Distribution of regular and irregular inter-oestrus interval in sows during different months of the year in Northern Italy

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SUMMARY
The objective of this study was to determine the incidence of regular or irregular inter-oestrus interval in sows during different months of the year in Northern Italy.

In this study, 5,103 sows that returned to oestrus were inseminated and assigned to different groups based on the length of their inter-oestrus interval:

- Regular inter-oestrus interval type 1 (Rint-1): sows with inter-oestrus interval of 18-23 days
- Regular inter-oestrus interval type 2 (Rint-2): sows with inter-oestrus interval of 36-48 days
- Irregular inter-oestrus interval (IRint group): inter-oestrus interval of 24-35.

Based on meteorological data of the area in which the farms are located, animals were considered to be under heat stress during the high temperature months of June to August while animals were not considered to be under heat stress during September to May. The proportion of sows with Rint-1 was greater (P<0.05) during the high temperature months compared than during the rest of the year. There was no difference between months for the proportion of sows with Rint-2. The proportion of sows with IRint was greater (P<0.05) during the months of September and October than during the other months of the year.

Results from this study indicate that, in Northern Italy, during the high temperature months of June-August, there was an increase in the proportion of sows with regular inter-oestrus interval, suggesting a failure of conception or an increase of early embryo losses, while there was an increase in the proportion of sows with irregular inter-oestrus interval during September-October, suggesting later embryo losses.

KEY WORDS
Swine, seasonal infertility, regular and irregular oestrous cycles.

INTRODUCTION
Seasonal infertility in the domestic sow is recognized as a source of considerable economic losses for the swine industry. Manifestations of seasonal infertility include reduced farrowing rate, prolonged wean-to-oestrous interval, delayed onset of puberty, and autumn abortion syndrome. Analyses of reproductive performance data have attempted to identify factors that contribute to the overall reduction in farrowing rate and reproductive performance. These results indicate that both photoperiod and temperature are important. Embryo and foetal losses, primarily during the first weeks of gestation, are exacerbated during the summer months because of heat stress. The exact mechanisms that determine embryo or foetal losses in swine remain unknown. Understanding the differences between embryo and foetal losses need to consider that in the pig the pregnancy status of sows could be recognized in two phases on the bases of estrogenic signal:

1) the blastocyst produces the first estrogenic signal around day 12 and 2) the conceptus produces the second signal around day 18. The first signal re-orientates endometrial prostaglandin-F2α (PGF2α) secretion in an exocrine direction (towards uterine lumen) for a few days and prevents the regression of corpora lutea (CL). The second signal is needed to prolong the re-orientation of PGF2α secretion until the end of normal gestation. At approximately 35 days of gestation the embryonic phase ends and the foetal phase begins. Therefore, when the oestrus interval is delayed to 25-35 days, the first embryonic signal was complete while the second one might have been inadequate or missing. From the above, it is possible to conclude that sows that have experienced a conception failure or very early embryonic losses, will return to oestrus at a regular interval (18-24 days), while animals that were pregnant but subsequently show a complete embryo loss return at irregular intervals (25-36 days). From a clinical point of view, in swine it is important to know the distribution of regular and irregular inter-oestrus interval and the incidence of pregnancy losses due to non-infectious causes, because the therapeutic approaches designed to reduce incidence of conception failure and pregnancy failure may be extremely different. The aim of this study was to determine the incidence of regular inter-oestrus interval type 1 (Rint-1): sows with inter-oestrus interval of 18-23 days

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were always below 40% during the rest of the year.

observed in June, July and August, while the “tropical” days

Concerning the incidence of regular or irregular inter-oestrus interval to oestrus during different periods of the year, a previous study in Minnesota,13 reported a prevalence of irregular (56%) compared regular (44%) inter-oestrus interval to oestrus in sows farrowing during the spring and summer. In contrast, studies of Dawson et al.14 showed a prevalence of regular (59%) compared to irregular inter-oestrus interval (41%). Similarly to results of Dawson et al.,14 our results showed a greater proportion of sows with regular inter-oestrus interval in oestrus during the high temperature months. These differences between studies may be related to the different temperature and humidity between the respective areas of studies, or to the genetic of the animals as a difference in heat stress tolerance has been described between breeding lines.15

This increased number of sows with regular inter-oestrus interval during the high temperature months could be related to a failure of the first embryo signal or to an increase of the

RESULTS

The mean (±SD) parity among the sows included in this analysis was 2.8±0.8 and the mean (±SD) wean-to-service interval (WSI) among sows was 5.8±0.23 days.

The number of not pregnant sows at ultrasound pregnancy exam was 6,773 of which, 5,103 (75%) returned in oestrus.

The rate of successful insemination during the high temperature months of June, July and August was 83.6%, and 87.7% (P<0.05) during the rest of the year. The proportion of sows with Rint-1, Rint-2 and IRint is shown in Figure 1. During the high temperature months between June and August the proportion of sows with Rint-1 was significantly increased (p<0.05) respect to the rest of the year and the same increase for IRint sows was observed between September and October, while no differences were observed in the fraction of Rint-2 throughout the year.

DISCUSSION

In the present study the percentage of sows (83.1%) that became pregnant after insemination during the high temperature months of the year was similar to previous studies on the effect of season on pregnancy rate.3,5,11,12

Concerning the incidence of regular or irregular inter-oestrus interval to oestrus among seasons, the nonparametric Kruskal-Wallis test was used. To test differences in pregnancy rate (successful in insemination) the χ² test was used. The significance level was set at p<0.05.
variability of the oestrus-ovulation interval (personal observation) with an increased number of inseminations performed at incorrect times.

During the period of September and October, similarly to previous studies\(^5\)\(^6\)\(^7\), we observed an increase in the incidence of irregular inter-oestrus interval. These data indicate that there was a failure of the second signal for maternal recognition of pregnancy due to a long lasting effect of summer heat stress on follicular development, oocyte quality, embryo development and survival.

Cooling systems were present on the farms studied, nonetheless, the farms experienced a reduction in pregnancy rate during the high temperature months (83.6%) compared to the rest of the year (87.7%). The reduction in fertility during summer in the northern hemisphere can be, in part, due to the effect of photoperiodism\(^10\). In addition, cooling systems are effective only up to a certain temperature. In fact, it is technically difficult for a cooling system to be fully effective at temperatures above 30-35°C\(^1\). Our study has two limitations: first, weather data were only available at a regional level. It would be interesting to obtain data on the microclimate within each farm; second, light intensity was not recorded. However, it is difficult to access this kind of information for a large number of herds.

Results of this study indicate that, in Northern Italy, during the high temperature months of the year (83.6%) compared to the rest of the year (87.7%), the farms experienced a reduction in pregnancy rate during the high temperature months (83.6%) compared to the rest of the year (87.7%). The reduction in fertility during summer in the northern hemisphere can be, in part, due to the effect of photoperiodism\(^10\). In addition, cooling systems are effective only up to a certain temperature. In fact, it is technically difficult for a cooling system to be fully effective at temperatures above 30-35°C\(^1\). Our study has two limitations: first, weather data were only available at a regional level. It would be interesting to obtain data on the microclimate within each farm; second, light intensity was not recorded. However, it is difficult to access this kind of information for a large number of herds.

Results of this study indicate that, in Northern Italy, during the high temperature months there is a greater proportion of sows with regular inter-oestrus interval, that can be due to a failure of the insemination or to an increase of early embryo losses, than during the lower temperature months when there was a greater proportion of sows with irregular inter-oestrus interval, which can be related mainly to embryo losses. These patterns of reproductive losses are useful from a clinical point of view because they suggest that during the high temperature months of the year the focus should be on insemination management while during the period of September-October, the focus should be mainly on pregnancy maintenance.

**References**