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EVALUATION OF SELECTED REPRODUCTIVE PARAMETRES IN GILTS AND LOSS OF PIGLETS AFTER REPOPULATION

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Abstract

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The aim of this study was to evaluate selected parametres of reproduction in sows in the first litter and piglets loss from birth to weaning after repopulation in a production sow herd. Observed parametres were evaluated in two commercial programs. An experimental group consisted of 80 gilts (40 in commercial program A and 40 in commercial programm B). Gained values of the total number of piglets per litter were 16.23 ± 2.26 from gilts in the program A and 15.63 ± 2.13 from gilts in the program B. Evaluation of live-born piglets per litter showed numbers of 14.74 ± 2.09 in the program A and 14.50 ± 2.10 in the program B. Numbers of stillborn piglets per litter were 1.48 ± 1.30 for gilts in the program A against 1.13 ± 1.42 for gilts in the program B and numbers of reared piglets per litter were 13.20 ± 1.52 in the program A against 13.68 ± 2.00 in the program B. Statistical evaluation confirmed no significant differences between the two commertial programs in the selected reproductive parametres. Piglet losses from birth to weaning were also evaluated. In the program A 1.55 ± 1.48 piglets were lost per a gilt against 0.83 ± 1.39 in the program B. The percentage of piglet loss was 9.55 ± 9.04 in the program A and 5.28 ± 8.67 in the program B. The statisticaly significant difference ($P \leq 0.05$) was proved between the two commercial programs. The values found by the experiment in both programs can be considered very competitive therefore recovery by the means of repopulation and induction of SPF herds can be recommended.

repopulation, SPF, sow, piglet, reproduction, weight

Breeding sows is from the farming and economical aspects one of the most exhausting branches of pig breeding. The aim of breeding sows is to produce piglets and to gain a profit. A prerequisite of efficiency of breeding sows is ensuring good health and high performance of sows characterized by a number of reared piglets per sow (Boudný and Špička, 2012). It is constantly poited out, that particularly the number of reared piglets per sow is the cause of problems in Czech famrs and also that there is a fundamental difference between our and succesfull foreign farms (Rozkot, 2012). Rodríguez *et al.* (2012) consider the number of reared piglets for a major economic efect of breeding sows. Čechová (2006) states, that achievement of high number of reared piglets is also influenced by the quality of born piglets, therefore the piglet weight at birth plays an important role in this respect. This parameter affects piglet loss before weaning and is fundamental for profitability of fattening pigs. Šprysl *et al.* (2010) say that the decisive step of breeders is the choice of suitable genotypes of sows ensuring profitable pig production. Rootwelt *et al.* (2012) state that the genetic diversity of sows influences the litter size, birth weight and piglet losses before weaning. Genetic potential of sows can be fully used only in healthy population. According to Itoh *et al.* (1992), induction of specific pathogen free (SPF) herds leads to an improvement of health condition associated with full realization of reproductive potential of sows.

Ensuring optimal reproduction is besides various endogenous and exogenous factors influenced by health condition which is subsequently reflected in pig rearing and fattening, thereby affecting the entire herd prosperity. Poor health situation in herds negatively influences the farm economy (Lambert *et al.*, 2012). Smola (2009) states that it is beyond a doubt, that the main center of problems lies in the issue of viral diseases such as virus of porcine reproductive and respiratory syndrom (PRRS) and porcine circovirus 2 (PCV-2) and remarks that it is due to completely open pig market at the international level. Epidemiological situation in the Czech republic is not different from the situations in other countries of European Union. Holkamp *et al.* (2012) say that underestimation of PRRS as a very important disease significantly decreasing level of health condition in porcine population is the most likely reason of massive spread of infection to most production, reproductive and breeding farms.

PRRS virus undisturbedly spreaded in porcine population from the top of breeding pyramide to its base. Insufficient attention followed by the absence of necessary moves led to hard devaluation of health condition in pig herds consisting of infection of PRRS virus. Zhao *et al.* (2012) highlight that due to the virus spread and a high risk of its reinfection from surrounding farms it is important to obey the rules of biosecurity and closed herd turnover. This author adds the impacts of PRRS on reproduction of sows, which are according to the phase of disease loss of piglets, observed mainly as lower number of piglets per a litter, weight unbalance of piglets and also lower viability of piglets with consequent losses within the first week of life. Even more serious problems in herds than PRRS itself are infections occuring in parallel with it such as Mycoplasma hyopneumoniae or PCV-2 (Mortensen *et al.*, 2002; Neumann *et al.*, 2005; Holkamp *et al.*, 2012). According to Shibata *et al.* (2002) SPF pigs should be PRRS and Mycoplasma negative but it is necssary to obey hygienic rules at all breeding levels to prevent induction of the patogenes to the herd.

Poor health situation in herds can be solved by the method of radical recovery by the metod of repopulation. According to Pelikán (1989) this method comes originally from the USA from the year 1952 and it continuously started to apply in conditions of the Czech Republic. Plhal (1987) states that the environment, nutrition, gene pool and health as conditions of high performance must be systematically checked and it is necessary to renew them in time periods and preferably by radical recovery by the method of repopulation. The method consists of extracting piglets shortly before birth either by Caesarian operation or by extraction of all whole uterus (hysterectomy) or by aseptic capture of piglets. According to Koliander *et al.* (1989), the disease life cycle can be interrupted this way as there is no contact between piglets and sow. This method is known as specific pathogen free (SPF). The method is economically more demanding than conventional rearing piglets by a sow. Therefore it is recommended for production of pigs in breeding or reproductive farms. In production farms sows give birth naturally (Černý, 1989; Schwarzer *et al.*, 1986). It is necessary to follow the rules of biosecurity to prevent reinfection in a repopulated farm (Drábek, 2001). The merit of SPF herds is that they allow preservation of genetically valuable material of original herd. The higher expenses on special breeding techniques return in two years after repopulation at the latest and under appropriate breeding and hygienic conditions the high health standard of SPF herd should maintain for over five years (Černý, 1989). Šlechta and Martinek (1989) state that recovery should bring mainly increase of growth and decrease of feed consumption per unit of growth and reduce of treatment costs and they add that reproductive qualities are economically extremelly important, as the effects of production character (fattening and carcass value) are realized only in fattening pigs while they are negligible in reproductive or breeding farms unlike the reproductive effects.

The aim of this study was to evaluate selected reproductive parametres in the first litter sows and the piglet losses from birth to weaning after repopulation in productive farm of sows with SPF status. Monitored parametres were evaluated for two commercial programs.

MATERIAL AND METHODS

Experimental population consisted of 80 repopulated gilts (40 in commercial program A and 40 in commercial program B). The original population of sows was removed. Newly delivered SPF gilts were placed into decontaminated stable with strict batch, black and white breeding system with stringent hygienic provisions:

- Stable entry was via one main entrance with mandatory showering, clothing and footwear exchange for all nursing staff and visitors.
- Each building entrance was equipped with disinfection mat for desinfection and cleaning of footwear.
- A strict control of persons and visitors movement in the area of the farm was applied and the entrance of those who came into contact with other pigs within last three days or who breed pigs at home was prohibited.
- Gilts were brought from proved source farm applying the same strict measures as the observed farm.
- The group of newly brought breeding gilts were first acclimated and then stabled in quarantine.
- Vehicles were properly cleaned and disinfected before entering the farm, drivers were not allowed to move either in the area of the farm or in the stables.

- Vectors such as insect and rodents, which are considered to carry viral infections must be regularly eliminated by the means of desinfection and deratization.

Folloving provisions were made inside the stables:

- Movement of piglets among litters was disabled, except for the first 24 hours after birth if necessary.
- Injection needles and other utilities were used only for one litter.
- Windows of stables for both served and pregnant sows were equipped with nets against birds and insect.
- Thorough cleansing and desinfection of stables is performed after batch emptying of each section.

In the category of served sows there were two groups of gilts stabled individually from the onset of estrus to the detection of pregnancy thus for one month. The pregnant gilts were subsequently moved into static group pens for 15 to 20 pieces. The gilts were provided with transponder for their identification and allocation of feed rations at the feed station. In these pens they were until an average of five days before giving birth. In the category of gilts in advanced stage of pregnancy, farrowing and lactating, the gilts were stabled in individual farrowing pens with slatted plastic floor and the farrowing house was devided into sections. All the above mentioned categories were fed by automatic distribution of feed. Air exchange both in farrowing section and in section of served and pregnant sows was solved by automatic methods. 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 gilts (commercial program A, B) phenotypic levels of selected reproductive parametres were observed, namely the total number of born piglets, the number of live-born piglets, the number of stillborn piglets, the number of reared piglets and the number of piglets lost from the birth to the weaning.

The obtained reproductive paramteres and the loss of piglets in the commercial program A were compared to the parametres obtained for commercial program B and elementary statistical characteristics for differences in evaluated parametres between the groups of gilts were analyzed, namely mean, standard deviation and relevance based on the t-test. The symbol *** stands for $P < 0.001$, ** stands for $P < 0.01$, * stands for $P < 0.05$ a NS stands for $P > 0.05$. The statistical evaluation was done using the programs STATISTIKA version 9.0 and Microsoft Excel 2010.

RESULTS AND DISCUSSION

Tab. I displays numbers of all, live-born, stillborn and reared piglets per a litter after repopulation in production farm with SPF status within two commercial programs. The results indicate that the phenotypic level of reproductive parametres is not significantly different between the evaluated commercial programs.

The total number of born piglets from gilts in commercial program A reached 16.23 ± 2.26 aganist 15.63 ± 2.13 piglets in commercial program B. The difference between the programs was 0.61, however this difference is not statistically significant. 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 notes that first litter sows have less numerous litters than older sows. According to Wolf *et al.* (2008), the aim of the present genotypes of sows is to give birth to the highest possible number of viable piglets. His experiment showed 13.70 piglets born per litter. Damgaard *et al.* (2003) piont out that litter size affects survival of piglets after birth. Olanratmanee *et al.* (2010) report 12.10 born piglets per a litter from sows in good hygienic conditions against 11.70 from sows in poor hygienic conditions, which indicates the need of breeding sows in good health status.

Total number of born piglets is important parameter, however for pig farmers the number of live-born piglets is even more sigificant. The numbers in Table I show 14.75 ± 2.10 live-born piglets in commercial program A against 14.50 ± 2.10 in commercial program B. The difference between the two programs was 0.25 piglet, which is not statistically significant. The values gained in experiment, such as 14.75 and 14.50 live-born piglets indicate high health standard of sows, which is demonstrated by the results found by Nevrkla *et al.* (2012), who reported 11.25 live-born piglets before repopulation and after the repopulation of the breed the value increased to 14.63 live-born piglets. Improvement of health status of sows with the influence on reproduction is documented also by Olanratmanee *et al.* (2010), who found 10.30 live-born piglets per litter for sows with health problems, against 11.10 live born piglets for sows without health problems. These findings suggest that induction of SPF herds improves numbers of live-born piglets. Lewis *et al.* (2009) state that PRRS virus influences reproductive performance of sows and gilts. Their results show that healthy gilts in the first litter had over 9 live-born piglets compared to only 7 live-born piglets of gilts with health issues and note that this parameter is also dependent on the genetics of animals. According to Cozler *et al.* (1998) besides the health status also breeding management, 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 of Dandbred sows in normal breeding conditions: in the first litter 9.80, in the second litter 10.10, in the third litter 9.50 and in the forth litter 11.00. Gained values of number of live-born piglets in both evaluated programs demonstrate excellent health of sows.

The Tab. I also displays numbers of stillborn piglets per litter. Gilts in commercial program A had 1.48 ± 1.30 stillborn piglets per litter while those in commercial program B had 1.13 ± 1.42 stillborn piglets. The difference between the programs was not statistically significant and amounted to 0.35 piglet. Number of stillborn piglets is determined by size and order of the litter (Lucia *et al.*, 2002; Borges *et al.*, 2005; Canario *et al.*, 2006). Lewis *et al.* (2009) state that PRRS positive sows or gilts have higher incidence of stillborn piglets and note that also the order of litter plays an important role in this aspect because of immunity state of the sows. Older sows are imunologically more competent than younger sows. Nielsen *et al.* (2002) reported 2 to 6 stillborn piglets per litter from sows with health problems. Lewis *et al.* (2009) found 3.00 stillborn piglets from ill gilts and 0.60 stillborn piglets from healthy sows per litter and their observation highlights that gilts have higher incidence of stillborn piglets. Schneider *et al.* (2011) points out that the number of stillborn piglets is determinated by size of the litter, which also influences parturition lenght. Longer parturition means higher number of stillborn piglets. Vanderhaeghe *et al.* (2010) found 2.02 ± 1.61 stillbirths per litter with 14.70 ± 3.19 all born piglets. Similar results were also demonstrated by Arango *et al.* (2006) who observed 2.10 stillbirths. Both commercial programs in our experiments despite the very high total numbers of piglets (program A 16.23 ± 2.26 a program B 15.63 ± 2.13) reached very good results in numbers of stillborn piglets (program A 1.48 ± 1.30, program B 1.13 ± 1.42) which again indicates the benefits of repopulation.

The number of reared piglets is considered the most important effect of breednig sows. The result of experiment were 13.20 ± 1.52 reared piglets per litter in commercial program A and 13.68 ± 2.00 reared piglets per litter in commercial program B. The difference between the programs was 0.48 piglet. Statistical evaluation did not prove a significant difference. 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, which includes also appropriate health programs. It is importanst to use suitable management from the first litter, which significantly affects the number of reared piglets. Lewis *et al.* (2009) reported 7.50 reared piglets per litter from sow with health problems against 9.25 reared piglets per litter from healthy sows. Nevrkla *et al.* (2012) found 9.68 ± 1.75 reared piglets before repopulation and more than 13 after repopulation. Wolf *et al.* (2008) document in their work, that the quantity of reared piglets should exceed number 11. Schwarzer *et al.* (1986) say that the number of reared piglets increases after repopulation and in suitable breeding conditions the effect will be maintained for five years, which they consider economically advantageous. The results of the experiment can be regarded as excellent from the sows in their first litter.

Tab. II and Fig. 1 show losses of piglets from birth to weaning per litter. In the commercial program A the loss amounted 1.55 ± 1.48 piglets against 0.83 ± 1.39 piglets in commercial program B. The percentage of loss of piglets was 9.55 ± 9.04 in commercial program A and 5.28 ± 8.67 in commercial program B. The statistical analysis demonstrated statistically significant difference ($P \leq 0.05$) between evaluated programs. According to Plhal (1987) a prevention of loss of piglets is very difficult issue, which is systematically divided into optimal production of health in herds of sows and piglets health protection per se. The issue of rearing pigs is an indicator of health and disease situation in breeding sows. The state of the basic herd of sows decides whether a litter will be numerous, born piglets balanced and with good vitality and with inborn resistance to stable diseases. This author also points out that the creation of health of piglets must be based on precautionary requirements for achievement of optimal health of their mothers, where recovery of sows by repopulation plays an important role. This statement is supported by O'Donoghue and Ballantyne (1965) who report, that SPF sows are characterized by lower loss of piglets before weaning, but they emphasize that repopulation itself is not sufficient and that it is necessary to ensure strict hygiene in the herd. Munsterhjelm *et al.*

I: *Basic statistical characteristics of selected reproductive parametres by the commercial program*

Parameter	Program	n of litters	n of piglets	$\bar{x} \pm s_x$	Significance
Total number of piglets (pcs/litter)	A	40	649	16.23 ± 2.26	NS
	B	40	625	15.63 ± 2.13	
Number of live-born piglets (pcs/litter)	A	40	590	14.75 ± 2.10	NS
	B	40	580	14.50 ± 2.10	
Number of stillborn piglets (pcs/litter)	A	40	59	1.48 ± 1.30	NS
	B	40	45	1.13 ± 1.42	
Number of reared piglets (pcs/litter)	A	40	528	13.20 ± 1.52	NS
	B	40	547	13.68 ± 2.00	

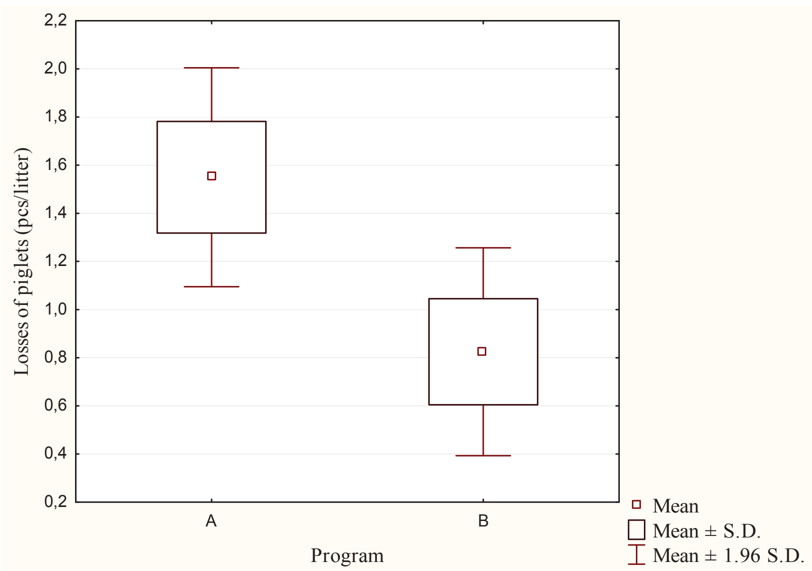
NS = statistically insignificant difference ($P \geq 0.05$)

(2006), Andersen *et al.* (2009) and Oliviero *et al.* (2010) state that appropriate health programs in herds of sows minimize loss of piglets after birth. According to Rootwelt *et al.* (2012) the loss of piglets from the live-born to the weaned in problematic herds reaches 16.20 %. 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) and in their work they add that of the piglets lost from birth to weaning, the loss during first day is around 4 %, the second day after birth the mortaliy is the highest up to 17 % and 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 %. Lee and Haley (1995) report that loss of piglets significantly affects size of the litter and the associated birth weight of piglets, genetics of animals and they add that hybrid sows carry the genes for survival of piglets. Wolf *et al.* (2008) point out that loss of piglets from birth to weaning has a relatively high heredity, therefore the choice of suitable genetics is an important way to reduce losses of piglets. For the sows of Czech Large White the mean loss of piglets is refered to be 1.80 ± 2.00 pieces and 13.00 ± 12.50 % per litter, which are higher values then those recorded in the experiment. Kozlowski and Wilk (1984) say that in large-scale production conditions the loss of piglets before 28th day should not exceed 10 %. This is confirmed by Vrbanec *et al.* (1995). Pour (1992) highlights as an important cause of piglet loss before weaning a diarrheal disease of different origin and notes the importance of reduction of pathogenic agents in herds. Jung *et al.* (2008) state that a viral infection present in some herds can bring an increased mortality of newborn piglets and they add that rotavirus infections are the cause of acute diarrhea in suckling piglets and that outbreaks of these infections are associated with impaired immune system response. In this regard an important role is played by programs of recovering pig herds. Also Vaillancourt *et al.* (1992) say that an intensive production of sows is accompanied by certain critical phases. Loss of piglets from birth to weaning is considered an important one, either as a result of infectious diseases or nonpathogenic causes, therefore monitoring of piglets allows its optimization. They also point out that in problematic herds, the losses can be very high. For example in England, the worst herds reached 12–30 % of loss of piglets before weaning, 17.6 % in

II: *Basic satistical characteristics of loss of piglets by the commercial program*

Parameter	Program	n of litters	n of piglets	$\bar{x} \pm s_x$	Significance
Number of live-,born piglets (pcs/litter)	A	40	590	14.75 ± 2.10	NS
	B	40	580	14.50 ± 2.10	
Number of reared piglets (pcs/litter)	A	40	528	13.20 ± 1.52	NS
	B	40	547	13.68 ± 2.00	
Loss of piglets (pcs/litter)	A	40	62	1.55 ± 1.48	*
	B	40	33	0.83 ± 1.39	
Loss of piglets (%/litter)	A	40	62	9.55 ± 9.04	*
	B	40	33	5.28 ± 8.67	

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



1: *Losses of piglets by the commercial program (pcs/litter)*

Croatia and 22.2% in Slovenia. The loss of piglets observed in the experiment can be considered satisfactory, however it is evident that even in SPF conditions of production farms attention has to be paid to the genetics of animals, which plays an important role in this respect.

CONCLUSION

The experiment did not reveal statistically significant differences in selected reproductive parametres of gilts between evaluated commercial programs in production farm, which indicates high health and genetic quality of sows used in observed herd. Evaluation of loss of piglets showed statistically significant difference (P ≤ 0.05), which suggests that genetic basis of piglets is crucial for their survival to weaning. Values of selected reproductive parametres found in the experiment within both programs can be considered very competitive, therefore recovery by the means of repopulation and induction of SPF herds can be recommended. The obtained results show that good heath situation in herd and associated strict hygienic measures significantly influence important reproductive parametres of sows.

SUMMARY

The aim of this study was to evaluate selected reproductive parametres of sows in the first litter and loss of piglets from birth to weaning after repopulation in a production farm of sows. Monitored parametres were evaluated in two commercial programs. Experimental population consisted of 80 gilts (40 in commercial program A, 40 in commercial program B). The original population of sows was removed. Newly delivered SPF gilts were placed into decontaminated stable with strict batch, black and white breeding system with stringent hygienic provisions. The total number of born piglets from gilts in commercial program A reached 16.23 ± 2.26 aganist 15.63 ± 2.13 piglets in commercial program B. Evaluation of live born piglets per litter showed numbers of 14.74 ± 2.09 in the program A and 14.50 ± 2.10 in the program B. Numbers of stillborn piglets per litter were 1.48 ± 1.30 for gilts in the program A agains 1.13 ± 1.42 for gilts in the program B and numbers of reared piglets per litter were 13.20 ± 1.52 in the program A against 13.68 ± 2.00 in the program B. Statistical evaluation proved no significant differences between the two commertial programs in the selected reproductive parametres. Piglet losses from the birth to the weaning were also evaluated. In the program A 1.55 ± 1.48 piglets were lost per a gilt against 0.83 ± 1.39 in the program B. The percentage of piglet loss was 9.55 ± 9.04 in the program A and 5.28 ± 8.67 in the program B. The statisticaly significant difference (P≤0.05) was confirmed between the two commercial programs. The values found by the experiment in both programs can be considered very competitive therefore recovery by the means of repopulation and induction of SPF herds can be recommended.

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