



Vaccination Strategies to Maximize Preventive Health and to Minimize Adverse Effects on Market Quality

*New York State Cattle Health Assurance Program
Expansion Module*

The Role of Vaccination in Herd Health Programs

- ◆ Vaccine programs are useful tools in decreasing disease incidence and severity; however, no vaccine is 100% effective if used alone to control disease.
- ◆ Vaccines work best when used strategically with animal health management practices.
- ◆ Failures in vaccine programs occur largely because vaccines are not used according to label instructions for handling or because use was not timed for peak response before critical events..

Vaccination Strategies to Maximize Effectiveness of Vaccine Programs

- ◆ Vaccine programs will vary with farm specific issues such as the type of industry (dairy vs beef), type of management or husbandry (ie replacement rearing operation, dairy herd, open or closed structure, cow-calf vs feedlot), physical facilities, labor, and herd specific and geographical differences in disease issues.
- ◆ Recommendations regarding the type of vaccines and strategy best for each farm should be made by veterinarians working closely with each farm and designed to fit each farm's specific needs.

Steps in developing a vaccine strategy:

- ◆ What to vaccinate for - identify which infections pose a risk to your farm.
- ◆ Who and When to vaccinate - identify which groups are at risk of infection on the farm and the timing required to protect the group at risk.
 - New born calf – generally best protected by colostral immunity
 - Protecting animals from clinical disease – vaccinate as replacements as maternal antibody declines and prior to exposure; boost as recommended by manufacturer or based on duration of immunity in the literature.
 - Protect against subclinical infection causing reproductive or fetal losses – vaccinate prior to breeding.
- ◆ How often to vaccinate – depends on type of vaccine used and type of farm operation.

Vaccination program considerations: Factors affecting the Immune Response

Vaccination does not always lead to immunity and protection against infection. The following factors can affect how an animal responds to vaccination:

Age of calf - even though a calf's immune system begins to develop before birth, maximal responsiveness does not occur until 5-6 months of age. Most calf vaccination programs start at or after 4 months of age to take into account the calf's own ability to respond as well as waiting for a decline in colostral or passive immunity from the dam.

Presence of colostral immunity - maternal antibody from colostrum (passive immunity) protects calves against disease until they develop their own antibodies in response to vaccination or infection (active immunity). Colostral immunity also can potentially interfere with a calf's immune response to vaccination. Duration of colostral immunity varies with the immune status of the dam, the amount of colostrum ingested and longevity of the specific type of antibody. Passive immunity to some cattle viruses persists for up to 4 months but can be overwhelmed by challenge at earlier ages under certain conditions.

Stress including high environmental temperature, illness, transport, weaning, nutritional changes, handling, and commingling groups potentially reduce an animal's ability to respond adequately to vaccine. Vaccines should be administered at times of low stress and several weeks prior to expected changes in management that may increase stress or exposure to infectious agents. Good nutrition, both for protein and energy and for trace minerals and vitamins (such as Vit E and A, selenium, and copper), is required for an adequate immune response.

Timing of vaccination. Timing between vaccination and challenge with infectious agent is an important determinant of vaccine success. Ideally, for full effect, animals need time to develop peak antibodies before an expected challenge such as shipping and mixing groups. If a killed vaccine is used, this means giving

the first dose 6-8 weeks before and the second dose 2-4 weeks before shipping and mixing. Although the problem is rarely reported problem, it is generally recommended to separate recently vaccinated animals from separated from pregnant cows and heifers for ~ 2 weeks because of the potential for virus shedding after use of a modified live vaccine.

Selecting a Vaccine and Vaccine Handling to Maintain Maximum Effectiveness

Important differences in modified live and killed vaccines have an impact on how they should be handled in the field and also in selection for use of one type or the other in vaccine programs. The major differences are summarized in the table below.

Modified Live Vaccines	Killed Vaccines
<ul style="list-style-type: none"> ❖ Advantages <ul style="list-style-type: none"> - SINGLE DOSE CAN IMMUNIZE - Lower cost per dose - More natural and complete immune response; antibodies and cellular immunity stimulated with resulting longer duration of response. - Longer <i>in utero</i> protection ❖ <u>Disadvantages</u> <ul style="list-style-type: none"> - Require more careful handling - Easily inactivated by improper storage - Must be used within hours of reconstitution - Risk of introducing contaminants during mixing - Avoid exposure to disinfectants - Not recommended for all stages of gestation – ie potential to cause delayed estrus or abortions - Sensitive to antibody interference 	<ul style="list-style-type: none"> ❖ Advantages <ul style="list-style-type: none"> - No risk of reversion to virulent form - Less risk of viable microbial contamination - Greater stability - Less concern about stage of gestation at time of vaccination - Easier to incorporate new strains ❖ Disadvantages <ul style="list-style-type: none"> - MULTIPLE DOSES REQUIRED WITHIN SET TIME for immunization - More costly per dose - Cell-mediated immune response may be sub-optimum with shorter duration of immunity - Require adjuvants, which are additives needed to increase immune response to vaccine- these chemicals can also cause tissue damage and other side effects.

General Vaccination Recommendations:

- ◆ **Design heifer vaccination program** for protection during high risk periods: 3-6 months of age, prebreeding, and early pregnancy
 - ❑ If a MLV is used prior to 6 months of age, a second dose is recommended between 6-8 months of age to ensure protection of those calves not adequately responding to the initial dose due to persistent colostral immunity or illness at the time of initial vaccination.
 - ❑ When using inactivated or killed vaccines for the first time, *be sure to use a two dose series of vaccine according to label directions*. Single doses at 4-6 month intervals are recommended thereafter.
 - **Failure to use the second dose of killed vaccine within the recommended time frame is the single most common cause of vaccine failure when using killed vaccines.**
 - ❑ Current information would indicate that it is desirable to give at least one dose of modified live vaccine sometime prior to first breeding.

- ◆ **Design adult vaccination program** for protection during high risk or opportunity periods:
 - ❑ Early pregnancy - Current information would indicate that MLV given prior to breeding may impart some level of fetal protection against BVDV infection during gestation.
 - ❑ Late gestation (killed vaccine- to achieve high colostral antibody levels) to protect the neonate.

Typically Recommended Vaccines Used in Cattle Health Programs in Expanding Herds

Vaccine programs are farm specific. Contact your herd veterinarian for specific recommendations. The vaccines listed below are recommended for most herds considering expansion.

IBR/PI3 Infectious Bovine Rhinotracheitis and Parainfluenza III vaccination –

intranasal MLV used in calves less than 4-6 months of when colostral antibodies may be present. Intramuscular modified live vaccines are effective and inexpensive and require fewer doses than killed vaccines to induce immunity. For killed vaccines, a primary dose boosted with a second dose 2-4 weeks later day is required to induce immunity. After the primary series, animals are typically boosted at least once yearly.

BVDV	Bovine Virus Diarrhea Virus vaccination - MLV can be used in minimally stressed calves that are well separated from pregnant cows. A warning against exposure of pregnant cattle to this vaccine is present on the label. Killed vaccine requires 2 doses 2-4 weeks apart - a single dose does not provide protection. After the primary series, animals are typically boosted at least once to twice or more yearly.
BRSV	Bovine Respiratory Syncytial Virus vaccination - MLV or killed vaccines available. Two initial doses (2 weeks apart) are required for MLV and/or killed products to induce immunity.
Leptospirosis	typically available as a killed 5 –way vaccine; Two booster doses required timed before pregnancy; may require boosters up to 4 times per year
Clostridial	May be needed on some but not all farms. Injection site reactions are common. To decrease injection site abscesses, use vaccines labeled for subcutaneous use only, and use vaccines, which require lower volume or single doses for immunization.

Combinations of the above respiratory viruses are available in all modified live combination injections, mixed modified live and killed injections, and all killed. IM and subcutaneous vaccines are available. Some of the respiratory vaccines are routinely add Leptospira (5 way) and are starting to combine Pasteurella and Hemophilus, and clostridial vaccines in combination. Follow your herd veterinarian's recommendations and follow label instructions for use.

Evaluating a vaccine program:

- ◆ Monitor serological response: groups of 10 animals
- ◆ Prevacination titer compared to 2 wks post vaccination
- ◆ Monitor rates of illness in vaccinated groups

Failures of Vaccine Programs

- ◆ Vaccines are not 100% effective.
- ◆ Vaccines administered under conditions that do not allow for an optimal immune response:
- ◆ General Rules of Thumb
 - ❑ administer vaccines to produce peak response at least 2 weeks prior to anticipated exposure.
 - ❑ Avoid vaccinating ill or stressed animals
 - ❑ Animal factors that interfere with vaccine response:
 - Age
 - Antibody interference - Colostral immunity
 - Nutritional level
 - Concurrent disease – other infections may interfere with ability to mount a good immune response
 - Stress – poor nutrition, crowding, shipping, changes in groups and commingling with new animals, high environmental temperatures
 - Genetics – some animals respond better than others
 - ❑ Factors associated with the infection
 - New strain or variation in strain of infecting organism not covered by available vaccines.
 - Too little time between vaccination and exposure
 - Duration of vaccine induced immunity may be short relative to frequency of exposure
 - Overwhelming challenge
 - ❑ Factors related to the vaccine or vaccination process
 - Outdated vaccine – observe expiration dates on the label.
 - Improper mixing or storage especially important for Modified Live vaccines

- o **Refrigeration required for shipping and after reconstitution.** Organisms remain viable for a limited amount of time after the vaccine powder is reconstituted - sensitive to heat, light, and only effective if used within hours after reconstitution.
- o Use only diluent supplied by the manufacturer and in the correct quantity; never mix with other vaccines unless specifically recommended by the manufacturer
- o Can be killed by chemical disinfectants so **avoid contact with disinfectants** used to sterilize needles and syringes etc.
- Not vaccinating all at risk animals;
- Not following label recommendations regarding vaccine quantity and timing– the most common mistake in vaccine programs is not giving the required booster. When first administered – a killed vaccine requires a booster dose within 2-4 wks (follow label instructions) and 1-4 times annually after the primary series.

Beef Quality Assurance and Vaccine Injections

(for a complete discussion , please refer to the NYS Beef Quality Assurance Manual)

Injections can cause detectable lesions at slaughter and have an effect on beef tenderness up to a year after administration. Muscle tissues respond to injections with increased amounts of connective tissue and fatty deposits. Meat tenderness is affected at the core of the lesion and up to several inches from the center of the injection site. To enhance beef quality and to minimize injection site reactions, the following recommendations are suggested:

- ◆ **Use vaccines labeled for subcutaneous or under the skin use whenever possible.** The best sites for subcutaneous injections are on the neck in front of the shoulder or behind the shoulder.
- ◆ **Eliminate all intramuscular injections in the top butt and rounds** to protect these higher priced cuts. The preferred sites for intramuscular injection include the large muscle masses of the shoulder and neck. Highly irritating intramuscular injections should be avoided in the neck near the spinal column.
- ◆ **Inject in a clean site** - Avoid injecting vaccines when animals' coats are wet or muddy.
- ◆ **Single use needles are highly recommended** for to prevent spread of blood born infections such as bovine leukosis virus, and anaplasmosis in endemic areas.
 - While single use needles increase processing time and cost, they are recommended whenever possible. If multiple use needles are used, avoid overusing needles when injecting groups of animals or use of old needles. Needle points may develop burrs with multiple use which increase muscle damage. Needles should not be used more than 3 to 5 times if used for more than one animal because bacterial numbers increase rapidly with repeated use of needles.
- ◆ For subcutaneous use, a 16 or 18 gauge 3/4 or 1 inch needle is recommended. For intramuscular use, a 1 inch or 1 1/2 inch, 16 or 18 gauge needle is recommended.
- ◆ Use good sanitation techniques when withdrawing vaccines or medications from multidose bottles. Only withdraw vaccine from the source bottle with a sterile needle to avoid contaminating the remaining contents with dirt or manure.