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INFLUENCES WHICH AFFECT REPRODUCTIVE CHARACTERS OF SOWS IN STUDIED REPRODUCTIVE BREEDING

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Abstract

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The aim of the study was to evaluate influences which affect reproductive characters of sows in chosen reproductive breeding. These reproductive traits of sows were studied: number of all, live born and weaned piglets, losses from live born piglets till weaning. These influences which affect reproductive characters were studied: order of litter, number of piglets in litter, birth weight of piglets and influence of sex on birth weight of piglets.
An average number of all born piglets per litter it was 11.74 animals. From that 11.33 live born piglets per sow and litter. 10.15 piglets were weaned from each litter in average. It represents 11.68 % of losses in live born piglets till weaning. An influence of litter order on number of live born piglets in litter was studied in an experiment. The first litters show 11.36 of live born piglets in average, the second litters 10.38 piglets, the third litters 10.43 piglets and the fourth litters 10.75 piglets. Maximum was reached on fifth litter with 13.33 of live born piglets. From the sixth litter number of live born piglets was decreasing. On the sixth litter it was 12.33 piglets, on the seventh only 9.40 of live born piglets. Between fifth litter (13.33 piglets) and seventh litter (9.40 piglets) statistical conclusive difference ($P \leq 0.05$) was found. The sixth litters showed the highest number of weaned piglets – 11.00. On the contrary the lowest number of weaned piglets it was on the seventh litter – 8.40 piglets. Statistical conclusive difference among the numbers of weaned piglets according to litter order it was not proved. Higher average birth weight (1.50 kg) was found in boars in comparison to gilts (1.46 kg). Next birth weight of gilts and boars was studied in dep
endence on litter order. The lowest birth weight in both sexes was found on the first litters – gilts (1.27 kg) and boars (1.36 kg). Gilts reached the highest birth weights on the seconds and the sixths litters (1.62 kg). Statistical conclusive difference ($P \leq 0.05$) was found in gilts among litters one (1.27 kg) and two (1.62 kg) respectively six (1.62 kg). Boars reached the lowest birth weight (1.36 kg) on the first litter. The highest birth weight of boars (1.73 kg) was reached on the fourth litter. Statistical conclusive difference ($P \leq 0.05$) was found among these litters. Next statistical conclusive difference ($P \leq 0.05$) was found between the first (1.36) and sixth (1.70 kg) litter and statistical conclusive difference ($P \leq 0.01$) between the first and the second litter (1.68 kg).

Keywords: sow, reproductive characters, fertility, litter

INTRODUCTION

Fertility belongs among the most important characters not only because it makes survival of species possible but especially for economic importance. Measure and intensity of fertility is basic productive factor with an influence on number of weaned and fattened pigs.

Level of reproduction is taking high participation on profitability of production. Profitability of piglet production starts after reaching of 20 weaned piglets per sow per year. It is possible to rear 24 piglets per sow per year in actual breeding (Pulkrábek *et al.*, 2005).

Reproductive characters are distinguished by very low heritability which means selection on these traits is difficult, lengthy and selective

effect is low. On the other hand because of low heritability in reproductive characters manifest of the effect of heterosis is expressive (Čeřovský, Vinter, 1989). Improving of reproductive traits is given by influencing of productive abilities of pigs and by biological rules and respect of physiological characters of pigs. Traits as number of piglets per sow per year, number of weaned piglets per year, number of litters per year etc. are usually used for measuring of productivity in pig breeding (Huml, Klepáč, 2003). Basic condition for successful reproduction it is normal development of sexual organs and their physiological function. Beside this it is important to provide optimal environmental conditions, timely placement into breeding, optimal nutrition in relation to growth and reproductive phase, breeding work and matching zoo-hygienic conditions (Stupka *et al*., 2009).

Excellent reproduction of sows, vitality and balance of piglets in a litter and their readiness for weaning are crucial for breeding efficiency. During the last 30 years fertility of sows increased for approximately 20 % because of genetic progress. Optimal level of reproduction cannot be reached without good health condition of sows (Lambert *et al*., 2012). Matoušek *et al.* (2011) mention in their study that one of the serious problems it is to keep pigs without diseases. Luo *et al.* (2010) remark at the moment there are not effective methods of treatment for disposal so attention is focused on searching of genes which determine resistance against diseases. Birth mortality is assessed according to number of dead born piglets in a litter. Size of litter, order of litter, age of sow and length of interval, birth weight of piglets belong among factors with an influence on birth mortality (Fischer, 2004). Birth mortality is usually higher in less numerous or high numerous litters. In high numerous litters mortality is probably increasing because of insufficient nutrition of foetus (reduced supply of nutrients due to higher number of embryos during intrauterine development). According to study of Hellbrugge *et al.* (2008) total mortality of piglets is considerable problem. Kozumplík, Kudláč (1980) mention it is quite difficult and long-standing to reach more considerable improvement of fertility in sow by method of selection. That is the reason why effect of heterosis is used in pigs and considerable and fast improvement of fertility can be reached by purposeful inter-breed hybridization. Effect of heterosis in gilts (hybrids) shows earlier start of sexual maturity, regularity in breeding rhythm, higher milk production, higher vitality of offspring and higher weight of litter. Kerr *et al.* (1996) mention duration of sow´s staying in breeding can be influenced by productive traits in time of gilt´s growth, their first mating and in period of pregnancy. Order of litter is a factor with a significant influence on numerousness of litter (Jakubec *et al*., 2002). It is used in dependence on development of reproductive functions of sow. According to the first litter it is not possible to predict next fertility and to predict efficiency. The peak of fertility in breeds with middle early maturity it is on 4^{th} – 5^{th} litter and then it successively declines. Number, weight, vitality of piglets during birth in litter it has economic importance for the farmer. Piglets with birth weight lower than 1 kg are piglets with problems and if we do not take special care about them during the first week of age they usually die because of hunger. Piglets with weight up to 0.8 kg are considered as unsuitable for breeding. Magnabosco *et al.* (2015) confirmed in their study that piglets with lower birth weight than 1.1 kg have higher mortality and lower growth ability because of lower intake of colostrum in comparison with piglets with higher birth weight. Optimal weight of live born piglet should be in interval 1.3 – 1.6 kg. Birth weight of piglets is one of the most important factors with an influence on survival and vitality of piglets till weaning (de Almeida et all., 2015). According to Rekiel et all. (2015) optimal birth weight has a positive influence on meatyness of slaughtered pigs and qualitative characters of pork.

MATERIALS AND METHODS

The own analysis was carried out in chosen reproductive breeding of pigs. In an enterprise there is a breeding herd of 712 sows - originally Czech Large White. Today there is a hybridization in a frame of Dutch program TOPIGS. Insemination portions for production of gilts for own herd renewal they are produced in Insemination Station Nový Dvůr u Chotěboře, for production of piglets for commercial breeding in Insemination Station Velké Meziříčí. In farrowing house sows are stabled individually in farrowing pens with fixation cages. Farrowing house is divided to 8 sections with two divisions in each section. In each division there are 14 farrowing pens. During whole time spend in a farrowing house sows are fed with feeding mixture KPK. Program FARM is used for register in this enterprise. 54 sows were integrated into experimental group. Altogether 612 piglets from 54 litters were weighted – 302 gilts and 310 boars. Weighting was done up to 24 hours after birth. These data were monitored during experiment: number of all born piglets, number of live born piglets, number of weaned piglets, length of interval, length of gravidity, birth weight of piglets, age of piglets during weaning, number of litters per year, mortality, order of litter, register of boar. Studied file of sows was divided into groups according to order of litter. In studied group of sows these influences with an impact on reproductive characters were monitored: influence of litter order on number of live born and weaned piglets and weights of boars and gilts according to litter order. These basic statistical characterizations were determined in studied file of sows: average, standard deviation, coefficient of variation, minimum and maximum in studied trait. Gained data were evaluated by statistical program STATISTICA 10 and

conclusiveness of differences among groups was tested by statistical method ANOVA.

RESULTS AND DISCUSSION

In Table I there is an average number of all born piglets per sow and litter which was 11.74 animal. From this there were 11.33 of live born piglets per sow and litter. In average 10.15 piglets were weaned from each litter. With a turnover rate 2.4 litters per year can be reached 27.19 of live born piglets per sow and year and 24.36 of weaned piglets per sow and year. Smola (2012) studied determination of minimal number of weaned piglets per sow and year. He mentions determination of minimal aim of 22 weaned piglets per sow and year is easy to reach, but it cannot lead to improvement of production. Our breeding are quite commonly reaching number of 25 weaned piglets per sow and year (Velechovská, 2013). It is result of good organizing of work, feeding of sows and responsible handling by keepers.

As it is visible from Table II from total number of 634 born piglets 612 were live born and 548 piglets were weaned. It represents losses of 11.68 % in live born piglets till weaning. Approximately 40 % of potential piglets die as embryo or foetus till 40 days of pregnancy. This phenomenon is a natural reaction of sow organism which serving to keep pregnancy. An average number of dead born piglets reached 3.59 %. Number of dead born piglets is usually around 5–10 %, higher number of dead born piglets is especially in more numerous litters with 14 piglets and more (Václavková and Lustyková, 2011). Herment *et al.* (1994) mention higher numerousness of litter causes higher percentage of dead born piglets and it is depending on occurrence of piglets with lower live weight and lower vitality. According to Huml and Klepáč (2003) range of physiological mortality is between 10 – 14 %. Mentions physiological mortality up to 10 %. Mortality should not exceed 15 %. It is influenced by group of factors such as birth weight of piglets, milk production of sow, zoo-hygienic and microclimatic conditions in a farrowing house, technology of housing, pre-starter which is used, time and method of weaning. From all losses till weaning 52 % of piglets die because of overlie by sow, 17 % die because of starvation, 12 % die from other specific reasons, 9 % because of diarrhoea, 7 % from unknown reasons and 3 % because of diseases of respiratory system.

Table III shows number of live born and weaned piglets in particular litters. The first litters show 11.36 piglets, the second litters 10.83, the third litters 10.43 and the fourth litters 10.75. Maximum was reached on the fifth litter (13.33 piglets) again. From sixth litter number of live born piglets in a litter was decreasing again. On the sixth litter it was 12.33 piglets, on the seventh litter only 9.40 piglets. A statistical conclusive difference ($P \leq 0.05$) was found between the fifth (13.33 piglets) and seventh litter (9.40 piglets). Old sows on sixth and more litters reliably become pregnant but they have more dead born piglets (Hájek and Smolák, 1992).

Sows on sixth litter shown the highest number of weaned piglets (11.00). The lowest number of weaned piglets was on the seventh litter (8.40). The rest of the litters shown following results: the first

I: *Traits of reproduction in studied group of sows*

Number of litters	54
Average number of all born piglets (animals)	11.74 ± 3.43
Average number of live born piglets (animals)	11.33 ± 3.33
Average number of weaned piglets (animals)	10.15 ± 2.59
Average number of live born piglets per sow per year (animals)	27.19
Average number of weaned piglets per sow per year (animals)	24.36
Losses from live born piglets till weaning (%)	11.68
Average lenght of interval (days)	152.48 ± 9.24
Number of litters per sow per year (average)	2.40 ± 0.13
Average lenght of gravidity (days)	114.38 ± 1.62
Average service period (days)	37.89 ± 9.34
Average lenght of interval from weaning till mating (days)	7.45 ± 5.96

II: *Traits of reproduction in studied group of sows*

Trait	Number of all born piglets (animals)	Number of live born piglets (animals)	Number of weaned piglets (animals)
Number (animals)	634	612	548
Average	11.74	11.33	10.15
S_x	3.43	3.33	2.59
X_{min}	5	5	5
X_{max}	18	18	14

litters 10.64, the second litters 10.00, the third litters 9.86, the fourth litters 9.50 and the fifth litters 10.67. Statistical conclusive difference among particular orders of litters was not found.

Table IV shows basic statistical characterizations of determined birth weight of gilts and boars. Higher average birth weight was found in boars (1.50 kg) in comparison to gilts (1.46 kg). Birth weight of piglet is important for its survival till weaning. Birth weight under 1 kg is believed to be critical. If the piglet with such a low weight did not die till weaning, low birth weight has an influence on its following development. In a high numerous litters an average birth weight is decreasing and number of weak piglets is increasing and sows do not produce enough milk for all piglets. Only 28 % piglets with a birth weight under 1.10 kg survive till 7 days of age. Up to two thirds of piglet mortality are caused because of low birth weight. According to Magnabosco *et al.* (2015) because of higher number of piglets in a litter breeders prefer birth weight around 1 kg with a higher risk of mortality and lower growth ability. Beaulieu *et al.* (2010) studied an influence of birth weight of piglets on their growth. They found out that piglets with lower birth weight are reaching lower weaning weight, lower weight in 5th and 7th weeks after weaning so their fattening takes longer time. Gondret *et al.* (2006) compared growth in a group of piglets with low birth weight (average 1.05 kg) with a group of piglets with high birth weight (average 1.89 kg). In the end of fattening period piglets with lower birth weight were for 12 days older and a content of lean meat was lower. Smith *et al.* (2007) found out differences in birth weights of piglets in their study. Piglets with lower birth weight reached a low weight in age of 42 days too. Škorjanc *et al.* (2007) found out positive correlation among live birth weight of piglets and their live weight in age of 7, 14, 21 and 28 days. According to Rehfeldt and Kuhn (2006) average birth weight of piglets should be from 1.3 to 1.5 kg. In many studies (Bocian *et al.*, 2012, Rehfeldt and Kuhn, 2006) a negative relation was found between low birth weight of all piglets and their survival till weaning.

Table V shows birth weights of gilts and boars according to order of litter. The lowest birth weight in both sexes was determined on the first litters – gilts (1.27 kg) and boars (1.36 kg). Gilts reached the highest birth weight on the second and on the sixth litters (1.62 kg). On productive litters these values were determined: on the third litters 1.46 kg, on the fourth litters 1.53 kg and on the fifth litters 1.42 kg. On the seventh litter an average birth weight of gilts reached 1.54 kg. Statistical conclusive difference ($P \leq 0.05$) in gilts was determined between litters one (1.27 kg) and two (1.62 kg), respectively six (1.62 kg). The lowest birth weight of boars (1.36 kg) was determined on the first litter.

The highest birth weight was reached by boars on the fourth litter (1.73 kg). Between these litters statistical conclusive difference ($P \leq 0.05$) was found. The rest of the productive litters shown following values: second litters 1.68 kg, the third litters 1.49 kg, the fifth litters 1.47 kg, the sixth litters 1.70 kg, seventh litters 1.48 kg. Next statistical conclusive difference ($P \leq 0.05$) between the first litter (1.36) and sixth litter (1.70 kg) and statistical conclusive difference ($P \leq 0.01$) between the first and the second litter (1.68 kg) was found.

Bocian *et al.* (2012) detected in their study higher birth weight in gilts (1.35 kg) in comparison to boars (1.25 kg). Detected difference in birth weight between sexes it was statistical conclusive ($P \leq 0.05$). They detected higher weaning weight of gilts (6.90 kg) in comparison with boars (6.68 kg). Results highlighted negative influence of low birth weight of piglets on their subsequent growth till slaughter of animals.

III: *Number of live born and weaned piglets according to order of the litter*

Order of the litter	Number of litters	Average of live born piglets per litter	Average of weaned piglets per litter
1	11	11.36 ± 2.16	10.64 ± 2.16
2	12	10.83 ± 3.27	10.00 ± 3.02
3	7	10.43 ± 3.78	9.86 ± 3.24
4	4	10.75 ± 4.03	9.50 ± 3.11
5	9	13.33^{a} ± 3.91	10.67 ± 2.50
6	6	12.33 ± 2.07	11.00 ± 1.26
7	5	9.40^{a} ± 4.56	8.40 ± 3.36

a: $P \leq 0.05$

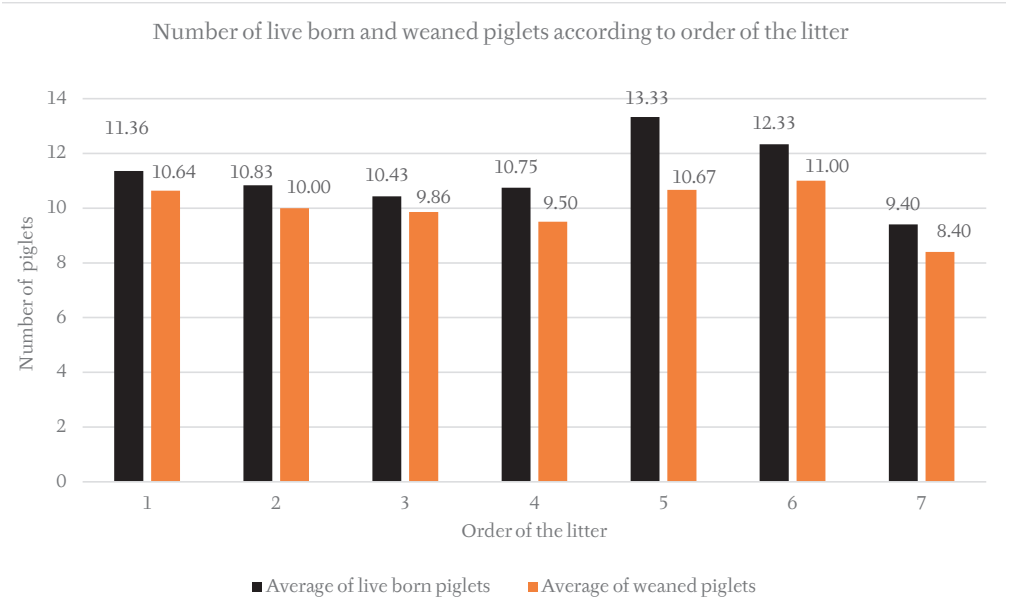
IV: *Basic statistical characterization for trait – birth weight of piglets*

Sex	Birth weight (kg)				
	n	Average	S_x	X_{min}	X_{max}
Gilts	317	1.46	0.28	0.6	2.0
Boars	310	1.50	0.29	0.7	2.1

V: *Birth weight of gilts and boars according to order of the litter*

Order of the litter	Number of litters	Average birth weight of gilts in kg	Average birth weight of boars in kg
1	11	$1.27^{a,b} \pm 0.27$	$1.36^{c,d,e} \pm 0.28$
2	12	$1.62^{a} \pm 0.29$	$1.68^{e} \pm 0.30$
3	7	1.46 ± 0.28	1.49 ± 0.31
4	4	1.53 ± 0.29	$1.73^{e} \pm 0.29$
5	9	1.42 ± 0.28	1.47 ± 0.30
6	6	$1.62^{b} \pm 0.29$	$1.70^{d} \pm 0.28$
7	5	1.54 ± 0.29	1.48 ± 0.29

a,b,c,d: $P \leq 0.05$
e: $P \leq 0.01$



1: *Number of live born and weaned piglets according to order of the litter*

2: *Birth weight of gilts and boars to order of the litter*

CONCLUSION

From reached results it is possible to pronounce that the highest number of live born piglets was registered on the fifth litters and the lowest number of live born piglets on the seventh litters. The highest number of weaned piglets shown sows on sixth litter. On the contrary the lowest number of weaned piglets was on the seventh litter. Higher average birth weight (1.50 kg) was found in boars in comparison to gilts (1.46 kg). The lowest birth weight was found in both sexes on the first litters – gilts (1.27 kg) and boars (1.36 kg). The highest birth weight in gilts was reached on the second and the sixth litters (1.62 kg). In boars the highest birth weight was reached on the fourth litter (1.73 kg).

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