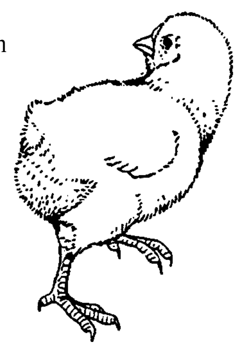
CURRENT CONCEPTS IN Broiler Production WINTER 2000

Necrotic Enteritis In Broilers

Necrotic enteritis is a complex disease of chickens that occurs in all poultry-producing areas of the world. Although the disease can occur at any time in the life of the bid, the majority of the cases occur in broiler chickens from 2-5 weeks of age. Associated with outbreaks of coccidiosis and the presence of *Clostridium perfringens* Type A and C, the disease is capable of rapidly producing a high incidence of morbidity and mortality.



Dietary alterations have been shown to affect the intestinal and cecal flora of poultry. Levels of intestinal *C. perfringens* and the subsequent development of necrotic enteritis have been postulated to be associated with various dietary factors, such as high levels of wheat or fish meal, which may in some way alter the normal microflora of the bird.

Alteration of the intestinal mucosal surface appears to be critical for the development of necrotic enteritis. Normal bacteria, such as Lactobacilli or Streptococci colonize the alimentary tract of healthy birds. The lining of the intestine is covered with a sticky mucous-like substance, which engulfs bacteria that attempt attachment to the cells of the intestine. Normal flora also interferes with attachment of undesirable bacteria to receptors on the cells of the intestinal lining, preventing incoming bacteria from colonizing tissues. This, in turn, allows them to be carried away by the peristaltic action of the gut as food moves through the intestine.

Dramatic and rapid changes in dietary ingredients or inclusion of high rates of more fibrous, less digestible materials, fish meal, or wheat can cause physical damage to the intestine. This damage can also be induced by the presence of bacterial toxins, particularly those from *Clostridium perfringens.* Once damaged the intestinal cells become vulnerable to colonization by pathogenic bacteria as well as digestive enzymes. Once introduced, these factors can in turn cause further intestinal damage, leading to conditions that enhance pathogenic bacterial colonization.

Although the mechanisms are not well understood, products such as Flavomycin, Stafac, BMD, Lincomix, and other feed additives have long been widely and successfully used in promoting intestinal health and preventing necrotic enteritis. Recent trade disputes among the European Union member countries, coupled with rising consumer concern about antibiotic resistance, have caused some nations to severely curtail or prohibit the use of nontherapeutic antibiotics. Successful implementation of these barriers to the lawful use of these products in some of the Scandinavian countries should serve as a wakeup call for the American poultry industry. Subsequent reemergence of necrotic enteritis in these same countries should also serve as a warning.

Countries that previously used scientific evidence as the basis for policy development have now succumbed to the

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AU Notes

FAA Poultry Career Development Events Go Statewide

ast July, the Auburn University Poultry Science Department conducted a poultry m-service short course attended by 40 Alabama high school agriscience teachers. This was to assist the agriscience teachers in teaching poultry science units in their classes and coaching teams of students participating in the first statewide FFA poultry events to be held next spring. These events will be held in each of Alabama's four FFA districts. High-ranking teams from each district event will participate in the state contest at AU next summer. The winning team at the state event will represent Alabama at the national championship in Kansas City, Missouri, next fall. Five-person teams from each high school will judge broiler breeder replacements, laying hens, broiler carcasses, breaded chicken patties, and table eggs, as well as identify cut-up broiler parts, and complete a thirtyquestion written exam on commercial poultry production. Funds for conducting the short course, district events, and state championship, as well as for sending the state's champions to the national championship, are being provided by the AP&EA's Allied Industry Committee, the Goldkist Foundation, and the United States Poultry and Egg Harold E. Ford Foundation. Auburn's Poultry Science Department will assist the FFA in conducting the district and state events and will also provide the agriscience teachers and students with information on the excellent educational opportunities in poultry science and career opportunities in the poultry industry.

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excesses of the "precautionary principle." Rather than abide with existing trade treaties and gather data so that rational decisions can be made, these countries have adopted the approach that what "might happen" is sufficient to warrant discontinuation of antibiotic usage, even when the causal evidence link is weak or none existent. The result is a more emotional approach to antibiotic use in agricultural animals with little thought as to the economic-, social-, and health-related impacts the alternative approach may have on the world. The American poultry industry and the academic community must educate the American Congress, so that this same approach to policy development is not adopted and that decisions continue to be made on the basis of rational thought and scientific evidence.

The best strategy for necrotic enteritis prevention is a multifactorial approach in which bacterial exposure is minimized by litter cleanout. Clostridia, unlike many bacteria, are spore formers. This highly resistant stage causes high levels of the bacteria to continually accumulate in the litter and contaminate feed and water. Once ingested, the bacteria rapidly change into an actively growing stage and colonize. If the particular isolate is one capable of toxin production, or the infection is coupled with coccidiosis or other intestinal damage, disease can result. Rapid and dramatic changes in feed ingredients, which substantially alter normal passage rate, should be avoided. Flocks should also be regularly monitored and vaccination programs systematically reviewed to insure maximum immunological competence.

Robert Norton, *Assistant Professor*
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Hatchery By-Product Disposal

The concentration of the poultry industry has resulted in the production of large volumes of by-products including manure, farm mortalities, hatchery, and processing plant wastes that require daily attention. The poultry industry has responded well in objectively evaluating economically and environmentally sound management principles in dealing with by-product utilization as opposed to disposal.

From the billions of eggs set in broiler hatcheries each year, over 100,000 tons of by-products are generated. The by-product consists primarily of eggshells, nonfertile eggs, dead embryos and dead or culled chicks. Principle methods for the disposal of hatchery by-products include landfill, land application, rendering, egg wringing, fermentation, and cornposting. Each has its own advantages and disadvantages.

Landfill

The major concerns with the landfilling of hatchery by-products are the tipping fees and trucking costs ($20/ ton minimum) for transportation and disposal of the material. Landfill operators have also been concerned about odors from hatchery by-products. This option tends to be expensive and yields poor utilization of recyclable nutrients.

Land Application

Based on guidelines for poultry manure, the rate of hatchery by-product application is adjusted to meet crop and soil nutrient requirements. The cost of labor and equipment for land application may offset its value as a fertilizer, but it is an alternative to landfill fees. If hatchery waste is applied to the land, it should be incorporated into the soil with a disc to prevent odor problems. Recycling large quantities of hatchery by-product to agricultural lands raises some serious issues in regards to nutrient management and biosecurity.

Rendering

Hatchery by-products can be rendered. However, most rendering facilities are not designed for handling this type of product, and processing this product can pose major difficulties in the system. Renderers are not typically interested in hatchery by-products for several reasons.

(1) Hatchery by-products are perishable and require frequent hauling as a consequence of poor storage facilities at the hatchery.

(2) Typically small loads incur higher transportation costs.

(3) Existing rendering equipment is not set up to adequately handle the liquid components of hatchery by-products.

(4) The customer perceives that small amounts of eggshell in a rendered product may contaminate or dilute the protein meal.

Egg Wringing

A promising alternative is the delivery of waste to a centralized facility where the liquid fraction is separated, dehydrated, and processed into an animal feed ingredient. Although this process recovers about 40 percent of usable by-product, the remaining fraction requires disposal/utilization.

Fermentation

Fermentation has been used as a method for preserving a variety of products utilizing bacterial species that exhibit organic acid production. Lactobacillus fermentation has been proven to be a safe, convenient, farm-operated process by which carcasses can be stored for extended periods of time prior to rendering. By using an active culture, providing an anaerobic environment, and the addition of a suitable carbohydrate source, fermentation by lactic acid-producing bacteria can adequately generate organic acids, which lower the pH necessary to inhibit the growth of harmful bacteria and to preserve most by-products. Hatchery by-products spoil rapidly unless they are rendered immediately or dehydrated to a stable form. Preservation by fermentation could be a solution to this problem. It would allow a hatchery to accumulate a large quantity of the by-product, which would be more highly stabilized, prior to transportation to a rendering facility.

Hatchery by-products have been successfully fermented in combination with a bacterial culture and an added carbohydrate source under anaerobic conditions. Results indicate that fermentation of hatchery by-products may be a viable alternative to current hatchery waste handling practices. This process may be less costly than landfilling and generates a stable and biosecure product that can be stored prior to rendering. Nutrients preserved with fermentation could be stored for several weeks with little change in nutrient concentration.

Composting

The co-composting of hatchery by-products with other organic compounds can be accomplished, and opportunities exist for the composting of hatchery wastes with other organic products such as broiler litter, yard leaves and clippings, horse manure, wood by-products, etc. Hatchery wastes can be successfully composted. The following requirements must be met to ensure a healthy compost process:

1. **Nutrient Mix** - A carbon: nitrogen ratio (C:N) in the range of 20:1 to 35:l is important for the bacteria to process the organic materials in the compost.
2. **Moisture** - A range of 40 to 60 percent is desirable for microbial activity to process the organic materials in compost. If allowed to be too wet or dry, the process will not operate effectively.
3. **Oxygen** - Composting is an aerobic process. Oxygen levels should not be less than 5 percent or odors may develop. Proper aeration (through turning) of the compost mixture is important.
4. **Temperature** - When the C:N ratio, moisture, and oxygen requirements are properly met, thermophilic aerobic bacteria will cause the mass to heat at temperatures above 130 degrees F and carbon dioxide and water vapor will be produced as by-products.
5. **pH** - When C:N ratio, moisture, and oxygen requirements are properly met, pH should also be met. If pH exceeds 8, then ammonia and other odors may become problematic. For best cornposting, a pH in the range of 6.5-7.2 is acceptable.

Hatchery by-products can be collected and the supernates can be extracted by centrifugation. The by-product remaining typically goes to a local landfill for disposal. Cornposting this by-product, primarily shells, may be an alternative. A simple composting recipe comprises one-part wood shavings to one-part hatchery by-product. Adequate water must be added to maintain proper moisture levels. Hatchery by-products and wood shavings can be mixed with a front-end loader and approximately 200 gallons of water would have to be added to every ton of mixture to achieve about 60 percent moisture in the initial compost mixture. The compost mixture should be turned frequently during the first four weeks of the composting cycle, every second or third day. Afterward, less frequent turning can be used. The cycle should be completed within 45 days.

Hatchery waste can be successfully co-composted with other organic materials not limited to a specific region. It effectively inactivates disease-causing organisms if a temperature of at least 130 degrees F is maintained for three consecutive days. Also, composted product obtained from the hatchery by-product after supernate removal has a high calcium content (approximately 25 percent), which may make it a suitable soil buffer.

As the poultry industry grows, one of its major priorities is the protection of our natural resources. The industry demands new technologies in poultry by-product development and utilization in its efforts to protect water quality and foster a cleaner environment. The poultry industry must be aware of management procedures that will have a direct effect on maintaining the quality of surface and groundwaters, soil, as well as human and animal health.

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(Excerpted from his presentation at the 1999 Alabama Breeder/ Hatchery Workshop. For more information on setting up a composting system, contact Dr. Blake at 334-844-2640.)

PRACTICAL FIELD STRATEGIES TO REDUCE PATHOGENS IN THE PLANT

Slaughter and processing operations have a considerable influence on the microbiological quality of meat products. Carcass contamination with spoilage and the presence of pathogenic microorganisms is undesirable, but yet, is an inevitable consequence of transforming live animals into ready-to-cook products. Therefore, contamination and cross-contamination should be considered likely at each stage-slaughter and processing. Research clearly indicates that the type and number of microorganisms present on the final product are directly related to the extent of microbial contamination of the live birds entering the plant.

Many bacteria, including human enteropathogens such as *Salmonella* and *Campylobacter*, are natural inhabitants of the digestive tract of poultry (i.e., crop or intestinal carriage and/or cecal colonization) and easily transferred by fecal material to the external surfaces (skin, feathers, and feet) prior to and during (skin and exposed muscle tissues) processing. The primary objectives during slaughter and processing operations should be to reduce the load, restrict the spread, and limit the growth of microorganisms brought into the plant with live birds. Processing equipment and technology currently available can reduce the load and limit the growth of bacteria significantly, from receiving live poultry to shipping the end product. However, many opportunities exist during processing for the spread of pathogenic bacteria, even in the form of a single cell, from a contaminated carcass to an uncontaminated carcass. When present, numbers of food poisoning bacteria are often very low on finished products,

In spite of tremendous advances in plant automation and processing technology in recent years, controlling cross contamination has been especially difficult for poultry processors, primarily because of many unique aspects of the slaughter process. First of all, modem-day poultry processing facilities handle thousands of birds daily, usually from multiple farms. Consumer preference for intact skin on many of the poultry products requires immersion of birds in scalding tanks to aid in feather removal. Subsequently, the internal organs are removed through a relatively small opening in the body cavity to maintain tissue integrity. Finally, eviscerated carcasses are chilled in cold immersion tanks to limit bacterial growth. During this highly mechanized process, pathogenic bacteria, often found on the skin and digestive tract, can easily be disseminated from positive to otherwise negative flocks.

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Efforts at pathogen reduction must be coordinated both in the field and in the plant for maximum effect. The following suggestions are designed to highlight the role of field efforts and efforts at the field-plant interface in reducing plant problems associated with bacterial contamination.

Field Measures to Reduce Bacteria in the Plant

- Implement control measures at the farm level to control the growth, multiplication, and spread of pathogenic microorganisms. This will reduce the amount of pathogenic bacteria brought into the plant in (digestive tract) or on (skin, feet, and feathers) live birds. This may include interventions in feed and ingredient quality, competitive exclusion cultures, or live-production practices to reduce field bacterial load.
- Introduce strategic scheduling of flocks for processing. Establish a pre-testing program during the growing period for pathogens so that negative flocks can be processed prior to those that have tested positive for pathogens. This will greatly reduce cross-contamination during processing.
- Design and implement an effective feed and water withdrawal program prior to catching (in the house) and until processing (total time). Adhere rigidly to established programs and communicate often with grow-out farms, catching crews, and the processing plant for timely modifications.
- All live-haul equipment (coops, crates, cages), including the transport vehicles should be cleaned and sanitized between the lots, as they can be carriers of pathogens between the grow-out farms and cross-contaminate other flocks brought into the plant.
- Minimize stress during live-haul of poultry to the processing plant, as fasting and transportation can increase the pathogen populations in the digestive tract of birds. Use minimum amount of yard time prior to processing. Under extreme fasting and confinement and environmental stress, carrier birds will become pathogen shedders. This will not only contaminate the transportation equipment but also increase the pathogen load on birds through external contamination and consumption of potentially contaminated droppings.
- Control dust and airborne particulates (i.e., dander and feathers) in and around the receiving (bird unloading) and hanging areas. Frequently clean the unloading area and hanging belts to prevent buildup and cross-contamination.
- Check and verity clean and dirty airflow patterns in and around the plant. Make sure that a negative pressure environment is created in hanging, slaughter, and picking areas of the plant (or alternatively have positive air pressure in finished product areas) and clean air intakes of the plant are dint from the plant exhaust.

Sacit Bilgili, *Extension Poultry Scientist*, Professor
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Research Shorts........

Recent Research of Interest to Poultry Managers

1. Cox, N.A., M.E. Berrang, R.J. Buhr, and J.S. Bailey, 1999. Bacterial treatments of hatching eggs II. Use of chemical disinfectants with vacuum to reduce *Salmonella*. Journal of Applied Poultry Science 8:321-326.

When chloride or hydrogen peroxide was applied to hatching eggs under a vacuum, bacterial levels were reduced over the sanitation chemicals alone. No loss in hatch was seen. This technology is not ready for field use but may be useful for the near future.

2 Howie, M., 1999. Poultry-soy product may be valuable addition to growing pig diets. Feedstuffs 71, Number 48, pp. 10-11.

A dehydrated broiler mortality-soybean meal product was fed to pigs to determine safety and efficacy as a feed ingredient. Pig growth rates were not affected when the product was swapped for soybean meal, indicating that dehydrated poultry-soy blend may be a useful ingredient in feeds. Significant information is provided on the nutritional profile of this ingredient.

3 Bilgili, S.F., G.I. Montenegro, J.B. Hess, and M.K. Eckman, 1999. Sand as litter for rearing broiler chickens. Journal of Applied Poultry Research 8:345-351.

One of two papers in this issue on the sand work done at Auburn. As most of you have heard us say, sand appears to have potential as a litter source if pine shavings availability problems continue or worsen.

4. Enterline, B., 1999. High output pelleting. Feed Management 49, Volume 12, pp. 17-20.

This article reviews the use of a l00-ton/hr-pellet mill in a feed plant in Georgia. Lower capitol costs, lower installation costs, lower operating costs, and reduced maintenance needs were cited as advantages of a unit this large over two 50-ton/hr-pellet lines.

We would like to compile an updated list of individuals interested in receiving ***Current Concepts In Broiler Production*** on a regular basis. If others in your organization would like to receive this publication, please fill out this form and return it to:

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