

Effect of season of birth of Polish Large White and Polish Landrace sows on the number of born and reared piglets

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The aim of the work was to determine the effect of the period (half-a-year, quarter, month) of birth of the sows on the obtained reproduction parameters, the number of piglets born (PBN) and the number of piglets reared until the age of 21 days (PRN). The research material included the results of reproduction performance of the sows, utilized in pedigree herds of Polish Large White (1048 records) and Polish Landrace (1791 records) breeds in the years 2004-2009 in the Mazovian Voivodeship. The tendencies in respect of effect of the season of the sows' birth on the analyzed indicators were observed. Any significant effect of month, season and half-a-year of birth of PLW and PL sows in the analyzed area and period of sow performance was not, however, found, what indicates that unification of the conditions of sow management in pig houses equalizes the seasonal effects on basic reproduction parameters.

KEY WORDS: sows / season of sows' birth / reproduction parameters

Production efficiency of pigs is determined by many factors, including the levels of reproduction performance traits in sows and piglet rearing indexes [2, 10]. In contrast to their wild ancestors, domestic pigs are polyoestrous; however, in the summer and early autumn values of reproduction indexes decrease [11, 20]. When the day length is extended and ambient temperature is higher, the number of empty days increases, oestrus is not markedly manifested, farrowing rate deteriorates and return to oestrus is more common [10, 11, 16, 17, 18, 19, 20].

A major cause for inferior fertility of sows in the summer period is believed to be connected with lower feed intake, which is the effect of decreased appetite observed at overheating of animals. The predominance of catabolic metabolism over anabolic metabolism results in a loss of fat and protein reserves of the organism, a disadvantageous change in

body condition and disturbed endocrine function, including e.g. a lower concentration of luteinizing hormone LH [3]. The underlying causes for deterioration in fertility and reduced sexual activity of sows, i.e. the summer infertility syndrome (SIS), are connected with atavistic past signals and high ambient temperature. Overheating causes a decrease in the ovulation rate and conception rate, deterioration of embryo viability, corpus luteum dysfunction, abnormal embryo development and increased mortality [11, 20].

Continuity and/or seasonality of reproduction are also determined by changes in the photoperiod. Light stimuli affect the production of gonadotropins, follicle-stimulating hormone (FSH) and LH, responsible for follicle and oocyte maturation, ovulation and progesterone synthesis. In early summer FSH and LH levels decrease, while in autumn they increase; additionally, the shortening day time causes changes in the secretion and the diurnal profile of melatonin, controlling the secretion of gonadotropins [11, 20].

Górecki [6] stressed the fact that sows which farrowed in the period from September to February gave birth to litters with higher shares of boar piglets than gilts, in contrast to those farrowing in the period of March to August. Studies also confirmed a theory suggesting e.g. that sows born between September and February produce less numerous litters with the predominant share of boar piglets. This theory leads to a hypothesis indicating a potential effect of season of birth of the sow on levels of basic reproduction indexes.

The aim of this study was to determine the effect of the month, season (quarter and half-year) of birth of Polish Large White and Polish Landrace sows on the number of piglets born in the litter and reared to the age of 21 days.

Materials and methods

Material for analyses comprised reproduction performance records of sows utilised in nucleus herds of the Polish Large White (a total of 1048 records) and the Polish Landrace breeds (1791 records) in the years 2004-2009 in the Mazowieckie province. Analyses were conducted on the number of piglets born in the litter and the number of piglets in the litter reared to day 21 of life depending on the month, quarter and half-year of sows' birth. The monthly lists comprised consecutive calendar months (January-December), quarterly lists distinguished the seasons: winter (Z) – December, January, February; spring (W) – March, April, May; summer (L) – June, July, August; and autumn (J) – September, October, November). The half-year periods were two: autumn-winter (September-February) and spring-summer (March-August).

The collected material was analysed statistically. A one-way analysis of variance was conducted (SPSS 2006), with the month, season and half-year of the sow's birth being the experimental factors. The tables present mean values for traits (\bar{x}) with their standard errors (Se).

Results and discussion

Tables 1-3 present reproduction performance of sows, i.e. mean numbers of piglets born in the litter and reared to day 21 in terms of individual months, quarters and half-years.

PLW sows born in March had the highest mean number of piglets born in the litter, while it was lowest for sows born in July (4.19% difference, Table 1). For sows born in March the mean number of weaned piglets was also highest and it was lowest for those born in May (3.62% difference). In PLW the highest mean number of piglets born in the litter was recorded for sows born in February and the lowest for those born in May (4.89% difference). The highest numbers of piglets born in the litter (exceeding the mean) were found for PLW sows born in January, March, September-December, while in PL – for sows born in February-April, July and September-December. The numbers of piglets born and reared did not differ significantly ($P>0.05$) for sows born in the months January-December.

Slight differences were recorded in mean numbers of piglets born and weaned in the litter depending on the season of sows' birth (Table 2). Mean numbers of piglets in the litter liveborn and reared to day 21 were highest in PLW sows born in the winter season and

Table 1

Mean number of piglets born and reared until 21 day by Polish Large White and Polish Landrace sows according to their month of birth

Breed	Monthly period	n	Piglets born (x)	Se	Piglets on 21. day (x)	Se
PLW	I	91	11.68	0.140	10.60	0.123
	II	85	11.50	0.145	10.52	0.127
	III	92	11.70	0.139	10.76	0.122
	IV	118	11.49	0.123	10.47	0.108
	V	82	11.41	0.147	10.37	0.129
	VI	81	11.52	0.148	10.41	0.130
	VII	96	11.21	0.136	10.38	0.120
	VIII	90	11.48	0.141	10.58	0.124
	IX	87	11.53	0.143	10.50	0.126
	X	98	11.58	0.135	10.46	0.118
	XI	67	11.58	0.163	10.52	0.143
	XII	61	11.60	0.171	10.52	0.150
	I-XII	Σ 1048	11.52		10.50	
PL	I	187	11.35	0.102	10.36	0.093
	II	121	11.65	0.127	10.59	0.116
	III	191	11.40	0.101	10.41	0.092
	IV	165	11.45	0.109	10.51	0.099
	V	149	11.08	0.114	10.11	0.105
	VI	182	11.29	0.103	10.37	0.095
	VII	172	11.40	0.106	10.44	0.097
	VIII	181	11.22	0.104	10.28	0.095
	IX	145	11.39	0.116	10.38	0.106
	X	127	11.47	0.124	10.37	0.113
	XI	82	11.42	0.154	10.50	0.141
	XII	89	11.49	0.148	10.50	0.135
	I-XII	Σ 1791	11.37		10.39	

Table 2

Mean number of piglets born and reared until 21 day by the Polish Large White and Polish Landrace sows according to their season of birth

Breed	Quarterly period	n	Piglets born (x)	Se	Piglets on 21. day (x)	Se
PLW	Z	176	11.59	0.101	10.56	0.088
	W	292	11.54	0.078	10.53	0.069
	L	267	11.39	0.082	10.46	0.072
	J	313	11.57	0.075	10.50	0.066
		Σ 1048	11.52		10.51	
PL	Z	397	11.47	0.070	10.46	0.064
	W	505	11.32	0.062	10.36	0.057
	L	535	11.30	0.060	10.37	0.055
	J	354	11.43	0.074	10.40	0.068
		Σ 1791	11.37		10.39	

Z – winter period (December-February); W – spring season (March-May); L – summer season (June-August); J – autumn season (September-November)

they were lowest for those born in the summer season. Differences for the analysed indexes, depending on the season of sows' birth (Z vs. L), amounted to 1.72% and 0.95%, respectively. For PL the highest number of liveborn piglets was also recorded for sows born in the winter season and the lowest - for those born in the summer season (1.48% difference). The mean number of piglets reared in the litter was best in the case of sows born in winter and worst in those born in spring (0.96% difference). The lowest fertility was observed in PLW and PL sows born in the summer season. No significant effect ($P > 0.05$) of the season of dam's birth was observed in either of the breeds in the numbers of piglets liveborn or reared in the litter over the analysed 5-year period.

A comparison of the results in terms of half-years showed their slight variation (tab. 3). Mean numbers of piglets born in the litter and reared to day 21 were greater in sows, which were born in the autumn-winter half-year (PLW – 1.03% and 0.19%; PL – 1.22% and 0.67%). However, these results were not confirmed statistically ($P > 0.05$).

There are no studies in available literature, in which the analyses of reproduction performance of sows were directly connected with environmental factors (light and length of day time, temperature and other microclimate parameters of the external environment – outside the piggery, and the piggery building environment – the internal environment), to which they were exposed in the fetal life (the prenatal stage of fetal growth and development) and after birth (the postnatal stage), and next in the maternal nursing period and in the successive stages of rearing of future dams. There are no such studies on pigs covering several generations over a longer period. As a consequence it was difficult to analyse and discuss presented results.

In ancestors of domestic pigs, i.e. monoestrous wild boars, the reproductive cycle is connected with the birth of piglets in the spring months, when their survival is more certain

Table 3

Mean number of piglets born and reared until 21 day by Polish Large White and Polish Landrace sows according to a half-a-year of their birth

Breed	Half-a-year period	n	Piglets born (x)	Se	Piglets on 21 day (x)	Se
PLW	1	489	11.58	0.060	10.52	0.053
	2	559	11.46	0.056	10.50	0.050
		Σ 1048	11.52		10.51	
PL	1	751	11.45	0.051	10.43	0.047
	2	1040	11.31	0.043	10.36	0.040
		Σ 1791	11.37		10.39	

1 – autumn-winter period (September-February); 2 – spring-summer period (March- August)

than in the winter period [17]. This means that a vast majority of females – future dams are born in the spring period, i.e. in March or April. As a result of domestication pigs are polyoestrous animals. This determines the continuity of reproduction events and relatively uniform distribution of farrowing throughout the year. Consequently all females utilised in reproduction (replacement gilts, primiparous and multiparous sows) were born throughout the year, in all the months. This phenomenon refers to analysed animals; nevertheless, the smallest number of observations for sows of both breeds was recorded in November and December. Analysis of seasonal data showed the lowest number of observations for PLW from the winter season of sows' birth, while the number was highest for the autumn season. For PL sows these dependencies were different, as the lowest numbers were recorded for sows born in the autumn and the highest in the summer season.

The season and ambient temperature have an effect on the course of reproduction events and reproduction indexes in sows. A deteriorating reproduction performance in the summer period is reported in many piggeries in various countries [4, 14, 16, 18] and it coincides with the seasonal *anestrus* in the wild boar [21]. Environmental factors such as temperature, lighting and length of day time play an important role in the occurrence of SIS [4, 21]. In the summer period sows' oestrus is delayed, the farrowing rate is lower and the average litter size is smaller [21]. At the strict selection of replacement gilts used in herds of maternal breeds the number of females constituting replacement material is decreasing. The above-mentioned number of sows born in November and December analysed by the authors confirms this finding. Additionally, in the case of the autumn abortion syndrome observed in herds of sows, spontaneous abortions occur at an early stage of pregnancy, between weeks 5 and 7. This phenomenon extended in time is caused by a high amplitude of temperatures between day and night in the pig housing facilities, while the underlying cause for litter loss is connected with disturbed endocrine function in pregnant sows.

A major sign of the effect of seasons of the year on reproduction is connected with the length of the interval between weaning and oestrus. Most females go in oestrus within 10 days after their piglets have been weaned, typically after 4-7 days. Research results indi-

cate that this period is longer in warm months, particularly in primiparous animals [5, 19, 21, 22]. In sows exposed to high temperatures oestrus occurs as late as even 21 days after weaning of their litter. In such sows higher cortisol and beta-endorphin concentrations and lower LH concentrations are recorded [12]. Post-slaughter analyses show a high percentage of females with inactive ovaries in July and August [13]. In the summer sows exposed to higher temperatures exhibit a reduced production of progesterone and lower numbers of antral follicles on ovaries, while the farrowing index decreases below 90% [1, 7].

Oestrus intensity depends on the season of the year, as its symptoms are most evident in the winter. Ineffective oestrus detection is a major cause contributing to a reduced farrowing rate (by 15%) and decreased numbers of piglets born in the litter (by 0.6 head) [15]. In the late autumn and early winter (e.g. in November) service efficiency is higher; thus, the farrowing rate and litter size are also improved, being more advantageous than in the summer [16]. The sexual maturation of gilts is also dependent on the season of the year. Research results show that gilts born in the spring mature at a later age than those born in the autumn [8]. This is caused by decreased FSH and LH secretion in the early summer.

Jarczyk and Nogaj [9] were of an opinion that spring and summer seasons of sows' birth have a desirable effect on their reproduction performance and lifetime productivity. This is not confirmed by the results of this study, in which the autumn and winter seasons are advantageous, at a very low variation of results for the four analysed periods. The cited authors investigated the numbers of piglets born in the litter and reared to day 21 depending on the season of sows' birth. The largest number of piglets born on farm A was recorded in the autumn season (10.81 head), while on farm B it was in the summer season (11.69 head), with the values differing significantly ($P \leq 0.05$) from sow fertility on that farm in the autumn and winter seasons. The lowest sow fertility was observed on farm A in the winter season (10.58 head). Similarly, low values of this index were recorded in the winter for sows from farm B (11.25 head). Results reported by Jarczyk and Nogaj [9] indicate the effect of the season on the number of piglets born and reared in the litter as well as the length of productive life of sows, which is manifested in the number of produced litters.

It needs to be stressed that analyses conducted both within this study and by other authors [9] are important for animal production practice. They may be a source of information to be used when selecting gilts as future dams. Slightly better reproduction performance found in this study for sows born in the winter and spring seasons, although not confirmed statistically, indicates such potential. This problem requires further studies, since available literature on the subject shows such a relationship only in the case of a very small population of *Złotnicka* pigs [6].

Summing up we may state that these trends for the effect of the season of sows' birth on the analysed reproduction indexes indicate the need to continue research on the subject. No significant effect of the month, season and half-year of birth was shown for PL and PLW sows in terms of the numbers of piglets born and reared in the litter in the investigated region and utilisation period of those sows, suggesting that standardised sow management conditions in piggeries eliminate seasonal effects on basic reproduction indexes.

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