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Original Paper

Influence of the breeding environment factors on the number of the weaned piglets

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A prerequisite for the successful pig breeding isthe achievement of high reproductive performance, which can be influenced by several environmental factors. Therefore, the aim of our research was to assess the impact of the season, microclimatic indicators and technology of housing of the lactating sows on the number of the weaned piglets in the litter. The experiment was performed on a production farm in Slovakia and a total of 800 litters were evaluated. The results have shown that the season had a statistically significant effect on the number of the weaned piglets (p <0.01), least in the summer and most of them in the fall. The highest number of the weaned piglets was found at the temperatures from 18 to 22 °C (p <0.05), temperatures outside the stated range had a negative impact on the number of the weaned piglets. An increase of the relative humidity – above 70% (p <0.05) and an increase in the flow – above 0,4 m/s (p <0.05) led to a decrease in the number of the weaned piglets. In the housing with a freemovement of the lactating sows, the number of the weaned piglets was higher than with the restricted movement (p <0.05).

Keywords: microclimate, technology, weaned piglets

1 Introduction

In terms of the microclimate requirements, pigs are considered the most demanding farm animals (Matoušek et al., 2013). The demands of pigs can be secured by a optimal heat balance of the stables, by an adequate density of the pens´ occupation, functional ventilation equipment, nursing care and the proper hygiene (Novák and Rožňovský, 2009). The prosperity of breeding and production of the weaned piglets is influenced by many factors, including the technologies used (Horký, 2014) and the latest feeding practices (Rolinec et al., 2020). The technologies used should, in addition to saving the energy, feed, and labor, create suitable breeding conditions (Rodríguez et al., 2012). Modern technologies used in the sow breeding lead to the improved reproductive performance of the sows (Nevrkla et al., 2016). The aim of the sow breeding is to achieve profit through the production of piglets, which is evaluated by the number of the weaned piglets (Boudný and Špička, 2012). Also according to Vanderhaeghe et al. (2010), the number of the weaned piglets is the most important indicator of the sow performance. The aim of the experiment was to assess the influence of the season, microclimatic conditions and the housing technology on the number of the weaned piglets.

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2 Material and methods

2.1 Biological Material

The number of the weaned piglets was monitored on a farm in Slovakia, which is focused on the production of the utility hybrid LW × PIC (LW – sow, PIC – boars). In the experiment, a total of 800 litters were evaluated. Litters were evaluated after 2nd to 5th farrowing.

2.2 Experimental design

The experiment was conducted in the years 2016–2018. The influence of the season, temperature, relative humidity, air flow and housing technology were monitored. The division into groups was as follows: Seasons: Spring: from 21st March – 20th June, Summer: from 21st June – 22nd September, Autumn: from 23rd September–21st December, Winter: from 22nd December – 20th March; Temperature: from 14 °C to 17 °C, from 18 °C to 22 °C, from 23 °C to 26 °C; Relative humidity: from 60% to 70%, from 71% to 80 %, from 81% to 90%; Air flow: from 0.20 m/s to 0.40 m/s, from 0.41 m/s to 0.60 m/s, from 0.61 m/s to 0.8 m/s; The lactating sow housing technology: with the permanently restricted movement and with the free movement.

Environmental parameters (temperature, humidity and air flow) were evaluated during lactation period of the sows (from birth to weaning of piglets on average after 28 days).Sows with the permanently restricted movement were housed in the standard pens of about 1.5 × 1.8 m with metal farrowing crate with adjustable dimensions. The pens contained heating area for piglets. Sows with the free movement were housed in the large multi-suckling pens of about 5 × 4 m. Four sows were grouped already before farrowing in this pens. The pens contained separated heated area for piglets.

2.3 Statistical analysis

The results were analyzed in the IBM SPSS Statistics 20 Programme. In order to evaluate the effect of individual factors on the number of the weaned piglets, the Analysis of Variance (ANOVA), with the contrast testing by means of the Scheffe test at a significance level of $p < 0.05$, was used.

3 Results and discussion

The influence of the monitored factors of the breeding environment on the number of the weaned piglets is shown in Table 1. The season had a statistically significant effect on the number of the weaned piglets ($p < 0.01$). According to Prunier et al. (1996), deterioration of the reproductive indicators is attributed to the effect of higher temperatures in the summer months. A negative influence of the high temperature affects the reproductive properties of sows either by acting on the ovarian function directly, or through the hypothalamic-pituitary-ovarian axis (Suriyasomboon et al., 2006). The claims of the mentioned authors correspond to the results of our experiment, because the lowest number of the weaned piglets was found in the summer season. In the autumn period (the highest number of the weaned pigs), there were 1.6 piglets in the litter more than in the summer season ($p < 0.05$). The number of the weaned piglets in the spring and in the winter was similar. In contrast to our results, Wegner et al. (2014) found the highest number of the weaned piglets in the spring and the lowest number in the autumn season ($p < 0.05$), they have not found any significant difference between the summer and winter seasons.

Significantly the highest number of the weaned piglets was found at the temperatures from 18 to 22 °C ($p < 0.05$). The environment temperature below 18 °C led to a reduction in the number of the weaned piglets by 1.4 pieces and the temperature above 22 °C to a reduction by 1.2 pieces. According to Myer and Bucklin (2018), an acceptable temperature range for the lactating sows is from 13 to 27 °C, while the negative effect of the heat stress begins to manifest itself already at the temperatures above 20 °C. Wegner et al. (2014) have found a negative effect of the higher temperature on the number of the live-born piglets before in the prenatal period. In our experiment, this could also have been the reason for the reduction in the number of the weaned piglets at higher temperatures. In contrast, low temperatures negatively affected the survival of piglets, which also led to a decrease in the number of the weaned piglets, as the optimal temperature for the piglets weighing from 2 to 5 kg is in the range from 27 to 32 °C (Myer and Bucklin, 2018). The results of the experiment showed that the most suitable humidity in the housing of the lactating sows with the piglets was in the range from 60% to 70%. A significantly lower number of the weaned piglets was recorded ($p < 0.05$) at a higher humidity. Wegner et al. (2014) has found that higher values of THI (thermo-humidity

index) in the prenatal period reduce the number of the live-born piglets. A negative influence of the high temperature and a relative humidity, resp. their combinations for the sow litter size, were also reported by Suriyasomboon et al. (2006). As the air velocity increased, there was a demonstrable decrease in the number of the weaned piglets in the litter (p <0.01). Increasing the air velocity leads to the increased heat output from the surface of the animal's body, whereas the rate of increase in the heat loss depends on the body weight, group size and the duration of action (Sällvik and Walberg, 1984). For the lactating sows, higher airflow values might be an advantage in terms of cooling at high ambient temperatures. However, young pigs are more sensitive to changes in air movement than the older ones (Holmes and Mount, 1967). Excessive cooling of the stables may occur at the high airflow values. Cold environment worsens the development of thermostability and causes a hypothermia of the piglets. Their vitality, colostrum intake, and thus the immunoglobulins deteriorate. Therefore, piglets may have an increased incidence of the diseases (Close 1992).

Table 1 Comparison of the influence of the environmental factors on the number of the weaned pigs

Factor		Number of litters (n)	Weaned piglets ($x \pm s$)	Significance
Season	spring	179	9.7 ±2.2^{b}	**
	summer	217	8.5 ±1.8^{c}	
	autumn	206	10.1 ±1.5^{a}	
	winter	198	9.3 ±1.9^{b}	
Temperature	14 to 17 °C	289	8.4 ±1.9^{b}	*
	18 to 22 °C	243	9.8 ±2.1^{a}	
	23 to 26 °C	268	8.6 ±1.5^{b}	
Relative humidity	60 to70%	256	10.1 ±1.5^{a}	*
	71 to 80%	302	9.1 ±1.4^{b}	
	81 to 90%	247	9.4 ±0.9^{b}	
Air flow	0.2 to 0.4 m/s	386	9.3 ±2.2^{a}	**
	0.41 až 0.6 m/s	247	8.4 ±1.6^{b}	
	0.61 až 0.8 m/s	167	7.2 ±1.3^{c}	
Technology	limited movement	492	8.7 ±1.5^{b}	*
	free movement	308	9.8 ±1.9^{a}	

$x \pm s$: mean ±standard deviation, **: p <0.01, *: p <0.05, different letters in the column indicate significant differences among the mean values (p <0.05)

There was a significantly higher number of the weaned piglets per litter (+1.1 pieces) in the housing with a free movement of the lactating sows, compared to the limited movement (p <0.05). Originally, the farrowing crates for sows were introduced for the purpose to control the movement of the sows during lactation and thus to reduce the mortality of the newborn piglets (English and Edwards, 1996). However, lack of the welfare in the way of housing can lead to the serious consequences for the reproductive performance of sows (Silva et al., 2006). According to Rozkot (2014), most deaths of the piglets take place during the first days after farrowing, which means that the sow does not have to be restricted in movement during the whole lactation period. The results of our experiment have also shown that the sows with a higher level of welfare achieved a higher reproductive performance.

4 Conclusions

It can be stated from the results that there were seasonal changes in the reproductive performance, whereas the smallest number of the weaned piglets per litter was monitored in the summer. It is necessary to maintain the suitable microclimatic conditions in the housing, as the increase of the temperature above 22 °C, resp. decrease below 18 °C, increase in the relative humidity above 70% and increase in the flow above 0.4 m/s, led to a decrease in the number of the weaned piglets. Allowing the sow to move freely near piglets had a positive effect on the reproductive performance.

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References

Boudný, J. and Špička, J. (2012). The effect of production efficiency on economic results in pig breeding. *Res. Pig Breeding*, 6(1), 1–8.

Close, W. (1992). Thermoregulation in piglets: Environmental and metabolic consequences. *BSAP Occasional Publication*,15, 25–33. https://doi.org/10.1017/S0263967X00004067

English, P. R. and Edwards, S. A. (1996). Management of the nursing sow and her litter. In Dunkin A. C. and Taverner, M. (eds.). *Pig Production. World Animal Science* (Vol. C10). Amsterdam, Netherlands: Elsevier (pp. 113–140).

Holmes, C. W. and Mount, L. E. (1967). Heat loss from groups of growing pigs under various conditions of environmental temperature and air movement. *J. Anim. Prod*., 9, 435–452. https://doi.org/10.1017/S0003356100042008

Horký, P. (2014). Influence of increased dietary selenium on glutathione peroxidase activity and glutathione concentration in erythrocytes of lactating sows. *Ann. Anim. Scie*., 14(4), 869–882. https://doi.org/10.2478/aoas-2014-0056

Matoušek, V. et al. (2013). *Livestock breeding II.* České Budějovice: JU ZF. In Czech.

Myer, R. and Bucklin, R. (2018). Influence of hot-humid environment on growth performance and reproduction of swine. *AN107: UF/IFAS Extension*, 1–6.

Nevrkla, P. et al. (2016). analysis of reproductive parameters in sows with regard to their health status. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 64, 481–486. https://doi.org/10.11118/actaun201664020481

Novák, P. and Rožňovský, J. (2009). Influence of microclimate on the pig performance. In *Current knowledge about the pig breeding: proceedings from the International Scientific Conference 41 held on the occasion of the 90th anniversary of MZLU in Brno*. Brno: MZLU (pp. 45–48). In Czech.

Prunier, A. et al. (1996). Environmental and seasonal influences on the return-to-oestrus after weaning in primiparous sows. *Livestock Production Science*, 45, 103–110. https://doi.org/10.1016/0301-6226(96)00007-3

Rodrígues, S. V., Plà, L. M. and Albornoz, V. M. (2012). Modeling tactical planning decisions through a linear optimization model in sow farms. *Livest. Sci*., 143(2–3), 162–171.

Rolinec, M. (2020). The Effect of coconut oil addition to feed of pigs on rectal microbial diversity and bacterial abundance. *Animals (Basel)*, 10(10), E1764. https://doi.org/10.3390/ani10101764

Rozkot, M. (2014). Pigs technology and the public. *Náš chov*, 74(10), 63–66. In Czech.

Sällvik, K. and Walberg, K. (1984). The effects of air velocity and temperature on the behaviour and growth of pigs. *J. of Agricultural Engineering. Research*, 30, 305–312. https://doi.org/10.1016/S0021-8634(84)80031-1

Silva, B. A. N. et al. (2006). Effect of floor cooling on performance of lactating sows during summer. *Livest. Sci*., 105, 176–184. https://doi.org/10.1016/j.livsci.2006.06.007

Suriyasomboon, A. et al. (2006). Effect of temperature and humidity on reproductive performance of crossbred sows in Thailand. *Theriogenology*, 65, 606–628. https://doi.org/10.1016/j.theriogenology.2005.06.005

Vanerhaeghe, C. et al. (2010). Longitudinal field study to assess sow level risk factors associated with stillborn piglets. *Anim. Reprod. Sci*., 120(1–4), 78–83. https://doi.org/10.1016/j.anireprosci.2010.02.010

Wegner, K. et al. (2014). Climatic effects on sow fertility and piglet survival under influence of a moderate climate. *Animal*, 8(9), 1526–1533. https://doi.org/10.1017/S1751731114001219