Popular Article

Artificial Insemination of Cattle: Current and Future Trends

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Introduction

Artificial Insemination (A.I) is an in vivo fertilization process to avoid sexual intercourse or in vitro fertilization. In this process sperm is introduced into a female's cervix or uterine with the help of proper instruments for achieving pregnancy. A.I is used for human, pets, endangered animal species, livestock, animal in zoo etc. Although the A.I is very common for cattle (75% of all inseminations) and swine (85% of all inseminations). Artificial insemination is very much popular among the livestock breeder to improve their herds using the semen of the males having improved and desirable traits. Artificial insemination adoption reduces both genital and non-genital diseases considerably in livestock.

History of Artificial Insemination

The first successful experiment with artificial insemination in animals was performed by Italian physiologist Lazzaro Spallanzani in 1780, who developed a technique for artificial insemination in dogs.

1887- First equine A.I

1949- Semen freezing technique developed.

1960- PVC straws used for storing semen.

1963- First cattle A.I.

1965- Cattle A.I becomes commercially available.

1996- First cloned sheep born.

2000- Sexed semen commercially available for cattle.

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Steps of Artificial Insemination of a cattle

a) **Proper Positioning of the cattle**

The success rate of artificial insemination is greatly increased when the cattle stand on a level surface with relaxation. The cow should not mix with the cows of other groups. The A.I of a cow should be done in an area with which the cow is already familiar with the provision made for food and water.

 b) **Softening of the Straw**

Temperature for softening the straw should be 35 C. The straw should be removed from the flask with forceps and submerged in the water. Leave it in for 20-30sec for a 0.25 ml straw and 40 sec for a 0.5 ml one. The A.I gun should be pre-warmed by rubbing in hands and straw should be placed in it. Gun should be hold vertically and gently press the plunger upwards, until the semen rises to the top.

c) **Insertion of palpating arm**

Point your fingers and your thumb together and gently insert your palpating hand into the rectum. With your free hand, use a paper towel to wipe the vulva free of any manure in order to avoid bringing in infectious bacteria. In addition, making a fist and applying downward pressure with your palpating hand will cause the vulva to slightly open, allowing for a clean entrance.

d) **Insertion of the AI catheter**

Insert the AI catheter into the vulva at a slight upward 30-degree angle to avoid inserting the catheter into the urethra and into the bladder.

e) **Inserting the catheter into the cervix**

After bringing the tip of AI catheter close to the cervix, the next step is to insert the tip of the AI catheter into the opening of the cervix. The vagina forms a blind-ended pocket around the cervix called the fornix vagina. It is common for the tip of the catheter to be in the fornix rather than in the opening of the cervix.

f) **Depositing semen**

Depositing semen in the correct place is critical. Semen should only be deposited in the uterine body. If semen is deposited in the cervix instead of in the uterus, the vast majority of the sperm cells will actually flow back into the vagina rather than the uterus. To ensure that the AI catheter is in the correct place for depositing the semen, feel for the tip of the catheter with fingers.

Advantages of A.I

1. Disease control. This is accomplished by preventing skin contact such as in natural service. The most important diseases it protects against are transmission of the herpes virus- equine coital exthanema - and contagious equine metritis, which is caused by a bacterium. In addition, antibiotics can be added to the semen at the time of insemination or collection and reduce or totally eliminate breeding the mare with any bacteria at all.

2. Decreases chances of injury. Semen is generally only collected every other day in an AI programme, so there is much less chance for injury. In addition, semen can be collected on a phantom and a mare in heat may not even be needed. Not only does this almost eliminate injury to the mare (if she didn't want to get served) and stallion but also it dramatically reduces the chances of injury to those staff involved in the breeding shed. It may be in future that farms could be in legal trouble when staff are hurt and AI could have been used.

3. Semen can be collected from stallions with problems. Each year stallions are either injured or have trouble breeding due to inherent libido (sexual behaviour) problems. Because semen only needs to be collected every other day it reduces the effects of breeding pressure and injuries.

4. Semen is evaluated each time it is collected. With natural service we are flying a bit blind because it is not until pregnancy rates are established can we assume that the semen was OK at the time of breeding. With AI we can look and measure parameters related to fertility every time we collect. One way to look at reproduction is to say that when we feel the testicles we are "feeling the future" and when looking at semen we are "looking at history" as one represents potential and the other the recent event of semen production.

5. Prevents stallion overuse.

6. Allows more mares to be bred. AI lets us divide the semen up into as many doses as he is capable of giving in an ejaculate. Typically, that is around 10-15 doses on every other day collection schedule.

7. Permits breeding of mares with problems. Each year mares are presented for natural service that may not be psychologically ready for service. Sometimes this is due to the mare's own agitation and sometimes it may be because she has a 'foal at foot' and becomes worried about her foal (foal proud).

8. Permits use of older valuable stallions. As stallions get older their sperm numbers decrease. This typically begins at around 13 years old. Many stallions are already exhibiting quite obvious sperm reduction by the time they are 16 - 17 and many are almost infertile by the time they are 19 - 20 years old. AI allows deposition of the correct number of sperm to be made for each mare and removes the guesswork.

9. Allows mares to be bred at the best time for conception. Because we can store semen either cooled or frozen mares can be bred when they are most suited for conception. In a natural service programme this would necessitate breeding the stallion as many as 5-6 times per day. Most stallions would not handle a breeding schedule like that for very long.

Disadvantages of AI

1. Specialized equipment is needed. An artificial vagina (AV), thermometers, warmed containers and equipment non-spermicidal gel and equipment to measure motility (warmed stage microscope) and sperm concentration are all necessary for AI to be practised properly. This is expensive and a well-equipped laboratory may cost in vicinity of $40 000 just for the equipment (without the building and fittings).

2. Technical expertise is needed. Personnel need to know how to make the AV so that it is right for the stallion and then how to collect and process the semen properly.

3. Incorrectly practiced AI can cause problems. You would be surprised to learn just how often the wrong lubricating gel is used in the AV and that there have been weeks before anyone realised that the pregnancy rates were disastrous.

Future Developments in AI technology

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1. **Semen Storage after dilution**- It is observed that the sperm fecundity reduced after dilution of 15-20 hours, so future work should be attempted to prepare some diluents with can sustain sperm fecundity for a longer time after dilution.

2. **Semen Evaluation-** In case of human andrology some procedures are used to evaluate the semen and cell culture may be adopted to to evaluate the semen of the animals.

3. **Tom Selection-**Tom selection based on specific polygenic traits such as semen volume will be (or may already be) made on the basis of genetic markers revealed in DNA analysis or biochemical or serological analyses. Selection based on such markers could be performed soon after hatch rather than waiting for the onset of semen production.