VIDENCENTER FOR SVINEPRODUKTION

# FERTILITY HIGHER WITH POOLED DUROC SEMEN THAN WITH SEMEN FROM ONE BOAR

TRIAL REPORT NO. 969

Litter size increased by 0.3 piglets when sows were inseminated with semen doses containing sperm from several boars than from just one boar.


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PUBLISHED: JUNE 13, 2013


## Abstract


The aim of this trial was to investigate the fertility of semen doses that contain sperm from either one, three or six Duroc boars.

The trial was conducted on five different farms where sows were randomly assigned to three different groups:

**Group 1:** Sows were inseminated with semen doses containing sperm from one boar.

**Group 2:** Sows were inseminated with semen doses containing sperm from three boars.

**Group 3:** Sows were inseminated with semen doses containing sperm from six boars.

Results revealed that when the semen dose contained sperm from several boars, litter size – measured as total born piglets – increased by 0.3 piglets compared with doses containing sperm from just one boar.

This has consequently lead to the decision that in the future commercial semen doses from Danish DanAvl AI stations will always consist of sperm from minimum three boars. Economically, the increase in litter size of 0.3 piglets corresponds to approx. DKK 150 per sow/year [1].

FUNDING
The trial was financially supported by the Pig Levy Fund and the EU and the Rural District Programme under the Ministry of Food, Agriculture and Fisheries of Denmark. Activity no. 50-351900. File no: 3663-D-10-00461.

# Background

To ensure optimum fertility with the semen doses used and to streamline work routines at the AI stations, pooled Duroc semen – so-called commercial semen – has for years been used on Danish AI stations for production of finishers. Commercial semen was originally defined as a semen dose containing sperm from up to 10 Duroc boars [2].

Research has previously demonstrated that the fertility of high-quality sperm is not adversely affected by being pooled with low-quality sperm [3]. In that trial, semen was categorized as high or low-quality based on sperm motility. Semen doses were produced containing high-motility sperm from three boars (group 1); low-motility sperm from three boars (group 2); and a mix of high and low-motility sperm from six boars (group 3). Results demonstrated that using low-motility sperm, total born piglets dropped significantly (0.5 piglets/litter) compared with groups 1 and 3. In comparison, semen doses containing high-motility sperm had the same fertility – recorded as total born piglets – as the doses containing both high and low-motility sperm. The fact that a semen dose contains sperm from boars with low-motility sperm does not reduce the fertility of the dose as long as it also contains high-motility sperm. No previous trials have investigated whether a positive effect on fertility can be obtained by pooling sperm from random boars approved for AI.

Semen consists of sperm cells and seminal plasma – seminal plasma is a fluid, ie. that part of the semen that is not sperm cells. The effect of pooling sperm from different boars and thereby the effect of seminal plasma on the sperm of another boar has not been thoroughly investigated, but research indicates that the components of seminal plasma may reduce as well as improve the fertility of sperm. Foreign studies have found that seminal plasma from individual boars may affect sperm from other boars positively as far as the seminal plasma of these boars is concerned [4].

Seminal plasma contains a wide range of proteins some of which are believed to affect sperm fertility [5]. Different boars will have different concentrations of these proteins. Consequently, sperm and

seminal plasma from one boar with high concentrations of these proteins may actually improve the sperm fertility of other boars whereby a positive effect can be obtained by using pooled semen.

The aim of this trial was to investigate the effect on litter size of using semen doses containing sperm from one, three or six boars.

# Materials and methods

The trial was conducted on five sow farms – see appendix 1 for a detailed description of each farm. The trial period ran from September 2010 to December 2012.

The semen doses used in the trial were produced at Hatting AI, Viborg, and Boar Station Mors, respectively. Three different kinds of semen doses were produced:

Group 1: Sows were inseminated with semen doses containing sperm from one boar.
Group 2: Sows were inseminated with semen doses containing sperm from three boars.
Group 3: Sows were inseminated with semen doses containing sperm from six boars.

All doses were produced according to “Guidelines for AI stations – semen preservation and health control” [2]. All doses were produced three days prior to the first insemination on the farms – recommendations state that commercial semen be used no later than 4 days after collection.

The trial comprised 6,761 sows randomly assigned to groups 1-3. The trial only included sows inseminated the first time on d 4 or 5 post-weaning. At each insemination within the same oestrus cycle, the sows were inseminated with semen doses from the same group. The sows were subject to oestrus detection according to the 5-point plan and a teaser boar was used.

Primary recordings included whether the sow made it to farrowing and the total number of piglets born at farrowing.

For each day of production, one semen dose from each group was subject to analysis of number of sperm per dose. The sperm from each dose was weighed, and 1.00 ml semen was diluted with 10.00 ml Reagent S100 (Chemometec, Allerød, Denmark) for recording of sperm concentration. Using NucleoCassette SP1 (Chemometec), a sample of the diluted semen was analysed in the NucleoCounter SP100 (Chemometec). All analyses were conducted as two separate consecutive measurements.

### Statistical analyses

All analyses were made with the SAS programme. Differences in total born piglets per litter between the groups were subject to analyses of variance. Group and sow age were included as explanatory variables, and sow farm as systematic effect. Differences in farrowing rates between the groups were subject to logistic regression analyses. The model included group and sow age as explanatory variables and sow farm as systematic effect. Differences in sow age between the groups were also subject to logistic regression analysis. The model included group and sow age as explanatory variable and sow farm as systematic effect.

The number of sperm per semen dose was subject to analysis of variance. Group, batch and sperm motility (sperm motility and the percentage of defect sperm in the dose are routine recordings in the production process [2]) were included as explanatory variables and day of collection as random effect.

# Results and discussion

Table 1 below shows the production results recorded for each of the five farms.

**Table 1.** Production results for all three groups.

| | Group 1<br>Sperm from 1 boar | Group 2<br>Sperm from 3 boars | Group 3<br>Sperm from 6 boars |
|---|---|---|---|
| Sows inseminated | 2,237 | 2,244 | 2,280 |
| Average parity | 4.4 | 4.4 | 4.5 |
| Litters | 2,044 | 2,023 | 2,076 |
| Farrowing rate, % | 91.4 | 90.2 | 91.1 |
| Litter size, total born, ±SEM | $17.91^{a}$ ±0.08 | $18.19^{b}$ ±0.08 | $18.22^{b}$ ±0.08 |

a, b: Significant difference.

SEM: Standard Error of the Mean.

As seen in table 1, farrowing rate and parity were on average identical for the sows in all three groups. Litter size in the form of total born piglets differed significantly between the groups (P=0.0103). Litter size in group 1 (sperm from one boar) was significantly smaller than in groups 2 and 3 where the doses contained sperm from three and six boars, respectively. Litter size did not differ whether the semen doses contained sperm from three or six boars. A positive effect of pooling semen was observed when the dose contained sperm from three boars.

**Table 2.** Sperm content per dose.

| | Group 1 Sperm from 1 boar | Group 2 Sperm from 3 boars | Group 3 Sperm from 6 boars |
|---|---|---|---|
| Analysed semen doses per group | 212 | 228 | 212 |
| Motile sperm per dose, billion motile sperm ± SEM | 1.84 ± 0.01 | 1.81 ± 0.02 | 1.81 ± 0.02 |

SEM = Standard Error of the Mean.

The content of sperm per dose was recorded in 652 doses to confirm that the content did not vary between the groups. Results confirmed that the number of sperm per dose was identical for all groups (table 2). Consequently, the difference observed in litter size cannot be attributed to differences between semen doses.

It is uncertain what function caused the increase in litter size, but the outcome of this trial demonstrates that the fertility of a semen dose increases when it contains sperm and seminal plasma from several boars. The slightly lower litter size observed in group 1 may be attributed to a few low-fertility boars causing a lower litter size in some sows. By pooling semen, this effect may be neutralized as the pooled dose will contain sufficient amounts of “good quality sperm”.

# Conclusion

This trial demonstrated that semen doses containing sperm from several boars affected fertility positively compared with doses containing sperm from just one boar.

When a semen dose contained sperm from three or six boars, litter size – measured as total born piglets – increased by 0.3 piglets compared with doses containing sperm from one boar only.

The outcome of this trial has led to the decision that commercial semen doses from Danish DanAvl AI stations will in the future always consist of sperm from minimum three boars.

# References


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## Assistance


**Technical support:** Mogens Jakobsen & Erik Bach

**Statistical support:** Mai Britt Friis Nielsen


Trial no.1067

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# Appendix

## Herd description

| Herd | A | B | C | D | E |
|---|---|---|---|---|---|
| Sows/year | 1,200 | 325 | 400 | 1,025 | 750 |
| Batch size | Large batch of 65 sows<br>Small batch of 20 sows | 35 sows | 40 sows | 40 sows | 24 sows |
| Weekly operation | 1-week | 2½-week | 2-2-3-week | 1-week | 1-week |
| Service unit | Stalls with boar in front | Stalls with boar in front | Stalls with boar in front | Stalls with boar in front | Stalls with boar in front |
| Use of boar | Boar cart + boar behind the boar cart for subsequent stimulation | Fence line contact – one boar per 5 sows | Fence line contact – one boar per 5 sows | Fence line contact – one boar per 5 sows + boar for subsequent stimulation | Fence line contact - one boar per 4-5 sows |
| Semen production | Purchased | Purchased | Purchased | (On-farm AI) Purchased during trial | Purchased |
| Gestation unit | One feeding stall/sow | Stalls | One feeding stall/sow | One feeding stall/sow | Stalls |
| Feeding | Liquid feeding | Dry feeding | Dry feeding | Liquid feeding | Liquid feeding |

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