

Additives in Poultry Feed

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All animals need to receive a nutritious diet in order to maintain good health and production. In the wild, animals consume a wide variety of feed ingredients. Today the nutrient requirements of farm animals and the nutrients provided by different feed ingredients are well understood. Diets for poultry generally consist of a cereal grain (most commonly corn, but also wheat, barley, sorghum, and others) and a protein source (most commonly soybean meal, but there are also several animal and plant protein sources). Animals that receive only these rudimentary ingredients will not thrive. Feeds include trace vitamin and mineral supplements and, sometimes, macrominerals, such as calcium, that improve their nutritiousness.

The nutritional quality of a feed also depends on a variety of other factors, including feed presentation, microbial contamination, content of antinutritional factors, digestibility, palatability, and intestinal healthfulness. A variety of feed additives are available to deal with these issues.

Feed Presentation

Antioxidants

Fat included in poultry diets has a tendency to go rancid. The level of rancidity is affected by storage temperature, light, and the presence of trace minerals. **Trace minerals** are essential nutrients typically added to feeds in the form of mineral premixes. Rancidity is a chain reaction that proceeds at ever increasing speed, so it is essential to prevent rancidity as early as possible. Adding **antioxidants** to feed is an effective way of doing so. By preventing oxidation, antioxidants are able to stop food spoilage, and their preventative properties last until the reserves of the antioxidants are used up. Compounds with antioxidant properties include ethoxyquin, butylhydroxytoluene (BHT), butylhydroxyanisole (BHA), vitamin C, and vitamin E.

Free-Flowing Agents

Ingredients used in poultry feed range from dried cereals to oils, fats, molasses, and trace minerals. The flow characteristics of these ingredients are very different. **Free-flowing agents** are substances added to feed to improve the pourability and storage stability of slow-flowing, moisture-sensitive materials. Most free-flowing agents are fine particulate structures that are resistant to compression and exhibit chemical neutrality. The fine particles surround the particles of other ingredients in feed and prevent clumping. They also bind fluids in the feed. An example of a flowing agent is hydrated sodium aluminosilicate.

Pelleting Additives

Pelleting additives are similar to free-flowing agents. They are added to feeds prior to pelleting to help improve the quality of the pellets. These additives can, for example, reduce feed dust and help pellets better adhere.

Antinutritional Factors and Digestibility

Many feedstuffs contain **antinutritional factors** that interfere with the utilization of dietary nutrients. These factors act in many different ways. Some reduce protein digestibility, bind to dietary nutrients, or damage the gut wall. Soybeans, for example, contain protease inhibitors that inhibit the activity of the enzymes needed to digest protein. As a result, the animal produces more of the digestion enzymes, which in turn damage the pancreas. Raw soybeans contain trypsin inhibitors, but these antinutritional factors are inactivated by the heat generated in the production of soybean meal or when whole soybeans are roasted.

Corn and soybean meal are commonly used in commercial poultry diets in the United States. With the ever higher prices for corn and soybeans, many producers and companies are looking at alternative feed sources. Although several alternatives exist, most of them contain one or more antinutritional factors.

- Wheat contains **xylans** (a type of pentosan), substances that can increase the viscosity of the gut material (digesta), thus reducing the level of nutrients that can be absorbed. Although the increased viscosity slows nutrient flow through the intestines, it also insulates the nutrients from exposure to intestinal microvilli, reducing absorption of the nutrients. Signs of high viscosity digesta typically manifest as a pasting of material around the vent, especially with chicks. The effects of pentosans can be corrected by supplementing a diet with enzymes, xylanases, that are able to digest xylan.
- Sorghum (milo) contains **tannins** that bind with various proteins, reducing their digestibility. Different sorghum varieties have different tannin levels, so the type of sorghum used in feed is important. Generally, the darker the outer seed coat of the sorghum variety, the higher the tannin content. Birds will refuse to eat grain with high levels of tannins.
- Barley contains moderate levels of **trypsin inhibitors**, but the major problem with barley is the level of **beta-glucans**. Similar to xylans, beta-glucans increase the viscosity of the digesta, thus reducing the digestibility of nutrients. Again, the adverse effects of the beta-glucans can be reduced with the use of feed enzymes.
- Canola meal contains **sinapine**, which causes a problem only for brown-egg layers. When canola meal is used in the feed for these layers, the eggs have a fishy and offensive odor.

Mold Contamination and Mycotoxin Reduction

The cereals frequently used in poultry diets are subject to mold growth. Mold contamination can occur in the field or during post-harvest handling, storage, and processing. Mold inhibitors such as organic acids are used to prevent mold growth, but they are not effective against the mycotoxins that molds produce. **Mycotoxins** are poisonous chemical compounds produced as secondary metabolites by actively growing molds. There are more than 300 types of mycotoxins that affect animals, but aflatoxin, vomitoxin, zearalenone, ochratoxin, and trichothecenes are the most common. Even if the mold is no longer visible, the mycotoxins remain. For this reason, many poultry feeds contain a mycotoxin binder that binds to the mycotoxins and prevents them from being absorbed through the gut and into the bloodstream. Common mycotoxin binders are Mycosorb, Mycofix, ProSid, Mycoad—which appears on the Organic Materials Review Institute (OMRI) list—and Toxisorb.

Intestinal Health

Coccidiosis

Coccidiosis in poultry is caused by a single-cell protozoa (*Coccidia*) that lives much of its life in the digestive tract of a host animal. During their development, they enter the cells lining the gut, multiply, and destroy the cells. The damaged intestines cannot absorb nutrients properly. Coccidiostats are used to prevent coccidiosis. They do not treat the condition, but help in preventing it. Common coccidiostats include amprolium (Aprol, Corid), decoquinate (Deccox), diclazuril (Clinacox), halofuginone (Stenorol), lasalocid sodium (Avatec, Bovatec), monensin (Coban), robenidine (Robenz), and salinomycin (Bio-Cox, Sacox).

Blackhead Disease

Blackhead is a disease that primarily affects turkeys. It is caused by the protozoa *Histomonas meleagridis*. The protozoa colonizes the cecum of infected birds. The only drug approved for prevention is nitarsone (Histostat), and it is approved only for the treatment chickens and turkeys. Nitarsone is preventative and will not stop an infection that is more than four or five days old. Unlike the coccidiostats, the use of nitarsone requires a feed-mill license. Feed containing nitarsone should not be fed to ducks and geese.

Worms

Poultry raised with outdoor access can have problems with worms. The only dewormer currently approved in the United States is nitarsone (Histostat). To use nitarsone, you must have a feed-mill license. Nitarsone is approved for chickens and turkeys and is dangerous for waterfowl. Food-grade diatomaceous earth has been shown to be relatively effective in controlling worms, but it is not sufficient to treat an infestation. There has been some anecdotal evidence indicating that garlic and cayenne pepper can be used to control worms.

Necrotic Enteritis

Necrotic enteritis (NE) is a common problem in commercial poultry production (large- and small-scale). *Enteritis* indicates an inflammation of the wall of the digestive tract, and *necrotic* refers to dead tissue. NE typically results from an imbalance in the type of microbes in the gut. There are "good" bacteria and "bad" bacteria. Obviously, the best situation is to have more of the good and less of the bad. Providing nutrients, such as mannan oligosaccharides (MOS), that promote good bacteria will help to maintain gut health. There are a number of MOS products available, including Bio-MOS, Celmanax, Nupro, and SAF-Mannan.

Other products sometimes used to treat NE are referred to as direct-fed microbials. These collections of good bacteria are given to newly hatched chicks or to chickens that have been on an antibiotic regimen (antibiotics kill good bacteria as well as bad). Direct-fed microbials allow the good bacteria to become established in the gut before exposure to bad bacteria.

Fly Control

Cyromazine is fed to chickens as part of a control program for flies, soldier flies, and lesser mealworms. Examples of cyromazine include Flyzine, Larvadex, and Solitude IGR.

Disclaimer: References to commercial products are intended for informational and educational purposes only.