

## **SUBSTANCE ADMINISTRATION FOR DAIRY CATTLE**

### **1. PURPOSE**

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To describe the methods to maximize the effectiveness of medications for cattle, while minimizing potential risks for the animal, the operator, and the consumer. The most used routes for administering treatments to dairy cows are subcutaneous (SC), intramuscular (IM), intravenous (IV), intramammary, topical and oral.

### **2. RESPONSIBILITY**

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- 2.1 Trained and qualified personnel
- 2.2 Principal Investigator (PI) and research staff.
- 2.3 Veterinarian

### **3. MATERIAL**

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- 3.1 Latex gloves
- 3.2 For injections:
  - 3.2.1 Needles
  - 3.2.2 Syringes
- 3.3 For oral administration:
  - 3.3.1 Bolus gun or applicator (pilling)
  - 3.3.2 Stomach tubes or glycol drenching gun (drenching)
- 3.4 For Intramammary Infusion:
  - 3.4.1 Teat dip
  - 3.4.2 Gloves
  - 3.4.3 Clean towels
  - 3.4.4 Sampling tubes
  - 3.4.5 Antibiotic tubes
  - 3.4.6 Alcohol swabs
- 3.5 Thermometer
- 3.6 Administration volumes chart
- 3.7 Substance to be administered.

### **4. GENERAL**

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- 4.1 Consult with the Lead Technician regarding any health problems and before administering any substances.
- 4.2 The label on the substance package/ bottle describes the appropriate routes of administration and dose of medication to administer. Always follow the label recommendations for dosage and volume per administration site unless directed to do otherwise by your veterinarian.
- 4.3 The substance:
  - 4.3.1 The pH of solutions injected subcutaneously or intramuscularly must have a pH of 7.3 to 7.45 and be isotonic (same tonicity as blood; 280–310 mosm/L). Non-isotonic solutions must be injected slowly if the intravenous routes are used.
  - 4.3.2 For larger volumes (>250 ml) warm the solutions in a water bath immediately prior to administration until temperature reaches body temperature ( 37.5C–38.5C°).

- 4.3.3 Verify the solubility of the substance. Precipitation may cause the formation of large particles which, if injected intramuscularly, can be painful. For intravenous injections, solutions, not suspensions, must be administered. Consult with the Herd Manager or Herd Veterinarian if in doubt.
- 4.3.4 Inject different substances at different sites, at least 10 cm apart, to avoid cross-reaction of chemicals.
- 4.3.5 Use the smallest possible gauge of needle.
- 4.3.6 Substances to be injected must be sterile as contamination can lead to infection or irritation of the injection site. Sterilize solutions by autoclaving or microfiltration and use aseptic technique for injection. (Wipe the bottle top and site of injection with alcohol)

4.4 Needles:

- 4.4.1 Do not reuse needles. Use a new, sterile needle for every animal.
- 4.4.2 Use only needles with aluminum hubs because they are less likely to break during injections.
- 4.4.3 Select the needle gauge depending on the viscosity of the substance. The thicker the substance, the smaller the gauge (e.g., a thick drug will require a 16 gauge needle while a less viscous drug will require a 20 gauge needle). Use the smallest gauge needle possible that allows accurate injection of the substance.
- 4.4.4 Recommended needle size (Gauge /length)

	INTRADERMAL	SUBCUTANEOUS	INTRAMUSCULAR	INTRAVENOUS	EPIDURAL
Calf (<500 lbs)	NA	1" length 20, 18 G	1" length 20, 18 G	Performed ONLY under the supervision of a veterinarian	Performed ONLY by Veterinarian
Heifer	NA	1" length 20, 18, 16 G	1½" length 20,18, 16 G	14, 16 x 1-1,5"	Performed by a veterinarian or trained and qualified personnel
Cow	NA	1" length 20, 18, 16, 14 G	1½" length 20,18, 16 G	16,14G x 1½-2"	

4.5 Volumes:

4.5.1 Maximum volumes for substance administration:

	ORAL	SUBCUTANEOUS (volume/ site)	INTRAMUSCULAR (volume/site)	INTRAVENOUS BOLUS
Calf	4L for a 100lbs calf	10ml	5 ml	1 ml/kg
Heifer	20L for a 400kg heifer	20ml	10 ml	1 ml/kg
Cow	40L for an adult cow (700kg).	50ml (Except Cal-Boro 23%- max 250ml)	Neck : 15-20 cc/site Semi-membranous : 15-20 cc/site Rump : 10 ml	1 ml/kg

\*\* refer to [SOP DC-308](#) for dehorning volumes

- 4.6 If the volume administered must exceed the recommended volumes listed in section 4.5.1, justification must be provided and will require approval by the FACC, unless under the direction of the veterinarian. Injections:
  - 4.6.1 Use the subcutaneous route of injection whenever that option is available to reduce the risk of injection site lesions.
  - 4.6.2 Adequate restraint of cattle prior to injection is necessary to decrease the risk of injury to both the animal and humans.
  - 4.6.3 Expel air bubbles from the syringe before injection.

- 4.6.4 The injection site must be free of manure and dust.
- 4.6.5 Do not inject into inflamed or damaged tissue (including abscesses).
- 4.6.6 Vary the injection sites if multiple injections are required, placing the injection sites at least 4 inches apart.
- 4.6.7 Ensure the proper placement of the needle prior to injection. Withdraw the syringe plunger; if blood enters the needle hub, the needle has entered a blood vessel. Unless it is an IV injection, withdraw the needle slightly and redirect it.
- 4.6.8 No resistance should be encountered during injection. Do not apply overt pressure on the syringe plunger. The injected substance should flow freely to prevent any unnecessary pain and tissue damage.
- 4.6.9 Give injections at a constant flow rate.
- 4.6.10 If bleeding occurs after injection, apply pressure with gauze until bleeding stops.

4.7 Routes of substance administration:

ROUTE	Calf	Heifer	Cow
Subcutaneous	✓	✓	✓
Intramuscular: Neck	✓	✓	✓
Intramuscular: Thigh	NO	✓	✓
Intravenous	✓ (Only Veterinarian)	✓	✓
Oral (gavage)	✓	✓	✓
Epidural	✓ (Only Veterinarian)	✓	✓

- 4.8 Dispose needles in a “sharps” container.
- 4.9 Monitor animals for reactions after administering vaccines and antibiotics.

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**5. PROCEDURE**

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- 5.1 Before administering an injection, ensure the following.
  - 5.1.1 Consult a veterinarian about the proper use of medication.
  - 5.1.2 Read and follow the directions on the product label. If there is an option to choose between an intramuscular (IM) and subcutaneous (SC) injection route, always go for the SQ as it is less invasive.
  - 5.1.3 Select the correct needle size and gauge for the method of injection and for the viscosity of the product. (Refer to sections 4.4.4 and 4.5.2)
  - 5.1.4 Aim for a site that is free of dust and manure.
  - 5.1.5 Use a new sterile needle.
  - 5.1.6 Disinfect the site with clean gauze and alcohol.
- 5.2 Always discard used needles and syringes in a container designed for that use. Unplug trainers before treating animals tied in the dairy barn.
- 5.3 Calculate dosage and determine the route of injection per label or veterinarian’s instructions.
- 5.4 Select the correct needle size for the method of injection and animal size and the appropriate gauge for the viscosity of the product (refer to sections 4.4.4 and 4.5.2).

- 5.5 Draw the substance into a syringe and expel any air bubbles from the syringe and needle.
- 5.6 Restrain the animal properly.
- 5.7 DOCUMENTATION/ IDENTIFICATION:
  - 5.7.1 Log all treatments in the dairy treatment log.
  - 5.7.2 Any drugs with milk withdrawal must be entered in the green "Treated Cows" book.
  - 5.7.3 Lactating cows given drugs with a milk withdrawal:
    - 5.7.3.1 Identify with red leg band.
    - 5.7.3.2 Identify with antibiotic card hanging over name card.
    - 5.7.3.3 Update the Milker Action Sheet with the cow's name and number in the treated cows section.

**\*\* BROKEN NEEDLE:**

1. Contact the veterinarian to have the needle removed.
2. Mark the site of the needle location on the animal.
3. Record the ID of the animal carrying a broken needle.
4. Do not let an animal with a broken needle enter the food chain.

5.8 SUBCUTANEOUS (SC) INJECTIONS (Calves, Heifers and Cows) FIGURE 2: Subcutaneous injection site



FIGURE 1: Subcutaneous injection zone

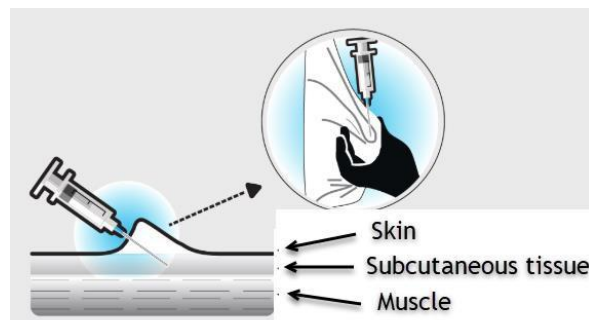


FIGURE 2: Subcutaneous injection site

5.8.1 Subcutaneous injections must be administered in a fold of the skin in front of the shoulder in order to minimize carcass damage.

5.8.2 Hold the syringe in your dominant hand.

5.8.3 Identify the injection triangle and dust off any dirt.

5.8.4 Using your alternate hand, pinch some of the animal's skin between your 2 forefingers and thumb.

5.8.5 Lift this piece of skin straight out and away from the neck to form a "tent."

5.8.6 Guide the 1" needle at 30-45 ° angle from the surface of the neck into the center of the tent.

5.8.7 Check the proper placement of the needle prior to injection by withdrawing the syringe plunger; if blood enters the needle

5.8.8 hub, the needle has entered a blood vessel. Withdraw the needle slightly and redirect it.



FIGURE 3: Tenting for subcutaneous injection

5.8.9 Release the skin.

5.8.10 Depress the syringe plunger slowly and steadily, if resistance is felt, withdraw the needle slightly and redirect it into the subcutaneous space. Repeat until the plunger can be depressed with no resistance.

5.8.11 Once complete, withdraw the needle.

5.8.12 Press and rub the injection site for a few seconds to avoid leakage of the injection fluid.

## 5.9 SUBCUTANEOUS (SC) INFUSION

5.9.1 Subcutaneous injections can be administered behind the shoulder when large volumes of fluid (maximum 250 ml per side) need to be administered (ex. Calcium borogluconate). (Figure 1).

5.9.2 warm the solutions in a water bath) immediately prior to administration until temperature reaches body temperature ( 37.5C-38.5°C).

5.9.3 Connect the IV tubing to the bottle and allow fluid to run through IV tube before attaching it to the needle.

5.9.4 Uncap the needle and insert the needle subcutaneously as described in 5.8.1 to 5.8.8.

5.9.5 Unclamp the IV line.

5.9.6 Elevate the bag/ bottle to allow the substance to flow.

5.9.7 Massage the skin as fluid is being administered to diminish the appearance of lump.

5.9.8 It can take up to 4-6 hours for fluids to completely absorb.

5.9.9 Once complete, withdraw the needle.

5.9.10 Press and rub the injection site for a few seconds to avoid leakage of the injection fluid.

## 5.10 INTRAMUSCULAR INJECTIONS (IM)

**If there is an option to choose between an intramuscular (IM) and subcutaneous (SQ) injection route, always go for the SQ as it is less invasive.**

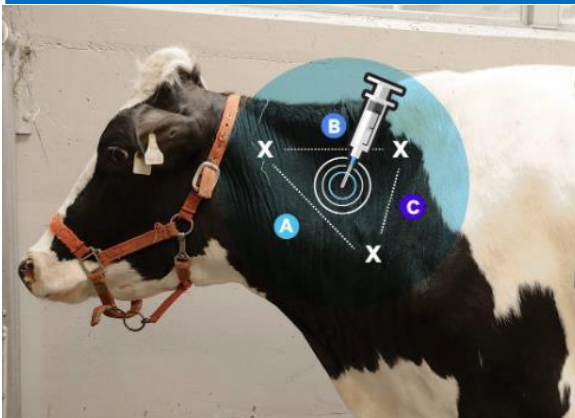


FIGURE 4: Intramuscular injection zone: NECK

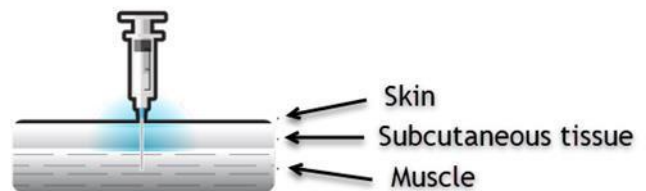


FIGURE 5: Intramuscular injection site

5.10.1 All intramuscular injections must be administered in the neck muscle. It may be impossible to inject an animal in the neck under the following circumstances: In such cases, alternate sites are recommended (See 5.10.8)

5.10.1.1 The animal cannot be properly restrained.

5.10.1.2 The safety of the person attempting to administer the injection will be compromised.

5.10.2 The required site for injection is a site called the "injection triangle." This triangular area is located on either side of the cow's neck and contains a few vital structures (like blood vessels and nerves). The injection

triangle is broadest at the shoulder and tapers up towards the ear (Figure 4). The landmarks for finding the triangle are:

- 5.10.2.1 The upper boundary is located below the spinal column following the line of the neck crest. (“A” illustrated in Figure 4)
- 5.10.2.2 The lower or angular boundary runs along and above the jugular furrow, which is in the middle of the neck. (“B” illustrated in Figure 4)
- 5.10.2.3 The posterior boundary (the one closest to the rear of the animal) follows the line above the point of the shoulder, which angles up towards the top line or top of the shoulder. (“C” illustrated in Figure 4)

5.10.3 Hold the needle in a tight grip between your first and middle finger, the needle facing outwards.

5.10.4 Push your thumb under the bottom of the needle for support and close your hand into a fist.

5.10.5 With the side of your palm, give two warning taps on the site of injection (this tends to desensitize the area slightly) and on the 3rd tap, swiftly push the needle through the skin in the area shown above.

5.10.6 It is normal for the site to bleed a little, but if there is excessive blood DO NOT ADMINISTER THE INJECTION. Remove the needle slowly and try the other side of the cow.

5.10.7 Once the needle is in, attach the syringe and inject the fluid at a constant rate while rubbing around the area.

5.10.8 Alternate I.M. injection sites:

5.10.8.1 Semitendinosus / Semimembranosus (The muscle area behind the thigh, (Fig. 6))

5.10.8.1.1 Inject a small volume per site: no more than 10 to 15 ml (follow label directions).

5.10.8.1.2 Repeated injections in this area may cause inflammation and pain.

5.10.8.2 The Rump (ONLY AS A LAST RESORT)

In the area delineated by the sacrum (A), the wing of the ilium (B) and the ischium (C) (Fig. 7).



FIGURE 6: Intramuscular injection zone: THIGH

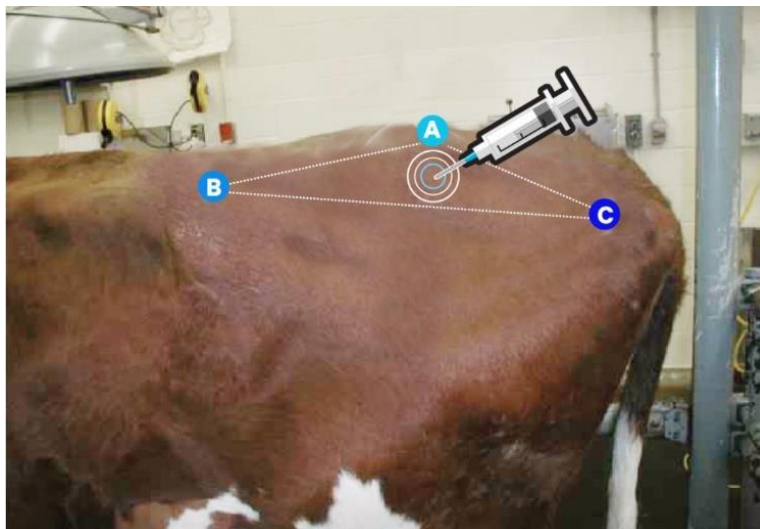


FIGURE 7: Intramuscular Injection zone: RUMP

## 5.11 INTRAVENOUS (IV) INJECTIONS:

5.11.1 The veterinarian will administer IV injections for calves.

5.11.2 Restrain the animal with a halter. If cow is unable to stand, tie the halter to her hind leg, just above the hock.

5.11.3 For larger volumes (>250 ml) warm the solutions to in a water bath immediately prior to administration until temperature reaches body temperature ( 37.5C-38.5°C). Attach IV tube to bottle or bag.

5.11.4

5.11.5 Raise the vein by pressing in the jugular groove with your thumb.

5.11.6 Insert the needle at 30-45° angle to the skin and wait for drips of blood from the needle hub before attaching the IV tube. If there is a fast stream of bright red blood the needle may be in the carotid artery.

5.11.7 Ensure the fluid is flowing through the IV tube before attaching it to the needle. This confirms the needle is in the jugular vein.

5.11.8 Regulate the flow to a slow steady rate using the Flow Control Clamp or pinch the tube.

5.11.9 On completion of injection, remove the needle and apply digital pressure to the site to ensure hemostasis.



FIGURE 8: Intravenous injection zone

## 5.12 CAUDAL EPIDURAL INJECTION:

This method is commonly used for the administration of anesthesia to desensitize caudal sacral nerves within the spinal canal. The motor functions of the hind limbs are not affected. Areas that are desensitized by low volume epidural are the tail, vagina, vulva, anus, rectum, caudal prepuce, scrotum, and urethra. This technique is commonly used to prevent or control tenesmus and contractions during repair of a prolapsed rectum or vulva, repositioning of a prolapsed uterus, and dystocia.

5.12.1.1 The most common sites of administration are the First coccygeal intervertebral space (Co1-Co2)

5.12.1.2 Sacrococcygeal intervertebral space (S5-Co1)

5.12.2 Place animal in a standing position.

5.12.3 Move the tail up and down in a pumping motion to locate the joint.

5.12.4 The first proximal moving space is the preferred location for injection.

5.12.5 Clip the site in the dorsal midline and aseptically prepare with alcohol.

5.12.6 Penetrate the intervertebral space using an 18G x1''' needle.



FIGURE 9: Caudal epidural injection

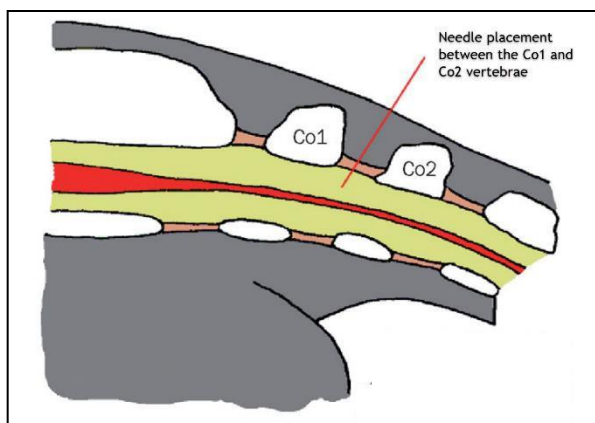
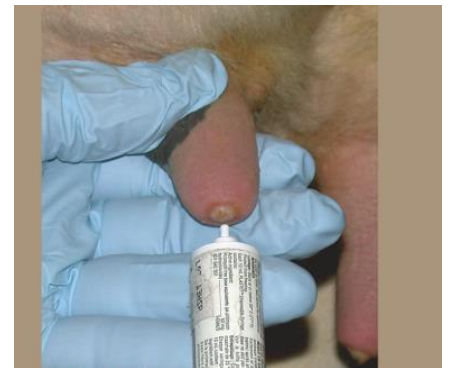


FIGURE 10: Needle placement between the Co1 and

- 5.12.7 Direct the needle in a slightly cranial direction (approximately 10 degrees) and advance slowly. (see Fig.10)
- 5.12.8 Push the needle ventrally through the interarcuate ligament to the floor of the neural canal, which is at approximately 2 to 4 cm; withdraw the needle slightly (about 0.5 cm) into epidural space and test by injecting 1 mL of air; no resistance should be felt.
- 5.12.9 A lack of resistance or popping sensation usually indicates that the epidural space has been entered.
- 5.12.10 Check the correct placement of the needle using the hanging drop technique:
  - 5.12.10.1 Place a few drops of sterile water or lidocaine into the needle hub during insertion.
  - 5.12.10.2 When the needle enters the correct space, the drop of saline or lidocaine is observed to be aspirated under the effect of the negative pressure in the epidural space.
- 5.12.11 Check proper placement of the needle prior to injection by withdrawing the syringe plunger; if blood or spinal fluid enters the needle hub, withdraw the needle slightly and redirect it.

### 5.13 INTRAMAMMARY INFUSION

- 5.13.1 Use products only approved for intramammary infusion.
- 5.13.2 Make sure the environment is clean and restrain the cow as needed.
- 5.13.3 Prepare all necessary Materials.
- 5.13.4 Practice aseptic technique to avoid introducing pathogens into the teats and prevent damaging the interior of the teat canal.
- 5.13.5 Don clean disposable gloves.
- 5.13.6 Milk out the quarters completely.
- 5.13.7 Disinfect the end of the teat with clean alcohol swab, starting with the furthest teats and finishing with the nearest to avoid contaminating it with your sleeve. Repeat as needed until the swab remains clean.
  - 5.13.7.1 When treating for mastitis; Perform a California Mastitis Test ([SOP DC-617 California Mastitis Test \(CMT\)](#))
  - 5.13.7.2 Obtain Milk sample ([SOP DC-615 Milk Sampling](#))
  - 5.13.7.3 Culture the milk ([SOP DC-616 Milk Culturing](#))
  - 5.13.7.4 Mastitis treatment ([SOP DC-306 Mastitis Treatment](#))
- 5.13.8 For Dry treating cows: See [SOP DC-614 Dry Treating Cows](#)
- 5.13.9 Make sure not to touch anything with the cannula prior to insertion. Use the insertion tip supplied with a partial insertion cannula to avoid damaging the teat canal keratin.
- 5.13.10 Start the treatment with the nearest teat.
- 5.13.11 Gently infuse the antibiotic preparation in the quarter. Make sure to empty the tube completely and massage the base of the quarter to ensure penetration of the antibiotic preparation.
- 5.13.12 Apply teat dip, ensuring complete coverage (Not applicable to dry treating cows).



**FIGURE 11:** Intramammary Infusion



## NOTE:

Partial insertion of a long cannula avoids pushing in bits of bacteria contaminated keratin into the teat cistern. It also avoids dilating the sphincter muscle.

TIP: When using a long cannula, pinch it with your fingers 3 mm from the tip before insertion.

### 5.14 CORNUAL NERVE BLOCK:

- 5.14.1 Insert needle subcutaneously below bony ridge approximately halfway between the base of the ear and corner of the eye.
- 5.14.2 No resistance should be encountered during injection. Do not apply overt pressure on the syringe plunger. The injected substance should flow freely to prevent any unnecessary pain and tissue damage.
- 5.14.3 Look for drooping eyelids (ptosis) after injection as an indicator of a successful block – the nerve used to move the upper eyelid is in the same space as the corneal nerve.

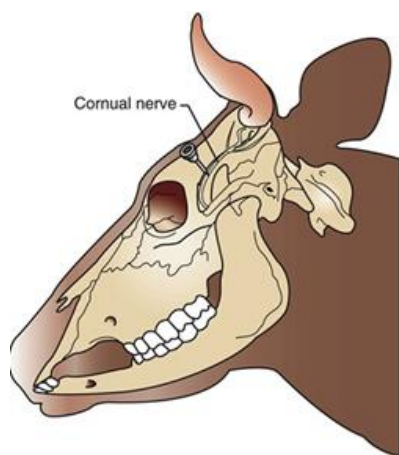


FIGURE 12: Corneal Nerve Injection

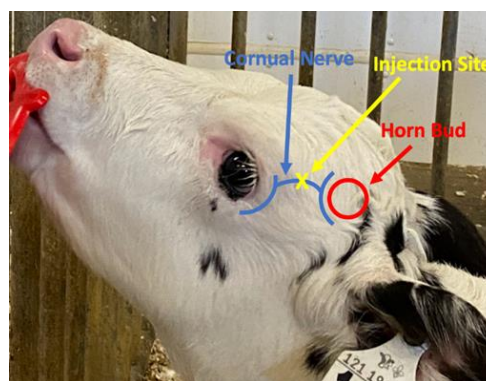


FIGURE 13: Corneal Nerve Injection

### 5.15 ORAL ADMINISTRATION: BOLUS (Pilling)

- 5.15.1 Properly restrain the animal.
- 5.15.2 Load the treatment bolus into the bolus gun or applicator.
- 5.15.3 Place the cow's head under the neck rail. Elevate the head.
- 5.15.4 Open the animal's mouth by placing several fingers in the interdental space (between the lower jaw front teeth and the upper jaw back teeth). Rubbing the roof of her mouth will make her relax and open it making it much easier and safer to get the bolus gun in. Insert the bolus gun through the side of the cow's mouth and advance past the base of the tongue. Note: It's normal for the animal to chew on the balling gun as she swallows it.
- 5.15.5 Allow the animal to swallow.
- 5.15.6 Slowly let the end of the gun work its way down while applying pressure. (Do not force it down you will damage the esophagus). Once the handle reaches the corner of the mouth, press the plunger to deliver the bolus to the back of the throat and swallowed.
- 5.15.7 Gently remove the balling gun and wash it.

### 5.16 ORAL ADMINISTRATION: DRENCHING

- 5.16.1 For calves, refer to [SOP DC-506: Tube Feeding a Calf](#).

- 5.16.2 Restrain the recipient cow with a halter and tie her head up under the neck rail or above the side of the box stall to reduce her ability to swing her head. If a cow is very weak, and cannot stand, ask a second person to hold her head.
- 5.16.3 Place the stomach tube into the cow's mouth and then gently advance down the esophagus into the rumen.
  - 5.16.3.1 Once the stomach tube has advanced most of the way down the esophagus it meets resistance at the point where it enters the rumen.
  - 5.16.3.2 Slightly rotate the tube while advancing it to help pass it all the way into the rumen.
- 5.16.4 Hold the probe in place while a second person pumps the fluid.
- 5.16.5 Slowly pump the drench/ fluids into the cow. Note: Pumping too fast causes reflux into the esophagus and throat.
- 5.16.6 The cow should be chewing on the handle of the probe/tube.
- 5.16.7 Kink the hose before slowly removing the probe.
- 5.16.8 Untie the halter.
- 5.16.9 Rinse the exterior and interior of the hose by pumping hot water through it.

**SUBSTANCE ADMINISTRATION FOR DAIRY CATTLE****6. REFERENCES**

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**Document Status and Revision History**

DATE (yy-mm-dd)	NEW VERSION
13-Sept-2020	Version 01: MacDonald Campus FACC approved
15-Sept-2023	Version 02: MacDonald Campus FACC approved