Anticoccidials and Coccidiosis

Anticoccidial drugs were the first products available to the poultry industry to help combat the effects of coccidiosis. Once the poultry industry moved from small farm raised flocks to the modern day concept of intense management coccidiosis became rampant. The main factor contributing to this increase was the extreme change in chick density. Farmers that once managed 5-10,000 birds are now responsible for 20,000+ birds in a very small space. The birds ingest Eimeria spp. oocysts that have either sporulated in the litter or will sporulate in the intestinal tract, the oocysts are then excreted in the feces and are reingested by the bird[3,5]. The degree to which a flock becomes infected depends upon the number of Eimeria species present, the amount of infectious oocysts ingested, type of production system, and the environmental conditions[2,3]. Depending on the anticoccidial being used the mode of actions are all very different, although all anticocidials work by altering the metabolism of the parasite in some manner[1,3,6]. Unlike vaccines which work by modulation of the immune system anticoccidials do not work intentionally through the immune system. An effective anticoccidial works by preventing the acquisition of immunity and parasite development. If growth of the parasite is not completely suppressed then the bird will acquire immunity over time[2,3]. In broilers which are raised for short periods of time, anticoccidials are the primary products used to combat the production effects caused by coccidiosis. The acquisition of immunity in broilers is far less important than in breeders and layers due to their very short life spans. Coccidiosis immunity takes between 6-8 weeks to acquire and causes the most significant losses between 3-5 weeks[2,5].

Anticoccidials can be broken down into synthetic drugs (chemicals) or ionophores. Synthetic drugs include amprolium, clopidol decoquinate, and halofuginone. Ionophore examples include monensin, salinomycin, and narasin. The following are claimed benefits of Ionophores[6]:

1) Protection against coccidiosis due to field strains during the period before protective immunity has developed
2) Protection against coccidiosis due to species not present in the vaccines
3) Control of necrotic enteritis due to Clostridium perfringens
4) Feed saving, which would lead to improved feed conversion ratio

Ionophores are known to be effective against gram positive and anaerobic bacteria which is hypothesized to help reduce feed conversion when compared to unmedicted birds[3]. The application of anticoccidials is most commonly through the feed but can also be provided through the watering system. Management practices can significantly alter the potency of the product and its intended effects upon coccidiosis. Empty feeds pans do not allow for adequate intake of the medication nor does over flowing feed pans which promotes litter consumption and the intake of infectious oocysts[3]. It is of extreme importance to be fully aware of the anticoccidial product being used as some have been shown to have negative effects under specific environmental situations. For instance, nicarbazin used during high temperatures causes severe mortality and has also been shown to be highly toxic to layers. Layers receiving nicarbazin will show signs of brown shelled eggs bleaching along with reduced hatchability and production. Ionophore toxicity can range from mild cases resulting in temporary paralysis to severe cases causing mortality and permanent paralysis [5].

Due to the complex life cycle of Eimeria spp. drug resistance to all anticoccidials presently on the market has been reported. Farms that are having drug resistant coccidiosis issues should consider using a vaccination on their next flock in place of the anticoccidial. Live vaccines that are made of drug sensitive strains have been shown to interbreed with the local drug resistant strain and overtime the parasites will become resensitized to the anticoccidial (See Vaccinations and Coccidiosis)[1,2,3,4]. Shuttle or dual programs are also advisable for use to combat drug resistant strains. These programs work by changing up types of products being used in order to theoretically reduce the buildup of resistance by the Eimeria. For example, the use of an ionophore in the starter feed then switching to a synthetic drug in the grower, or the use of two different ionophores or two different synthetic drugs first in the starter diet then in the grower diet[2,3,5]. Single drug programs are also commonly utilized in broilers and can be ineffective if the drug being used is the drug the Eimeria spp. have established immunity to. A withdrawal period is also recommended for many anticoccidial medications in order to guarantee that no drug residue is passed along to humans through consumption. Even with the use of anticoccidial products cocci can multiple for various reasons:

1) Some drugs have poor response even when the parasites have not been previously exposed to the. These products cannot suppress the total completion of Eimeria life cycles and oocyst production, despite being protective against clinical disease.
2) Multiplication of cocci may result from acquired drug resistance
3) Cocci may develop during intermittent medication; the timing between expose of drug-sensitive parasites and the ingestion of the drugs.

Breeder pullets and laying birds are raised for long periods of time and rely on acquired immunity to combat coccidiosis. Vaccines are far more common in these industries than the broiler industry but the use of anticoccidials in breeders is also common; consequently, anticoccidials are not used in layers once they begin reproducing as these can reduce egg production[2]. Birds raised in cages have less access to feces containing oocysts, if proper management techniques are being followed, and have been shown to acquire proper immunity even with anticoccidial treatments. Breeders raised under feed restriction intake less amounts of drugs than non-feed restricted birds and the dosage amounts will need to be adjusted to obtain proper performance of the drug[2,3].

Alternative Methods:

Due to the increasing controversy of utilizing antibiotic growth promoters (i.e. ionophores) in poultry many alternative methods for controlling coccidiosis have been explored. While many alternatives have shown great potential in affecting Eimeria spp., significant consistent research to support these alternative methods is lacking. Many of these products work through mechanisms of the immune system that are not clearly understood. Probiotics, or direct fed microbials, work by seeding the intestinal tract with beneficial microflora indigenous to the chicken. While prebiotics provide a nutrient source for these beneficial bacteria to utilize for growth. Both products essentially work by competing with the cocci parasites for attachment sites along the mucosal lining of the gut, competitive exclusion, essentially decreasing oocysts sporulation sites and increasing the immune system. Studies on vitamin A have shown its important effects in development of the mucosal lining and immune system[4]. A deficiency of this vitamin would lead to a high susceptibility to coccidiosis and other enteric diseases. ϒ-tocopherol or vitamin E , has shown to be effective against upper and mid intestinal species such as E.acervulina and E.maxima but not E.tenella. N-3 fatty acids such as fish oil or flaxseed oil have been shown to reduce lesions caused by E.tenella but not E.maxima during research challenges due to their nature of inducing oxidative stress[1]. Other products of noteworthiness include oregano, artemisinin, and betaine . Many of these alternative methods have shown to be more successful when being used in conjunction with an ionophore as opposed to the ionophore or the product individually [1,5].

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