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EFFECTS OF THE PHOTOPERIODICITY ON THE REPRODUCTION IN SOW. II-EFFECTS ON THE ESTROUS CYCLE, PREGNANCY LENGTH AND TOTAL BORN PIGLETS

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Abstract

In the frame of this paper it was researched the relationship between season and some reproductive parameters (oestrus length, pregnancy length and total born piglets) in primiparous and multiparous sows in terms of the photoperiodicity climate in Romania. The research was conducted on a crossbred Yorkshire sows (♀) × Landrace (♂) sow population and consisted of monitoring the oestrus duration, the gestation period and the number of total born piglets related to astronomical seasons: fall, winter, spring and summer. They were found seasonal influences characterized by a longer gestation length in autumn and spring seasons vs. summer and winter, with a difference of about one day between the seasons, and an annual average difference of about one day between primiparous and multiparous sows. Gestation length was inversely correlated with total born piglets. The oestrus length had an annual average of about 2.16 days in primiparous and 2.98 days in multiparous sows, with peak values in seasons of growing photoperiodicity and minimum values in seasons of decreasing photoperiodicity.

Key words: season photoperiodicity, estrous length, pregnancy length, sow.

INTRODUCTION

Estrous and pregnancy in the sow could be influenced by a series of factors, among them photoperiodic seasonal influence could be important to take into account by the pig commercial managers. Year season photoperiodicity is well-known as complex factor of influence on the reproduction in many species. Scientific data acknowledge a period of reduction of reproductive performance in sows during late summer and early autumn and a growing in late autumn and early winter (Karveliene *et al*., 2008; Peltoniemi *et al*., 2000; Sandru *et al*., 2012; Tummaruk *et al*., 2000). The parity seems to be another influencing factor on the reproductive parameters: studies showed that the month of weaning had a greater influence on weaning-to-estrous interval in primipary sows compared to multipary sows (Hurtgen *et al*.; 1980, Untaru *et al*., 2011). The aim of this study was to investigate the season photoperiodiciy influences on the estrous cycle and gestation length in sows raised during the four annual season, which are different by photoperiodicity and some other environmental factors in the temperate climate of South Romania.

MATERIALS AND METHODS

Researches were performed on 481 cap. DAN BREED crossbred Yorkshire (♀)×Landrace (♂) population sows sourced from Denmark in 2012, belonging to a commercial ranch from Southern Romania. Both, primiparous (gilts) and multiparous (sows) females were monitored for the length of the estrous and gestation periods, during the four annual seasons. The

animals were raised under natural light conditions and the inner temperature of the stables ranged between the thermic neutrality limits. Estrus diagnosis was performed on the base of clinical, morphological and behavioral signs of the monitored sows, two times a day: in the mornings and afternoons, according to Belstra *et al*., 2004, Seiciu *et al*., 1989, and Voicescu *et al*., 1996. The farm practices the weekly breeding system. Thus, every week, a number of 32 LY sows are artificially inseminated by Duroc sperm, resulting in meat pig. The LY population sow is maintained by mating YY sows × Landrace. The piglets are weaned at 25-26 days of age (on Thursdays). Then the mother-sows are separated from weaned piglets and individually housed, being mated at estrous. Weaning-to-estrous interval lasts 4-6 days. The gilts are mated at 31-33 weeks of age. Pregnancy diagnosis is done at 25-28 days from mating. Pregnant sows are transferred in free-access pens. Last Friday of the pregnancy period, the pregnant sows are transferred in maternity for delivery. Farrowing take place from Friday evening until Sunday, so they are grouped. They induce a synchronization of farrowings: Thursday morning at 8 o'clock, 0.7 mL cloprostenol is i.m. injected and the farrowing starts in 24±5 hours. Pergnancy length was measured form the date of the last artifical mating to the day of farrowing. Researches were performed on a total number of 191 primiprous sows and 290 multiparous sows. The data were recorded electronically in double system, both by technological staff of the farm, and directly, by the research team, on a farm software, as illustrated in Table 1.

Table 1. The record pattern of pregnancy period in a farm where they have been monitored seasonal influences on the duration of gestation period

No.	Animal number	Location	Status	Last service	Last weaning	Farrowing date
1	7155 LY	Gestație 12	Pregnant	16.09.2014	11.09.2014	09.01. 2015
2	7114 LY	Gestație 12	Pregnant	16.09.2014	11.09.2014	09.01. 2015
3	6229 LY	Gestație 12	Pregnant	16.09.2014	11.09.2014	09.01. 2015
4	7129 LY	Gestație 12	Pregnant	16.09.2014	11.09.2014	09.01. 2015
5	6266 LY	Gestație 12	Pregnant	16.09.2014	11.09.2014	09.01. 2015
6	6364 LY	Gestație 12	Pregnant	16.09.2014	11.09.2014	09.01. 2015
7	6214 LY	Gestație 12	Pregnant	16.09.2014	11.09.2014	09.01. 2015

The collected data were statistically analyzed and the results were compared by ANOVA mono/multifactorial factors using a commercial soft (Statistica). The significance was stated for $P<0.05$. When any statistical significant differences between the groups were found, the Tukey post hot test was performed. The data are presented as mean standard error of mean ($\bar{X} \pm s_{\bar{x}}$).

RESULTS AND DISCUSSIONS

The results regarding the monitoring of the estrous length (in days) are presented in Table 1. According to the data from Table 1, estrous length increased from the primiparous to multiparous sows. Thus, in primiparous sows, the annual average estrous length was 2.43 days, increasing to 3.06 days in multiparous, which represents an increase of 25.9%. This increase was highest in percentage terms in winter and autumn seasons compared to the spring and summer. The values of the estrous length were lowering in primiparous vs. multiparus sows for all the four monitored seasons. The greatest increase of the estrous length was found for the winter season (47.8%, $P = 0.0329$), followed by the autumn season. Belstra *et al*. (2003) found considerable variation in duration of estrous (range, 12 to 90 h; mean = 59.5) in 86 weaned sows. These authors found that sow genotype may be an important source of variation in duration of estrous but there is a weak negative correlation between weaning-to-estrous interval and duration of estrous, and no influence from parity or lactation length.

Table 2. Seasonal influences on the estrous length (in days) in a crossbred Yorkshire ×Landrace sow population along of the fours seasons during a year of monitoring

Item		Season			
		Dec.22nd – March 20th	March 21st – June 21st	June 22nd – Sep. 21st	Sept. 22nd - Dec. 21st
Primiparous	n	48	51	48	44
	$\bar{X}\pm s_{\bar{x}}$	1.84±0.54	2.83±0.90	2.92±1.04	2.16±0.66
Multiparous	n	63	67	81	79
	$\bar{X}\pm s_{\bar{x}}$	2.72±0.41	3.30±0.51	3.26±0.40	2.98±0.26
% of modification from the primiparous to multiparous sows		47.8	16.6	11.6	37.9
P		0.0329	0.0650	0.0511	0.9551

Legend: n = number of monitored animals

According to Petroman (2014), the season with the best results in oestrus symptoms was winter, followed by spring and autumn.

The lowest results were in the hot season, when oestrus is less intense in symptoms which makes farmers look for installing air-cooling and moisturizing devices.

It seems the season temperature must be in fact the main factor of estrus influence.

There are many authors who consider the season photoperiodicity the main factor which can be responsible for the differences of estrous length between the seasons (Peltoniemi *et al*., 2000; Kraeling and Webel, 2015; Ramirez *et al*., 2009; Tast *et al*., 2002).

According to Chokoe and Siebris, (2009), the most common manifestation of seasonal infertility encountered in the pig industry includes delayed puberty in gilts, prolonged weaning to oestrus interval, reduced farrowing rate and reduced litter size which occur more frequently during late summer and early autumn than in the winter-spring season.

The reason: during summer the levels of the follicle stimulating hormone and luteinizing hormone (main reproductive hormones) are low while in winter increased levels are observed.

It is generally accepted that plasma melatonin levels increase during the hours of darkness while light suppresses its synthesis and release from the pineal gland (Malpaux *et al*., 1988; 1999, cited by Chokoe and Siebris, 2009; Peltoniemi *et al*., 2000)

Table 2 shows the results of the monitoring of the pregnancy length in primiparous and multiparous sows along of fours seasons during a year.

According to the data presented in Table 2.11 in primiparous sows, the average length of gestation during four seasons amounts to 114.0 mean days while the average length of gestation in multiparous sows amounts to 115.17 mean days, representing a difference of 1.17 days (statistically significant, p = 0.0102 for primiparous × multiparous).

Season analysis evolution relieves that pregnancy length represented a descendent trend in primiparous sows, from the winter season toward the summer season of the next year: from 114.20 to 113.6 days.

In the case of the multiparous sows, the pregnancy length seems to have the same descendent trend on the same season succession: 116.6 → 115.7 days. ANOVA single factor statistic analysis relieved no significant differences between seasons, for both, primiparous sows (P = 0.184) and multiparous sows (P = 0.0592).

It is noted that pregnancy length correlates inversely with the number of litter in multiparous sows, at least to some extent, in the sense that a larger number of litter results in a certain shortening of the period of gestation.

Along with the number of litter and season, parity is another factor influencing the gestation period.

Data show that an average increase of 1.6 piglets per farrowing causes a decrease in the average day gestation period (when the total number is those presented, not being compulsory for any litter size).

Table 3. The results of the monitoring of the relationship between season and pregnancy period and total born piglets in gilts and sows ($\bar{X} \pm s_{\bar{x}}$)

Sow parity	Item	Season monitoring period				
		22nd Sept.-21st Dec.	22nd Dec-20th March	21st March-21st June	22nd June-21st Sept.	Annual mean
Primiparous	n	48	51	48	44	
	Days of pregnancy	114.2 ± 6.7	114.5 ± 3.8	113.8 ± 11.0	113.6 ± 9.9	114.0± 4.5 days
	Total born piglets	14.45 ±1.35	14.01 ± 1.45	13.14 ± 1.64	12.68 ± 1.39	13.56±1.26 cap.
Multiparous	n	63	67	81	79	
	Days of pregnancy	116.6 ± 6.0	116.4 ± 11.4	115.0 ± 8.0	115.7 ± 10.0	115.17± 3.88 days
	Total born piglets	15.81± 2.00	15.85 ± 2.15	14.51 ± 1.66	14.20 ± 2.80	15.09± 2.33

In primiparous, correlations between the number of litter and number of days of gestation are less obvious than in multiparous sows. Data regarding the correlation gestation length - season are ambiguous in some extent. There are presented many sow age-correlations (pregnancy length is lower in primiparous), total born piglets-correlations (lower length of pregnancy for sows farrowing more piglets) (Hughes and van Wettere, 2010; Kraeling and **Webel,** 2015), which generally correlates with our results on the studied crossbred (Yorkshire × Landrace). Summer seems to be the season of the lowest reproductive performances. Photoperiod is considered the primary environmental cue to seasonal infertility (Love *et al*., 1993) but a whole variety of other environmental factors seem to interact with season either to exacerbate or to alleviate this infertility (Peltoniemi *et al*., 2000). Peltoniemi *et al*. (1999, cited by Gourdine *et al*., 2006) concluded photoperiod as the primary environmental factor influencing the lower reproductive performance in summer.

CONCLUSIONS

In terms of annual seasonal photoperiodicity of Romania, the crossbred Landrace × Yorkshire support annual seasonal influences on reproductive parameters, some of them according to parity. Lowest-duration oestrus place in autumn. Longest-duration estrus run from winter to summer. The maximum duration of gestation is found throughout the winter, lowering during the spring and summer, with differences according to parity, but correlated with total born piglets.

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