Efficient reproduction in heat-stressed multiparous sows

After more than a decade of research, the use of single Fixed-Time Artificial Insemination (sFTAI) in swine is now a reality via the use of GnRH analogues to induce ovulation at a precise time, to allow high fertility rates from a single, well-timed AI.

In September 2013 Porceptal (MSD Animal Health) was the first GnRH analogue product to obtain registration in European countries for use in swine (gilts and sows) to allow sFTAI with equivalent reproductive performance to classical breeding methods (that involve daily heat checking and multiple AIs).

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In sows, 2.5mL of Porceptal (containing 10μg buserelin) is administered to sows between 83-89 hours post-weaning, and then a single AI is given 30-33 hours thereafter. It is recommended to expose the sows to a boar at the designated time for AI, to induce standing heat which facilitates the act of giving the AI.

During periods of heat stress, it is known that lactating sows tend to eat less, and can more easily slip into negative energy balance, leading to low body condition score (BCS).

Slow follicle growth

Post-weaning, the heat-stressed sows have less available energy reserves and it takes longer for them to develop a fresh wave of mature follicles ready to start the next reproductive cycle. This is manifested as longer weaning-to-oestrus-intervals in heat-stressed sows (as compared to non-heat-stressed sows), with the effect being most obvious in primiparous sows that have just weaned their first litter, since primiparous sows are actually still growing and tend to have less body reserves than fully-grown multiparous sows.

To counter the effects of slow follicle growth during heat stress conditions, it is possible to boost the development of the follicles by administering PG600 at weaning.

PG600 contains gonadotropin molecules which stimulate follicle growth and maturation thus helping to ensure that the follicles produce sufficient oestradiol to trigger oestrus and ovulation within the week following weaning.

Classically, daily or twice daily heat detection, starting on day three post-weaning is used in sows treated with PG600 at weaning, with two or more AIs being given once the oestrus has been detected.

In view of the widespread use of PG600 at weaning during heat stress, we decided to explore whether the use of Porceptal could replace, or add to, the use of PG600 at weaning, thus allowing the use of sFTAI in heat-stressed sows.

This article reports on the first exploration of the combined use of PG600 and Porceptal to allow efficient sFTAI in heat-stressed sows. The study was performed during the summer of 2014 in a commercial 1200 sow herd, in north-east, Spain.

The highest and lowest maximal external environmental temperatures recorded during the study were 34.3°C and 19.2°C (average ± StD: 27.5 ± 4.2°C), representing strong heat-stress conditions.

The farm practices three week lactation, and systematically gives PG600 to all multiparous sows at weaning during the summer months (June to Oct).

The average (baseline) farrowing rates at the farm during the summer months (June to Oct) in 2012, 2013 and 2014 were 79.9%, 84.5% and 78.6% respectively.

The study aimed to explore the reproductive efficiency of a sFTAI for heat-stress sows following both the standard administration timings for Porceptal (used alone, without PG600), as well as investigating varied timings for Porceptal when used with PG600, in both multiparous and primiparous sows.

The results of the groups with Porceptal were compared to a control group that used the farm's normal practice of systematic use of PG600 at weaning followed by multiple AIs on detected heat.

All sows in the trial received an equivalent quantity and quality of pooled semen from boars of known high fertility. The semen dose was 1 x 10^9 sperm, administered post-cervically. The study was conducted under the supervision of a qualified veterinarian.

Study design

The study consisted of four groups and the results are shown in Table 1:

- **Group 1:** Control group: multiparous sows given PG600 at weaning and bred via two or three AIs on detected heat.
- **Group 2:** Standard Porceptal treatment:

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Parameter	Group 1	Group 2	Group 3	Group 4
Number of sows	167	54	146	84
Number farrowed	143	44	122	60
Farrowing rate (%)	85.6	81.5	83.6	71.4
Average total born (± StD)	12.24 ± 3.29	11.66 ± 3.37	11.85 ± 3.60	10.35 ± 3.83
Average live born (± StD)	10.97 ± 3.00	10.36 ± 3.58	10.93 ± 3.38	9.93 ± 3.51
Live Piglet Index (LPI)	939.5	844.4	913.1	709.5

Table. 1. Results of the study in heat-stressed sows (Live Piglet Index = average live born x farrowing rate).

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multiparous sows. Porceptal 83-89 hours post-weaning, with sFTAI 30-33 hours later if in heat, or a single AI on detected heat thereafter.

- **Group 3:** Multiparous sows: PG600 at weaning. Porceptal at 72 hours post-weaning, with sFTAI 30-33 hours later if in heat, or a single AI on detected heat thereafter.
- **Group 4:** Primiparous sows: PG600 at weaning. Porceptal at 96 hours post-weaning, with sFTAI 30-33 hours later if in heat, or a single AI on detected heat thereafter.

Study results

The 85.6% farrowing rate of the multiparous sows in the control group (group 1) during the study was higher than the average farrowing rate for the whole farm during the summer of 2014 (78.6%).

This difference most likely reflects a lower farrowing rate in the primiparous sows that were present on the farm (ca. 20% of the population) but which were not present in group 1. It could also have been linked to an unintentional increase in the degree of attention to good reproductive practice during the study.

As compared to the farrowing rate of the control group, the results of group two show that in heat-stressed multiparous sows the use of Porceptal (alone) with the standard administration timing (83-89 hours post-weaning) and a single FTAI 30-33 hours later provides similar (albeit numerically slightly lower) reproductive performance as compared to the use of PG600 and multiple AIs on detected heat (72.13% vs. 75.17%, respectively).

Note that the relatively low number of sows in this group (54) makes the farrowing rate value very sensitive to a small variation in the number of sows farrowing. It would be interesting to explore the use of Porceptal alone with a larger group of heat-stressed multiparous sows.

The results of group 3 show that in heat-stressed multiparous sows the use of PG600 at weaning followed by Porceptal 72 hours post-weaning, followed by a single FTAI 30-33 hours later provided a very similar farrowing rate (83.5%) as compared to the control group (85.6%). The average total born and live born values were also comparable between the two groups.

Efficient combination

This exploratory study did not have sufficient statistical power to conclude whether the farrowing rates of the two groups are statistically equivalent; however it appears that the combination of PG600 at weaning and Porceptal at 72 hours post weaning provides efficient reproduction from a sFTAI in heat-stressed multiparous sows.

The treatment scheme in group 3 allows the known benefits of using a sFTAI: decreased labour for daily heat checking, lower semen costs and less labour requirements for AIs (one AI instead of two or three), potential for better farm planning so as to use very fresh sperm (= higher fertility), potential for investing in sperm of higher genetic merit, better grouping of farrowing dates, and more homogeneous litters that arise from fewer (better) sires.

Furthermore, data from the farm between 2012 and 2014 showed that the average weaning-to-oestrus interval in heat-stressed multiparous sows after using PG600 at weaning was 5.5-6.0 days. If we assume that such sows then received two AIs at 12 hour intervals, this means that the weaning-to-last-AI-interval with the farm's standard practice for heat-stressed sows was 6.5-7.0 days.

In group 3 the weaning-to-last-AI-interval was 72 hours + 30-33 hours = approximately 4.25 days. The results of group 3 were therefore achieved with the added bonus of saving 2.0-2.75 non-productive 'open' days per sow.

In group 4 it was hypothesised that primiparous sows are the sub-population that would be most affected by heat stress, and that as such, they would take the longest to have mature follicles capable of responding to ovulation induction by Porceptal. We therefore chose to extend the weaning-to-Porceptal interval in group 4 to 96 hours.

As can be seen in Table 1 the use of PG600 at weaning and Porceptal at 96 hours post-weaning, followed by a sFTAI 30-33 hours thereafter achieved a farrowing rate of 71.4% in the heat-stressed primiparous sows.

In this exploratory study, there was no control group of heat-stressed primiparous sows with which to compare the results of group 4 (because the farm does not routinely give PG600 to primiparous sows at weaning).

Thus, whilst it is difficult to assess the reproductive efficacy of group 4, it is known that the farrowing rate in heat-stressed primiparous sows can be around 10% lower than that of multiparous sows, and that litter size is lower in primiparous sows compared to multiparous sows.

Exploration of the farm's historical data revealed that the average weaning-to-oestrus interval on the farm for heat-stressed primiparous sows in 2012, 2013, and 2014 was 8.3 days, 8.6 days and 6.8 days (respectively). In swine, when oestrus is expressed >5 days after weaning, ovulation naturally occurs quite quickly after the oestrus (between 0-48 hours).

Again, assuming that primiparous sows then usually receive two AIs at 12 hours intervals, this means that the weaning-to-last-AI-interval with the farm's standard practice for heat-stressed primiparous sows is usually between 7.8 and 9.6 days.

The results obtained in group 4, were obtained with a weaning-to-last-AI-interval of around 5.25 days.

The results of group 4 were therefore achieved with a single AI and a reduction of between 2.55-4.32 non-productive 'open' days per sow. Further exploration of the use of PG600 and Porceptal in heat-stressed primiparous sows is warranted.

Conclusions

This exploratory study has shown that the use of Porceptal (alone) with its standard administration timings provides similar (although slightly lower) reproductive results from a sFTAI in heat-stressed multiparous sows when compared to the classical practice of administering PG600 at weaning followed by multiple AIs on detected heat.

Moreover, it appears that the combination of PG600 at weaning, followed by Porceptal 72 hours later, plus a single AI 30-33 hours thereafter provides very similar reproductive performance in heat-stressed multiparous sows compared to classical practice, with the added benefit of a useful reduction of 2.0-2.75 non-productive (open) days.

In heat-stressed primiparous sows, the use of PG600 with Porceptal and a sFTAI, achieved a 'normal' farrowing rate and litter size for this type of sow, with a useful reduction of between 2.55-4.32 open days. Overall these results offer new perspectives to achieve efficient reproductive performance in heat-stressed sows via a sFTAI. ■