

## Bacterin Usage

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### SUMMARY

A good vaccination program, along with proper flock management and biosecurity, plays a key role in the health and productivity of broiler breeders. The use of bacterins has been shown to lessen the effects of certain diseases by giving the bird resistance to harmful pathogens, but the success of vaccination lies with the skill and technique used by the vaccination crew. It is advised to administer bacterins using either subcutaneous (SQ) or intramuscular (IM) injections, however, care must be taken to ensure that birds receive a full dose of vaccine. With SQ injections, do not vaccinate too close to the head, base of the neck, or neck bones. With IM injections, do not vaccinate too close to the keel bone or too deep into the breast muscle. With either type of injection, it is imperative that personnel handle equipment safely to avoid self-injury.

Things to consider when administering bacterins are:

- Use only bacterins that have been provided by a veterinarian.
- Ensure correct storage and handling of vaccines. Plan ahead and allow bacterins to come to room temperature before vaccination.
- Vaccine should only be administered by trained personnel who have full knowledge of correct techniques.
- Tissue reactions at the injection site are the birds immune system responding to the vaccine.
- Visual inspection of the vaccination technique at the injection site is the best method to determine accuracy of the injection.
- The ultimate goal of any vaccination program is high, uniform, and longlasting antibody titers.
- Ensure that no birds are skipped or missed. A bird that is not injected is not protected.

Bacterins are a critical component of breeder vaccination programs and are used to stimulate high levels of immunity. However, because of their aggressive reactivity, it is recommended that bacterins be given at 8-10 weeks of age so that birds are conditioned in terms of body mass to respond to and assimilate the vaccine.

By properly implementing a good vaccination program, it is possible to achieve the most productivity from the flock while maintaining bird health. The focus of this article is to provide a description of bacterins, the correct bird age and procedure for administration, auditing of the immune response, and troubleshooting potential issues.

**THE REMAINDER OF THIS ARTICLE PROVIDES MORE DETAIL ON THE POINTS SUMMARIZED ON PAGE ONE.**

## INTRODUCTION

The use of vaccination programs in commercial poultry production is fundamentally important to the growth, welfare, and success of the flock. When used in conjunction with good management practices and biosecurity, vaccines can help to prevent or reduce the harmful effects of diseases and provide the flock with protection against infection.

Bacterins are a critical component of breeder vaccination programs and are used to stimulate high levels of immunity. These bacterins or inactivated bacterial vaccines are used to induce immune response to bacteria protecting the bird from pathogens like *Salmonella* spp., *Pasteurella multocida* (Cholera), *Escherichia coli* (*E. coli*), *Avibacterium paragallinarum* (Coryza), and in some countries, *Ornithobacterium rhinotracheale* (ORT). If administered correctly and at the proper times, bacterins can provide bird resistance to these harmful agents; however, if given incorrectly, they can have potential negative effects. The focus of this article is to provide a description of bacterins, the correct bird age and procedure for administration, auditing of the immune response, and troubleshooting potential issues.

## CHARACTERISTICS OF BACTERINS

Bacterins generally consist of two components, a liquid and adjuvant phases, which are blended into a solution called emulsion. The liquid phase contains the antigen and the adjuvant generally enhances the bird's response to the antigen. The antigen can be part of the bacteria or components of it. In the case of the adjuvant, aluminum hydroxide and mineral oil are commonly used. These oil emulsion vaccines can be single or double emulsions. Single emulsions consist of a liquid phase surrounded by a continuous oil phase and are referred to as a water in oil (W/O) emulsion. Consequently oil in water (O/W) emulsions have water as the continuous phase. Double emulsions (W/O/W) are manufactured by dispersing water into oil and then dispersing this W/O emulsion into water.

The level of antibody response and subsequent immunity is dependent on the level of tissue reaction and the antigenic concentration of the vaccine. In general, the tissue reaction following injection of oil emulsion bacterins is much more severe than the reaction to the injection of inactivated viral oil-emulsion vaccines, this is true due to the fact that the emulsion of inactivated toxic bacterial cell constituents (especially lipopolysaccharides or endotoxins) in mineral oil creates a very potent immunizing agent.

Most commercially available bacterins are mineral oil based, particularly with Fowl Cholera, *Salmonella* and Coryza oil emulsion bacterins the tissue reaction at the site of injection is usually more severe when compared with aluminum hydroxide inactivated vaccines, thus inducing higher antibody levels.

## AGE TO ADMINISTER BACTERINS

Unless the field challenge is high, in which case a review of the biosecurity program is critical, it is advisable not to expose very young birds to the aggressive effect of bacterins. A comprehensive vaccination plan will allow for bacterins to be given at 8-10 weeks of age so that birds are conditioned in terms of body mass to respond to and assimilate the vaccine.

Inactivated vaccines require two doses for best results and this is especially true for bacterins. Due to the reaction caused by bacterins, it is recommended for broiler breeders that the last application be given at 18-19 weeks of age, thus giving the bird enough time to recover from the injection before onset of egg production. If the injections are too close together or too close to onset of egg production, the onset of lay and peak egg production could be compromised.

## PROCEDURE FOR BACTERIN ADMINISTRATION

### Vaccine Preparation

General recommendations are to remove the vaccine from the refrigerator 24 hours ahead of vaccination and allow it to stay at room temperature. Bacterin manufacturers advise warming their products to 27-29 °C (80-85 °F) using a warm water bath before injection to reduce local reaction and facilitate application (**Figure 1**). To avoid breaking the emulsion, do not freeze or overheat bacterin vaccines. Be aware that other killed vaccine products, such as viral killed vaccines, can be warmed up to 37 °C (100 °F) which may cause issues for bacterins. Overheating bacterins could release more endotoxins causing severe tissue reactions and liver/spleen issues, resulting in hen mortality (often called post-bacterin hemorrhagic syndrome). It is recommended, therefore, to have a separate warm water bath strictly for bacterins.

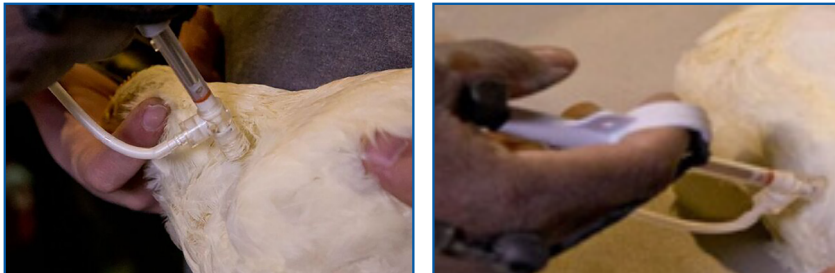
**Figure 1:** Vaccination supplies and cooler/warmer used to keep vaccine at the correct temperature.



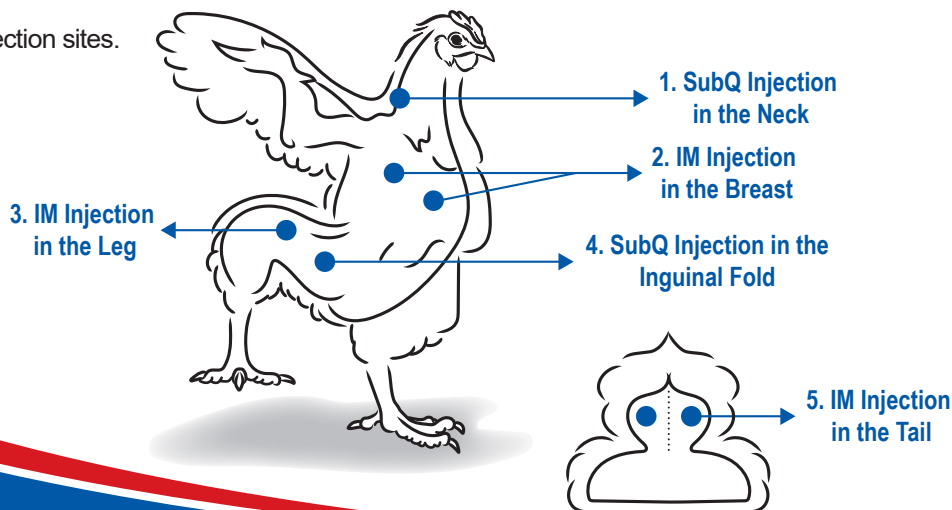
### Injection Site

Commonly used vaccination sites are subcutaneously (SQ, under the skin) (**Figure 2**) in the back of the neck and in the inguinal fold and intramuscularly (IM, in the muscle) (**Figure 2**) in the breast, thigh and leg. An alternative injection site into the underside of the tail is practical to use in 16-18 week-old pullets, younger than this age the tail is too small and accuracy can be compromised. **Figure 3** illustrates the described injection sites. The site of injection does not have a significant effect on the immune response to the vaccine; it is more important to deliver it accurately.

**Figure 2:** Example of SQ injection (left) and IM injection (right).



**Figure 3:** Injection sites.



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The success of vaccination is dependent on the skill of the vaccine administrator in delivering a full dose of the bacterin to each bird, and also on the capability of the bird to manage the reaction. Birds will better manage the tissue reaction if they are the correct age for vaccination (8-10 weeks of age), are on target for body weight, and have good health status. Both the vaccine administrator's technique and the site chosen for injection of the bacterin can have an impact on the extent of the tissue reaction. Generally speaking, if given correctly, subcutaneous (SQ) administration is gentler and offers less reaction compared with intramuscular (IM) injection. A permanent scar is often seen after IM, whereas after SQ injection, a visible scar is less likely.

### Vaccination Technique

Delivering bacterins by means of SQ or IM injection is a very precise and demanding task, only to be performed by trained individuals within a vaccine crew. These individuals are able to ensure accuracy when vaccinating thousands of birds at a time. Correctly training the vaccination crew can be challenging when dealing with employee turnover, labor cost, and personnel availability, but it is a critical factor for optimum results.

When performing SQ injections, the vaccine should be applied at the distal third of the neck. It is critical to avoid personnel self-injection as this could lead to serious injury and also to avoid injections too close to the head, the base of the neck or neck muscles (**Figure 4**). The use of new sterile needles is recommended and regular replacing (at least once every 500 birds) is encouraged. For SQ injections, needles should be 18-19 gauge and 10 mm to 12 mm (0.4 in to 0.5 in) in length. In the case of IM injections, the recommended needle dimensions are 18 gauge and 6 mm (0.25 in) in length. Blunt needles and needles with burs must be replaced immediately. Dull needles require more force to penetrate the skin and may potentially cause unnecessary tissue damage. Select the correct size needle according to age of birds, site of injection, and type of vaccine used.

**Figure 4:** Correct SQ vaccination technique of the neck, tail and inguinal fold.



When doing IM injection, it is best to select the breast muscle whenever possible. This location is best due to the thickness of the pectoral muscle offering a cushion for vaccine injection. However, it is also acceptable to vaccinate in the leg muscle. When injecting into the breast, make sure that the needle is localized about 2.5-3.8 cm (1-1.5 in) away from the keel bone to avoid striking the bone with the needle (**Figure 5**). Place the needle in the upper third of the breast, directing the needle in a downward direction at a 45° angle. This will help to avoid injecting vaccine into the body cavity. In broiler breeders, using the leg for vaccination should be avoided unless absolutely necessary because of the possibility of mis-injection or an excessive reaction.

**Figure 5:** Correct IM vaccination of the breast muscle (injection does not reach the pectoralis minor/tender). The photo on the right is of postmortem evaluation and is shown to demonstrate that correct IM vaccination does not reach the pectoralis minor.



Emphasis should be placed on the accuracy of the injection and not the speed in which the vaccination can be performed.



### AUDITING OF THE IMMUNE RESPONSE

Visual inspection of the vaccination technique and deposition of the vaccine at the correct site is the best method to determine accuracy of the injection. With the SQ injection in the neck, the feathers at the site of injection can be separated to allow visualization of the vaccine under the skin (**Figure 6**). Wet feathers indicate that the vaccine was poorly administered and either full or partial dose ended up in the feathers due to anticipated or delayed expulsion of the vaccine from the syringe. Inspection timing is important; make sure the examination is done within an hour of vaccination. Unannounced visits to evaluate the vaccination crew technique are preferable to get a true picture of the job being done. To visually evaluate the vaccination procedure for the purpose of properly training the vaccination crew on IM injections, some sex slips (sex errors) can be euthanized to inspect the site of injection.

**Figure 6:** Visualization of SQ vaccination under the skin (left) and in the breast muscle (IM) (right). The photo on the right is of post-mortem evaluation and is shown to demonstrate correct IM vaccination into the breast muscle.



The ultimate goal of a well planned vaccination protocol is high, uniform and long-lasting immunity measured in antibody titers. However, results may not be as expected due to several factors related to the method of application and/or the technical skill of the operators. The immune response to bacterins is dose related. Therefore, when a large percentage of the birds are missed or partially vaccinated, a poor flock immune response is expected. Vaccines are no good if they do not get into the birds.

It is very difficult to determine how many birds within a flock received less than a full dose of vaccine or actually missed being vaccinated. Therefore it is extremely important to implement a monitoring procedure of the vaccination program. Commonly, serological testing is used to indirectly assess the accuracy rate of vaccination. Usually, a minimum of 23 blood samples per group are used with various serological tests such as Enzyme-Linked Immunosorbent Assay (ELISA), which is considered to be specific, sensitive and repeatable. Bad vaccine application could produce serological titers that are not uniform (high %CV) but are also below the expected average (low mean titers). This result could indicate a large percentage of the birds were missed or did not receive the full dose.

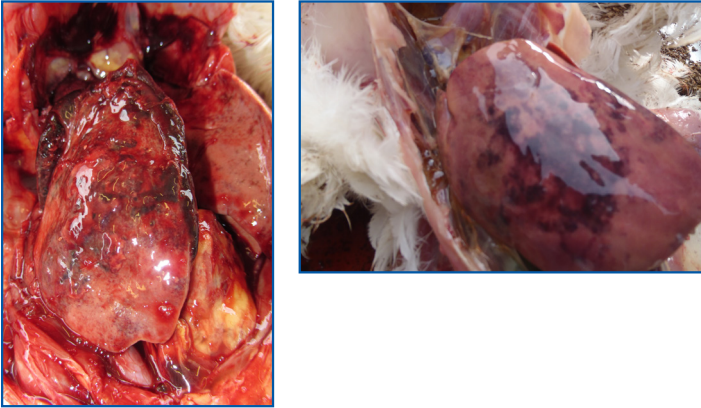
### TROUBLESHOOTING

If there is an indication that the use of the bacterins is causing problems to the birds or the serological results, the following signs or findings should be considered:

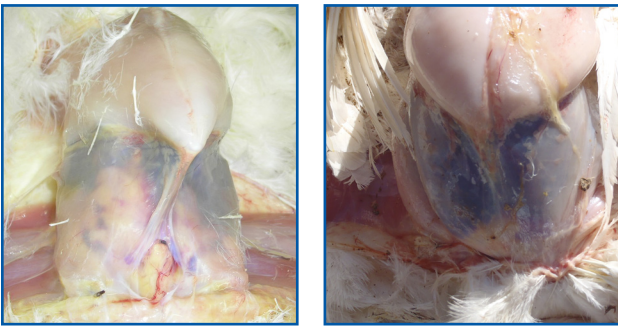
**Bird discomfort due to the tissue reaction** – Particularly with neck injections, some pullets may appear depressed and lethargic, affecting feed consumption for a few days. Because inflammation at the injection site is an energy demanding process diverting body resources for developing good immunity, a higher demand for nutrients may be needed to overcome the tissue reaction. It is recommended that feed be adjusted accordingly during this period (consult an Aviagen® representative). Pullet flock uniformity can be heavily affected by exacerbated tissue reactions.

Post-bacterin Hemorrhagic Syndrome could possibly occur due to an adverse reaction to the endotoxin components of some bacterins. The inflammation process involves protein deposits in organs such as the liver, causing enlargement with a hemorrhagic and mottled appearance (**Figure 7**) and fluid in the abdomen cavity (**Figure 8**). Typically this lesion is accompanied with a breast reaction at the site of vaccine injection. To help avoid this condition, plan vaccination programs so that the delivery of bacterins is timed correctly (avoid giving too many bacterin vaccines too quickly) and avoid using bacterins that are more reactive than others.

**Figure 7:** Swollen liver with mottled and hemorrhagic surface.

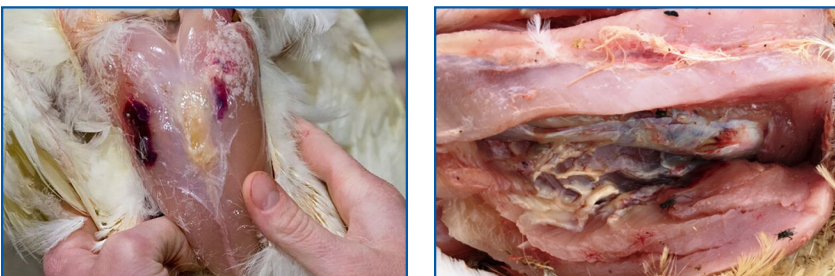


**Figure 8:** Hemorrhaghd in the abdomen cavity.



Residual lesion at the site of injection that can cause potential condemnation problems -- Oil emulsion bacterins tend to cause more of a muscle tissue reaction than inactivated viral vaccines when injected into the breast muscle. Most vaccine manufacturers recommend bacterins to be administered by the SQ route rather than IM to avoid injecting the deep pectoral muscle (also called tender) causing damage and possible necrosis of the muscle (**Figure 9**). Some manufacturers have released new concentrated vaccines, thus the same amount of antigen that is used in the regular form (bottle of 500 mL, 0.5 mL per dose) is now available in a concentrated form (bottle of 250 mL, 0.25 mL per dose). The concentrated form reduces the tissue reaction at the site of injection.

**Figure 9:** Lesions at the site of an IM injection.



**Missing birds** – A bird that is not injected is not protected. Inspection at the site of injection in sex errors and culls will help training the vaccination crew.

**Dose of bacterins** – The bird's immune system does not recognize bacterial antigens in the same way it recognizes viral antigens, thus it is recommended bacterins be applied twice before moving the birds to production.

### CONCLUSIONS

A well-established vaccination program is critical to the productivity of the poultry flock. Correct administration of the vaccine on a set schedule will help to ensure that the birds are protected from certain diseases that may be detrimental to flock health. Some key points to consider when administering bacterins include:

- Bacterins are valuable tools in vaccination programs. Use only bacterins that are prescribed by your veterinarian.
- Plan the procedure ahead of time and give the bacterin enough time to reach room temperature.
- Proper management and application of bacterins is critical for getting the most out of them. If managed and applied incorrectly they may cause injury or performance issues.
- Any tissue reaction at the injection site is the birds immune system responding to the injected vaccine.
- The site of injection does not have a significant effect on the immune response to the vaccine; it is more important to administer it correctly.
- Delivering bacterins by means of SQ or IM injection is a very precise and demanding task, only to be performed by trained individuals who are able to ensure accuracy when vaccinating thousands of birds at a time.
- Visual inspection of the vaccination technique at the correct site is the best method to determine accuracy of the injection.
- The success of the vaccination ultimately depends on the accuracy of the administrator.
- The ultimate goal of any vaccination program is high, uniform and long lasting antibody titers.
- Ensure that no birds are skipped or missed. A bird that is not injected is not protected.

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