Ethiopian ATI
Agricultural Transformation Institute
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DAIRY CATTLE ARTIFICIAL INSEMINATION SERVICE BUSINESS

TRAINING COURSE FOR YOUTH AGRI-ENTREPRENEURS

Ethiopian Agricultural Transformation Institute

ADDIS ABABA, ETHIOPIA
2025

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OVERVIEW OF THE MODULE

This training module is designed to equip organized youth entrepreneurs who are expected to operate enterprises delivering Artificial Insemination (AI) services—with the foundational knowledge, skills, attitudes, and practices necessary to provide high-quality AI services in their communities.
Each section of the module includes a dedicated overview, learning outcomes, estimated time requirements, guiding questions, post-assessment questions, and key messages. A blended learning approach will be used, combining visual aids, instructional videos, practical demonstrations, and theoretical presentations to ensure comprehensive understanding.

The full training spans 21 days, comprising 3 days of theoretical instruction and 18 days of hands-on practical training. A minimum education level of Grade 10 or 12 is required to participate in this training.
Participants will be introduced to the essential tools and equipment used in AI service provision and trained in their handling and operation. They will gain a deep understanding of the AI service business, enabling them to manage it as a viable and sustainable enterprise.

The module also covers core technical competencies, including:

- Basic anatomy and physiology of the female reproductive system
- Heat detection and optimal timing for insemination
- Selection of suitable breeding cows or heifers
- Proper semen handling, storage, and usage
- Pre-insemination checks and safety/hygiene protocols
- Step-by-step insemination procedures
- Pregnancy diagnosis techniques

In addition, the module addresses key business aspects such as AI record-keeping, marketing strategies, feasibility assessments, and identification of potential risks with corresponding mitigation techniques.
If implemented effectively and adhered to rigorously, this training module has the potential to significantly enhance Ethiopia's dairy genetics and transform the livelihoods of youth entrepreneurs by enabling them to serve as professional community-based AI providers.

Introduction

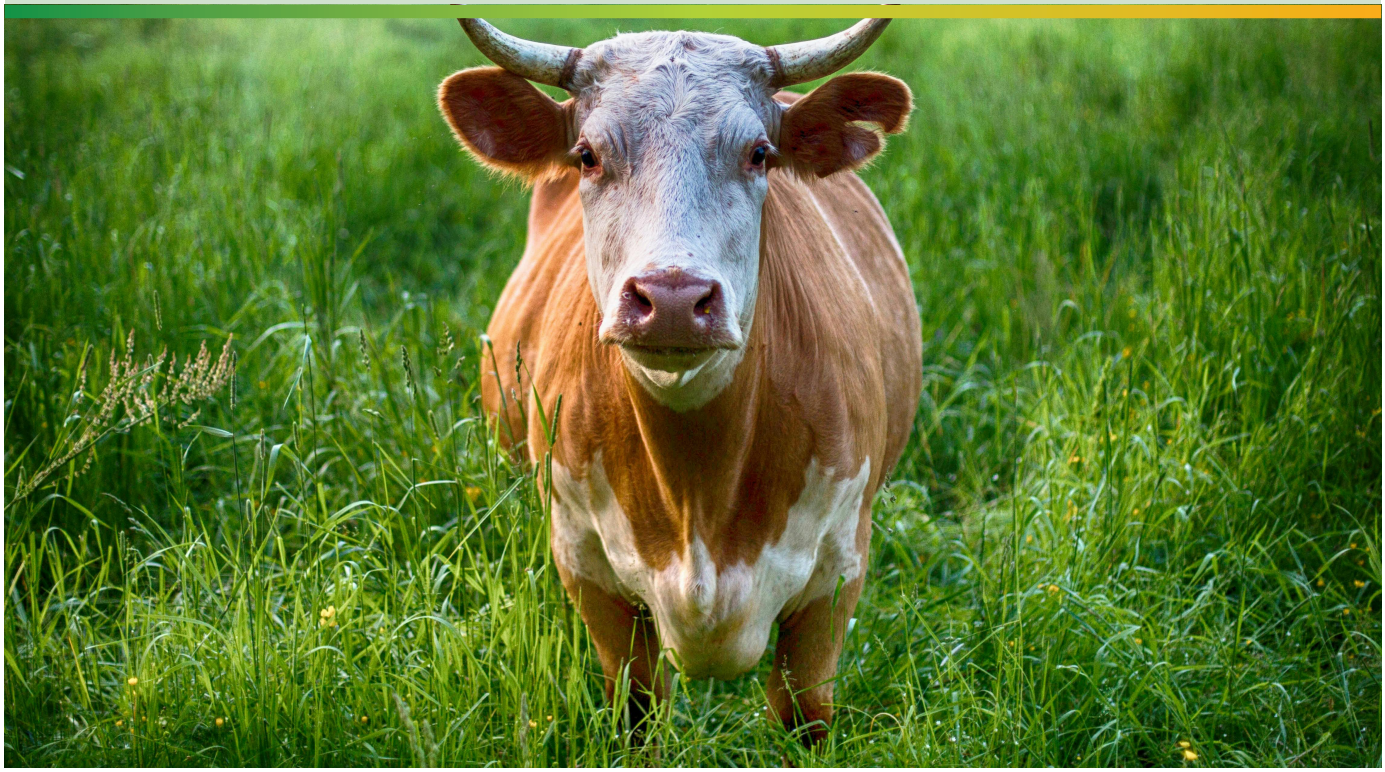
Artificial Insemination (AI) is a reproductive technology in which sperm is collected from a bull, processed, stored, and then artificially introduced into a cow's reproductive tract to achieve conception.

AI holds great potential to enhance the productivity and profitability of dairy cattle in Ethiopia. Despite its benefits, adoption of AI remains limited—mainly due to a shortage of skilled technicians and the low availability of services in many dairy-producing areas. While public AI services are more affordable, their reach is limited. This presents a valuable opportunity for private AI technicians to deliver more efficient, business-oriented services and complement existing public efforts.

This training module has been developed to provide youth entrepreneurs with the foundational knowledge, practical skills, professional attitudes, and hands-on experience required to deliver quality AI services. In addition to the technical training, the module introduces key agribusiness concepts to help participants commercialize AI service delivery and operate sustainable, youth-led enterprises.

Ultimately, the goal of this module is to create dignified and fulfilling employment opportunities for young people in Ethiopia, while contributing to the improvement of dairy genetics and productivity at the community level.

The Agriculture-focused Dignified Employment for Youth (ADEY) program is implemented by the Ethiopian Agricultural Transformation Institute in partnership with the Mastercard Foundation to enable 611,343 inclusive and dignified work opportunities for young women and men and support youth entrepreneurship, employability, and sustainable livelihoods in the agribusiness sector.



TRAINING METHODOLOGY

Training Approach: The way the module will be presented is (Theoretical presentation, practical demonstration Pictorial presentation, learning video and pre-and post-assessment, self-learning)

Training Materials: Marker, white board, notebook, pen, flipcharts, laptop, LCD

Duration: 21 Days

TARGET PARTICIPANTS

The target participants for this training module are entrepreneurs, micro, small, medium enterprises (MSME), youths with minimum educational background of diploma or 10+3 graduates in animal health, animal science and other related fields.

SECTION 1. THE ANATOMY AND PHYSIOLOGY OF FEMALE REPRODUCTIVE SYSTEM

OVERVIEW OF THE SECTION:

This section provides a brief understanding about the anatomy and physiology of female reproductive system which is the basic knowledge for undertaking artificial insemination.

This will help the trainees to understand the anatomy, topography and functions of reproductive organs of breeding animals.

It also helps to recognize morphological, physiological and behavioral changes that occur during estrus period, and recognize the palpable changes of reproductive organs during estrus period through rectal palpation.

Learning outcome

At the end of this section the learners can:

- Understand and explain the basic anatomy and physiology of female reproductive system
- Recognize morphological, physiological and behavioral changes that occur during estrus period.
- Identify the palpable changes (Tonicity, Temperature, Moisture, Color) of reproductive organs during estrus period through rectal palpation

Time Required: The total time required to accomplish this section is 3 days and 4 hours (4 hr. theoretical and 3 days practical)

Learning Question

- Explain the anatomy and physiology of female reproductive system?
- How do you recognize morphological, physiological and behavioral changes that occur during estrus period?
- How do you identify the palpable changes of reproductive organs during estrus period through rectal palpation?

1.1 THE FEMALE REPRODUCTIVE SYSTEM

Anatomy is the science or study of the structure of the animals body and the relationship of its parts. Whereas, physiology is the science that treats the parts and functions of living organisms. The female reproductive system of cows consists of a vulva, vagina, cervix, uterus, two oviducts and two ovaries.

1.1.1 VULVA

The vulva is the external portion of the female reproductive tract. It appears as two prominent, vertical folds of skin beneath the cow's anus. Although

of no importance in palpation, the vulva is an indicator of the latter stage of pregnancy. At that time, the vulva is swollen and more prominent.

- During estrus period the inner lumen of vulva becomes very red and moist.

Figure 1. Cow Vulva

1.1.2 VAGINA

It is an important organ for sperm transport, urination and the expulsion of fetus. Especially during estrus, the vagina membrane secretes a large amount of mucus, which makes clean inside the vagina. It is about 30 cm in length in an adult cow.

- It swells and become hot on touch during estrus period.

1.1.3 CERVIX

The cervix is a heavy, smooth muscle sphincter which is tightly closed except during estrus and parturition periods. Especially, at the time of estrus, the cervix becomes loose and is secrets the mucus, which is expelled together with mucus from vagina and vulva. During pregnancy, the thicken cervix mucus changed into a gel-like plug, which seals and protects the uterus during pregnancy. At the early stage of parturition, this plug becomes softy and melted.

- The cervix is a landmark for artificial inseminator, the technician lead the AI gun by handling the cervix according to its shape and size.

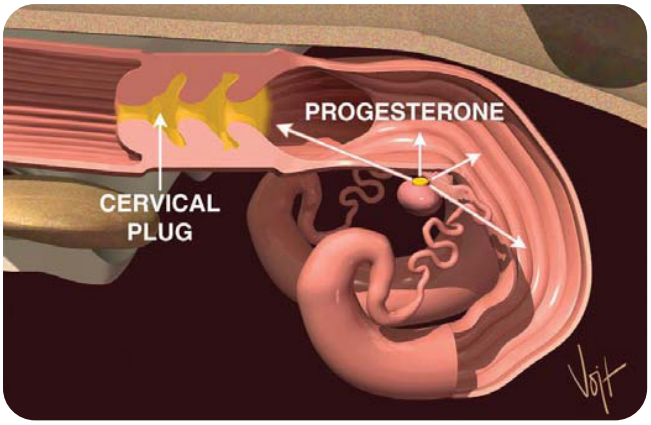


Figure 2. Cow Cervix

1.1.4. UTERUS

The uterus consists of a cervix, a corpus, uterine body (place for semen deposition during AI) and two uterine horns. The dorsal part of the cervix is called as the external uterine orifice, of which portion adjacent to the vagina is called as a vaginal portion of uterine cervix (portion vaginalis uteri), and the proximal region is called as the internal uterine orifice. It is about 10-12 cm in length.

The uterus in cattle is composed of three distinct regions: the uterine body and two uterine horns. Following the cervix, the uterine body remains a single tube. The uterine body is approximately 1 inch in length and functions as a “common area” of the two uterine horns that follow. The corpus locates to the proximal part of the cervix. The corpus is short, about 1.5 to 2.0 cm in length.

The shape of the uterus is a good indicator for physiological changes during estrus detection and pregnancy test. The uterine horns in cows in heat become turgid and enlarged, which indicate physiological changes under hormonal influence. The shape, size, consistency and location of the uterus changes during different stages of pregnancy.

The major function of the uterus is to retain and nourish the embryo or fetus. Before the embryo becomes attached to the uterus, nourishment comes from yolk within the embryo or from uterine milk which is secreted by glands in the mucosal layer of the uterus.

After attachment to the uterus, nutrients and waste products are conveyed between maternal and embryonic or fetal blood by way of the placenta.

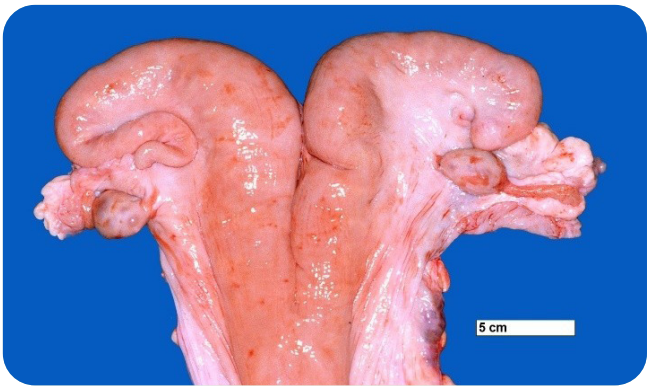


Figure 3. Cow Uterus

1.1.5 OVIDUCTS

The oviducts, also called uterine tubes or Fallopian tubes, are paired convoluted tubes which transport oocytes from each ovary to uterine horns, serve as the usual site for fertilization by spermatozoa, and transport fertilized oocytes or embryos to the respective horn of the uterus. They are about 15 to 20 cm in length and 3 mm in diameter. The portion of the oviducts adjacent to the ovary is expanded to form a funnel-like structure called the infundibulum.

- It is not possible to palpate the oviduct during rectal examination.

1.1.6 OVARY

The ovaries are the primary organs of reproduction in the female, just as the testis are in the male. The ovary, unlike the testis, remains in abdominal position throughout life. The ovaries may be considered to have both cytogenic (cell producing) and endocrine functions, since they produce oocytes which are expelled from the gland and ovulated into oviducts, and also secret hormones (Mainly estrogen and progesterone) which are absorbed directly into the blood stream.

The normal, mature cow possesses two almond shaped ovaries which are suspended in the abdominal cavity by a ligament (the mesovarium) and are partially surrounded by the infundibulum (fabriae).

An oocyte and the follicular fluid are expelled into the abdominal opening of the oviduct. If the oocyte encounters spermatozoa in the ampulla, a spermatozoon fertilizes the oocyte there. The fertilized oocyte develops to an embryo, and is transported into the uterus about day 4 of post fertilization. At the same time, corpus luteum is formed in the ovary. The corpus luteum grows continuously for 10 to 12 days to the size as same as the whole ovary. When the fertilization occurs and the embryo develops, the corpus luteum secrets progesterone.

This is defined as a corpus luteum of pregnancy. When the fertilization is not completed, the corpus luteum of the estrus regresses and disappears around 16 to 18th days after the ovulation.

The AI technicians need to palpate ovaries to know the reproductive phase of an individual cow to test for pregnancy and for estrus synchronization work. The presence of corpus luteum on the surface of ovaries is an indicator of actively cycling cow, whereas the absence of any size of corpus luteum may indicate lack of active reproductive activity for various underground reasons.

Cows with mature corpus luteum (more than 5 days after ovulation) can respond for 2 ml intra-muscular Prostaglandin hormone treatment.

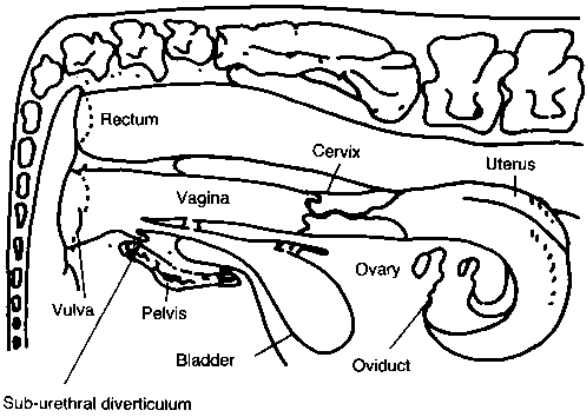


Figure 4. Different Components Of The Cow Reproductive Tract

Hormones of Reproduction

In addition to the organs the reproductive system of a cow is made up of hormones, and other substances that work together to enable pregnancy and the birth of a calf.

The following are some of the major hormones:

Gonadotrophic releasing hormone (GnRH): Secreted by the hypothalamus, this hormone stimulates the pituitary to produce follicle stimulating hormone (FSH) and luteinizing hormone (LH).

- Estrogens: Produced by the follicles, these hormones play a key role in estrus (heat)
- Progesterone: Secreted by the corpus luteum, this hormone helps maintain pregnancy
- Prostaglandins: Produced by the uterus, these hormones control the reproductive cycle

Post assessment question

1. Explain basic anatomy and physiology of female reproductive system involved in artificial insemination service?
2. Explain the anatomical and physiological feature of cervix?

Key message

Knowing the anatomy and physiology of female reproductive system is the basic knowledge to perform artificial insemination.

SECTION 2. ESTRUS/HEAT DETECTION

OVERVIEW OF THE SECTION:

This section provides a brief understanding about heat detection, how to detect heat, the hormonal and ovarian milieu around the heat which are accompanied by some alteration in animal's behavior. The section will also familiarize the trainees with the different heat signs exhibited by cows, the importance of timely heat detection, the duration of the heat period, the negative consequence of missing a heat period and finally how to select the breeding cow/heifer for artificial insemination.

Learning outcome

At the end of this section the learners can:

- Define estrus/heat detection
- Explain the major signs of heat period
- Select the breeding cow/heifer for artificial insemination
- Determine optimal time for artificial insemination

Time required: The total time required to accomplish this section is 2 days and 2 hours (2 hr. theoretical and 2 days practical)

Learning questions

- What do you understand by heat detection?
- What are the different heat signs exhibited by cows and how to detect the heat properly for on time insemination?
- How do you select the breeding cow/heifer for artificial insemination?

2.1 ESTRUS DETECTION AND BEHAVIORAL CHANGES AROUND HEAT

Estrus detection, commonly referred to as heat detection, is one of the most important reproductive management tasks performed on the farm. if cows are not identified in estrus they will not be bred by Artificial Insemination (AI) and have no chance of becoming pregnant. Heat in cow is well-defined period when she exhibits sexual desire and receptivity to the male.

The hormonal and ovarian milieu around the heat is accompanied by some alteration in animal's behavior. Standing to be mounted by herd mates is considered to be the best indicator of an animal in heat. Timely

heat detection is a very important component of successful AI. The heat duration only lasts about 15 – 20 hours, with the standing heat only lasting 6-12 hrs on average depending on the bred. Once this is missed, it will take another three weeks to reach the next heat leading to increased costs mainly from feed during this period when they are not producing.

A rough calculation on an assumption of 50 ETB as feed costs per cow shows that the farmer can lose 1,050 ETB on feeding alone if he misses one heat period. In addition to extra feeding, there is lost production during this period since the cow stays dry. Therefore, the importance of a proper and timely heat detection is vital for AI practitioners.

2.1.1 DIFFERENT BEHAVIORAL CHANGES AROUND HEAT

Before Heat (6-10 hrs. before)

- Altered vocalization
- Smells other cows
- Attempts to ride other cows
- Vulva- moist, swollen reddening of mucus membrane

Figure 5. Smelling other cow/ Sniffing

Standing Heat (18 hrs.)

- Stands to be mounted
- Nervous and excitable
- Bawls frequently
- Rides other cows
- Clear mucus-string from vulva
- Vulva- moist, swollen reddening of mucus membrane
- Off fed and reduced milk
- Rubbed tail head & dirty flank

Figure 6. Riding another cow

Figure 7. Standing to be mounted and mounting

After Heat (10 hrs. after)

- Will not stand to be mounted
- A smaller amount of turbid mucus may still be present on the vulva
- Metestrus bleeding
- Bloody mucus discharge, though always may not be seen

2.1.2 HOW TO DETECT HEAT

Based upon behavioral changes mentioned above, different methods of heat detection have been developed starting from visual appraisal of heat symptoms to fully automated heat detection aids like infrared camera or radio-telemetric implant devices.

INTERESTS	
Time	Cows show heat signs, (%)
6 a.m. to noon	22
Noon to 6 p.m.	10
6 p.m. to mid night	25
Mid night to 6 a.m.	43

2.1.3 SELECTION OF THE BREEDING COW/HEIFER FOR ARTIFICIAL INSEMINATION

Body condition at calving and at the subsequent insemination influence the interval from calving to first estrus and conception rate. Thus,

- Breeding cows should have optimal condition score between 3.0 and 4.0 (on 1-5 scale). Cows/heifers that are too thin (< 2.5 BCS) that are losing condition will have delayed estrus and poor conception rates.
- Cows that are too fat (>4 BCS) at calving are likely to have calving difficulties and are more prone to early fetal death.
- Cows/heifers to be selected for AI or synchronization should be conditioned starting two months before breeding
- The cow should be in good health. It should be free from any infection of the reproductive tract; particular attention should be paid to cows that had abnormal calving.

Post assessment question

1. Define estrus/heat detection?
2. List the major signs of heat and explain the importance of proper heat detection in artificial insemination service?

Key message

- *Proper heat detection is the major duty for successful artificial insemination*
- *Cows can only conceive if and only if bred when she shows heat sign*

Section 3. Artificial Insemination and pregnancy diagnosis

OVERVIEW OF THE SECTION

This section provides the basic knowledge and skill about artificial insemination techniques. It includes the preparations for insemination (pre-insemination checks), the detail and step by step procedures of insemination, the hygienic and safety measures during insemination, semen handling during insemination, proper semen deposition and pregnancy diagnosis.

Learning outcome

At the end of this section the learners can:

- Define and explain the importance of artificial insemination
- Know how to perform artificial insemination
- Understand how to handle, preserve and store semen
- Know how and when to make pregnancy diagnosis

Time Required: The total time required to accomplish this section is 14 days (1 day theoretical and 13 days practical)

Learning Question

- What do you understand by the importance of AI service?
- What are the basic knowledge and skill of AI service?
- What are the major techniques for semen handling, preservation and storage?
- How do you perform pregnancy diagnosis and associated processes?

3.1 ARTIFICIAL INSEMINATION

Artificial insemination is a simple technique that, when performed with skill properly founded on knowledge, offers ease of use and a good level of success. However, results can be discouragingly poor for an inseminator lacking knowledge and the necessary attention to details needed for a successful outcome. It is good to keep in mind that the success of any artificial insemination program is largely dependent on three primary factors:

- The use of live/viable fresh cooled or frozen semen.
- The appropriate timing of insemination in relation to estrus and ovulation.
- The proper deposition of semen in the cow.

Successful artificial insemination procedure based on a clear understanding of the anatomy and physiology of reproduction in cattle. Before attempting to inseminate cows, you must develop a mental picture of the anatomical parts that comprise the female and male reproductive tract.

In order to understand.

- Why an animal displays the many signs of estrus?
- When it should be inseminated?
- How the pregnancy develops?

You must clearly understand the hormonal mechanisms controlling the estrous cycle in cattle.

3.1.1 PREPARATIONS FOR INSEMINATION (PRE-INSEMINATION CHECKS)

1. Prepare a list of selected mattings, if numerous AI sires are to be used for breeding in different farms of your business area. This list could be used in selecting which unit of semen is to be thawed and inseminated for each particular cow. An inventory system describing the location of semen from each bull within the semen tank is also desirable.
2. Restrain the cow before thawing the straws for insemination. The restraint area should be free of stressful conditions (Unnecessary excitement may interfere with physiological mechanisms important to achieving a good conception rate).
3. Confirm identity of the cow/heifer to be inseminated.
4. Make a quick appraisal of the animal submitted for AI for presence of correct estrus signs, good body condition and physical stature, and freedom from disease/disorder.
5. Always bear in mind that selecting the appropriate location for AI requires consideration of safety for both the animal and technician, ease of use and protection from adverse conditions including bad weather.

3.1.2 PROCEDURES OF INSEMINATION

1. Prepare a water bath that is between 90 to 95^{0}F (or 34 to 35^{0}C) in a thermos. Use a thermometer for better accuracy.
2. Identify which canister contains the semen you need. A semen inventory on the tank that keeps track of the location of each bull prevents any unnecessary searching.
3. Remove the canister from its storage location to the center of the tank. Lift the canister just high enough into the neck region of the tank to grasp the desired cane of semen. Keep the tops of the canister or canes no higher than the frost line, or two to three inches from the top of the tank. Grasp the desired cane then immediately lower the canister to the tank floor. Keep the cane as low inside the tank as possible while removing the straw of semen with tweezers. You only have 10 seconds to take the semen straws out.
4. Shake the straw to remove excess liquid nitrogen (nitrogen quickly goes into a gaseous state when exposed to air and warmer temperatures).
5. Immediately place it the prepared thermos of water and keep it in there for 40 to 45 seconds. After the straw is put into the warm water, put the can back in the canister by raising the canister up and over the cane and return the canister to its storage position.
6. Thaw only one straw at a time.
7. Anytime it takes over 10 seconds to locate a cane the canister must be lowered back into the tank to cool completely. Never return a unit of semen to the tank once you've removed it from the cane.
8. Get your AI gun ready by having it pre-assembled (this should be done before/after you prepare the thermos with warm water. If it's cold outside,

warm the "business end" of the gun up in your coveralls close to your body so it warms up completely. Rubbing a paper towel on the rod also helps warm it up. If it's hot outside, keep it in a cool place. The AI gun should not be extremely hot nor cold to the touch.

9. Remove the straw from the thermos and wipe it dry with a paper towel. It should be completely dry before you do anything else with it. Flick your wrist slightly, while holding the crimped end, to adjust the air bubble in the straw. The flick should move the bubble to the end you are holding.
10. Put the straw in the rod. Clip 1/2" (or 1 cm) from the crimped end of the straw. Use sharp scissors or specially designed straw-cutter scissors should be used, and cut in the area that the air bubble is located.
11. Wrap the AI gun in a clean dry paper towel or protective sheath and tuck it in your clothing close to your body to both transport it to the cow and to maintain a constant temperature.

3.1.3 INSEMINATION STEPS

1. Raise the tail with one hand (preferably the right) and with the other (which should be gloved and lubricated), gently reach inside the cow to clean out any feces that may interfere with the process of feeling for and inserting the AI gun into the cow's vagina.
2. Clean the vulva with a clean paper towel or rag to remove excess manure and debris.
3. Take the gun out of your jacket or overalls, unwrap it, then insert it at a 300 angle into the cow's vulva to avoid going into the urethral opening into the bladder.
4. With your left hand in the rectum of the cow feel with your fingertips through the wall of the rectum and vagina the location of the end of the AI gun until you reach the cervix.
5. Grasp the cervix with the hand in the rectum of the cow and hold it steady while you thread the rod into and through the cow's cervix.
6. When the rod is all the way through the cervix, check the location with your index finger. The rod should be only 1/2 to 1/4 of an inch into the uterus.
7. Slowly depress the plunger at the end where your right hand is so that 1/2 or is deposited.
8. Recheck the location of the semen to make sure you are in the cow's uterus and not in any of her "blind spots", and deposit the other half of the straw's contents.
9. Slowly remove the AI gun, your hand and arm from inside the cow. Check for any blood, infection or semen "feedback" from inside the sheath.
10. Recheck the straw to see if you used the right bull semen for the cow.
11. Dispose the straw, glove, and towels in the proper place.
12. Clean the AI gun if necessary.
13. Record breeding information on any record keeping system you have on hand

Figure 8. Performing artificial insemination

3.1.4 TAKING HYGIENIC AND SAFETY MEASURES

- Apply good sanitary procedures and practices throughout the insemination process.
- Assemble all insemination devices, protect from contamination and maintain them at optimal temperature.
- Avoid using products that are irritant and spermicidal lubricants.
- The perineum must be thoroughly wiped clean with a paper towel.

3.2 PROPER SEMEN DEPOSITION

Many inseminators will check heat once in the early morning and once in the late afternoon with a teaser bull or an intact bull outfitted with a mating apron. Those cows found to be in standing heat in the morning are scheduled to be inseminated in the afternoon and cows found in standing heat in the afternoon are scheduled to be inseminated the next morning. If a cow is still in standing heat at the next heat check, then a second, or even a third, insemination can be scheduled. This decision is contingent upon the price of the semen and the availability of the inseminator.

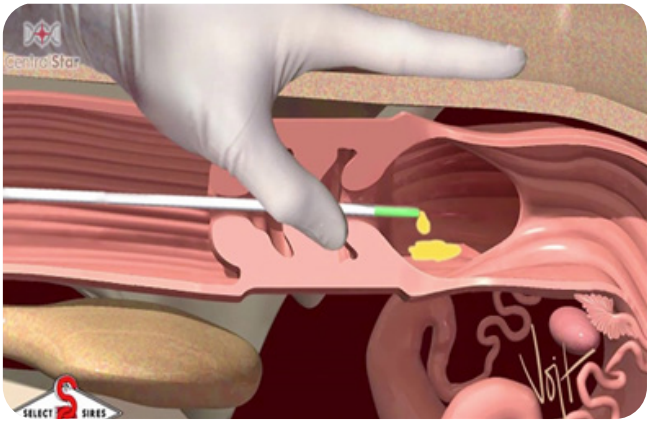


Figure 9. Proper semen deposition

3.2.1 SEMEN HANDLING DURING INSEMINATION

Cattle semen is usually stored in liquid nitrogen at-196oC, and before insemination it has to be thawed. Most technicians did not master the thawing process properly, which lead to some unsuccessful inseminations. It is advised to thaw the semen to 34oc-35oc for a minimum of 40 seconds by immersing the straw in warm water.

Figure 10. Semen Handling

3.3 PREGNANCY DIAGNOSIS

Once inseminated, the technician should check the cow for non-return to heat between 18 to 24 days of insemination. If the cow didn't come to heat pregnancy diagnosis is recommended within two months for highly experienced and 3 months for AI technicians, to confirm that the insemination was successful. Rectal palpation is probably the most commonly used method for pregnancy diagnosis. Although the technique of palpation is relatively simple, the use of breeding records greatly increases the accuracy of the diagnosis and speeds up the palpation process.

Knowledge of when a cow was bred gives the producer some idea as to the stage of pregnancy but only if the cow conceived. Most producers consider rectal palpation to be the fastest and most accurate method to diagnose pregnancy in cattle.

The insemination is repeated in the following heat cycle if pregnancy is not confirmed. Because of the small size of the embryo during the early weeks of pregnancy, technicians require special skills to rightly diagnose pregnancy of less than 2 months. If ultrasonography is available, the pregnancy diagnosis can be checked as early as 30 days after insemination.

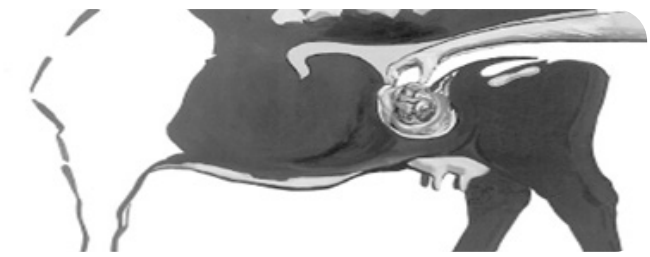
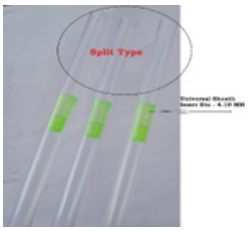


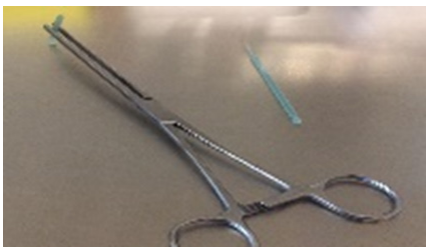
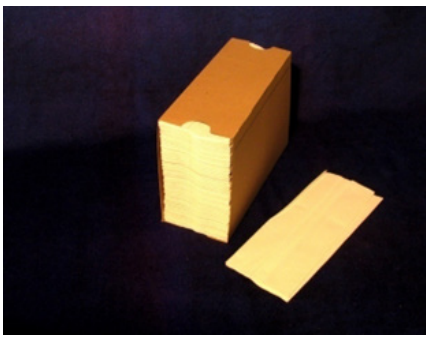
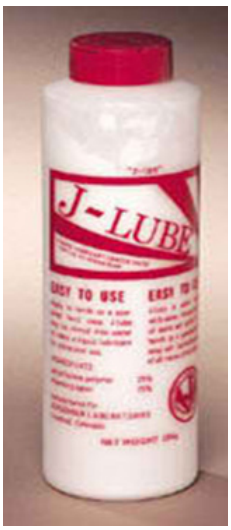
Figure 11. Rectal Palpation

3.4 INPUT REQUIRED

Use of standardized inputs (materials, tools and equipment) for the effective and efficient AI service delivery is mandatory, and AI technicians and service givers have to stick to the recommended standards.

Table 1. Materials And Equipment To Be Available For Semen Transportation And Storage, And Efficient Ai Service.

INPUT/SUPPLY ITEM	DESCRIPTION
Liquid nitrogen container 	**2 or 3L capacity for routine service delivery.** • At least 1.8-2.8L. • A neck diameter of 30- 51 mm. • A static evaporation loss rate of <0.1L/day. • At least 3 stainless steel canisters and 2 more replacements, • If the canisters are sieving type at the bottom, the canisters should have 5 goblets. • <12 cm Canister height with single level, • >100 straws (0.25ml size) capacity. • Must have a liquid nitrogen level measuring rod.
Dewar (Medium size) 	**35L holding capacity used for semen storage at district level** • Need to have a minimum of 33L holding capacity with bottom pad or extension for footing and mobility/portable. • A neck diameter of 51 to 70 mm. • A static evaporation loss rate not > 0.15L/day. • Should have at least 6 stainless steel canisters and 2 more replacements. • At least 12 Goblets as per the model of the dewar and 4 more replacements. • Have a canister height of 24 cm for double level. • Must also have liquid nitrogen level measuring rod. • It should have a straw (0.25ml) holding capacity >3000 in its 6 canisters.
Artificial insemination gun 	• Must be made of high-quality stainless-steel material with a barrel length of 435 mm and an outer diameter of 3.60 mm which is compatible with sheath that has outer diameter of 4.50 mm for a 0.25 ml straw • The plunger length should be 449 mm • Its barrel should be attached with a conical-shape stainless steel adopter along with a Plastic O-Ring. Preferably it shall be conical O-ring with auto-lock style • Must have a Gun Container
AI sheath 	• AI sheath must be made from non-toxic material (please observe manufacturer specification). • The length should be 443 mm with an outer diameter of 4.50 mm which is compatible with 0.25ml straw. • It should have an adapter to fix the straw at the center to guarantee expulsion of all the semen without back-flow into the gun chamber/sheath • Preferably the sheath is individually packed and split end type for use by both conical O-ring and fixer type AI gun
Glove 	• It should be made of low-density polyethylene material with no tears or blisters or any nicks and cuts along the edges • It should have a thickness of 25µm (double wall thickness of 0.05 mm) • It should have a length of 920-930 mm
Protective Covering	• Protective Covering for the Palpator Because the palpator must insert the hand and arm into the cow's rectum, it is necessary to cover those body parts

INPUT/SUPPLY ITEM	DESCRIPTION
Chute	• A holding chute will allow the cow to stand on the ground in a normal position to prevent any unnecessary physical stress.
Thermos flask and thermometer 	• For accurate measurement of thawing temperature during AI • The thermometer should be calibrated and annually certified to fulfill set standards
Tweezer, Scissors, Paper towel and Lubricant   	• Materials used for drawing straws from dewar, for cutting straw end, for drying the straws and lubricant for transrectal access need to be ready before one starts the AI service

Assessing Your AI practice

The performance of AI delivery can be assessed using the conception rate. The non-return rate can provide an early warning of a low conception rate to AI service. If the non-return rate for your inseminated animal is less than 60%, or conception rate is low, you need to investigate potential causes, and take the recommended action:

1. Inadequate AI practices or poor-quality semen
2. Poor body condition at calving or excessive loss of body condition following calving- review body condition score targets and the farm nutrition formulation

Inaccurate heat detection: Review your heat detection efficiency

There are other possible causes of low non-return rate and low conception rate. You may need to seek help from an adviser.

AI technicians can measure their performance using the conception rate.

Conception rates can be compared to expected performance or between individual AI technicians.

The conception rate achieved in a herd can vary for a number of reasons. That makes it difficult to compare the conception rate achieved by a single technician to expected performance targets. However, conception rates achieved in heifer AI programs are generally high (expect 60% in heifers achieving target weights) and can be used to assess the AI practices of the technician.

A conception rate of less than 55% in well-grown heifers suggests that AI practices should be reviewed.

Post assessment question

1. *Explain the importance of artificial insemination?*
2. *Explain step by steps procedures of artificial insemination?*
3. *What are the materials and equipment's required for AI service?*
4. *Explain how to conduct pregnancy diagnosis in cattle?*

Key message

As proper semen deposition is necessary for successful conception of the cows, pregnancy diagnosis is also necessary to know the outcome of the AI service.

SECTION 4. RECORD KEEPING

The AI technicians must be able to take records of all activities related to the AI service delivered and report the record/data to the report managing body. Thus, AITs must understand the critical role and purpose of keeping in the genetic improvement program, enhancement of individual dairy cattle or herd production and productivity.

The content of the record must not preclude producers' profile, animal history and individual feature of the breeding animal such as Cow ID, Breed type, blood level, history of past AI or parturition, frequency/repetition of insemination, profile of Bull used (ID, breed, age, date of collection), PD test result and calf gender, etc.) as indicated in Annex1 AI data recording sheet, and application of technical formulae in measuring reproductive efficiencies/indexes is indispensable.

SECTION 5. FINANCIAL FEASIBILITY

OVERVIEW OF FINANCIAL FEASIBILITY

Financial feasibility assesses whether the provision of Artificial Insemination (AI) services is financially viable and sustainable as a business. It involves analyzing key financial components such as the initial investment requirements, operational and production costs, and

estimated revenue from service delivery.

- This analysis helps determine:
- The profitability of the AI service business
- The break-even point, or the minimum level of service provision needed to cover costs
- The payback period, or the number of years required to recover the initial investment

By examining these elements, aspiring AI service providers can make informed decisions about whether to invest in the business. A clear understanding of financial feasibility supports sound planning and reduces the risk of business failure, ultimately guiding youth entrepreneurs in evaluating and selecting viable agribusiness opportunities.

Learning outcome

At the end of this section the trainees equip on:

1. How to determine initial investment requirement to start the business
2. How to estimate periodical production costs, operating expenses, and sales revenue of the business
3. How to determine profitability and cash flow of the business
4. How to calculate break-even point (minimum level of production) to recover total cost and generate profit.
5. To calculate payback period (time requirement to recover initial investment and
6. How to make decision to accept or reject the investment alternative

Time required: 4 hours

Learning question

1. Do you know how to determine financial feasibility of the given specific agri-business to make wise investment decision?
2. How do you determine the initial investment requirement to start the business?
3. How do you estimate periodical production costs, operating expenses, and sales revenue of the business?
4. How do you determine profitability and cash flow of the business?

5.1 INITIAL INVESTMENT

Initial investment is the minimum capital requirement to start the business.

Example of initial investment requirement to start AI service business includes AI tools and equipment, semen storage (liquid N2 tank), working capital, etc.

Table 1: Template To Estimate Initial Investment Requirement For Agri-Business

DESCRIPTION	TOTAL COST	REMARK
AI Tools and equipment		
Semen storage (liquide N2 tank)		
Working capital		
Etc		
Total		

5.1.1 LONG-TERM INVESTMENT

Long-term investment in agri-business involves all asset requirements for the business which can serve for more than one year.

Example AI tools and equipment, semen storage (liquid N_2 tank), etc

Table 2: Template To Calculate Total Cost For Acquisition Of Long-Term Investment

TYPES OF INVESTMENT	UNIT OF MEASUREMENT	QUANTITY	UNIT COST	TOTAL COST

5.1.2 WORKING CAPITAL

Working capital for the planned agri-business includes all payments requirement for day-to-day operating activities like production and operating expenses.

Example:

- Production costs include cost of semen, liquid N2, glove etc.
- Operating expenses includes administrative salary, sales commission, promotion, etc.

Working capital excludes long term investments such as warehouse, tools and equipment, and etc.

A. Production cost

Production costs are a key component in agri-business.

It includes all costs associated with production including value addition to make the product ready for sale.

Table 3: Template for estimating production cost AI service

TYPES OF INVESTMENT	UNIT OF MEASUREMENT	QUANTITY	UNIT COST	TOTAL COST
Semen	No.			
AI kit (tools and equipment's)	No.			
Armed glove	No.			
Liquid N2	Litter			
Lubricant	No.			
disinfectant	Litter			
Labor cost	Person			
Transporting	Trip			
Storage if rental/ month	Number			
Total				

B. Operating expenses

Operating expenses are all costs not directly associated with production and service.

They are common costs incurred for administrative and selling activities.

Example administrative salary, promotion cost, sales commission, transport cost to sale, etc.

Table 4: Template To Estimate Operating Expenses For Agri-Business

TYPES OF COSTS	TOTAL COSTS
Administrative salary	
Utility (electric, water, tele.)	
Interest	
Promotion	
Sales commission	
Tax	
Etc...	

5.2 ESTIMATED PRODUCTION AND SALE REVENUE

1. Production volume is the main source of revenue for the agri-business to generate profit.
2. Producers should determine the estimated average production volume from the planned production season.

FORMULA 1
Total production volume = Average Production per hectare X Land size (ha)

3. After determining the estimated volume of production, it is possible to determine the expected sales revenue for the planned production

FORMULA 2
Total sales revenue = Total production Volume X unit selling price

5.3 PROFIT AND LOSS STATEMENT

1. The primary objective of any business is to generate profit.
2. Profit and loss statement is the main tool to calculate profitability of the business.
3. It is used to accept or reject the investment based on estimated profit.

FORMULA 3

1. Gross profit = Total sales revenue – Cost of goods sold
2. Net profit = Gross profit – Total operating expenses

Table 5: Template For Profit And Loss Statement Preparation

DESCRIPTION		
Sales Revenue		
No. of AI service provided		
No. Pregnancy diagnosis provided		
Total Sales revenue		
Cost of goods sold		
AI service cost		
PD test cost		
Ending inventory		
Cost of services sold		
Gross profit		
Operating Expenses		
Salary if any		
Utility (electric, water, tele.)		
Interest		
Promotion		
Depreciation		
Tax if any		
Total operating expense		
Net profit		

5.4 BALANCE SHEET

Balance sheet used to know the total resource owned, amount of claim by creditors and amount of owners' equity

- Balance sheet contains asset, liability, and own capital
- Assets are all resources available for use or for sale
- Example cash, inventory, warehouse, land, equipment etc.
- Liabilities are all debts obtained from bank, microfinances, individuals or others
- Own equity/capital involves own/member contribution, grant/donation, etc.

FORMULA 4

Total Asset = Total liability + Total own capital

Table 6: Template For Balance Sheet Preparation

DESCRIPTION		
Asset		
Current asset		
Cash		
Inventory		
Total current asset		
Fixed asset		
Tools and equipment		
Warehouse		
Land		
Total fixed asset		
Total asset		
Liability and Capital		
Liability		
Bank loan		
Debt from relative		
Total liability		
Owners' capital		
Own capital contribution		
Grant/donation		
Total owners' capital		
Total liability and capital		

5.5 CASH FLOW STATEMENT

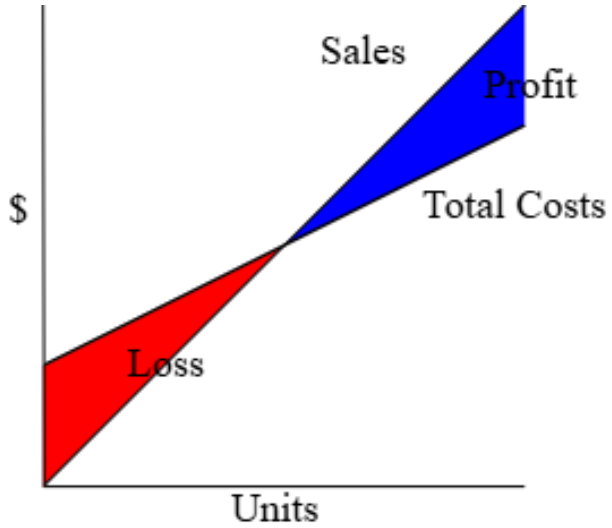
- Cash flow is all cash inflow and outflow for any purpose in the business operation
- Example:
- Cash inflows include sale of seed/seedling, debt obtained from banks, members capital contribution, etc.
- Cash out flow includes purchase of input, payment for construction, repayment of debt,

payment for salary, etc.
- Example cash, inventory, warehouse, land, equipment etc.
- Liabilities are all debts obtained from bank

FORMULA 5
Beginning cash balance + total cash inflow = ending cash balance + total cash out flow

Table 7: Template for cash flow statement preparation

DESCRIPTION	AMOUNT OF OUTFLOW	AMOUNT OF INFLOW
Owners' investment		
Debt		
Grant		
Sale of AI service		
Warehouse construction cost		
Purchase of AI service equipment		
Purchase of input		
Warehouse rent		
Labor cost		
Cash Operating costs		
Ending cash balance		
Total		



5.6 BREAK EVEN ANALYSIS

1. Break even analysis is used to determine the minimum level of production to cover total cost
2. At break-even point no profit no loss
3. To make profit, level of production and sale should exceed/greater than breakeven point.
4. Fixed costs are fixed in total amount regardless of increase/decrease in volume of production.

Example: depreciation, warehouse rent, administrative salary, promotion cost, etc.

5. Variable costs varied in total in response to increase/decrease in level of production

Example production costs, packaging cost, loading and unloading, etc.

FORMULA 6
Break-even point = Fixed cost/(Unit selling price – unit Variable cost)

5.7 PAYBACK PERIOD

Payback period is used to determine number of years/ periods it takes to recover initial investment.

FORMULA 7
1. When the annual profit of the business is uniform/equal

   Payback period = Initial investment/annual profit
2. When the annual profit fluctuate/vary from year to year

   Pay back period = # of year before coverage + uncovered amount/profit of the next year

1. Which of the following is part of working capital

   a. Purchase of fertilizer
   b. Purchase of tractor
   c. Transportation cost,
   d. Purchase of chemical

2. Which of the following should include in profit/ loss statement

   a. Purchase of tools and equipment
   b. Sales revenue
   c. Debt
   d. Owner investment

3. Which of the following is variable cost

   a. Purchase of seed
   b. Administrative salary
   c. Depreciation
   d. Rent of storage

Key message

Analyzing financial feasibility of agribusiness enables to pre-determine the applicability of the business in terms of initial investment requirement, profitability, and sustainability.

Potential Risks And Mitigation Strategy

The following are some of but not limited the potential risks that may occur during implementation of AI service business and its respective mitigation strategies.

NO.	POTENTIAL RISKS	MITIGATION STRATEGY
1.	Lack of input supply for undertaking the AI service business	Collaborating with livestock development institute and Regional AI centers to have sufficient stocks of input supply
2.	Lack of semen handling and storage facilities	Creating strong linkage with the office of agriculture in the respected woredas to support the youths in providing the required facilities
3.	Failure of the artificial insemination service	Proper identification of the reason for failure and working hard towards that specific problem
4.	Less acceptance of the youth groups engaged in AI service business by the community	Awareness creation in the community about the importance of AI service delivery
5.	Security issue of the country	Subsidies in case of such risk happened

Annexes

Annex 1. Artificial Insemination Data Recording Sheet

AI NO.	DATE	FARMER/FARM	COW ID AND BREED	LAST CALVING DATE AND LACTATION NO	HEAT TO AI (HR)	AI TIME (AM, PM)	SERVICE OF AI (U/C/V*)	BULL & BREED	SEMEN BATCH	PD DATE & RESULT	SERVICE CHARGED (BIRR)	NAME OF INSEMINATOR AND SIGN	REMARK

U= Uterus; C=Cervix; V=Vagina

Ethiopian ATI

Agricultural Transformation Institute

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