Artificial Insemination Training Program
First AI research reports 200 years ago.

A long ago, Arabs obtained semen from mated mares belonging to rival groups during night hours to inseminate their own mares.
In 1930, Russians had the technology for massive application of AI in agriculture.

By late 30’s AI reaches the US. AG is born in 1941.

During early 50’s, the modern freezing and thawing technique, which revolutionized and spread out the usage of AI across the world was developed in England.
The main reasons for using AI.

- Easy
- Inexpensive
- Successful

Over 75 years of massive use
ADVANTAGES

- Allows to use the best proven bulls (genetic improvement)
- Mating programs
- Less reproductive health risks
- Helps Identify reproductive problems
- Facilitates the implementation of synchronization programs
- Eliminates the danger of manipulating bulls
REQUIREMENTS

- Healthy and well fed animals
- Trained personnel
- Heat detection
- Individual records
- Facilities
- Equipment
- Success or failure depends on the program manager
Protect your self and take good care of cows
YOUR SAFETY AND WELLBEING

- Wear appropriate clothing and protection
- Avoid working with overexcited or nervous animals
- Allow cows know you are around to prevent accidents
- Handle cows with care so they don’t over react
- Use proper equipment in good condition to prevent spread of disease
Never hit, scream or force cows. They need to feel you are a friend, not a threat.

Cows need free access to fresh feed, clean water, resting place, and veterinary medical attention.
Anything we do with cows should make them feel comfortable. Cows love routine.

Do not over manipulate cows for AI training.

Cow comfort is the start point for a successful dairy: healthy cows, good production and reproduction.
OUTLINE

1. Reproductive Anatomy of the Cow
2. Reproductive Physiology of the Cow
3. Semen Processing
4. Artificial Insemination Technique
5. AI Equipment and its Care
6. Preparing AI Equipment for Breeding
7. Inseminating the Cow
8. Records
IN SUMMARY, AI IS:

- Cleanliness
- Consistency (Technique)
- Recordkeeping
LEARN THE ANATOMY

- Rectum
- Ovary
- Oviduct
- Uterine Body
- Cervix
- Vagina
- Vulva
- Urethra
- Bladder
- Suburethral diverticulum
- Uterine Horn
COW REPRODUCTIVE TRACT

- Ovary
- Uterine Horns
- Oviduct
- Ovary
- Uterine Body
- Cervix
- Vagina
- Vulva
ANATOMY OF THE CERVIX
CERVIX DISSECTION

Cervix (Open Vagina)

Cervix (Open Vagina and Cervix)

- Uterine Horn
- Uterine Body
- Open Cervix
- Bifurcation
UTERUS AND OVIDUCT

Right Horn Open

Bifurcation

Ovary

Oviduct

Oviduct
OVARIES

Follicle and Corpus Luteum

Corpus Luteum Open

Corpus Luteum with Cavity
OVARIAN STRUCTURES
PRODUCTIVE CYCLE AND REPRODUCTIVE CYCLE

MONTHS POST CALVING

0 1 2 3 4 5 6 7 8 9 10 11 12

Lactating

0 1 2 3 4 5 6 7 8 9 10 11 12

Dry

Open AI

Gestation

0 1 2 3 4 5 6 7 8 9 10 11 12

Modifiable Stage

No Modifiable Stage
In a 12-month Calving Interval, Both Cycles Combine as Follows:

<table>
<thead>
<tr>
<th>Event</th>
<th>Duration</th>
<th>Event</th>
<th>Duration</th>
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</thead>
<tbody>
<tr>
<td>Lactation</td>
<td>10 mo</td>
<td>Voluntary Waiting Period</td>
<td>2 mo</td>
</tr>
<tr>
<td>Dry</td>
<td>2 mo</td>
<td>First service to conception</td>
<td>1 mo</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conception to calving (Gestation)</td>
<td>9 mo</td>
</tr>
<tr>
<td>Total</td>
<td>12 mo</td>
<td>Total</td>
<td>12 mo</td>
</tr>
</tbody>
</table>
VOLUNTARY WAITING PERIOD

- It is a management decision
- Not recommended: <45 DIM
- Ideal: 55-60 DIM for heat detection AI
- Ideal: >65-70 DIM for TAI programs
ANATOMICAL INVOLUTION

1 day  5 days  10 days  15 days  20 days
LUTEAL/FOLLICULAR PHASE

**FOLLICULAR PHASE**
- Day 0
- Day 1
- Day 4

**LUTEAL PHASE**
- Day 11
- Day 13
- Day 16
- Day 18
- Day 19
- Day 20

**Levels**
- $P_4$ increases
- $E_2$ decreases
ESTROUS CYCLE

-4  0  5  18  21  0  5
Day of Estrous Cycle

Ovulation

Follicular Phase

Progesterone

Luteal Phase

Estradiol

Follicular Phase

Ovulation
Ovulation

Follicular Phase

Progesterone

Luteal Phase

Estradiol

Follicular Phase

Cow

Ovary
OVULATION
SEMEN PROCESSING & HANDLING
CHAPTER 3

ARTIFICIAL INSEMINATION TRAINING PROGRAM
A sperm cell has three parts
- Head
- Central piece
- Tail
Sperms need to be around 6-8 hours in the cow’s reproductive tract before they acquire fertilizing capacity.
Prior to fertilization, other chemical reactions must occur on the sperm head before entering the egg.
SEMEN COLLECTION

- Bulls are safely housed and transported to the collection area.
Semen is collected by Artificial Vagina

- Plug
- Rubber funnel
- Plastic shield
- Glass tube
- Rubber liner
- Warm Water

**Artificial Vagina**
SEMEN COLLECTION AND PROCESSING

- After collection, semen is:
- Evaluated Macroscopically
  - General appearance (color)
  - Volume
  - Density
- Evaluated Microscopically
  - Morphology
  - Motility
SEMEN COLLECTION AND PROCESSING

- Added antibiotics
- Weighted
- Incubated at 41° F (5°C) until processing
Common Semen extenders in the industry:
- Citrates, Glycerol, antibiotic, egg yolk and milk
- Accelerated Genetics uses a non animal extender (Biosecurity)
Pre labeled straws are filled with semen using an electronic pump.
- 0.50ml straw in the US.
- 0.25ml straw in many other countries

Straws are sealed by ultrasound

Semen is placed on trays at 39°F (4°C)
Trays with semen straws are brought from 39 °F (4 °C) to -184 °F (120 °C) by Liquid Nitrogen vapors for a 10-minute period.

Semen straws are placed in LN at -320 °F (-196 °C)
Quality control

18 h after freezing two straws per batch are rigorously examined under microscope. If quality criteria are not met, the whole batch is discarded.
MORPHOLOGIC ABNORMALITIES

- Normal
- Pear head
- Double head
- Swollen central piece
- Coiled tail
- Double tail
Bovine semen straw

- Health certified logo
- NAAB Code
- AI stud
- Sire number
- Sire name
- Collection date
ACCESSING SEMEN STRAWS

- Use your index and middle finger leaving your thumb free.

- Bring canister up only as far as needed to reach straws.
Do not hold the straw with your fingers. Use the tweezers to get them out.
If nitrogen boils when lowering the canister back into the tank, you are holding the canister up too long in the neck tube.

Hold canister in neck tube a maximum of 7 seconds.
CONSISTENCY

- Work Below Frost Line
- Work Under 5 Seconds
- Lower Canister if Delayed
- Use Tweezers
CRITICAL TEMPERATURE

- Thawing and Re-Freezing Damages Cells
- Critical temperature range is
  -100 °C to -130 °C
  (-148 °F to -202 °F)
TEMPERATURE VARIANT

Top: 45°F
1 inch: 10°F
3 inches: -110°F
4 inches: -160°F
5 inches: -235°F
6 inches: -300°F

Neck to base: -320°F
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ARTIFICIAL INSEMINATION
TECHNIQUE
CHAPTER 4

ARTIFICIAL INSEMINATION TRAINING PROGRAM
FINDING THE CERVIX
ALWAYS BE AWARE OF THE LOCATION OF THE TIP OF THE GUN.
To relax constricting rings, put two fingers through the center of a ring and massage back and forth.
NATURAL OBSTRUCTIONS

- Blind pouch
- Cervical rings
- Vaginal folds
BLADDER AND SUB URETHRAL DIVERTICULUM
VAGINAL FOLDS
BLIND POUCH AND CERVICAL RINGS
The cervix is placed over the gun, not the gun inserted through the cervix.
LOCATING THE TARGET

- When all rings of the cervix have been cleared, the gun should slide forward freely.
- Since the uterine wall is very thin, you will once again be able to feel the insemination gun.
THE TARGET

- UTERINE HORN
- UTERINE BODY
- OVARIIES
- SYRINGE
- CERVIX
- SEMEN

(Additional text or diagram details could be included here if necessary.)
CERVIX SHAPES
Pull back on the gun until you feel the tip directly underneath your finger near the internal opening of the cervix.
Raise your finger slowly and deposit the semen
SHIPPER TANKS

- Shippers are not intended for long term storage.
- Transfer immediately to your work tank
FIVE SECONDS RULE

When moving semen from one tank to another, try to limit exposure outside of tank to under 5 seconds.
EQUIPMENT NEEDED

- Liquid Nitrogen Tank
  - Many sizes to choose from depending on your needs.
- 4-month or 6-month tank recommended depending on availability of liquid nitrogen.
TANK CARE

- Store in a dry, well-ventilated area
  - Nitrogen displaces oxygen
- Place on board or off concrete to prevent corrosion to bottom of tank.
SEMEN TANK

Know your tank inside and outside

A. Cap
B. Cap rester
C. External shield
D. Neck
E. Lock holder
F. Canister handle
G. Vacuum retention system
H. Index spider
I. Cork
J. Insulation
MORE ABOUT THE SEMEN TANK

- LN2 evaporates colorless, odorless and tasteless. It may cause suffocation in poorly ventilated areas.
- Inside vacuum may last up to 10 years in well managed tanks.
- Cork cannot be hermetical to allow for the normal LN2 evaporation. It may explode!!
- The neck is the weakest point. Avoid sudden movements, and be gentle when moving it.
- If the outer shell frosts, the vacuum has been lost and you have a few hours to transfer the semen to another tank.
- Keep an accurate inventory… you cannot physically count your straws by hand!!
SEMEN TANK

outer tank

inner liner

+54° to +36°
+5° to -8°
-40° to -51°
-103° to -116°
-148° to -184°
-220° to -256°
-292° to -313°

frost line

vacuum and fiberglass insulation

liquid nitrogen

-320°
KEEP TANK LOCKED

- Child Safety
- Quality Control
- Protect Investment
All tanks come with an LN2 measuring stick to monitor tank performance.
MEASURING LN2 LEVELS

- Drop plastic measuring stick into the center of the neck tube all the way to the bottom until the nitrogen stops boiling.
READING LN2 LEVELS

- Remove stick and read the frost level as shown here.
- Tank should be checked a minimum of once a week.
NECK TUBE CORK

- Remove by lifting straight up.
- Grooved to accommodate canisters.
INDEX SPIDER

- Holds canisters in place.
- Located on bottom of tank.
- Lift canister towards middle of neck tube and up to access semen.
Canisters have a fiberglass protective covering to prevent frost bite on your fingers.
BURN PREVENTION

- Do not hold onto the metal part of the canister at any time as frostbite will occur.
Use of protective gloves is recommended to prevent injury to skin.

Temperature of LN2 is -320 degrees Fahrenheit and -196 Celsius.

Handle LN2 like you would handle boiling water.
BREEDING KIT
NECESSARY EQUIPMENT

- Thaw Unit
- Lube
- Gloves
- Insemination gun
- Paper towels
- Cito cutter or scissors
- Sheaths
- Tweezers
Either an electric thaw unit or good reliable thermos are necessary to thaw semen.

NOTE- remember that the goal is to maintain constant water temperature.
Always have an accurate thermometer with any type of thaw unit.
A RED LIGHT INDICATES THAW UNIT IS NOT READY FOR SEMEN
A GREEN LIGHT INDICATES THE THAW UNIT IS READY FOR SEMEN
AI GUN WARMER
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PREPARING YOUR ARTIFICIAL INSEMINATION EQUIPMENT FOR BREEDING
CHAPTER 6

ARTIFICIAL INSEMINATION TRAINING PROGRAM
STEP 1

- Use index and middle finger to hold canister...your thumb remains free.
STEP 2

- Raise rack and hold with thumb and index finger.
- Use tweezers to lift straw straight up.
- Do not bend the straw.
STEP 3

Using tweezers, lift the straw straight up while releasing rack back into canister and lowering canister gently back into tank.
STEP 4

- Transfer straw immediately to thaw unit.
- Note - Temperature of water should be 95-98 °F or 35-37 °C.
- Thaw straw for at least 40 seconds but not more than 15 minutes.
STEP 5

Remove insemination gun from breeding kit.
STEP 6

Warm the insemination gun with a paper towel by using friction.
A properly-warmed insemination gun will feel warm to the touch.

Sperm damage will occur if placing semen straw in a cold syringe.

Temperature of semen should always be rising up to the cows body temperature.
STEP 7

- Store gun in a warm place.
STEP 8

- With tweezers, remove and dry straw.
- Place in a clean paper towel.
- NOTE: Water droplets will kill sperm cells. Always use a paper towel when handling a straw.
Cut off the crimped end of the straw with a scissors or Cito cutter.
STEP 10

- Cut the straw off 60° to 90°
- NEVER cut at an acute angle (< 60°)
STEP 11

Insert the cut end of the straw into the sheath with the adapter.
STEP 12

- Hold the adapter in place with your thumb and finger while gently pushing the straw into the adapter.

- **NOTE** - The straw will “snap into place” do not bend the straw.
STEP 13

Push the straw all the way into the sheath.
STEP 14

- Take your insemination gun out of your coveralls and pull back the plunger about 5 inches. (This is the length of the straw).
STEP 15

- Slide sheath with semen straw over insemination gun.
STEP 16

Use a twisting motion to secure sheath at base of insemination gun.
STEP 17

Very slowly push the plunger in while watching the tip of the gun to verify that:

- Semen will freely flow, with no leaks
- Gun was properly assembled
STEP 18

Place insemination gun in your coverall until ready to breed the cow.
INSEMINATING THE COW
CHAPTER 7

ARTIFICIAL INSEMINATION
TRAINING PROGRAM
PLACE THE GLOVE ON THE ARM YOU WILL WORK WITHIN THE COW.

- Make sure it is stretched completely up the arm and the fingers are well filled.
- If you are right-handed place the glove on your left hand.
Use a small amount of A.I. lubricant or K-Y jelly.

**Note** - Never use soaps, detergents or lubricants containing disinfectants. They can irritate the rectum and are harmful to semen.
Pick up the cow’s tail and move it towards the outside of the arm that will enter the cow.
With your fingers forming a cone shape, gently push your hand into the rectum.
With a paper towel, clean the vaginal opening.
PLACE A FOLDED TOWEL JUST INSIDE THE LIPS OF THE VULVA.

This helps to eliminate contamination as the gun is inserted into the vagina.
Insert the insemination gun into the vagina and locate target.
WITH THE TARGET LOCATED, SLOWLY DEPRESS THE PLUNGER.

- This process should take about 5 seconds.
- Do not depress plunger too fast.
After depositing semen, slowly withdraw the gun and arm.
Release the sheath containing the straw from the gun, holding it in your gloved-hand.
Peel the glove over the used sheath for easy cleanup.
RECORD DATA ON CALVES BORN

- ID of the calf
- ID of the sire
- ID of the dam
- Sex of Calf
- Date of birth
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