Use, Handling and Care of Vaccines

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Many livestock producers use vaccines at one time or another in the day-to-day operation of their farms. The goal of vaccinations is to produce a strong immune response with resulting protection against the disease agent. If these products are not properly handled, little or no immunity will result. In addition to being costly, the false sense of security gained by the producer could result in severe losses before the actual cause of the disease is discovered.

Vaccines are used to produce immunity to livestock diseases. The produced immunity will vary in its protective ability due to the type of vaccine used, organism targeted for protection (bacteria or virus), and the degree of challenge the animal receives from the virulent (infecting) organism. Stress and environmental conditions, as well as handling of the vaccine and equipment used for the process will affect the production and duration of immunity.

Types of Immunity

Passive immunity

This is a short-lived immunity. It will last from two weeks to seven months. In farm animals, it is usually derived from the transfer of antibodies in colostrum to the newborn within the first 24 hours of life. The longevity of this immunity depends on the amount of antibody passed, the type of antibody and the specific disease. Passive immunity can also be transferred by blood transfusions or use of specific antisera or antitoxins. These are products designed to produce a short-lived passive immunity. They are produced by exposing an animal to massive doses of vaccine or live disease organisms. The cell-free portion of the blood from these animals is used to produce the antisera or antitoxins..

Examples of products that induce short term, immediate passive immunity include:

1. Plasma transfusions
2. Colostrum replacement products (only when given in the first 12 hours to 24 hours of calf's life and does not include colostrum supplements)
3. Clostridium perfringens type C and D antitoxin
4. Tetanus antitoxin

Active immunity

This is a longer-lived immunity, usually lasting from six months to one year or longer. In some instances, active immunity will last a lifetime. This type of immunity is developed in animals that have been infected with and recovered from a disease or from inoculating them with a vaccine derived from the disease organism. These vaccines produce an immune response without the symptoms or problems associated with the disease. Immunity or protection after vaccination may take seven days to 10 days to develop.

Biological products or vaccines are produced in several different forms for several specific types of immunity responses. Definitions explain these differences are:

1. **Vaccine.** Any biological agent used to produce an activity immunity.
2. **Bacterins.** Suspension of killed or inactivated disease organisms. They will not cause the disease, but initiate an immune response. An example of a bacterin is blackleg bacterin.
3. **Toxoids.** Inactivated toxins or poisons or disease organisms. They will not cause the disease, but produce immunity to the disease. The inactivated bacterial poisons are no longer capable of harming the animal, but prevent the establishment of the living organism. Examples of toxoid products include Tetanus toxoid and Clostridium perfringens type C and D.
4. **Live virus and bacterial suspensions.** Occasionally used to produce immunity, these are given in very small doses or at a time when the animal is not as susceptible to the disease. An example of a live bacterial suspension is Bang's Vaccine – RB 51. A live virus vaccine example is contagious ecthyma or sore mouth in sheep and goats.
5. **Modified live-virus vaccines.** These are prepared from live viruses modified by passage through an unnatural host until they no longer cause the disease, but still produce immunity. An example of a modified live virus is I.B.R. (Infectious Bovine Rhinotracheitis) vaccine.

6. **Inactivated viruses**. These vaccines are produced by killing the virus through various methods, rendering the virus incapable of causing the disease, yet still capable of producing protection. An example of an inactivated virus vaccine would be killed I.B.R. (Infectious Bovine Rhinotracheitis or red nose) vaccine.

Care and Handling of Vaccines

All animal biological products are produced under license from the USDA. All vaccines must be pure, effective and safe before permission is given to sell the product in interstate commerce. All government control is lost after the product leaves the manufacturing plant. It is important to know how these products are handled after leaving the plant until they are injected.

1. All biologicals should be shipped in a cool (packed with freezer packs) and well-insulated container. When the vaccines arrive, they should be cool. Store all vaccines immediately in the refrigerator. If the products arrive at room temperature or warmer, or if they are frozen, they may have lost efficacy. Return all warm/frozen products to the sender. Biological products should be stored at 35 F to 45 F, unless the nature of the product makes storing at a different temperature advisable (APHIS 2007). If vaccines are not stored within this temperature range, efficacy of the vaccine can and will be reduced. Killed vaccines are especially susceptible to freezing temperatures. Freezing a killed vaccine will alter the adjuvant or delivery system of a killed vaccine. This negatively affects the immune response to the antigen in the vaccine. Modified live viruses (MLV) are more stable, but can be inactivated if repeatedly cycled warmer than or cooler than the required temperature range (Gunn et al, 2013). Researchers from the University of Arkansas and Idaho analyzed the consistency of temperatures for different types, ages and locations of refrigerators through a 48-hour period. They found that only 26.7 percent and 34.0 percent of refrigerators were within the acceptable temperature limit 95 percent of the time, respectfully. Refrigerator location can also effect temperature. Refrigerators located in barns (35.6 F) were colder than in mud rooms (41.72 F) and kitchens (40.82 F). (Troxel and Barham 2009). Temperature within a 24-hour period can also be highly variable for individual refrigerators. Troxel and Barham (2009) demonstrated some refrigerators may take up to eight hours to cool down to the required 45 F or temperature can drop below freezing and range from 28.4 F to 44.6 F, while others will remain too cold varying from 24.8 F to 35.6 F during the same period of time.

   Producers need to be aware of these variations in temperature to adjust refrigerator temperature as needed. Thermostats can also be variable from unit to unit, so keeping a thermometer inside works well to monitor and to make adjustments as need. Simple indoor-outdoor thermometers work well to achieve this goal. The outdoor unit can be placed in the refrigerator while the LCD display can be hung with a magnet on the door. This allows temperature to be monitored without opening the door. Many models will record the high and the low temperature in a 24-hour period, so producers can adjust accordingly.
2. Lyophilized /freeze-dried products should not be mixed with the liquid portion until ready to be used. These products come in two containers, one containing a small dry powder or cake, and the other is a liquid. When mixing, the powder is contained in a vacuum, puncture the liquid portion with a transfer needle first then add liquid directly to powder. Do NOT shake vigorously; mix gently to avoid damage to biological. Do not mix more than what will be used in one hour or less. While in use, store these products at the 35 F to 45 F temperature range to maintain efficacy. Never keep mixed portions, even until the next day. All of these products lose their immunizing properties after a few hours of being mixed.
3. Always observe the expiration date printed on the bottle. Do not use if the product has expired.
4. Never allow biologicals to sit in the sun before or after mixing. Sunlight will heat and destroy the product. Maintain your biological products in a cooler chest with frozen ice packs. This will keep them cool as well as out of the direct sunlight. Coolers can easily be modified for syringes and are important to maintaining vaccine efficiency chute side. Using a 1 ½-foot PVC pipe or sink tail piece purchased at any hardware store and a 1 ½-foot hole saw, inserts can placed through the cooler and work well to keep syringes cool and out of light while in use. Either ice or freezer packs can be used as a coolant to maintain temperature for several hours, depending on outside ambient temperature. Make sure enough coolant is used to maintain temperature while working cattle. Extra ice may be needed if working cattle all day or during warm days. It may also take up to an hour for the cooler to reach the needed 45 F, so producers need to plan ahead prior to processing cattle.

5. Do not save parts of vials. If using a multiple-dose container, always use a sterile needle.
6. Never use syringes and needles that have been sterilized in chemical disinfectants. Several methods can be used to sterilize syringes and needles. Syringes and needles can be sterilized for vaccines by boiling in distilled water for 20 minutes. The Beef Quality Assurance recommendation is to boil distilled water and rinse syringes and needles four times to five times after cleaning the outside. Plastic syringes can be wrapped in damp paper towels and mi-

crowaved for four minutes to five minutes in a zipper-type plastic baggie. Once cooled, the dry towels and syringe is sealed and placed in a dust free environment such as a freezer or cabinet.

Disposable needles are just that--disposable. They will be blunted if you try to boil them. Chemical disinfectants will destroy modified live vaccine and live biologicals. Do not waste the effort of livestock handling and the cost of vaccine by trying to clean equipment in alcohol or some other chemical disinfectant. For more information on how to clean syringes see http://fyi.uwex.edu/wbic/2012/01/25/bqa-tip-how-to-clean-syringes/

7. Always burn or otherwise destroy vaccine bottles. It poses a hazard to people and animals to leave them lying around.
8. Please follow all withdrawal periods to avoid potential violative residues.
9. Be as clean as possible with the inoculation procedure. This does not mean efficiency need be sacrificed. Keep an adequate supply of clean, sterilized needles available and change when one becomes contaminated, dirty blunted or bent. It is a good idea to change needles about every 5 to 10 cows. More frequently changes may be warranted in anaplasmosis risk areas.
10. Always give biologicals according to the manufacturer's directions. The neck is the preferred site for both IM and SubQ injections. Needles are sold by gauge (diameter) and length.
    - IM / Intramuscular means in the muscle and should be given with a $1^{1}/_{2}$-inch long needle.
    - Sub Q / Subcutaneous means under the skin and 1/2-inch to 5/8-inch needles should be used. "Tenting" the skin will allow you to place the vaccine subcutaneously.
    - If the intranasal route is used, as is recommended for some products, remember to change cannulas often. For effective immunizing, a certain amount of vaccine must come in contact with the lining of the nose. Do not reduce the dose.

    Needles are classified by gauge (thickness). The larger the gauge number, the smaller the diameter of the needle. The larger gauge (29 gauge) are very small in diameter and used in human insulin therapy. In cattle, 16- or 18-gauge needles are typically used. These larger diameter needles do not bend as easily and last longer for both IM and Sub Q routes.

    If the manufacturer recommends the use of large quantities such as antiserum, use 1/2- to 5/8-inch needles and do not put more than 10 cc to 15 cc in each site. Do not increase or decrease the manufacturer's recommended dose.

    The dose of a vaccine is based on the number of immunizing units per cc, and this concentration may vary from one manufacturer to the next. Always read the instructions. The dose of vaccine is NOT dependent on animal size, as in the case with antibiotics.
11. Do not expect the vaccination to offer protection until 10 days after giving the vaccine. The exception is the intranasal route. This route will give a relatively short duration of protection within a few hours to a few days after administration.
12. Keep records of all vaccines given. Record vaccine vial serial numbers. Some vaccines have removable labels to retain serial numbers. These records can be vital ifyou an adverse vaccine event occurrs.

In conclusion, use extreme care in purchasing and caring for immunizing products. Do not use chemical disinfectants. Keep them cool, out of the sun and don't save parts of unused or mixed bottles. Do not mix products unless specifically recommended by the manufacturer. Do not use outdated material, and follow the manufacturer's recommendation on dosage and route of administration. Consult a local veterinarian for recommendations on specific vaccines. Above all, do not be in a hurry or be sloppy with procedures. Careful attention to handling and administration of vaccines can ensure a protective level of immune response.

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Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

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- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.
- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

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