EARLY GUT HEALTH AND LITTER MOISTURE

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Early gut health, litter conditions, poultry barn infrastructure, house ventilation, incubation and hatchery conditions, brooding conditions, water quality and maternal health and immunity are all interconnected. Seemingly unrelated items such as the price of fuel can be strong determinants of house litter moisture and conditions. A few of these items are discussed briefly in the following paragraphs.

INCUBATION AND HATCHERY CONDITIONS

The direct role of hatcheries in litter moisture problems is negligible and difficult to document. However, overheating has been documented as a cause of increased gut permeability to undefined pathogens. The combination of unsanitary conditions, a long hatch window and overheating may result in an unhealthy gut in general, which is potentially unable to cope with ordinary challenges to come in the first weeks of age.

MATERNAL IMMUNITY AND NEONATAL VIRUSES

Natural or artificial exposure of broiler breeders to a variety of defined and undefined agents allows them to mount immune responses that ultimately result or should result in the transfer of maternal protection to the progeny. Although not thoroughly documented, passive immunity seems to play a role in early gut health such that the intestinal tract of young chicks is at least partially protected against infectious agents that tend to infect to gastrointestinal tract of young chicks. Immunoglobulin Y (IgY), functionally an analog of IgG is concentrated in the yolk of embryos and is absorbed via the blood circulatory system of the embryo, beginning at 8 days of incubation, and is maximized by 4 days pre-hatch; IgA and IgM are both secreted by the lining cells of the oviduct and are acquired by the embryo by ingestion for the protection of the gastrointestinal mucosa. Thus, IgY is critical for the control of pathogens that tend to induce not only local but also systemic infections; and IgA and IgM are particularly useful for the control of pathogens that challenge the gastrointestinal tract at very young ages. Viruses cause some of the early infections that can result in profuse diarrhea and thus wet litter, albeit their individual or collective roles are poorly understood. Some of the viruses known to cause neonatal infections resulting in profuse diarrhea include chicken astrovirus (CAstV), avian rotavirus, avian orthoreovirus, avian parvovirus, calicivirus and others. Their collective action in the small intestine of very young chicks often results in multicystic enteritis, shortened intestinal villi, maldigestion and malabsorption, severely delayed growth and poor uniformity. The syndrome resulting from early viral intestinal infections of this nature has received names such as runting and stunting syndrome (RSS), or malabsorption syndrome (MAS). From the litter quality point of view, RSS is a significant contributor to litter moisture because of the profuse watery diarrhea that frequently develops in flocks affected with this syndrome.

BROODING CONDITIONS

The combination of poultry house infrastructure characteristics, house equipment, equipment management, and brooding conditions (husbandry) is perhaps the most important determinant of litter and environmental quality. Used litter can be managed to the advantage of producers and it can be compatible with economic production of broiler chickens. However, removal of excess moisture is critical for a successful reduction of ammonia, and of bacterial and protozoal pathogens. The infrastructure of the poultry farm and the equipment and its maintenance must support the intended production pressure imposed on them. That is, the number of kilograms or chickens per square metre, or the number of chickens or kilograms per cubic metre must be determined based on the capacity of the house for air exchanges per minute and is

also dependent on the equipment distribution, all of which should be able to support the intended bird density and the production pressure imposed. Excessive production pressure relative to the infrastructure of the farm will often result in increased litter moisture, increased ammonia, respiratory disease, a degraded gut health, and increased litter moisture as a consequence of impaired gut health. One of the most common problems resulting in wet litter in the colder months tends to occur after the growers' desire to save fuel. The brooding chamber is maintained longer than usual to conserve energy and with that, the litter inside the brooding chamber acquired more moisture than the rest of the house. Tunnel ventilation is not used in the cold months and thus it may become impossible to remove the excess moisture accumulated in the brooding area with just cross ventilation and the use of "oxygen" fans. Flocks exposed to such conditions often have a more difficult time coping with coccidial challenge (vaccinal or field) because Eimeria parasites may sporulate and multiply more actively in warm, moist conditions. Inadequate coccidial cycling and excessive challenge during the fourth week of age may also be associated with suboptimal economic performance, gut fragility and increased opportunity for product contamination at the processing plant.

VIRAL INFECTIONS IN THE GROWING CHICKEN

Although not strictly an enteric pathogen, nephrotropic infectious bronchitis virus (IBV) can affect the kidneys and induce profuse diuresis and thus wet litter. Once a severely affected flock has experienced a significant infection with nephrotropic IBV it is very difficult to restore a healthy moisture level in the litter by ventilation, litter removal and replacement, or by tilling the litter. Controlling nephrotropic IBV often relies exclusively on biosecurity, cleaning and disinfection and extended downtime because most commercial vaccines are antigenically unrelated to nephrotropic IBV strains. This type of infection is certainly important regarding poultry health and economic performance, but is also important from the welfare point of view and in terms of food safety. It can become a welfare issue because the wet litter conditions invariably result in significant dermatitis problems; and the wet litter also results in severe soiling of the plumage of the birds in the affected flock, thereby increasing the bacterial load that ends up contaminating the live haul equipment and processing plant itself.

TOXICOSES AND PRIMARY PATHOGENS

Few toxic syndromes will result in wet litter, but an occasional case of excess sodium in the diet may result in wet litter in broilers, breeders or layers. Some nutritionists may use increased sodium levels as a tool to increase early feed consumption in broilers with the goal of attaining high 7-day-old body weights, which can result in watery droppings. Likewise, the use of bakery byproduct of unproven quality in layers often results in watery droppings. Excess calcium will result in kidney damage in young pullets and thus one of the first signs of calcium intoxication is kidney damage, which in turn may be associated with increased moisture in the droppings and wet litter. Brachyspira spp. infections in layers are well known agents that induce watery droppings in adult commercial layers. In general, some of the pathogens reported to induce diarrhea (and wet litter) include coccidia, worms, viruses, some bacteria viruses causing kidney damage, and excess protein in the ration. Subclinical clostridial infection may also be associated with increased moisture in the droppings and ultimately in the litter. Although not mentioned often, gastrointestinal and urinary Cryptosporidium infection has been implicated in excess moisture in the droppings and indirectly, in the litter.

WATER QUALITY AND DRINKER MAINTENANCE

Highly alkaline water may lead to an unstable gut, diarrhea, poor feed conversion and even reduced water and feed consumption. A high pH can be the result of high calcium and Magnesium levels. Highly alkaline water is to be interpreted as any levels higher than 8.5. An indirect indication of a possible excessive concentration of calcium, magnesium and sodium is a high reading of total dissolved solids (TDS). Moderate levels of sulphates may also induce wet litter. An additional problem derived from the accumulation of minerals in the drinker lines consists of the deterioration and buildup of minerals on the sealing of nipple drinkers and the consequent water leaks that are often observed in farms with hard water problems.

THE PRICE OF FUEL

The cost of fuel would appear on the surface to be completely unrelated to poultry health, but in reality it is one of the most important determinants of respiratory and gut health, particularly in areas where growers are responsible for the fuel used to heat poultry houses. During the cold moths of the year growers will do as much as possible to reduce cost. Fuel can represent up to 10% of the total cost of production and for growers, fuel, electricity and amortization are the major components of their cost of production. A grower that wants to save on fuel will tend to extend the brooding period, thus causing an incremental and disproportional water concentration in one end or area of the house, the brood chamber. Providing broiler chicks with the entire length of the house as living space is a synonym of having to spend more in fuel to heat up the entire house, instead of just the brood chamber. Even after providing the entire house as living space for the broilers, another way to save on fuel is by not moving as much air such that the house temperature will not be reduced substantially as a result of air exchanges. These actions will conserve fuel but they will also cause the air quality problems and the litter moisture to escalate to the point that field vaccinations with respiratory viruses will encounter severe vaccine reactions and the integrity of the gastrointestinal tract will be detrimentally affected because of the increased litter moisture, and the proliferation of bacteria and coccidia in the litter. Often times the price of fuel is pegged to the incidence and severity of respiratory and intestinal disease.

SUMMARY

In summary, when it comes to gut health or litter and air quality there are multiple interdependent factors, some of which are infectious, economic, nutritional, toxic, infrastructural, etc. and all must be considered in order to improve and maintain litter and air quality.