

BVS Poultry Talk

Best Veterinary Solutions, Inc.

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www.bestvetsolutions.com



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MEETINGS & EVENTS:

National Turkey Federation Annual Convention

February 11-14, 2015

Caribe Hilton | San Juan, Puerto Rico

Midwest Poultry Federation Convention

March 17-19, 2015 • Saint Paul, MN

Iowa Turkey Federation Summer Meeting

June 9-11, 2015

MTGA Summer Conference

June 17-19, 2015 • Chase on the Lake Resort | Walker, MN

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Why Chlorine Dioxide Should be Your Choice for Water Sanitation

Ross Thoreson

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Chlorine Dioxide technology has really taken off over the past couple of years in the poultry industry and has shown to be a great alternative to Chlorine and even stabilized Hydrogen Peroxide for continuous water sanitation. As we have tried to utilize the Chlorine Dioxide technology there are a lot of things we have learned along the way. I still think there are plenty of things to learn about this technology and I certainly don't know all of it but I am going to share some of the things I know about Chlorine Dioxide and why I feel it is the best choice for water sanitation / disinfection on your farm.

I have continuously seen this technology used incorrectly on the farm while growers think they are using Chlorine Dioxide they truly are not. There are a lot of different opinions on how to administer this technology correctly. I am going to go over some of the things I have seen on the farm and how to properly use Chlorine Dioxide that I have seen work better than most alternatives.

There are a lot of reasons why people have started to use Chlorine Dioxide (disclaimer: I will continue to refer to Chlorine Dioxide as CLO2 for the rest of this article) as their choice for water sanitation. CLO2 is chemically quite different from Chlorine. CLO2 only has 2/3 the oxidation potential of Chlorine or stabilized Hydrogen Peroxide but it has 2.5 times more oxidation capacity compared to both of those chemicals. CLO2 is NOT pH dependent like Chlorine and can disinfect your water from a pH of 2 to 10. It is far less corrosive on equipment compared to Chlorine. CLO2 can work on and eliminate biofilm, take out sulfur odors and helps eliminate mineral build up and filtering / removing iron out of your water becomes more effective. The biggest reason why CLO2 has become more popular is *most* products on the market are EPA registered and have claims to 'disinfect water supply for poultry, swine, cattle and other livestock'. Most chlorine products are not EPA registered to run with poultry present and **NO** stabilized hydrogen peroxide product is EPA registered to run with animals present on a continuous basis to disinfect the water supply.

Most CLO2 products on the market are purchased in the Sodium Chlorite form and are not actually Chlorine Dioxide. This is very important to understand

continued on page 3

BVS

has manufactured, branded
and private-labeled water
soluble vitamins and
nutritional supplements!

MANAGE[®]

Get into the Manage Zone
Contains Buffered Acids
Plus Copper.

Omegamune[®]

Omegamune[®] Plus

Omegamune[®] GutPro

Omegamune[®] GutStart

Acid SOL

Water acidifier without copper

Starter Pak

*New improved highly concentrated
vitamins with citric acid*

Vita Pak[®]

*Highly concentrated vitamins
& electrolytes*

Solulyte

Balanced Electrolytes

Organic Iodine

Vitamin E

Dry Cider Vinegar

Citric Acid 410

Acidified Copper

Vitamin B Complex

Poultry Talk

Off to a new year... 2014 flew by! As I write this, January is almost over... As I get older it seems like time goes by faster than ever!

2014 was a great year for the broiler, turkey, and commercial egg people! I hope that, that will continue as we face continued lower feed and energy costs, but there is uncertainty around the world in regards to trade i.e. China, Russia, and other countries as we face a world with much instability around the globe. We live in a time that we need to adapt to the change and demands on our businesses all of the time. Your customers are demanding more ABF, NAU, and organically produced poultry products.

As an animal health supplier we are working hard to vet new products for ABF, NAU, and organic production that have good science to help you produce healthy turkeys and chickens. As a result of these demands on our business we are happy to announce the addition of Dr. Bob Owen to our staff as Director of Technical Services. Dr. Owen comes to us with a wealth of knowledge and experience.

Dr. Owen will be spending 50% of his time through BVS as the

veterinarian for VPGC. The remaining 50% of his time will be spent working with our broiler and turkey customers in the Shenandoah Valley, Central PA, and the Delmarva Shore and helping us vet new products for ABF, NAU, and organic production. We plan on keeping Dr. Owen very busy with research projects and helping our customers to understand how to use these products and where they fit into their programs. At the end of the day it comes down to producing healthy animals!

We are soon approaching the MPF Show, which will once again be held at the St. River Center in St. Paul, MN. The dates are March 17 - 19. We look forward to seeing you there! Please stop by and visit us at our booth. Also, make plans to visit us on the 22nd floor of the Crowne Plaza in Downtown St. Paul for our hospitality night, starting at 5:00 - 8:30 p.m.. Following our event the MPF/MTGA will be taking over our space to host their hospitality event for the remainder of the evening.

Till next time and God Bless,
Randy



Visit us at: www.bestvetsolutions.com

Chlorine Dioxide for Water Sanitation, *continued from cover*

when trying to utilize these products to their fullest potential. Depending on the percentage of CLO₂ you buy will depend on what percentage of Sodium Chlorite is in the jug or drum. If you buy a 'stabilized' 5% Chlorine Dioxide product (Pro Oxine, Anthium Dioxide, MaxKlor), you are actually getting a 8.35% Sodium Chlorite product in that jug or drum. If you buy a 2% CLO₂ product (Oxine), you are actually getting a 3.35% Sodium Chlorite in that jug or drum. It is essentially a 1.67 multiplier from the percentage of CLO₂ that product claims.

Sodium Chlorite is widely used as a sanitizer and can be effective at inhibiting bacteria. It is important to know that chlorite solutions can carry anti-microbial claims listed as static or stasis by the EPA. That means chlorite solutions can inhibit or prevent bacteria growth of present organisms. It is also important to know that Sodium Chlorite solutions are NOT Chlorine Dioxide. If you use the product straight from the jug without 'activating' the product you are using Sodium Chlorite technology NOT Chlorine Dioxide. In order for the product to become biocidal and make disinfecting and sterile claims you have to show efficacy with activated product. Activated product is the process of taking the Sodium Chlorite solution and changing some of that chemistry to Chlorine Dioxide. The 'activation' step is the part of CLO₂ I believe gets misunderstood the most when working with these products and generally results in no activation taking place or needing to run the product over label usage rates to achieve some activation to generate CLO₂.

There are many ways the EPA allows Sodium Chlorite to be 'activated' to CLO₂. The most common and effective 'activator' that is used to convert chlorite to CLO₂ is generally a single acid product like Lph 100 which is FDA & USDA approved and is safe for well and ground water (LpH 100 has a trade name of Acidic Calcium Sulfate) or some kind of liquid inorganic acid. You can also use Citric Acid (liquid or dry) and that can be effective but we have found the liquid inorganic acids like LpH 100 work best and allow for less acid to be used with higher conversion to CLO₂.

When working with Sodium Chlorite solutions and using an acid as your 'activator' it is important to understand that there are TWO dynamics that determine the percentage of conversion you achieve from Sodium Chlorite to CLO₂. Contact time with your acid or 'activator' and pH of the working solution your acid is creating. Those two dynamics will determine how much Chlorine Dioxide you actually generate. If you do not allow enough contact time with your 'activator' and the pH of the solution is not low enough you will get little to no activation generating no biocidal activity in your water. If you do not have biocidal activity you are not truly 'disinfecting' your water supply as per the label statement.

Simply mixing the two components together without adequate "dwell time" for activation results in little to no CLO₂ being generated. The common practice of injecting the acid or activator through one pump and injecting the chlorite solution through another pump and introducing the two products in the water line is grossly inadequate for allowing the proper activation time to convert the solution to a preferred % of CLO₂. Mixing the chlorite solution and acid into a 'T' station before entering the water system has shown to work in some cases at generating CLO₂ but is very inconsistent and takes a tremendous amount

of acid to generate some or if any CLO₂. The times you are able to generate CLO₂ your total working solution is generally much higher than what label usage rates allow or you need to use so much acid (2 or 3 parts acid for every 1 part of chlorite) it burns off all the 'TOTAL' solution only leaving some residual 'FREE' which makes the overall product not as stable to be effective in water lines from injection point to the end of your water line. Remember these are EPA registered products and running them at label usage rates is very important to follow.

When using 5% stabilized CLO₂ products like Pro Oxine after you achieve proper activation you will convert about 25% to 30% of that solution to CLO₂. 70 to 75% of that solution will remain chlorite and be a part of your TOTAL working solution. The remaining sodium chlorite is important and will play a critical role in how well your product works over time. Only converting 25% of your overall solution to CLO₂ is NOT a bad thing. The TOTAL working solution only tells you how much 'potential' active solution you could have. Your TOTAL solution in truly only telling you how many ppm's of sodium chlorite you have in the water. When you see the label on these products that tell you to run up to 5 ppm of total solution that is telling you nothing in terms of FREE CLO₂ (activated product) and is referring to total sodium chlorite solutions. Most labels allow up to 5 ppm of total working solution and out of that working solution you want to generate around 1 ppm of FREE CLO₂. Being able to measure some FREE CLO₂ in your water is the most important part of utilizing CLO₂ technology properly. However it is important to have a good working solution ratio between TOTAL and FREE. The TOTAL solution plays a key role in allowing the product to stay stable and effective from the injection point to the end of your water line which is key for a good water sanitation program. Plus having a good TOTAL solution will allow for some sanitation in your water lines when using other supportive care products that may neutralize the FREE component of your solution which I will explain later.

It is also important to note there is a difference in 'tech' grade chlorite products compared to in house generated chlorite solutions like Pro Oxine. Bio-Cide who is the manufacturer of Pro Oxine is able to manufacture formulations that are of very high purity through an in house patented process. This expertise in manufacturing also makes BCI one of the only chlorine dioxide producers whose products are FDA approved for human pharmaceutical use. Other 'manufacturers' of 5% chlorine dioxide products buy their chlorite solutions from other manufacturers to make their 5% chlorine dioxide products. Biocide generates in house chlorite solutions and then makes their own 5% chlorine dioxide product. Simply put 'tech' grade chlorites use different buffers and stabilizers to generate their chlorite solution making it more difficult to properly activate and generally needing a more aggressive acid and more total acid to achieve activation. Pro Oxine's product is buffered to an 8 to 8.5 pH solution while most tech grade products are buffered between a 9 to 10 pH solution, therefore the higher pKa acids perform poorly with tech grade chlorites. That is why you generally need more chlorite and more acid to generate FREE CLO₂ with tech grade chlorites. Remember the two dynamics: Contact time and pH of your working solution. You want your working solution to generally

continued on page 4

Chlorine Dioxide, *cont. from pg. 3*

be around 2 to 2.5 pH for it to be effective at generating FREE CLO₂. One can simply look at the products labels to see the difference. With tech grade chlorites it calls for at least 15 minutes of contact with your acid or 'activator' before being administered into the water system. With Pro Oxine it calls for 10 minutes of contact time before being administered into the water system. This means it was able to generate the FREE component of the solution (actual CLO₂) quicker. Pro Oxine was also able to get a FREE component at a lower TOTAL solution. Pro Oxines label shows it was effective at 3 ppm while tech grade chlorites show they were effective up to 5 ppm TOTAL solution to generate any biocidal or FREE activity. Remember you need the FREE component to generate any disinfecting properties in your water system. If you have 5 ppm TOTAL solution with no FREE activity you are essentially just running chlorite solution and not CLO₂.

PROPER ACTIVATION IS THE KEY:

Unfortunately there are no perfect products and every product does have some draw backs. On farm activation (generating CLO₂ from Sodium Chlorite) as mentioned earlier has seemed to be the biggest hurdle in using CLO₂ properly and effectively and is the biggest issue when trying to use CLO₂ technology. To achieve enough 'dwell' time and pH in your solution you can manually mix the two products together but this creates a very unfriendly environment for the users due to the CLO₂ gas that is created when activating the product. Bio-Cide International has come up with a very user friendly way of properly activating the solution before entering the water system that does not require manual mixing. Bio-Cide's AANE system which stands for Automatic Activation Non Electric is a government patented system to deliver product without ever having to mix products but allows for proper contact time and pH in your working solution to generate FREE CLO₂ in your water system. The system is very easy to set up and can be used with any pump system you already have on your farm including a 1:128 medicator. We generally recommend using a Stenner pump system with a Flow Meter pulsing to the pump. Having the pump run off the flow meter allows for consistent amounts of product being injected into the water system and using a Stenner pump allows you to adjust the amount of product being injected into the water system. Each farm has different water so that will determine the amount of total solution required to achieve free CLO₂ in your water system. We have been able to get consistent FREE CLO₂ readings of up to 1 to 1.25 ppm FREE CLO₂ while only having 3 to 4 ppm TOTAL solution. This system allows for very little acid being used to generate CLO₂ and requires fewer product to be used to achieve desired results. Below is a picture of an AANE system set up on a farm with a Stenner pump and flow meter.

I have found that a 'T' system or introducing the acid and chlorite solution directly into the water line does not allow for consistent TOTAL and FREE readings. Sometimes it requires TOTAL solutions up to 10 or 15 ppm to achieve any FREE in your water line and most times you do not get any FREE readings at all. If you do get FREE readings it usually requires 5 to 6 times the amount of acid required to achieve any FREE

levels in your water. These systems make it very difficult to manage your conversion on a consistent basis.

When testing for ppm levels you can use 3 different things. Test strips: Remember most test strips will only tell you what your TOTAL solution is in the water. Test strips are not good to test for FREE CLO₂. They are essentially testing the Sodium Chlorite solution in your water. Reagent Test Kit: Test kits can test for both TOTAL and FREE but are generally not very accurate for testing the levels of FREE we are looking for on the farm. Spectrophotometer: These are the best for testing FREE CLO₂ levels in your water. They can accurately test levels of FREE from .05 to 5 ppm. I recommend at least 1 ppm FREE and 3 to 4 TOTAL. Some EPA registered products like Pro Oxine also have potable drinking water claims on their label. Meaning it is safe and allowed for human drinking water as well. The levels allowed for human drinking water are different then what is allowed for poultry or livestock drinking water. The potable water claim on Pro Oxine is up to .8 ppm FREE with a residual of up to 1 ppm chlorite solution. So you can essentially have 1.8 ppm TOTAL and .8 ppm FREE under the potable water claim approved by the EPA. The potable water claims are very tricky to understand but if you have a system on your farm that also connects to human drinking water you need to make sure that the water being used for human consumption falls under the potable water usage amounts. Pro Oxine and other products also have NSF clearance and approvals for potable water of up to 10 ppm TOTAL solution. However it is my understanding that any EPA claim or clearance on the products label would trump the NSF clearance or claim for that product.

THE BEST THING ABOUT CLO₂ FOR POULTRY GROWERS:

One of the biggest reason I like CLO₂ technology over other products is because of CLO₂'s ability to be a 'selective' oxidizer when working in your water system. As I mentioned earlier CLO₂ has 2.5 times the oxidation capacity compared to Chlorine or stabilized Hydrogen Peroxide. The reason CLO₂ has 2.5 times the capacity is because CLO₂ is a 'selective' oxidizer meaning it is not greatly affected by 'organic matter' or other containments in the water which allows it to be useful at much lower ppm's or dilutions in your water system. CLO₂ can generally be effective at 5 ppm TOTAL and 1 ppm FREE residual activity in your water. Hydrogen Peroxide will oxidize a wide spectrum of substances in your water line which will not always be beneficial and thus Hydrogen Peroxide generally needs to be run between 25 to 50 ppm residual activity for it to be effective. Because Hydrogen Peroxide oxidizes a wide spectrum of substances in water it is generally not recommended to run any other product if you are using Hydrogen Peroxide as your continuous sanitizer. If you want to run Vitamin D for example while using Hydrogen Peroxide the peroxide will most likely oxidize out the active ingredients in the Vitamin D before getting to the bird rendering the product useless. The same is true for a lot of other products. That is why you most likely see reactions and plugged lines or nipple drinkers if you run Hydrogen Peroxide with other products. Because you have to run higher ppm levels with Hydrogen Peroxide, the peroxide will oxidize those products creating an unfavorable environment in your water system and plug drinking lines. So if you want to run those supportive care products, which most growers like to do from time to time, you need to turn off your water sanitation to run those products. This will then compromise your water system by allowing biofilm and other bacteria to grow and thrive in your lines

which will then likely compromise bird health down the road. It has been documented that leaving your water sanitation off for 12 to 24 hours can create an environment for biofilm and bacteria to thrive and grow in your water system. This is also true for Chlorine / Acid, one or both needs to be turned off to run other supportive care products or water soluble antibiotics which negatively affect your overall water sanitation program. I think it has been well documented that a consistent water sanitation program is one of the best things a poultry grower can do to achieve better overall performance. Using stabilized Hydrogen Peroxide or Chlorine doesn't allow you to achieve that consistent program.

When utilizing the CLO2 technology you never have to turn off your system to run other supportive care products or water soluble antibiotics. Since CLO2 is a 'selective' oxidizer it doesn't seem to negatively affect these other products because CLO2 can be effective at much lower ppm levels and the other products don't negatively affect the TOTAL solution of the CLO2. I have documented TOTAL and FREE solutions in grower's water lines while they are running other supportive care products with CLO2. I have found that some products like penicillin or Biosupreme L will affect the FREE readings and I have found that some products like Manage, LC Energy or a vitamin pack do not affect FREE readings. Having said that I have not found a product that will affect the TOTAL solution to a point where you don't have some sanitation properties in your water line while using those products which is the key. Although the FREE component will be negated when using some products, which again means no biocidal activity, you still will have a TOTAL reading (sodium chlorite) which means you have some anti-microbial or static activity while you are using those products. This at least gives preventative sanitation properties while using soluble products through water line administration which is much better than other products like hydrogen peroxide or chlorine since you have to completely turn them off to run most of these supportive care products. Also as mentioned earlier the TOTAL and FREE components of the solution will *not* affect the efficacy of soluble antibiotics or supportive care product unlike stabilized hydrogen peroxide or a chlorine / acid administration. The **ONLY** time you need to turn off your CLO2 system is when you want to vaccinate or run a probiotic. It is still necessary to turn off your system when using a live organism like a vaccine through your water system. However, with the advancements in vaccine stabilizer technology it should allow you to have your CLO2 system off for no more than 12 hours to run these types of products. This to me is a HUGE advantage of CLO2 over other water sanitizers and something that gives the growers more freedom without compromising their water system. In a perfect world a grower would never have to run a supportive care product or a soluble antibiotic in the water line however from time to time stuff happens. Utilizing CLO2 as your water line sanitizer allows you to use those products and not compromise your water system to the point you are creating more problems than you are trying to solve. When using other supportive care products never mix them in the same solution or bucket with your chlorite and acid solutions. Always run the products through a separate pump or medicator.

The fact that you can consistently run your CLO2 system while utilizing other supportive care products is one of the best things that has happened to a poultry grower in a long time. One of the biggest challenges for growers is to keep their water sanitation program consistent and keep it running from start to finish. The AANE system allows for growers to set up a water sanitation system that utilizes the CLO2 technology properly and

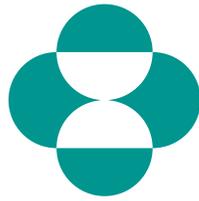
keeps it simple for them to use on their farm from START to FINISH which is the key to any water sanitation program. As I mentioned at length in this article there is a lot to understand about CLO2 and how to properly use those types of products. We are all still learning and as time goes I am sure more will change with these types of products. I do know that the key to using ANY CLO2 technology is **MANAGING** your percentage of conversion from chlorite to chlorine dioxide. If you can properly manage those two dynamics you will have consistent results and success with CLO2.

It is kind of like Apple's technology, just wait 6 months and something new or different is on the market. I know reading this article may have probably made things more confusing but there are people that can help. Contact your local BVS representative and they can help sort through the difficulties of understanding CLO2 and how to best utilize its technology. As I have worked with this technology and have seen first-hand what it can do for growers overall performance including helping with respiratory diseases and improving their overall water sanitation program, there is no doubt that CLO2 is the best option for any poultry grower. As time goes I know we will continue to find ways to better utilize this technology on the farm.

*Example of the AANE system set up on a farm using a Stenner pump. Note: Only one Stenner pump is necessary and being used with this system. They had two set up because the farm was using Chlorine and an acid before Pro Oxine.

The AANE system has a 15 gallon tank that acts as the holding tank allowing for proper activation before entering the water system. The AANE set up has two 'floats' in the tank that allows you to determine how much solution you want mixed up at one time. Once the solution gets to a low enough point, the system automatically kicks on mixing fresh water through the hose attachment, Pro Oxine and LpH 100 or the acid. Once it mixes enough product, which is determined during set up, it will stop and that solution will sit and 'activate' before entering the water system. The Stenner pump tube put down into the 15 gallon tank and based on settings and water flow will inject the activated solution into your water line. Once the solution is mixed it can work off that solution for 3 or 4 days depending on water consumption and usage on that farm. Most growers will set this up at a point that will treat the entire farm or complex so only one system is necessary. Once the system is set you never have to mix or touch the system again. You only have to replace the empty jugs when necessary. ●





MERCK

Animal Health

INNOVAX®-ND

TSP-V-048278 2000 dose ampules
TSP-V-116951 4000 dose ampules

Marek's Disease - Newcastle Disease Vaccine (Serotype 3, Live Virus, Live Marek's Disease Vector)

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

TSP-V-066953 1000 dose units

Newcastle Disease Vaccine (B₁ Type, clone-selected LaSota Strain) (Live Virus, Chicken Embryo Origin)

Newcastle Cloned N-79 is a live virus vaccine of chicken embryo origin containing a clone-selected B₁ 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:

- Clone-selected LaSota strain stimulates strong immunity against Newcastle disease, while producing only mild reactions
- Product of choice for immunization of turkeys against Newcastle disease
- May be used to revaccinate broilers



ORALVAX-HE®

TSP-V-065396 5 x 2000 dose vials
TSP-V-065398 5 x 5000 dose vials

Hemorrhagic Enteritis Vaccine (Live Virus)

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 hemorrhagic enteritis.

Advantages:

- Safe and efficacious: produced with a stable and avirulent strain of type II avian adenovirus of pheasant origin
- Produced under federal quality control standards, ensuring purity and sterility
- Consistent high potency titers to ensure 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

(B₁, Type, C2 Strain, Live Virus)

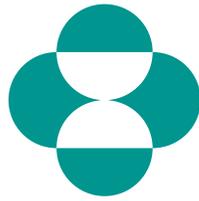
NEWHATCH-C2® is the patented, virtually nonreactive C2 strain of B₁ Type Newcastle disease (ND) virus. It is a lyophilized vaccine approved for spray vaccination of chickens one day-of-age or older for protection against Newcastle disease.

Advantages:

- Effective against field challenge of Newcastle disease virus
- C2 strain of B₁, 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



MERCK
Animal Health



MERCK

Animal Health

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 has 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 occurring 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.*



MERCK
Animal Health

Solutions for Organic Production

Acidifiers:

BVS Citric Acid
BVS Liquid Citric Acid
BVS Acidified Copper Sulfate

Essential Oils:

Biosupreme® L
Biosupreme® Organic Feed Grade
EnviroSupreme Green

Cleaners/Disinfectants:

Keno™ X5
Keno™san
Pro Oxine®
Gil-O-Fact II

Supportive Care:

AviCare™
XPC™ Green
CitrisStim®
Hilyses™
Aspirin (Liquid or Dry)
Mucosol®
BVS Vitamin D3 Liquid
BVS Poult Start
BVS Vitamin EKA + D3
BVS Sol-U-K
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Ceva Leading the Way in Technology Vaccine Development

Dr. Kristi Moore Dorsey, Ceva Biomune's Vice President of Research and Development, has been working to raise awareness and understanding about new technology vaccine development and the exciting future it offers.

“Molecular technology and next generation sequencing has come a long way and its progress will only increase in the next ten years,” said Moore Dorsey. “Adjuvants are also becoming more and more important thanks to new technology.”

There are three major components that are responsible for driving the advancement of new technology vaccine development.

Vaccine Design

New vaccine design and reverse vaccinology has been made possible by next generation sequencing. The process starts with RNA/DNA of the virus/bacteria (instead of living virus/bacteria) and uses high throughput techniques to sequence, compare and identify antigens. Prior to 2005, it took an entire year to sequence the salmonella genome. Now, it only takes a matter of days to sequence the genome.

Adjuvants and Delivery Systems

An adjuvant may be added to the vaccine and enhance the efficacy of the vaccine. They allow the antigens in a vaccine to stimulate a response in the immune system. New technologies have allowed us to target specific arms of the immune system (B cell, T cell, or innate immunity).

The delivery systems available to

transport antigens into the vaccinee were limited to oil based emulsions, water based emulsions, and aluminum salts. New technology development has allowed liposomes, toll-like receptor ligands, cytokines, pathogen-associated molecular patterns, and CpG sites to be used as adjuvants which optimize the efficacy of the vaccines.

A recent development by Ceva, Imuvant™ DUO, is a dual-adjuvant technology created by combining water in oil in water (WOW) and aluminum hydroxide. The aluminum hydroxide provides a quick immune response, while the WOW provides a slow release of antigen, sustaining the immune response.

Evolving to Improve Efficacy

In the past, only live attenuated and inactivated vaccines were used to protect against disease. Now, new technology vaccine development has opened the door for more effective vaccines to be administered.

Vectored vaccines have proven to be safer than live attenuated vaccines. They are being used in recombinant platforms to and are able to stimulate the desired response from the immune system. Subunit, universal, and DNA vaccines have all become new vaccine options.

Subunit vaccines work by taking an antigen/protein from the targeted virus and placing it into an expression system such as a baculovirus. The antigen is then extracted from the expression system and introduced as a vaccine.

Universal vaccines have been used to combat different types of avian influenza. Vectormune AI was proven to be effective against multiple H5 strains of avian influenza throughout the world.

DNA vaccines feature a gene inserted into bacterial plasmid DNA and mass-produced in *E. coli*, purified and then inoculated into the vaccinee. Enhancement of DNA vaccines with liposomes have reduced to inoculating dose so that it is possible for vaccine companies to produce and make a profit.

Ceva is one of the first companies to achieve market success with recombinant vaccines. Biotechnology has allowed Ceva to develop new technology vaccines to effectively combat zoonotic diseases such as salmonella and avian influenza and many more that can threaten the human population. ●

Coming soon. Additional details about how technology is used in vaccine production

October 2014





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- 2 **SAFE:** Does not cause bursal damage¹.
- 3 **EFFECTIVE:** Provides broad-spectrum protection against IBD and MD².
- 4 **EASY TO ADMINISTER:** Administered in ovo or subcutaneously in the hatchery.
- 5 **CONVENIENT:** Single hatchery vaccination eliminates field vaccination.
- 6 **RELIABLE:** Highest quality product and support from the leading MD vaccine manufacturer.

1 Merial Study ID-12446, data on file
2 Merial Studies #0-MD-04-07, #0-MD-05-06, #0-MD-06-08, #0-MD-07-06, #0-MD-10-06, #0-MD-11-06, #0-MD-12-06, #0-MD-13-06, #0-MD-04-06, #0-MD-05-06, 02-319, data on file



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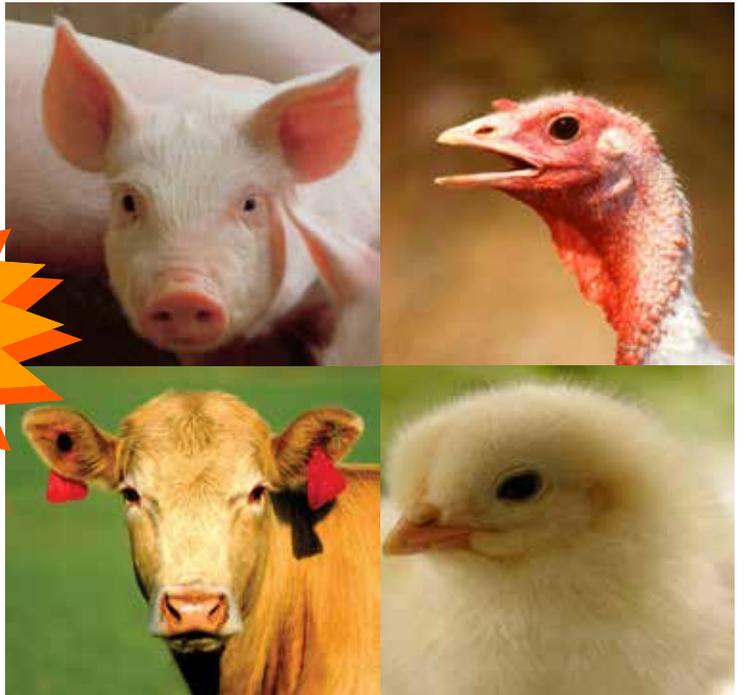
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Keeping the hatchery clean and disinfected

By Colin Russell, Consultant Microbiologist, Aviagen, UK

A hatchery is the very earliest stage in chickens' lives. Each type of contamination in this environment is a true threat to their health status. Hence, proper hygiene, disinfection and permanent monitoring in the hatchery are of paramount importance for an upcoming healthy flock.



While hatcheries have been in use within the poultry industry for many years, growing in size and complexity, many of the issues relating to hatchery hygiene have not changed. Our greater understanding of cause and effect and our ability to identify monitor and control disease causing agents has given us more robust methods to protect our chicks from infection but at the same time more challenges to overcome. Periodically even the best hatcheries will suffer from depressed hatch, higher first week mortality and a general reduction in chick quality. It is often attributed to 'E coli', 'Pseudomonas' or another microorganism used as a generic term for the condition. Post mortems of first week mortalities or culls often result in isolation of the above species and others from conditions such as omphalitis/yolk sac infection and inflamed/infected hock joints.

The first environment in a chicks life

If we consider the conditions we use in a laboratory to isolate these organisms and scale these up we have the same conditions as hatchers and setters provide, so perhaps

the isolation of these organisms should not be a surprise. The real question should be, how do we prevent contamination of the hatchery initially, and how can we achieve microbiological control and prevent infection of the day old chick. Some of these microorganisms are of course true poultry pathogens: *Aspergillus fumigatus*, for instance, which will cause extensive lung infection and associated poor growth rate and high mortality in the day old chicks. Others, such as *E coli*, can act as a true pathogen but generally act as an opportunist pathogen. These organisms may infect the chick because they are present and are able to do so, not because they are obligate pathogens and need to colonise the chick to survive.

Hygiene programs

The growth of microorganisms can be represented graphically (Figure 1). This shows that bacteria in particular can multiply quickly with short generation times which, if unlimited, can result in one bacterium becoming over two million within seven hours. Obviously this growth rate does not normally occur outside the laboratory as growth conditions and nutrients are limiting, but a dirty hatchery following a hatch gives a good habitat for bacterial growth with adequate levels of moisture and nutrients in the form of chick fluff, egg debris, and other organic material. If left uncleaned, these areas provide a source for further colonisation of hatchery air, water and drainage systems. For this reason hatcheries should be cleaned immediately after the hatch day using a proven hygiene programme which is monitored to prove efficacy. It is important that the hygiene programme is tailored to the structure of the hatchery. A modern hatchery, constructed from composite panels, can withstand a much more aggressive hygiene programme with much more effective and aggressive chemicals, than an old hatchery constructed of wood and fibreboard. Electrical installations should also be

Figure 1 - The bacterial growth curve.

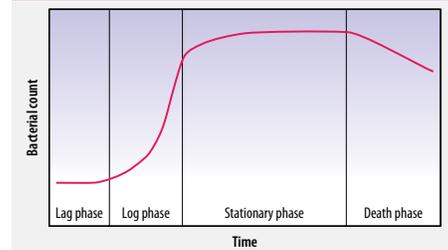


Figure 2 - Differences between results before and after cleaning.

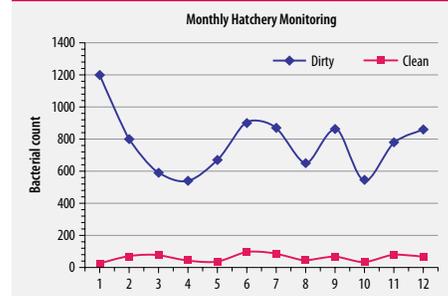


Table 1 - An example of a basic hatchery monitoring programme.

Area	Sample types	Rational
Surface counts – walls and equipment	Swabs – both before and after cleaning	Hygiene programme efficacy – establish levels of contamination at the end of a hatch day for comparison to post cleaning results (Figure 2)
Drains	Swab	Specific analysis of particular challenges e.g. Salmonella
Air counts	Settle plates or air samplers	Monitor – Bacteria – Moulds e.g. <i>Aspergillus</i> species – Measure of filtration efficiency
Incoming water Recycled water Machine water	Water samples	Prevention of pathogen distribution Water treatment efficiency Monitoring of risk points

considered as some caustic cleaners can make conduits, cables and switches brittle over time.

Effectiveness of disinfectant

Similarly, the hatchery equipment should be regarded as a factor when selecting cleaning chemicals, as stainless steel gives much more chemical option than aluminum (no chlorine!) where chemical-induced corrosion can be rapid and severe. Once suitable chemicals have been selected for the hatchery structure, consideration should be also be given to the compatibility of the chemicals; for example, the detergent should be compatible with

the disinfectant, as there is the risk that an incompatible chemical nature of the detergent can 'knock out' the effectiveness of the disinfectant. In general, most hatcheries benefit from a three stage hygiene programme: Wash down, detergent application and sanitizer application. This can be detailed as follows:

- Wash down (remove organic debris)
- Detergent application (emulsify the remaining organic debris making it more readily removed)
- Rinse (remove any remaining debris)
- Let dry
- Disinfect surfaces
- Aerial disinfection

Where there are specific problems in the hatchery, for example insect infestation, then an insecticide should be chosen which will be compatible with the general hygiene chemicals.

Clean water essential

Additionally, consideration should be given to water treatment coming into the hatchery which can introduce contamination to machines, in particular through the humidity systems. Some methods employed for this task are as follows:

- UV treatment
- Chlorination
- Chlorine Dioxide generator

Again, thought should be given to a combination of efficiency and corrosive effects of these methods dependant on hatchery structure and compatibility to the chemicals used in the hygiene programme.

There is a school of thought that there should be a shuttle program for disinfectants, where two different chemical types are rotated alternately over a period of time to prevent bacterial resistance building up within the hatchery environment. While this strategy was applicable previously, we now have complex sanitizers on the market which have up to four different chemical



Photo 1 - Foam overly watery with inadequate aeration resulting in inadequate adhesion and contact time.

classes combined in the preparation to produce a broad spectrum of biocidal activity. So far resistance to these types of sanitizers have not been reported.

Bacterial resistance

Environmental monitoring of the hatchery should be used as a sole indicator of bacterial resistance, and any changes made based on the results generated and compared against a known monitoring standard with acceptable limits. Many microbiological contamination problems are often assumed to be due to bacterial resistance to the chemicals employed in the hatchery, but these chemicals are only as good as the method and consistency of application. For instance, the application of a foam cleaner allows the operator to confirm that they have applied an even coverage over all areas; however the consistency of the foam is as important as the coverage. Foam should be thick with the consistency of shaving foam and have the ability to adhere to vertical surfaces for at least 20 minutes (see photos 1 and 2 below).

The equipment used to produce the foam is key to the consistency; where inadequate foam is produced it can be enhanced by addition of a foam thickener or the introduction of additional air pressure to the foaming system.

The use of recycled water in the cleaning procedure should be avoided and, where this is designed into a cleaning system - for example some tray and basket washers systems, then water treatment such as chlorination should be employed as the water is recycled. Monitoring and control of chlorination levels is important from a potential corrosion and health and safety point of view.

Hygiene monitoring programs

In order to establish the effectiveness of the



Photo 2 - Foam with the correct levels of water and aeration, producing thick foam with a good adhesion and good contact time.



All debris must be removed adequately, for which high pressure cleaning is a useful method.

hatchery hygiene programme and address potential contamination problems before they result in chick quality problems, a comprehensive monitoring programme and analysis of results is required. The monitoring results should be assessed for absolute microbial loading trends over time, including an analysis of seasonal fluctuations. Internal air samples should be compared to external air samples which are likely to enter the hatchery. This comparison also gives an indication of the current efficiency of hatchery air filtration where fitted.

Microbiological monitoring results

The results generated from a monitoring programme allow analysis of the hatchery hygiene programme and its ability to control potential pathogen introduction, and to minimise contamination from specific high risk points in the production system. The programme should highlight seasonal trends such as aerial fungi especially in hatcheries located in rural areas where a seasonal peak of aerial fungal spores can cause sudden and significant health problems in the day old chick.

While the access to laboratory facilities is advantageous, the hatchery can implement its own monitoring programme where a laboratory is not available by the use of rapid diagnostics, such as ATP measurement (equivalent to aerobic bacterial counts) and rapid culture techniques such as Petrie film. ATP in particular can be employed after cleaning to ensure prescribed standards are being met in real time and remedial action taken prior to the next hatch.

From the knowledge gained through the operation of monitoring programmes, changes in the hygiene programme in the form of chemical types or application methods can be implemented to ensure chicks hatch into a high hygiene environment which is pathogen free.



Poultry Grit

Cherry Stone is 100% crushed quartzite which makes it the hardest, sharpest grit available and helps the gizzard to be faster & more efficient. Cherry Stone won't dissolve or upset the mineral balance of feed or neutralize digestive juices. And birds are attracted to the pink-gray color! Available in 50 lb. bags or 2,000 lb. bulk bags.



- Poultry Grit #1
- Average Size 1/16"
- For turkeys age 1-5 days
- For chickens age 1-3 weeks



100% Natural Quartzite
50 lb. bag



- Poultry Grit #2
- Average Size 3/16"
- For turkeys age 6-21 days
- For chickens age 4-7 weeks



- Poultry Grit #3
- Average Size 5/16"
- For turkeys age 3-8 weeks
- For chickens age 7+ weeks



- Poultry Grit #4
- Average Size 3/8"
- For turkeys age 8+ weeks
- Also great for hobby crafts!



SPEC BLENDED CONSTRUCTION PRODUCTS

Visit www.cherrystonegrit.com for a list of Cherry Stone dealers or distributors.

PRODUCT INFORMATION



Is a natural feed ingredient for livestock and poultry used to control odors, ammonia and other gas emissions, which can be detrimental to livestock performance. Is a 100% natural product, manufactured from pulverized *Yucca schidigera* plant, which is native to Baja California, Mexico.

Our Food Safety Management System is the most important basic principle in our production and in the marketing of our products. This innocuous process must comply with strict international standards for quality and organic certification as well as an integrated system of checks and balance to assure quality and continuous improvement (HACCP, ISO 22000:2005, GMP+, B2 and B3).

BIOSUPREME is produced by Baja Agro International S.A. de C.V., the only manufacturer of *Yucca schidigera* extract, that harvests the plant in its own ranches and those of its associate farms. This assures the highest quality products offered on the international market.

SPECIFICATIONS

Content	Pure <i>Yucca schidigera</i> ⁽¹⁾ powder
Appearance	Free flowing powder
Color	Light beige
Odor	Sweet
Density	550 – 650 g/L
pH (10% AQ solution)	4.0 ± 0.5
Toxicity	Non toxic
Shelf life	Min 48 months at room temperature
Heat stability	Excellent
pH stability	Excellent
Packaging	55 lbs (25kg) Box

ANIMAL FEED INGREDIENT

APPLICATIONS

Improvement of animal feed

Research in several universities, in addition to many successful trials and studies that have been conducted on farms worldwide, show that the use of *Yucca schidigera* extract in animal feed improves the health conditions of turkeys, broilers, chicken layers, ducks, geese, quails and pheasants by reducing the emission of ammonia and odor.

Synergy

Research indicates that there are additional secondary benefits from inclusion of *Yucca schidigera* extract in feeds, specifically, an increase in animal weight gain and better feed utilization.

Gas reduction

Reduces ammonia and other irritant gases in confined buildings, this creates healthier living conditions, including lower stress levels, helping to improve feed utilization and growth rates.

Odor reduction

Reduces waste odor, creating a better environment for animals, employees, visitors and neighbors.

Economical

Is one of the most cost-effective products to add for improved performance, allowing producers to maximize returns.

SUGGESTED USAGE LEVELS

POULTRY	onces per ton
Turkeys	4 - 16 oz
Boilers	4 - 16 oz
Chicken Layers	4 - 16 oz
Ducks	4 - 16 oz
Geese	4 - 16 oz
Quails	4 - 16 oz
Pheasants	4 - 16 oz



SPECIFICATIONS

Content	<i>Yucca schidigera</i> ⁽¹⁾ concentrate liquid extract
Appearance	Dark Brown
Color	Dark Brown
Odor	Sweet
Density	1.10 ± 0.05 (25° C/25° C)
pH (10% AQ solution)	4.0 ± 0.2
Toxicity	Non toxic
Shelf life	Min 24 months at room temperature
Heat stability	Excellent
pH stability	Excellent
Packaging	2.5 gallons plastic jugs

APPLICATIONS

Animal drinking water

Adding to the drinking water of poultry will reduce the level of ammonia in the animal's digestive track and in the litter thereby reducing the level of ammonia in the poultry houses.

Broiler beds

Spraying over broiler beds will reduce the ammonia and other toxic gases, as well as accelerate the organic matter degradation of the litter.

FOR USE IN DRINKING WATER

SUGGESTED USAGE LEVELS

Broiler beds

Spray 6 oz per 1000 square feet twice a week over the litter until odor and toxic emanations are reduced.

Recommendations

The use of **BIOSUPREME L** can be stopped when desired ammonia or odor level is achieved, but it is recommended that **BIOSUPREME** be added in the animal's feed on a continuous basis to reduce noxious ammonia levels.

To obtain an even product distribution, it is recommended to dilute **BIOSUPREME L** in water at a ratio of 10 to 1, or as needed.

Application in animal drinking water

Broilers, turkeys, chicken layer, ducks, geese, quails and pheasants. 8 oz per 1000 gallons of water.

(1) *Yucca schidigera* is approved by the U.S. Food and Drug Administration as a natural food adjuvant under Title 21 CFR 172.510.

(2) Due to the natural composition of the extract, its contents may vary throughout the year; therefore, this is an average approximate analysis.



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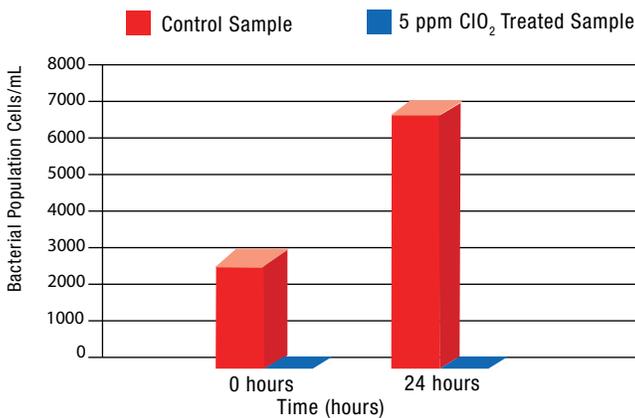
ProOxine® (AH) Disinfecting Solution For Animal Drinking Water

ProOxine® is the most effective tool for water management in animal facilities. ProOxine® keeps the bacteria level down in the water lines, and prevents biofilm from developing thus keeping the animals healthier by keeping down the pathogen level that could potentially travel from one animal to another. ProOxine® makes drinking water more palatable to poultry and livestock and therefore they drink more. Additionally, ProOxine® is highly effective in keeping water systems free of build up.

Efficacy of ProOxine® against Biofilm

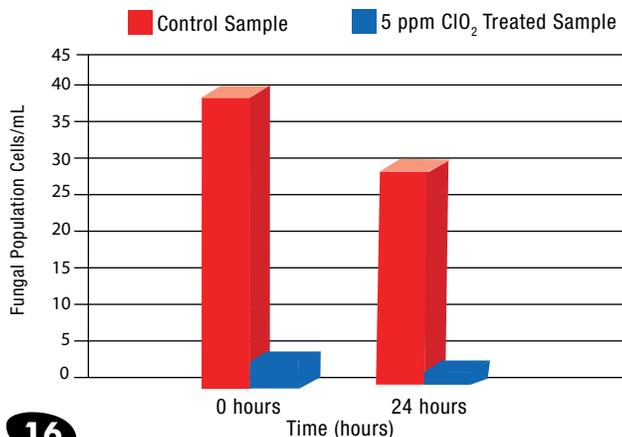
CONTROL EFFECT OF 5 ppm ClO₂ AGAINST BIOFILM BACTERIA

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



CONTROL EFFECT OF 5 ppm ClO₂ AGAINST BIOFILM FUNGI

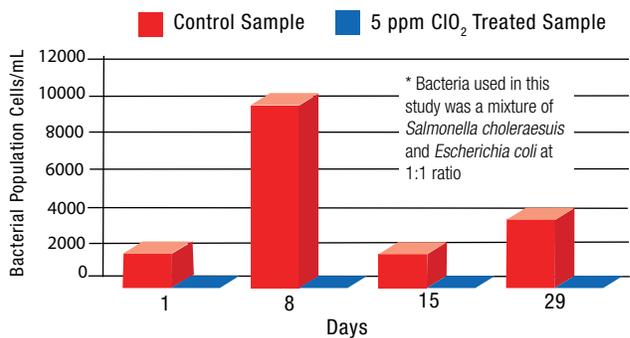
On Fungi	Control Sample	5 ppm ClO ₂ Treated Sample
0 Hour	40	4
24 Hours	30	2



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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Use Gut Pro to supply naturally occurring 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 birds 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

OMEGAMUNE GUT START

- Extremely fortified probiotic for poults and chicks containing 6 strains of live (viable) naturally occurring micro-organisms
- Applied at the hatchery at 1 day of age (Hatch Day) or at placement
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- Gel appears as droplets on poults or chicks and is visible and readily picked up by the birds which increases the amount of product getting to the birds and the amount of birds that get the product.
- All droplets are gone within 2 or 3 minutes
- Unlike water spray, the gel spray does not soak the poults / chicks, keeping them dry and warm
- Can easily be mixed with IMMUCOX vaccines for same time application
- Contact your poult / chick supplier and ask them to apply Gut Start on your next order

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- ✓ Jumbo Corrugated Feed Lids
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COMPLETE SANITATION PROGRAM FOR FIELD AND HATCHERIES



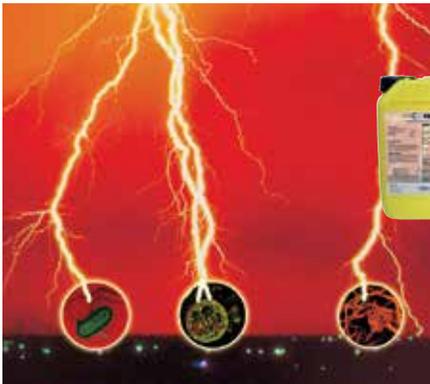
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- Deeply penetrating alkaline foam for farms, incubators, trucks, ...
- Apply at 1 to 1 ½ oz / gal only with a foam wand.
- Non corrosive in dilution.



VIROCID®

- EPA approved "broad spectrum disinfectant"
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- Non corrosive
- Apply by spray, foam or (thermo) fog
- Maintains pad cooling systems



KENO™ X5

- EPA approved "broad spectrum disinfectant"
- Per Acetic Acid based, dil ½ oz/gal
- 100% biodegradable



CID 2000

- H2O2 removes heavy soils
- Peracetic Acid removes scale / mineral build up
- Equipment friendly
- Proven "greatest reduction in microbial load" by U. of Arkansas



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- 50% Stabilized Hydrogen Peroxide
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- NO heavy metals

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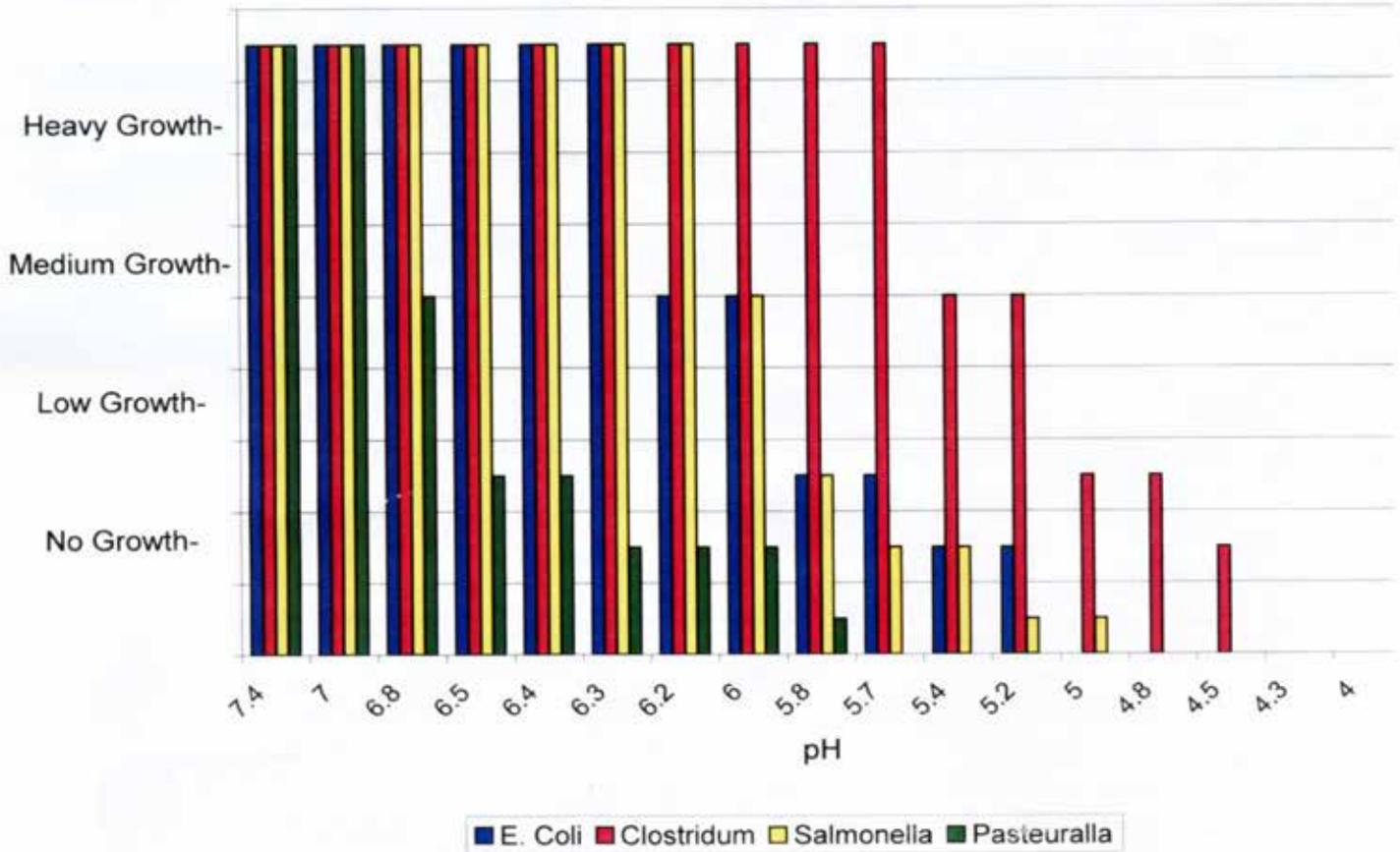
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Effects of pH on Selected Bacterial Pathogens Growth in Drinkers

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



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For Use in Closed Drinking Water Systems for Poultry

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Patents
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CuSO₄.....18%

INGREDIENTS: Copper, Organic Acids, BioSupremeL, Buffers, Dye #40, Extract from Essential Oils.

Omegamune-Plus Precautions

- 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:

4 x 1 gallon cases.....(Product # 100801)
5 gallon pails.....(Product # 100810)
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- ✓ 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.
- ✓ 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.
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Turkeys raised in commercial field conditions may experience stress during routine management practices including catching, relocation, and vaccination, as well as during extreme ambient temperatures. Exposure to these challenges can result in loss of appetite, lethargy, reduced body weight gain, loss of feed efficiency, and increased mortality.

Products such as Original XPC™ can be effective in helping to manage production-related challenges that can negatively affect performance.

Diamond V has introduced a new liquid product that is conveniently administered via drinking water. Using proprietary technology and comprised of similar metabolites to Original XPC (XPC), AviCare™ has been designed to support the health and wellbeing of birds during times of production challenges, when feed consumption may be suppressed. Therefore, it was of interest to investigate the potential effects of AviCare, with and without XPC, on performance in commercial turkeys during a known challenge.

Objectives

The objectives of this experiment were to:

1. Determine the effects of production-related induced stress events on turkey performance and stress indicators in the blood; and
2. Determine whether AviCare supplementation and AviCare plus XPC can ameliorate any such stress effects on performance and blood stress indicators.

Research Update

Effects of AviCare™ and Original XPC™ during production challenges in turkey hens



Don McIntyre, Ph.D., PAS
Director, North America Poultry Research & Technical Service
Diamond V



Jesse L. Grimes, Ph.D.
Professor, Prestage Department of Poultry Science
North Carolina State University

Experimental design

Day of hatch Nicholas turkey hen poults (n = 960) were used in this study, consisting of:

- 4 treatments
- 12 replicates per treatment
- 48 pens
- 20 birds per pen

Treatment groups included:

- T1 – negative control (NC) – no challenge, no treatments
- T2 – positive control (PC) – management challenge, no treatments
- T3 – AviCare (AV) – PC plus 20 oz AviCare/100 gal water (0-10 d and 28-42 d)
- T4 – AviCare plus XPC (AVX) – AV plus 2.5 lb/ton XPC in feed (0-63 d)

Experimental diets and treatments

Common corn-soybean meal-poultry meal starter and grower basal diets were prepared (nutrient profile in Table 1). Treatment diets were then completed from allocated portions of the basal diets. The pelleted-crumbled starter diet was provided to birds from 0 to 42 days of age, followed by a pelleted grower diet from 42 to 63 days of age.

Table 1. Experimental starter and grower feed nutrient composition

Nutrient	Starter	Grower
CP (%)	29.50	25.10
ME (kcal/lb)	1410	1511
Lysine (%)	1.87	1.55
Met + Cyst (%)	1.30	1.03

Production challenge

To evaluate the effects of production challenges in turkey hens and the potential impact of treatments, the following adverse situations were imposed on birds in T2, T3, and T4:

1. Re-used litter (pine shavings) whereas T1 pens had new pine shavings for bedding;
2. Live coccidia vaccination (Immucox, CEVA Animal Health, USA) at 1X dose at 0 days of age, except for T1 poults; and
3. Fasting stress for 12-hour to simulate relocation from brooding to growing facility at 35 days of age.

Following a 3-hour rest, poults were placed into assigned pens.

Data and sample collection and analysis

All birds were weighed by pen on 0, 7, 28, 35, 36 (at 8:00 a.m. and 8:00 p.m.), 42, and 63 days of age. Body weight gain was calculated. Feed and water were recorded when new feed and water were added and when birds were weighed. Feed and water intake and feed conversion were calculated.

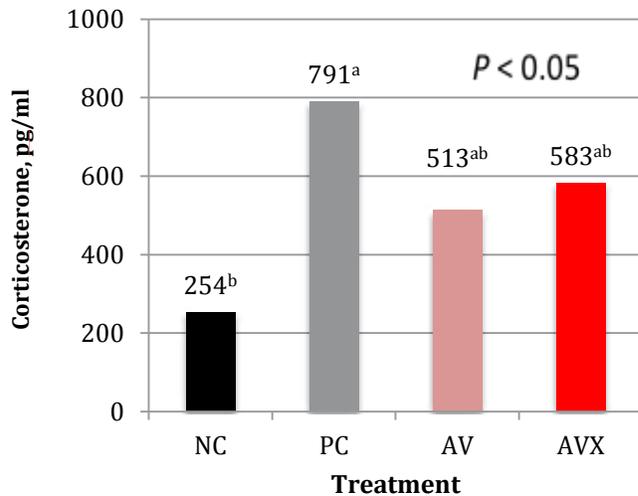
Blood sampling and analysis: At 35, 36 (8:00 a.m. and 8:00 p.m.), 42, and 63 days of age, blood samples were collected from the wing vein of two birds per pen and analyzed for corticosterone concentration. Blood was collected from naïve birds (birds that had not previously been bled) at each time point. Plasma corticosterone concentrations were determined using a corticosterone EIA (enzyme immunoassay) kit (Cayman Chemical, Ann Arbor, MI).

Results and discussion

Significantly higher ($P < 0.05$) serum corticosterone was observed in PC vs. NC immediately following the fasting at 36 days of age, with AV and AVX being intermediate (Figure 1). No treatment differences in corticosterone were observed at later testing dates.

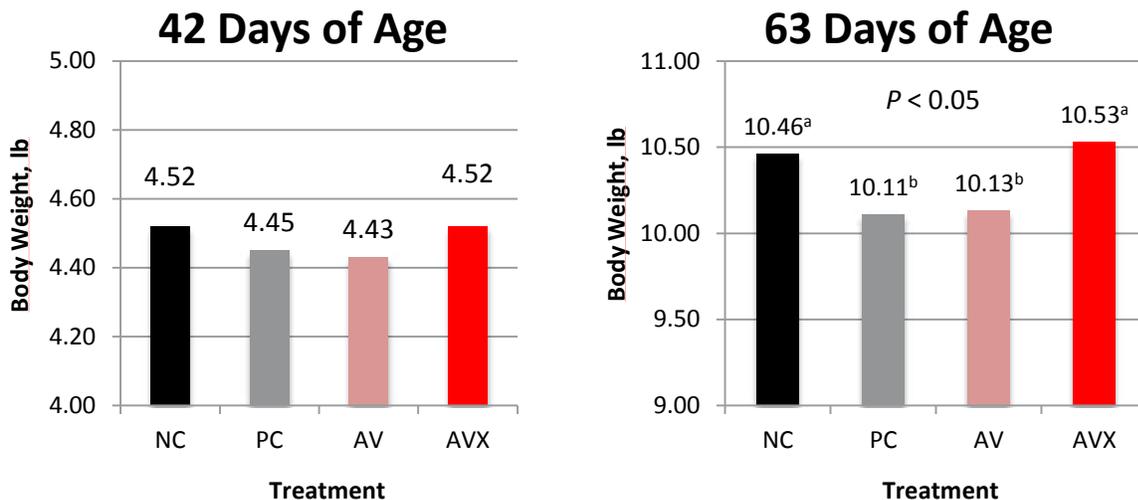
Corticosterone is a non-specific stress response adrenal hormone produced during stress events. Corticosterone impacts muscular efficiency and influences carbohydrate and electrolyte metabolism. The hormone has been shown to inhibit protein synthesis and degrade proteins in birds.

Figure 1. Serum corticosterone levels after 12-hour fast in turkey hens at 36 days of age



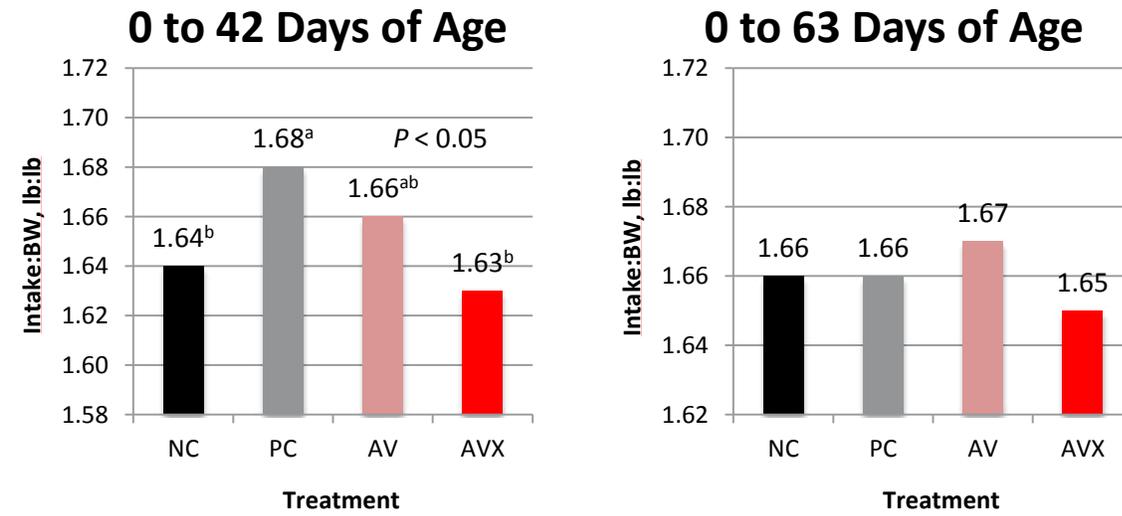
Body weights were reduced ($P < 0.05$, data not shown) in PC, AV, and AVX treatments compared to controls (NC) after the fasting stress at 35 days of age. At 36 days of age, birds returned to feed (post fasting). At 42 days of age, body weights were similar between treatments (Figure 2). However, by 63 days of age, average body weight of PC birds was significantly lighter ($P < 0.05$) compared to NC birds. Birds in the AVX group (fed XPC and administered AV in the water) were not different ($P > 0.05$) from NC birds and were significantly ($P < 0.05$) heavier than PC birds (Figure 2).

Figure 2. Body weight of turkey hens



Feed conversion was not affected post-fast at 36 days of age (Figure 3). However, when evaluating feed conversion ratio (FCR) from 34 to 42 days of age and cumulative FCR from 0 to 42 days of age, PC treated birds had significantly lower ($P < 0.05$) feed conversion compared to control (NC). Supplementing feed and water with both XPC and AviCare (AVX) statistically improved ($P < 0.05$) feed conversion compared to PC, with AV birds being intermediate. Furthermore, birds receiving AVX had similar ($P > 0.05$) FCR compared to NC birds. There were no treatment differences ($P > 0.05$) in FCR from 42 to 63 days of age (Figure 3).

Figure 3. Feed conversion ratio (FCR) of turkey hens



No differences were observed between treatments for livability or water consumption during this study.

Conclusions

1. AviCare in the water (AV) and AviCare in the water plus XPC in feed (AVX) reduced corticosterone levels following a 12-hour fast in turkey hens.
2. Feed conversion was improved from 34 to 42 days of age and cumulatively from 0 to 42 days of age by the supplementation of AviCare (AV) or AviCare plus XPC (AVX). Feed conversion in turkey hens receiving the combination of AviCare plus XPC (AVX) was similar to non-stressed birds (NC).
3. Body weight gain was greatest in the AviCare plus XPC (AVX) turkey hens at 63 days of age, similar to non-stressed birds (NC).



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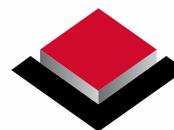


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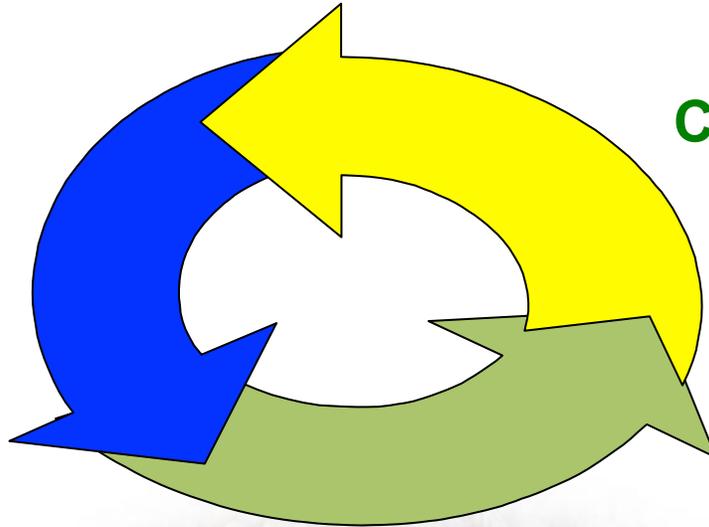
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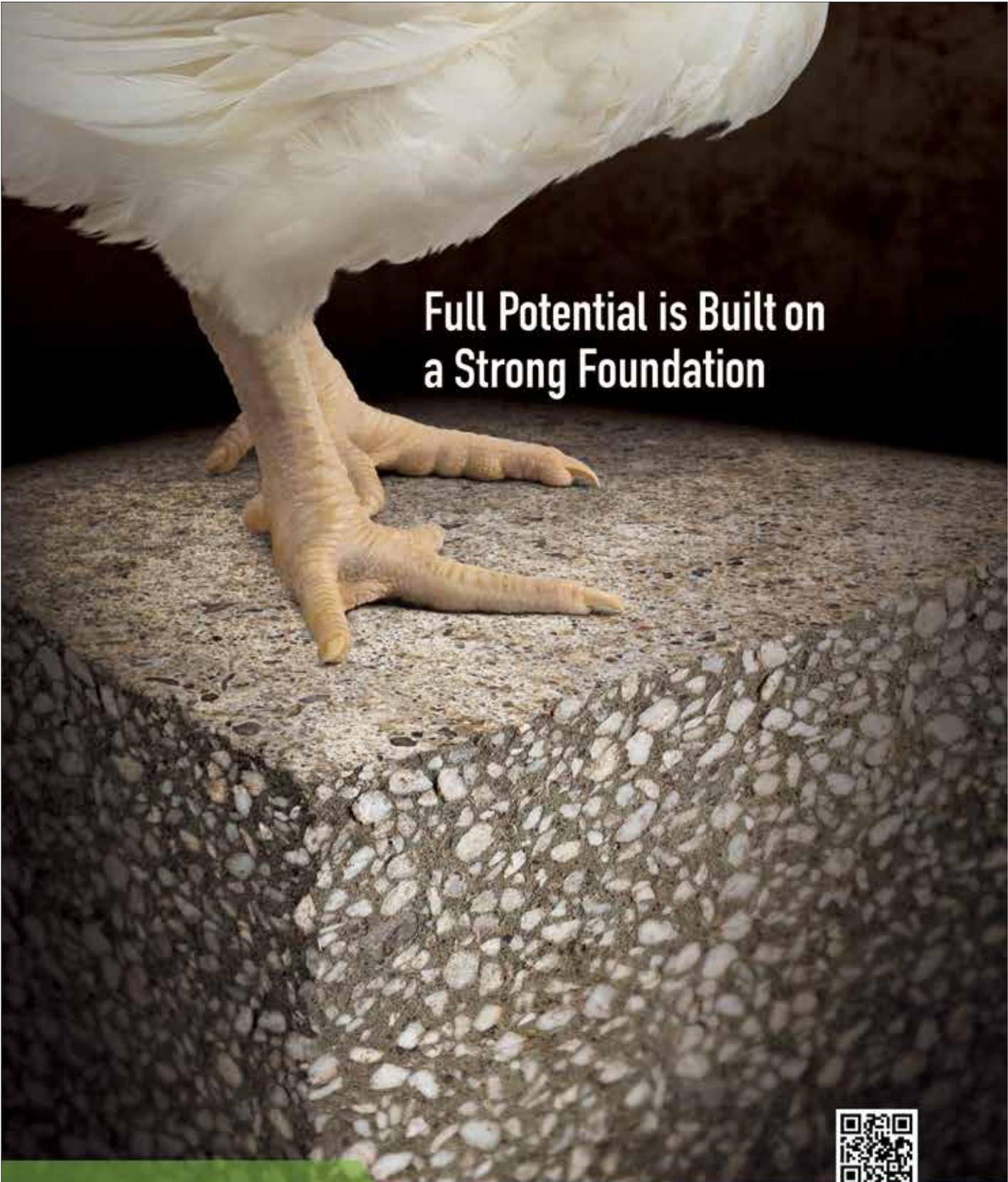
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Role of pH in Poultry Production

One of the many factors that influence the homeostasis and stability of a living organism is pH value. The pH value is the measurement of the amount of hydrogen ions (H^+) in a solution. Through manipulation of pH values, one can influence basic biologic mechanisms in both a positive and a negative way depending on the objective. In order to reduce pH, hydrogen ions have to be added to the system. Because acids are hydrogen ion donors, they will reduce the pH of a solution. The effectiveness of the acid depends on its strength.



The pKa value indicates the strength of a particular acid. The lower the pKa value the stronger the acid. Table 1 list various acids in their order of strength (pKa value). From this list it is easy to see that sodium bisulfate is a fairly strong acid and will significantly lower the pH of any environment.

pH and Poultry Litter

Used poultry litter has an average pH of 8.0-9.0 and new poultry litter a pH of 6.0-7.0. Because new poultry litter has a neutral pH, it can favor the growth of Salmonella, Clostridium and other pathogenic bacteria even more so than used litter, more quickly facilitating bacteria transfer from infected birds within the flock. Pathogenic bacteria will still grow in used litter, but they

	Greatest Ability to Lower pH	pKa
↑	HCL	-6.1 (strongly acidic)
	Sulfuric Acid	-3.0
	Sodium Bisulfate	1.92 (Immediate acidification)
	Phosphoric Acid	2.12
	Citric Acid	3.14
	Lactic Acid	3.86
	Acetic Acid (vinegar)	4.75
	Propionic Acid	4.87
	Calcium Phosphate Monobasic	7.20
↓	Alum	Not directly acidic; Requires a hydrolysis reaction to produce acid.
	Least ability to lower pH	

Table 1. Effectiveness in adjusting pH values

will grow more easily in new litter because of the more favorable pH. By manipulating the pH of the litter to one unfavorable for most bacterial growth, dropping the pH of the litter to below 4.0 will convert the litter into a medium hostile to the growth and survival of pathogenic bacteria. Normal gut flora, on the other hand, prefer a low pH environment so while dropping the litter pH to 4.0 or less will reduce pathogenic bacteria, it will actually create a favorable environment for healthy bacteria to flourish. Acidifying the litter with sodium bisulfate creates an environment that is more favorable to the desirable lactic-acid producing bacteria present in the litter. In a study conducted in Norway¹, researchers showed that acidifying the litter to a 2.8 prior to bird placement resulted in lower levels of *Clostridium perfringens* and *Enterococcus sp.* in the intestinal tracts of birds raised on the acidified litter compared to the controls. So by manipulating this one basic biologic principle, one can create an environment that is good for the good bacteria and bad for the bad bacteria.

pH and Poultry Water

This same concept holds true inside the bird as well. Drinking water at a low pH influences the type of bacteria that establish in the GI tract of the bird. Research shows that acidifying drinking water will acidify the crop both before and after the normal crop flora becomes established². By providing the bird with water at a pH below 4.0 for its first drink and for the next few weeks, the crop is protected while normal flora is being established and during times of great gut flora instability due to rapid growth. This assists in the establishment of normal flora, the exclusion of pathogens such as salmonella and the prevention of necrotic enteritis. The use of a mineral acid such as sodium bisulfate allows the pH of the water to be lowered to biologically significant levels without negatively impacting water consumption.

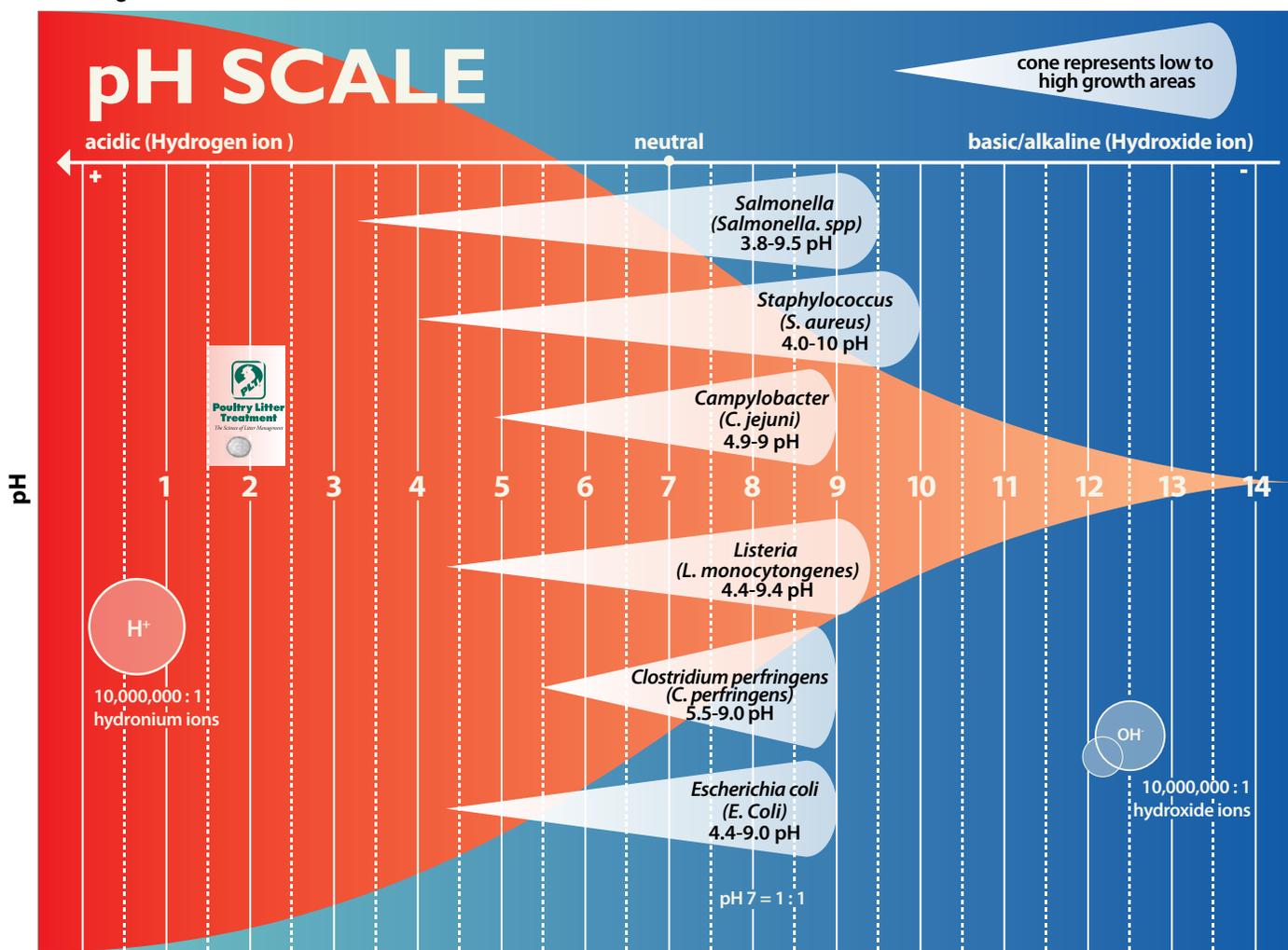


Table 2. pH growth range of selected poultry bacterial pathogens³

pH and Air Quality

The pH value also matters in terms of air quality. Ammonia is produced from the nitrogen (N) in the manure excreted from the bird. At a pH of above a 7.0, much of that nitrogen is in the form of ammonia gas (NH₃). This ammonia gas is harmful to the birds reducing weights, increasing feed conversion and damaging the respiratory system.

NH ³ Level	Detrimental Effects
20 PPM (continuous for 6 weeks)	<ul style="list-style-type: none"> pulmonary edema, congestion, and hemorrhage⁴ increased susceptibility to respiratory disease due to ciliastasis⁴ reduced weights (19 points less at 49 days)⁵
40 PPM	<ul style="list-style-type: none"> deciliation and decreased clearance of E. coli from lungs and airsacs⁶
25-50 PPM	<ul style="list-style-type: none"> reduced body weights (0.50 lbs. Less at 49 days), feed efficiency and increased airsacculitis in birds exposed to IBV^{5,7} Corneal edema and ulceration⁵
50-100	<ul style="list-style-type: none"> keratoconjunctivitis, deep corneal ulceration, and blindness^{5,7} poor weight distribution⁵

By adding hydrogen ions to the litter in the form of an acid, the additional hydrogen ions (H⁺) attach to the ammonia gas (NH₃) turning it into ammonium (NH₄). This ammonium interacts with the sulfate portion of sodium bisulfate and becomes a valuable solid fertilizer, ammonium sulfate, rather than a harmful ammonia gas inside the poultry house.

So whether one is trying to improve the air for bird health and performance or influence the development of good bacteria over bad in the litter and water, pH matters.

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³*Microbial Survival in the Environment*, E. Mitscherlich and E.H. Marth (eds.), Springer-Verlag, Berlin and Heidelberg, 1984.

⁴Anderson, D.P., et al. *The Adverse effects of ammonia on chickens including resistance to infection with Newcastle Disease Virus, Avian Disease*, 1964.

⁵D. Miles and B. Lott, publication pending, USDA-ARS and Mississippi State University, 2002. Source: 1997 Edition of CRC

⁶Nagaraja, K. V., et al. *Scanning electron microscopic studies of adverse effects of ammonia on tracheal tissues of turkeys, Am J Vet Res*, Vol 44:8, 1530-6.

⁷S. H. Kleven and J. R. Glisson, *Multicausal respiratory Disease, Diseases of Poultry*, tenth edition, pg. 1009.



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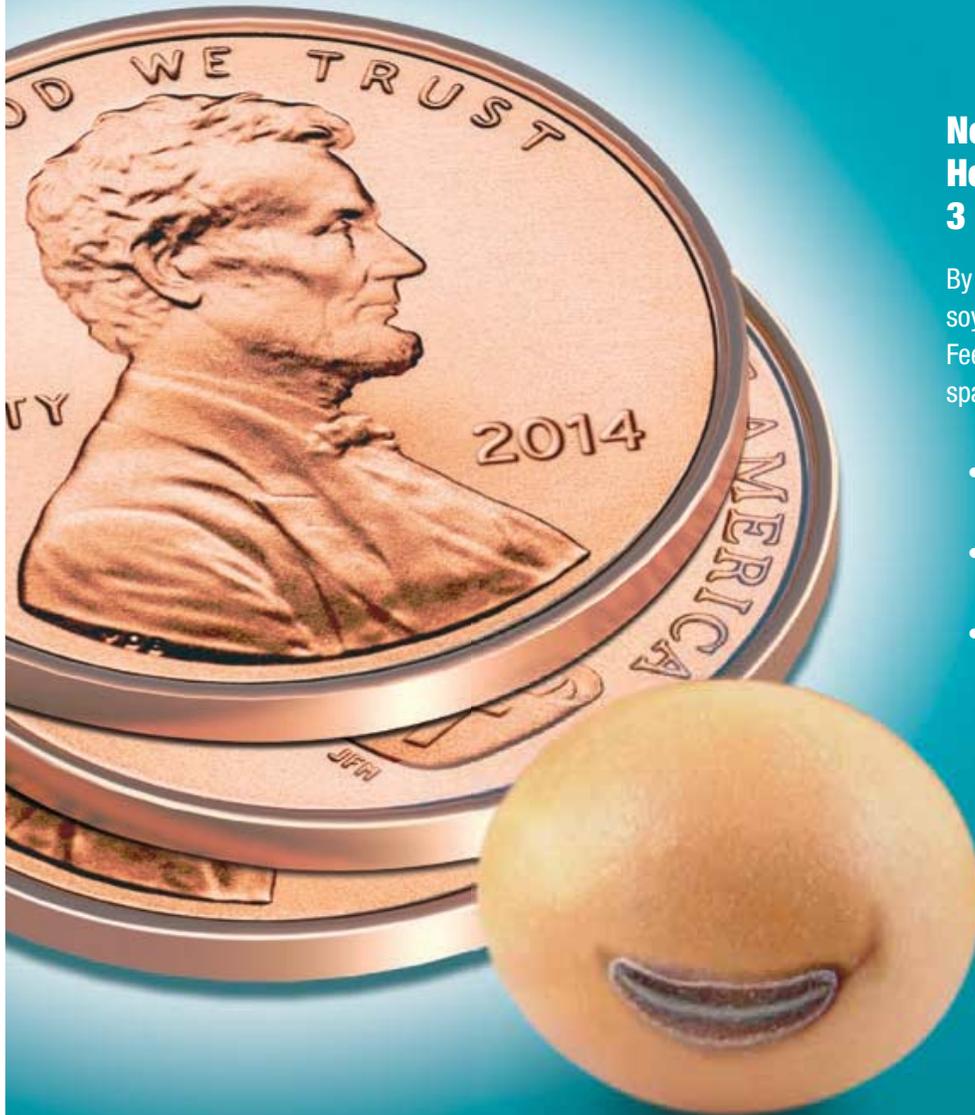
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1. Study ENZUS130029. Elanco Animal Health. Data on file.

2. Lee, J., Bailey, C. and Cartwright, A. 2003. " β -Mannanase Ameliorates Viscosity-Associated Depression of Growth in Broiler Chickens Fed Guar Germ and Hull Fractions." Poultry Sci. 82: 1925-1931.

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