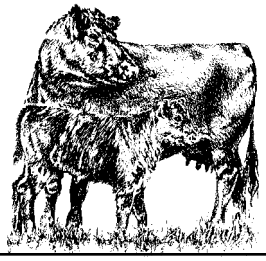

Western Beef Resource Committee *Fourth Edition*

Cattle Producer's Handbook

Animal Health Section 614

Handling Vaccines

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University studies in Arkansas, Nevada, and Idaho have indicated that veterinary vaccine product efficacy is at risk due to improper handling and storage. Most animal vaccines require maintenance at refrigeration temperatures of 35°F to 45°F. These studies have shown that refrigerators often fail to maintain consistent temperatures adequate for vaccine storage. The studies identified a lack of awareness and the need for training producers, distributors, and retailers when transporting, handling, and storing vaccines.

University of Arkansas research found that cattle producers are careful to store animal health products under refrigerated conditions (Troxel and Barham 2009). However, this research found a large variation in proper setting, maintenance, and function of refrigerators. In fact, 76 percent of tested refrigerators in this study were deemed unacceptable for storing animal health products.

Similar research at the University of Nevada found 25 percent of tested refrigerators failed to maintain proper storage temperatures and 80 percent of those actually froze the vaccine (Torell 2006). Monitoring and management of refrigerators and animal health products were the major recommendations from these studies.

University of Idaho research conducted in 2010 found that 67 percent of tested producer refrigerators and 66 percent of tested retailer refrigerators were unacceptable for storing vaccines (Fife et al. 2012). Temperature adjustment, monitoring, and improved record-keeping practices were some of the recommendations for producers. Monitoring and improved employee training at the retail level were also suggested.

Vaccines in Brief

Infectious disease in beef cattle can cause a significant loss of production and profit to producers. One way to reduce these losses is to increase the animal's ability to fight disease through good vaccination practices. Vaccines stimulate the body's immune system to build immunity or resistance against disease-causing organisms.

Most vaccines are manufactured by growing a particular organism that is later weakened or killed. When a vaccine is introduced to the body, the immune system must first recognize it as a foreign antigen or protein, such as a virus, bacteria, toxin, or parasite. An immune response is then produced to fight the antigen by developing specific antibodies and immune cells to remove or kill the infectious agent. Memory cells are then developed for each antigen.

When the body is later re-exposed to the same antigen, memory cells will recognize the infectious agent and remember the most effective way to protect the body. With any inoculation, it generally takes 7 to 14 days for the body to develop immunity to an antigen on primary exposure and as little as 48 hours to respond in a vaccinated animal.

It is important to understand that some animals' immune systems fail to develop an immune response sufficient to create immunity to a disease. Factors contributing to this failure are inadequate nutrition, poor health, stress, and environmental conditions. Healthy animals on a sound nutrition program should develop the best immune response. *However, remember that vaccinating your animals is not a 100 percent guarantee all vaccinated animals will gain immunity to that particular pathogen. The degree of protection is dependent upon animal health and vaccine efficacy at the time of administration.*

Two common types of vaccine are killed and modified-live. Killed vaccines are made by growing an organism in a growth medium. The organism is then inactivated or killed utilizing chemicals or heat. A killed vaccine can be produced for viruses, bacteria, or toxins. Adjuvants, which are specific chemical materials that help stimulate immunity and hold the organism at the injection site to strengthen the immune response, are regularly added to killed or inactivated vaccines.

Killed vaccines often require two separate inoculations over 2 to 4 weeks to obtain a full immune response. Therefore, it is important to administer both inoculations of a killed vaccine. An example of a killed vaccine is Triangle 5® by Boehringer Ingelheim. Triangle 5® protects against infectious bovine rhinotracheitis (IBR), bovine virus diarrhea (BVD types 1 and 2), parainfluenza 3 (PI_3), and bovine respiratory syncytial (BRSV) viruses. These vaccines are already constituted and ready to use when purchased.

Modified-live vaccines (MLV) are made with a virus or bacteria that is attenuated, or weakened, so the organism will not cause disease in most healthy animals but will still stimulate immunity. These types of vaccine are not stable in solution so the isolates are freeze-dried to a cake in a vaccine bottle. To use a MLV, a special sterile liquid or a specified killed liquid vaccine is added to the "cake" to make a vaccine solution ready for injection.

Modified-live vaccines are unstable and have a short efficacy life once they are reconstituted, often as short as 1 to 2 hours. Therefore, only reconstitute MLVs as needed. These vaccines should be mixed gently when reconstituted. Discard any MLV that is not used within 2 hours. An example of a MLV is Vista Once SQ® by Merck. Vista Once SQ® protects against IBR, BVD type 2, PI_3, BRSV, bovine virus diarrhea virus (BVDV) type 1, *Mannheimia haemolytica*, and *Pasteurella multocida*.

Why Worry?

Improper handling and storage procedures, including exposure to ultraviolet light from the sun, temperature extremes, and improper injection techniques, can render vaccine less efficacious or even useless. Livestock do not gain immunity from vaccines that are damaged, destroyed, or altered through improper handling and storage practices. Furthermore, vaccines can be costly and average anywhere from 25¢/head to $3.50/head depending upon the vaccine used. This represents wasted money if vaccines have been rendered useless by poor handling or storage practices.

Refrigerator Monitoring

Refrigerator temperatures should be monitored through the use of minimum/maximum thermometers (Fig. 1). Monitoring refrigerator temperature on a daily or even weekly basis will help you determine if the refrigerator is functioning properly. Temperatures should be monitored and recorded at least weekly.

When monitoring refrigerators, also consider the age, type, and location (barn, porch, or other storage areas) of the refrigerator. Refrigerator location can have a substantial impact on how efficient the refrigerator operates. For example, a refrigerator kept in a non-insulated barn may be adversely affected by high and low ambient temperature extremes. These temperature extremes can damage products stored inside the refrigerator.

Fig. 1. Minimum/maximum thermometer (photo by Scott Jensen).

Temperature Effects on Vaccine

Most animal health products require refrigeration at 35°F to 45°F. Storing animal health products at temperatures below 35°F is the most damaging to killed vaccine products. Freezing temperatures will change the adjuvant structure (Figs. 2 and 3). This change affects vaccine efficacy by altering the immune response to the antigen. Refrigerators that freeze vaccine are the worst! Frozen killed vaccines may have deadly consequences due to the release of bound toxins from the adjuvant. *Take precautions to avoid freezing your vaccines and do NOT use vaccines that are or have been frozen.*

For MLVs, temperatures below 35°F or above 45°F do not necessarily destroy the active ingredient. In the freeze-dried state (cake), these vaccines are remarkably stable. However, over time, repeated cycles above

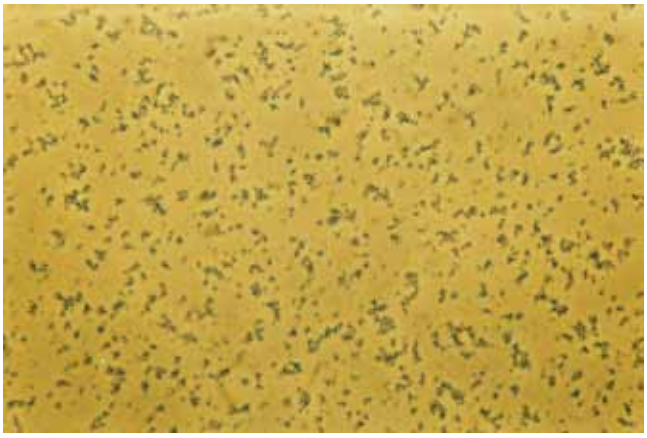

Fig. 2. Fine-grained vaccine structure when stored at appropriate temperature. (Source: Used with permission, World Health Organization, #73898.)

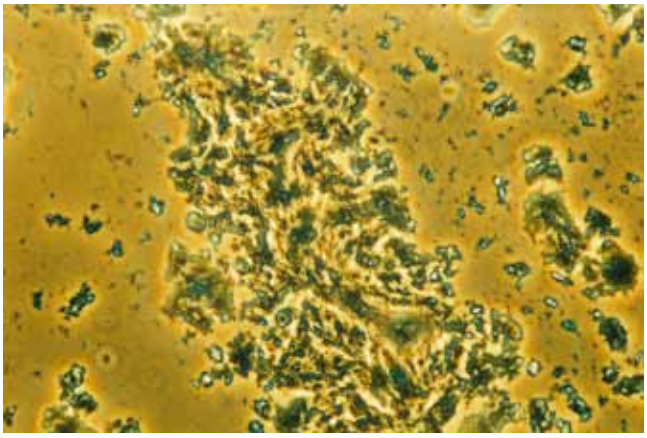

Fig. 3. Crystalline vaccine structure after being frozen. (Source: Used with permission, World Health Organization, #73898.)

or below the recommended holding temperatures will inactivate MLVs. High ambient temperatures (>75°F) will reduce the efficacy of MLVs even in the dried state.

Once modified live vaccines are activated (made into a solution through the addition of the appropriate liquid), they need to be used within 2 hours and kept cool between temperatures of 35°F to 45°F. To accomplish this practice, keep vaccine in a cooler next to the chute and out of direct sunlight to prevent premature warming and to avoid UV damage while vaccinating animals.

Other Considerations

Other vaccine handling considerations include transportation from retailer to ranch, storage location within the refrigerator, ultraviolet radiation (sunlight) exposure, record keeping practices, and product expiration dates. *Do NOT use expired vaccines.* Federal code states that biological products shall be considered worthless after the expiration date has passed.

Vaccine Disposal

Proper disposal of animal health products at the farm and ranch level is as important as proper use. Environmental contamination, particularly in water with hazardous or potentially hazardous biological wastes, is one of the top 30 environmental public concerns.

As of 2012, federal and state laws do not specify how animal vaccine should be disposed of. Animal vaccine may be discarded in household trash receptacles. Additionally, animal vaccines containing live attenuated virus may enter a municipal solid waste landfill without being autoclaved or otherwise treated to inactivate the virus. Some landfills may have special treatment requirements and policies for discarded live and attenuated animal vaccines. It is recommended that you contact your local government and landfill to find out possible requirements for accepting animal vaccine. Always read the label or package insert and follow any disposal instructions that are provided.

Best Management Practices for Purchasing Vaccine

- Consult your local veterinarian before purchasing vaccine to determine what vaccinations are necessary for your operation and area.
- Only purchase vaccines you can use in a timely manner.
- Check expiration dates when you purchase and/or receive vaccine.
- If you order vaccine by mail, order on Mondays to prevent weekend delays at unknown storage temperatures and to ensure it does not sit in a warehouse or on a truck over the weekend. Vaccines handled and stored by shipping personnel may not be maintained at adequate temperatures, reducing vaccine efficacy.
- Check cooler as soon as it arrives and refrigerate vaccine immediately.
- If you have any concerns regarding vaccine handling before and during shipping, contact your distributor immediately.
- If you purchase vaccine locally, take or request MULTIPLE ice packs.
- Ask the retailer the following questions:
  - Is there a thermometer in the vaccine refrigerator?
  - Are minimum and maximum temperatures monitored and recorded on a regular basis?
  - Is the temperature maintained within the recommended range?
  - Did you immediately check and store the vaccine when it arrived?
  - How do you handle the vaccine after you receive it?

Best Management Practices for Storing Vaccine

- Read and follow label instructions.
- Use a minimum/maximum temperature thermometer.
- Check and log temperatures at least weekly.
- Discard any vaccine that freezes.
- Check expiration dates and discard if expired.
- Store vaccine closest to its expiration date near the front in the refrigerator to be used first.
- Do not overstock vaccine because it was a "good deal" if you cannot use it by the expiration date.
- Train employees, family members, and others on proper vaccine handling.

Best Management Practices for Chute-Side Coolers

- Pre-cool the cooler for at least 1 hour before placing vaccine inside.
- Use enough ice or cold packs to maintain a steady temperature of 35°F to 45°F.
- Take enough vaccine for the morning or afternoon, not both.
- Keep cooler out of the sunlight.
- Identify any unopened bottles of vaccine left over to use first next time.

Vaccine Handling Procedures

- Read and follow all label directions before using animal health products.
- All vaccines should be refrigerated at 35°F to 45°F unless otherwise specified on the label.
- Purchase some of each vaccine in small-dose vials to minimize waste.
- Mix vaccine gently and thoroughly before filling vaccine guns or syringes. Remember that excessive agitation can negatively impact vaccine efficacy.
- Dispose of all expired and unused animal health products according to the label.
- Do not mix products or combine different vaccine products in the same bottle, syringe, or animal injection site.

- Do not use the same vaccine gun for different vaccines.
- Keep vaccine cool in a dark environment and out of sunlight when storing and using.
- Do not mix modified live vaccines if they cannot be used 1 to 2 hours after being reconstituted.
- Use transfer needles for mixing modified live vaccine to prevent contamination and accidents.
- Discard bottles of killed vaccine that have been opened for more than 2 days because vaccines can be contaminated by repeated introduction of air and needles during use.

Vaccine Injection Techniques

- Follow your State Beef Quality Assurance Guidelines.
- Read and follow all label instructions.
- Injections should be given in front of the shoulder in the middle neck region.
- Avoid giving injections in the nuchal ligament of the neck region.
- As indicated by state Beef Quality Assurance Guidelines, injections should be given subcutaneously unless otherwise specified on the label.
- Remove air from syringes and/or guns before injecting vaccine.
- Use the correct gauge and length of needle as specified by the label.
- Change needles every time you fill a syringe or vaccine gun.
- Change needles that become burred, bent, or broken.
- Never straighten and re-use a broken needle.
- For multiple injections, space 4 inches apart on the animal to avoid mixing different products.
- Most vaccines have 21-day withdrawal periods; those with oil-based adjuvants generally have 60-day withdrawal periods. Always read the label to determine withdrawal times and follow them appropriately.
- A common problem is contamination from repeated entry into bottles with used needles. Use a new needle each time syringes are filled.

General Recommendations for all Injectable Drugs

- Read and follow label instructions.
- Practice good sanitation of equipment and working environment.
- Clean syringes with hot water only and dry completely.
- Never use soap or disinfectant to clean internal parts of syringes and vaccine guns. They will leave a residue that can affect vaccine efficacy.
- Use a minimum/maximum refrigerator thermometer.
- Record product lot numbers of animal health products, administration dates, and withdrawal times.
- Maintain vaccination records for a minimum of 3 years.
- Have all members of your operation complete Beef Quality Assurance (BQA) certification and routinely follow its guidelines.

Conclusion

Remember, no vaccine is 100 percent effective and poor handling exacerbates the problem! Vaccine failure is generally due to improper handling and storage techniques, failure to follow label instructions, poor herd health status, and stress. Following these recommended guidelines can help you improve vaccine efficacy and the level of disease immunity in your herd.

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Disclaimer

ALWAYS read and follow the instructions printed on the animal health product label. The recommendations in this publication do not substitute for instructions on the label. Use animal health products with care in conjunction with a licensed veterinarian consultation.

Trade Names: To simplify information, trade names have been used. No endorsement of named products is intended nor is criticism implied of similar products not mentioned.

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