

## **SEMEN STORAGE AND HANDLING**

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### **Introduction**

Artificial insemination offers the potential to accelerate genetic progress in a breeding program. Currently, the industry relies on the straw as the predominant form of semen packaging and delivery for insemination. Straws permit more uniform control of the freezing and thawing process which has led to improved sperm cell recovery. However, the major disadvantage of the straw system is vulnerability to mishandling. The 0.5-ml French straw is the most popular semen package available today; however, 0.25-ml straws may be available in some areas and from various semen providers. Each of these packaging systems has a different surface-to-volume ratio, which requires unique handling procedures. Furthermore, it is not uncommon that recommendations for handling semen vary among AI organizations using the same package. This has resulted in confusion in some cases within the industry, and on occasion, fostered the notion that almost any method of handling semen is adequate. It is important to understand that semen should be thawed according to the recommendations of the company supplying the specific unit(s) of semen.

Sexed semen is packaged in 0.25-ml straws. These straws require more careful handling due to the larger surface- to-volume ratio compared with larger straws. Thus, 3 seconds is the absolute maximum time for moving these straws from one liquid nitrogen tank to another without damaging the sperm, and similarly for moving straws from the tank to the thaw bath (Seidel, 2011).

### **Liquid Nitrogen Tanks**

Semen storage tanks should be stored away from direct sunlight in a cool, clean, dry, dust-free, well ventilated environment. Tanks should be elevated on a wooden pallet and never stored directly on a concrete floor to prevent acids in the concrete from corroding the bottom of the tank. With proper handling, most tanks will last for years; however, all liquid nitrogen tanks will eventually fail due to aging and loss of vacuum. The first indication of tank failure is an accumulation of thick, icy frost around the neck or vacuum fitting at the top of the tank, caused by liquid nitrogen evaporation. Owners should monitor the level of nitrogen in the tank with a dip-stick twice a month, and note any sudden changes in nitrogen levels. To avoid damage to stored semen, tanks should be re-charged before the liquid nitrogen level falls below 2 inches. Technicians should be aware of differences in temperatures that exist in the upper half of the neck tube for most semen tanks used on farms (Table 1).

**Table 1.** Temperatures found in the neck tube of a typical semen tank.<sup>1</sup>

Location in neck tube	Range in temperature (Fahrenheit)		
Top	+36°	to	+54°
1 inch from top	+5°	to	-8°
2 inches from top	-40°	to	-51°
3 inches from top	-103°	to	-116°
4 inches from top	-148°	to	-184°
5 inches from top	-220°	to	-256°
6 inches from top	-292°	to	-313°

<sup>1</sup>The upper half of the neck tube is the critical danger zone in a semen tank. From Saacke, 1974.

### Semen Handling and AI

Table 2 provides an equipment and procedural check list for managing an AI program. Outcomes resulting from AI programs rely heavily on technicians and farm managers paying close attention to detail, avoiding shortcuts, and not cutting corners. As the beef industry expands the use of fixed-time AI, producers should seriously consider breeding services provided by the various AI companies. Making the move, from breeding cows based on heat detection to inseminating all heifers or cows at a predetermined fixed time, places stress on technicians. Professional technicians that breed cows on a routine basis are recommended in these situations. Furthermore, the role of the technician in an AI program cannot be understated relative to outcomes that result.

Dr. Richard Saacke's recommendations or "on the ranch" philosophy for realizing optimum results from an AI program were published in the 1974 Proceedings of NAAB's Eighth Conference on Artificial Insemination of Beef Cattle. These recommendations hold true today and include:

1. Deal with a reputable AI organization. Have confidence in the source of semen you purchase and the recommendations you receive from the organization.
2. Follow explicitly the producing organization's recommendations for handling and inseminating cows using their product.
3. Stay alert for changes in that organization's recommended procedures and keep up-to-date, we have been and will continue to see change in the industry.
4. Avoid experimenting on your own. It is almost impossible to draw valid conclusions from data collected from a single herd.

### References

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**Table 2.** Artificial insemination equipment and procedure check list.

**Equipment checklist**

1. AI kits allow equipment to be easily transported and should be maintained in a clean environment. Kits should be clean and free of dust, dirt and manure.
2. Forceps for removing straws from tank.
3. A liquid nitrogen tank for storing semen at -320° Fahrenheit (-196°C)
4. Cito Thaw unit or thermos that will maintain a water temperature of 94°- 98° Fahrenheit
5. Sharp stainless steel scissors or Cito cutter.
6. Paper towels.
7. AI gun for insemination (Be sure the gun will accommodate the straw size being used).
8. Disposable plastic breeding sheaths designed for your particular AI gun and straw size.
9. Disposable plastic palpation gloves.
10. Lubricant for assisting in AI procedure.

**Straw retrieval and thawing**

1. Remove plug from liquid nitrogen tank and set aside. Locate desired canister within tank and raise the canister until the cane tops are two to three inches below the top opening of the tank. Avoid raising straws above the frost line in the liquid nitrogen tank. Be sure to keep the canister below the frost line when locating a straw of semen. Avoid lifting the canister too high or for too long during this process. If the semen unit cannot be located within 5–10 seconds, lower the canister back into the tank and try again.
2. Keep a frequently updated semen inventory with the tank for quick location of bull numbers.
3. On new canes bend the identification tab up to a 45° angle to allow better access to semen straws.
4. Use the forceps to remove one straw at a time from the top. If it takes more than 10 seconds to retrieve the straw, lower the canister back into the tank and allow to re-cool for 20 to 30 seconds.
5. Shake the straw gently to remove excess liquid nitrogen and promptly place in 95°F water to thaw for at least 45 seconds. Thaw only as many straws as you can use in 10 to 15 minutes. When multiple straws are thawed, do not allow direct contact during thawing process.
6. Lower the cane and canister into the nitrogen tank as soon as possible after you have placed the straw into the thaw unit. Replace the canister in its proper slot in the neck ring and re-plug the nitrogen tank.

**Loading the insemination gun**

1. Before loading the AI gun, pre-warm the barrel by stroking it vigorously with a clean paper towel or placing close to your body several minutes in advance. Be sure you have the correct AI gun and plastic sheaths for the size of AI straws you will be using. Gun warmers are being used more commonly by the industry and serve a useful purpose.
2. Make sure the plunger of the AI gun is retracted about 6 inches to allow for insertion of the straw.
3. Remove the straw from the thaw water and wipe it completely dry with a paper towel. Protect the straw from sunlight, wind and debris with your body.
4. Check to see that the straw contains semen from the desired bull and that a small bubble is at the crimped end of the straw. If the bubble is not at the crimped end, gently tap the straw until the bubble moves to its correct position.
5. Place the cotton plug end of the straw into the AI gun.
6. Wipe the scissors with a paper towel and cut the straw at a right angle ¼ inch below the crimped seal.
7. Slide the plastic sheath over the straw and gun and firmly attach the sheath and gun together.
8. Inspect the straw end of the gun to ensure a proper seal between sheath and straw.
9. Wrap loaded gun in a paper towel or in a plastic sheath cover to provide both thermal and hygienic protection and place the gun inside your clothing or gun warmer for transport to the cow.

**AI procedure and follow-up**

1. Properly clean the vulva with a paper towel and insert the inseminating gun into the cow, proceeding to the target site of deposition.
2. Deposit semen slowly and completely. Recheck the target if needed.
3. Remove glove with sheath inside and recheck the used straw to confirm that the correct semen was used.
4. Record cow number, semen code or bull's name, insemination date and time, and technician.
5. Clean used equipment prior to storage and disinfect boots.