

Artificial Insemination (AI) is the process of collecting sperm from a bull for an AI technician to insert into a heifer's cervix whilst on heat using special equipment. AI is only successful if the insemination occurs during the cow's oestrus cycle, which is 12-24 hours during the standing heat stage. Artificial insemination is done instead of natural mating to control genetics and what time of year the cows calve. AI has also been shown to improve milk production in the dairy industry.

The first step is thawing out the semen and preparing the heifer for insemination. Semen, once thawed out, is only active for 15 minutes, so the technician has to be aware of how much they can insert within the 15 minutes. Once the semen is thawed out, it'll be dried off and then loaded into a pistollet, one semen straw per insertion. Once loaded, the pistollet needs to be handled with care so it can't be contaminated. It needs to be kept out of the sun, away from any chemicals and handled with clean gloves. The heifer needs to be put into a yard or chute where it will be restrained for the safety of the technician. Then the cow's vulva is wiped clean to prevent any infections in the reproductive tract and to make sure there's a clear entrance for the AI technician.

Next, the pistollet is guided into the cow's cervix by a gloved hand in the rectum. The hand in the rectum needs to palpating the cervix to ensure the pistollet has a smooth passage. To ensure good semen delivery, the hand in the rectum must guide the pistollet to the correct place, which is near the entrance to the uterus but not blocking it or misdirecting it into the uterine horn.



The pistollet must also not be inserted too deep, or it'll cause severe injury to the heifer and could cause infertility. The semen must be inserted slowly to increase the amount of sperm; also, slow insertion ensures that the pistollet is empty and that all the semen has been inseminated into the cow. Then the pistollet is slowly removed from the reproductive tract and the hand is removed from the rectum. The cow is then released and monitored by farmers to ensure that the cow is pregnant.

The final step is to monitor the cows that have been inseminated to ensure that the insertion has been successful. One way to do this is to notice the change in their behaviour, whether their appetite has changed, or whether they are gaining weight. Another way to tell if it has been unsuccessful is if the heifer comes on heat again within the next 2-3 weeks. This means that she is not pregnant and that she will need to be inseminated again.

Flushing is a technique used to increase the success rate of ewes pregnancies. Flushing is the process of feeding high-quality pasture three weeks before mating and three weeks during. It improves the chance of ovulation by the ewes gaining weight and triggering higher levels of hormones such as follicle-stimulating hormone (FSH). The higher the ovulation rate, the more successful the lambing will be. The success of flushing depends on the quality and quantity of the feed. Silage and leafy pasture are the best feeds for this method.

To ensure you are feeding the right pasture to the right ewe, you must examine their body condition score (BCS). To do this, the farmer needs to get the ewes into a yard where they can be examined by a BCS expert, who would then tell you what their score is. If they are lower than a 3, then they would be drafted off into a herd that would be fed higher quality feed to try to increase the BCS before mating. If the ewes score was higher than a 3, then they would be drafted off separately and fed pasture for maintenance.

After separation, the ewes will be fed high-quality foods like silage, lucerne and leafy pasture. Feeding them more of this high-quality feed increases the chances of lambing by producing a higher level of FSH. This is done 3 weeks before mating to try to increase the hormones and then 3 weeks during to ensure that the ewes are healthy. If feed is low during autumn or due to drought, the farmer needs to feed the ones with a lower BCS to help them be the same live body weight as the ones with a higher BCS.



During a drought, the ovulation rates drop, which may delay mating and ovulation rates until the drought breaks, the ewes won't go back to their normal state.

Embryo Transfer (ET) is the process of giving a ewe a series of hormone injections such as follicle-stimulating hormone (FSH) to stimulate more ovulations. These eggs will then be fertilised with the sperm from artificial insemination (AI), which allows them to form embryos. Embryos are the unborn offspring of a mammal. This procedure is mostly carried out in dairy cows but can be done in other animals such as merino sheep. This procedure is very risky and doesn't always work, it also costs a lot of money. If successful, it will increase the number of offspring by 50%, and it also increases the genetic base of a herd and will decrease the chances of diseases.

The steps of embryo transfer are very precise, and if they are done incorrectly, it could affect the ewe seriously. First, you have to choose a ewe that is healthy, has a high BCS and has the best genetics. Embryos can also be bought in from overseas. Ewes that are the embryo donor will undergo the process of being in superovulation,

which is when the ewe is injected with hormones such as FSH to stimulate the ovulation. This process takes around 26 days. On day one, the first injection will take place, then on day 7, the CIDR will be inserted. A CIDR is a silicone-type, T-bone-shaped device that is inserted into a ewe to increase progesterone levels. Progesterone is absorbed from the CIDR by the vagina which will then cause the body to realise levels of lutenising hormone (LH) and FSH. On day 15, the CIDR is changed out for another one, and on days 16, 17 and 18, the ewe is injected twice daily with FSH to increase her hormone levels again. Once again, on day 19, she will be injected twice again, and the CIDR will be removed. This drops the levels of progesterone and increases the FSH levels, then the ewe will start its oestrous cycle. On day 20, the farmer will do two heat detections to make sure that this process has worked. Lastly, on day 26, the surgery to extract all the embryos will take place.

The embryos are extracted using a laparoscope and are directly injected into the uterus of the ewe that is at the same stage of oestrous. To get the recipient ewe at the same stage as the donor, the use of CIDR is in place to synchronise their oestrus cycles. The success of this process depends on the detection of heat of both ewes and the recovery of the fertile eggs. Because there will be lower progesterone levels because of the removal of the CIDR, the timing of the insertion is crucial.



The advantages of this process include a more widespread use of genes from genetically superior ewe, which could also include ones from overseas. This procedure will also increase the number of offspring. It can increase the ewes genes and can increase her number of offspring throughout her lifetime. Also, another advantage is that the flock will be increased genetically, so there will be less chance of diseases transferring over, and the health rate of the ewes will change dramatically.

Justification of the use of Artificial Insemination by beef farmers.

Quality: AI can improve the quality of a herd because you can choose exact genes. With AI, you can choose what bull you want to get your herd pregnant. The more money you spend, the higher chance there is that your bull is very high quality. Being able to choose high-quality semen will also increase the milk production rate because it improves the heifer's genetics. There is also less chance that diseases will be transferred over. AI is also an easier way for farmers to monitor the pregnancies. This technique doesn't just increase the quality of the herd, but it can also improve the quality of farmer's safety and the farmer's yards. Having bulls can be dangerous, and they could cause damage to the yards if provoked. Bulls also can cause issues when the herd is getting milked, so not having one on the farm can increase the chances of having fewer issues around the farm.

Quantity: AI creates more pregnancies; a bull will impregnate 50-60 heifers naturally mating. Using AI, one bull's semen can inseminate thousands of cows. AI has a higher success rate than natural mating, which means that farmers will have bigger replacement herds. Also, the replacement herd will have better genetics from this bull's semen and have a lower chance of getting a disease. AI increase the milk production in herds as well because you can choose the genetics of your semen. If you pay more for sexed semen, you could only have females being born, which means better for replacement herds and better for milk production. AI could also increase fertility and how many calves the heifer has by 10%, which benefits the farmer.

Timing: AI can help farmers know what to feed the cows and when. When on heat, you need to increase their feed to increase the rate of conception. AI helps with this because farmers need to keep a close eye on which cows are on heat so they know when to inseminate. Using AI also means that you can calve throughout the year and can control when the heifers calve. Natural mating means that you have calves whenever the bull feels like it, but with AI, the farmers know when the cows are going to calve. This condenses calf rearing into a shorter period and is less costly because the farmers don't have to pay someone constantly to feed the calves. Artificial insemination also means that the heifers will all be on heat at the same time because of the increase in hormones, which is more beneficial for the farmer because then they can control when the cows have their calves.

Economics: AI may seem more expensive than natural mating because you have to pay for semen and technicians, but over time, it ends up being a more affordable and more successful way to go. AI has more benefits than natural mating because farmers can control the genetics and calving times. Natural mating means having to maintain the bull and pay for its feed and repairs when it gets provoked. Artificial insemination also increases the safety on the farm by not having the risk of an angry bull breaking fences or ruining cattle yards when the herd gets milked. AI also reduces the cost of calf rearers by being able to choose when the heifers calve.

Disadvantages: Some of the disadvantages of the technique are if the cow is not on heat and is inseminated, it could affect the cow's fertility and is a waste of semen and money. Also, the money spent on the semen and technician can be a negative, and the labour put into the inseminating the cow could also be a downside because natural mating is much simpler and less labour. Farmers also have to monitor which heifers are in heat, which is also more time-consuming. The maintenance of the yards could also be a negative as the yards where the heifers are being inseminated have to be reasonably clean to decrease the chances that the cow being inseminated gets an infection or disease from the pistolette being dirty.