

Practical Aspects of Broiler and Broiler Breeder Vaccination

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Introduction.

Live and inactivated vaccines are the most common types of vaccines currently used in poultry for the prevention of diseases. Live vaccines contain attenuated microorganisms which are able to produce a very mild form of the disease. Attenuation of live vaccines is mainly achieved by successive passages in different systems. Live viral vaccines are attenuated by successive passages in chicken embryos or in cell cultures. Bacterial vaccines are attenuated by successive passages in artificial growth media containing specific nutrients. Once attenuated, the microorganisms lose their pathogenicity (capacity to cause disease) while keeping their immunity. In inactivated vaccines, the antigens are replicated, inactivated with formalin or β -propiolactone and finally emulsified or added to aluminum hydroxide. Since no multiplication in the host is possible, inactivated vaccines must contain high bacterial or virus concentration to be able to stimulate an adequate humoral immune response. Some advantages and concerns related with the use of live or inactivated vaccines are summarized in following table:

		Type of Vaccine	
		Live	Inactivated
Advantages	<ul style="list-style-type: none"> • Ease of administration • Rapid onset of immunity • Broader cross-protection • Low cost 	<ul style="list-style-type: none"> • Very safe and stable (storage conditions) • Multiple antigens can be included • Slow antigen release <ul style="list-style-type: none"> ○ High, uniform and persistent antibody levels 	
Concerns	<ul style="list-style-type: none"> • Uniform application during massive vaccination • Vaccine reactions <ul style="list-style-type: none"> ○ i.e. rolling reactions • Stability of the attenuation <ul style="list-style-type: none"> ○ Increased pathogenicity after back passages 	<ul style="list-style-type: none"> • Local reactions in the site of inoculation • Low cross protection • False positive serology to <i>Mycoplasma</i> • Personnel self injection • Cost 	

Several routes are used for poultry vaccination. Live vaccines can be administered by the *in ovo* (Marek's disease virus (MDV), infectious bursal disease virus (IBDV), Newcastle disease virus (NDV)), **subcutaneous** (MDV), **drinking water/eye drop** (NDV, infectious bronchitis virus (IBV), infectious laryngotracheitis (ILT)), **wing web** (fowl pox, avian encephalomyelitis (AE), fowl cholera, chicken anemia virus (CAV)) or **spray** (IBV, NDV, IBDV) routes.

Inactivated vaccines can be administered **subcutaneously** (fowl cholera, Salmonella sp., infectious coryza, Mycoplasma) or intramuscularly (IBDV, ND, IBV, reovirus).

In Ovo Vaccination. Vaccines are usually inoculated during embryo transfer from the setters to the hatchers (around 18 days of embryonic development). In 2002, Wakenell *et al*, evaluated the level of protection in broilers after inoculation of Marek's vaccine in several embryo compartments. Good protection (100%) was achieved when the vaccine was inoculated in the amniotic cavity (vaccination at 18.5 days) or in the body of the embryo (vaccination at 19 days). Vaccination against MDV can also be performed subcutaneously in the neck at day of age in the hatchery.

An adequate storage, manipulation during preparation and an adequate vaccination technique have a tremendous impact in the development of an adequate protection against MDV. The following are some recommendations for a proper handling and use of cell associated MDV vaccines:

- Vaccine storage and transportation
 - Keep the vaccine ampoules in liquid nitrogen
 - Periodically review the level of liquid nitrogen in the tank
 - At least 4 inches
 - Ampoules can be stored upside down. The presence of vaccine in the top of the ampoule indicates thawing during storage. Such ampoules should be discarded
- Vaccine preparation
 - Handle in a separate room in hatchery
 - Only remove one ampoule at a time from the tank for mixing
 - Thaw the vial in a 80 F water bath (approximately 90 seconds)
 - Use distilled water with chlorine (approx 200 ppm)
 - Disinfect the ampoule with alcohol before the top is snapped off
 - Remove the vaccine with an 18 gauge, 1^{1/2} inch needle
 - Smaller needles will break the cells, killing the virus
 - Slowly inoculate to a sterile diluent bag (1,000 doses per 200 ml bag)
 - Mix carefully
 - Use within 30 min to 1 h
 - If antibiotic or dye is used, it should be added 15 min before the vaccine using a different syringe
- Vaccine inoculation
 - Check the vaccination equipment to evaluate the dose size injected
 - Monitor vaccination crews by checking vaccinated chicks

Water Vaccination. Water administration is one of the preferred methods for mass application of poultry vaccines. This method offers several advantages such as low labor cost, good stimulation of local immunity and minimal bird stress. The following are some recommendations for a successful vaccination via drinking water:

- Vaccine preservation
 - Keep the vaccine at a constant temperature of 35F to 45F
 - Avoid direct contact with sunlight (UV radiation)

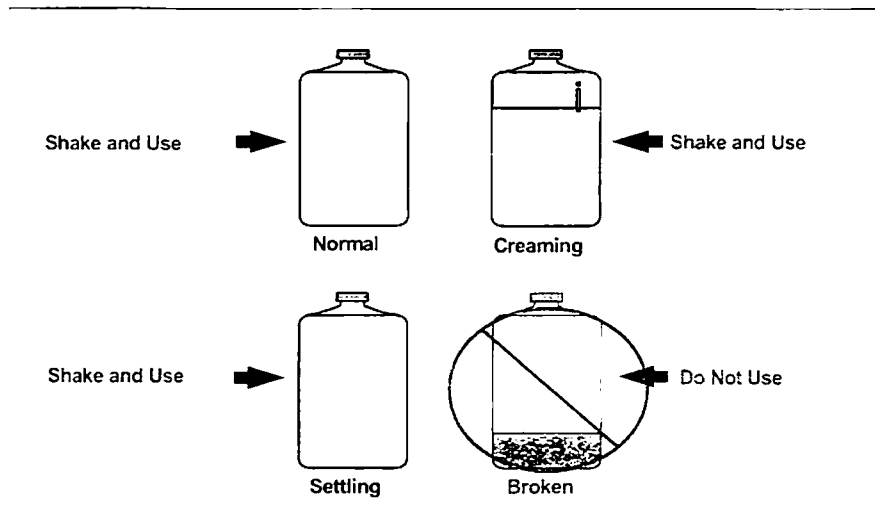
- Review expiration date and serial number
- Water quality
 - No chlorine or other disinfectant residues should be present in the water lines before, during or immediately after vaccination
 - Turn off chlorinator 48 to 72 hours before vaccination
 - Add skimmed milk (1.5 lb/50 gallons of water) or other vaccine preservatives to the water at least 20 min before adding the vaccine
- Water consumption, mainly at early age, is highly variable
 - Age, type of bird, temperature and season dependent
 - Estimate before vaccination
 - Water meter readings
 - Trial vaccination one or 2 days before real vaccination
- Effective drinker space
 - Enough space per bird is crucial
 - Bells: 1/100 birds
 - Nipple drinkers: 1/15 birds
 - Cups: 1/30 birds
 - Clean the drinkers with chlorine or disinfectant free water
- Vaccination process
 - Water starvation (guideline 1 ½ to 2 h)
 - Depends on temperature, season, time of the day..
 - Must be estimated before vaccination
 - Drain the water systems prior to vaccine administration
 - Open vaccine vials under the water, rinsing completely
 - Vaccinate on feed days (stimulates water consumption)
 - Bell drinkers and cups filled by hand
 - Nipple drinkers: filled with a 1/3 H.P pump or by gravity
 - Open the water line at the end of the line
 - Close when the milky water or dye comes through
 - Move through the house to encourage drinking
 - Open the normal water supply (free of chlorine and disinfectants) checking for the presence of trapped air in the water lines
 - Vaccine should be consumed within 2 to 3 hours of reconstitution
 - Goal: at least 90% of the birds correctly vaccinated
 - Use dye to monitor vaccination coverage

Spray Vaccination. A very important factor to consider for spray vaccination is the type of spray to be used. Two main spray types are available. Coarse spray is characterized by the formation of particles sizes between 50 and 150 microns. These relatively big droplets allow the delivery of vaccines to the upper respiratory tract and the eye. It is the recommended spray for young and unprimed birds, showing moderate respiratory reactions after vaccination. Mist spray is characterized by a smaller particle size (less than 50 microns). Due to the smaller droplets size, the antigen reaches the lower respiratory tract, which might cause undesired respiratory reactions.

The following recommendations should be consider for a successful spray vaccination:

- Disinfect the sprayer before vaccination. After disinfection, wash the sprayer with abundant distilled water
- Carefully estimate the amount of distilled water needed for vaccination
 - Spray trial one or two days before vaccination
 - Uniformity of application can be evaluated by locating water sensitive paper in selected locations at the house
- Turn the fans off during vaccination and 20 min after vaccination
- In opened side houses, raise the curtains. If needed, lower the curtains at least 20 min after vaccination
- Check the pressure of the sprayer

Subcutaneous and Intramuscular Vaccination. These are the main routes to inoculate oil emulsion or aluminum hydroxide (AlOH) vaccines. Oil emulsion vaccines might have four distinct appearances during storage (normal, creaming, antigen settling and broken emulsions), as shown:



A normal emulsion should appear as a homogeneous white to slight off-white liquid. The off-white appearance is usually noticed when the antigenic content is high (multiple antigens included) or when viral antigens have been propagated in tissue culture. Creaming occurs due to excess of free oil floating on the top of the emulsion. Two layers, a light white or clear top layer above the normal white colored oil emulsion might be observed. Vaccines showing "creaming" can be normally used after shaking. Settling usually occurs with vaccines of high antigen content, with small globules of water (containing the antigen(s)) surrounded by oil showing a heavier density than oil alone. A gradual increase in darkness toward the bottom will be present. As in "creaming", oil emulsions showing "antigen settling" can be used after shaking. A broken emulsion occurs when the two phases, aqueous and oil, are separate from each other. Two well defined layers, an upper layer with a normal emulsion color and a lower tea to coffee colored layer, are present. Broken emulsions should be discarded. If inoculated, a weak initial immune response might be observed; however, the immune response will be short lived.

Oil emulsion vaccines should be stored between 35F to 45F. The day before use, the vaccines should be kept overnight at room temperature. During the day of vaccination, prior to inoculation, the oil emulsion vaccine can be warmed (not boiled) in a 95 F to 100 F water bath up to 5 hr. By warming up the vaccine, a lower emulsion viscosity is observed, causing lower tissue reactions at the site of inoculation without affecting the immune response.

Subcutaneous inoculation of poultry vaccines can be performed in the neck, tail or groin area. The following recommendations apply to subcutaneous vaccination in the neck:

- Lift the skin on the dorsal midline of the neck
- Use an 18 gauge ½ to ¼ (depending on the age of the bird) inch needle
 - Insert needle through the skin into the SQ space
 - Direct the needle parallel to the neck
 - Replace needles at least every 1,000 doses
- A full dose of vaccine should be injected before retraction

Intramuscular (IM) inoculation can be done in the muscle of the breast, legs or wings. The following are recommendations for IM vaccination in the breast muscle:

- Use an 18 gauge, ¼ inch needle to inject the vaccine in the superficial pectoral muscle
 - Replace needles at least every 1,000 doses
- Direct the needle caudally at a 45° degree angle
 - Necrosis can be observed when bacterins are inoculated in the internal pectoral muscle
 - Liver puncture will cause the death of the bird due to internal hemorrhage
- Insert the needle 1 to 1.5 inches lateral to the keel bone, midway the length of the keel bone
- Complete the injection before withdrawing the needle.

References

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