

Raising Organic Chickens, *Salmonella*, and the Issues of Outdoor Access

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Abstract.

Chickens raised on the family farm, running through the yards pecking in the grass have been part of the American agricultural landscape since the founding of the first colonies. The National Organic Program was initiated to standardize guidelines for agricultural production practices that, for the first time, include regulations that govern welfare for livestock and poultry. A centerpiece of the livestock regulations focuses on the access to outdoors for farm animals and specifically poultry.

Salmonella is a bacterial pathogen that can affect many species of livestock and poultry. This pathogen is also responsible for food borne illness in humans. When problems occur in animal management practices or improper handling and sanitation occurs in the processing plant, *Salmonella* can contaminate the meat or eggs.

Large farming businesses, reluctant to provide outdoor access, are using the threat of *Salmonella* as a scare tactic to exempt farmers from being required to raise poultry outdoors by the National Organic Program. In fact, there is even the possibility that not only would organic farmers be affected, but that all farmers wishing to allow chickens outdoor access would be prohibited. The arguments for greater susceptibility of outdoor chickens are unproven since there haven't been any scientific studies to show this. What is apparent, however, is that birds raised by the large commercial poultry companies have had significant problems with *Salmonella* in their "protected environments". This casts doubt both on the arguments about outdoor access and the motivation of such companies in raising them.

The National Organic Program includes for the allowance of outdoor access for the production of poultry. No one is making people turn to organic production; therefore, the requirement for organic certification that makes outdoor access a standard is only necessary for farmers wishing to sell poultry products as USDA Certified Organic. Under proper management practices, allowing poultry access to the outdoors lets the birds exhibit natural behavior of pecking through vegetation, freedom of movement, suitable exercise, fresh air and sunlight, and social interactions. Consumers are accustomed to thinking of poultry as being outdoors.

Several times during the year 2002, there have been attempts by poultry companies and poultry grower groups to circumvent the regulations, in some way, for various reasons. The main obvious reason that a large poultry operation would want to be exempt from the outdoor access standard is cost. How much land would be necessary to convert to a free-range poultry facility that raises over several hundred thousand birds at a time? The answer is, a substantial area. The management and production practices of these operations would also have to change drastically. Everything from house design to the breed of bird would have to change. Furthermore, the cost to adapt to a system that requires greater interaction with the chickens rather than a mechanized production system would be great.

While economics is doubtless the main concern of the industry, the big argument that is being used to influence the thinking of legislators, consumers, and the federal government agencies, USDA Agriculture Marketing Service (AMS) and the Federal Safety and Inspection Service (FSIS), is biosecurity. Food safety falls under this phrase.

The fear of the food borne illness, *Salmonella enteritidis*, for one, is being used in the argument concerning poultry. Food borne illnesses, according to the Center for Disease Control, are estimated to account for 76 million cases, 325,000 hospitalizations, and 5000 deaths each year. Three pathogens, *Salmonella*, *Listeria*, and *Toxoplasma*, are responsible for 1500 of these deaths and 140,000 hospitalizations.

There is a food borne illness crisis occurring in this country. Over 53 million pounds of meat products have been voluntarily recalled by the industry already this year, at the time of writing (November 2002). Voluntary is the key word here since the federal government is powerless in requiring the meat industry to recall contaminated products in any other manner.

The National Organic Program Final Rule is quite explicit concerning certain criteria of livestock and poultry production. Appropriate housing and sanitation, along with suitable pasture conditions are required. The proper selection of species that is suitable for the site conditions where the animals are to be raised including considerations for resistance to diseases. Allowances for sufficient space and conditions for freedom of movement and natural behavior must be made. Feed shouldn't contain animal based proteins. Restricting access to outdoors would compromise many of these tenets of the Rule.

To restrict outdoor access of organically raised poultry, or any other poultry for that matter, based on the fears of disease, is generally unfounded. Animal production is very dependent on what kind of job the stockman does. A farmer raising animals under best management practices, however, is limited by external variables. Granted, wild animals such as rodents, can be carriers of *Salmonella*, however, there is no evidence that suggests chickens raised outdoors are any more susceptible than poultry raised exclusively indoors. In fact, the clear majority of *Salmonella* cases in poultry have come from the industrial rearing of chickens indoors under high density populations.

Researchers have been studying the problem of *Salmonella* in animal production and the research has focused on commercial indoor production practices and facilities. The key points listed below highlight several topic areas where indoor commercial industrial poultry production, have encountered problems with *Salmonella*. Considered also, are points where changes have been made in systems to improve prevention of the disease.

The State of Meat Production and *Salmonella*

- Disease-causing bacteria are a routinely found in animal products. A 1994 USDA survey found that 15 percent of beef carcasses were tainted with disease-causing bacteria. About 30 percent of chicken products carry live *Salmonella*, and 60-80% of chickens carry *Campylobacter*. Many strains of these pathogens are resistant to common antibiotics. The use of excrement as a portion of the feed ration, which occurs on many farms, increases the risk that disease-causing bacteria will spread.¹
- According to the Swedish Food Act, any type of foodstuffs found to contain *Salmonella* is considered unfit for human consumption. In Sweden, such products may not be placed on the market.²

- *Salmonella* is a known problem in this country and the burden is put on the consumer to handle and cook meat properly since it must be considered as contaminated.
- Salmonellosis is one of the most common bacterial food borne illnesses, but many cases could be prevented by proper food handling practices. *Salmonella* present on raw chicken can survive if the chicken is not cooked thoroughly. *Salmonella* can also cause food borne illness through cross contamination. For example, juices from raw meat or poultry prepared on a cutting board could contaminate salad ingredients if the board was not washed before preparing salad ingredients. The person who eats the salad then also eats the bacteria and becomes ill.³
- The burden of the bacterial problem is left with the consumers. Food borne pathogens that lead to illness are tolerated by the meat production industry in the United States.
- In Sweden the production of *Salmonella*-free chickens is based on the basic principles of starting production with salmonella-free day old chicks, Salmonella-free feed and water, proper hygiene for housing, regular monitoring throughout the production chain, and immediate action whenever Salmonella is detected.⁴
- According to an article by the Center for Infectious Disease, the USDA states that *Salmonella* in meat and poultry is declining. Baseline amounts of *Salmonella* in the meat processed in the country are tolerated. The USDA states that the prevalence of *Salmonella* on all raw meat and poultry products it inspects has declined, in some cases by half or more. However, *Salmonella* is still fairly common on some products. For example, it was found in about a quarter of ground turkey samples and a fifth of ground chicken samples. The USDA statement said the *Salmonella* prevalence in broiler chickens dropped from 20% at baseline to 10.7% for 1998-2001. Secretary of Agriculture, Ann Veneman issued a report on April 18, 2002 that stated, “this data shows *Salmonella* prevalence levels well below the product baselines set prior to HACCP (Hazard Analysis and Critical Control Points) and this indicates that HACCP has contributed to a reduction in the prevalence of *Salmonella* in the nation’s meat and poultry products.”⁵
- In figures obtained from the USDA National Agricultural Statistics Service – Poultry Slaughter Report, in the first seven months of 2002, 3.2 billion pounds (ready to cook weight) of poultry had been slaughtered.⁶ Therefore, if *Salmonella* turned up in 10.7% of the samples as the report mentions above, then over 340 million pounds of meat could be contaminated in this country. This would be allowable under HACCP baseline figures.
- From January 1 to October 14, 2002, roughly 49 million pounds of meat has been voluntarily recalled by the meat industry due to pathogen contamination.⁷

- Last December (2001), a federal appeals court ruled that USDA can't shut down a meat processing plant solely because the plant's products don't meet the *Salmonella* performance standard.⁸

Housing, Production, and *Salmonella*

- *Salmonella* infection of animals will occur more frequently and affect more individual animals as concentration of confinement increases. Range-reared animals are not as apt to infect one another as are intensely confined animals.⁹
- Poultry confined in large houses with large population densities can have increased levels of contamination. A survey of litter and dust samples from commercial turkey flocks in Canada, for example, found *Salmonella* in 86% of the flocks.¹⁰
- The system of intensive production of broilers is in itself fundamentally flawed. Researchers into the widespread contamination of poultry by *Salmonella* noted that broilers raised in high-population densities eat, sleep, and defecate on the floor or litter inside the houses. Their feet and breast feathers have fecal matter stuck to them. The fecal material on the breast also comes from the broilers' practice of resting on their breasts on the floor of the broiler houses. Selective breeding of broiler chickens has produced many birds whose legs are so weak that they cannot support the weight of their own bodies. They therefore spend much of their time squatting on the floor.¹¹
- *Salmonella* contamination in poultry houses can become so intense that pressure-washing or steam cleaning of the house between the rearing of separate batches of chickens can lead to an increase in bacterial levels.¹²
- As with the issue of stress in forced molting, the strains of poultry reared for caged production have been bred for precisely that, production, at the expense of their immune system. Poultry raised for outdoor production have been derived from strains accustomed to being outdoors. Therefore, these can be far hardier animals. Breeding for the proper environment is essential and practical.
- An article in the July-September 1997 issue of the Center for Disease Control's "Emerging Infectious Disease" states: "the doubling of salmonellosis incidence in the last two decades has accompanied modern food industries' centralized production and large-scale distribution...The trend toward larger markets and consolidation of industry has exacerbated the *Salmonella enteritidis* problem in another way. Changes in egg production have adversely affected infection control in poultry flocks. In 1945, a typical hen house contained 500 birds. By 1995, many houses contained 100,000 hens, and multiple houses were often linked by common machinery, resulting in large flocks with common risk profiles. Large-scale distribution of shell eggs from infected flocks has caused outbreaks in which contaminated eggs were distributed in many states over a period of months".¹³

- Having animals tightly packed together encourages the rapid spread of pathogens. Hen cages allow only 48 square inches per bird which is 6"x8" and there are 5-7 birds per cage where a bird's own size is roughly 40-52 square inches. Infectious bacteria are often spread by manure. In large egg laying poultry houses, cages are stacked one upon another from near the floor to the ceiling, and the manure from the birds above can drop onto the birds below.
- Development of more virulent variant strains of endemic pathogens is also associated with high-density poultry populations. Flocks of over 1 million hens are particularly vulnerable to infections transmitted from hen to egg.¹⁴
- *Salmonella enteritidis* infection from eggs is typically traced to infections in hens' ovaries. Changes in management practices at the production level are imperative.¹⁵
- While new microbial feed-additives appear to hold promise for the reduction of *Salmonella* contamination in poultry, control of *Salmonella* in the poultry house environment is equally important. Recent studies have indicated that when litter moisture levels were more than 25%, an elevated number of broilers within the house were found to be contaminated with *Salmonella*.¹⁶ So management procedures to keep litter dry are promising for *Salmonella* reduction.
- Cleaning the air in hatcheries can reduce *Salmonella* transfer. A new air cleaning system has produced a 94% reduction of *Salmonella* in a commercial hatchery according to the USDA Agricultural Research Service who developed the system. If it can be incorporated into commercial poultry operations, the system promises to improve the food safety by reducing *Salmonella* in hatching cabinets – a primary source of *Salmonella* contamination for broiler chickens. Strong air currents can spread *Salmonella* from a single infected chick to all the chicks in a hatching cabinet.¹⁷
- In England, scientists from the Central Veterinary Laboratory found that bacterial infections can be spread through the air particularly when raised in intensive confinement. Poor ventilation in poultry houses can cause the concentrations of ammonia to be very high causing irritations in the respiratory tract which creates the opportunity for disease infection.¹⁸
- Swedish chicken producers have collaborated through the Swedish Poultry Meat Association in creating national standards for animal management and health care. A classification system has been created for breeding farms and production farms. This system combines good livestock care with sound economy. Growers are rewarded on the basis of their results. Good profitability leads to increased investments, to improvements in housing and technology and subsequently to better livestock care and animal conditions.¹⁹

- The National Organic Rule states in section, 205.238 (a) that, “The producer must establish and maintain preventive livestock health care practices, including: (3) Establishment of appropriate housing, pasture conditions, and sanitation practices to minimize the occurrence and spread of diseases and parasites; (4) Provision of conditions which allow for exercise, freedom of movement, and reduction of stress appropriate to the species”.
- *Salmonella* can also have affects on the health of the birds. A report in 1995 in the Veterinary Record found that a *Salmonella* contaminated batch of day-old chicks had a 70% mortality rate.²⁰
- In a study published by the Institute for Agriculture and Trade Policy and the Sierra Club, 18% of the store-bought chicken they tested were positive for *Salmonella*. Nearly 6% of the *Salmonella* tested were resistant to at least one type of antibiotic used in poultry feed while another 6% were resistant to 4 or more antibiotics. Turkey had a contamination rate of 45% with 62% resistant to one or more feed antibiotics. These antibiotics were the same of similar to those used in human health.²¹

Farm Animal Feed and *Salmonella*

- Poultry rations often use feed ingredients made up of meat and/or bone meal as a cheap source of protein.²²
- Spent hens have been used as sources of animal protein in feed meal.²³
- The National Organic Rule states under 205.237 (b) The producer of an organic operation must not: (5) Feed mammalian or poultry slaughter by-products to mammals or poultry.
- The National Organic Rule also includes under Livestock Living Conditions 205.239(a) The producer of an organic livestock operation must establish and maintain livestock living conditions which accommodate the health and natural behavior of animals including: (1) Access to the outdoors, shade, shelter, exercise areas, fresh air, and direct sunlight suitable to the species, its stage of production, the climate, and the environment; (3) Appropriate clean dry bedding. If the bedding is typically consumed by the animal species, it must comply with the feed requirements of section 205.237.
- The Food and Drug Administration’s (FDA) Center for Veterinary Medicine (CVM) reported that half of livestock and poultry feed meals and 16% of complete feeds were contaminated with *Salmonella*.²⁴
- The CVM has also called for zero tolerance for *Salmonella* in feed in 1990 after government appointed task forces in 1973, 1975, and 1978 confirmed that *Salmonella* was a problem in feed.²⁵

- In 1967 the FDA published a guidance program for renderers that included Good Manufacturing Practices (GMPs). Between 1967 and 1972 increased surveillance of the rendering industry and enforcement actions did not significantly reduce *Salmonella* in animal feeds.²⁶
- *Salmonella* contamination in rendered product and finished feed is most likely due to recontamination as shown by a CVM survey of selected poultry renderers in 1989. The contamination rate for rendered product can range from 0-100%. The industry wide incidence rate for 1989 was approximately 49%.²⁷
- Recycled animal waste, such as processed chicken manure and litter has been used as a feed ingredient for almost 40 years. The animal waste is used because it contains large amounts of protein, fiber, and minerals and has been deliberately mixed into animal feed for these nutrients.²⁸
- Finland is one country that is almost free of animal diseases. *Salmonella* bacteria can be introduced to the feed stuff chain through animal feeds. Through legislative control, Finland has managed to ensure a 95% certainty of *Salmonella*-free feeds.²⁹
- The use of antibiotics as growth promoters has been banned in Sweden since 1986 as these products may lead to an increase in *Salmonella* colonization and to an increase in antibiotic resistance. Antibiotics may only be used for animals after prescription by a veterinarian and on medical indications. *Salmonella* infection is caused by a number of factors such as poor hygiene, bad management, feed composition, and housing environments. In the 1980's research was carried out in close co-operation with the feed industry and broiler producers to find alternative ways to prevent infections. Changes were made in the composition of chicken feed, reducing the protein contents, increasing contents of fiber and coarse grains particles and adding enzymes. As a result of these measures, the use of antibiotics for treatment of *Salmonella* has decreased from about two tons in 1987 to 100kg in 1988 and to only a negligible level since 1995. This corresponds to the decrease in infection of *Salmonella* in birds and people. The Swedish *Salmonella* Control Program initiated by the Swedish legislation is very strict with regard to *Salmonella*.³⁰
- From England, the Advisory Committee on the Microbiological Safety of Food stated that animal feed is a vector responsible in the transmission of pathogenic bacterial infection in poultry. They regard animal feed as one of main sources of *Salmonella* contamination in poultry and it is economically feasible for the feed industry to produce *Salmonella*-free poultry feed.^{31, 32}
- Treatment of animal feeds reduces the overall level of organisms in the animal population, improved slaughtering practices prevent cross-contamination of animal products and proper hygienics by food-handlers prevents contamination at the consumer level.³³

- According to Dr. Stephen P. Sundlof of the FDA's Center for Veterinary Medicine, *Salmonella* in animal feeds is cause for concern because feed can be a vehicle for transmitting *Salmonella* not only to animals but also to humans. Another prominent issue that the FDA is studying is antimicrobial resistance resulting from the use of antibiotic drugs in food animals. Dr. Sundlof stated that bacterial loads are still being found in virtually all animal feeds and are more heavily associated with those animal feeds that contain meat and meat by-products than is for those that are purely vegetable in origin.³⁴
- *Salmonella* contamination in live bird preharvest production facilities can usually be traced to three production factors: 1. feed contamination, 2. environmental contamination, and/or 3. egg transmission. The weakest link in *Salmonella* control in live preharvest facilities is often the ability to produce *Salmonella*-free feed consistently. For example, it is well known that *Salmonella* can be transmitted from feed ingredients to the completed mixed feed and on to live poultry. This transmission sometimes results in the production of *Salmonella*-positive products (meat and eggs).³⁵
- High risk ingredients should be screened carefully. Generally, animal proteins have higher levels of *Salmonella* contamination than do plant proteins. Meal containing poultry offal (discarded poultry organs etc.), and feather meal should be considered high risk ingredients. It may be advisable at times to minimize the use of high risk feed ingredients in diets of certain animals such as very young, stressed, or breeder birds. Young birds are very susceptible to salmonellosis when they are 1-14 days of age.³⁶
- Rodents and wild birds must not be allowed in or near a milling facility. Dust control in the feed milling facility is essential for controlling *Salmonella*. Dust is the major source of *Salmonella* contamination in feed mills.³⁷
- The *Salmonella*-contaminated feed issue is not unique to poultry. *Salmonella* commonly causes illness in calves; however, it can affect cattle of all ages. It is usually passed from animal to animal by fecal-oral contact. On-farm contamination of feed is the most common source of *Salmonella* infection. The size of the herd also plays a role in contamination. A 1996 National Animal Health Monitoring System study showed a fairly strong positive correlation between *Salmonella* shedding and herd size.³⁸
- For pork producers, consideration of *Salmonella sp.* entails not only the disease of salmonellosis in pigs generally attributed to *S. choleraesuis* or *S. typhimurium* but also food borne salmonellosis in human beings in which any of a number of *Salmonella* serotypes that can potentially contaminate pig meat may be implicated. It has been reported that more than 14% of the outbreaks of salmonellosis in human beings was attributed to pork.³⁹

- Adding capsaicin, the spicy component of hot peppers, to the diet of broiler chicks appears to increase their resistance to *Salmonella*, according to Dr. Audrey McElroy, assistant professor of poultry science at Virginia Tech University. Birds seem to have no objections to the taste or sting of capsaicin. Rodents on the other hand have an aversion to hot seeds. Feeding poultry feed to which capsaicin has been added could be very beneficial in poultry houses according to Dr. McElroy. If it can be proved that feeding capsaicin to poultry reduces *Salmonella* significantly and consistently in a commercial poultry production system, it would provide a non-antibiotic way of reducing food-borne pathogens.⁴⁰

Hatcheries and *Salmonella*

- *Salmonella* in poultry meat can often be traced back to the hatchery where chicks were born. In a research report published in WATT Poultry USA, the leading poultry industry journal, findings show that hatcheries play an important role in the spread of *Salmonella*. The report also indicated that poultry processing plants are another source of contamination of meat before it reaches the marketplace.⁴¹
- Young chicks can become colonized after exposure to 1-5 cells of *Salmonella*, and the organism spreads rapidly in the flock. Shedding of *Salmonella* starts 2-22 hours after exposure, peaks after 2-3 weeks and most birds become negative after 7 weeks. Four-week old chickens do not become colonized after exposure to 100 cells of *Salmonella* and among adults, only a few become colonized after exposure to 10,000 cells. *Salmonella* can be brought into flocks from the addition of replacement birds shedding the bacteria. Rodents can bring *Salmonella* into houses where it spreads quickly due to the high density of birds. *Salmonella* can grow in water contaminated with very small amounts of feed and manure and it can even grow in fresh manure for a few days. In poultry houses that have tested positive for *Salmonella*, there can be several thousand times as many *Salmonella* in wet spots as compared to dry.⁴²
- In the UK, breeding flocks of 250 or more birds and hatcheries with incubator capacity of 1000 or more eggs must be monitored for *Salmonella enteritidis* and *S. typhimurium*. If a flock is confirmed to be infected with these serotypes no eggs may be sent for hatching and the flock is slaughtered. In this way, control of *Salmonella* starts with disease-free breeding stock.⁴³

Feed Withdrawal and *Salmonella*

- Prior to slaughtering, feed withdrawal from the birds is often practiced. Because of increased emphasis on carcass bacterial contamination, some establishments have considered lengthening their feed withdrawal times to minimize carcass

fecal contamination. However, birds off feed for longer periods of time eat more non-feed substances (litter, feces, etc.) which harbor bacteria, and carcass contamination can increase instead of decrease.

- Researchers at Texas A&M University have demonstrated that contamination can increase with longer feed withdrawal times. In two studies, broilers held off feed for 18 or 8 hours had the highest incidence of *Salmonella* contamination with the birds off feed for 18 hours having more than twice the incidence of contamination than the birds who were held off feed for 8 hours.⁴⁴

Forced Molting and *Salmonella*

- Molting is a natural physiological cycle that laying hens go through where old feathers are replaced by new ones. In order for egg production to continue after the first season, poultry producers use forced molting whereby feed is withheld for up to 14 days while the birds lose their old feathers and start to grow new ones. *Salmonella enteritidis* (SE) is an important pathogen for the layer industry primarily because of its ability to infect hens and ultimately contaminate egg contents. Research has shown that there is an associated increase of severity with *Salmonella enteritidis* infection and molting.⁴⁵
- The stress resulting from an induced molt significantly depresses the cellular immune response in laying hens and will increase the severity of a concurrent intestinal SE infection. Molted birds shed significantly higher numbers of SE during a forced molt as compared to unmolted birds.⁴⁶
- During forced molting, hens need only to ingest 10 *Salmonella* cells to become infected. Unmolted hens need to ingest about 50,000 cells.⁴⁷
- The amplification of intestinal *Salmonella enteritidis* in the molted hens, plus their previously described higher susceptibility to *Salmonella enteritidis* infection, accelerated the transmission of the organism to the uninfected hens in neighboring cages. Once infected, these hens shed far more bacteria in their feces than unmolted birds and are more likely to lay contaminated eggs. Moreover, *Salmonella* spread through the air among the molted birds, despite the conventional wisdom that this microbe infects the animal solely through ingestion of contaminated feces. Thus forced molting can have an affect on the overall SE status of a flock.⁴⁸

Conclusion

The poultry industry tries to increase their profits by raising poultry in a fashion that maximizes the number of birds per square foot under industrial manufacturing conditions. To make their system work, outdoor access is not allowed. Disease

pressure is rampant. The use of the inexpensive feed ingredients for rations that allow for bacterial contamination is tolerated. The threat of *Salmonella* infection is a great worry.

To apply the worry of Salmonella contamination to poultry raised with access to outdoors is unproven. What is proven is that poultry raised indoors under factory-farmed conditions does contribute greatly to *Salmonella* contamination. The use of organic production practices that allow for outdoor access and the proper management of the animals and land will provide consumers with a great product. The fear of contamination from pathogens that cause illness is a worry that all farmers have to be alert to. Creating an atmosphere of worry by the industry who would rather not invest financially into the time and management necessary to obtain the National Organic Program should not be allowed to earn the USDA seal of certification.

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