

NAE Production Challenges Poultry Industry on Several Fronts



No antibiotics ever (NAE) programs are challenging the poultry industry in numerous areas. Cleanliness of farms, egg packs, and hatcheries, farm management practices, feed milling and diet formulations, drinking water quality, litter management, broiler lighting programs, flock stress levels, and processing and food safety are all challenged by current NAE production programs. Is there science behind NAE production or is it the result of consumer beliefs that may or may not be valid?

What We Know

There is an increasing amount of research related to the potential impact of antibiotic use in poultry and animal feed on the development of antibiotic resistance in humans. However, there is **little scientific evidence** that use of antibiotics in food-producing animals is contributing to antibiotic resistance currently relevant in human medicine (Phillips et al., 2004; Phillips, 2007; UK Five Year Antimicrobial Resistance Strategy, 2013). Trends in consumer preference, including a desire for NAE products, are **based largely on perception** rather than scientific facts (Brewer and Rojas, 2008).

According to the U.S. Organic Trade Association, sales of NAE organic foods have grown at a rate of 20 percent per year since 1990, in spite of increased recognition that **antibiotic resistance in humans is caused by antibiotic use in humans** and not in food-producing animals (Cervantes, 2015). In fact, research has indicated that antibiotic resistance in a community closely matches antibiotic use by people from that same community (Magee et al., 1999). In addition, antibiotic use in food-producing animals, in a worst-case scenario, contributes less than 1 percent to the overall antibiotic resistance problem confronted by the medical profession (Bywater and Casewell, 2000).

On the other hand, there is currently limited information about how NAE production systems impact level and prevalence of foodborne pathogens on raw poultry products. While hormone use in poultry production has been banned in the U.S. since the 1950s (Tabler et al., 2013), poultry feeds have, for many years,

contained sub-therapeutic levels of antibiotics, known as antibiotic growth promoters (AGPs), to optimize growth potential and limit broiler disease challenges. However, because of growing concerns associated with antibiotic resistance, use of antibiotics in poultry feed has decreased significantly in recent years. How this decreased antibiotic use in poultry feed may be affecting bird uniformity and bacterial loads entering processing plants is an area currently in need of further investigation.

Poultry feed can be divided into three general categories regarding antibiotic use: NAE, reduced-use, and conventional or full-spectrum. NAE programs apply to birds that have **never received antibiotics (at the hatchery or in the feed) throughout their lifetime**. This includes antibiotics that are medically important to humans as well as those that have no use in human medicine. Flocks in reduced-use antibiotic programs do not receive antibiotics that are medically important to humans but may receive antibiotics that are not used in human medicine, such as ionophores for coccidiosis control. Full-spectrum programs allow any U.S. Food and Drug Administration-approved antibiotic to be used in poultry feed. The number of reduced-use and full-spectrum programs continue to decline each year. In fact, *Poultry Health Today* (2019) reported that **more than 50 percent** of birds produced in the U.S. are in NAE programs.

Challenges of NAE Production

Poultry integrators producing NAE birds face multiple challenges at the live production level; perhaps the **two most daunting being coccidiosis and necrotic enteritis**. Coccidiosis is caused by intestinal infection with coccidian protozoan parasites, commonly found in poultry houses. It causes enormous economic losses in the poultry industry each year. The most common species are *Eimeria tenella*, which causes cecal (or bloody) coccidiosis, *Eimeria necatrix*, which causes bloody intestinal coccidiosis, and *Eimeria acervulina* and *Eimeria maxima*, which cause chronic intestinal coccidiosis. Since the 1970s, coccidiosis has been controlled with ionophores. Although **ionophores have no use in human medicine**, they are classified as antibiotics in the U.S. and are, therefore, not allowed in NAE programs.

As a result, non-antibiotic compounds and/or coccidial vaccines are now being used in place of ionophores to control coccidiosis in NAE flocks. Live coccidial vaccines have seen greater use in recent years, but this practice often challenges NAE flocks receiving no antibiotic assistance. Outbreaks of coccidiosis can cause varying, and often serious, levels of intestinal damage. As intestinal damage increases, NAE flocks **become more susceptible to necrotic enteritis**, which often occurs as a secondary infection of the intestinal epithelium with *Clostridium perfringens*, a bacteria normally present in the hind gut of chickens. Other predisposing factors may increase risk of necrotic enteritis, such as issues with diet formulation (large amounts of animal protein or non-starch polysaccharides [NSPs] without proper enzymes to break down NSPs) or changes in flock immune status caused by mycotoxins or disease, but the **most common predisposing factor is coccidiosis** (Bourassa and Wilson, 2018).

There are a variety of feed ingredients (probiotics, prebiotics, essential oils, enzymes, and acids) being used by the poultry industry as replacements for antibiotics today that have specific physiological, immunological, and/or bacteriostatic effects in the intestine. However, none to date offer the range and versatility of antibiotics (Applegate et al., 2010).

Probiotics, or direct-fed microbials, are live bacterial microorganisms intended to provide health benefits by improving intestinal microbial balance. Common probiotics are often combinations of lactic acid-producing bacteria that include *Lactobacillus* and *Bacillus* strains that have been shown to reduce pathogens and potentially improve growth (Caly et al., 2015).

Prebiotics are carbohydrates or plant-source nutrients used to enhance growth of bacteria in the gut (Tabler et al., 2019). However, when given through the water system, they can enhance bacterial growth in water lines, as well. Growers in an NAE program can't afford bacterial growth in water lines; **clean, safe drinking water is a must for NAE programs**. Prebiotics are not digested by the bird but, instead, selectively stimulate growth of beneficial bacteria, thus improving bird health. Some of the more common prebiotics include nondigestible oligosaccharides such as manno-, fructo-, and galacto-oligosaccharides (MOS, FOS, and GOS). Prebiotics such as MOS work by blocking binding sites on intestinal epithelium for pathogens, including *Salmonella typhimurium* (Spring et al., 2000).

Essential oils, enzymes, acids, vitamins, minerals, and electrolytes are also currently used by integrators/growers to improve bird health. However, their overall performance is inconsistent at best—sometimes they work, sometimes they don't. Unfortunately, the numerous

essential oils and essential oil combinations being used are extremely slimy and sticky and create major problems when given through the water if lines are not thoroughly cleaned on a regular basis. If essential oils are given through the water supply, a thorough water line cleaning program must be in place.

Frustrations with NAE Production

It is frustrating to poultry integrators that none of this wide variety of feed ingredients (prebiotics, probiotics, enzymes, essential oils, acids, etc.) demonstrate consistent performance improvements. This is likely because **we do not understand the precise mode of action** of these ingredients, in part because of the complexity of bacteria populations within the chicken's gut and the **lack of information on chicken-microbe interactions/relationships** (Bourassa and Wilson, 2018). Until we better understand microbial communities present in the chicken and take into account factors such as flock-to-flock variability, administering these ingredients will continue to give inconsistent results, and outbreaks of intestinal disease will likely continue (Bourassa and Wilson, 2018).

Intestinal disease outbreaks often seen in NAE programs create issues of an **ethical nature for poultry veterinarians**, who have taken an oath to, in part, "relieve animal suffering and protect the health of the public and environment." They find it difficult to endorse NAE programs unless safeguards are in place to ensure that treatment is not withheld from flocks that need it, regardless of NAE mandates.

In addition, NAE programs frustrate many **scientific professionals who have a philosophical problem** with endorsing programs that are less efficient and less sustainable, create a larger carbon footprint, and have greater environmental impact. They find it difficult to justify using a program that cannot be scientifically proven but is, nevertheless, viewed as beneficial by consumers who believe often misleading information (Smith-Spangler et al., 2012; Schroeder, 2014). While the internet and social media are powerful, valuable, and useful tools, **not everything posted on the internet or social media is true**.

These are the facts:

- **NAE production results in greater health challenges**, thereby worsening (not improving) consequences on bird health and welfare.
- **Bird health has a significant impact on processing factors** associated with flock uniformity and bacterial loads that directly relate to food safety (Bourassa and Wilson, 2018). When birds are smaller or larger than the processing equipment is designed to handle,

procedures such as opening the body cavity and removing the viscera pack and crop become less efficient and could allow intestinal contents, which can contain high numbers of foodborne pathogens, to come in contact with carcasses on the processing line (Bourassa and Wilson, 2018).

- **NAE production is less efficient** than conventional production that incorporates prudent use of antibiotics. NAE production results in a larger carbon footprint and greater environmental impact: NAE birds must consume more feed and water, producers must raise more birds to offset additional mortality losses and still meet demand, and more birds produce more waste.
- From a food safety standpoint, there are **no scientifically documented benefits of producing NAE birds** versus conventional flocks (Smith-Spangler et al., 2012). Proper care and handling practices, particularly after chicken is brought home from the store, will resolve most food safety issues. When properly handled and cooked, poultry meat contains no viable bacteria, and dead bacteria cannot transmit antibiotic resistance to people (Cervantes, 2015).
- Numerous poultry integrators have at least a portion of their production in some form of NAE program. However, **NAE programs require numerous management changes that will likely increase production costs.**

Summary

NAE programs are challenging poultry integrators/growers and changing how chickens are produced in the U.S. Perhaps the greatest challenge from the live production side is controlling coccidiosis and necrotic enteritis.

In addition, one thing integrators have learned is that “clean” before NAE programs and “clean” during NAE production are two different things. During NAE production, all segments of production must be cleaner than before (pullet farms, broiler-breeder farms, egg packs, hatcheries, feed mills, and broiler farms). For NAE programs to be successful, management practices must focus greater attention on cleanliness, sanitation, and reducing stress levels on broilers.

There are also philosophical questions to address: How do we justify NAE production when it is less sustainable and less efficient, leaves a larger carbon footprint, and results in greater environmental impact?

Finally, NAE programs result in greater challenges for processing plants trying to maintain food safety standards. Health challenges in the field may mean flocks are carrying greater bacterial loads and are less uniform entering processing plants. This challenges plant personnel to prevent intestinal contents from coming into contact with poultry carcasses during the evisceration process.

Despite the challenges, many integrators are making NAE programs work these days. However, there are numerous added costs associated with NAE production, and these costs will ultimately be passed on to consumers and the environment.

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