FRESH BOAR SEMEN

Careful handling is a primary factor in maintaining the fertility of fresh boar semen from collection through shipping and storage. However, there is very little science-based literature on the relationship between semen fertility and shipping.

It is well understood that fluctuations in semen temperature during storage are detrimental to spermatozoa. Most storage methods have been developed to minimize these temperature changes and to optimize the shelf life and fertility of the semen. By the same token, the basic goals of semen shipment should be to minimize this same factor—fluctuation in semen temperature—as well as control two other key aspects of the shipping process, namely, rough handling and cost.

From a physiological standpoint, temperature and rough handling are what have the most impact on the fertility of semen doses used on a sow farm. This brief article will provide a summary of some of the common semen-shipping procedures in the swine industry and give some personal insights into how well these processes work.

Boar semen can be packaged and shipped either fresh or frozen and delivered to the farm by various means. It can be shipped commercially (ground or air) or through an in-house delivery system. Most boar stud operations have developed an in-house delivery system that allows stringent control of the two main factors in semen quality—temperature and handling.

Importance of temperature

We know that the optimal storage temperature for freshly ejaculated boar semen is around 17°-18° C and that fluctuations in temperature up or down 1 or 2 degrees can decrease stored sperm viability. Following collection and the addition of a semen extender, semen should be slowly cooled to storage temperature, and then held stable until insemination (Figure 1). A consistent process of semen cooling and a constant storage temperature will directly affect the metabolic activity of the sperm cells. A gradual and constant reduction of sperm metabolic activity conserves spermatozoa energy and viability, while reducing the risk of pH fluctuations and nutrient depletion of the semen extender. In short, sperm will store longer.

<table>
<thead>
<tr>
<th>Collection</th>
<th>Transport</th>
<th>Storage</th>
<th>Insemination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (Celcius)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Figure 1. Ideal pattern of semen temperature changes from collection to insemination](Theoretical diagram adapted from Flowers 1996).

Importance of packaging

Shipping containers, transit time, and the vehicles used for delivery are all factors that can affect the physical environment of spermatozoa during shipment. Based on the method chosen for delivery, there are numerous ways semen can be packaged.

With either in-house or commercial delivery, semen should be securely packaged in shipping containers and protected from physical stress with shock-absorbent material (Styrofoam peanuts). Since in-house deliveries are generally made on the day of collection and handled by a company employee to ensure gentleness and short transit times, maintaining a suitable thermal and physical environment for artificial insemination (AI) doses during shipment is controlled primarily through the choice of packaging or containers. For in-house delivery, AI doses are packaged in Styrofoam containers; in large, insulated coolers; or in mechanized, 12-volt semen storage units maintained at a constant temperature. With the first two containers, cool packs (15° C) are placed around the semen in summer and winter.

Styrofoam shipping containers are used exclusively for commercial shipments of semen because they are lightweight (cost reducing) and designed so that the semen doses can be placed in a smaller box, surrounded by cold packs, and enclosed in a larger container (double-packed). Air cavities between the inner and outer boxes should be filled with Styrofoam packaging peanuts to insulate the doses from rough handling.

During the summer months, frozen packs should be placed in the spaces between the smaller, semen-containing box and the larger Styrofoam container. There
is no set guideline for how many cool or frozen packs to use. It depends on shipping distance, past experience with the shipper, and volume of semen being shipped.

This method appears to be the best one for commercially shipping semen overnight. Flowers (1996) examined the influence of shipping containers on semen quality and, in brief, determined that the presence of cool packs improved the viability of shipped semen in either Styrofoam or plastic containers; however, the improved effect was much more dramatic in Styrofoam containers (Table 1).

**Table 1. Influence of transportation container and presence of “cool packs” on the viability of spermatozoa in transit for 24 hours.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Viability (%)</th>
<th>Temperature Change (°C)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Styrofoam container +</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no cool pack</td>
<td>70.3 x</td>
<td>5.1 y</td>
<td>35</td>
</tr>
<tr>
<td>Styrofoam container +</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cool pack</td>
<td>88.9 y</td>
<td>3.4 y</td>
<td>35</td>
</tr>
<tr>
<td>Plastic container +</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no cool pack</td>
<td>77.7 x</td>
<td>2.1 y</td>
<td>35</td>
</tr>
<tr>
<td>Plastic container +</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cool pack</td>
<td>86.8 y</td>
<td>2.1 y</td>
<td>35</td>
</tr>
<tr>
<td>s.e.m b</td>
<td>4.1</td>
<td>0.2</td>
<td>-</td>
</tr>
</tbody>
</table>

* (Flowers, 1996).

a Temperature change is the difference between high and low temperature within a container.

b Standard error of the mean.

x,y,z Means written with different superscripts within the same column are different.

It is important to consider that commercially produced semen is transported in two different ways: via air or ground. In either case, once the semen leaves the collection facility, stall personnel have no control over where the box will be placed on any vehicle, and temperatures can vary significantly within the vehicle from one location to another. Although boar semen is very tolerant of temperature change (Althouse, et al., 1998), boxes should be labeled “live semen shipment,” and a request for minimal changes in temperature during transit should be communicated with the shipping company.

**Monitoring temperature fluctuations during shipment**

Temperature fluctuations during semen shipment can be monitored in two ways. The first is with a simple, low-cost, high-low thermometer. From a practicality standpoint, this method seems best since semen is almost always shipped “next day overnight,” and in a commercial setting, recovery of thermometers may not always occur.

However, small digital data loggers are available and can be used to examine temperature changes during transit on a minute, hourly, or daily basis. This equipment is generally more expensive and often requires some type of computer system to recover data. Because of the cost, this type of equipment may be more practical in in-house delivery systems or with controlled experiments. Use of this type of equipment may be useful in troubleshooting semen quality problems, especially if the problems are seasonal or transit-route-specific.

One of the most frequently questions asked by shippers is if semen should be cooled to 18° C before shipment? The answer depends on the projected temperature changes during transit. If semen temperatures rise or fall during transit, pre-cooling may not be the best way to handle the material. Once sperm have reached the 18° C storage temperature, it is probably more critical that the temperature remain at that level, in contrast to the temperature swings that may be encountered in the first 24 hours of cooling. Placing extra cool packs in the outside container of double-packed semen (~ room temperature) before transport will ensure a slow, consistent reduction of temperature during transport and will avoid the potential up-and-down temperature changes.

**Summary**

Making sure boar semen remains fresh and viable during shipping can be accomplished by following some common-sense procedures for cooling and by handling it with care:

- Minimize physical stress on the semen.
- Cushion-pack with Styrofoam peanuts.
- Maintain a constant thermo-environment.
- Cool-pack.
- Double-insulate.
- If feasible, use mechanized, 12-volt, shipping and storage containers.

Finally, if shipping commercially, build a good relationship with the shipping company.

—Kevin Rozeboom

**2000 MARKET HOG SHOW WINNERS, NORTH CAROLINA STATE FAIR**

The 2000 North Carolina State Fair attracted a tremendous field of 289 market hogs.

The Junior Market Barrow Show, held at 9 a.m. Friday, October 13, judged pigs weighing between 220 and 270 pounds. The 149 entrants were divided into 10 classes and 3 divisions.

Class winners in Division I were Nicholas Smith, Tyler Sharp, Collin Byrum, and Abi Earle. Sharp drove the Champion and Collin Byrum, the Reserve Champion.

Division 2 class winners were Earlie Byrum Jr., Paul Tucker, and Justin Williams. Earlie Byrum had the Champion and Justin Williams, the Reserve Champion.

Division 3 class winners were Hannah Haynes, Daniel Sharp, and Christina Williams. Daniel Sharp had the Champion and Hannah Haynes, the Reserve Champion.

Earlie Byrum’s 244-pound pig from Class 5 was named the Grand Champion Junior Market Hog by Judge Warren Beeler of Caneyville, Kentucky and Daniel Sharp’s 261-pound pig out of Class 9 was the Reserve Grand Champion Market Hog.

In the Sale of Champions at 3 p.m. Saturday, October 14, the Grand Champion Barrow sold for $7,500 to Harris Teeter...
supermarket, and the Reserve Champion brought $3,100 from Southern States Cooperative. The sale was held in the Kelley Building. Afterward, 98 individual exhibitors are allowed to sell one pig through the auction, and Lundy Packing Company of Clinton placed a $41-per-hundredweight floor on these animals. While there were numerous buyers, Farm Bureau and Southern States purchased most of the pigs.

The Performance Market Hog Show, held at 2:30 p.m. Friday, October 13, attracted 72 pigs and 17 exhibitors in 6 classes. These pigs were from a large group placed on test by producers in July, and each pig carried its average daily gain paint-branded on its rump.

Class winners were Anthony Locklear, Wesley Looper (twice), Sharp Farms, Inc. (twice), and Daniel Sharp. Daniel Sharp drove the Grand Champion on Foot, and Wesley Looper showed the Reserve Grand Champion. The Champion weighed 270 pounds, and the Reserve weighed 226 pounds.

The Reserve Champion on Foot won the Performance Market Hog Show with 0.40 in backfat, a 7.47 square-inch loin, and 1.02 pounds lean-gain-per-day-on-test. The average carcass measurements for show animals averaging 243 pounds on foot were 0.58 in backfat, a 7.09 square-inch loin area, and a 0.815-pound lean-gain-per-day-on-test. Carcass data were obtained through Real-Time Ultrasound measurements.

The Open Barrow Show, held Saturday, October 14, included 68 pigs ranging from 220 to 270 pounds, shown by 27 exhibitors in 5 classes. Class winners were Frank Feeser, Jeremy Allred (twice), and Wesley Looper (twice). The Grand Champion was shown by Wesley Looper, a 267-pound pig from Class 5. Todd Brown showed the Reserve Champion, a 256-pound pig from Class 5.

The only pigs not in competition were the sow and nursing pigs housed on the porch of the Kelley Swine Building.

Bruce Shankle coordinated the swine shows. Some of those assisting were Todd See, Bob Jones, Frank Hollowell, David Lee, and James Pope. Carcass information was prepared by Todd See and Frank Hollowell.

—James R. Jones

EDUCATIONAL PROGRAMS AT THE 2001 N.C. PORK CONFERENCE

The 2001 North Carolina Pork Conference will provide an opportunity for formal and informal learning on important topics.

Slated January 9-10, 2001, in New Bern, the annual conference will bring the industry together so participants may make and renew friendships, evaluate new products, and obtain the latest information. Educational programs will be offered on Tuesday and Wednesday on the second level of the New Bern Riverfront Conference Center.

This year’s program has been designed for both the unique structure of the North Carolina pork industry and the progressive nature of North Carolina’s pork producers. Three sessions will be offered. The first is designed for managers and other people involved with the breeding herd on a daily basis. The second is a forward-looking session on legislative and economic issues for 2001 and beyond. The third will

### CALENDAR OF EVENTS

#### December

1. **Sludge Management and Closure Procedures for Anaerobic Lagoons (Classroom)**
   - 2.0 credit hours as course number AB03020003
   - Contact James Norris, 910-641-3396

2. **Certification and Continuing Education of Animal Waste Operators**
   - 0.5 credit hour as course number AB12039704
   - Contact Mark Hucks, 252-459-9810

3. **Excel/Computerized Records**
   - 1.0 credit hour as course number AB10019804
   - Contact Mark Hucks, 252-459-9810

4. **Plan of Action for High Freeboard**
   - 2.0 credit hours as course number AB06130002
   - Contact Mark Hucks, 252-459-9810

5. **Cattle Production and the Environment**
   - 1.0 credit hour as course number AB03049804
   - Contact Mark Hucks, 252-459-9810

6. **Determining CAWMP Irrigated Acres**
   - 1.5 credit hours as course number AB06219903
   - Contact Mark Hucks, 252-459-9810

7. **Water Conservation on Swine Farms**
   - 1.0 credit hour as course number AA02049905
   - Contact Star Maready, 910-296-2143

8. **Waste Application Scheduling**
   - 2.0 credit hours as course number AB04089801
   - Contact Star Maready, 910-296-2143

9. **Winterization and Maintenance of Irrigation Equipment**
   - 1.0 credit hour as course number AB01079805
   - Contact Star Maready, 910-296-2143

10. **Odor BMPs**
    - 1.0 credit hour as course number AB04019903
    - Contact Star Maready, 910-296-2143

11. **Hogless Hog Farms**
    - 0.5 credit hour as course number AB07110001
    - Contact Star Maready, 910-296-2143

12. **Southeast Swine Farm Inspection Update**
    - 0.5 credit hour as course number AB07110002
    - Contact Star Maready, 910-296-2143

13. **National Swine Improvement Federation meeting**
    - Nashville, Tenn.

#### January, 2001

9-10 **North Carolina Pork Conference**
New Bern Riverfront Convention Center
New Bern, N.C.

#### February

13 **Edenton Regional Pork Conference**
Edenton, N.C.
present the latest information on animal waste management technologies and odor control.

Dr. Kevin Rozeboom of North Carolina State University will open the program on Tuesday morning with “Successful Sow Farm Management.” He will discuss current and potential applications of reproductive technologies, ranging from the use of ultrasound to advanced artificial insemination techniques.

Dr. Dean Boyd of PIC USA, an internationally recognized expert in feeding the lactating sow, will follow, discussing a variety of methods and concepts that can be used in sow-feeding programs. He also will detail what methods work and what methods do not work in each situation and how to select the best feeding program for your operation.

This session will be rounded out by Steve Mathis of Sampson Community College, who will present information on repair and maintenance in the swine operation.

Tuesday afternoon’s session will provide important information and lively discussion on the “State of the Industry.” A highlight will be a panel of key state senators and representatives, who will give their views on pork production and the state of North Carolina. Then Dr. Dennis Dipietre, a nationally recognized economist will talk about “The Evolving Pork Industry.”

On Wednesday morning, the most recent results of research trials on swine manure management and odor control will be presented by NC State University researchers. This session also will allow participants to earn two hours of continuing education credit for operators of animal waste management systems. The talks will be presented in one-hour blocks, and participants may earn one or two credit hours.

Dr. Mike Williams, director of the Animal and Poultry Waste Management Center at NC State University, will discuss the ongoing evaluations of “Environmentally Superior Waste Management Technologies.” Dr. Theo van Kempen of NC State University will present results from his studies that show promise: “Novel Nutritional Solutions for Odor Control and Waste Management.”

The popular Industry Partner Sessions will be offered again this year. The N.C. Pork Council has always had the strong support of an active allied industry group, and these sessions allow them to add their support to the educational program. Exhibitors were invited to submit papers and give presentations addressing the technical aspects of their products. A number of exhibitors will step from their booths to participate in the sessions. The Industry Partner Sessions will round out the annual conference educational program, allowing producers to get the latest information from both public and private research. This year’s Industry Partner Program will take place in a special educational area on the trade show floor.

Everyone attending the conference will receive a proceedings containing papers from each session. I would encourage you to review the educational program and plan to attend the presentations that best meet your interests. I look forward to seeing you at the Pork Conference.

—Todd See