ACTA UNIVERSITATIS AGRICULTURAE ET SILVICULTURAE MENDELIANAE BRUNENSIS

Volume 65 130 Number 4, 2017

https://doi.org/10.11118/actaun201765041247

EFFECT OF MINIMAL DISEASE IN A HERD ON REPRODUCTIVE PARAMETERS OF SOWS

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Abstract

NEVRKLA PAVEL, HADAŠ ZDENĚK, HORKÝ PAVEL. 2017. Effect of Minimal Disease in a Herd on Reproductive Parameters of Sows. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis,* 65(4): 1247–1251.

The aim of this study was evaluation of reproductive performance in sows from herds with minimal disease. Total number of 40 sows were included in the observation and evaluated from the 1st to the 4th parity. The highest reproductive performance was recorded at the 3rd parity. Statistically significant difference ($P < 0.05$) was found between the 1st and the 3rd parity and highly statistically significant difference ($P < 0.01$) was recorded between the 2nd and the 3rd parity in number of live-born piglets. Comparison of numbers of stillborn piglets showed statistically significant difference ($P < 0.05$) between the mean values of the 1st and the 4th parity. The results also showed highly statistically significant difference ($P < 0.01$) in number of reared piglets between the 3rd and the 4th parity. The conclusions of this study indicate that creation and maintenance of herds of sows with high health status lead to excellent results in the area of pig reproduction.

Keywords: minimal morbidity, parity, reproductive performance, sows, piglet

INTRODUCTION

Parity order significantly influences reproductive performance of sows. According to Town *et al.* (2005), litter size has an increasing tendency up to the fourth to fifth parity and it decreases later. Parity order influences also length of the interval from weaning to the first insemination. Decisive factors are age or weight of a sow. Also Olanratmanee *et al.* (2010) state that fertility reaches its top level at the fourth parity and later it gradually decreases. Todd (2006) reported that the number of live-born piglets was the lowest in the first litter, then it increased up to the 4th to 5th parity, later its level stabilized before it started to decrease around 7th to 8th litter. Wolf *et al.* (2008) observed maximum fertility on the 3rd and 4th parity in sows of Large White and on the 4th and 5th parity in sows of Landrace. Milligan *et al.* (2002) documented that parity order affected birth weight of piglets. They proved that the highest birth weight was recorded in the piglets of the second litters and according to the authors, the piglets of these litters had the highest survival rate. Achievement of good results is influenced by a range of factors. Čechová *et al.* (2012) name technological equipment of farms, nutrition, health status and others among external factors. Opriessnig *et al.* (2011) emphasize that potential of sows can be fully exploited only in a healthy population. Therefore, a meaningful way of improving the competitiveness of breeding of sows is creating herds with high health status. The focus of the problems nowadays lies in the issues of porcine respiratory diseases caused by viruses, such as porcine respiratory and reproductive syndrome virus and circovirus, which is facilitated by open market with pigs on the international level. According to Yin *et al.* (2013), introduction of e.g. porcine respiratory and reproductive syndrome virus (PRRS) to the herd means that the farm loses PRRS-free farm status, which leads to worsening of reproductive performance of sows. This disease can mediate development of mixed infections of respiratory tract. Maes *et al.* (2008) state that *Mycoplasma hyopneumoniae* can be another problem causing significant economic losses in the form of increased treatment expenses and decreased production of pigs. If a herd is also infected by porcine pleuropneumonia, it loses its high health status and gets to the level of a common herd. The system must be set in a way to preserve the high health status grade as long as possible. Bad health situation in herds can be solved by eradication programs and applying of biosecurity rules on farms. Laanen *et al.* (2013) assume that modern pig production with high intensity and related production of pork meat demands extraordinary provisions concerning biosecurity on farms and overall farming spiral.

Therefore, the aim of the study was to evaluate reproductive performance of sows from the 1st to the 4th parity in herds with minimum disease, where biosecurity rules were applied.

MATERIALS AND METHODS

Animals and housing

The experimental work was realized in operating conditions of selected production pig farm with minimal disease (MD) status. Observation included 40 sows of commercial program Danbred, in which reproductive performance from the 1st to the 4th parity was analysed. In the category of inseminated sows, the animals were stabled individually from the oestrus onset, through the time of insemination up to the gravidity detection, i.e. for approximately one month. This category of sows was given dry feed mixture according to individual condition by the means of individual dispenser. Pregnant sows were transferred to group static pens for 15–20 animals. The sows were equipped with transponders for dosing of feed mixture. The pregnant sows were fed with moisturized feed mixture. They stayed in group pens till approximately 5 days before farrowing. Animals in the category of sows in the high stage of gravidity, farrowing and lactating sows were stabled in individual farrowing pens. This category was also given dry feed mixture automatically. Air exchange, both in farrowing house and in the stable for inseminated and pregnant sows, was automatic. Piglets were given supplementary feeds since the 3rd day after birth. After bringing repopulated gilts, strict rules of biosecurity were applied on the farm, protecting from introduction of infection and spread of pathogenic agents.

Virological, serological and bacteriological examination

Samples were taken from all observed sows 5–7 days after each farrowing. Examination of samples was performed in the diagnostic laboratories of the State Veterinary Institute in Olomouc and Jihlava and the results are presented in Table 1. The samples were analysed for the occurrence of Aujezsky's disease (AD), enzootic pneumonia (EP), classical swine fever (CSF), porcine circovirus (PCV-2), pleuropneumonia (P), porcine respiratory and reproductive syndrome (PRRS), porcine parvovirus (PPV), brucellosis (BA) and dysentery (D). ELISA test was used for the diagnostics of PRRS, PCV-2, AD, EP, P and CSF. Haemagglutination-inhibition test was used for the detection of PPV. BA was diagnosed by the complement fixation (CF) and the Rose Bengal test (RBT). D was detected by cultivation test.

Observation and evaluated parameters

The experimental work was focused on evaluation of reproductive performance parameters in sows from the 1st to the 4th parity. Experimental gilts were inseminated at the mean age of 233.9 ± 27.34 days. Parameters of reproductive performance were evaluated in 40 sows after the first parity, 34 sows after the second parity, 31 sows after the third parity and 29 sows after the fourth parity. For exact identification, the piglets were labelled with individual codes by the means of ear notching after birth. Boars were castrated from the 5th day after birth. The piglets were weaned at the mean age of 28 ± 3 days.

I: *Examination of the presence of pathogens in samples*

Disease	Sample				
	examined	negative	positive	inconclusive	Not applicable
AD	5	5	0	0	0
EP	10	10	0	0	0
CSF	5	5	0	0	0
PCV-2	10	10	0	0	0
P	10	10	0	0	0
PRRS (E.s.)	10	10	0	0	0
PPV	10	10	0	0	0
BA	5	5	0	0	0
D	5	5	0	0	0

AD – Aujezsky's disease, EP – enzootic pneumonia, CSF – classical swine fever, PCV-2 – porcine circovirus, P – pleuropneumonia, PRRS – porcine respiratory and reproductive syndrome, E.s. – European strain, PPV – porcine parvovirus, BA – brucellosis, D – dysentery

II: *Basic statistical characteristics of reproductive parameters in sows from the 1st to the 4th parity*

Parameter	Parity			
	1st	2nd	3rd	4th
Gestation length (days)	116.48 ± 1.09	116.18 ± 0.98	116.08 ± 1.09	116.14 ± 1.36
Total number of piglets/litter	16.28 ± 2.25	15.41 ± 1.63	17.08 ± 2.84	16.24 ± 3.13
Number of live-born piglets/litter	14.70^{a} ± 2.24	14.41^{A} ± 1.31	16.39^{aA} ± 2.41	15.21 ± 2.95
Number of stillborn piglets/litter	1.58^{b} ± 1.39	1.00 ± 1.06	0.71 ± 0.92	1.03^{b} ± 1.61
Number of stillborn piglets (%/litter)	9.45^{c} ± 8.07	6.14 ± 6.37	3.37 ± 4.33	5.92^{c} ± 8.97
Number of reared piglets/litter	13.18 ± 1.53	13.09 ± 1.38	14.03^{B} ± 1.20	12.45^{B} ± 1.59

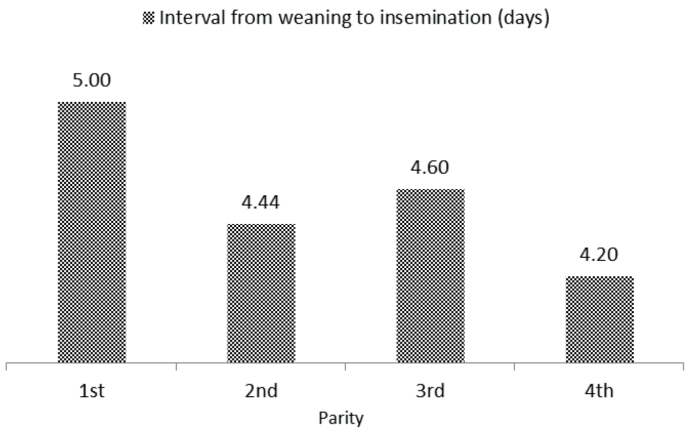
a, b, c = statistically significant difference (P < 0.05) and A, B = highly statistically significant difference (P < 0.01) of the mean values in the same row

Statistical analysis

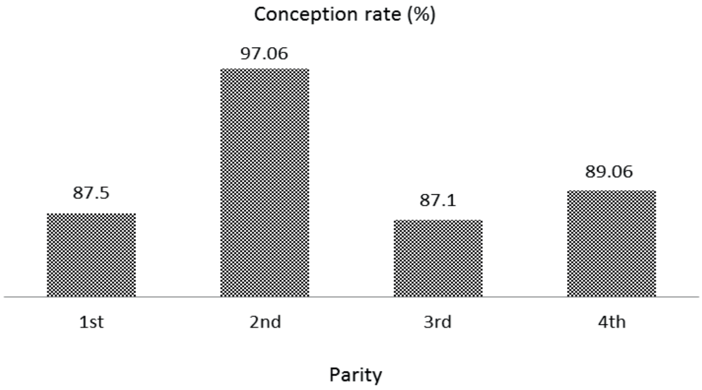
The data were analysed using software QC expert (TriloByte Statistical Software Ltd.). All data were expressed as mean ± SD. One way ANOVA and the Student's test were used to determine differences between the means. The probability value of $P < 0.05$ was considered statistically significant (a, b, c) and the value $P < 0.01$ was considered highly statistically significant (A, B).

RESULTS AND DISCUSSION

The results of reproductive performance parameters in sows are presented in Table 2. It is evident that the length of gravidity was not influenced by parity. Neither evaluation of the total numbers of piglets revealed statistically significant differences among individual parities. The highest total number of piglets was achieved at the 3rd parity as same as the number of live-born piglets. The difference between the numbers of live-born piglets at the 1st and the 3rd parity was statistically significant ($P < 0.05$). The most prominent difference of 1.98 piglet was recorded between the 2nd and the 3rd parity and was highly statistically significant ($P < 0.01$). The numbers of stillborn piglets were significantly different ($P < 0.05$) between the 1st and the 4th parity. The recorded results also show that



1: *Interval from weaning to insemination (days) in sows from the 1st to the 4th parity*



2: *Conception rate (%) after the 1st insemination in sows from the 1st to the 4th parity* the highest numbers of reared piglets were at the 3rd parity. Highly statistically significant difference ($P < 0.01$) of 1.58 piglet was observed between the 3rd and the 4th parity. The longest interval from weaning of piglets to insemination was recorded after the 1st parity. The values after later parities were lower and differences between individual parities were not statistically significant (Fig. 1).

No significant difference was found among individual parities ($P > 0.05$).

Conception rate in sows after the 1st insemination after the first parity reached 87.50 %. The highest conception rate was recorded in the sows after the 2nd parity (97.06 %). After the 3rd parity the value of conception rate was 87.10 % and after the 4th parity 89.66 % (Fig. 2).

Results of our study show that sows with high health status (minimal disease), which are kept in conditions with applied rules of biosecurity, achieve good competitiveness in the field of reproductive performance. Von der Lage and Hoy (2008) analysed reproductive performance in sows in repopulated herds on five farms and found increased reproductive parameters in sows of the repopulated herds and maintenance of high health status usually for several years when strict rules were followed. Olanratmanee *et al.* (2010) observed increased performance parameters in sows in good hygienic conditions, which highlights the necessity to keep the basic herd of sows in high health status. Results of our experiment document that the highest performance was achieved in sows at the 3rd parity and it decreased later, which corresponds to the results published by Simmins *et al.* (1993) who observed increasing fertility till the 3rd to the 4th parity with subsequent continuous decrease. The effect of parity order was also evaluated by Smith *et al.* (2008), who recorded increasing trend in reproductive performance of Danbred sows till the 3rd parity with later decrease. Fix *et al.* (2010) described in their work that the share of stillborn piglets represented 10–15 % and the authors considered it a result of viability of piglets in uterus and during farrowing, which is influenced by many factors, the health status of sows among others. Another observed parameter was the length of the interval from weaning of piglets to insemination, however the differences between individual parities were not statistically significant. Interval weaning of piglets – insemination was shortened to 5–7 days on farms with intensive production (Behan and Watson, 2005). According to Knox and Rodriguez – Zas (2001) oestrus appears from the 3rd to the 8th day after weaning of piglets in 95 % of sows. Chansomboon *et al.* (2009) proved that the interval in gilts was longer (8.5 days) than in sows (5.8 days). The results of our study show different conception rates after individual parities. Roca *et al.* (2003) recorded conception rate of 78.79 % in sows in a production herd. Xue *et al.* (1998), who evaluated reproductive capabilities of sows, found conception rate of 93.40 % in gilts after the first insemination and 93.7 % in sows.

CONCLUSION

Our study analyses reproductive performance of sows according to the parity order in a herd free from majority of economically important diseases. The results show that creation and maintenance of sow herds with high health status lead to excellent results in the field of pig reproduction, which can be a meaningful element increasing competitiveness of the business and a significant step to reduction of medication in herds.

Acknowledgements

This study was supported by the project of MENDELU, Faculty of AgriSciences IGA No. TP 7/2017: Analysis of performance and behaviour of farm animals in relation to ambient temperature variability and possibilities of elimination of its impact and the project NAZV No. QK1720349: Nanoparticles zinc an alternative to antibiotics in pigs.

REFERENCES

BEHAN, J. R and WATSON, P. F. 2005. The effect of managed boar contact in the post-weaning period on the subsequent fertility and fecundity of sows. *Anim. Reprod. Sci.*, 88(3–4): 319–324.

ČECHOVÁ, M., HADAŠ, Z., NOWACHOWICZ, J. and WASILEWSKI, P. D. 2012. The Effect of Feed with the Addition of Conjugated Linoleic Acid or Sunflower Oil on Fatty Acid Profile of Crossbred Pigs Meat. *Bulg. J. Agric. Sci.*, 18(6): 827–833.

FIX, J. S., CASSADY, J. P., HOLL, J. W., HERRING, W. O., CULBERTSON, M. S. and SEE, M. T. 2010. Effect of piglet birth weight on survival and quality of commercial market swine. *Livest. Sci.*, 132(1–3): 98–106.

CHANSOMBOON, C., ELZO, M. A., SUWANASOPE, T. and KOONAWOOTRITTRI-RON, S. 2009. Genetic and environmental factors affecting weaning-to-first service interval in a Landrace-Large White swine population in Northern Thailand. *Kasetsart J. – Natural Sci.*, 43(4): 669–679.

KNOX, V. R. and RODRIGUEZ-ZAS, S. L. 2001. Factors influencing oestrus and ovulation in weaned sows as determined by transrectal ultrasound. *J. Anim. Sci.*, 79(12): 2957–2963.

LAANEN, M., PERSOONS, D., RIBBENS, S., DE JONG, E., CALLENS, B., STRUBBE, M., MAES, D. and DEWULF, J. 2013. Relationship between biosecurity and production/antimicrobial treatment characteristics in pig herds. *Vet. J.*, 198(2): 508–512.

MAES, D, SEGALES, J, MEYNS, T, SIBILA, M, PIETERS, M. and HAESEBROUCK, F. 2008. Control of Mycoplasma hyopneumoniae infections in pigs. *Vet. Microbiol.*, 126(4): 297–309.

MILLIGAN, B. N., DAVEY, C. E. and DE GRAU, A. F. 2002. Neonatal-piglet weight variation and its relation to preweaning mortality and weight gain in commercial farms. *Prev. Vet. Med.*, 56(1): 119–127.

OLANRATMANEE, E., KUNAVONGKRIT, A. and TUMMARUK, P. 2010. Impact of porcine epidemic diarrhoea virus infection at different periods of pregnancy on subsequent reproductive performance in gilts and sows. *Anim. Reprod. Sci.*, 122(1–2): 42–51.

OPRIESSNIG, T., GIMENEZ-LIROLA, L. G. and HALBUR, P. G., 2011. Polymicrobial respiratory disease in pigs. *Anim. Health Res. Reviews*, 12(2): 133–148.

ROCA, J., CARVAJAL, G., LUCAS, X., VAZQUEZ, J. M. and MARTINEZ, E. A. 2003. Fertility of weaned sows after deep intrauterine insemination with a reduced number of frozen-thawed spermatozoa. *Theriogenology*, 60(1): 77–87.

SIMMINS, P. H. 1993. Reproductive performance of sows entering stable and dynamic groups after mating. *Anim. Prod. Sci.*, 57(2): 293–298.

SMITH, A. L., STALDER, K. J., SERENIUS, T. V., BAAS, T. J. and MABRY, J. W. 2008. Effect of weaning age on nursery pig and sow reproductive performance. *J. Swine Health Prod.*, 16(3): 131–137.

TODD, M. 2006. Obtaining optimal reproductive efficiency. *Swine News*, 29(1): 1–4.

TOWN, S. C., PATTERSON, J. L., PEREIRA, C. Z., GOURLEY, G. and FOXCROFT, G. R., 2005. Embryonic and foetal development in a commercial dam-line genotype. *Anim. Rep. Sci.*, 85: 301–316.

VON DER LAGE, A. and HOY, S. 2008. Leistungsaspekte der Repopulation von Sauenanlagen. *Tierärztl Umschau*, 63: 79–84.

WOLF, J., ŽÁKOVÁ, E. and GROENEVELD, E., 2008. Within-litter variation of birth weight in hyperprolific Czech Large White sows and its relation to litter size traits, stillborn piglets and losses until weaning. *Livest. Sci.*, 115(2): 195–205.

XUE, J. L., LUCIA, T., KOKETSU, Y., DIAL, G. D. and MARSH, W. E. 1998. Effect of mating frequency and weaning-to-mating interval on sow reproductive performance. *J. Swine Health Prod.*, 6(4): 157–162.

YIN, S. H., XIAO, C. H., GERBER, P. F., BEACH, N. M., MENG, X. J., HALBUR, P. G. and OPRIESSNIG, T. 2013. Concurrent porcine circovirus type 2a (PCV2a) or PCV2b infection increases the rate of amino acid mutations of porcine reproductive and respiratory syndrome virus (PRRSV) during serial passages in pigs. *Virus Res.*, 178(2): 445–451.

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