sow. Especially the number of reared piglets per sow is a fundamental element of competitiveness, since a high number of reared viable piglets per sow is considered a necessary condition for reducing the costs per kilogram of pig carcass. Successful breeding of sows is based on creation of suitable conditions in individual phases of reproductive cycle for maximizing their reproductive potential (Panzardi *et al*., 2013). Achievement of good results is influenced by a range of factors. Milligan *et al.* (2002) and Todd (2006) assume that, besides others, the parity order is an important intrinsic factor influencing reproductive performance and losses of piglets. Čechová *et al.* (2012) and Horký (2014) name technological equipment of farms, nutrition, health status and others among external factors. As Wolf *et al.* (2008) stated, losses of piglets have a relatively high heritability and for that reason, selection of suitable commercial programs is also an important way for their elimination. According to Haley *et al.* (1995) an important factor influencing reproductive parameters is genotype of sow, while genotype of piglet, thus the breed or hybrid combination used in paternal position, is much more limited. Contrary to this statement are the conclusions published by McCann *et al.* (2008), that the breed in terminal position has an impact on survivability of piglets. Nevertheless, Šprysl *et al.* (2010) say that genetic factors of reproductive performance are applied only little in the sphere of productive farms, where environment has a dominant influence.

The aim of the experiment was to analyze selected reproductive characteristics of sows and losses of piglets before weaning. Another objective was to evaluate losses of piglets according to their age and impact of sex on their survivability before weaning.

MATERIAL AND METHODS

The experimental observation involved 80 sows and their second litters (40 sows of genotype I and 40 sows of genotype II). The sows were mated with a boar of Danish Duroc. The sows labelled as the genotype I were hybrids of two synthetic lines. They have an excellent fertility, a fast estrus onset after weaning and a high edacity. The sows of the genotype II were two-breed sows, selected for a high fertility and robustness. They have strong signs of estrus, numerous and balanced litters with a high survivability.

The evaluated parameters were: numbers of live-born piglets, numbers of reared piglets, losses of piglets from birth to weaning per litter (from birth to the 14th day, from the 14th day to weaning and according to the sex of piglets).

The mated sows were stabled individually from the onset of estrus to the detection of pregnancy, thus for one month. The pregnant sows were subsequently moved into static group pens for 15 to 20 animals. The sows were provided with a transponder for their identification and allocation of feed rations at the feed station. They were kept in these pens until an average of five days before giving birth. The categories of sows in advanced stage of pregnancy, farrowing and lactating were stabled in individual farrowing pens with slatted plastic floor and the farrowing house was divided into sections. All the categories mentioned above were fed by automatic distribution of feed. Air exchange was solved by an automatic methods both in farrowing section and in section of served and pregnant sows. Optimal microclimate for piglets was ensured using heated plates, supplementary feeding followed from the fifth day after birth. The piglets were weaned at the mean age of 28 ± 3 days. The experiment ran in the term from April to June. In both groups of sows (genotype I, II), phenotypic levels of selected reproductive parameters were observed, namely the number of live-born piglets, the number of reared piglets and the number of piglets lost from birth to weaning.

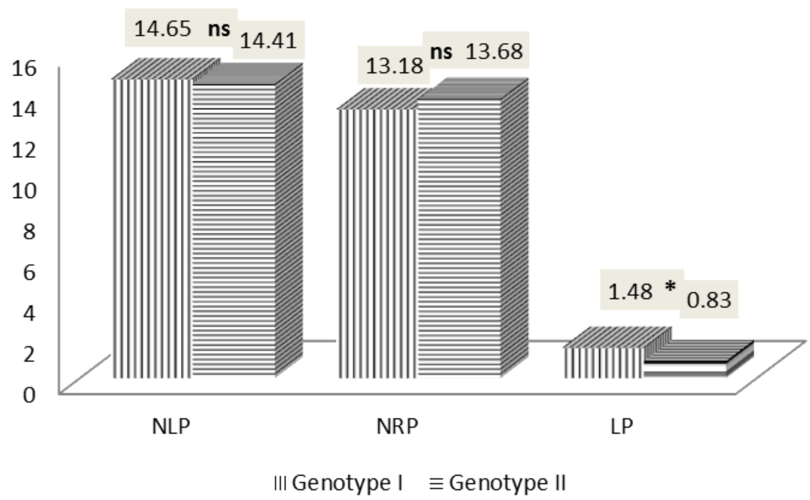
The obtained reproductive parameters and the losses of piglets in the genotype I were compared to the parameters obtained for genotype II and elementary statistical characteristics for the differences in evaluated parameters between the groups of sows were analyzed, namely mean and relevance based on the t-test. The symbol *** stands for $P \leq 0.001$, ** stands for $P \leq 0.01$, * stands for $P \leq 0.05$ a NS stands for $P \geq 0.05$. The statistical evaluation was performed using the programs STATISTIKA version 11.0 and Microsoft Excel 2010.

RESULTS AND DISCUSSION

Fig. 1 presents numbers of live-born and reared piglets per litter and subsequently their losses before weaning. No statistically significant difference was found between the evaluated genotypes of sows in the numbers of live-born and reared piglets, however, evidently better results were achieved by the sows of the genotype II, with 0.5 more piglet reared per litter. Also the losses per litter were lower, by 0.65 piglet ($P \leq 0.05$) in the sows of the genotype II.

Nguyen *et al.* (2011) state that the litter size at birth is influenced by many factors. By examination of performance of five hundred hybrid sows he found 12.3 piglets born per litter and noted that the first litter sows had less numerous litters than older sows. According to Wolf *et al.* (2008), the aim of contemporary genotypes of sows is to give birth to the highest possible numbers of viable piglets. His experiment showed 13.70 piglets born per litter. Damgaard *et al.* (2003) point out that litter size affects survival of piglets after birth. According to Cozler *et al.* (1998) the genetics of sows and the order of litter have an impact on the number of live-born piglets. This is confirmed by Smith *et al.* (2008) who found following numbers of live-born piglets in Dandbred sows in normal breeding conditions: 9.80 in the first litter, 10.10 in the second litter, 9.50 in the third litter and 11.00 in the fourth litter. Knauer *et al.* (2011) state that the aim of modern pig breeding is the highest number of reared piglets from a sow per year while minimizing production costs. According to Cozler *et al.* (1998), the number of reared piglets is used to express the performance of sows. These authors note that productivity of sows depends mainly on genetics and farm management. Wolf *et al.* (2008) document in their work, that the quantity of reared piglets should exceed number 11. In the sows of Czech Large White, the average loss of piglets is referred to be 1.80 ± 2.00 pieces and 13.00 ± 12.50% per litter. Kozlowski and Wilk (1984) say that the loss of piglets before 28th day should not exceed 10% in large-scale production conditions.

Tab. I summarizes correlation dependence between reproductive parameters and losses of piglets. In the sows of the genotype I, there was a high correlation found between the number of live-born piglets and the number of reared piglets per litter ($r = 0.750$). A correlation was found also between the number of live-born piglets and their losses before weaning ($r = 0.716$).



1: *Selected reproductive parametres in sows and losses of piglets (pcs/litter) by the genotype*
NLP = number of live-born piglets; NRP = number of reared piglets; LP = losses of piglets; * = statistically significant difference (P ≤ 0.05); NS = statistically insignificant difference (P ≥ 0.05)

I: *Correlation analysis of dependences between reproductive parameters in sows and losses of piglets*

Genotype I			
Parameter	**Number of live-born piglets (pcs/litter)**	**Number of reared piglets (pcs/litter)**	**Loss of piglets (pcs/litter)**
Number of live-born piglets (pcs/litter)		0.750**	0.716**
Number of reared piglets (pcs/litter)			0,075 NS
Genotype II			
Parameter	**Number of live-born piglets (pcs/litter)**	**Number of reared piglets (pcs/litter)**	**Loss of piglets (pcs/litter)**
Number of live-born piglets (pcs/litter)		0.770**	0.399 NS
Number of reared piglets (pcs/litter)			–0.279 NS

* = statistically significant difference (P ≤ 0.05); NS = statistically insignificant difference (P ≥ 0.05); ** = highly statistically significant difference (P ≤ 0.01)

II: *Losses of piglets from birth to weaning by the sex (pcs, %/litter)*

Parameter	**Gilts**		**Barrows**	
	Genotype I	**Genotype II**	**Genotype I**	**Genotype II**
Number of live-born piglets (pcs)	293	266	293	312
Number of piglets at the age of 14 days (pcs)	273	258	265	298
Number of weaned piglets (pcs)	266	256	261	289
Loss of piglets from birth to 14 days (psc)	20	8	28	14
Loss of piglets from14 days to weaned (pcs)	7	2	4	9
Loss of piglets from birth to weaned (pcs)	27	10	32	23
Loss of piglets from birth to 14 days (%)	6.82	3.01	9.56	4.49
Loss of piglets from14 days to weaned (%)	2.39	0.75	1.37	2.88
Loss of piglets from birth to weaned (%)	9.22	3.76	10.92	7.37

Both the correlations were statistically significant ($P \leq 0.01$). Similar trend was observed also in the genotype II, however without statistical significance of the correlation between the number of live-born piglets and the losses of piglets before weaning.

Olanratmanee *et al.* (2010) described a highly significant correlation between the total number of piglets and the number of live-born piglets. Škorjanc *et al.* (2007) reported a positive correlation ($r = 0.815$) with a highly statistically significant dependence ($P \leq 0.01$) between the number of live-born piglets and the number of reared piglets. Also Nevrkla *et al.* (2016) confirmed a significant ($P \leq 0.01$) correlation dependence between the number of live-born piglets and the number of reared piglets per litter ($r = 0.752$) and the number of live-born piglets and the losses of piglets before weaning ($r = 0.560$; $P \leq 0.05$).

The Tab. II shows that of the total number of 586 live-born piglets in the genotype I, 293 were of female sex and 293 of male sex. In the genotype II, a total of 578 piglets were born alive, with 266 females and 312 males. The numbers or weaned piglets were 266 females and 261 males in the genotype I and 256 females and 289 males in the genotype II. It is also evident that the losses of piglets were higher in the genotype I. The results indicate that most piglets die younger than 14 days after birth, while the losses of male piglets are greater than of female piglets. The losses of gilts of the genotype I before the 14^{th} day after birth were 6.82 %, in gilts of the genotype II it was 3.01 %. The losses of barrows during this period were 9.56 % in the genotype I and 4.49 % in the genotype II. From the 14^{th} day to weaning, the losses counted 2.39 % vs. 0.75 % in gilts and 1.37 % vs. 2.88 % in barrows. The total losses from birth to weaning were 9.22 % vs. 3.76 % in gilts and 10.92 % vs. 7.37 % in barrows.

Baxter *et al.* (2008) carried out an evaluation of losses of piglets according to sex and they found out that among 135 piglets born to experimental sows, 56 were boars and 59 were gilts.They found no significant difference between the genders in survivability of piglets. In another study on higher numbers of piglets (511 pieces), Baxter *et al.* (2009) described significantly higher losses in barrows than in gilts (46 vs. 18 pieces), which was confirmed by Bereskin *et al.* (1973) who point out a higher level of survivability in gilts than in boars or in barrows. A model calculated by the authors increases survivability of gilts by 9.32 %. Also Panzardi *et al.* (2013) observed lower losses of gilts than of boars (8 % vs. 12 %) before the third day of age. Rohe and Kalm (2000) highlight that the highest losses of piglets are recorded during the first week of life, which is confirmed by Arango *et al.* (2006) who add that the loss during the first day is around 4 %, the mortality is the highest up to 17 % during the second day after birth and during the following days it declines: the third day 16 %, the fourth day 9 % and the fifth day 7 %. From the sixth day, the mortality is stabilized at 4 %. Also the work by Bereskin *et al.* (1973) documents, that the losses of piglets are the highest during the first 3 days of life. The losses before weaning represent the most important problem of modern pig production (Balenović *et al.*, 1994). An acceptable state is when 8–10 % of piglets die from birth to weaning. The mortality of piglets is the highest during the first three days of their life, it covers 60–80 % from the total losses from birth to weaning (Tuchscheres *et al.*, 2000).

CONCLUSION

The experiment revealed no statistically significant differences in the selected reproductive parameters in the analyzed genotypes of sows, which suggests a high quality of sows used in the observed farm. More significant differences between the genotypes of sows were recorded in the losses of piglets, which indicates that the genetic basis of piglets is a fundamental condition of their survival before weaning. The results of genders of the piglets from the genotype I sows were not different, however, more boars than gilts were born in the genotype II. The results show that the piglets die most often before the 14^{th} day after birth, while the losses of male piglets are higher that of female piglets.

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