CURRENT CONCEPTS IN WINTER 1995

Broiler Production

What Is HACCP?

The Hazard Analysis Critical Control Point (HACCP) System

The HACCP system is a series of interrelated steps that should be taken for all foods processed or prepared in any one establishment, including all operations from the time foods are produced until they are consumed. The HACCP concept is rational because it is based on historical scientific data about causes of foodborne illness. It focuses attention on critical operations where control is essential. This is in contrast to inspections, which are often concerned with matters relating to aesthetics and code requirements of minor significance to health. Interpretations of the requirements and action to take are often left to the discretion of the inspector. These may differ from inspector to inspector, jurisdiction to jurisdiction, and for different types of establishments. The HACCP system is comprehensive because it relates to ingredients, processes, and subsequent use of products. It is continuous because problems are detected when they occur or shortly thereafter, and prompt action is taken for correction. It is systematic because it is a thorough plan covering step-by-step operations, procedures, and control measures. Thus, it greatly reduces risks of foodborne disease. The HACCP approach can prevent the false sense of security that is often associated with inspections when hazardous practices are missed during brief and infrequent visits.

Steps of the HACCP system are illustrated in Figure 1.

Definitions that are associated with the HACCP system follow:

A *hazard* is unacceptable contamination of a biological chemical, or physical nature, and/or survival or multiplication of microorganisms of concern to safety, and/or unacceptable production or persistence in foods of toxins or other undesirable products of microbial metabolism. Biological hazards include infectious or toxigenic bacteria, viruses, and parasites. (The term pathogen refers to infectious or toxigenic microorganisms.) Chemical hazards include pesticides, cleaning compounds, antibiotics, and heavy metals. Physical hazards include metal fragments, bones, glass, wood splinters, and stones.

Severity is the magnitude of a hazard or the de-

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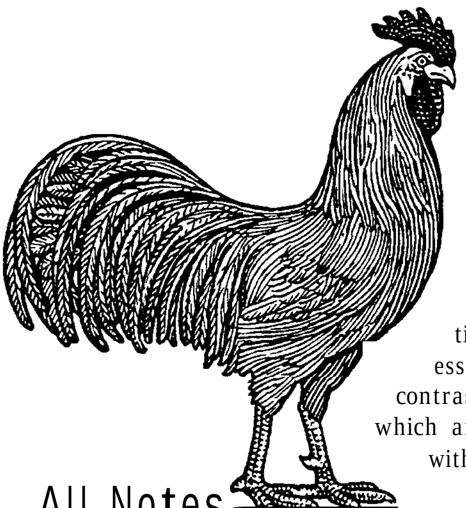

AU Notes

Dr. Emilio Mora, Emeritus Professor in Poultry Science at Auburn University, died following heart surgery October 18. Dr. Mora had recently retired after 37 years on the faculty at Auburn, during which time he directed more than 60 graduate students and advanced the sciences of microbiology and virology as they relate to poultry. One of his recent projects demonstrated the antiviral effects of a compound that may one day reduce disease symptoms in poultry and man. It would be a fitting tribute to this man of science if this or another of the compounds Dr. Mora was testing someday reduces suffering in others.

The 1994 National Poultry Waste Management Symposium was held October 31 through November 2 in Athens, Georgia. As has been the case with other seminars in this series, the 1994 meeting showcased new technologies and ideas to improve our stewardship of the land. In addition, new regulations were reviewed and updates on existing programs were presented to help educate the audience on the current status of environmental legislation.

The 344-page proceedings is available for $25.00, plus $5.00 for shipping and handling. Make checks payable to: National Poultry Waste Management Symposium.

Anyone wishing to purchase the proceedings from this meeting may contact John Blake, Department of Poultry Science, Auburn University, AL 36849-5416 (205-844-2640, Fax 205-844-2641; Auburn's area code will change to 334 on January 15,1995).

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gree of consequences that can result when a hazard exists. Three categories of disease-causing hazards are: life-threatening, severe or chronic, and moderate or mild illness. Most agents cause a spectrum of illness that ranges from asymptomatic colonization to severe illness or death. Some agents fall into more than one category. For general guidance, the following agents are classified into one of three categories:

- Life-threatening illnesses include those caused by *Clostridium botulinum, Escherichia coli* 0157:H7, *Salmonella typhi,* and *Listeria monocytogenes* (for fetuses, infants, or immunosuppressed persons).
- Severe or chronic illnesses include those caused by *Campylobacter,* pathogenic *Escherichia coli, Salmonella, Shigella, Streptococcus* Type A, and hepatitis-A virus.
- Moderate illnesses include those caused by *Bacillus* spp., *Clostridium perfringens, L. monocytogenes* (for previously healthy adults), *Staphylococcus aureus,* Norwalk-like viruses, most parasites, and most heavy metals that cause mild acute illnesses.

Time and place may require movement of individual agents to different categories. Severity varies with dose and individuals. Usually the higher the dose is, the shorter the incubation period and the more severe the outcome. Groups who are more susceptible to microbiological hazards than healthy adults include: pregnant women, infants, immunosuppressed persons (e.g., cancer or AIDS patients), or elderly or hospitalized persons. Hence, illnesses in these people will be more severe.

Risk is an estimate of the probability of occurrence of a hazard or the sequential occurrences of several hazards. Degrees of risks are high, moderate, low, and negligible. Risky situations may vary, depending on what is happening at the time. Outbreak and other epidemiological data indicate the microbiological hazards of highest risks to the greatest number of persons. Physical hazards usually affect individuals rather than groups.

A *critical control point* (CCP) is an operation (practice, procedure, process, or location) at which a

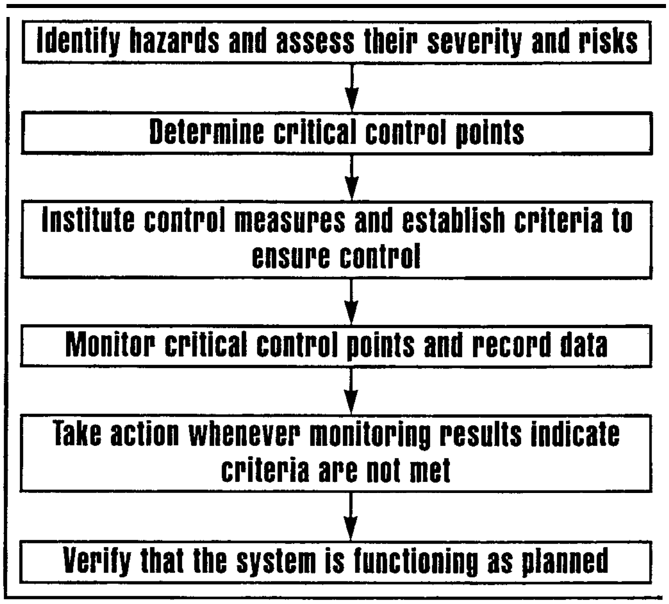

Figure 1. The HACCP system.

preventive or control measure can be exercised that will eliminate, prevent, or minimize a hazard or several hazards. Hence, there are different types of critical control points because of the control exerted. They will either eliminate, prevent, or minim&the hazard. Critical control points are sometimes referred to as a CCPl, where hazards are eliminated or prevented, and a CCP2, where hazards are only minimized, reduced, or delayed. This does not imply, however, that a CCP2 is less important than a CCP1. These definitions indicate that control of hazards at a CCP ranges from absolute to partial Furthermore, a critical control point must be distinguished from ordinary control activities or control points.

A *control point* is an operation at which preventive and/or control actions are taken because of good manufacturing practices, regulations, product reputation, corporate/company policies, or aesthetics. Such distinction between control points and critical control points is one of the unique aspects of the HACCP concept which sets priorities on risks and emphasizes operations that offer the greatest potential for control.

Criteria are specified limits or characteristics of a physical (e.g., time or temperature), chemical (e.g., amount of salt or acetic acid), or biological (e.g., sensorial or microbiological) nature. Criteria must be specified for each critical control point.

Monitoring is checking that a processing or handling procedure at each critical control point meets the established criteria. Monitoring may be accomplished by: (a) observing handling practices and cleaning procedures; (b) measuring time/temperature, pH or acidity, water activity, detergent/disinfectant (sanitizer concentration, container/package condition (e.g., seams, vacuum); and/or (c) collecting

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Current Concepts In Broiler Production is a publication of the Alabama Cooperative Extension Service with the cooperation of the Department of Poultry Science at Auburn University. This publication is designed to provide new and emerging concepts and information to those involved in broiler and breeder production.

Information on management, feeding, and disease will be compiled from research underway at Auburn University, as well as from other sources. New technologies and practices will be highlighted as they become available.

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and testing samples of foods. It involves systematic observation, measurement, and/or recording of the sign&cant factors for prevention or control of hazards. This usually calls for making and maintaining records, which confirm that monitoring has been done effectively. Records include time-temperature charts and graphs, control charts, check-sheets, forms for recording observations and measurements, and laboratory reports.

Corrective action is specified, prompt action(s) to be taken when criteria are not met. These include actions taken to reestablish control of a CCP and the disposition of product produced when the process was out of control.

Verification is the supplemental tests and/or the review of monitoring records to determine whether the HACCP system is in place and functioning as planned and to ensure that monitoring is carried out effectively and efficiently. Verification is different from monitoring in that it does not always call for immediate corrective action. It may, however, necessitate modification of some component of the HACCP system or holding or reworking a finished product.

This information was provided by Donald Conner, Associate *Professor in the Poultry Science Department* at Auburn University.

Nutrition And Waste

Among the presentations at the National Poultry Waste Management Symposium held recently in Athens, Georgia were three papers dealing with the effects of nutrition on levels of nutrients in manure or litter, Larry Vest of the University of Georgia spoke on nutrient levels of broiler litter after four grow-outs. When compared to the level in the diet, levels of individual elements were concentrated from 1.05 to 12.04 times, depending on the element. In general nutrients were concentrated approximately 2.5 to 3.5 times that found in feed. Under these conditions, birds consuming litter take in elevated levels of copper, iron, magnesium, sodium, calcium, and phosphorus compared to birds on new litter. 'These levels could be beneficial or detrimental, depending on the bird's health and environmental conditions. Interestingly, nitrogen was only concentrated 1.05 percent over that in the feed, because a substantial quantity of this nutrient is volatilized as ammonia.

Paul Patterson of Penn State spoke on nutrient concentration in the manure of table egg hens. Of the nutrients taken in from feed, approximately 90 per cent could be accounted for in the birds, eggs, and manure. Nitrogen, again, was the exception, due to losses into the air. Although hens need constant quantities of many nutrients to remain healthy and productive, they do not store large quantities in their systems, with less than 1 percent of most nutrients staying with the hen. Anywhere from 12 to 50 percent (depending on nutrient) of the nutrient intake was deposited in the eggs produced.

A third paper reviewed the use of feed-grade enzymes to improve feed utilization and reduce wasted nutrients. Craig Wyatt of Finnfeeds International highlighted the use of enzymes to improve energy and protein digestion of grains such as wheat and barley which are not used as efficiently by poultry as is corn. Enzyme usage was shown to raise the energy value of wheat 6 percent and the protein value 20 percent, making better use of this ingredient's nutrient profile and reducing fecal waste at the same time.

Wheat becomes an attractive feed ingredient in the Southeast each year after harvest. Although this "window of opportunity" is limited to only a portion of the year, feed savings from using this ingredient could be substantial if it could be used with little fear of lost performance. Unfortunately, wheat usage is frequently correlated with performance losses that are often substantial. Wheat can vary greatly in nutrient content and availability. Enzyme usage, although an added cost, may allow this ingredient to be utilized to its fullest.

Although the author did not discuss this area of research, many who work with enzymes are interested in products that can break-down the complex starches in soybean meal and canola meal possibly gaining more energy and added value from these ingredients.

These three papers presented information of interest to those charged with reducing nutrient buildup on our lands and in our water supplies. When you look a little deeper, however, you can find information in these articles that pertains directly to bird health and live performance.

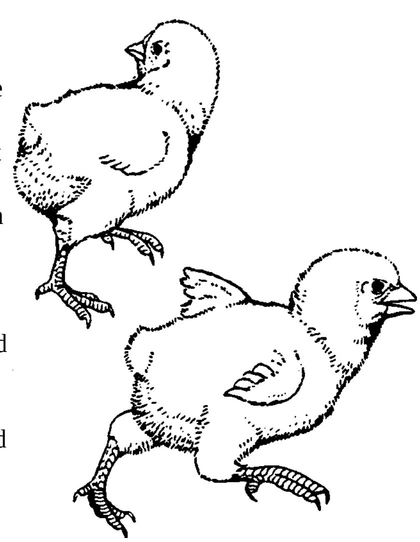
References:

Vest, L. R 1994. Estimating nutrient levels in broiler litter. *Proc Nat. Poultry Waste Mgmt. Symp.* pp. 97-103.

Patterson, P. II. 1994. Estimating manure production based on nutrition and production: Laying hens. *Proc. Nat. Poultry Waste Mgmt. Symp.* pp. 90-96.

Wyatt, C. L., 1994. Feed formulation with enzymes to reduce nutrient output *Proc. Nat. Poultry Waste Mgmt. Symp.* pp. 81-89.

This information prepared by J. B. Hess, Extension Poultry Scientist at Auburn University.



QAC Programs: True Fertility, Shell Quality, Embryonic Mortality, Point Spread, And Hatchability ---- Practical Applications

The collection and proper interpretation of QAC data are paramount for an effective breeder/hatchery egg break-out program.* First the program must be conducted routinely and the data organized following collection. In this first of a series of articles, methodology, data collection, and organization will be stressed

The ideal break-out program includes a 10- to 12-day candle-out of incubating eggs, followed by examination of the residue at hatch. Typically, a sample of 450 to 750 eggs is required for initial candling. Although the smaller sample is adequate, the larger sample provides greater accuracy. Trays (3 to 5) of eggs are candled (hand or mass), examined for infer tiles, early dead, upside-down sets, cracks, and general egg pack quality with regard to uniformity and cleanliness. Egg samples are then marked for subsequent examination at hatch. This latter examination will assess mid- and late-dead, culls, cracks, and pips. Contaminated (bacterial/fungal) eggs may also be determined at this time. The total figures will establish true fertility, early-, mid-, and late embryonic mortality, culls, cracks, pips, and point-spread. Point-spread is true fertility less actual hatch.

Eggs from each breeder flock should be placed in the break-out rotation twice monthly from the first setting of eggs through at least 55 weeks of lay. Ideally, break-out data from flocks throughout the entire period of lay are recommended, as they may be of value in planning future pullet/breeder programs. The mechanical or operational portion of a sound break-out program is relatively simple. Personnel can be trained easily in 4 to 8 hours; then, a subsequent review of techniques should be conducted following several months of practical experience. In a typical one million placement per week complex, 30 to 40 breeder flocks are in production continuously, and as previously outlined, each must be in the break-out rotation every 30 days. This generally requires one full-time employee with break-out, data collection, and organization responsibilities. Information from an egg break-out program is extremely valuable with regard to current operations of the breeder/hatchery phases, but also for future program implementation in pullet/breeder practices.

A quality, yet practical, break-out program measures/assesses the following: (1) True fertility (%); (2) Early embryonic mortality (%); (3) Mid-embryonic mortality (%); (4) Late embryonic mortality (%); (5) Culls, cracks, pips (%); (6) Projected hatch (%); (7) Actual hatch (%); (8) Point spread (%); (9) Upside-down sets (%); (10) Soiled eggs (%); (11) Uniformity (egg/air cell); and (12) visual shell quality.

Assessing these 12 factors in the bi-monthly rotation for 30 to 40 breeder flocks for 40 weeks of lay generates a tremendous quantity of data. such information must be organized on a continuous basis into the following categories for assessment:

- Flock age (4): 30 weeks or less; 31-39 weeks; 40-49 weeks; and 50 weeks or older.
- Month.
- Quarter.
- Strain cross.

Proper organization of data allows you to assess breeder/hatchery performance by flock age, seasonal extremes, and strain cross. Fertility, for example, is strictly a function of the pullet/breeder phases; however, all other factors assess a blend of pullet/breeder/hatchery operations. In summary, a quality, yet practical, egg break-out program is invaluable for the immediate and long-term decision-making processes in the breeder/hatchery phases of a modem-day broiler complex.

In the next article, detailed assessment of break-out figures will be discussed and interpretation of true fertility, projected hatch, actual hatch, and point-spread reviewed.

This information was prepared by M. K. Eckman, Extension *Specialist and Poultry Pathologist in the Poultry Science Department* at Auburn University.

Mini-Cowposting Dead Broilers On Small Farms

The testing and adoption of composting as a method for the disposal of poultry carcasses in Alabama began in 1989. To date, more than 500 composters are operating on Alabama broiler farms. Poultry producers have readily accepted composting, but composter operation requires a tractor with loader for loading, turning, and removing the compost On the other hand, small to medium sized broiler farms, those with only one or two broiler houses, do not have tractors with loaders and have not adopted composting. About 50 percent of the Alabama broiler farms fall into this category.

Methods for the mini-cornposting of poultry carcasses have been investigated in other states as well as at Auburn University during the past 5 years. A main difference between mini-composting and full-scale composting is cost A mini-composter can be constructed for about half the cost of a full-scale composter. The equipment requirements differ: full-scale composting requires a tractor and loader for loading, turning, and removing large amounts of litter, while mini-compost& requires manual labor to move small amounts of litter. Another difference is that full-scale composting requires a secondary bin for turning the com-

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post Mini-cornposting is a single stage process that does not require turning and less litter is required to operate a mini-composter than is required for a large-scale composter.

The simplest design for a mini-composter consists of a wooden box to hold dead poultry and other composting materials. The portable compost bin developed at Auburn University is 4 feet by 4 feet and 4 feet high with removable side panels, and the bin is constructed from pressure-treated lumber with ½ inch air spaces between side boards. This bin can handle normal bird mortality (two to four carcasses per thousand per day). An average 20,000 bird house requires four to five bins to handle normal bird mortality.

In Alabama, the compost bins are placed on concrete under a small shed which is separated from the poultry house. A shed ensures all-weather operation and controls the moisture content of the compost Concrete prevents soil contamination, excludes vermin, and, most importantly, provides an excellent working surface.

Alternative methods for the disposal of poultry carcasses are limited, and mini-cornposting presents itself as an acceptable environmentally sound method for the disposal of poultry carcasses. Applied research conducted at Auburn University in the early 1990s demonstrated that small-scale composting puts an effective and simple composting system within the reach of virtually every poultry producer. The mini-composter fills the need for a small, simple composter that can process complete grow-out mortality on small to medium sized farms. The operation is simple, yet highly effective, and construction costs are reasonable.

In an effort to assist poultry producers, the Alabama Agricultural Development Authority has approved a loan program that will allow producers to construct low-cost composting structures. The loan amount is based on the number of houses and the size composter that is required to accommodate normal mortality. The loan program is being administered in cooperation with Alabama Poultry and Egg Association and Alabama Cooperative Extension Service.

County Extension agents will be the primary link with the poultry grower and the poultry industry in the success of this project. Composting information and structural plans are available from county Extension offices. Also, county Extension agents can help growers determine composter size, placement, and management requirements.

For additional information, the following sources are available from Alabama Cooperative Extension Service: Circular ANR-804, "Mini-Composters in Poultry Production"; Circular ANR-850, "Questions and Answers About using Mini-Cornposters"; and Videotape, Composting Poultry Carcasses; and Videotape, *Disposal of Dead Poultry Using Mini-Composters.*

Prepared by J. P. Blake and D. E. Conner of the Poultry Science Department and J. O. Donald of the Department of Agricultural Engineering, Aubum University.

Research Shorts

Recent poultry research of interest to poultry managers

1. Kotula, K. L., and Y. Wang. 1994. Characterization of broiler meat quality factors as influenced by feed withdrawal time. *J. Applied Poultry Research* 3(2): 103.

Broiler meat was evaluated for moisture and tenderness in birds 0,3,6,12, 18,24, and 36 hours after feed withdrawal. Moisture decreased in breast meat and increased in thigh meat as feed withdrawal time increased. Shear values, a measure of tenderness, increased with increasing withdrawal time beyond 6 hours.

2. Rosales, A. G. 1994. Managing stress in broiler breeders: A review. J. *Applied Poultry Research* 3(2):199.

Stress is au important contributor to reduced performance and decreased disease resistance. Broiler breeders are subjected to more stress than most birds to maintain reproductive fitness. It is important, therefore, to manage breeders in ways that help minimize stress.

3. Neighbor, N. K., L. A. Newberry, G. R. Bayyari, J. K. Skeeles, J. N. Beasley, and R W. McNew. 1994. The effect of microaerosolized hydrogen peroxide on bacterial and viral poultry pathogens. *Poultry Sci.* 73(10): 1511.

Direct exposure to 5% H_20_2 gave complete inactivation of the bacteria species studied *(E. coli, S. aureus,* and *S. typhimurium)* and the LT virus. Newcastle, bronchitis, AI, and bursal disease viruses were more resistant A 10% H_20_2 solution gave complete inactivation of all

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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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pathogens, but was more corrosive to uncoated and galvanized steel.

4. Renden, J. A, E. T. Moran Jr., and S. A. Kincaid. 1994. Lack of interactions between dietary lysine or strain cross and photoschedule for male broiler performance and carcass yield. *Poultry Sci.* 73(11): 1651.

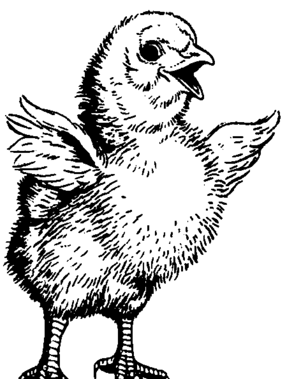
Lighting schedules with 14 hours light:10 hours dark or 16 hours light:8 hours dark from 3 weeks on resulted in poorer Live performance and reduced breast meat yield than a lighting schedule of 23 hours light:1 hour dark Added lysine improved performance, but did not overcome the effects of the reduced-light program.

5. Casteel, E. T., J. L. Wilson, and R J. Buhr. 1994. The influence of extended posthatch holding time and placement density on broiler performance. *Poultry Sci.* 73(11): 1679.

Twelve hundred eggs were set and chicks banded at 528 hours (22 days) incubation. Half the chicks were removed at this time, while the other half were returned to the hatcher for an additional day. Although these chicks showed no outward signs of dehydration, immunity measures were reduced with added holding time. Immunity and feed conversion were also reduced in broilers set at high density.

6. Anderson, S. 1994. Beyond screen size. *Feed Management* 45(9): 20.

The use of Large rotor, high speed hammer mills to switch grinding from the screen to the hammers is discussed. Efficiency is improved and particle size can be reduced. This system would be best used by operations pelleting most of their feed, as broiler operations do. There is also an interesting article in this issue concerning twin shaft mixers.



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