

Gut Health Investigation and Interventions in Layers

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Introduction

Gut health investigations and interventions in commercial pullets and layers have remained fairly basic over the extended history of the egg industry. To some extent gut health has not been a focus of commercial pullet and layer flocks unless the problem contributed to a significant mortality problem for a company or facility. Gut health has also been less of a focus in commercial egg production due to the fact that a large percentage of commercial egg production has been conducted in various styles of cage housing and therefore there has been less opportunity for gut health challenges as these flocks have limited fecal-oral exposure from hatch to depopulation. As live production operations move to newer styles of alternative housing of pullets and layers we will likely see increased gut health challenges in these flocks due primarily to the increase in access to fecal matter. In addition to the lower potential for GI diseases to occur it is also easy to overlook gut health challenges in commercial layers because common indicators of subclinical and clinical gut health challenges, such as feed conversion, are not as closely monitored as they are within other sectors of the poultry industry. Breed companies continue to make progress in flock efficiency and productivity and producers may find that maintaining gut health will be a critical component to exercising these bird's genetic potential. Layer veterinarians, nutritionists, and flock service personnel will have to learn to adapt to investigation and interventions for gut health in variety of ways that may have never been explored before in layer operations. As our counterparts in the broiler and turkey industries already know, both subclinical and clinical gut health challenges can impact the health, welfare, and profitability of flocks. Investigation strategies, diagnostic testing, and gut health interventions can often be viewed as added costs, however, they should be evaluated as a potential return on investment opportunity to improve flock performance. This presentation will briefly discuss approaches to gut health investigations and interventions currently available to pullets and layers.

Field Gut Health Investigation Tools:

- Production data:
 - Production data should be reviewed for accuracy of collection methodology and should be reviewed historically in flocks with data collected over time. Major categories of production data to review in relation to gut health challenges include:
 - Hen Day % Production
 - Body Weight
 - Case Weight (egg weight)
 - Feed Consumption
 - Feed Conversion (if available)
 - Water Consumption
 - Decreases in Hen Day %, lack of body weight gain or body weight loss, below expected egg weight and egg size averages, and unexpected changes in feed/water intake could be indicators of gut health challenges that could be occurring either in combination or as independent issues. These flocks must be investigated to rule out gut health as a potential cause of suboptimal performance.
- Manure evaluation:
 - Manure quality from flocks should be continuously evaluated by farm and production staff. Depending on the type of housing system the manure should be evaluated in one of several locations including:
 - Deep pit areas
 - Scraper boards
 - Manure belts
 - Litter areas or outdoor access areas
 - In the event a farm would like to look at fresh fecal matter it works best to place cardboard or other flat collection material underneath affected flocks just prior to a

- feeding time and leave these beneath the flock for 30-45 minutes to collect the fresh fecal matter. This method also allows the user to evaluate the moisture content and texture better than inspecting the manure collection areas in the house. This fresh fecal matter is also a high-quality sample should it be needed for further investigation.
- Manure can be difficult to evaluate in poor lighting and production staff are encouraged to use a high-quality flashlight to look for changes in manure conditions. Many problems can be overlooked due to poor lighting or farm staff not taking time to note manure conditions.
 - In addition to the overall quality in reference to moisture content of the manure, the manure should be inspected closely for any of the following abnormalities:
 - Feed passage (undigested feed ingredient particles passing in fecal matter)
 - Intestinal sloughing (orange to red material present in manure)
 - Watery droppings
 - Abnormally colored or textured droppings (foamy, pasty, butterscotch color, etc.)
 - Live bird handling:
 - Randomly selected live birds within the flock should be handled and inspected by production staff, flock management personnel, nutrition staff, and veterinarians to evaluate for external indicators of a gut health challenge including the following:
 - Wet, stained, or dirty vent feathers.
 - Poor feather quality and condition
 - Lack of body conditioning
 - Although these notes will be subjective based on the person handling the birds they can be good indicators to further evaluate gut health issues.
 - Mortality evaluation:
 - Mortality should be evaluated by a person trained in necropsy. Necropsy of mortality, even if mortality is not elevated relative to breed standards, can still be helpful to identify potential gut health challenges. Mortality can be found to have grossly visible lesions such as necrotic enteritis and can also be evaluated for trends of thin and under-conditioned birds. Other than grossly visible lesions mortality are generally not useful for interpretation of the overall gut health of a flock. Sacrifice birds or birds culled with other clinical signs offer a better opportunity to evaluate gut health. After death, the GI tract degrades very quickly and post-mortem changes can be confused with a GI problem (ballooning GI tracts, watery contents).
 - Sacrifice bird evaluation:
 - Sacrifice birds or selected cull birds are a major component of an investigation into gut health challenges. A minimum of 5 randomly selected birds are euthanized and evaluated by flock service personnel or a veterinarian. Body condition including muscle, fat, and skeletal composition and health should be evaluated and scored when possible. Birds should remain on feed as close to possible to euthanasia to prevent artifacts of feed withdrawal from interfering with the evaluation. Sacrifice birds from unaffected flocks can be a helpful comparison to evaluate birds. The GI tract should be opened from the crop to the distal end of the tract to inspect the quality of the GI lining in each section of the tract and to note any obvious gross lesions (i.e. crop mold, focal duodenal necrosis, necrotic enteritis). As the tract is opened in each section the integrity of the GI lining and the intestinal contents should be evaluated. Abnormalities that are worth noting on a gut health investigation are:
 - Unusual crop and gizzard contents
 - Thin-walled GI tract
 - Watery, mucous coated GI digesta
 - Watery to foamy contents
 - Presence of orange to red mucous in the tract
 - Undigested feed particles in the distal GI tract near the cloaca
 - Visual identification of internal parasites (tapeworms, roundworms, etc.)

Diagnostic Methods for Gut Health Investigation:

- Coccidiosis oocyst counts
 - Fresh fecal matter can be collected and submitted to technical services laboratories or university laboratories to obtain coccidiosis oocyst counts. This method is quantitative and can give an indicator as to the presence of cocci oocysts present and a general estimate of the amount of cycling that could be occurring a flock. A representative sample of the flock, although relatively small, can be a useful tool in determining if coccidiosis is contributing to subclinical gut health issues.
- Internal parasite egg counts
 - Similar to cocci oocyst counts, fresh fecal matter can be submitted to identify presence of other intestinal parasites, such as roundworms, and obtain a quantitative count that might identify the general burden of whatever parasite is identified.
- Gastrointestinal scrapings
 - Well-trained individuals can perform scrapings of different GI tract segments from sacrifice birds to evaluate for presence of abnormal GI flora, parasites, and to an extent assess the integrity of the GI lining microscopically.
- Gut histopathology surveys
 - Freshly sacrificed birds can be sampled for GI histopathology surveys. This method includes collecting fresh tissues from pre-determined locations in the GI tract into formalin for evaluation and scoring by a trained histopathologist. The pathologist can look for trends across multiple submissions by utilizing a scoring system and note any specific abnormalities which might represent a specific disease condition.
- Gut flora enumeration
 - Technical service laboratories offered by some companies offer various ways to assess GI flora by collection and analysis of fresh GI tracts. The bacterial flora of these GI tracts is enumerated in the technical service laboratory to determine the balance of typical GI flora such as *E. coli*, *Lactobacillus*, *Clostridium*, etc.
- Viral GI Diagnostics
 - In cases where most typical gut health challenges have been ruled out viral causes of gut health problems may be pursued. Layer flocks are routinely exposed to a variety of enteric GI viruses so interpretation of viral GI diagnostics in these cases can be difficult. Although less of a focus in caged birds, viral GI diseases will likely be found to be a significant contributor to the overall gut health of alternatively housed flocks with litter access. Samples for isolation and identification of GI viruses can be difficult to obtain and diagnostics can be expensive. Some of the more commonly used methods to obtain viral GI isolations include:
 - Submission of affected live birds to a diagnostic lab for direct sample collection.
 - Submission of fresh fecal matter from affected flocks.
 - Cloacal swabs of affected birds in a viral transport media.
 - Use of sentinel birds placed within the production system of affected flocks.
 - Isolation and identification of specific viral enteric challenges that correlate well
- Ancillary aspects of gut health investigation
 - Nutrition changes
 - Production staff and veterinarians should work with nutritionists to make sure that major diet or ingredient changes do not correlate with a current gut health challenge.
 - Finished feed and ingredient quality
 - Production staff and veterinarians should work with nutritionists to make sure that a quality feed ingredient and finished feed testing program are set up and being conducted to rule out influence of poor quality feed ingredient sources and feed manufacturing.
 - Water quality
 - Drinking water should be routinely tested for all flocks to ensure that drinking water and drinking water lines are not contaminated with coliforms, *E. coli*, or

other biofilm-forming bacterial growth. Samples should also be tested for mineral and pH balance to make sure they are not contributing to gut health challenges.

Intervention Methods for Gut Health in Pullets and Layers

- Gut flora interventions
 - When flocks are found to be in a state of dysbacteriosis some of the following products can be of value in restoring the proper GI flora and trending farms and flocks back to a more normal flora. These products can also be used on a continuous basis to help maintain and prevent abnormal shifts in gut flora and gut health problems. Each product has to be closely evaluated for scientific data, potential return on investment, and practical usage of the product.
 - Prebiotics
 - Probiotics
 - Essential oils
 - Phytogetic products
 - Water sanitation can play an important role in maintaining normal flock flora. If flocks are consuming poorly sanitized water sources there is a higher likelihood flocks will trend to dysbacteriosis. Water sanitation should always be a high priority intervention method in gut health challenges.
- Gut pH interventions
 - When GI tract pH is maintained under more optimal conditions (<7 pH) the normal gut flora is more likely to be maintained, the gut is more likely to be efficient, and less prone to GI challenges. Drinking water acidification can be helpful in helping the bird maintain a proper gut pH and flora. If feasible, maintaining drinking water pH less than 7 can be a helpful intervention for gut health challenges.
- Management interventions
 - Facility maintenance
 - When possible, access to fecal matter by flocks should be limited as much as possible. In existing cage systems this might include proper maintenance and routine cleaning of manure shields/curtains or proper maintenance and care of manure belts.
 - Litter and range management
 - In systems which provide access to litter or range areas careful care must be taken to manage these areas to prevent buildup of bacterial, viral, or parasite loads.
 - House downtime and sanitation
 - Although many pullet and layer flocks in the US are housed on multi-age facilities, use of extended downtime between flocks and cleaning and disinfection can be a useful tool in limiting exposure of replacement pullets and layers to reinfection with viral and bacterial challenges that are present in the facility.
 - Whole house fumigation
 - Contract crews can be utilized to do higher intensity disinfection protocols such as whole house fumigation with formaldehyde. These products are applied by third-party personnel and employees are not permitted to return into the house until the house environment returns to below an acceptable OSHA threshold. Whole house formaldehyde application can be very effective at destroying hard to reach pathogens in areas that traditional disinfectants cannot penetrate.
 - Whole house heating
 - Some viral causes of enteritis such as astrovirus and reovirus, are heat susceptible. Research on Runting-Stunting Syndrome (RSS) in broilers has indicated that heat treatment of litter and or houses can reduce the impact of viral enteritis on future flocks housed in these facilities. Heating protocols can vary, and may be difficult to conduct during colder months, but generally if a house can be heated to above 90°F for 5 or more days there is may be some reduction in the viral load present in the house. Higher temperatures or longer time periods

may be more effective at reducing viral loads but are not practical to achieve in a cost efficient manner or in a way that will not damage equipment in the barn (i.e. water lines, electrical equipment).

- Interventions for bacterial GI challenges
 - Commercial layers are fairly limited in available treatment options, in particular with regards to antibiotic usage. Bacitracin (BMD) products are available in the US and can be used in pullet and layer flocks without a Veterinary Feed Directive. Flocks that tend to respond to bacitracin use such as those with Focal Duodenal Necrosis (FDN) or Necrotic Enteritis also respond fairly well to pre- and probiotic products to help correct abnormal GI flora. Care must be taken when using any antibiotic protocol to make sure the use of the product does not affect the marketing of the egg products or create any negative effects on gut flora for the flock. Bacitracin use should be conducted in connection with pre or probiotic use to maintain a healthy gut flora following treatment of bacterial enteritis.
- Interventions for viral GI challenges
 - Autogenous vaccination
 - If viral causes of enteritis are routinely found that correlate with production challenges an autogenous vaccine can be created. This autogenous vaccine can be produced from virus isolations taken from clinical case submissions.
 - Autogenous vaccine creation and use can be a costly process and has limitations due to autogenous vaccine regulations. Autogenous vaccines generally must be made in large serials and therefore usually constitute large orders to obtain the product. These autogenous serials have a limitation in which the product can be used. Ideally autogenous vaccines should be administered in two separate doses, but it would be difficult to inject a commercial layer pullet with two doses of vaccine.