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The influence of induced parturition and the moment of vaccination against Swine erysipelas during lactation on the weaning-to-oestrus interval in sows

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CONTENTS

SUMMARY

This experiment was carried out to investigate the effect of vaccination during lactation with Porcilis® Ery+Parvo on the weaning-to-oestrus interval and the reproduction in sows. An exploratory study had indicated that vaccination during particularly the first few days of lactation might lead to a longer weaning-to-oestrus interval. To find out whether vaccination during lactation and/or the moment of vaccination actually affects the weaning-to-oestrus interval, sows were vaccinated the first, second or last weeks of lactation with either Porcilis® Ery+Parvo or a placebo. In the same experiment the combination with induced parturition on the weaning-to-oestrus interval was examined. Also the influence of the treatments on the use of PG600® was considered, as was pregnancy rate from first insemination and litter size, and the number of stillborn piglets or born alive in the subsequent litter.

This experiment was carried out on the experimental farm of the Research Institute for Pig Husbandry, Rosmalen, the Netherlands, in the period of September 1996 until July 1998. In total 965 litters were assigned to this experiment. Sows were screened from transfer to the farrowing house until the subsequent litter. The main results and conclusions are:

- Vaccination of sows during the first week of lactation (with Porcilis® Ery+Parvo) against Swine erysipelas and Parvo has no significant adverse effect on reproductive performance.
- Induced parturition causes earlier parturition, which results in lighter piglets.
  Induced parturition has no effect on percentage of piglets born alive; the percentage of piglets with splayleg is significantly higher.

1 INTRODUCTION

Calculations with data from the study Electronic Breed Test (StEM) showed that on sow farms where fewer vaccinations were done, sows had a shorter weaning-to-oestrus interval (Van Riel and Vesseur, 1996). On closer analysis it was shown that there was a possible connection with whether or not vaccinating against Swine erysipelas. In an observational study with data from the experimental farm at Rosmalen over a period of six months it appeared that multi-litter sows that had been vaccinated against Swine erysipelas in the first week of lactation showed a somewhat longer weaning-to-oestrus interval, compared with sows having been vaccinated in the second week of lactation. The difference was especially clear if vaccination had taken place in the first four days of lactation. Due to too few sows, a comparison with sows having been vaccinated in the third or fourth week of lactation could not be made; every two weeks the veterinarian came to vaccinate sows that had just had their litters against Swine erysipelas. Since induced parturition was applied to have the sows farrow before the weekend, and vaccinations were done on a fixed day in the week, there was a linkage between moment of vaccination and whether or not applying induced parturition. Therefore, the effect could not be attributed to either factor for sure. Based on an article (Van Riel and Vesseur, 1996), Intervet in Boxmeer was interested in this study. In consultation with this firm it was decided to conduct an experiment with a combined Swine erysipelas/ Parvo vaccine in order to find the effects of moment of vaccination during lactation and applying induced parturition on the length of weaning-to-oestrus interval in sows and their reproductive performance up to the subsequent litter.

2 MATERIAL AND METHODS

2.1 Location of experiment and experimental animals

The experiment was conducted at the Research Institute for Pig Husbandry at Rosmalen with sows that had farrowed in the period of September 1996 to January 1998.
Rotation crossbreeds were used, consisting of Dutch Landrace, Finnish Landrace and Great Yorkshire-sows. The sows were screened from transfer to the farrowing house prior to the experimental treatment up to and including the subsequent litter, or to disposal if no litter was produced.

2.2 Experimental design and experimental treatments

The experiment was set up as a 2 x 3 x 3 factorial design. Sows were allocated at random to one of the treatment levels of each of the three experimental factors before transfer to the farrowing pen.

Factor 1: 'vaccination', with either a vaccine or a placebo, levels:
- administering the combined vaccine against Swine erysipelas and Parvo: Porcilis® Ery+Parvo (Intervet, Boxmeer);
- administering physiological saline solution.

Physiological saline solution was not supposed to have any influence. Physiological saline solution was also administered by injection to prevent that there was any linkage of vaccination to giving injections. Of both products 2 ml were administered intramuscularly. In order to maintain a reasonable level of disease prevention, sows were given the placebo only two subsequent litters at maximum.

Factor 2: 'moment of treatment', moment of treatment with vaccine or placebo (see factor 1), levels:
- treating sows in the first week after farrowing (from farrowing (day 0) until day 7 after farrowing);
- treating sows in the second week after farrowing (from day 8 until day 14 after farrowing);
- treating sows in the third or fourth week after farrowing (from day 15 until day 25 after farrowing).

To get as good a distribution as possible in the number of sows per moment of treatment and to prevent any linkage between moment of treatment and day of the week the sow farrowed, the veterinarian visited the farm twice a week (Tuesdays and Fridays).

Factor 3: 'induced parturition', whether or not induced parturition is applied with Prosolvin® (Intervet, Boxmeer), levels:
- sows had farrowed before day 114 ('early farrower');
- no induced parturition on day 114 of gestation;
- induced parturition on day 114 of gestation.

Induced parturition took place on day 114 after insemination, counted from the first day after insemination leading to pregnancy, at about 7.30 a.m. Sows assigned to treatment level 'induced parturition' that were not farrowing were treated with 0.75 ml of Prosolvin@ in the vulva. Induced parturition was not applied before day 114 to prevent piglets having too low a weight at birth. With lower weights there is more chance of disposal during the weaning period.
Some of the sows farrowed already before or on day 113 or in the night of day 113 to 114 before administering the inducing medicine or not. These sows were categorised under a separate group: 'early farrowers'. Because this concerned a rather large number of sows, the experimental factor 'induced parturition' has been considered at three levels, that is, early farrowers, induced parturition or not.

2.3 Housing, management and feed

2.3.1 Housing

During the empty and gestation periods sows were housed in one of the four different farm systems: individual housing in feed cubicles, group housing with lockable feed cubicles with indoor outlet, group housing with feed stations, and group housing with the Biofix feeding system. These systems have been described in detail by Backus et al. (1997). Sows from all farm systems stayed in one farrowing house from approximately 10 days prior to farrowing to weaning. All sows were free-standing in the farrowing pen.

2.3.2 Management

Approximately 10 days before the expected farrowing date the sows were showered and taken to the farrowing house. Each individual piglet was weighed and given a number within 24 hours after birth, after which litter size was standardised, if possible. In principal the weaning period of the sows was 4 weeks (approximately 28 days). After weaning, the sows were transferred to the serving pen of the serving/gestation compartment and the first few days after weaning were allowed to walk for a couple of hours on a concrete floor next to the barn or in the compartment. As soon as they showed oestrus they were no longer allowed to walk freely. Objective of this free walking was to stimulate oestrus and to promote group forming before insemination (in the group housing systems). At the farm, do-it-yourself Al was applied. Sows were inseminated when they showed the stand reflex to the farmer. When they showed this reflex also the next day, they were reinseminated. Sows not having shown oestrus on day 15 after weaning were treated with PG600® (Intervet, Boxmeer). In principle, sows were vaccinated against Aujeszki 3 times a year at random. To prevent this vaccination taking place during lactation and possibly influencing the results of this experiment, these vaccinations were postponed until one month after serving for sows that were in the farrowing house during vaccination against Aujeszki's disease on the farm.

2.3.3 Feed and water supply

Sows were provided with two-phase feeding was applied: lacto sow feed (ME = 1.03 and digestible lysine = 0.64%) in the farrowing house and gestation sow feed (ME = 1 .OO and digestible lysine = 0.47%) for empty and pregnant sows. Until the day of insemination sows received a maximum of 3.5 kg per day, until a maximum of 7 days after weaning. After that the feed was reduced to 2.2 kg/day. The feed ration was increased three times during gestation, whereby a distinction was made between the zeroth and older farrowing sows and the sows' condition. The day before the expected day of birth the feed ration was reduced to 0.5 kg. During lactation the ration was increased after farrowing by approximately 1 kg/day to a maximum of 1.5 kg plus 0.5 kg per piglet per day for first parity sows. Older parity sows received maximal 2 kg plus 0.5 kg/piglet/day during lactation.

In the feed cubicles empty and pregnant sows were supplied with water twice a day for one hour after feeding. In the three group-housing systems sows had water at their disposal ad lib from a drinking bowl, besides a limited amount of drinking water in the trough. In the farrowing pen sows could take water ad lib via a drinking nipple.

2.4 Data processing

2.4.1 Collecting data

The following data on sows were collected: litter number, first oestrus after weaning (in principle this was also the insemination date), date of first insemination leading to pregnancy, date of farrowing, number of stillborn piglets and born alive and mummies, weight at birth of piglets born alive, number of splayleg piglets, number of piglets fostered, date of weaning, number of weaned piglets, use of PG600®, date of first insemination or possible repeat breeders, date of subsequent litter with number of stillborn piglets and born alive and number of mummies and possible disposal (date and reason) of sow.

From the above data the following parameters were calculated: length of gestation, number of piglets at the start (= piglets born alive + number of piglets fostered - piglets removed), lactation length, weaning-to-oestrus interval, number of sows treated with PG600®, farrowing rate from 1st insemination, size subsequent litter and percentage of stillborn piglets and born alive in subsequent litter.

2.4.2 Statistical analysis

The experiment was analysed on the basis of a 2 x 3 x 3 factorial design. In all analyses a cycle of a sow was assumed the smallest experimental unit. In processing the data, only the results of sows whose lactation period was 19 days at minimum have been considered.

Effect of the combination of vaccination, moment of treatment and induced parturition
The effect of the combination of the experimental factors vaccination, moment of treatment and induced parturition on the weaning-to-oestrus interval was analysed, as was the farrowing rate from first insemination and litter size and the percentage of stillborn piglets and born alive in the subsequent litter. The following model was assumed:

Model 1

$$Y_{ijklm} = C + W_i + Sj + Z_k + M_m + T_l + P_n + M_m \times T_l + M_m \times P_n + T_l \times P_n + M_m \times T_l \times P_n$$

where:

- Y_{ijklm} = weaning-to-oestrus interval, farrowing rate from 1st insemination, litter size and stillborn piglets and born alive in subsequent litter,
- c = constant,
- W_i = litter number (1, 2, 3, 4, 5, 6, 7 and higher),
- Sj = season (Oct 96 - Dec 96, Jan 97 - March 97, Apr 97 - June 97, July 97 - Sep 97, Oct 97 - Dec 97, Jan 98 - March 98),
- Z_k = lactation length,
- M_m = vaccination (vaccine or placebo),
- T_l = moment of treatment (day 0 - 7, day 8 - 14, day 15 - 25 after farrowing),
- P_n = induced parturition (yes, no, early farrower).

The use of PG600® was analysed by means of the Chi-square test, the farrowing rate from 1st insemination by loglinear regression analysis (Oude Voshaar, 1994). For analysing the weaning-to-oestrus interval, the proportional odds model of McCullagh (Oude Voshaar, 1994) was used to study whether there was a clear shift in the length of the interval. The size of the subsequent litter was analysed by regression analysis. Stillborn piglets and born alive in the subsequent litter were analysed as a percentage of the total number of piglets born (including mummies) by binomial regression analysis (Oude Voshaar, 1994). The results of the subsequent litter were only considered if the sow farrowed from first insemination.

Induced parturition
In analysing the effect of induced parturition, whether or not to apply induced parturition in combination with the gestation period of the sows was investigated.
In this analysis the experimental factor induced parturition was taken into account at 5 levels: farrowing before day 114, not induced and farrowing on day 114, not induced and farrowing after day 114, induced and farrowing on day 114, and induced and farrowing after day 114. Whether or not applying induced parturition might affect a few results, whereby vaccination and the moment of treatment did not play a role yet. This concerned the gestation period, the percentage of piglets born alive, weight at birth and the occurrence of splayleg in the litter produced. Therefore the following model was assumed:

Model 2

$$Y_{ijk} = C + W_i + Sj + P_k$$

where:

- Y_{ijk} = gestation period, percentage of piglets born alive, weight at birth, percentage of splayleg piglets,
- c = constant,
- W_i = litter number (1, 2, 3, 4, 5, 6, 7 and higher),
- Sj = season (Oct 96 - Dec 96, Jan 97 - March 97, Apr 97 - June 97, July 97 - Sep 97, Oct 97 - Dec 97, Jan 98 - March 98),
- P_k = induced parturition (not induced and farrowing before day 114, on day 114 and after day 114; induced and farrowing on day 114 and after day 114).

The number of piglets born alive and the number of splayleg piglets were analysed as a percentage of the total number (= piglets born alive + stillborn + mummies) of piglets by binomial regression analysis. The parameters gestation period of the litter produced and weight at birth of the piglets born alive were analysed by regression analysis.

3 RESULTS

3.1 Effect of the combination of moment of treatment, vaccination and induced parturition

3.3.1 Weaning-to-oestrus interval

Sows that came into oestrus within 15 days after weaning spontaneously were investigated as to whether the weaning-to-oestrus interval was affected by one or more of the experimental factors. The interval was divided into 5 classes: days 3 and 4, day 5, day 6, day 7 and days 8 - 14. Table 1 shows the effect of the combination of moment of treatment and vaccination on the length of the weaning-to-oestrus interval. Because of interaction, three levels of treatment of the experimental factor induced parturition have been distinguished.

There is a tendency ($p = 0.08$) towards a difference in the weaning-to-oestrus interval in the *early farrowers*, the sows having farrowed on or before day 113. The weaning-to-oestrus interval seems to be a bit longer when sows have been treated in the first week after farrowing compared with sows that have been treated in the third or fourth week of the lactation period. The product used (vaccine or placebo) had no effect. Because the number of sows having farrowed on or before day 113 was rather small, these results should be interpreted with caution.

Sows in which *no induced parturition* was applied showed an interaction between vaccination and moment of treatment and length of weaning-to-oestrus interval. That means that the difference between vaccine and placebo for the moments of treatment is different, or that the difference between moments of treatment is different for vaccine and placebo. Within the moments of treatment no significant difference could be found as to percentage of sows per length of interval between treatment with vaccine and placebo. Within treatment with vaccine there was no effect of moment of treatment. Within treatment with a placebo, there was a difference in the distribution of the percentage of sows per length of interval between treatment in the first week and treatment in the third or fourth week of the lactation period. A significantly larger part of sows that were treated in the first week of the lactation period proved to have come into oestrus on day 6 or later (and a significantly smaller part before day 6) compared with sows having been treated with a placebo between day 15 and 25. Moreover, there is a tendency ($p = 0.09$) towards a somewhat longer weaning-to-oestrus interval with the combination of treatment with a placebo in the first week of the lactation period compared with a placebo in the second week of the lactation period. There is also a tendency ($p = 0.08$) towards a somewhat longer weaning-to-oestrus interval with the combination of treatment with vaccine in the second week of the lactation period compared with treatment with a placebo in the third or fourth week of the lactation period. For the other combinations of vaccination and moment of treatment the number of sows per weaning-to-oestrus interval was in between the above-mentioned cases a nd showed no difference. No effect could be found as to vaccination and/or moment of treatment on the length of the weaning-to-oestrus interval in sows in which *induced parturition* was applied.

Use of *PG600®*

Sows with a weaning-to-oestrus interval of more than 15 days were treated with PG600®. The extent to which it was used is presented in table 2.

There was no clear effect of moment of treatment and/or vaccination on the number of sows having been treated with PG600® on day 15 after farrowing. Sows in which induced parturition was applied showed a tendency ($p = 0.08$) towards a fewer number of sows that had to be treated with PG600®, when treated in the first week of the lactation period (irrespective of the product) compared with sows having been treated as from day 8 of the lactation period. Of the sows that farrowed on or before day 113, significantly more animals had been treated with

PG600® on day 15 after weaning (9.5%) than sows in which either induced parturition was applied or not. Applying induced parturition had no significant effect on the percentage of sows treated with PG600®: of sows in which induced parturition was applied, 4.0% was treated with PG600® and of sows with no induction this was 5.2%.

3.1.2 Farrowing rate from first insemination
It was studied whether sows inseminated during first oestrus produced a litter. In this

Table 1: Effect of the combination of the three experimental factors moment of treatment, vaccination and induced parturition (early farrowers, induced parturition yes and no) on the weaning-to-oestrus interval of sows having come into oestrus spontaneously within 15 days after weaning

moment of treatment	day 0 - 7		day 8 - 14		day 15-25		significance[1]		
vaccination	vaccine	placebo	vaccine	placebo	vaccine	placebo	moment	vaccine	interaction
early farrowers:									
number of sows in oestrus spontaneously	19	24	24	28	24	26			
percentage of sows per weaning-to-oestrus interval (days);							#	n.s.	n.s.
3 - 4	48	8	29	50	46	30			
5	32	42	50	28	38	54			
6	10	29	4	14	8	8			
7	10	8	17	4	4	0			
8-14	0	13	0	4	4	8			
no induced parturition:									
number of sows in oestrus spontaneously	63	66	64	61	56	61			
percentage of sows per weaning-to-oestrus intervals (days);	a	a	ab	ab	ab	b			
3 - 4	38	30	41	43	39	56			
5	38	42	41	39	45	33			
6	16	15	8	13	9	3			
7	5	11	4	5	5	5			
8 - 14	3	2	6	0	2	3			
induced parturition:									
number of sows in oestrus spontaneously	59	55	53	42	40	41			
percentage of sows per weaning-to-oestrus intervals (days);							n.s.	n.s.	n.s.
3 - 4	54	39	45	43	38	46			
5	34	36	42	43	41	27			
6	3	18	11	12	7	15			
7	2	0	0	2	7	7			
8 - 14	7	7	2	0	7	5			

[1] significance: moment = effect of moment of treatment; vaccine = effect of vaccination (vaccine vs placebo); interaction = interaction between vaccination and moment of treatment; n.s. = not significant ($p > 0.10$); # = ($p < 0.10$); * = ($p < 0.05$)

[a,b] a different letter within a row indicates a significant difference between the experimental treatments

analysis the sows treated with PG600® were not taken into account, due to the fact that this might have affected the effect of the experimental factors. A litter is considered to be from this insemination if it is produced within 125 days after this insemination. Figure 1 presents the farrowing rate for the different combinations of experimental factors.

An interaction was found between the three experimental factors moment of treatment, vaccination and whether or not induced parturition was applied. This indicates that farrowing rate depends on the combination of the levels applied of the three experimental factors. For sows that were vaccinated with vaccine, the farrowing rate from 1st insemination remained at the same level (sows without induced parturition) or increased a little (sows with induced parturition) when vaccinated later in the lactation period. For sows treated with a placebo (whether or not after induced parturition), the farrowing rate from 1st insemination was significantly higher when sows were treated in the second week of the lactation period compared with treatment in the first week. However, treating in the third or fourth week of the lactation period resulted in a significantly lower farrowing rate, approximately at the level of sows having been treated in the first week of the lactation period. In general, the farrowing rate from 1st insemination was somewhat lower for sows that farrowed on or before day 113. Particularly sows that were vacci-

Table 2: Use of PG600® in sows (on day 15 after weaning) per combination of the three experimental factors vaccination, moment of treatment and induced parturition (early farrowers, induced parturition yes and no)

moment of treatment	day 0 - 7		day 8 - 14		day 15 - 25		significance[1]		
vaccination	vaccine	placebo	vaccine	placebo	vaccine	placebo	moment	vaccine	interaction
early farrowers:									
number of weaned sows[2]	23	26	27	33	28	31			
number of sows treated with PG600®	4	2	0	3	2	5	n.s.	n.s.	n.s.
percentage of sows treated with PG600®	17	8	0	9	7	16			
no induced parturition:									
number of weaned sows[2]	71	70	75	73	65	66			
number of sows treated with PG600®	2	2	4	2	5	2	n.s.	n.s.	n.s.
percentage of sows treated with PG600®	3	3	5	3	8	3			
induced parturition:									
number of weaned sows[2]	63	58	58	50	47	49			
number of sows treated with PG600®	0	2	4	4	3	4	#	n.s.	n.s.
percentage of sows treated with PG600®	0	3	7	8	6	8			

[1] significance: moment = effect of moment of treatment; vaccine = effect of vaccination (vaccine vs placebo); interaction = interaction between vaccination and moment of treatment; n.s. = not significant ($p > 0.10$); # = ($p < 0.10$)

[2] number of sows that have been weaned and not been disposed of within 7 days

nated with vaccine in the third or fourth week of the lactation period had, in absolute terms, a very low farrowing rate from 1st insemination. For the early farrowers that were treated with a placebo, the moment of treatment had no significant effect on the farrowing rate from 1st insemination.

3.1.3 Size of subsequent litter

Litter size is considered to be the total number of stillborn piglets and born alive and mummies. In the analysis only litters have been taken into account of sows that had produced a subsequent litter from 1st insemination and had not been treated with PG600®. No interaction was found between the three experimental factors moment of treatment, vaccination and whether or not applying induced parturition, nor two-way interactions. That is why the main effects of the three experimental factors have been estimated, which are presented in table 3.

No significant differences could be found between the different moments of treatment as to litter size and percentage of stillborn piglets and born alive in the subsequent litter. Nor were there found any differences in the above-mentioned factors between the three levels of treatment of induced parturition. Vaccination vs treatment with a placebo had no significant effect on size of the subsequent litter. There was a tendency ($p = 0.12$), however, towards more piglets born from sows that were treated with vaccine compared with sows treated with a placebo. The percentage of piglets born alive in the subsequent litter was significantly higher (approximately 2%) and that of stillborn piglets somewhat lower ($p = 0.07$) for sows treated with a placebo, compared with sows treated with vaccine.

3.2 Effect of induced parturition

Table 4 shows the results of characteristics that can have been influenced by whether or not induction was applied. Induced parturition took place on day 114. These results cannot have been influenced by moment of treatment with either vaccine or placebo and/or the product used (either vaccine or placebo), since this took place later.

The average gestation period of the non-induced sows was approximately half a day longer than of sows in which induction was applied. For sows farrowing on or before day

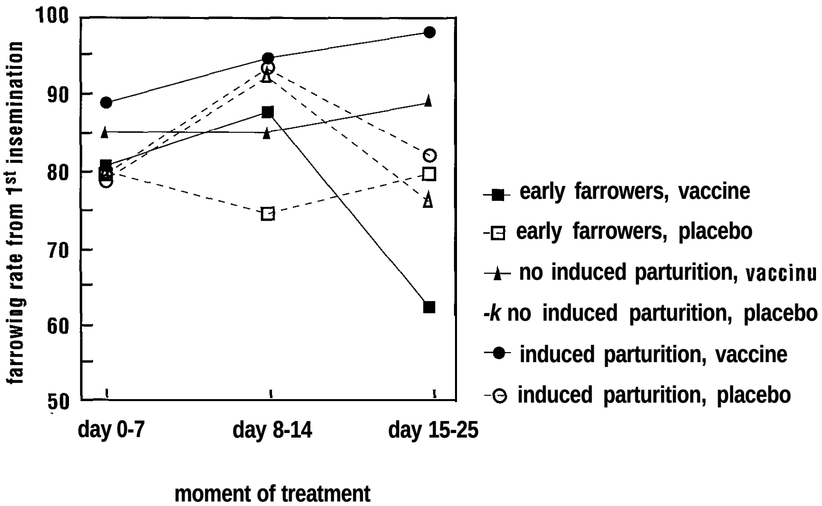

Figure 1 Relationship between moment of treatment and farrowing rate from 1 st insemination per combination of the experimental factors vaccination and induced parturition (three-way interaction)

113, the total number of piglets born was higher than for sows farrowing on or after day 115. The percentage of piglets born alive was lower for sows farrowing on or before day 113 than for those farrowing on day 114 without induction and also lower for

Table 3: Estimates of the main effects of the three experimental factors on size of the subsequent litter and the percentage of stillborn piglets and born alive (only litters from 1st insemination)

		subsequent litter			significance[1]		
experimental factor	level	size	% piglets born alive	% stillborn	size	% piglets born alive	% stillborn
moment of treatment					n.s.	n.s.	n.s.
	dag 0- 7	11.1	93.4	5.8			
	dag 8-14	11.7	93.6	5.2			
	dag 15-25	11.2	92.6	6.4			
vaccination					n.s.	*	#
	vaccine	11.5	92.2[a]	6.5			
	placebo	II.2	94.2[b]	5.0			
induced parturition					n.s.	n.s.	n.s.
	early farrowers	11.3	92.9	5.9			
	no induced parturition	11.5	93.0	6.0			
	induced parturition	II.2	93.7	5.4			

1 significance: n.s. = not significant ($p > 0.10$); # = ($p < 0.10$); * = ($p < 0.05$)
a,b a different letter within a column indicates a significant difference between the experimental treatments

Table 4: Effect of whether or not applying induced parturition on litter results

	early farrowers	no induction		induction			
gestation period	< = 113	114	> = 115	114	> = 115	SEM[1]	significance[2]
number of sows	131	156	374	50	311		
litter number	3.6	3.9	4.4	4.2	4.4		
gestation period	112.6[a]	114.0[b]	116.2[c]	114.0[b]	115.3[d]	0.09	***
total number born	11.9[a]	11.6[ab]	11.2[b]	11.7[a]	11 .0[b]		
born alive (%)	91 .0[a]	94.7[b]	92.9[ab]	92.5[ab]	94.3[b]		
weight at birth born alive (kg)	1.34[a]	1.41[bc]	1.44[c]	1.37[ab]	1.44[c]	0.019	***
splayleg piglets (%)	1.5[a]	0.9[b]	0.8[b]	1.4[ab]	1.6[a]		

1 SEM = pooled standard error of the mean (indicates the accuracy of the estimate of the variable measured)
2 significance: * = ($p < 0.05$); *** = ($p < 0.001$)
a,b,c a different letter within a row indicates a significant difference between the experimental treatments

sows farrowing on or after day 115 after induction. When sows farrowed on or after day 114, no effect of whether or not applying induced parturition could be found on the percentage of piglets born alive.

Piglets born alive from sows with a gestation period of 113 days or less had the lowest weight at birth. When the gestation period was 115 days or more, weight at birth was significantly higher, irrespective of whether or not induced parturition was applied. The percentage of splayleg piglets for sows in which induction was applied was significantly higher than for sows in which this had not been done. Sows that farrowed early, 'on or before day 113, showed to produce the same percentage of splayleg piglets as induced sows.

4 DISCUSSION

4.1 Experimental design

The objective of this experiment was to study the effect of moment of vaccination against Swine erysipelas-Parvo during the lactation period on reproductive performance of sows. Emphasis was placed on the effect on the weaning-to-oestrus interval. Based on this experiment no pronouncements can be made as to the vaccine used compared to other vaccines. A different Swine erysipelas-Parvo vaccine cannot be ruled out to produce different results. As far as the use of the product for induced parturition is concerned, it has been assumed that not the product itself, but the treatment and the fact that the process of birth is induced prematurely can affect performance. It was decided to take the factor induced parturition into account because, on the basis of preliminary research (Van Riel and Vesseur, 1996), it could not be excluded that this had also an effect. Besides, sometimes questions arise from practice as to applying induced parturition and, for example, the occurrence of splayleg. In this experiment induced parturition was applied on day 114 of the gestation period, counting from first insemination leading to pregnancy. In principle, this could be applied as of day 112. Because weight at birth at the experimental farm where the experiment was run was rather low, it was decided not to apply induction earlier than day 114.

4.2 Results

Early farrowers

The results showed that sows that farrowed on or before day 113 of the gestation period, the ‘early farrowers’, had a different response as to reproductive performance than sows that farrowed as from day 114. Because the number of sows in the early-farrower group was rather small, particularly for estimating two-way interactions, the results of those sows should be interpreted with caution.

Weaning-to-oestrus interval

In the analysis of the weaning-to-oestrus interval a distinction has been made between sows having come into oestrus spontaneously and sows treated with PG600®. By treatment with PG600®, coming into oestrus is influenced, and thus the length of the interval. Treatment with PG600® always took place on day 15 after weaning. Because also other reproductive performance can be influenced, sows treated with PG600® were

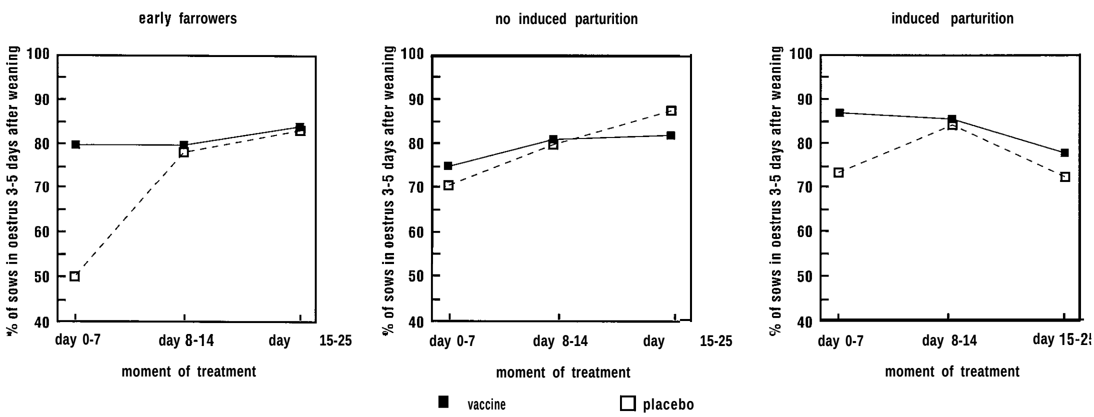

Figure 2: Relationship between moment of treatment and the percentage of sows that came into oestrus on day 3 to 5 after weaning for ‘early farrowers’, sows in which either induced parturition is applied or not respectively

not considered in the analyses. A significant difference has been found as to the percentage of sows treated with PG600® between early farrowers and sows farrowing as from day 114 (9.5% vs 4.6%).

Neither moment of treatment nor the product used proved to have significantly affected the weaning-to-oestrus interval in sows in which induced parturition was applied. It is striking that when no induction was applied both these experimental factors proved to have influence. This revealed itself, however, only in a higher percentage of sows that came into oestrus within 3 to 5 days after weaning when the animals were treated with a placebo in the third or fourth week of the lactation period, compared with sows that were treated in the first week, irrespective of the product used (figure 2). Vesseur et al. (1994a) and Leman (1990), among others, found that with a 4-day weaning-to-oestrus interval the sows produced the largest number of piglets born in the subsequent litter. With an increase in the length of the weaning-to-oestrus interval to 12 days, the farrowing rate from 1st insemination and size of subsequent litter decreased. On the basis of this, the somewhat lower farrowing rate of sows treated with a placebo in the first week of the lactation period could partly be explained, since a larger part came into oestrus later than day 3 - 5. However, no significant difference could be found between farrowing rates of sows treated with either vaccine or placebo in the first week of the lactation period. It is striking, however, that sows treated with vaccine showed a steady or even increasing farrowing rate with treatment later in the lactation period. Sows treated with a placebo in the second week of the lactation period showed a slightly to significantly higher farrowing rate from 1st insemination than with treatment in the first or third/fourth week of the lactation period. The early farrowers responded differently still, the reason of which is not clear. It cannot be explained on the basis of the length of weaning-to-oestrus interval.

Litter size

Size of the subsequent litter was not significantly affected by the three experimental factors, nor was there any relationship with the weaning-to-oestrus interval. In absolute terms, litter size was a little larger for sows treated with vaccine than those treated with a placebo (11.5 vs 11.2). This difference was just too small to be statistically significant ($p = 0.12$). This can be explained by

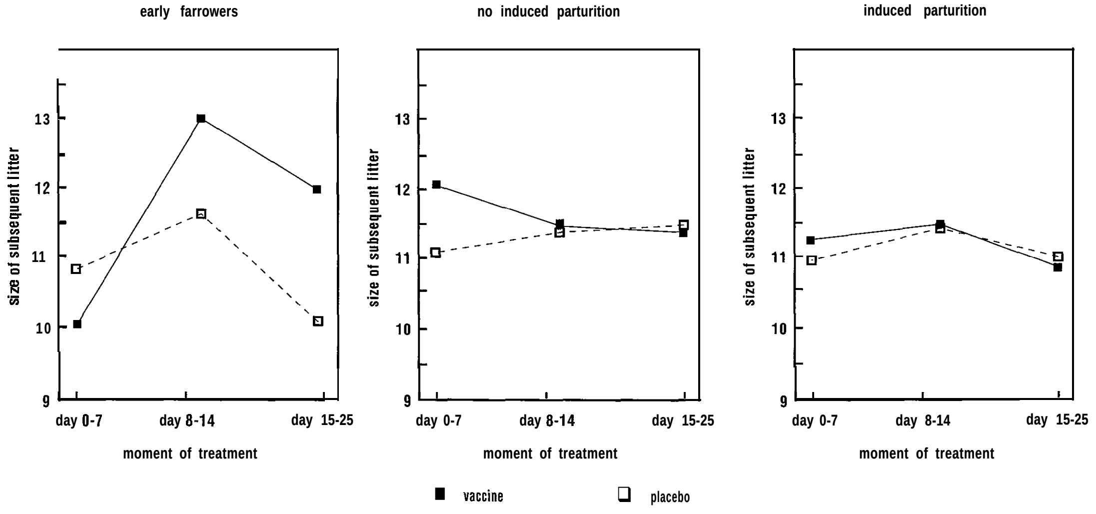

Figure 3: Relationship between moment of treatment and size of subsequent litter for 'early farrowers', sows in which either induced parturition is applied or not respectively

the fact that this difference did not show up with all comparable combinations of the experimental factors induced parturition and moment of treatment. The larger number of piglets, in absolute terms, was born from 1) sows from the group in which no induced parturition was applied and that had been treated with vaccine in the first week of the lactation period and 2) early farrowers treated with vaccine just after the first week of the lactation period. The size of the subsequent litter of the early farrowers treated in the first week was, in absolute terms, smaller. Induced sows showed almost no difference in size of the subsequent litter between vaccine and placebo. That sows treated with vaccine had somewhat larger litters, in absolute terms, might be a result of a better prevention against the consequences of, particularly, a Parvovirus. It was assumed that the Erysipelas microbe was not or barely present on the farm, contrary to the Parvovirus. During the rearing period the gilts were consistently vaccinated. However, if this vaccination is not repeated in sows each cycle, as was the case in the placebo group in this experiment, prevention against Parvo can be reduced.

There was no significant difference in litter size caused by moment of treatment ($p = 0.24$). Although the litter was, in absolute terms, 0.5 piglet larger when sows were treated in the second week (11.7 piglets) compared to 1st week treatment (11.1 piglets) or 3rd/4th week treatment (11.2 piglets), one cannot speak of a difference. The absolute differences have particularly been caused by early farrowers. Sows farrowing as from day 114, irrespective of whether or not induced parturition was applied, did not show (or hardly showed) these differences and surely not consistently (figure 3).

Percentage of piglets born alive

When sows were treated with a placebo rather than with vaccine, the percentage of piglets born alive in the subsequent litter was significantly higher. This difference, approximately 2%, seems to be somewhat related to the difference in the total number of piglets born. It is a known fact that an increase in litter size coincides with a relative increase in stillborn piglets. Moment of treatment did not significantly affect the percentage of piglets born alive. Treating in the

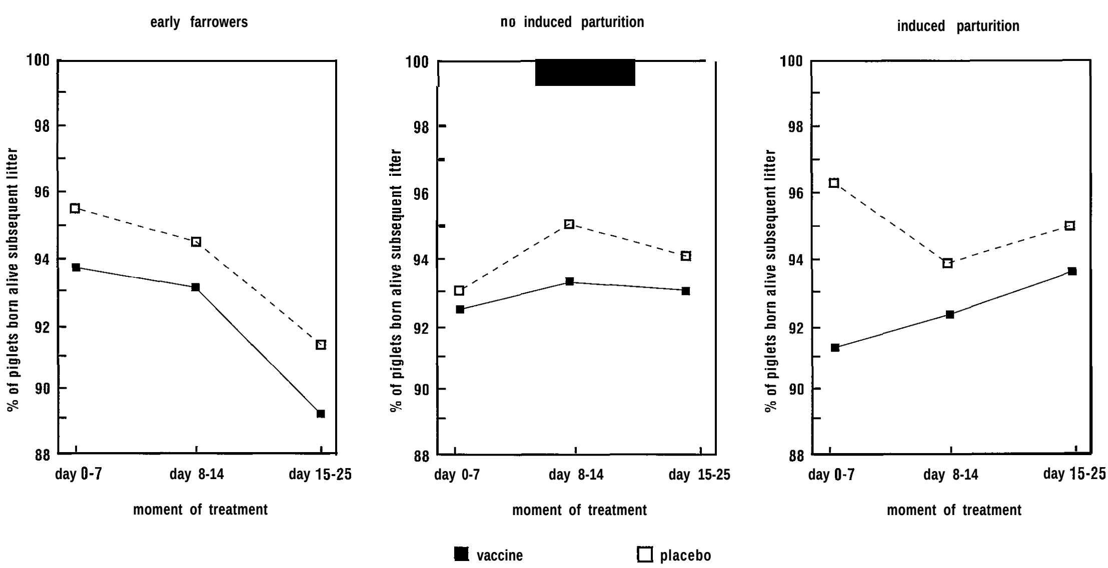

Figure 4: Relationship between moment of treatment and percentage of piglets born alive for 'early farrowers', sows in which either induced patturition is applied or not respectiveiy

third/fourth week of the lactation period seems less favourable than treating in the first or second week (92.6 vs 93.5% piglets born alive). However, as to percentage of piglets born alive, the early farrowers, non-induced and induced sows responded differently to moment of treatment in the lactation period (figure 4).

Induced patturition
The most important reason for applying induced parturition will be that sows that have been treated in the morning, will give birth during the day and that relatively many sows will do so within a relatively short period of time. In this way, farrowing can be controlled in a more efficient way. Moreover, weak piglets or those remaining in the placenta can be saved, by which the percentage of piglets born alive increases. There will also be more possibilities of standardising litters and/or fostering piglets, by which the number of weaned piglets can be increased. In this experiment no effect could be found of whether or not applying induced parturition on the percentage of piglets born alive. For each sow it was decided when induction was to take place (day 114 of the gestation period), by which sows to be treated within a farrowing period were not treated at the same time. Extra birth control of induced sows in comparison with non-induced ones did not take place during this experiment.
In applying induced parturition the average gestation period was approximately half a day shorter. Particularly the distribution of the length of the gestation period was smaller: after induction over 83% of the sows farrowed on the same or next day. Of the non-induced sows 20% farrowed on day 114 and 28% on day 115. Kirkwood (1996) found that approximately 68 - 74% of the sows had farrowed within 32 hours after induction. He, however, applied induction already on day 112 or 113 of the gestation period. Part of the induced sows farrowed on day 117 or later and did not respond well or insufficiently to treatment. Of the induced sows 0.5% did not farrow until day 119. Of the non-induced sows this was 3.6% on day 119 or even later.
Weight at birth of the piglets born alive from induced sows and farrowing on day 114 of the gestation period was significantly lower than from non-induced sows and from those induced sows that farrowed on or after day 115. In absolute terms, the difference was 40 to 70 grams. This difference is related to inducing on day 114 of the gestation period. When inducing on day 112 or 113 the difference is likely to be greater. To farms where weight at birth is sufficiently high this would not be a problem. However, should weight at birth be a bit low, it is recommended to exercise some restraint in applying induced parturition. Not applying induction sooner than day 113 or 114 of the gestation period might be an alternative. The number of splayleg piglets was slightly to significantly larger in induced sows and was almost equal to that of the early farrowers. During the experiment all splayleg piglets were accurately recorded to get a good insight into the effect of induced parturition. In absolute terms this proved to be rather low: 1 to 1.5%. Farms where splayleg is a problem are recommended to be very critical in applying induction of parturition or to limit it as much as possible.

4.3 Conclusions

A clearly larger part of sows in which no induction was applied and were treated with vaccine or placebo in the first week of the lactation period showed to have come into oestrus on day 6 or later than sows treated with a placebo between days 15 and 25. However, the length of the weaning-to-oestrus interval of sows farrowing on or before day 113 of the gestation period and of induced sows showed not to have been affected by moment of treatment and/or product.
Of sows having farrowed on or before day 113 of the gestation period, a significantly higher percentage had not come into oestrus spontaneously on day 15 after weaning, compared with sows farrowing on or after day 114 of the gestation period. This was not clearly affected by whether or not induction was applied, moment of treatment and vaccination as such.
Farrowing rate from 1st insemination was influenced by moment of treatment, use of either vaccine or a placebo, whether or not

induced parturition was applied and early farrowing. Here a three-way interaction applies. That is why no strong conclusions can be drawn as to the effects of the separate factors.
Size of the subsequent litter was not greatly influenced by moment of treatment, vaccination or whether or not induced parturition was applied. The Swine erysipelas-Parvo vaccine used in this experiment did certainly not negatively influence size of the subsequent litter. The percentage of piglets born alive was significantly lower (approximately 2%) than when administering a placebo, however, due to which the possibly positive effect on litter size was partly undone.
Induced parturition, applied on day 114 of the gestation period, reduced the average gestation period by approximately half a day. The percentage of piglets born alive was not significantly affected by this, weight at birth of the piglets born alive was significantly lower of induced sows farrowing on day 114. The percentage of splayleg piglets was significantly higher after induction.

4.4 Importance to practice

On the basis of this experiment vaccinating sows against Swine erysipelas and/or Parvo during the first week of the lactation period cannot be considered to have significant adverse effects. Vaccination in the first week of the lactation period showed a tendency towards a somewhat longer weaning-to-oestrus interval in sows having farrowed on or before day 113 of the gestation period (early farrowers). However, the number of sows in this group was limited, so that caution should be exercised in interpreting the results. Farrowing rate of the sows treated with vaccine remained at a comparable level or slightly increased when vaccination was done later in the lactation period. The farrowing rate of the early farrowers, treated with vaccine in the third/fourth week of the lactation period, was strikingly low. Vaccination in the first or third/fourth week of the lactation period resulted in a smaller litter size, in absolute terms, than vaccination in the second week. However, this was not significantly different.

It cannot be ruled out that the conclusions do not apply to other vaccines than the one used in this experiment (Porcilis® Ery+Parvo), or that the effects might even be greater. Although this was not the purpose of this experiment, it can be concluded that the Erysipelas-Parvo vaccine used in this experiment and administered during the lactation period did not adversely affect reproductive performance of the sows.
Treatment with vaccine resulted in an increase (statistically not significant) in litter size of approximately 0.5 piglet, compared with treatment with a placebo. The percentage of piglets born alive was, however, somewhat lower (significant: 2%).

Farms with a rather low weight at birth are advised not to apply induced parturition. If farmers want their sows to farrow at the same time as much as possible, they are advised not to administer the induction product until day 114 of the gestation period. Farms where relatively many splayleg piglets are born are advised not to administer induction products, since this will result in an increase in splayleg piglets.

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APPENDIX

Appendix 1: Farrowing rate from 1st insemination per combination of the three experimental factors moment of treatment, vaccination and whether or not induced parturition

moment of treatment	day 0 - 7		day 8 - 14		day 15 - 25	
vaccination	vaccine	placebo	vaccine	placebo	vaccine	placebo
early farrowers:						
number of sows inseminated[1]	19	24	24	28	24	26
farrowing rate from 1st insemination	80.4[ab]	80.6[ab]	87.8[bc]	74.8[a]	63.1[a]	77.1[ab]
no induced parturition:						
number of sows inseminated[1]	63	66	64	61	56	61
farrowing rate from 1st insemination	85.1[bc]	80.1[ab]	85.3[bc]	93.1[cd]	89.0[bc]	76.4[a]
induced parturition:						
number of sows inseminated[1]	59	55	53	42	40	41
farrowing rate from 1st insemination	89.2[bc]	79.3[ab]	94.1[cd]	92.2[bcd]	97.5[d]	81.5[ab]

[1] + insemination within 15 days after weaning

[a,b,c,d] a different letter within the table indicates a significant difference between the experimental treatments

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