What is artificial insemination?:

Artificial insemination (AI) is when farmers get diluted semen from a bull to then inseminate their cows. The semen will be directly placed into the cows **uterus** so that the embryo can become fertilised and the cow can raise a calf. AI is used to genetically improve the herd, access genetics from around the world, to reduce the number of bulls required, and to have access to breeds that aren't locally available.

Method of artificial insemination:

1 When the cows are ready for AI

For AI there needs to be the right timing for the process to be effective. For the AI to become effective the cow needs to be on standing heat. Standing heat is when the cow has been on its oestrous cycle for around 8-12 hours already. The oestrous is caused by **oestrogen** since the concentration of **progesterone** has decreased which is the hormone that helps to prepare the cows **uterus** for a pregnancy. **Oestrogen** also has a huge influence on standing heat as it helps to start the release of luteinizing hormone from the cows anterior pituitary gland located in the brain. This causes the cows to start standing to be mounted, swelling and reddening of the vulva, and mucus discharge. This then helps the farmers to know when the cows start their oestrous cycle. So if the cow starts its oestrous around 7am then the farmer can collect the cow. So that AI can happen around 3pm-7pm. The reason why it is important to get the timing right for AI is because if the AI is done too late the **sperm cells** won't be able to fertilise the **embryo** in the uterus during the **ovulation period**. This will mean that the cow will not become pregnant and rear a calf. Farmers will usually use fixed-time artificial insemination synchronisation programmes which is where the cows will get specific treatments so that they are all standing at the same time and the artificial insemination can be booked for a certain day. This will allow all the cows to be done at the same time and for the highest percentage of success rate.

2 Positioning the cow

The cow needs to be on a level surface and not on a slope and be slightly restrained to avoid getting kicked but also to still allow the cow to have some movement. The cow should also be in an area where they can have food and water still so they do not become stressed/uncomfortable. These things need to be done so that the cow is relaxed. The reason why the cow needs to be relaxed is because it will increase the success rate of the AI process because their muscles will be relaxed and will make manipulating the catheter easier.

3 Equipment and things to remember:

Preparation is very important because you will need to make sure that you have enough semen and equipment otherwise if you run out you will not be able to finish all the herd. The equipment that you will need is stainless-steel AI gun, non-spermicidal lubricant, gloves (some 35 inch (shoulder length) and smaller gloves). You will need to make sure that all the AI equipment that you are going to be using is clean and sanitary. This is to reduce the risk of bacteria going into the cows **reproductive tract** and an infection occurring in the reproductive tract and vagina. The person who is doing the process of AI will also have to make sure that all bracelets, rings and

watches are taken off. If they do not do this it will mean that these items will be rough and harsh to the cows **rectal lining**. The rings and bracelets could tear the rectal lining and cause harm to the cow . If not treated an infection could occur meaning the cow could die from an infection. The technicians will put the shoulder glove onto their non-dominant hand so that they can use their dominant hand control with the AI gun. If the technician used their non-dominant hand to hold the AI catheter they may not have as much control over the movement of the AI catheter in the **uterus**. This could cause the cow to become uncomfortable for the cow from the catheter touching the **rectal lining**, meaning that the cow will begin to move making it more difficult for the technician. Before the technician inserts their gloved hand that is the palpating hand, the technician will put lubricant onto their hand. This is so that the hand will be able to move in the cows **reproductive tract** without too much friction. This will then help the process to occur faster and for the technician to complete the AI on all cows faster. Before anything else the semen straw needs to be loaded into the catheter. Once the semen has been loaded into the catheter it can be put back into the warmer or in your shirt so that the catheter can stay at a consistent warmth. It should be kept around 35℃ This is so that it does not cool and kill the sperm cells. The semen needs to be used after 10 minutes of thawing the semen otherwise the possibility of an unsuccessful result will become higher.

4 Inserting gloved hand into rectum:

Before the technician inserts their lubricated palpating hand into the cow's **rectum** they will clean the cow's **vulva** with a paper towel. The reason why they clean the **vulva** is to reduce the possibility of taking in bacteria to the cow's **vulva** that can cause an infection. Once the **vulva** has been cleaned the technician will put their figures and thumb together to form a cone. They will gently insert their hand into the **rectum** and take out any excess cow dung (if any) and wipe it away with a paper towel again. However, if the **rectum** is swollen with gas or the cow continues to strain and move about the technician will need to remove their hand to avoid injuring the cow's **rectum wall**. This is because the cow is obviously tense and is holding gas. If they were to continue it could end up hurting the cow and will mean that the AI could become unsuccessful. If this does not happen it is fine for the technician to continue the process. They will apply some downward pressure with their palpating hand which will allow the **vulva** to open more for a clean entrance for the AI catheter.

5 Inserting AI gun:

From the palpating hand opening up the **vulva** the technician is able to easily insert the AI catheter in. To prevent entering the **urethra** and **bladde**r they will insert the AI catheter at a 30 degree upwards angle. The reason why they do not want to enter the **bladder** is because the semen will not be able to fertilise any embryo there. If they do accidently insert the catheter into the urethra the technician will pull the catheter out a bit leaving the tip in the cow's **vagina**. The reason why it is crucial that the tip of the catheter isn't completely pulled out of the **vagina** is because, if the catheter is pulled out completely it allows the possibility of bacteria to enter into the cows **reproductive tract**. It will then mean that the cow could get an infection and become sick needing antibiotics. As the technician pushes the catheter into the cows reproductive

system they will start to level out its angle because the angle of the **reproductive tract** changes the more the catheter is pushed in.

6 Moving the AI catheter:

The technician will continue to push the catheter through the cows **reproductive tract** without too much force with the arm holding the catheter. If too much force is applied it could cause an injury to the cows reproductive system or irritation. If the catheter has residence when trying to push the catheter through it could possibly be blocked by vaginal folds. To manoeuvre around this problem the technician will use their palpating hand to direct the catheter through the **reproductive tract.** Once the AI has been pushed through to the **reproductive tract** the catheter will come to the cervix. The technician will use their palpating hand to find where the cow's cervix is. This is because all cervixes are different sizes. Some are small, some are large. However, all cervix's feel dense so it makes it easy to find the cervix with the palpating hand. The technician will push the catheter to the opening of the cervix and push it in. If it is not going into the cervix they may need to use their palpating hand to straighten out the **reproductive tract** so that the catheter can easily be pushed to the opening of the cervix.

7 Pushing the catheter through the cervix to uterus:

Once the technician gets the catheter to the cows cervix they will push the tip through the opening. They will have to make sure that the tip does not accidently go into the fornix of the vagina. If this does happen the technician will pull the catheter back a little bit and use the palpating hand to hold and close the fornix areas so that the catheter can enter into the cervix easily. If the technician did not do this it would mean that the semen would not be deposited in the vagina instead of the cervix which would not get the cows embryo fertilised.

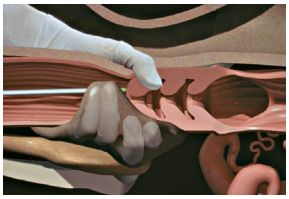
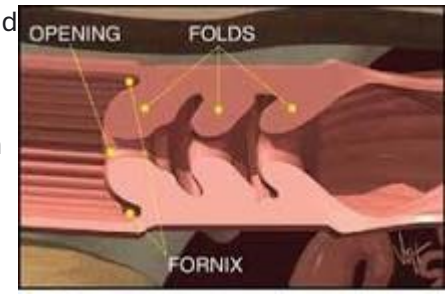


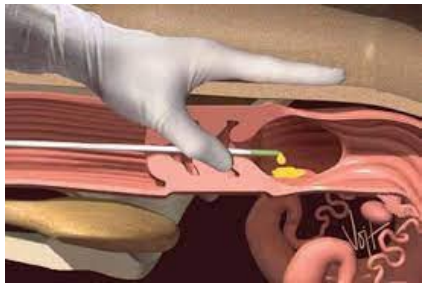
Image of AI catheter getting stuck on fornix

8 Getting catheter through cervix:



They will then continue to push the catheter through the cervix and annular rings. Most cows have around 3 folds. Sometimes the technician will press the cervix against the pelvis to create more support and make it easier for the catheter to be inserted through the cervix. Using their palpating hand they will move the cervix back onto the catheter rather than pushing the catheter through the folds. To get through all the folds in the cervix they will use a small amount of pressure while turning the cervix to get the catheter through the next ring. The reason why only a small amount of pressure should be applied is because they are close to entering the uterine body. This means that if too much force is applied then the uterine tissue could be punctured as it is very thin. This could then later cause prolapse.

9 Depositing the semen:



It is very important for the success rate that the semen is deposited into the uterus. This is because if it is deposited in the cervix most of the sperm will not go into the uterus but will go back out into the vagina. This will mean that the cow would not become pregnant and the AI would be unsuccessful. The way they check to see if the catheter is in the uterus is they will use their palpating hand to see if they can feel the tip of the catheter. If they cannot feel the tip it is still in the cervix. The reason why this is, is because the cervix is very dense whereas the uterus is very thin. So if they can feel the tip of the catheter they are in the uterus. They will deposit the semen in and make sure to do it slowly and to not pull the catheter out before it has finished depositing the semen. Once the semen has been deposited they will pull the catheter out and do the next cow.

What is Artificial Hormone Application?

Is when farmers will be given artificial hormones to get their herd on heat at the same time so that they can all be artificially inseminated on the same day. Generally the hormones will be injected into the cow. Some types of artificial hormones that are used in New Zealand are Cyclase (PG) injection, DIB-H progesterone insert, DIB-V progesterone insert and Gonasyn (GnRH) injection. Many of these artificial hormones applications work together to help ensure that the herd is on standing heat at the same time.

Method of synching herds cycle:

A common synchrony done by Agrihealth is the DIB-CoSynch. The process uses the hormone applications of DIB, Gonasyn and Cyclase. This Program is able to allow/get all the herd to be on standing heat at the same time. This will allow the farmer to have a set time where the AI technician can come in and inseminate all the cows. If the farmer does not use artificial hormones to sync up their herd it will mean that the technician will have to come when the cows get on to their standing heat at different times. This will then mean that the farmer could have a high cost from having to book the AI on many different days.

Day 0

On day 0 the cows will have a DIB inserted into the cows **vagina** using the applicator. The DIB's is a V shaped silicon elastomer and will generally contain 1.0g or 0.5g of **progesterone**. The DIB is very suitable for non-cycling cows or for **oestrus** synchrony programs like the DIB-CoSynch. The DIB insert will make the cow's amount of progesterone increase. The progesterone will help to prepare the cow's body for a pregnancy. On day 0 it is also important that Gonasyn (GnRH) is given to the cow through an injection. The reason Gonasyn is given to the cow is because Gonasyn is a hormone that helps to release more follicle stimulating (FSH) and luteinising (LH) hormones. These hormones help with ovulation in the ovaries. If these things weren't done then it could mean that from the lack of progesterone, FSH and LH hormones.

(DIB and DIB applicator)

Gonasyn injection

Day 7

On Day 7 the DIB will be removed from the cow's vagina. To do this you will pull on the DIB tail by pulling it firmly out of the vagina. However, you need to make sure you are not pulling it too hard otherwise it could be uncomfortable for the cow or damage the reproductive tract. If the tail is not out of the cow's rectum a vaginal examination may be needed and then remove the DIB insert. When the DIB device is removed the concentration of progesterone in the cow will decrease. This will then lead to their levels of oestrogen increasing to the herd going onto the estrous and ovulation at the same time shortly after. On the same day, inject the cows with 2mL of Cyclase. This will help to get the cows' estrous synched ready for artificial insemination to occur on the same day.

Day 9

On Day 9 before artificial insemination, inject the cows with 2mL of Gonasyn. The Gonasyn will help to release more follicle stimulating (FSH) and luteinising (LH) hormones. These hormones help with ovulation in the ovaries. It will also improve the cow’s fertility. This will then help the cow’s to have a successful pregnancy from artificial insemination. If this is not done then it could mean that the percentage of successful pregnancies in the herd could be lower meaning less cows will rear a calf.

Common synchrony programs