BVS POULTRY Talk

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Iowa Turkey Federation Winter Convention
West DesMoines Marriott
December 10-12, 2013

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IPE Show
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January 28-30, 2014

National Turkey Federation Annual Convention
Disneys Grand Floridian Resort
February 12-15, 2014

Managing Cold Weather Ventilation

By John Menges
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Wet litter can be one of the most costly environmental conditions that can occur in a turkey barn, both from a financial and bird comfort/animal welfare standpoint. Turkeys that develop low-grade enteritis can quickly increase litter moisture to an unacceptable level. Increased litter moisture can then negatively affect air quality and can provide favorable conditions for pathogenic microorganisms to proliferate. This has a negative impact on bird performance which is recognized as poor feed conversion, weight gain, flock uniformity, poor carcass quality (including breast blisters and buttons), and footpad dermatitis. In addition to the performance issues mentioned, there is also a higher energy cost related to reducing the environmental impact.

Poor environment and litter condition invariably exacerbate one another – birds remain "loose", environment moisture continues to rise, which stresses the birds, reduces their resistance and increases the severity of the enteric problems. As managers, we need to understand why this is occurring in order to determine what environmental management techniques would be most appropriate to halt this vicious cycle from spiraling out of control.

Effects of ventilation on barn environment and litter conditions

Cold weather ventilation is most critical in controlling litter condition and barn environment. Typically, ventilation rates are reduced or sacrificed to maintain adequate temperatures to keep birds comfortable. As energy prices increase, the fuel used to keep birds comfortable becomes more critical. This fuel is not limited to the propane, but also includes the feed energy that birds consume. According to information published by the North Carolina State University (Anderson and Carter, 1993), the comfort zone for adult turkeys is between 55°F and 75°F.

continued on page 3

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Poultry Talk

It's hard to believe that its mid-October already…. Living in Minnesota it feels like we just got over winter with the winter we had this past year. It's been a great year in most areas of the country for producing good crops. Corn prices are down significantly. Broiler markets have been very strong, making for record profits!

We work in an industry that is being attacked from many fronts…. EPA, FDA, USDA, Animal rights groups, Consumer Groups, etc… I just attended a meeting, which one of the speakers presented a recent survey that showed that the majority of the American public does not trust animal agriculture and how we produce our food. To me that is very disheartening. Being brought up in the turkey business and continuing to be part of the industry that I love, I know firsthand that the American Farmer and U.S poultry industry cares about how poultry and livestock are cared for. Yet the American public has not had that communicated to them very well. We need to do a better job of that. Recently Dr. Temple Grandin has put out a short video entitled "Turkey Farm and Processing Plant Tour". She did a great job of dispelling preconceived ideas of how we treat turkeys on the farm and how we process our flocks. We need more positive press like this to get the truth out about how we care for our animals.

With that said, I feel that the poultry industry is facing yet another threat. That is the threat that backyard poultry flocks present us in regards to infectious diseases. This is nothing new, but with the increased interest by people to produce backyard chicken, turkey and egg layer flocks; this has become a bigger threat to our industry. There's a group of people who think that they can produce better and safer food with these backyard flocks than that of the American Farmer. Yet they do not understand the threat they present to the U.S Poultry industry and to the U.S. and world food supply…. With the threat to expose our commercial poultry and breeder flocks to infectious diseases like Avian Influenza, New Castle Disease, Bronchitis, LT, and Mycoplasma. There are many examples over the past year of commercial flocks being infected by backyard flocks with MG, MM, and MS. These same people don't understand that breeder flocks have to be destroyed that are infected with Mycoplasma infections, that farms have to be depopulated and cleaned up before new flocks can be placed. And they don't understand that they are accountable and have a responsibility to prevent disease. They are quick to criticize how our industry produces food, yet they don't want to be held to the same accountability. Poultry producing states need to get a handle on where these backyard flocks are and educate these people on how to prevent disease and what their accountability is. Many of these flocks are not vaccinated; many times turkeys, chickens, ducks, and other poultry are raised together…

As an industry we have a lot of challenges ahead of us. Let's be proactive in how we approach these challenges!

God Bless… Till next time… Randy

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Manging Cold Weather Ventilation, *continued from cover*

Therefore, when the effective temperature (what the bird feels) is above or below this temperature, feed energy is used to maintain metabolic function rather than body weight. For young turkeys, this zone is more critical and the minimum temperature is increased. Not only is whole barn temperature critical in cold weather, but temperature uniformity from end to end and side to side within the barn can mean the difference between birds eating for body gain or eating and huddling for survival. When birds eat for survival or "binge eat" to stay comfortable, the enteritis conditions explained in the previous section can be the result. Therefore, it is critical to maintain proper air flow and temperature throughout the barn during the entire growing cycle.

When it comes to ventilating turkey barns during cold weather, 95% of the time we are primarily trying to manage barn/litter moisture levels (Czarick, 2010). It is well understood that excess litter moisture can lead to ammonia, bacteria/pathogen build up, and leg issues. Moisture must be removed from the barn in order to maintain litter and acceptable humidity levels by replacing the warm damp air in the barn with cold dry air from outside the barn, without chilling the birds and wasting fuel.

One of the most efficient methods for removing moisture in poultry barns is through negative pressure/minimum ventilation. Exhaust fans and inlets are designed to create a negative pressure in the barn, allowing the moisture to be removed (controlled), while at the same time conserving fuel and using the heat produced by the birds and artificially to maximum capacity. Proper minimum ventilation starts with a tight barn with little air leak, so that all air enters the barn through the designed inlets. When this occurs and the correct static pressure can be achieved, then the cold air can mix with the warm moist air concentrated at the ceiling (warm air from birds and heaters will concentrate at the ceiling as warm air rises and cold air falls). This accomplishes two goals. First, the cold air does not drop directly on the floor resulting in birds that are chilled (leads to huddling and binge eating), it does not allow condensation on the floor from the cold air, and it reduces the amount of heat required to warm the incoming cold air. Second, the warm air at the ceiling tempers the incoming cold air, expanding this air, allowing it to increase its water holding capacity. When air is warmed by 20°F, the water holding capacity of the same air volume doubles. When air is preheated and expanded to be able to carry moisture, it can then mix with the air near the floor, picking up moisture and removing it through the negative pressure fans.

The litter on the floor acts like a sponge. As birds add moisture to the litter, the sponge gets full. This process may take days and can go unnoticed. Once the sponge is full, either though poor digestion, enteritis, poor drinker management, or poor ventilation techniques, the litter is wet and then cakes. We then see the high ammonia condition related to poor air quality, litter burns on footpads, and high humidity levels. Before this occurs, humidity levels can be monitored and maintained to less than 65%, in most cases, and will alert managers when minimum ventilation rates are insufficient to remove excess moisture.

Summary

1. **Controlling incoming air requires a tight barn**
   - **Tight test the barn – close the barn as tight as possible (inlets, doors, curtains, etc). Turn on approximately 1 cfm/ft² inlet capacity. Static pressure (SP) should be 0.15" or greater. If not, then either the house is loose or the fan is not as strong as you think**
2. **Determine the number of inlets needed to control incoming air**
   - **Running the same fan as above, open enough sidewall inlets to equal 80 in²/1,000 cfm, with an approximate opening of 2-3".**

     Example – a 36" fan with 10,000 cfm
     10 x 80 in² = 800
     Inlet length of 36'"
     36" x 2.5" opening = 90 in²
     800/90 = 8.9 or 9 inlets

     This will allow the air to enter the barn high and carry to the center of the barn with an operating pressure of .08-.12" SP depending on width of barn
     - **If attic inlets are used, refer to the manufacturer specifications on fan volume and SP.**
3. **Maintain and monitor humidity, carbon dioxide and carbon monoxide levels**
   - **Humidity to less than 65%**
   - **Carbon Dioxide to less than 2,500 through the brood period**

   Note: high CO2 levels can have a negative impact on metabolism, poult starts and growth
   - **Carbon Monoxide to less than 25 ppm**

References

Czarick, M, 2010. "Ventilating Turkey Houses During Cold Weather", Midwest Poultry Show, St. Paul, MN.

Frame, et al. "Causes and Control of Spontaneous Cardiomyopathy or Roundheart Disease in Utah Turkeys". Frame, et al 2010

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NEW PRODUCT

bioSecure™ BacTrac™ FB

Product Code
8029

Product Description
bioSecure™ BacTrac™ FB is a proprietary combination of all-natural ingredients designed for use as a dry powder foot bath to prevent the transfer of bacteria from the environment into animal facilities and from one facility to another.

Application
bioSecure™ BacTrac™ FB can be used as a foot bath in facilities for all species and classes of livestock.

Recommended Application Rate
bioSecure™ BacTrac™ FB should be added to a designated foot bath container to provide sufficient depth of product to coat boots with a light layer of BacTrac™ when the foot bath is used.
The BacTrac™ in the foot bath should be replaced weekly, or as needed if located in a high-traffic area.

Ingredients
Clay, Lactic acid, Silica, Spices and Essential oils.

Guaranteed Analysis
Lactic acid, minimum.....2.5%

Packaging
bioSecure™ BacTrac™ FB is packaged in 50 pound (22.7 kg) bags.

Storage
Store bioSecure™ BacTrac™ FB in well-ventilated, cool and dry areas.

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REV102113

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pH Safe water acidifier is the first FDA-approved feed grade inorganic acid water treatment available to the poultry and livestock industries. Due to the unique chemistry of **pH Safe**, the consumption of treated water does not decrease at higher concentrations, as has been reported for organic acids. **pH Safe** contains the strongest animal feed grade mineral acid available. A much lower addition rate is required to acidify drinking water to biologically effective low pH levels. This lower addition rate provides pH reduction with no bitter taste. Birds won't back off from **pH Safe** treated water, so optimum water consumption is maintained. This advantage gives producers the flexibility for administration in a wide range of application in all livestock and poultry species.

Using Litter Amendments

Ross Muhlbauer, MSS AG

In many poultry and turkey production systems at least a portion of the previous flock's soiled litter is reused. With it comes ammonia production and bacteria that could become harmful to the new flock's health. Even if all litter is removed between flocks, bacteria remain on the earthen pad. This article discusses the benefits of using litter amendments to help control these two hazards as part of best management practices in poultry and turkey production.

Ammonia and Bacteria

It has been shown that in-house ammonia levels above 25 ppm can negatively affect bird performance[1,2] and that harmful diseases like clostridial dermatitis (cellulitis) can come from bacteria[3] in the litter or soil. Most bacteria increase reproduction with pH and because it is bacteria that break down uric acid in soiled litter to eventually form ammonia, ammonia production also increases with pH. Figure 1[4] shows the chemistry of ammonia production.

Both the size and the pH of the moisture layer surrounding a litter particle will affect the favorability of the environment for bacteria reproduction. In other words, the wetter the litter and the higher the pH, the better the conditions for bacteria and ammonia production. While ventilation can be used to keep litter dry and ammonia levels low, litter amendments can be used to lower pH and moisture helping to control both these problems—especially when over ventilation resulting in cooler than desired in-house temperatures (and excessive energy costs) can harm young bird health.

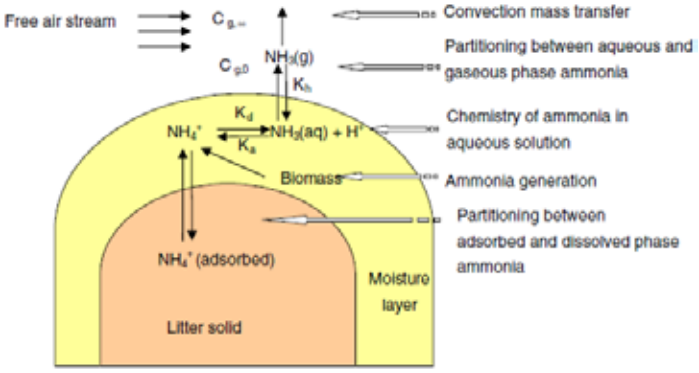

Fig. 1 Illustration of processes related to ammonia emissions from litter-based manure

Lowering pH

Lower pH creates an unfavorable environment for bacteria reproduction meaning fewer bacteria in general, and fewer to break down uric acid and form ammonia in the litter. Widely used litter amendments like PLT (sodium bisulfate, Jones Hamilton), KLASP (ferric sulfate, Kemira), and Al+Clear (aluminum sulfate, General Chemical) react with moisture and consume alkalinity in the litter. Alkalinity is what allows the litter to adjust its pH to 7 and up. By consuming this, amendments effectively lower litter pH for a period before they are completely reacted. At this point litter pH resumes its climb to 7 and above. As pH climbs, so does bacteria reproduction and ammonia formation.

Effective Litter Amendment Use

Since the three amendments discussed above all lower litter pH by consuming alkalinity, it is less important which product you use, than to understand how they work and to use each correctly. All require moisture to activate. PLT will react quickly regardless of litter moisture while KLASP and Al+Clear require more moisture in the litter to react. This means PLT usually reacts quickly (within 24 hrs) while KLASP and Al+Clear can react quickly with enough moisture, but usually react slower (2-5 days) under most normal dry litter conditions. KLASP and Al+Clear consume approximately 38% more alkalinity per unit of product applied than PLT but usually do not lower the pH any measurable amount more. This added alkalinity consumption can usually be noticed in extended effectiveness. Figure 2 shows amendment activation theory under normal dry litter conditions.

Use a litter amendment to lower pH for as long as possible with birds on the litter. The longer pH is lowered, the less favorable the environment for bacteria propagation and ammonia production. This helps the birds to grow stronger and resist the negative effects of both. Properly timing the application of your amendment of choice will greatly increase its effectiveness. Amendments can also be used to lower the pH of an earthen pad after a total litter cleanout. This also creates an unfavorable environment for any leftover bacteria to reproduce.

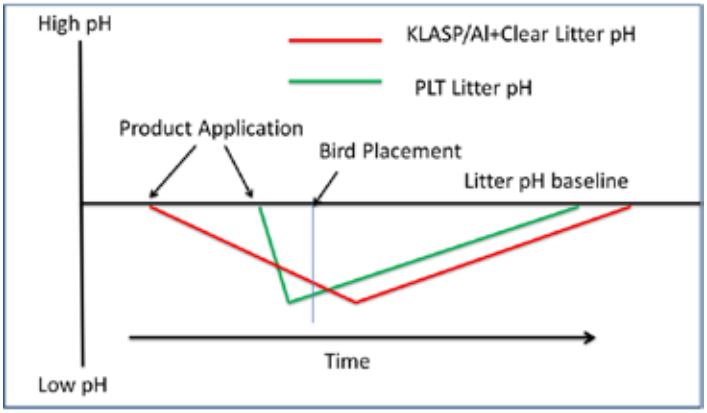

Figure 2. Amendment application timing for maximum effectiveness.

Application Rates

For most reused litter, application rates of 75-125 lbs/1000 ft^2 are recommended. Use more for wetter litter or extended ammonia control when increased ventilation is not optimal. Heavier rates of 200 lbs/1000 ft^2 have been shown to help control cellulitis, especially when treating the earthen pad following a total litter clean out. The best rate is the one that economically provides the control you are seeking for your litter management system. This may vary but will become evident with repeated use.

Summary

- **Litter amendments can be used to lower the pH of litter or an earthen pad creating an unfavorable environment for bacteria reproduction. Some bacteria break**

down uric acid to form ammonia while others can cause disease. Choose a product (or product combination) that fits your management system.

- Use PLT 1-2 days before bird placement for best effectiveness. PLT is especially effective in broiler production where bird placement day ammonia control is important. Using it will ensure quick pH reduction and ammonia control.
- KLASP or Al+Clear can be applied 2-5 days before bird placement. Reaction time will vary based on litter moisture (the wetter the litter, the faster the reaction) and will be evident with repeated use. These two products provide extended control but their reaction time is slower and more variable than PLT and must be used accordingly.
- A combination of PLT and KLASP or Al+Clear can be used to get immediate reaction and extended control in the same application. Result may vary but will become evident with repeated use.

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INNOVAX®-ND

TSP-V-048278 2000 dose ampules
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Marek's Disease - Newcastle Disease Vaccine
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INNOVAX®-ND is a frozen, live, cell-associated Newcastle disease (ND) and Marek's disease (MD) vaccine. It provides proven protection against virulent NDV and MD. It is approved for *in ovo* injection of 18-day embryonated eggs.

Advantages:
- Provides extended protection for virulent ND and MD
- Offers effective protection in the face of NDV maternal antibodies
- Replaces a conventional live ND vaccination program in the absence of exotic ND
- Removes the potential for respiratory reactions due to live ND vaccines
- Allows the use of monovalent infectious bronchitis (IB) vaccines, improving IB protection

NEWCASTLE CLONED N-79

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Newcastle Cloned N-79 is a live virus vaccine of chicken embryo origin containing a clone-selected B_1 Type, LaSota strain Newcastle disease virus. This virus has the ability to stimulate protection against a wide variety of Newcastle field strains while causing a milder reaction, in healthy chickens and turkeys, than other LaSota strain vaccines.

Advantages:
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- Product of choice for immunization of turkeys against Newcastle disease
- May be used to revaccinate broilers

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ORALVAX-HE® vaccine is a high titer vaccine that safely protects turkeys 6 weeks of age or older against the immuno-suppressive effects and death losses caused by hemorragic enteritis.

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- Produced under federal quality control standards, ensuring purity and sterility
- Consistent high potency titers to en sure protection of every vaccinated bird, flock after flock
- Recommended administration at 6 weeks of age or older helps assure no maternal antibody interference

NEWHATCH-C2®

TSP-V-053805 10,000 dose vials

Newcastle Vaccine
(B_1, Type, C2 Strain, Live Virus)

NEWHATCH-C2® is the patented, virtually nonreactive C2 strain of B_1 Type Newcastle disease (ND) virus. It is a lyophilized vaccine approved for spray vaccination of chickens one day-of-age or older for protection against Newcastle disease.

Advantages:
- Effective against field challenge of Newcastle disease virus
- C2 strain of B_1, Type Newcastle minimizes reaction to one day-of-age vaccination in broiler chicks
- NEWHATCH-C2 eliminates problems with lingering hatchery reaction prior to field boost
- Safe to use for hatchery application

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PM-ONEVAX®-C

TSP-V-065417 1000 dose units

Pasteurella multocida Vaccine
(Avirulent Live Culture, Avian Isolate)

PM-ONEVAX®-C vaccine. The seed culture used to make this vaccine hs been laboratory tested for protection of chickens against challenge with the X-73 (Type 1) strain of *P. multocida* and in turkeys against challenge with the P1059 (Type 3) strain of *P. multocida.*

Advantages:
- A temperature sensitive mutant of the CU strain that produces stronger takes than the M-9 strain, but less than the CU strain
- Offers protection against naturally occuring field strains of *P. multocida*
- Easy wing-web administration in broiler breeders, layers and turkey breeders

ART VAX®

TSP-V-065236 1000 dose units

Bordetella avium Vaccine
(Avirulent Live Culture)

ART VAX® vaccine is a live bacterial vaccine containing a chemically induced mutant of *Bordetella avium* which is immunogenic for turkeys when vaccinated by spray cabinet at day of age; then revaccinated in the drinking water at 2 weeks of age.

Advantages:
- Approved for spray administration at day of age followed by drinking water at 2 weeks of age
- Proven efficacy in preventing coryza in turkeys
- Time proven. This vaccine strain has been used effectively in the field for over twenty years
- Mild reaction
- Freeze dried product of proven quality and stability

M-NINEVAX®-C

TSP-V-065378 1000 dose units with diluent and wing-web stabbers

Pasteurella multocida Vaccine
(Avirulent Live Culture, Avian Isolate)

M-NINEVAX®-C vaccine is a live bacterial vaccine containing the mild avirulent M-9 strain of *Pasteurella multocida*, Heddleston Type 3-4 cross, in a freeze-dried preparation sealed under vacuum.

This vaccine strain has been shown to offer protection against fowl cholera in chickens and turkeys. The seed culture used to make this vaccine has been laboratory tested for protection in chickens against *P. multocida* serotype 1 and in turkeys against challenge with *P. multocida* serotype 3.

Advantages:
- Strong protection against *P. multocida* serotype 1 (chickens) and serotype 3 (turkeys)
- Mild. Less reactive than competitive products
- Safe. Avirulent live culture will not revert to virulence, will not cause mortality
- Specially formulated diluent provides excellent reconstitution stability

BVS is the exclusive distributor and marketer of Merck turkey vaccines in the U.S.

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Why Products Like CID 2000 Work Best To Clean and Maintain Water Lines

Most recent studies have shown that using a stabilized peroxide product work the best to clean water line between flocks. However it is important to know what type of peroxide product you are using and why some products work better than others.

Most end users classify all combinations of stabilized peroxide under the same umbrella whether it is a 34% stabilized peroxide or a 50% stabilized peroxide product. Most end users also classify stabilized hydrogen peroxides that are combined with acetic / peracetic acid (peroxyacetic acid) products under the same type of umbrella.

This is where we want to draw the distinction. When comparing straight stabilized peroxide products like Proxy-Clean or Cid Clean to a Peracetic Acid product like Cid 2000 that combines stabilized peroxide and acetic / peracetic acid, products like Cid 2000 are the clear choice to clean and maintain clean water lines.

CID 2000

Since Cid 2000 combines an oxidizer (hydrogen peroxide) with an acid (acetic / peracetic acid) it can remove both organic matter AND descale water lines at the same time.

PROXY-CLEAN or CID CLEAN

Since these products only have an oxidizer (hydrogen peroxide) they can only remove organic matter from your water lines. If you have 'hard water' which usually means high mineral content, iron and / or a high pH you will have scale build up. If you want to descale your water lines you will need to use a separate Acid based product following the use of Proxy-Clean or Cid Clean. This will cost you more time and money.

There are very few places that do not have hard water caused by high mineral content or iron that creates a scale build up issue in your water lines.

WHY YOU CAN NOT IGNORE SCALE

It has been well documented how biofilm is created and how much of a role it has in creating an unfavorable environment for your water lines. However, it is just as if not more important to pay attention to scale / mineral build up in your water lines. Bacteria produce carbohydrates (sugar) that allow them to attach to pipes; minerals also create deposits on the pipes; minerals like Iron also create deposits on the pipes and are used as a nutrient source by the bacteria. Mineral deposits also serve as attachment sites and form a structural matrix with bacteria / biofilm. Dissolving the mineral deposits destabilizes the structural integrity of the biofilm and assist in physical removal of organic matter from water lines and drinking systems. If you ignore the scale buildup you are leaving behind a major vector for bacteria and biofilm attachment and development that will compromise your drinking water.

SYNERGY IS THE KEY

The combination of ingredients in products like Cid 2000 creates a very unique and powerful product. The addition of the Peroxyacetic Acid (PAA) creates a powerful activated peroxygen compound which boosts the hydrogen peroxide oxidation potential 10 to 12 times in products like Cid 2000. Although Cid 2000 type products have less stabilized peroxide by percentage (20%) then products like Proxy-Clean or Cid Clean (50%) the oxidation potential of the peroxide is greater because of the combination of ingredients. This can also be seen in terminal disinfectants. For example products that combine glutaraldehyde and quaternary ammonia are much more powerful and broad spectrum than glutaraldehyde or quaternary ammonia on their own.

This is one of the reasons why products like Cid 2000 can be used at a 2% dilution compared to using products like Proxy-Clean or Cid Clean at a 3% dilution.

CID 2000

Cid 2000 has shown to be effective at a 2% / 1:50 dilution rate. It also has shown to be effective when left in the water lines for 12 to 24 hours depending on your build up. It takes less product and less time to use a product like Cid 2000. Saving you time and money.

PROXY-CLEAN or CID CLEAN

Proxy- Clean or Cid Clean type products have shown to be effective at a 3% / 1:33 dilution rate. These products also need to be left in the water line for 24-48 hours depending on your build up. It takes roughly 30% more product to clean water lines compared to products like Cid 2000 and these type of products only remove organic matter and cannot descale your water lines.

It is important to use these products at the 2% (Cid 2000) or 3% (Proxy-Clean / Cid Clean) dilution rate for them to work the best. Properly using any product plays a huge role is how that product will work on your farm!

Both Cid 2000 and Proxy-Clean or Cid Clean are completely safe for your equipment when used at label rates. The fact Cid 2000 only has 20% stabilized peroxide compared to 50% stabilized peroxide like Proxy-Clean or Cid Clean creates a safer and more user friendly product for the end user.

START CLEAN and STAY CLEAN with CID 2000. It is the clear choice for cleaning and maintaining proper water lines.

-Ross Thoreson
Best Veterinary Solutions

BVS Best Veterinary Solutions, Inc
Quality Animal Health and Hygiene

As published in Poultry Advisor

Improving vaccine titers with Original XPC

By Jonathan Broomhead, Ph.D.
Manager, Global Poultry Research and Technical Support
Diamond V

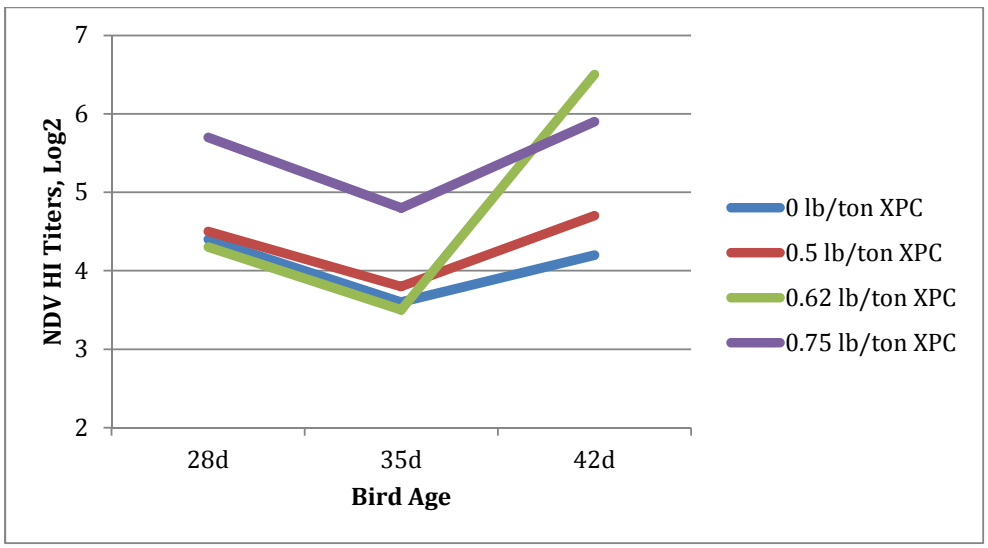
Vaccination is an important step in protecting animals from disease agents such as viruses, parasites, and pathogenic bacteria. The success of a vaccine program relies on several factors, including the timing and efficacy of the vaccine. Serological testing is one of the most common methods to evaluate vaccine antibody response or vaccination efficacy.

Birds that are immunosuppressed prior to vaccination due to underlying factors such as environmental stress, virus exposure, mycotoxin consumption, etc. will be less responsive to a vaccine. These stressed birds will have an adaptive immune system that is not functioning properly. In contrast, young and newly hatched chicks from breeder hens that have high antibodies to a specific disease will have higher maternally transferred antibodies. Vaccinating chicks with the same vaccine, when maternal antibodies are still present, will limit the ability of the chick to develop its own antibody response.

Diamond V Original XPC™ has been shown to balance the immune system by supporting both innate immunity and adaptive immunity. A specific example of how Diamond V's fermentation metabolite products support adaptive immunity has been evaluated by measuring the antibody titer response in broilers given Newcastle disease vaccine (NDV). Newcastle disease is known throughout the world as a respiratory disease that can be devastating in its most virulent form, but may also weaken a bird's defenses when present in subclinical forms. In four different studies, antibody titers were increased in birds fed XPC following NDV. The results of these studies are briefly described below.

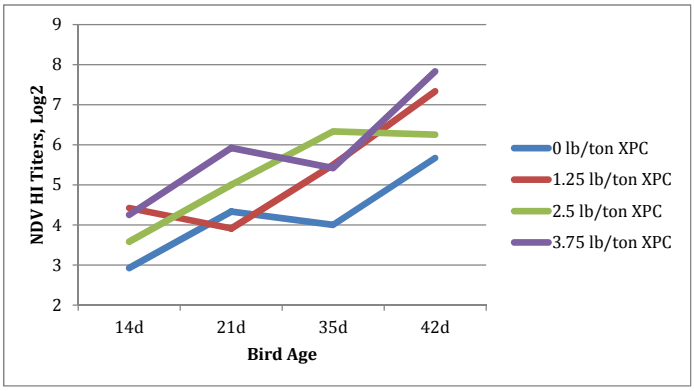
Study 1:
An independent study conducted by university researchers in Saudi Arabia (Fathi et al, 2012) compared three levels of Diamond V fermentation metabolite product (0.5, 0.62 or 0.75 lb/ton XPC#) to a control treatment with no XPC. Ross 308 broilers were vaccinated with Newcastle vaccine (LaSota strain) via the drinking water at 10 and 28 d of age. NDV antibody titers (Hemagglutination inhibition [HI] test1) were measured on three birds per replicate (n=12 birds per treatment) at 28, 35 and 42 d. Results (Figure 1) showed that the higher dose of XPC (0.75 lb/ton) maintained higher NDV titers compared to controls on 28, 35 and 42 d. The recommended dose of XPC in broilers is actually 2.5 lb/ton for starter and 1.25 lb/ton for grower/finisher, so it was not surprising that the highest dose in this study was required to see a consistent response.

Figure 1. Newcastle vaccine titers – Fathi et al, 2012



Study 2:
A research study conducted in China (Gao et al, 2008) also compared the effects of three levels of Diamond V fermentation metabolites (1.25, 2.5 or 3.75 lb/ton XPC*) to a control group with no XPC on several immune parameters. Arbor Acre broilers were vaccinated with Newcastle vaccine (LaSota strain) via eye drop on 7 and 28 d of age. NDV antibody titers (HI test1) were measured on 1 bird per replicate (n=12 birds per treatment) at 14, 21 and 35 d. Results in Figure 2 showed that birds fed XPC had higher NDV titers, particularly after a second vaccination.

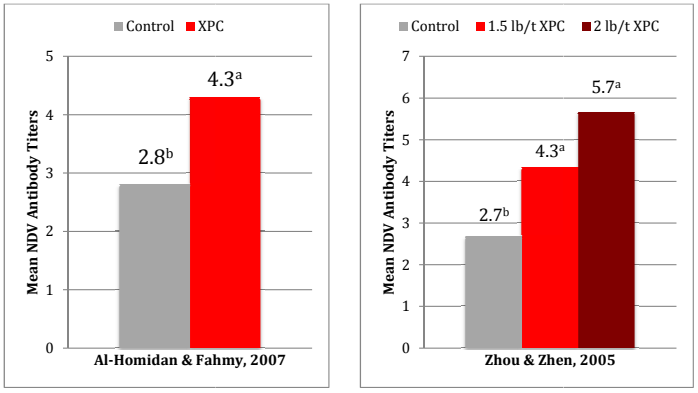
Figure 2. Newcastle vaccine titers – Gao et al, 2008



Study 3:
Another study was reported from Saudi Arabia (Al-Homidan & Fahmy, 2007) that evaluated the effects of feeding Diamond V fermentation metabolites at recommended levels (2.5 or 1.25 lb/ton XPC* during the starter and grower/finisher phases, respectively) on immune and intestinal parameters. Cobb broilers were vaccinated with NDV (type and age was not described in article) and antibody titers were measured on 10 birds per treatment at 21 and 35 d of age (mean titers reported). Results (Figure 3) show that birds fed XPC had significantly higher NDV titers than controls.

Study 4:
A commercial-type research study was conducted by Northeast Agricultural University in China (Zhou & Zhen, 2005; unpublished) evaluating the effect of two levels of Diamond V fermentation metabolites (1.5 or 2.0 lb/ton XPC*) compared to a control group that had no XPC but was given Trisulmix (sulfadiazine; 0.4 ml/L) added to the drinking water. A flock of 60,000 Arbor Acre broilers was divided into 3 treatment groups with 4 replicates of 5,000 birds per each. Broilers were vaccinated with NDV (type and age were not given) then HI1 antibody titers were measured on 2 birds per replicate (n=8 birds per treatment) at 21 and 42 d of age (mean titers reported). Results (Figure 3) show that XPC-fed birds at both levels had significantly higher NDV titers compared to the control treatment.

Figure 3. Newcastle vaccine titers – Al-Homidan & Fahmy, 2007 and Zhou & Zhen, 2005



[ab] *Column with different superscript are significantly different (P < 0.05)*

Conclusions
Feeding Diamond V fermentation metabolites studies, indicating that Original XPC affects increased antibody levels in broilers fed Original XPC protection following vaccination

Literature Cited
Al-Homidan A., and M.O. Fahmy. 2007. The effect of cerevisiae) supplementation on growth performance, carcass chemical analysis, immunity, ileum villi heights, and bacterial counts of broiler chickens. Egypt Poult. Sci. 27:613-623.

Fathi, M. M, S. Al-Mansour, I. Al supplementation on carcass yield and humoral immune response of broiler chicks. Vet. World 5:651-657.

Gao, J., H. J. Zhang, S. H. Yu, S. G. Wu, I. Yoon, J. Quigley, Y. P. Gao, and G. H. Qi. 2008. Effects of yeast culture in broiler diets on performance and immunomodulatory functions. Poult. Sci. 87:1377-1384.

[1] HI methodology: serially dilute blood serum and mix it with red blood cells (RBC) and the appropriate antigen. The HI titer score is determined at the point (dilution level) in which the agglutination of RBC's is no longer inhibited.
XPC equivalents. It was discovered that XP was utilized in the study but fed at or around the XPC suggested rates (as researcher was apparently unaware of the product differentiation).
* XPC equivalents. XP was utilized in study.

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Contains a source of live (Viable) naturally occuring micro-organisms and stabilizing agents to help contain viability of product through administration.

Use Gut Pro to supply naturally occuring micro-organisms to poultry in the first 1 to 5 days of placement, at periods of unusual stress, before and after moving or after therapeutic antibiotic treatment

DIRECTIONS FOR USE:

For starting birds supply one Gut Pro 4 oz. jar per 5,000 birds in first 8 hours of morning drinking water for 3 consecutive days.

For periods of stress, before and after moving or therapeutic antibiotic treatment supply one 4.0 oz. jar of Gut Pro per 5,000 bbirds in first 8 hours of morning drinking water as needed.

Turn off chlorine or water sanitizer and neutralize water system with Vaccine Stabilizer before use of Gut Check.

Make sure the entire watering system and stock solution are free of any anti-microbial agents.

GUARANTEE
11.2 billion CFU/gram total lactic acid producing bacteria
11.2 billion CFU/gram Bacillus cultures

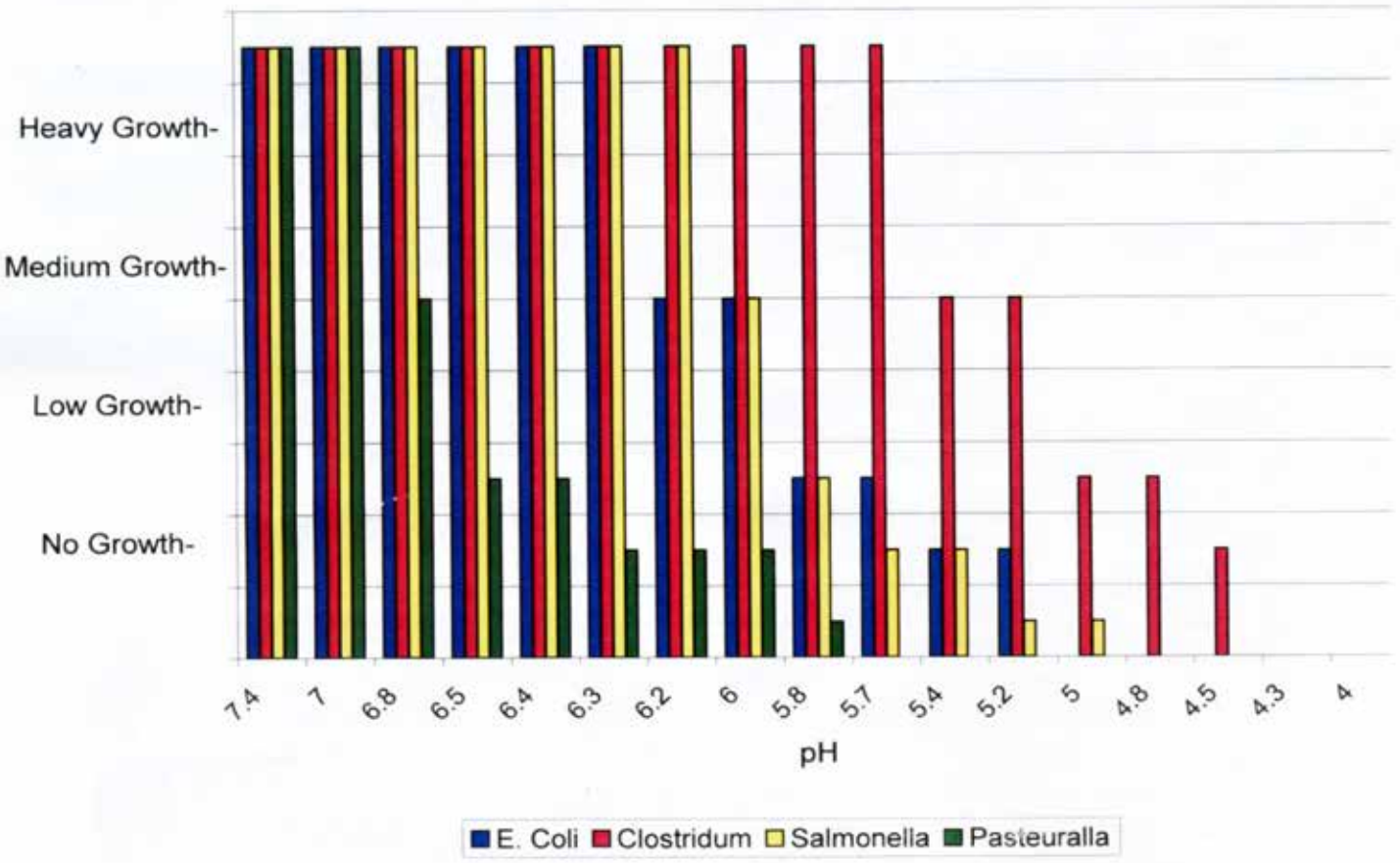
INGREDIENTS: Milk products, sodium thiosulfate, magnesium chloride, gelatin hydrolysate, Enterococcus faecium fermentation product, Lactobacillus casei fermentation product, Lactobacillus acidophilus fermentation product, Lactobacillus plantarum fermentation product and Bacillus subtilis fermentation product and Bacillus licheniformis fermentation product, sucrose

Net Weight: 4.0 oz. (113.4 grams)

Manufactured for:
Best Veterinary Solutions, Inc.
Willmar, MN 56201
Best Veterinary Solutions, The Solution Company

Effects of pH on Selected Bacterial Pathogens Growth in Drinkers

Boyd E. Hardin - C.S. Roney, DVM, MAM



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- Acidic solution
- Corrosive to galvanized and mild steel equipment, piping ..... and/or fittings.
- Wear goggles or full face shield when handling
- For animal use only; not for human consumption
- Keep out of the reach of children

WARNING: ***Follow label directions***

MIXING DIRECTIONS

Standard Dosage - 1:1024 gallons drinking water. Administer 1 part Omegamune-Plus in 1024 parts drinking water. For injectors/proportioners administer 1 oz. stock solution per gallon drinking water. Prepare stock solution by mixing 1 gallon Omegamune-Plus with 7 gallons water.

Optimum Dosage - 1:512 gallons drinking water. Administer 1 part Omegamune-Plus in 512 parts drinking water. For injectors/proportioners administer 1 oz. stock solution per gallon drinking water. Prepare stock solution by mixing 1 gallon Omegamune-Plus with 3 gallons water.

Available in the following packaging:

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5 gallon pails.....(Product # 100810)
55 gallon drums.....(Product # 100820)

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- has a pH of 1.3.
- when mixed at recommended levels will reduce drinking water to pH 3.5-5.5.
- will hold pH down longer than other commercially available acidifiers.
- contains higher levels of copper than other liquid copper products on the market.
- is a dark purple solution that stays in solution without any settling out like that of competitive products.
- fits well into an antibiotic free program.
- works very well to maintain waterlines. Prevents scale build up.
- is friendly to the environment. 40% less copper excreted by using Manage versus feed grade copper.
- Is the only Patented product of its kind!

The Acid Sol® Zone
Dietary Agent for Poultry and Swine

- is considered GRAS (generally recognized as safe).
- has a pH of 1.3.
- when mixed at recommended levels will reduce drinking water to pH 3.5-5.5.
- will hold pH down longer than other commercially available acidifiers.
- is a red solution that stays in solution without any settling out like that of competitive products.
- fits well into an antibiotic free program.
- works very well to maintain waterlines.
- is a combination of buffered acids.
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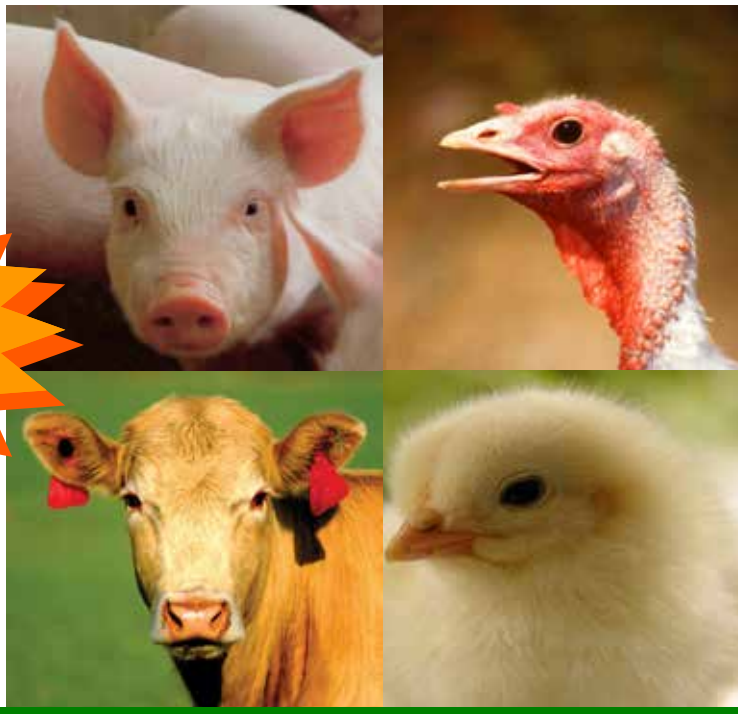

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Effect of CitriStim® in Rearing Pullets and Layers under Commercial Conditions in Spain

ADM Specialty Ingredients (NL) – ADM Alliance Nutrition (USA)
Granja AGAS (ESP) – Andres Pintaluba S.A. (ESP)

Background

A field trial was carried out under commercial conditions in Spain to evaluate the effect of CitriStim on the rearing performance of commercial egg-type pullets. After rearing, the trial was continued as a layer trial to assess the laying performance with and without dietary supplementation of CitriStim. A total of 70,000 pullets were used from one day of age until the trials were completed. The initial one-day-old weight average was 35.9 g. The chicks were placed in several houses in a commercial farm unit on August 14, 2012. Approximately, 20,000 pullets received feed with CitriStim at the following dietary doses:

- 0-6 weeks 1.0 kg/1000 kg
- 7-12 weeks 0.75 kg/1000 kg
- 13-17 weeks 0.5 kg/1000 kg
- 18-34 weeks 0.5 kg/1000 kg (throughout the laying period)

The feed matrix and composition were similar to the common practice in Spain (corn, wheat, soybean meal, vitamins and minerals). The only variable between the two treatments was CitriStim. Non-starch polysaccharides (NSP) enzymes and phytase was included in all rations during the entire trial period. During the rearing trial, bird weights were measured bi-weekly and uniformity was checked against the flock individual weights. The actual results were compared with historical farm data (2005-2012) and the standard growth curve as provided by the primary breeding guidelines. During the laying period (trial), feed consumption, egg production, egg weight and mortality were recorded.

Results

As shown in table 1, CitriStim-fed pullets outperformed historical data for live weight. The pullet results in the first half of the trial were ahead of the standard values given for this breed. Flock uniformity was much better with CitriStim compared with the historical uniformity figures. These two measurements have great impact on the subsequent performance of the flock in the laying house.

During the laying period week 18-34, the comparisons were made between hens in one house receiving CitriStim with hens that did not receive CitriStim in three other layer houses.

	Life Weight (g)			Uniformity (%)	
Week	**CitriStim**	**2005-2012**	**Standard**	**CitriStim**	**2005-2012**
0	35.9	38.2	35	84.2	79.5
2	140.4	123.7	120	64.4	70.9
4	295.4	268.4	250	60.4	68.7
5	346.4	350.6	335	69.4	67.4
7	570.9	565.5	540	75.8	62.3
9	737.6	761.4	750	61.9	75.8
11	953.1	961.8	960	78.5	71.3
13	1144.0	1135.6	1120	83.0	71.5
17	1365.1	1349.9	1400	80.6	73.4

Table 1: Live weight (g) pullets fed CitriStim compared with historical farm and breeder standard data; and uniformity (%) of CitriStim®-fed pullets compared with historical farm data (2005 – 2012).

Table 2 shows mortality and laying percentages during the week 18-34 period. Mortality was significantly lower in the CitriStim group compared with control groups. The average laying rate was remarkably higher for the CitriStim group compared to the non-supplemented groups.

	CitriStim	Control
Mortality (%)	1.79	2.63
Laying Rate (%)	88.1	76.9

Table 2: Mortality and laying percentage of CitriStim®-fed birds vs. control.

Page 2: Effect of CitriStim® in Rearing Pullets and Layers under Commercial Conditions in Spain

Figure 1 shows the weekly laying rates at the peak of lay for the CitriStim-fed birds and the control groups. The peak of lay was reached with the CitriStim group in week 24; however, the peak production occurred at week 27 for the non-CitriStim group. The CitriStim-fed group showed a plateau at a higher laying rate than the non-CitriStim group. This was mirrored in the produced egg mass, which was higher for the CitriStim group (Figure 2).

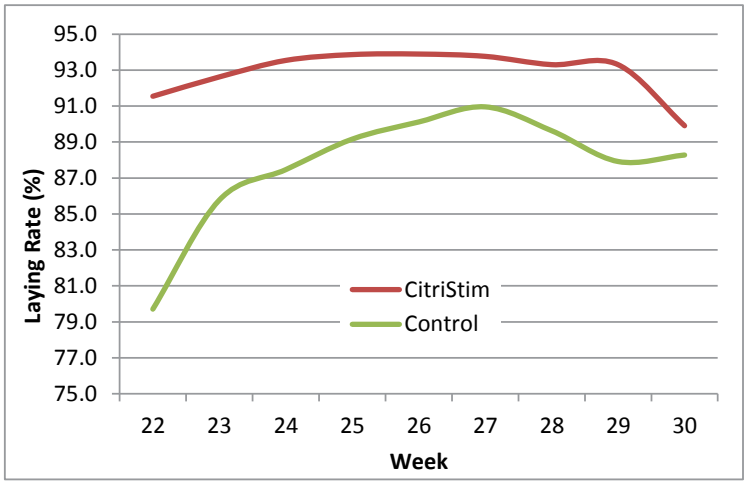

Figure 1: Peak-of-lay curves for CitriStim and control group.

Figure 2 shows egg mass and feed conversion ratio (FCR) during the laying period week 18-34. Egg mass of the CitriStim-fed birds was about 16% higher than the control. Feed intake was also higher in the CitriStim-fed group (112.7 g/d) vs. control groups (average 107.3 g/d). Despite somewhat higher feed intake in the CitriStim group, FCR was better compared with the control group due to the higher egg mass production. Single egg weight (not shown) was not significantly different between treatments.

Discussion and considerations

This trial supports previous findings that CitriStim may divert nutrients from immuno-related tasks to performance related metabolic processes through modulation of the immune system in poultry (Shanmugasundaram and Selvaraj, 2012). In particular, down-regulation of pro-inflammatory (IL-1) and up-regulation of anti-inflammatory (IL-10) cytokines produces a net anti-inflammatory environment at gut level. Other proven effects of CitriStim like specific pathogen binding at gut level act synergistically and may have contributed to the observed results.

Conclusion

- In pullets, CitriStim improved growth and flock uniformity.
- In laying period, CitriStim improved laying rate and reduced mortality.
- During the laying peak period (weeks 22 to 30), CitriStim increased egg mass production and feed efficiency.

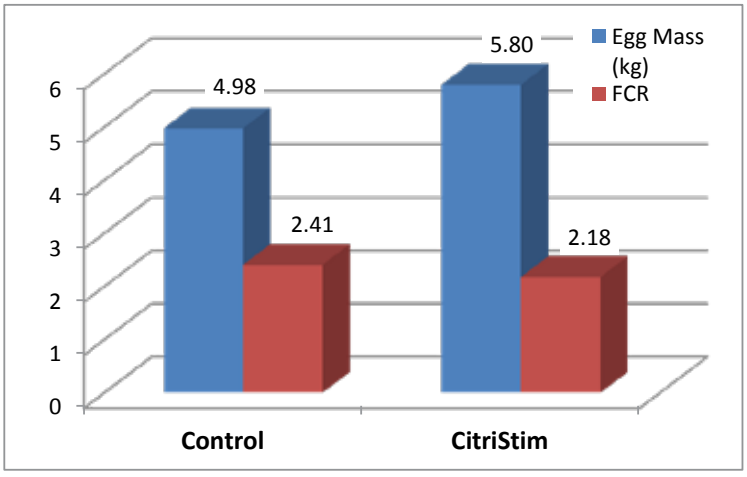

Figure 2: Egg mass and FCR during the laying period (week 18-34).

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Effective cleaning of poultry housing with the use of foam

By Peter Thompson, International division manager, Evans Vanodine PLC, Brierley road, Walton summit, Preston Lancs, WA6 9PF, UK

The poultry industry worldwide has, in the last 10 years, undergone a revolution in the thinking and technology behind the methods of cleaning before disinfection of poultry housing.

Particularly in the case of broilers, parent and grandparent farming, the use of simple high pressure water to remove dust and soiling is now seen as primitive, ineffective and quite simply a high risk procedure.

With the presence of highly pathogenic micro-organisms and viruses increasingly affecting the efficiency of poultry breeding and farming, mortalities of 5% and above simply due to persistent contamination between flocks cannot be tolerated and protection by an effective biosecurity system and now a key objective of modern poultry producers.

Transmission of viruses

During the foot and mouth disease outbreak in the UK in 2004, Defra, the UK Ministry of Agriculture, recorded the phenomenon of the virus transmitting through the air over long distances by water droplets.

It was discovered that this carrier mechanism was due to the use of very high pressure water cleaning machines, employed by the Ministry itself to help disinfect and clean infected farms. Instead the virus, and other pathogens, were being blasted into an aerosol by extreme water pressure; the resulting droplets carrying up to 6 miles from an infected farm.

Evans Vanodine International plc, the British manufacturer of animal health disinfectants and biosecurity systems, carried out tests which indicated micro-organisms from a poultry house could also be cultured from air samples taken up to 0.6 miles downwind from a house in the process of being cleaned with only medium sized pressure washers.

Some years later this process clearly obstructed efforts to eradicate the outbreak of AIV from infected farms with the virus simply moving from one house to another in the overspray, and then back again. It is now acknowledged that this contamination vector will also allow transmission of other dangerous viruses and bacteria.

Evans therefore decided that in order to help the industry, a new approach to cleaning was necessary to resolve this major critical control point in farm biosecurity.

The solution to aerosol transmission of pathogens however is simple: **replace the mechanical energy of the high pressure water washers, by chemical energy in the form of a low pressure detergent system** and prevent the droplets being created in the first place.

Established system

Use of a high foaming detergent for cleaning poultry houses is not new and was being used successfully in the UK in the 1980s and was well established.

Therefore, Evans Vanodine modified its Biosystem 3000 Cleaning and Disinfection auditable operating program to include foam cleaning, to help the industry overcome this issue. The key items required are few; a detergent and a generic foaming lance.

The objective is to apply the detergent to all surfaces of the housing and equipment to soften organic soiling and trap any dust. Because the detergent creates a high density foam in the foaming lance, the nozzle pressure of the water jet is reduced and no droplets are formed.

In addition, the **foam allows very rapid application of the detergent – up to three times faster than simple high pressure water** application and with consequent reduction in water consumption and application time.

After 20 minutes contact time, the foam will collapse onto the building surface and this effectively allows all dust and organic material to be removed using a low pressure rinse, and at no time whilst using the system is a pressure machine with higher than 70-100 bar necessary. Big pressure machines create overspray, damage the housing and simply use more water.

Efficient and effective

Finally, once the now thoroughly cleaned house has been allowed to dry, it can be disinfected using Evans GPC8 full spectrum biocide or a similar high performance product.

The application of a detergent by foam cleaning prior to the disinfection phase has proved to be very efficient and effective in terms of removal of organic material and subsequent improvement in disinfection standards.

Many integrators and poultry cleaning contractors are now using the Evans system and products, it should however be recognized that training in the use of the system is required for it to be fully effective.

Without adequate cleaning, the subsequent disinfection of poorly cleaned buildings is a recipe for disaster and offers no protection in the event of a pathogen entering the house. Contamination of one flock to the next becomes a clear probability.

Foam cleaning using a properly formulated, tested and proven detergent is therefore the ideal way for poultry producers to evade a major source of flock infection and improve efficiency.

Evans Vanodine cleaning and hygiene products are manufactured in the UK, Saudi Arabia and South Africa.

Reprinted from International Poultry Production – Volume 21 Number 5

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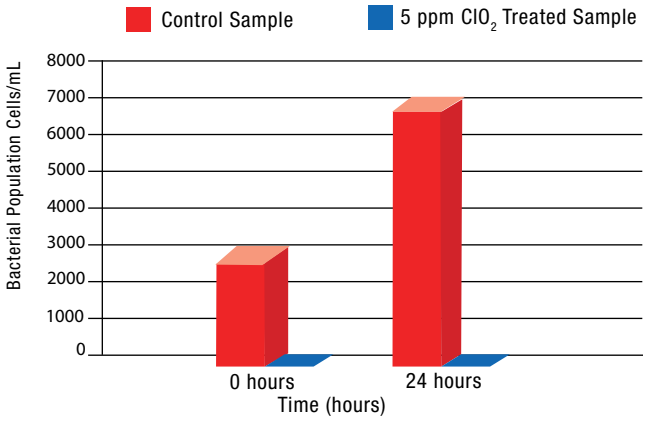
Efficacy of ProOxine® against Biofilm

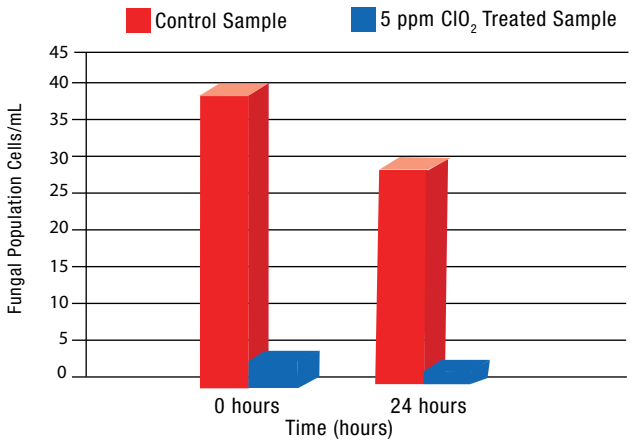
CONTROL EFFECT OF 5 ppm ClO_2 AGAINST BIOFILM BACTERIA

On Bacteria	Control Sample	5 ppm ClO_2 Treated Sample
0 Hour	3000	30
24 Hours	7000	2



CONTROL EFFECT OF 5 ppm ClO_2 AGAINST BIOFILM FUNGI

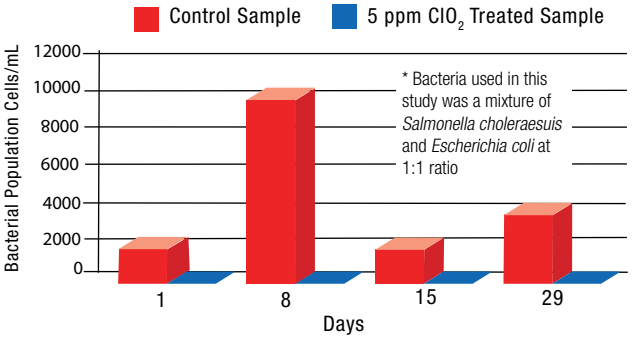
On Fungi	Control Sample	5 ppm ClO_2 Treated Sample
0 Hour	40	4
24 Hours	30	2



Efficacy of ProOxine® against Salmonella and E-coli

REDUCTION OF BACTERIAL POPULATION* IN WATER AFTER CONTACT WITH 5 ppm CHLORINE DIOXIDE

On Bacteria	Control Sample	5 ppm ClO_2 Treated Sample
1 Day	2000	20
8 Days	10000	2
15 Days	2000	2
29 Days	4000	2



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Experience with Coccidiosis Vaccine Use in Turkeys

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Coccidiosis in Turkeys:

- *Eimeria* sp.
  - Single celled parasitic protozoa
  - Fecal-oral transmission
  - Host specific & species specific immunity
  - 8 species of *Eimeria* affect turkeys, but only 4 are considered pathogenic
    - ***Eimeria meleagrimitis, dispersa, gallopavonis, adenoides****, innocua, meleagridis, subrotunda* & *edgari*
- Negative Economic Impact
  - Cost of coccidial control (medication & vaccination)
  - Increased susceptibility to secondary diseases (i.e. nutritional deficiencies; bacterial infections)
  - Morbidity→ decreased performance
    - Impaired growth rate; poor feed conversion; poor pigmentation; lack of uniformity

Diagnosis of Coccidiosis:

- Clinical Signs: diarrhea; depression; dehydration; ruffled feathers; general unthriftiness; loss of appetite; feed passage
- Lesion Scoring→ Not very effective in turkeys because lesions are commonly unremarkable
- Oocyst Counts
  - Intestinal scrapings
  - Fecal flotation
- PCR analysis

Chemicals & Ionophores: Amprolium, Monensin, Lasalocid, Clopidol, Diclazuril, Nitarsone

- Mode of Action:
  - Chemical: complete kill & shutdown of cocci life cycle
  - Ionophores: leakage occurs
- Advantages:
  - Increased growth rates (antimicrobial effects)
  - No post vaccinal "stress"
- Disadvantages
  - Chemical resistance→ severe breaks
  - Demand for natural poultry products (ABF & organic)
  - Sensitivity to ionophore toxicity
  - Delayed cycling may occur when birds are older

Vaccination for Immunity:

- Live virulent/unattenuated vaccines
  - Administration: liquid or gel spray application on the first day of life in hatchery or on the farm
  - Immucox T (*E.meleagrimitis & E. adenoides)*

        - Gel droplet application:
            - Doesn't tend to wet poults
            - Oocysts remain suspended in gel
            - Excellent uptake
    - Coccivac D (*E. meleagrimitis, adenoides, dispersa & gallopavonis)*
        - Currently unavailable in the industry
        - Liquid spray application:
            - Tendency to wet/chill poults
            - Oocysts can settle without agitation
        - Variation in "takes" and/or reactions
- Mode of Action:
    - Initiate immunity by providing the first low level dose of oocysts in a uniform, controlled manner
    - Dependent on re-cycling of oocysts in the field for immunity development
        - Multiple cycles are required for development of immunity
- Advantages:
    - Competitive to costs of chemical/ionophores
    - Vaccine oocysts remain sensitive to chemicals & can replace more resistant field strains
    - Can be used in organic & ABF operations
- Disadvantages:
    - Uniform application/uptake is critical
    - Water spray can wet & chill poults
    - Cycling is heavily dependent on management, as access to feces on farm is mandatory
    - Live virulent strains→ post vaccinal "stress" observed
    - Vaccine availability is at the mercy of the manufacturers/suppliers

Administration Tips:

- Hatchery Application:
    - Vaccine handling & mixing should be performed as per manufacturer's instructions
    - Gel spray should be checked for appropriate quantity & for proper spray pattern in the poult tray
    - Poults should be pulled at appropriate times, as poult fitness affects vaccine uptake
    - Providing extra light is advantageous for enhancing preening of gel droplets
    - Coccidiosis vaccination appears to be most successful if administered as close to the time of poult placement as possible
        - Extended delivery times (> 20 hrs) will negatively affect vaccination success
    - Theory that immediate access to feed & water is key for oocyst cycling in a more functional intestinal tract
        - Grinding action & enzyme release help break down oocysts
- Farm Application:
    - Best with prolonged transit times (> 20 hrs) between hatchery and farm placement
    - May provide improved vaccination, as it is thought that poults are more "fit" to not only consume the vaccine, but also to start the vaccine cycling process, as access to feed and water is immediately available to them post-vaccination
    - The farmer/company can be assured that the vaccine is applied properly vs. hatchery application which may be unknown

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Brooding Tips:

- Litter management during brood
  - Moisture needed for sporulation
  - Extremely low humidity levels <20% delay sporulation
  - Ideal litter moisture 25-35%
    - Controlled by bird density
- Ring Brooding:
  - Start poults off at a maximum of 0.5 ft^2/poult for the first 7d
  - Keep poults at a maximum of 0.75 ft^2/poult from 7-12d
  - Keep poults at a maximum of 1 ft^2/poult from 12-14d
- Whole Room Brooding:
  - Half barn from 0-10d (aim for 0.5 ft^2/poult)
  - Increase area to a maximum of 1 ft^2/poult from 10-14d
  - Release to whole barn after 14d
- Keeping birds at these parameters will help to ensure that there is enough oocyst exposure to provide adequate cycling
- Maintain proper litter moisture levels.
  - Excessive moisture will yield too many oocysts, whereas too little moisture in the barn will yield too few oocysts for proper cycling & immunity
  - Tilling should be avoided

Managing Coccidiosis Vaccine Reaction:

- Signs of poult discomfort & stress include:
  - Vocalization; pacing; unrest; litter consumption; change in fecal/cecal droppings
- Interventions may be necessary to help birds cope with enteric stress
  - Adjust temperature if birds appear cold or feverish (increase temperature 2°F)
  - Some administer anti-inflammatory aids
    - Aspirin in the drinking water
  - Some attempt to stimulate feed intake to help maintain a healthy gut flora by overlaying products over the feed
    - Grit, cracked corn, granular molasses over feed
- Prolonging the administration of enteric vaccines (e.g. HE vaccines) until after peak oocyst cycling helps to avoid adding enteric stress & discomfort
- Oocyst monitoring will help producers identify the cycling pattern in their operation, as well as the species of oocysts cycling in the barns
  - Pooled fecal samples from multiple locations in a house
  - Collected at 7d intervals beginning at 6d
- Use of products with anti-coccidial properties before 14 days is antagonistic
  - Tetracyclines, sulphonomides, essential oils (e.g. oregano), anticoccidials, etc.
- Curbing excessive cycling, however, may be helpful if a "clinical" problem exists in a barn
  - Use of anticoccidials may be helpful, but only at appropriate times, typically after 14d
  - Low levels of chemicals: amprolium; monensin; diclazuril
  - Products containing essential oils such as oregano
  - Administration of antibiotics and/or probiotics may be helpful in situations of dysbacteriosis caused by inflammation & excessive mucous production in the gut

Special thanks goes out to the team at CEVA and at BVS for their contributions to this report.

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For the prevention of early mortality in 1- to 3-day-ol turkey poults cause by *Arizona paracolon* susceptible to gentamicin sulfate.

Advantages:

- Significantly reduces early chick and poult mortality
- Bactericidal at low levels
- Safe for crews to handle
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- Rapid tissue distribution
- Prolonged activity in major organs

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CLINAFARM®-SG

(Smoke Generator) -- Brand of Imazalil (Enilconazole)

Indications

A fungicide used to control Aspergillus organisms and spores on cleaned poultry hatchery facilities and equipment prior to the introduction of eggs, chicks or poults. Clinafarm-SG is part of a comprehensive disinfection program.

Features and Benefits

- Highly effective against Aspergillus spp. organisms and spores
- Especially convenient for hard-to-reach areas such as ventilation systems and between machines and equipment
- Works well in closed rooms, empty setters, hatcher cabinets, store rooms, coolers, egg trucks and chick/poult buses
- Easy to use

CLINAFARM®-EC

Brand of Imazalil (Enilconazole)

Indications

A fungicide used to control Aspergillus organisms and spores on cleaned poultry hatchery facilities and equipment prior to the introduction of eggs, chicks or poults. Clinafarm-EC is part of a comprehensive disinfection program.

Features and Benefits

- Highly effective against Aspergillus spp. organisms and spores
- Compatible with quaternary ammonium compounds, glutaraldehyde and phenolic compounds
- May be applied by fogger or sprayer
- Convenient for use on large surface areas such as walls, floors and ceilings, where wetting is acceptable
- May be used to disinfect empty setters, hatcher cabinets, storerooms, coolers, egg trucks and chick/poult buses
- Convenient tip “N” measure bottle