Discovering the secrets of good sperm quality

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Good semen quality stands for a maximum in fertility and shelf life and the absence of contagious micro-organisms. To have a boar that has the ability to match these essentials is only half the task. The crucial task is to preserve the quality characteristics of a boar's ejaculate – a demanding and complicated process. Where are the pitfalls?

Good hygiene

Collection areas, boars and humans are a dangerous source of micro-organisms contaminating the ejaculate. Bacterial contamination leads to reduced viability and a shorter shelf life for sperm cells.

Therefore, good hygiene management during and after collection is essential to achieve high quality semen:

- The pens have to be kept clean.
- The boar's preputial hair should be cut regularly, and prior to collection his prepuce should be emptied, cleaned and dried.
- At the end of every semen collecting day, the collection area and the dummy have to be cleaned thoroughly, and with disinfectant at least once a week.
- The use of disposable materials (collecting bags, gloves) is essential.
- The 'double glove method' ensures a hygienically flawless semen collection.
- The semen collection vessel needs to be given to the laboratory through a hatch immediately after the boar has finished ejaculation. Semen collectors must not be allowed to enter the laboratory.

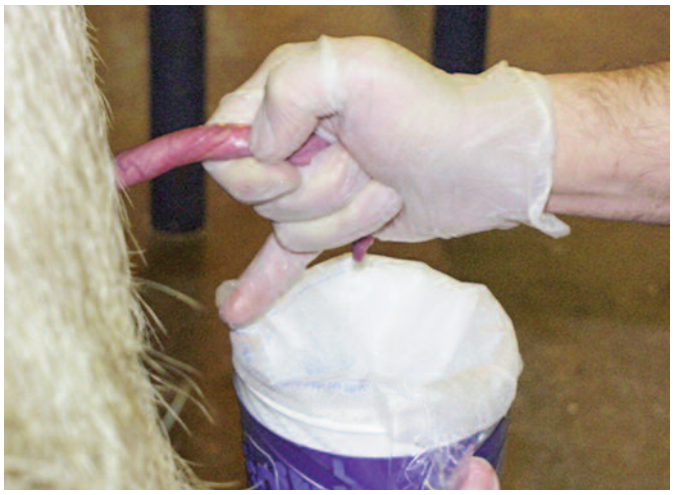
Supplies and persons are the greatest risk for the semen laboratory to receive bacterial contamination, therefore:

- Laboratory personnel should shower in the interior zone and put on clean laboratory clothing.
- No one should be allowed to walk from the boar pens or collecting room to the laboratory.
- Inside the laboratory, all objects that come in contact with semen or extender have to be disposable.
- The laboratory needs a comprehensive protocol of daily cleaning and weekly disinfection.
- Laboratory personnel should be well and frequently trained concerning hygiene matters.

Macroscopic	Microscopic	Physiochemical
Look	Concentration	pH value
Smell	Motility	
Volume	Morphology	

Table 1. Standard evaluation for mammalian semen.

Use disposable materials and the right technique for semen collection.



Semen evaluation

Regular quality control of holding samples of semen doses produced by a boar stud is an excellent practice that serves to monitor and improve the techniques used by stud personnel to collect, evaluate, process, package, and transport boar semen (see Table 1).

At the same time it provides confidence to the sow farmers that the final product received is of excellent quality for their AI programs.

The most practical way to measure the volume is using a balance.

The boar usually produces ejaculates between 100ml and 500ml. Volume varies according to the age, genetics, season and collection frequency.

Semen collection frequency should not be higher than twice per week for adult boars and not higher than three times in two weeks for boars younger than 12 months.

The ejaculate is composed of the pre-secretions and three phases:

- Pre-secretions: Secretions of urethra and accessory glands are the first jets with the function of cleaning the urethra. They are transparent and without semen cells.
- Rich semen phase: milky aspect contains approximately 70% of the spermatozoa of the ejaculate volume.
- Poor semen phase: aspect between transparent and milky, carries fewer spermatozoa and may be observed alternating with the rich phase.
- Gel secretion: usually at the final

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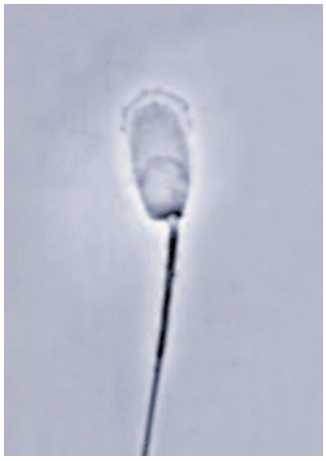
Distal plasma droplet.



Detached acrosome.

Bent tail.

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phase of ejaculation. For hygiene reasons, the first (clear pre-secretion) and last parts of the ejaculate (mainly gel fraction) must be discarded as they contain the highest level of contamination.

Measuring the concentration of spermatozoa in an ejaculate is easily done with a photometer. Today's devices are very accurate and simple to handle. Some of them do not need any sample predilution and the density of the semen is shown on the display within a few seconds.

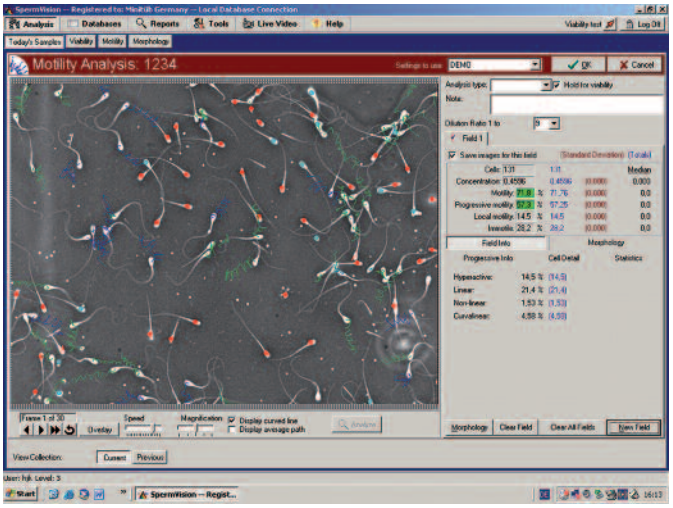
The percentage of (progressive) motile sperm cells in an ejaculate has a proven impact on its fertility.

Motility evaluation basically ranges from subjective microscopic to a more objective Computer Assisted Semen Analysis or CASA (image analysis with a phase-contrast microscope and computer measurements of motion parameters).

CASA systems today allow both an objective and time saving method to evaluate all basic characteristics of semen quality: concentration, motility and morphology.

Sperm cells can be motile, but at the same time have morphological deviations, which can substantially affect their fertility.

Morphological defects of sperm cells can be found on the head's cap (acrosome), the head itself or the middle piece. Various types of coiled tails as well as cytoplasm drops are frequently found abnormalities. This evaluation still has to be done manually by staining the sperm cells, but new systems for an automated detection of morphological abnormalities are coming onto the market.



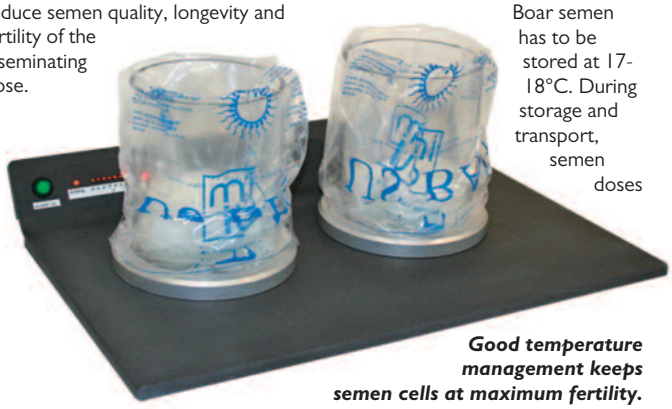
Evaluation of concentration, motility and morphology with SpermVision CASA software.

The umbrella Association of German Pig Producers (ZDS) defines the requirements for boar ejaculates as shown in Table 2.

Semen processing

During the time required for the evaluation of the concentration and motility and for the calculation of doses, the ejaculate and the extender have to be kept at the same temperature, preferably between 32-38°C, on a warming plate or in an extender vat, respectively.

Temperature variations may reduce semen quality, longevity and fertility of the inseminating dose.



Good temperature management keeps semen cells at maximum fertility.

Furthermore, it is of crucial importance that both semen and extender have the same temperature at the time of dilution, as boar semen especially is extremely sensitive to cold shock.

A difference of more than ±1°C may result in a decrease of quality of the semen dose.

Helping a good ejaculate to keep its quality and fertilisation capacity is where a good preservation medium makes an important contribution.

Long term extenders today protect membranes, acrosomes and cytoplasm by absorbing stress and toxins to which sperm cells are exposed.

Newly developed extenders aim to protect essential attributes of semen cells over an extended storage period with sometimes unstable and less favourable storage conditions.

But even the best preservation medium can not compensate for mistakes occurring in semen processing and even less, for quality of the semen itself.

The proper preparation and handling of the water that is used for making the extender is of great importance. It has to be purified by distillation, deionisation, reverse osmosis and, if necessary, by additional sterilisation. Once the ejaculate is evaluated, it must be extended within approximately 10 minutes, because its viability decreases later on. Dilution should proceed slowly and gradually, but thoroughly. The extender is always added to the semen and not vice versa.

The number of cells per insemination dose (normally between 1.5 and 2.5 billion) depends on the individual management and the quality of the ejaculate.

In modern semen laboratories, the calculation of semen doses is automatically done by the CASA software.

It is important to know that a too fast dilution or decanting as well as the use of pumps impose mechanical stress upon the cells.

After having finished dilution, a final microscopic motility test should be performed. Ejaculates with motility rates below 70% at this point should be discarded.

Boar semen has to be stored at 17-18°C. During storage and transport, semen doses are sometimes exposed to lower or higher temperatures than the optimum and over a longer period. In addition, the optimal temperature of 17°C is often not kept consistently on the farm.

As it would be a shame to lose fertile semen cells at this final stage, here are some recommendations for the farmer:

- Store the semen in a cooling box at a temperature range of 17-18°C until use.
- Do not expose it to sunlight and at best keep the tubes in a dark environment.
- Do not warm up the semen.
- Do not shake the tubes, not even prior to insemination.
- Do not open the tubes until just before AI.
- Finally, take only as many semen tubes out of the box as you need for the next insemination

In the end, if all the steps to produce and preserve high quality semen have been maintained, if the farmer uses a catheter with a hygienic sheath for insemination and he meets the optimal time point for insemination, success will come 114 days later – providing him and the boar stud with the basis for a prosperous partnership. ■

Table 2. Minimum requirements for boar semen quality (ZDS, 2006).

Characteristics	Minimum requirement
Colour	Grey-white, white, yellow-white
Consistency	Milky
Admixtures (urine, blood, pus)	None
Contaminations (faeces, hair)	None
Smell	Neutral
Volume without bulbourethral gland secretion	100ml
Sperm concentration (10^9)	Depends on boar age: ≤ 9 months: 0.150 > 9 months: 0.200
Total sperm in ejaculate (10^9)	Depends on boar age: ≤ 9 months: 15.0 > 9 months: 20.0
Motile spermatozoa (%)	70
Motile spermatozoa after three days of storage (%)	65
Total morphological abnormalities (%)	≤ 25
Sperm with head abnormalities (%)	≤ 5
Sperm with acrosome abnormalities (%)	≤ 10
Sperm with plasma droplets (%)	≤ 15
Sperm with coiled tails (%)	≤ 15
Other morphological abnormalities (%)	≤ 15
Microbial content	No specific pathogens for human or animal