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Necrotic Enteritis

by Vijay Durairaj and Dustan Clark, Center of Excellence for Poultry Science, University of Arkansas

INSIDE

Introduction

The disease necrotic enteritis was first described in chickens in England in 1961 and since that time has been reported in the majority of countries around the world. Necrotic enteritis has been identified in broilers, laying hens, turkeys and quail. Necrotic enteritis has been estimated to affect up to 40% of the commercial broiler flocks and is believed to cost the industry about 5¢ per broiler in the United States (McDevitt et al, 2006).

Cause

Necrotic enteritis is caused by toxins produced by *Clostridium perfringens* as it grows in the intestinal tract of birds. *Clostridium perfringens* is a bacterium that grows under anaerobic conditions (in the absence of oxygen) and produces spores that are highly resistant to drying, heat, acid and other harsh conditions. The spores produced by this organism are commonly found in water, soil, feed, manure and other environmental sources.

Although, small numbers of *Clostridium perfringens* are also commonly found in the intestinal tract of healthy broilers, they do not cause disease. Under normal conditions the "good bacteria" in the intestinal tract keep the *Clostridium perfringens* population small in number.

However, when conditions change in the intestinal tract, *Clostridium perfringens* numbers increase, toxins are produced and the disease appears.

While anything that causes intestinal irritation can lead to necrotic enteritis, stress; intestinal disease (particularly coccidiosis); intestinal parasites (especially round worms); and immune suppression by mold toxins (mycotoxins), chicken anemia virus, Gumboro disease or Marek's disease have all been specifically linked to the disease.

Symptoms

Necrotic enteritis is commonly seen in 2-to 5-week old broiler chickens raised on litter and in 7-to 12-week-old turkeys. At times, the only symptom the clinical (severe) disease is the rapid and unexplained death of the bird.

When symptoms such as severe depression, decreased appetite, dark colored diarrhea, closed eyes or ruffled feathers appear they are often short-lived because birds die rapidly. Dead birds appear dehydrated and seem to rot very quickly from the inside out.

When dead birds are opened it may appear that the bird has coccidiosis, but the intestines are ballooned with gas, fragile and contain a foul-smelling brown fluid. Early in the disease intestines may contain ulcers or light yellow spots on the surface. Later in the disease the interior surface of intestines may contain what seems to be a tan to yellow colored membrane that is often said to resemble a "Turkish towel."

The disease will linger in the flock for 5 to 10 days, causing 2 to 50% mortality (Merck Veterinary Manual, 1998).

While symptoms of the clinical (severe) form of necrotic enteritis are fairly easy to recognize, the sub-clinical (mild) form of the

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disease is not so easily recognized. Birds with mild necrotic enteritis may simply look like they don't feel good and/or may gain or perform poorly (Kaldhusdal and Lovland, 2002). Yet, scientists believe that the mild form of necrotic enteritis has a much greater impact on flock performance and profitability than the severe form.

Prevention, Control and Treatment

Antibiotics such as bacitracin, penicillin or lincomycin can be used to treat the necrotic enteritis, but it is often impossible to effectively use antibiotics since the disease progresses so rapidly and the toxins involved produce irreversible intestinal damage. Thus, it is most often easier to prevent necrotic enteritis rather than treat it. Unfortunately, it is not always possible to address every situation that may lead to the onset of the disease. Still, in view of the performance and economic issues involved, it is important to address all the issues possible, including: keeping bird stress to a minimum, maintaining feed storage and delivery systems, vermin control and coccidiosis control.

Any factor that causes stress in the bird can alter the intestinal environment, allowing *Clostridium perfringens* to grow and produce toxin. While stress can come from innumerable sources, the proper set-up and management of poultry house environment is the most obvious method of controlling stress.

Since it provides the power and raw materials required for the bird to grow, it is also important to properly handle feed. Feed that has been allowed to become old, damp or wet will encourage mold growth and possibly toxin (mycotoxin) production and should not be used. Almost all mycotoxins reduce disease immunity in the bird and certain mycotoxins are known to irritate the intestinal tract. Even if mycotoxins are not present, moldy feed is unpalatable and contains fewer nutrients that fresh feed. Hence, it is important to ensure that feed handling and storage equipment is properly maintained.

Rodents and wild birds (vermin) are often found to transmit disease organisms and parasites. Since, such microbes and pests can either cause disease or stress in the flock, it is imperative that these vermin be controlled.

Intestinal damage from the disease coccidiosis can easily allow an "opening" for necrotic enteritis to develop. Thus, it is extremely important to ensure that coccidiosis does not develop in the flock. While all poultry companies maintain coccidiosis control programs, inadequate management practices can threaten these programs.

Perhaps, the most important management practice involved in the control of necrotic enteritis is the regular collection and disposal of the dead. If the dead are not frequently collected, the cannibalism will occur, exposing other birds to large number of *Clostridium perfringens*, spreading the disease.

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CHECKING THINGS OVER - Dr. Dustan Clark, poultry veterinarian at the Center of Excellence for Poultry Science, does a routine check of a bird.

G. Tom Tabler, Manager, Applied Broiler Research Unit - Savoy
Center of Excellence for Poultry Science • University of Arkansas

Applied Broiler Research Farm Report: Electricity Usage Before and After Renovation

Introduction

The Applied Broiler Research Farm (ABRF) is a 4-house commercial scale broiler farm owned by the University of Arkansas with research capabilities that include the close monitoring of total electricity usage and the individual electricity usage of each house. The farm was constructed in 1990 and completely renovated in early 2006, with resumption of growing broilers in April 2006. This is the second of a planned series of "before and after" reports on ABRF performance in various areas.

Electricity Usage

The ABRF has electric meters on each broiler house that allows electricity usage to be closely monitored on the farm. Electric meters are read weekly and usage has been calculated for each of the 92 flocks of broilers raised on the farm since 1990. As expected, electricity usage is always much greater in the summer when tunnel fans and cool cells are running much of the time as opposed to the winter season when minimum ventilation is used. Total electricity usage by flock for the period 2001-2006 is listed in Table 1. During the period 2001-2004, the farm raised 6 flocks of broilers per year. In general, flocks were placed in the months of January, March, May, July, September, and November. There were no flocks placed in November 2005, January 2006, or March 2006 because the farm was shut down for renovations.

Table 1. Electricity usage (kilowatt hours) at the Applied Broiler Research Farm (2001-6).

Flock	Placement Month	2001	2002	2003	2004	2005	5-Year Avg.	2006
1	January	10920	9757	8672	6853	12640	9768	--
2	March	7258	9423	7570	6625	10729	8321	--
3	May	15341	9835	9900	13561	14283	12584	16070
4	July	23806	20709	14810	17042	19681	19210	23607
5	September	4326	18092	4683	17139	18464	12541	28964
6	November	6740	8633	7674	13607	--	9164	22300

Electricity usage increased for each flock in 2006 compared to the average of the previous 5 years. This was expected because there is no longer natural ventilation available since curtains were replaced by solid sidewalls on all 4 houses. Mechanical ventilation (either sidewall or tunnel fans) is now the only method of air exchange. In addition, there is also no natural light available after renovations. All lighting is now with artificial light (light bulbs), which requires additional electricity, compared to

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the period before renovations when natural lighting available during the day. We are currently investigating the use of cold cathode lighting in one house which may have the potential for substantial energy savings over more typical incandescent lighting and, unlike fluorescent lighting; cold cathode bulbs are easily dimmable. These efforts will be reported at a later date.

Even though electricity usage has increased versus before renovations, that may not be as bad as it sounds. While the solid sidewalls have increased electricity usage, if those same solid sidewalls can save enough fuel (propane), the farm is better off in the long run. When the farm was built, electricity costs were roughly $0.05 per kilowatt hour and propane cost $0.52 cents per gallon. Electricity costs are now roughly $0.06 per kilowatt hour while propane costs are roughly $1.35 to 1.50 per gallon. As you can see, electricity costs are roughly the same now as when the farm was originally built in 1990, but, propane costs have roughly tripled. Therefore, the farm can afford to use several extra kilowatt hours of electricity and still be ahead if it can save on propane use.

Kilowatt hours: Total and by individual house

Figure 1 illustrates the total kilowatt hours used on the farm from 2001 through 2006. During the 6 flocks per year in 2001 through 2004 and 5 flocks in 2005 before renovations, the farm had never used more than 76,500 kilowatt hours in a single year. However, in 2006, during which time only 4 flocks were grown after renovations were complete; the farm used almost 91,000 kilowatt hours. This figure will be considerable higher in the future when a full year's worth of production is calculated vs. the 8 months worth of production shown here. Again however, it may be possible to compensate for this greater kilowatt hour usage with increased fuel savings. This is something we will continue to investigate.

Figure 1. Total kilowatt hours of electricty used (by year) at the Applied Broiler Research Farm (2001-6).

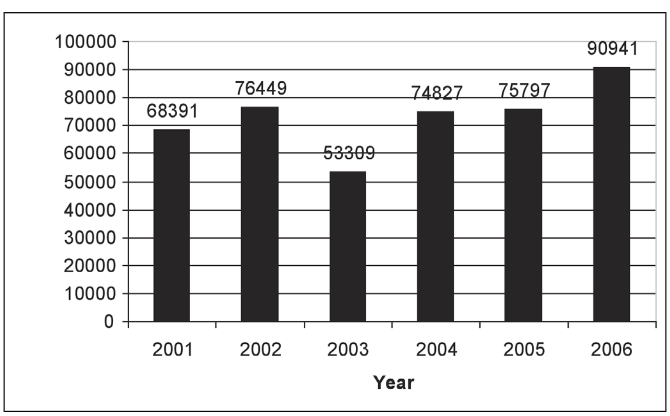
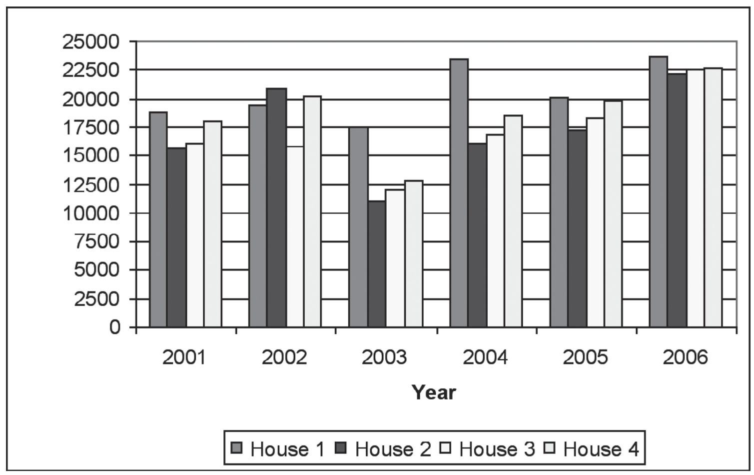


Figure 2 indicates the kilowatt hour usage by individual house for the period 2001 to 2006. During most years, house 1 used the most kilowatt hours. This was due (among other things) to the stir fans and jet tubes were used to distribute hot air off the ceiling back down toward the floor during winter periods. Also, an experimental litter burning furnace was installed at that house which used additional electricity that could not be separated from house electricity. After renovations, and during 2006, electricity usage was similar for houses 2, 3, and 4. Usage was somewhat higher in house 1 due, in part, to the experimental litter burning furnace.

Aside from the experimental furnace at house 1, renovations have made all 4 houses quite similar in design and (as illustrated by Figure 2) houses were similar electricity usage during 2006, especially in houses 2, 3, and 4. Again, only a partial year (8 months) is included in the 2006 data. In the future, more data collection will provide a better understanding of actual yearly usage.

Figure 2. Electricity usage by house at the ABRF (2001-6).



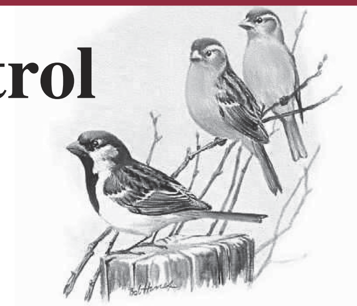
Summary

Electricity usage was higher after the renovations than before. This was expected and is due, in part, to solid sidewall construction, loss of natural daylight as a light source, and an increase in mechanical ventilation throughout the year. However, if the solid sidewall construction and an overall tighter house save enough on the fuel bill, the increase in electricity usage will be more than offset by increased fuel savings because propane is much more expensive than electricity at the present time. Data collection will continue on both propane and electricity usage and will be disseminated to provide producers a better "before and after" assessment of the value of renovations at the ABRF.

Frank T. Jones, Center of Excellence for
Poultry Science • University of Arkansas

Understanding and Control of House Sparrows

(Passer domesticus)



House Sparrow History and Invasion Tactics

In the 1800's attempts were made to introduce a number of European avian species to the United States. Few of these species survived, but the house sparrow (which will be referred to as a sparrow in the rest of the article) is an exception (Van Vleck, 1994). In the 1850's the sparrow was introduced into New York City's Central Park to eliminate the destruction of trees by inch worms (Eno, 1996). Other introductions were made by homesick European immigrants who wanted a reminder of their homelands (Kern, 2001). Following introduction, sparrow numbers increased rapidly, making them now one of the most common birds in North America (Zimmerman, 2005). Sparrows are found in nearly every locale except dense forests, alpine habitats and desert environments. Sparrow numbers have been estimated at 150 million (Zimmerman, 2007). However, sparrow numbers have fallen from their peak in the 1920's, when food and waste from horses furnished an unlimited supply of food (Fitzwater, 1994a).

Nevertheless, sparrows have adapted to life in close association with humans using following characteristics to successfully invade the United States and other countries: rapid reproduction; effective dispersal mechanisms; rapid, easy establishment; rapid growth and aggressive competition with other species (Zimmerman, 2007). One pair of sparrows can produce up to 20 chicks per breeding season. While unlikely, this means that one pair could potentially increase to 1,250 birds in 5 years. Sparrows are not exposed to the rigors and mortality associated with migration. Sparrows simply fly a few miles from the nest to take advantage of the nesting sites and food sources available. This steady progressing has effectively dispersed sparrow populations throughout the country. House sparrows are not finicky eaters or picky about nesting sites. They will consume virtually any food that is available and readily build nests near other bird species. House sparrows also quickly build nests 8 to 30 feet from the ground and reuse them each year. In addition, sparrows tend to feed in small flocks to avoid predation. It takes only 25 to 30 days from the time house sparrow eggs are laid to produce an independent juvenile and sexual maturity comes in 6 to 9 months. Additionally, house sparrows aggressively defend both nesting and feeding sites, destroying eggs and injuring or killing other competitive species. House sparrows are persistent, resourceful and intelligent. In fact, Fitzwater (1994b) reports that the brain usually accounts for about 4.3% of the body weight of sparrows, which is considerable more than those of other birds.

House Sparrow Biology

Sparrows (pictured above) are generally about 5.75 inches in total length and have brown plumage. Sexually mature males have a black striped back, gray on the crown of the head and a characteristic black "bib" or stripe on their throat. Females and young are brown with striped backs and a pale tan "eye brow" or stripe over their eyes (Kern, 2001).

Sparrows tend to be "home bodies," spending their entire life 2 to 3 miles from their roosts and feeding sites (Casto, 2001). Plant materials (grain, fruit, seeds and garden plants) make up 96% of the adult diet but young are fed insects until they are almost grown (Fitzwater, 1994a; Kern, 2001). However, sparrows are known to eat more than 830 foods and commonly use the same nesting site year after year (Casto, 2001).

Nests of sparrows are usually an untidy mass of dried grass, leaves, pine straw, string, paper and feathers, usually positioned 8-30 feet off the ground for protection from predators (Kern, 2001; Zimmerman, 2005). Nesting sites are usually claimed by the males in mid to late winter, prior to courtship in late winter or early spring (Eno, 1996). Both males and females participate in nest building, but females supply the majority of construction activity. Nest building may begin just a few days before the first egg (Zimmerman, 2005). About 90% of adults stay within a radius of 1.25 mi during nesting (Fitzwater, 1994a).

Sparrows are monogamous, but appear more closely bonded to a nest site than a mate. Males spend 60% of their perching time at nesting sites during breeding season. Males with wide bib sizes mate more often than those with narrower bibs, and aggressively defend nest sites mostly from other male sparrows (Zimmerman, 2005).

Egg laying starts in March or April usually with 3 to 4 clutches of an average of 5 speckled white eggs. Studies have shown that in a suburban setting 67% of house sparrow eggs were infected with *E. coli* pathogenic to avian species (Pinowski et al., 1994).

Eggs are incubated by both males and females for 10-16 days and the young remain in the nest about 15 days (Casto, 2001; Kern, 2001). Females take the primary responsibility

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for raising nestlings, visiting the young 15-19 times per hour, but both parents feed young by regurgitation. Fledglings are able to feed themselves 7-10 days after leaving the nest. After fledging, birds may wander 0.6 – 1.2 mi to find new feeding areas (Zimmerman, 2005).

Predators, disease and stress cause heavy sparrow mortality during the first year of life and few birds survive past the fifth season, but the typical lifespan of 3 years is relatively long in comparison to other species. However, individual birds have been found to live up to 11 years in the wild (Casto, 2001; Fitzwater, 1994a, Zimmerman, 2007).

Concerns about House Sparrows

House sparrows are often hated by bird lovers and some call them "flying rats" or "weeds of the air." Bluebird and purple martin lovers are particularly venomous toward house sparrows because they effectively (sometimes brutally) compete for nesting and feeding sites (Van Vleck, 1994).

Sparrows have also been reported to carry:

1. Bacterial diseases that can affect both humans and animals like salmonellosis (Whitney, 2004) and perhaps anthrax;
2. Mycoplasma diseases including such as *Mycoplasma gallisepticum* (MG), which is pathogenic to many avian species (including poultry);
3. Protozoan diseases such as sarcosporidiosis, and coccidiosis, which affect primarily animals as well as toxoplasmosis, and chlamydiosis (psittacosis) which are maladies in both humans and animals
4. Viral diseases such as West Nile Virus, Eastern Equine Encephalitis (EEE), Western Equine Enchephalitis (WEE), St. Louis Encephalitis, and Venezuelan Encephalitis which infect humans and animals via mosquitos; Poultry diseases such as Newcastle disease or fowl pox and TGE in swine;
5. Internal parasites such as round worms, tape worms, gape worms; and
6. External parasites such as fleas, ticks, mites (including the northern fowl mite), bed bugs and lice.

External parasite populations are readily propagated by sparrow populations since nests are unkempt and reused (Kern, 2001; Fitzwater, 1994a; Zimmerman, 2005). In addition, nesting materials may cause fire hazards when constructed near lights or other heat sources (Kern, 2001).

Sparrow Control Methods

Although sparrows are a nuisance as well as spreading disease organisms and parasites, their close association with humans limits safe alternatives for control. However, control methods can be divided into the following seven categories: exclusion, repellants, poisons, trapping, shooting, nest destruction and predators (Fitzwater, 1994a).

Exclusion

Since sparrows are intelligent, hardy and adaptable, total exclusion is virtually impossible. In addition, exclusion efforts must be sustained over long periods to be effective. Nevertheless, closing all openings of 0.75 inches or larger, covering large openings (such as under eaves) with hardware cloth, and attaching signs flat against buildings can assist in control of sparrows. It is also important to cover any source of grain or food to prevent access by sparrows.

Repellants

There are two general types of sparrow repellant systems: tactile and sound repellants. Tactile repellants are those that are placed on roosting or nesting surfaces to discourage sparrow activity. Unfortunately tactile repellants (such as electrified wire, porcupine wire or sticky substances) are generally more effective against pigeons than sparrows. Sound repellants (such as loud noises from fireworks or firearms; ultrasonic devices or recorded distress calls) may discourage sparrows for a time, but usually they learn to ignore the sounds (Fitzwater, 1994a; Kern, 2001).

Poisons

Poisons used to control sparrow populations are restricted use pesticides that are regulated by both federal and state laws. Considerable skill is required to ensure that these poisons do not affect humans. The use of poisons will also require considerable study of sparrow nesting, roosting and feeding sites and can have very serious unintended consequences. Remember that most bird species are legally protected by state laws, federal laws and international treaties. The person using poisons as a control method is legally responsible for the consequences (intended or not). In addition, poisons that affect sparrows may have similar affect on poultry species and/or could produce residues in poultry products.

Trapping

While trapping of sparrows is often more labor intensive and expensive than other control methods, trapping can effectively reduce sparrow populations. In addition, since most traps are live traps, if birds other than sparrows are caught, they can be quickly released. Yet, no matter what trap is used, the secret to trapping is to put out bait (pre-bait) about a week before setting traps (Kern, 2001). It is also important to use the right bait. Fitzwater (1994b) developed the data in Table 1, which show that sparrows preferentially consume white millet, corn cracked to 1/16 to 4/16 inch in size or whole milo.

Table. 1. Preference shown by sparrows for eight candidate bait materieals[1]

Bait Material	Materials taken in 24hrs	
	Grams taken	Percent of total
White millet	618	26.9
Cracked corn (1/16 to 2/16")	471	20.5
Whole Milo	435	18.9
Cracked corn (2/16 to 4/16")	396	17.2
Cracked corn (under 1/16")	177	7.7
Wheat	145	6.3

Bait Material	Materials taken in 24hrs	
	Grams taken	Percent of total
Cracked corn (over 1/4")	32	1.4
Lab chow	26	1.1

[1] Adapted from Fitzwater (1994b)

There are more types of traps available for sparrows than for any other bird, making it impractical to attempt to describe every model (Fitzwater, 1994a). Still there are a few general types of traps, each of which have pluses and minuses.

Funnel or drop-in traps are the most common type of sparrow trap and can accommodate a sizable number of birds. Funnel traps employ a funnel or trough shaped entrance that allows sparrows to easily pass through the large end into the trap, but the small end inside the trap discourages exits. Funnel traps can capture relatively large numbers of sparrows, but they can also escape with relative ease. Therefore, it is important to frequently check funnel type traps (Fitzwater, 1994a; Kern, 2001)

Although there are numerous design variations; automatic, counter balanced, or elevator traps that allow a sparrow to enter an enclosed compartment attached to the end of a holding cage. The sparrow enters to get the bait, which is on a small box inside the compartment. The box is enclosed on two sides with the entrance to the cage below. The shelf or box is attached to the end of rod or narrow thin board that pivots around a fulcrum in the center, similar to a see-saw. A counter weight balances the box, and as the sparrow consumes the bait, its weight causes the rod (or see-saw) to tip downward closing off the original entrance and, when the rod reaches the bottom, exposing the entrance to the holding cage. The sparrow enters the holding cage and the counter weight returns the box to its original position. Elevator traps tend to catch fewer birds than funnel traps, but the birds that are caught generally do not escape (Fitzwater, 1994a).

Triggered traps are snares that generally catch one sparrow at a time and usually involve a spring operated door or closure. Sparrows enter the trap, trigger the closing of the door and are trapped. Obviously this type of trap catches only one or maybe two sparrows at a time. Thus, such traps are not suited for controlling large populations, but may be effective against a few persistent individual birds.

Shooting with firearms

Since rifle slugs can travel over a mile and penetrate tin, drywall, plywood or other such materials, it may be wise to use air guns, a 410 gauge shotgun with a no. 10 to 12 size shot or a 22 rifle with rat shot. Such weapons may be an effective method of controlling a few sparrows in a relatively small area, but are ineffective at controlling large numbers of birds. Furthermore, such weapons can become increasingly ineffective when sparrows become wary.

Nest Destruction

Sparrow populations will continue to increase if nests are allowed to remain. Removal of nests, eggs and young tends to discourage birds from building. However, sparrows are persistent and nest removal must be repeated every two weeks during breeding season. Long insulated poles may be used to remove nests from high places and destroyed to prevent reuse. In addition, nesting materials may be infested with external parasites (especially mites) and infected with disease organisms.

Predators

Both cats and sparrows often live in symbiotic relationships with humans. One farmer used scrap lumber to build cat walks between exposed rafters where sparrows usually roosted or nested. These makeshift walks, allowed farm cats access to locations where sparrows usually roosted or nested and resulted in a reduction of the resident house sparrow population by 80% over the course of a year.

Summary

House sparrows are not native to the United States and in most cases are not protected by federal or state laws. House sparrows are intelligent, persistent and resourceful. However, house sparrows can destroy insulation, cause fire hazards with nesting materials as well as spread disease and parasites. Control of house sparrows may be accomplished through exclusion, repellants, poisons, trapping, shooting, nest destruction and predators (e.g. cats). However, control efforts must be consistent, diverse and organized. In addition, it is important to keep in mind that control efforts should not compromise flock performance or produce residues in poultry meat or eggs.

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Write Extension Specialists, except Jerry Wooley, at: Center of Excellence for Poultry Science University of Arkansas Fayetteville, AR 72701

UA Poultry Science Extension Faculty

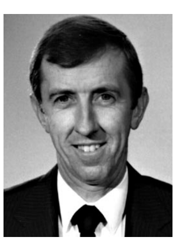
Dr. R. Keith Bramwell, Extension Reproductive Physiologist, attended Brigham Young University where he received his B.S. in Animal Science in 1989. He then attended the University of Georgia from 1989 to 1995 where he received both his M.S. and Ph.D. in Poultry Science. As part of his graduate program, he developed the sperm penetration assay, which is still in use today, as both a research tool and as a practical troubleshooting instrument for the poultry industry. He then spent one year studying in the Animal Reproduction and Biotechnology Lab at Colorado State University. In 1996, Bramwell returned to the University of Georgia as an Assistant Professor and Extension Poultry Scientist. Dr. Bramwell joined the Center of Excellence for Poultry Science at the University of Arkansas as an Extension Poultry Specialist in the fall of 2000. His main areas of research and study are regarding the many factors (both management and physiological) that influence fertility and embryonic mortality in broiler breeders. Telephone: 479-575-7036, FAX: 479-575-8775, E-mail: bramwell@uark.edu

Dr. Dustan Clark, Extension Poultry Health Veterinarian, earned his D.V.M. from Texas A&M University. He then practiced in Texas before entering a residency program in avian medicine at the University of California Veterinary School at Davis. After his residency, he returned to Texas A&M University and received his M.S. and Ph.D. Dr. Clark was director of the Utah State University Provo Branch Veterinary Diagnostic Laboratory prior to joining the Poultry Science faculty at the University of Arkansas in 1994. Dr. Clark's research interests include reoviruses, rotaviruses and avian diagnostics. He is also responsible for working with the poultry industry on biosecurity, disease diagnosis, treatment and prevention.
Telephone: 479-575-4375, FAX: 479-575-8775, E-mail: fdclark@uark.edu

Dr. Frank Jones, Extension Section Leader, received his B.S. from the University of Florida and earned his M.S. and Ph.D. degrees from the University of Kentucky. Following completion of his degrees Dr. Jones developed a feed quality assurance extension program which assisted poultry companies with the economical production of high quality feeds at North Carolina State University. His research interests include pre-harvest food safety, poultry feed production, prevention of mycotoxin contamination in poultry feeds and the efficient processing and cooling of commercial eggs. Dr. Jones joined the Center of Excellence in Poultry Science as Extension Section Leader in 1997. Telephone: 479-575-5443, FAX: 479-575-8775, E-mail: ftjones@uark.edu

Dr. John Marcy, Extension Food Scientist, received his B.S. from the University of Tennessee and his M.S. and Ph.D. from Iowa State University. After graduation, he worked in the poultry industry in production management and quality assurance for Swift & Co. and Jerome Foods and later became Director of Quality Control of Portion-Trol Foods. He was an Assistant Professor/Extension Food Scientist at Virginia Tech prior to joining the Center of Excellence for Poultry Science at the University of Arkansas in 1993. His research interests are poultry processing, meat microbiology and food safety. Dr. Marcy does educational programming with Hazard Analysis and Critical Control Points (HACCP), sanitation and microbiology for processing personnel. Telephone: 479-575-2211, FAX: 479-575-8775, E-mail: jmarcy@uark.edu

Dr. Susan Watkins, Extension Poultry Specialist, received her B.S., M.S. and Ph.D. from the University of Arkansas. She served as a quality control supervisor and field service person for Mahard Egg Farm in Prosper, Texas, and became an Extension Poultry Specialist in 1996. Dr. Watkins has focused on bird nutrition and management issues. She has worked to identify economical alternative sources of bedding material for the poultry industry and has evaluated litter treatments for improving the environment of the bird. Research areas also include evaluation of feed additives and feed ingredients on the performance of birds. She also is the departmental coordinator of the internship program.
Telephone: 479-575-7902, FAX: 479-575-8775, E-mail: swatkin@uark.edu



Mr. Jerry Wooley, Extension Poultry Specialist, served as a county 4-H agent for Conway County and County Extension Agent Agriculture Community Development Leader in Crawford County before assuming his present position. He has major responsibility in the Arkansas Youth Poultry Program and helps young people, parents, 4-H leaders and teachers to become aware of the opportunities in poultry science at the U of A and the integrated poultry industry. He helps compile annual figures of the state's poultry production by counties and serves as the superintendent of poultry at the Arkansas State Fair. Mr. Wooley is chairman of the 4-H Broiler show and the BBQ activity at the annual Arkansas Poultry Festival.
Address: Cooperative Extension Service, 2301 S. University Ave., P.O. Box 391, Little Rock, AR 72203