

SEASONAL CHANGES OF BOARS SEMEN PRODUCTION

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Abstract

The present study was conducted to provide data on the seasonal effect on semen production parameters in the fertile hybrid AI boars 24 – 48 months old ($n = 1170$ ejaculates) in a period of 5 years. The boars were kept in the same housing, feeding and breeding conditions. The semen gel free volume and sperm concentration were determined immediately after the collection. The daily output of spermatozoa was calculated from the total number of spermatozoa per ejaculate and the length of sexual rest. The ejaculates were divided into four groups according to season period of the year: winter (1st – 3rd month), spring (4th – 6th month), summer (7th – 9th month) and autumn (10th – 12th month). Semen gel free volume was significantly the highest ($P < 0.001$) in autumn 355.08 ± 109.95 ml vs. 294.49 ± 94.27 ml in spring and 320.19 ± 86.22 ml in summer. Sperm concentration was significantly the lowest ($P < 0.001$) in summer and autumn $276.69 \pm 102.27 \times 10^3/\text{mm}^3$ and $278.37 \pm 108.04 \times 10^3/\text{mm}^3$ vs. $354.37 \pm 127.63 \times 10^3/\text{mm}^3$ in winter and $342.53 \pm 121.46 \times 10^3/\text{mm}^3$ in spring. Number of spermatozoa per ejaculate was significantly the lowest in summer $84.37 \pm 27.29 \times 10^9$ vs. $101.31 \pm 36.10 \times 10^9$ in winter ($P < 0.001$), $95.60 \pm 34.29 \times 10^9$ in spring ($P < 0.001$) and in autumn $94.05 \pm 34.95 \times 10^9$ ($P < 0.01$). The daily output of spermatozoa was significantly higher ($P < 0.05$) in autumn $14.84 \pm 6.22 \times 10^9$ vs. spring $13.58 \pm 4.97 \times 10^9$. The significantly negative effect of the hot climate stress on semen production traits of boars was determined in the Czech Republic climatic conditions.

Introduction

Seasonality is a considerable factor affecting reproduction in pigs because boars and swine are very sensitive to seasonal changes. Season has an important effect on semen traits. The environment of the boar is made up of many parts, but certainly includes temperature, light and handling (Buhr, 2001). The variations in high ambient temperature and humidity are regarded as important components causing variations in semen production and semen quality in boars. Heat may adversely affect spermatogenesis, causing a mild to moderate testicular degeneration. Several studies have shown that elevated ambient temperatures, heat stress and/or hot weather have an adverse effect on sperm production (McNitt et al., 1970; Colenbrander et al., 1993) and sperm morphology in boars (Larsson et al., 1984; Malmgren, 1989). Huhn et al. (1995) found that the number of hours of sunlight daily did not affect the reproductive traits, other than by its effect on temperature.

The present study was conducted to provide data on the seasonal effect on semen production parameters in the fertile hybrid AI boars in a period of 5 years.

Material and methods

We used 1170 ejaculates from 22 the fertile hybrid AI boars 24 – 48 months old in a period of 5 years. Boars were kept in the same housing, feeding and breeding conditions.

Ejaculates were collected by the gloved-hand technique. The semen gel free volume and sperm concentration were determined immediately after the collection. The sperm concentration was determined by means of spectrophotometric method.

The daily output of sperm cell was calculated from the total sperm output per ejaculate and the length of the previous collection interval.

These ejaculates were divided into four groups according to season period of the year: winter (1st – 3rd month), spring (4th – 6th month), summer (7th – 9th month) and autumn (10th – 12th month).

Basic statistical characteristics of the results, arithmetic means, standard deviations and significances (P) were obtained using the QC Expert program. The statistical significance was checked by the t-test at significance levels of $P < 0.05$, $P < 0.01$ and $P < 0.001$.

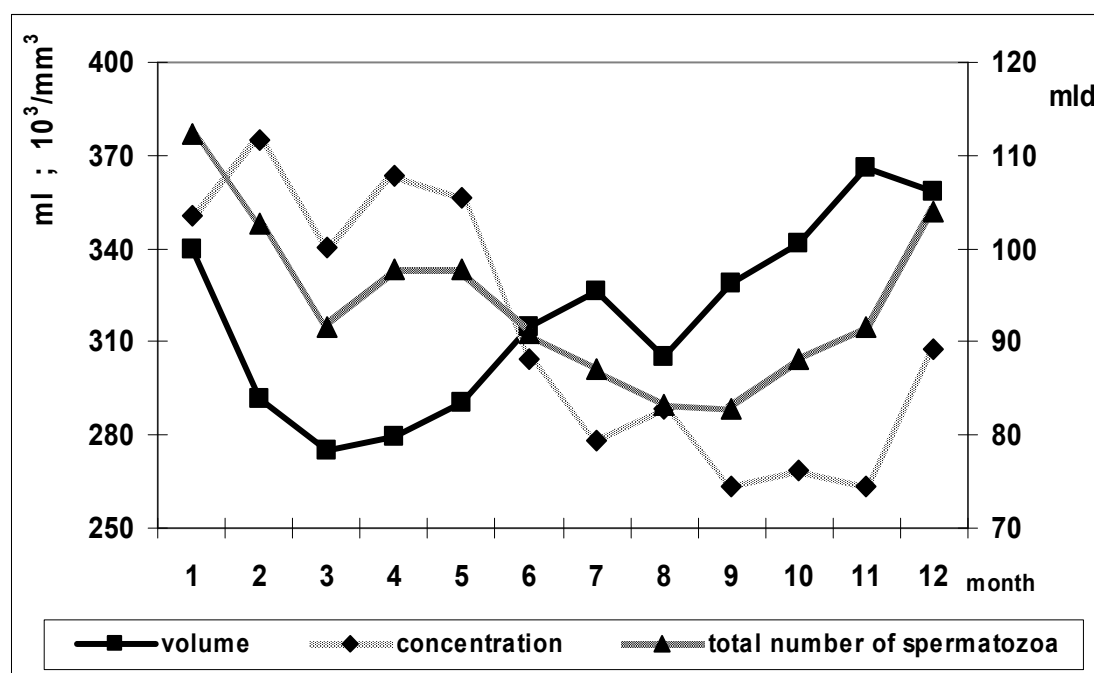
Results and discussion

A comparison of the results of semen production parameters according to season is presented in Table 1. There were no significant differences in the sexual rest whereas the other monitored parameters of semen production recorded significant differences. Semen gel free volume was significantly the highest ($P < 0.001$) in autumn 355.08 ± 109.95 ml vs. 294.49 ± 94.27 ml in spring and 320.19 ± 86.22 ml in summer. Sperm concentration was significantly the lowest ($P < 0.001$) in summer and autumn $276.69 \pm 102.27 \times 10^3/\text{mm}^3$ and $278.37 \pm 108.04 \times 10^3/\text{mm}^3$ vs. $354.37 \pm 127.63 \times 10^3/\text{mm}^3$ in winter and $342.53 \pm 121.46 \times 10^3/\text{mm}^3$ in spring. Number of spermatozoa per ejaculate was significantly the lowest in summer $84.37 \pm 27.29 \times 10^9$ vs. $101.31 \pm 36.10 \times 10^9$ in winter ($P < 0.001$), $95.60 \pm 34.29 \times 10^9$ in spring ($P < 0.001$) and in autumn $94.05 \pm 34.95 \times 10^9$ ($P < 0.01$). The daily output of spermatozoa was significantly higher ($P < 0.05$) in autumn $14.84 \pm 6.22 \times 10^9$ vs. spring $13.58 \pm 4.97 \times 10^9$.

Tab. 1. Boars semen production parameters according to season

Months	n	Semen volume	Sperm concentration	Total number of spermatozoa per ejaculate	Daily spermatozoa output	Sexual rest
		(ml)	($10^3/\text{mm}^3$)	($\times 10^9$)	($\times 10^9$)	(days)
1st – 3rd	268	299.76 \pm 97.94 ^e	354.37 \pm 127.63 ^e	101.31 \pm 36.10 ^e	14.37 \pm 4.83	7.12 \pm 1.44
4th – 6th	287	294.49 \pm 94.27 ^{ae}	342.53 \pm 121.46 ^e	95.60 \pm 34.29 ^e	14.10 \pm 5.34	6.96 \pm 1.37
7th – 9th	314	320.19 \pm 86.22 ^{be}	276.69 \pm 102.27 ^f	84.37 \pm 27.29 ^{cf}	13.58 \pm 4.97 ^a	6.45 \pm 1.36
10th – 12th	301	355.08 \pm 109.95 ^f	278.37 \pm 108.04 ^f	94.05 \pm 34.95 ^d	14.84 \pm 6.22 ^b	6.64 \pm 1.60
total	1170	318.18 \pm 100.13	311.06 \pm 119.96	93.49 \pm 33.70	14.21 \pm 5.39	6.78 \pm 1.47

a,b $P < 0.05$ c,d $P < 0.01$ e,f $P < 0.001$

Figure 1. Average values of semen volume, sperm concentration and total number of spermatozoa per ejaculate during year

Average values of semen volume, sperm concentration and total number of spermatozoa per ejaculate during year according to months (Figure 1) shows variations in values suggestive of seasonal effect on semen production parameters.

Some countries have provided information on the effect of climatic factors on the reproductive performance of pigs bred by artificial insemination. The significantly negative effect of the hot climate stress on semen production traits of boars was determined. Our results of the seasonal effect in the Czech Republic climatic conditions on the reproductive performance AI boars are similar as well as in other countries.

Performance is usually better in winter and spring than in summer (Nestor, 1976; Mathevon et al., 1998).

Kuo et al. (1997) reported a significant seasonal effect on boar semen quality, percent of normal sperm and sperm concentration declined during summer. Ciereszko et al. (2000) reported that semen quality varied with season, including high production of spermatozoa in autumn and winter and low production in summer. Schnurrbusch et al. (2002) reported that ejaculate volume and the number of spermatozoa per ejaculate decreased in August/September and increased from October to December/January.

According to the results of Janett et al. (2005), the volume was significantly higher in autumn and sperm concentration was significantly lower in autumn and in summer. Kunavongkrit et al. (1995) found that semen volume and sperm concentration was lowest during the hot season. In general, the seasonal effect seems not only be due to changes in the climate, but also due to the cyclic variations in photoperiod (Claus et al., 1985; Trudeau et al., 1986). Stone (1982) concluded that normal sperm output of Large White boars could be maintained at air temperatures as high as 29 °C. But the low temperature did not interfere with testicular development, sperm production or semen quality (Swierstra, 1970).

Conclusion

The present study found seasonal variations in sperm production of the fertile hybrid AI boars in the Czech Republic climatic conditions.

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