

By using liquid semen in the Caprogen extender, the New Zealand bull studs inseminate many thousands of cows per sire in full use. In 1975, a well known proved sire Welburn P.G. Buttermann was credited with over 100,000 services, plus some additional semen frozen in straws, for the year.

QUESTIONS

1. What is the purpose of extending or diluting semen?
2. What are the basic requirements for a satisfactory semen extender?
3. How do sperm motility examinations compare for diluted and undiluted semen?
4. What is osmotic pressure and why is it of importance in extenders?
5. What is isotonic solution and how is this characteristic of importance in extenders?
6. What precautions are followed in cooling semen from the time of collection to final dilution?
7. What is the purpose of: egg yolk; glycerol; sugar, and various salts in a semen diluent?
8. Name two basic semen extenders or diluents.
9. In making cytometer count how does the dilution rate affect the computation of sperm concentration?
10. If a sample of semen, 8 ml. in volume, had an estimated 1.5 billion sperm per ml. and motility of 70 percent, how much could it be extended (diluted) so as to provide 20 million sperm per ml. for insemination?
11. Where might semen preserved at ambient temperature be useful? What are two extenders used for semen at ambient temperature?
12. What is the usual number of sperm in a unit of semen (ampule, straw or pellet) used for one insemination?
13. What is the purpose of antibiotics in semen extenders? What antibiotics are used and what is level per cubic milliliter of extended semen?
14. Why is semen colored for field use? What are the colors for each dairy breed?

REFERENCES

- No. 1 (Chapters 16, 17)
No. 2 (Chapters 4, 5, 6)
No. 14 (pp. 5-12, 62-64)
No. 8 (Chapters 6,7)

EXERCISE XVII

FROZEN SEMEN, LONG TIME STORAGE — TRANSPORTATION — HANDLING

OBJECT

To become familiar with the processing and use of frozen semen, long time storage methods, transportation, and handling.

DISCUSSION

Frozen semen, or "deep freeze" semen as it is called in Europe, refers to semen frozen and stored at -79°C (-110°F) in dry ice and alcohol, or in liquid nitrogen as a refrigerant at -196°C (-320°F). Liquid nitrogen is the most commonly used refrigerant. It has simplified the entire frozen semen program because liquid nitrogen is fairly stable, non-explosive, and storage containers need be replenished with the refrigerant only every 6 to 20 weeks. Worldwide shipping of frozen semen stored in liquid nitrogen containers is routine. While dry ice and alcohol were used in the early days of frozen semen (1951-1956), it has largely disappeared as has mechanical refrigeration capable of producing and maintaining -79°C (-109 - 110°F). Liquid air is employed as a refrigerant for frozen semen in some parts of the world. Since it may permit oxygen buildup and become explosive, its use is limited.

The advantages of frozen semen are:

1. With frozen semen, selective mating is possible. A dairyman can use the sire of his choice at any time.
2. Frozen semen is valuable in extending the influence of sires long after they are dead. Semen stored in the frozen state for ten to twenty years has produced living calves.
3. Frozen semen permits almost one hundred percent utilization of the semen. No semen need be discarded because of age, as is true with liquid semen.
4. Transportation costs of semen from the bull stud to area technicians is greatly reduced. Instead of daily or every other day shipments of liquid semen -- the technician may have his supply of semen from selected bulls replenished every two or three weeks.
5. Dairy and beef cattle breeders can maintain a supply of frozen semen on their own premises and inseminate cows to selected bulls as a part of routine herd management.
6. Selected matings to sires in widely located areas are possible. It is possible to make matings almost anywhere in the world. Shipment from coast to coast and world wide is now a common practice.
7. A herd owner who owns a valuable bull may have semen "custom collected," frozen and stored for use in his own herd. Frozen semen also permits joint use of a partnership bull even though the owner's herds are hundreds — even thousands — of miles apart.
8. The freezing process does not kill *Vibrio* organisms, but if the extended semen is treated with streptomycin, penicillin, and polymixin B as recommended and at least six hours elapse before freezing, the semen is relatively safe for use in the frozen state.

FERTILITY

Experience indicates that non-return rates using frozen semen are approximately equal to field

results with liquid semen. Some bulls are discarded because the semen will not withstand freezing. Also, about 25 to 50 percent of the sperm are killed during the freezing process. Therefore, most organizations use 12 to 20 million sperm per cubic milliliter of extended semen for freezing.

EQUIPMENT FOR FROZEN SEMEN

The equipment needed for freezing semen in addition to beakers, flasks, graduated cylinders, and glass ampules is a cooling bath and dependable thermometers. There are liquid nitrogen cooled semen storage units holding a few hundred insemination doses for field use by inseminators on storage in breeders' herds. There are also large liquid nitrogen storage units that hold thousands of ampules, pipettes, straws, pellets, or other insemination doses. The processing of frozen semen is well mechanized in modern bull studs. Ampule fillers, sealers, and labeling machines are in regular use. These are universally used by bull studs or AI organizations throughout North America. This equipment can be purchased from many supply houses. (Figures 17.1 and 17.2).

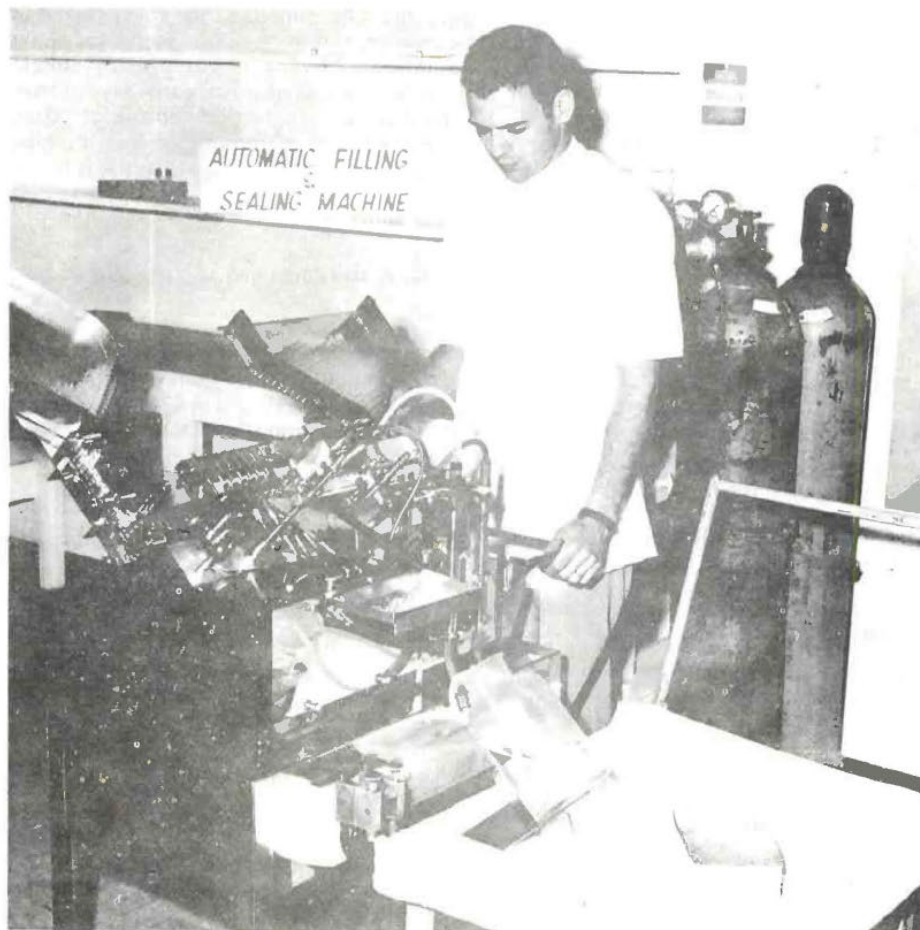


Figure 17.1 — An automatic ampule filling and sealing machine in operation.



Figure 17.2 — Central storage tanks for frozen semen. These tanks hold about 15,000 ampules each.
(Photo courtesy Curtiss Breeding Industries, Elburn, Illinois)

EXTENDERS FOR FROZEN SEMEN

The usual egg-yolk-citrate extender or boiled milk, treated with glycerol, MinnesotaGO, and modifications of these extenders are almost universally used as diluents for frozen semen.

New Jersey Station Circular 573 outlines the steps for preparing egg-yolk-citrate and milk extender and are reported here:

EGG YOLK DILUTER PREPARATION

(solution A) Transfer the yolks of four fresh eggs into a 250 ml. graduated cylinder; add an equal volume of sterile, distilled water; mix thoroughly, and allow to stand for a few minutes. (solution B) To a 100 ml. graduated cylinder, add 40 ml. of solution A, 2 g. of sodium citrate dihydrate, 100 mg. of streptomycin sulfate, and make up to a total of 100 ml. with sterile distilled water. Mix thoroughly. (Solution C) To a 100 ml. graduated cylinder, add 14 ml. of glycerol, 40 ml. of solution A, 2 g. of sodium citrate dihydrate and make up to a total of 100 ml. with sterile distilled water. Mix thoroughly.

By combining equal quantities of solutions B and C, a diluter of the following final composition will be formed:

20% egg yolk,
2% sodium citrate dihydrate,
7% glycerol, and 0.5 mg. of streptomycine sulfate per ml.

MILK DILUTER PREPARATION

(solution A) Heat whole homogenized, pasteurized milk in a double boiler to 92 to 96°C for 10 minutes and cool. (Solution B) To each 100 ml. of solution A, add 100 mg. of streptomycin sulfate. (Solution C) To a 100 ml. graduated cylinder, add 16 ml. of glycerol and 84 ml. of solution A, mix thoroughly.

By combining equal quantities of solutions B and C, a diluter of the following final composition will be formed: 92% heated, whole homogenized milk, 8% glycerol, and 0.5 mg. of streptomycin sulfate per ml.

Heated milk — glycerol extenders or the raffinose — glycerol extenders (Cornell) Exercise 16 — may be used with equally desirable results. A great deal of frozen semen is extended with heated milk — glycerol diluent. There are many modifications of extenders for freezing semen and the student is urged to consult current literature on this subject.

PROCEDURES FOR FREEZING SEMEN

The method of semen freezing as adapted by the British workers is described by C. Polge. With some modifications, it is followed by most American workers. The extender may be one of those mentioned above.

1. Immediately after collection, dilute the semen with a diluent made up of 50 percent by volume of 2.94 percent sodium citrate (dihydrate) solution. Usual predilution rate is 1:1 at room temperature (30°C).
2. Slowly cool the diluted semen in a refrigerator or refrigerated room for 3 to 5 hours. Temperature 5°C.
3. Dilute 1:1 with 16 percent glycerol by volume in 2.94 percent sodium citrate solution. Temperature 5°C. Add 1.5 mg. of streptomycin sulfate per ml. Final concentration is then: 8 percent glycerol, 25 percent egg yolk, 2.2 percent sodium citrate solution. (Some workers add glycerol in ½, ¼, & ¼ portions over a period of several hours.)
4. Equilibration period of 6 to 20 hours at 5°C. Most workers prefer 12-16 hours. Best results seem to be 14-16 hours equilibration period.
5. Package semen in straws or ampules that have been labeled for freezing.
6. FREEZING — There are several methods for satisfactorily freezing the packaged semen (ampules, straws, inseminating catheter, or vials. The whole scheme of cell freezing is to prevent crystallization of water in the cells; to freeze rapidly, with glycerol acting as a protective agent.
 - (a) Use of mixture of dry ice and alcohol (or acetone) cooling at the rate of 1°C per minute from 0°C to -15°C to -70°C at the rate of 3 to 4°C per minute. This is a fundamental method — valuable for research and controlled procedures but generally outmoded for AI operations.

¹Rapatz, G. L., "What Happens When Semen Is Frozen?", *Proc. 1st Tech. Conf. on AI and Bovine Reprod.*, Nat'l. Assn. Animal Breeders, Columbia, Mo., p. 45 (1966).

- (b) MECHANICAL, temperature controlled, liquid nitrogen freezers used in routine freezing by many large AI organizations. (See Figure 17.3)

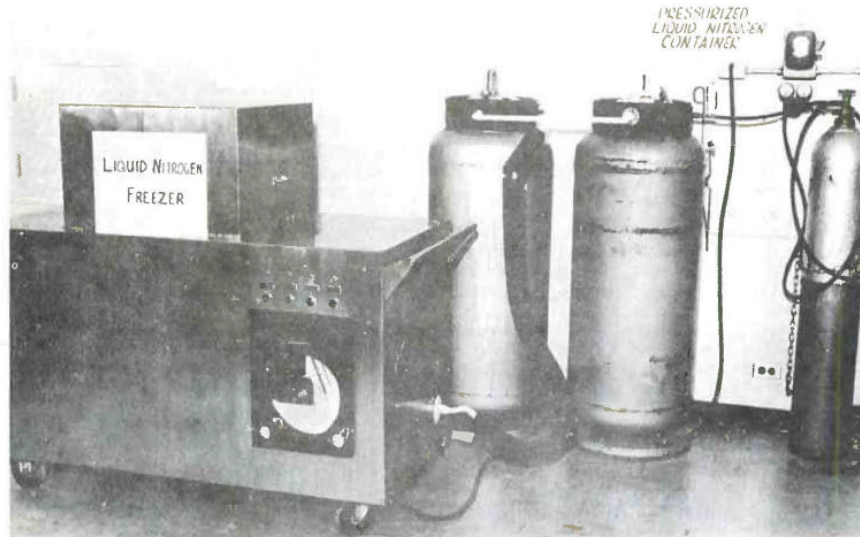


Figure 17.3 — A liquid nitrogen freezer used by some workers for frozen semen processing.

- (c) NITROGEN VAPOR FREEZING — The filled and sealed ampules affixed to the usual canes are suspended in the vapor below the mouth of a liquid nitrogen container and allowed to freeze. While there is no doubt some variation in freezing rate, survival of sperm is desirable and compares favorably with the more controlled methods (Clegg, et al., 1965).¹
- (d) Artificial insemination businesses (bull studs), where semen is routinely frozen, have special equipment for filling straws or ampules and pelleting semen. This equipment is designed so that timing and temperature are controlled throughout the process. This procedure does much to ensure semen of uniform quality being dispensed to the trade.

Straws filled with semen are generally frozen in racks placed in liquid nitrogen. The temperature of the liquid nitrogen bath is about -290° (See Figure 17.4).

¹Clegg, E. D., B. W. Pickett, and E. W. Gibson. *Non-mechanical Nitrogen Vapor Freezing of Bull Semen*. Conn. (Storrs) Agr. Exp. Sta. Res. Rep. 5, 1965.

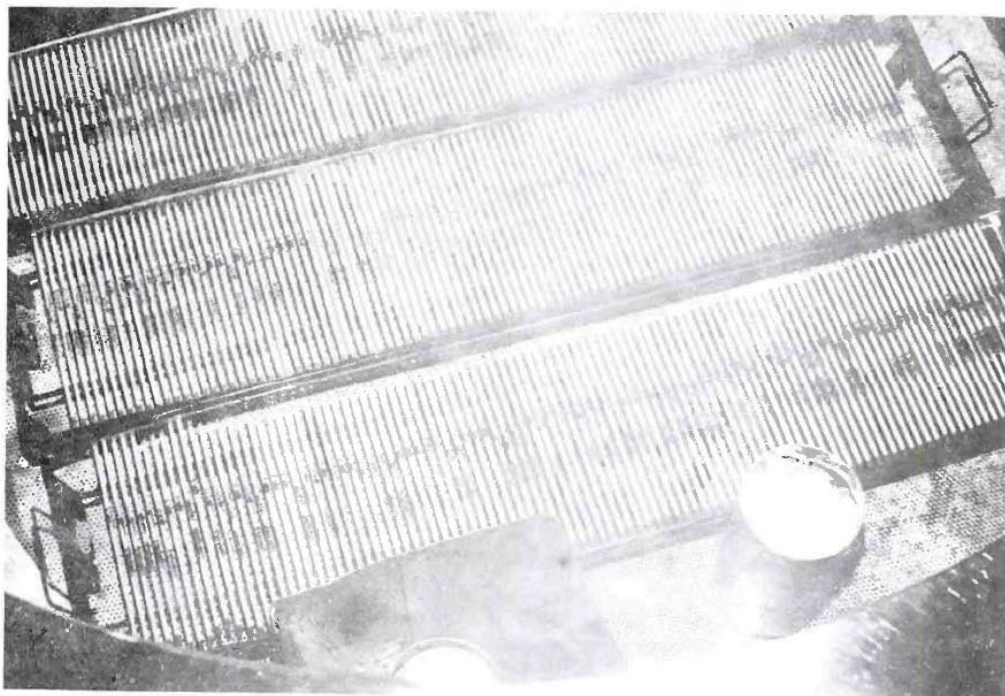


Figure 17.4 — Straws are frozen by placing in racks and immersing in liquid nitrogen. The packaged semen is thus rapidly cooled from 5° to -196°C . (Photo courtesy Curtiss Breeding Industries, Elburn, Illinois)

Modifications in this technique are made by many operators. The percentage of glycerine used may vary from 7 to 12 percent by volume, the equilibration time from 6 to 20 hours, and the percentage of egg yolk from 29 to 35 percent.

7. STORE FROZEN at -196°C (-320°F). Dry ice and alcohol mixture -79°C (-110°F) may also be used for temporary storage. If dry ice and alcohol is used as a refrigerant, it is best to initially store in this mixture and then transfer to liquid nitrogen which is the preferred method (See Figures 17.2 and 17.5).

HANDLING AND USE OF FROZEN SEMEN

Semen cannot be warmed and refrozen without destroying the cell structure. A rise in temperature of only a few degrees such as occurs when the liquid nitrogen or refrigerant runs low, slowness in transferring semen ampules, straws, vials, or other packages from one container to another and delays in transit. Improper handling of semen under field conditions accounts for low conception in many cases. The inseminator should learn the correct methods for handling frozen semen and follow them carefully at all times.

There are at least two times in the usual field practice of using frozen semen may be harmed by improper handling. These are:

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1. When semen is removed from the LN refrigerator to inseminate a cow. The neck of the semen container is much higher in temperature than the lower part (See Figures 17.5, 17.6, 17.7). The cannister containing the canes or goblets of frozen semen should be lifted



Figure 17.5 — A liquid nitrogen (LN) straw and ampule storage container. The ampules fixed to metal “canes” are suspended in cannisters (see at left). Straws are placed in goblets and in a container (shown at right) for suspension in the LN refrigerator. (Photo courtesy Eastern Artificial Insemination Cooperative, Ithaca, New York)

The modern liquid nitrogen refrigerated semen storage container. Constantly improved over the years, enables the AI technician to maintain a wide array of sires for the customer; permits storage of frozen semen on the farm or ranch; and, long distance shipments.

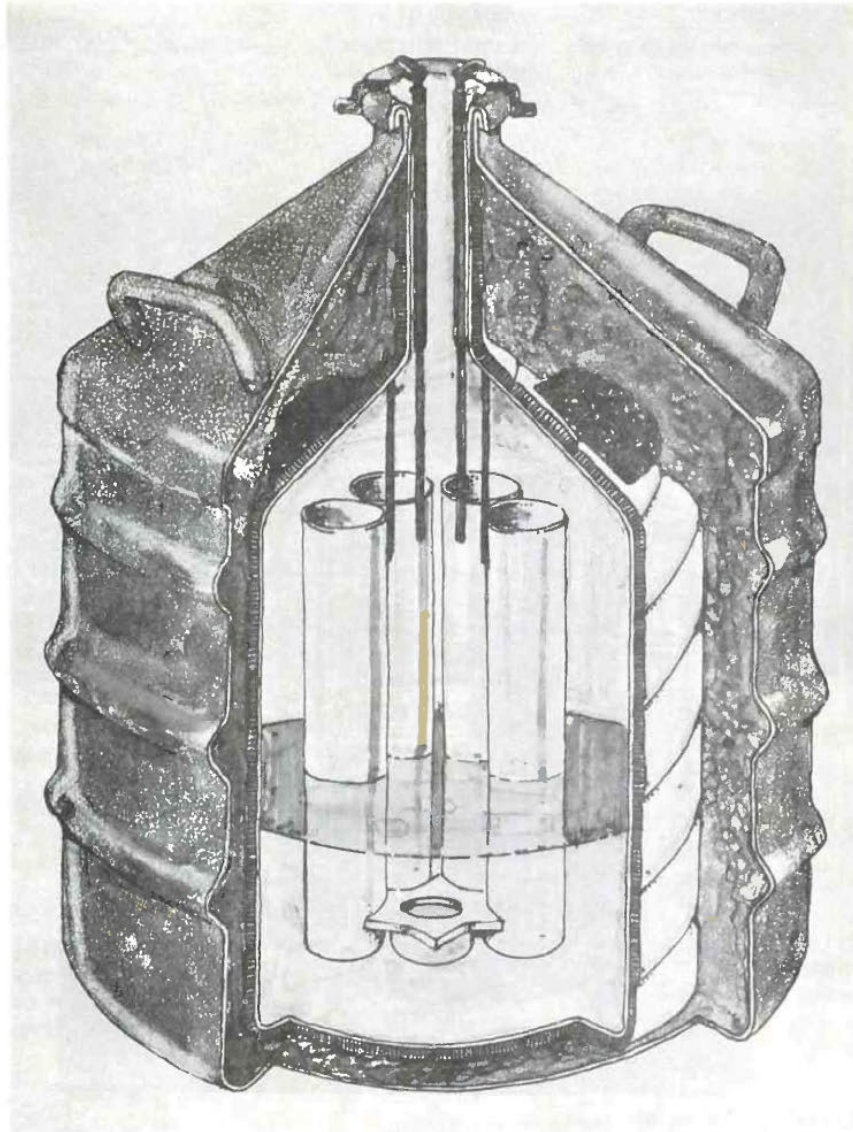


Figure 17.6 — A liquid nitrogen container (cut away section) showing construction and cannisters for semen ampules or straws in place. Liquid nitrogen level is shown at bottom of interior of container and vapor surrounding cannisters in upper portion. (Courtesy, R.D. Brunt, Union Carbide Corp., Linde Division, Indianapolis, Indiana)

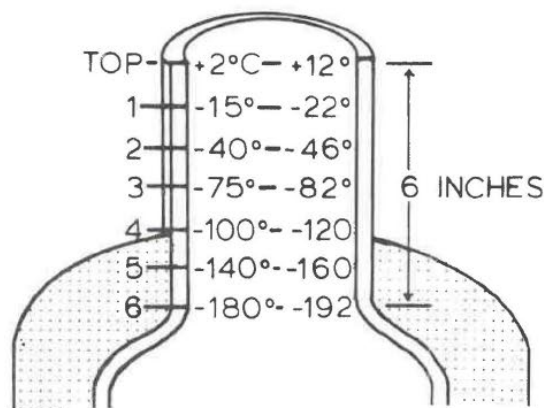


Figure 17.7 — Typical temperature range in the neck of a liquid nitrogen field storage unit. (Adapted from Saacke, 1974). The relatively high temperatures in the neck of the container make it apparent that units of semen should be removed from canes, lifted into the neck, in a matter of seconds.

just enough to identify the semen in terms of the bull wanted. The cane (rack) or goblet with the semen wanted is then pulled up to the neck of the container and the *first semen unit* removed with the tweezers or fingers. Never pull the cane or rack higher than the first semen unit. *This should be accomplished in not over 10 seconds.* If the unit of semen desired cannot be readily located, lower the cannister back into position and wait about a minute before exposing it again. Intermittent temperature changes are not as harmful to frozen semen as prolonged exposure.

To facilitate the location of and the removal of semen units from the LN refrigerator, the inseminator should have a diagram showing which bull's semen is in each container and the order in which the canes or racks are arranged. A semen inventory, so that the operator knows the exact number of units from each bull he has at all times, should be kept.

2. When a new supply of semen is added, or semen units are changed from one LN container to another. The rule of not exposing the semen to high temperatures not more than a few seconds applies here.

Transferring cannisters containing the canes or goblets of semen is fairly simple. Place the two LN refrigerators side by side and quickly transfer each cannister. Some liquid nitrogen may drip off the cannister, or boil out of the neck of the "jug" so the operator should wear gloves, shatterproof goggles, and put his pant legs over his boots.

The transfer of canes of semen requires two men for best results. One man selects the cane to be transferred while the second man brings the cannister, to receive the cane, into the neck of the second refrigerator. As soon as a cane is transferred, each cannister should be lowered into the bottom of the refrigerator. This transfer routine, one cane at a time, is followed until the job is completed. Again, the unit of frozen semen should not be exposed to air temperature longer than 10 seconds.

CARE OF THE LN REFRIGERATOR

1. On the farm, the LN refrigerator should be kept in a cool, well ventilated room. Escaping nitrogen may cause suffocation.
2. Keep the insulated stopper in the container at all times when not in use. The metal top cover should also be kept on the refrigerator when not in use. The stopper fits loosely and is vented to permit the escape of nitrogen gas so as to avoid the possibility of an explosion. The LN container *must not be more tightly stoppered than* when it comes from the supplier.
3. If the LN refrigerator is hauled in a car or truck, it should preferably be in a ventilated box and tightly secured so it cannot tip. It is also a good precaution in case of a car accident (See Figure 17.8).



Figure 17.8 — Showing raised section of car trunk — necessary for some cars to accommodate liquid nitrogen container.

The refrigerator should not be exposed to the sun. Park in the shade.

4. Handle the LN refrigerator carefully. Rough handling may cause a break in the wall, resulting in the loss of vacuum, loss of nitrogen, and ruining the frozen semen.
5. Liquid nitrogen will burn the skin (frostbite). If gloves or other apparel become saturated with liquid nitrogen, they should be removed promptly.
6. Semen in the LN container will remain frozen as long as any liquid nitrogen is present. If the liquid nitrogen level drops too fast or becomes very low, the semen supplier, or service organization, should be called immediately. In emergency, the semen may have to be transferred to another container.

THAWING FROZEN SEMEN — There are several methods used for thawing frozen semen. There are also some differences of opinion as to the most suitable thawing temperatures (See Reference 1).

The critical period affecting sperm fertility is during the freezing and thawing process. Thawing rates do affect the survival of frozen spermatozoa. There are interrelationships between freezing and thawing rates associated with the type of semen extender used, the type and size of the semen unit package and the temperatures involved. Thus, it is no surprise that some AI organizations recom-

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mend relatively high temperature and others lower temperatures for semen thawing. Most bull studs (semen suppliers) have conducted research on the most desirable method, from the standpoint of conception rate, for thawing semen they dispense. Since the extenders used and the processing of frozen semen differs somewhat among bull studs, the thawing method recommended by one may not apply to another. Therefore, the best advice for a herd operator, or an AI technician is to *follow the recommendations of the semen supplier in thawing the frozen semen he dispenses.*

The most commonly used procedures for thawing and utilizing frozen semen are: (1) Thaw ampules in ice water at a temperature slightly above freezing; or as recommended by some semen suppliers, thaw the ampules in a water bath at a temperature of 35 to 40°C. Directions for thawing and utilizing frozen semen in ampules follows.

(2) Thaw frozen semen in straws by plunging them into warm water, temperature 35° for 12 to 15 seconds. Straws are also thawed, apparently with good conception resulting, by using the ice water bath and some workers simply rub the straw (0.5 ml.) back and forth in the palms of the hands until it is thawed.

For the utilization of frozen semen in straws, see Exercise XIX (Insemination Techniques).

THAWING AND UTILIZING FROZEN SEMEN IN AMPULES

The recommendations for effectively utilizing frozen semen in ampules have been summarized by Dr. B. W. Pickett*, Colorado State University, Ft. Collins, Colorado, and are listed below. The reader should also study Figures A to J.

1. Semen may be shipped to technicians as soon as it has been frozen.
2. If semen is to be stored for more than one year, the insemination dose should contain approximately one-third more spermatozoa.
3. For maximum reproductive efficiency, frozen bovine semen should not be stored for more than one year.
4. Present the bull for "custom" freezing several months before the semen is actually needed.
5. For maximum reproductive efficiency, semen should be frozen during the fall and winter months.
6. When semen transfers are made at the central storage area or truck, the receiving tank should be filled with LN.
7. When semen is received via common carrier, be sure that the LN unit contained LN.
8. The technician should maintain a correct, up-to-date inventory of semen.
9. Semen should be packed in the canisters to permit easy, rapid removal.
10. Transfer ampules of frozen semen out of the wind and sunlight.
11. Do not lift the canister containing the semen higher than the frost line in the neck of the tank.
12. Do not expose the ampules to elevated temperatures for longer than 10 seconds.
13. Keep the number of exposures to an absolute minimum.
14. Transfer ampules from the field unit to an insulated thawing bath in 3 to 5 seconds.
15. Thaw the ampule in at least a pint of water for 8 to 10 minutes.
16. Use a thawing arrangement that will keep the ice cubes separated from the thawing ampules.
17. When several ampules are thawed at once, be sure that it is done in such a manner as to prevent them from freezing together.

*Pickett, B. W., *Factors Affecting the Utilization of Frozen Bovine Semen for Maximum Reproductive Efficiency*, The A.I. Digest, Vol. XIX, No. 2, pp. 8-23, February 1971. National Association of Animal Breeders, P.O. Box 1033, Columbia, MO 65205.

18. Put fresh, clean water in the thawing container each day.
19. Do not disturb the ampule while it is thawing.
20. Do not use the ampule after it has been thawed for more than one hour.
21. Dry the ampule thoroughly before it is opened.
22. Open the ampule in an upright position.
23. Insert the catheter slowly, withdrawing the semen as the catheter is being lowered.
24. The catheter and ampule should be held in such a position that all semen is withdrawn without breaking the liquid column in the catheter.
25. A steady, five-second squeeze should be used to expel the semen into the cow. Count, do not guess at five seconds.
26. The semen should be placed deep in the cervix or in the uterine body.
27. Initiate and maintain a technician training program employing the dye technique.
28. Follow routine procedures as outlined by the A.I. school. All inseminators should be retrained at regular intervals.
29. The requirements for proper evaluation of frozen semen are extensive and should not be attempted except by trained personnel at a properly equipped laboratory.

The steps for thawing and utilizing frozen semen ampules are illustrated in Figures A to J below: (Photos courtesy Dr. B. W. Pickett, Colorado State University, Ft. Collins, Colorado.)

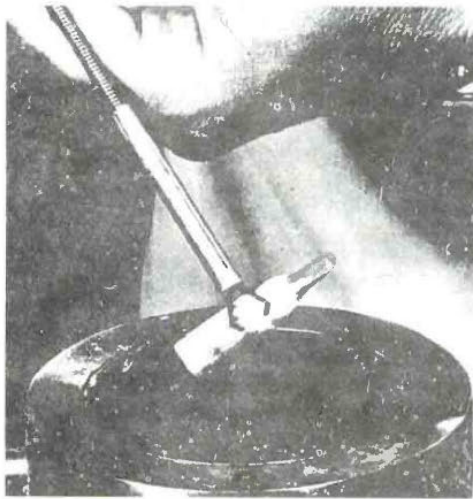


Figure A. Ampule of frozen semen being removed from bulk storage.

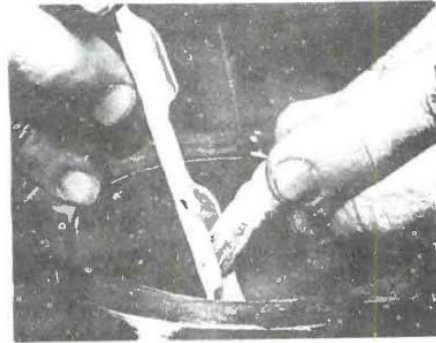


Figure B. Ampule of frozen semen being removed from a cane. Note that precautions are being taken to expose only the ampule being removed.

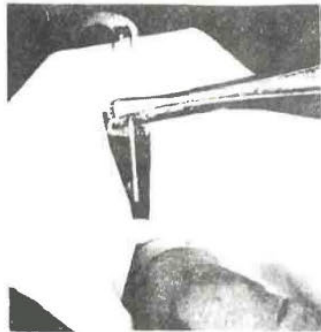


Figure G. Water is spermicidal. Dry the ampule carefully before opening.



Figure H. Open the ampule in the upright position.



Figure I. Insert the catheter slowly, withdrawing semen as the catheter is lowered into the ampule.



Figure J. Do not break the fluid column when withdrawing semen. A procedure such as shown here will result in a much greater loss of semen.



Figure C. Thawing bath that keeps the ice cubes separated from the thawing ampoules.



Figure D. Ampoules should not be permitted to freeze together during thawing.



Figure E. Do not remove the ice coat to hasten thawing of the ampule.



Figure F. Ampoules should be opened in the upright position.

TRANSPORTING AND SHIPPING SEMEN

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LIQUID SEMEN

Semen for shipment either long distances or within a state must be carefully selected for quality, cooled, diluted, and packed to withstand shipping. Most semen now shipped is frozen, but there are occasional shipments of liquid semen:

1. After the semen has been tested for quality, diluted, and cooled to 35-40°F, the amount to be shipped is placed in a properly labeled, sterile vial and sealed. The shipping vials must be full to obtain best survival. If necessary to fill vial, add mineral oil to fill to the top of the vial.
2. The vial is then wrapped in several thicknesses of paper for insulation purposes and placed along side a toy balloon, or small can filled with solidly frozen ice.
3. The vial and ice container are then wrapped together tightly in heavy insulating paper commonly referred to as "Jiffy Wrapper."
4. The wrapped package is inserted into the shipping container, and sufficient corrugated paper, packing, etc., used to hold it firmly in place. The container is then sealed, addressed, and mailed or delivered by truck.

For transportation by car, or short distances by bus or rail, semen may also be shipped by placing the insulated vials in thermos bottle filled with cracked ice. The thermos bottle should be well packed in a large container to prevent breakage. The ordinary thermos bottle, however, will not stand the rigors of shipping and one of the above methods is best if routine shipping is practiced.

Semen has been kept alive at a temperature of 40° to 45°F for over 20 days. English workers report successful impregnation with semen 96 hours old. The writers have successfully settled many cows using liquid semen over 48 hours old. In one case, a 198 hour old sample produced a calf. In general, liquid semen should be used in about 48 hours after collection.

Long-time shipments (60 to 80 hours) -- The requirements of long distance shipping are:

1. Adequate refrigeration of the package.
2. Protection of the semen from the intense cold of refrigerant.
3. Insulation of the refrigerant against the external temperature.

FROZEN SEMEN

Shipping frozen semen is best accomplished by use of liquid nitrogen containers with semen refrigerated at -196°C. Shipment of semen in such containers, by means of air transportation, to many foreign countries is now routine for many North American based AI organizations. Such containers may carry up to several hundred ampuls, straws, or insemination doses. By the use of liquid nitrogen as a refrigerant, the dangers of delay in transit are largely overcome as the container usually carries sufficient refrigerant to last for several weeks.

Shipping small amounts of frozen semen is easily accomplished by using a light weight expanded styrene container with dry ice and alcohol as a refrigerant. See Figure 17.9.



Figure 17.9 — A packed frozen semen container being loaded aboard a plane at San Francisco, California, for shipment to Japan. At left, J. F. Cavanaugh, Secretary, American Jersey Cattle Club, Columbus, Ohio. Right, James Kuhtz, formerly with Curtiss Breeding Service, Cary, Illinois.

As a rule, bull studs utilize large holding tanks for banking frozen semen and replenish the technician supply of semen and liquid nitrogen every few weeks. Large trucks are used to make the rounds. Some large bull studs have nationwide coverage of their technicians and customers in the field by this plan.

QUESTIONS

1. What are the chief advantages of frozen semen?
2. When was frozen semen first used and in what country?
3. How does the conception rate in cattle compare for liquid and frozen semen?
4. Name two semen extenders commonly used for frozen semen.
5. What is cryoprotective agent and how does it function? What is the cryoprotective agent commonly used in freezing semen?
6. What is the purpose of equilibration of semen during the processing period?
7. Why should extended semen remain unfrozen at 5°C for about 6 hours after antibiotics are added?
8. Briefly outline the basic steps in processing and freezing semen.
9. How is frozen semen stored? What temperature?
10. How should frozen semen in ampules and in straws be thawed?
11. How may frozen semen best be stored on the farm?
12. What precautions should be exercised in the use and handling of the liquid nitrogen refrigerator "jug".
13. How would you ship 500 units of semen to a cattle breeder in South America?
14. How would you ship a vial of liquid semen to a breeder in an adjoining state?

REFERENCES

- No. 1 (Chapter 17).
- No. 2 (Chapter 15, 16).
- No. 4 (Chapter 6).
- This exercise and current literature.

EXERCISE XVIII
CUSTOM FREEZING OF SEMEN

OBJECT

To become familiar with custom freezing of semen as carried out on the North American Continent.

DISCUSSION

With the development of frozen semen processing, storage and utilization, the practice of "custom freezing" has become an integral part of the artificial insemination program. In essence, custom freezing implies the collection, freezing and storage of semen from sires owned by a private individual or concern. During 1971, reports from AI organizations in the United States and Canada indicates between 2½ and 3 million insemination doses of bull semen custom collected. The fact that custom collection is practiced, under present procedures, in America is a further tribute to the free enterprise system under which the AI program operates.

There are admittedly many advantages, so far as private breeders and AI organizations are concerned in the custom freezing program. From the standpoint of producing semen from healthy sires — meeting the prescribed recommendations for sire health and hygiene of bull studs as set forth by AVMA-NAAB recommendations — there must remain questions as to how interstate and intrastate movement of such semen can best be controlled. We will briefly outline advantages, disadvantages and recommendations for custom freezing of semen.

ADVANTAGES OF CUSTOM FREEZING

1. Custom freezing makes it possible for the owner of a valuable sire to have semen frozen, stored and made available for use in his herd over a period of years. It is a form of "insurance" on a valuable sire.
2. Several owners of a sire, even though located hundreds of miles apart can, through custom freezing, utilize his services in a routine and systematic manner.
3. Custom freezing permits a dozen or more breeders to own bulls in partnership, including AI organizations and have offspring in many herds. This is an important factor in sampling and proving young sires so as to develop a dependable repeatable proof.
4. The owner of a valuable sire may add to his income through the sale of semen to other breeders. Such semen sales are usually handled through the custom freezing business which handles storage and fills orders as received.
5. Custom freezing makes it possible for semen, such as the "exotic" beef breeds to become available to the cattle industry — even though many of these bulls are located outside the U.S.A.

DISADVANTAGES OF CUSTOM FREEZING

Nearly every disadvantage of custom freezing involves the matter of sire health. In some cases, it also involves collection and storage of semen by unreliable parties and consequently disappointment to the sire owner and his patrons.

1. Any sire (cattle) in contact with the cow herd and used for natural breeding as well as

furnishing semen for AI use is rarely free of diseases that can be transmitted through use of his semen. These diseases include almost every disease known to cattle — and other species.

2. From the standpoint of improving cattle by utilization of the best sires available, which AI organizations strive to do, a herd owner may, based on his esteem for a less highly productive sire, supplant the inheritance available from progeny proved sires of above average merit. It is a herd owner's prerogative to use the sire of his choice and we can't argue with him on this point. From the standpoint of the organized AI program, custom collection and sale of semen by individual breeders "puts the bull back on the farm."
3. While most custom freezing businesses are established AI organizations and also some private owners that are legitimate operators in every sense of the word, there have been cases of individual operators going into the custom collection business with limited equipment, capital and sense of responsibility. The result has been no recourse for the sire owner if semen is low in quality, sometimes poorly labeled and patron service unsatisfactory. We hasten to add that unreliable operators of this kind do not last long. On the other hand, there are many individuals and organizations, privately owned, that do a highly commendable job in custom freezing and are an asset to the industry. Any herd owner who contemplates having semen custom frozen should seek out such organizations and individual operators.
4. The individuals that carry out custom freezing travel to the ranch or farm, collect semen from one or more bulls, evaluate the semen after collection, freeze if the quality is found satisfactory, store and provide the owner a supply as is necessary. However, adequate facilities for handling bulls during collection are lacking on many farms. This situation can be corrected.
5. One of the chief disadvantages of custom collection, as practiced in many instances, is the fact that collections of semen are made at very infrequent interval and there is little opportunity to establish a picture of semen quality for a given bull. All too often the bull, not being used to being handled is frightened; too, he may be in declining health and the resulting semen collected that day may not be as fertile as the bull is capable of producing.

GENERAL CONSIDERATIONS AND RECOMMENDATIONS

Breeders who desire to have semen from their sires should observe the following suggestions:

1. Contact the nearest established artificial breeding organizations, or a reputable individual or firm, engaged in the custom collection of semen. At the present time, there are at least 25 bull studs and some 20 individual operators, with established records of dependability, engaged in the collection, processing and storage of frozen semen on a custom basis. Generally speaking, *do not deal with unknown parties.*
2. If semen from the bull is to be offered for sale, it will be to the owner's advantage to make arrangements to offer services of the bull through one of the established bull studs. These organizations are equipped to do a complete job and will relieve the herd of the problems involved in selling and dispensing semen in a highly competitive market. In such cases, *the sire is housed by the bull stud, undergoes the necessary health tests, and if eligible is collected on regular schedule.*
3. If the bull is kept on the owner's premises and semen collected for freezing, the following practices should be followed:
 - (a) The bull should be kept in separate quarters and not used for natural breeding.

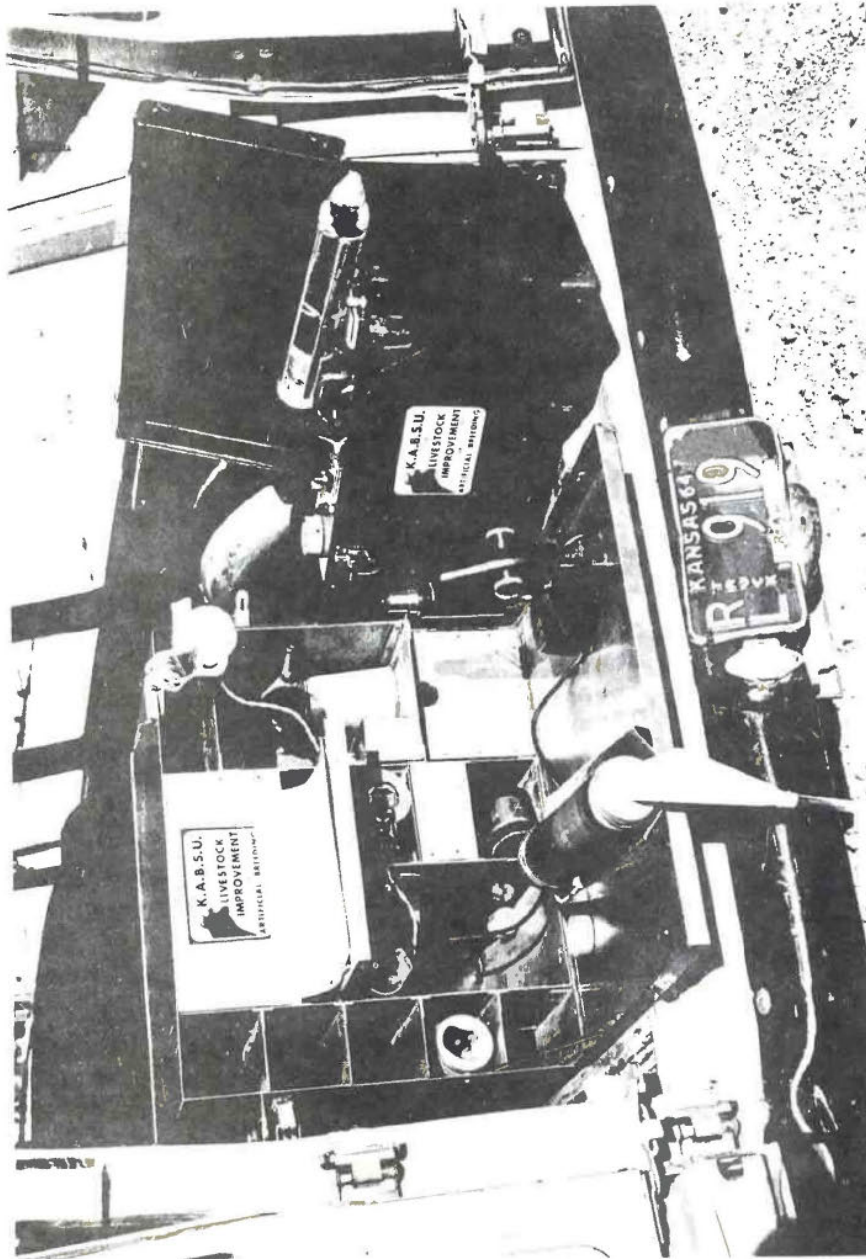


Figure 18.1 — A mobile custom collecting unit used by Kansas Artificial Breeding Service Unit, Manhattan, Kansas. Equipment for collection, evaluation, preliminary processing and storage of semen until it reaches the laboratory is available. Some mobile units carry complete facilities for freezing in the field.

- (b) The health tests as outlined by the AVMA-NAAB should be conducted and satisfactorily passed before semen is collected for freezing. So long as semen is being collected and frozen, particularly for use outside the owner's herd, the bull should be isolated and natural service prohibited.
- 4. Semen should be collected at a time the bull is active and healthy. In too many cases, herd owners postpone the "insurance" frozen semen in storage offers until a bull is crippled or too old to produce highly fertile semen.
- 5. In case of registered dairy cattle, and for most beef cattle, the bull must be recorded in the association herd books, blood typed, semen properly labeled and stored in an approved manner. The regulations governing the use of frozen semen for dairy cattle are outlined in Exercise 28. The student and the herd owner are urged to study this section carefully.

QUESTIONS

1. What are the advantages of custom freezing of semen?
2. Should custom collected semen be permitted to be used outside the owner's herd? If so, under what conditions?
3. How would you select an organization or individual to do custom collecting on bulls you own?
4. What advantages are there in having a bull to be custom collected housed at a bull stud?
5. How does the custom collecting and semen freezing program aid in the progeny testing program?
6. What are the general requirements of The purebred Dairy Cattle Association for custom collection and storage of semen used for purebred dairy cattle?

REFERENCES

No. 2 (Chapter 15, pp. 366-67).
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