Can mineral source lessen necrotic enteritis challenge in poultry?

Supplemental hydroxy copper and zinc help broilers maintain performance during a necrotic enteritis challenge.

By **JEFF COHEN***

NECROTIC enteritis (NE) is the most economically damaging disease to the commercial poultry industry, with annual costs due to lost productivity, prevention and treatment exceeding $6 billion (Wade and Keyburn, 2015). This disease has a number of predisposing factors, primarily *Clostridium perfringens* infection, coccidial infection and other disturbances to the gastrointestinal tract.

Traditionally, antibiotic growth promoters and coccidiostats have been useful in reducing the effects of this disease, but as regulatory agencies and consumers have demanded the reduction in their use, the incidence and cost of NE to the poultry industry has increased (Kaldhusdal et al., 2016).

Clearly, new strategies are needed to support growth performance and animal welfare in the face of NE challenges.

Mineral alternatives

Copper has been recognized since the 19th century for its associations with immunity to several health challenges in humans (Grass et al., 2011) and has demonstrated antimicrobial activity (Katwal et al., 2013). Zinc is a potent modulator of animal immunity and is critical for the maintenance and functionality of immune cells (Rink and Haase, 2007).

Supplemental copper and zinc may attenuate the poor performance typically associated with outbreaks of NE in the absence of traditional coccidiostats or antibiotics and, thus, mitigate the costs associated with this disease.

Hydroxy minerals

Hydroxy minerals represent a novel mineral source with unique properties that provide several advantages over commodity mineral sources like oxides and sulfates.

The unique chemical structure and bond strength of hydroxy minerals reduce solubility and reactivity in feed and the gastrointestinal tract — leading to, for example, improved phytase stability and phosphorus hydrolysis (Pang and Applegate, 2006) — they allow for more uniform mineral availability throughout the gastrointestinal tract (Arias and Koutsos, 2006) and they pose a lower toxicity risk than more soluble mineral sources.

These sources also provide an added benefit at the mill as their density, specific gravity and minimal generation of dust optimize blending and minimize carryover.

*Jeff Cohen is vice president marketing and sales at Micronutrients.

NE challenge trials

Two experiments were designed to determine of the effect of copper and zinc hydroxy minerals on broilers challenged with NE (Parr et al., 2017). This NE model involves a challenge with several *Eimeria* species and *Clostridium perfringens* and was conducted at Colorado Quality Research using modern commercial broiler breeds and corn/soybean meal diets representative of those typically fed in the integrated poultry industry.

In both experiments, birds were fed diets without antibiotics or coccidiostats that contained various combinations of copper and zinc hydroxy minerals (IntelliBond C and IntelliBond Z, respectively).

In trial 1, 2,376 Cobb 500 male broilers were raised to 28 days of age on one of nine treatments outlined in Table 1. The positive control treatment was fed traditional commodity minerals (copper sulfate, zinc sulfate and zinc oxide) and received a coccidiostat. All hydroxy mineral treatments were coccidiostat and antibiotic free.

As expected, demonstrating an effective NE challenge, the removal of coccidiostats from NE-challenged birds increased mortality ($P < 0.05$ for all). However, birds fed 200 ppm of copper as copper hydroxy plus 90-150 ppm of zinc as zinc hydroxy had lower mortality than those fed 125 ppm of copper (Table 1).

Additionally, when birds were fed 200 ppm of copper as copper hydroxy plus 120 ppm of zinc as zinc hydroxy, their gains, feed conversion and lesion scores were similar to birds fed the coccidiostat and showed significant improvement compared to birds fed sulfate/oxide minerals ($P < 0.05$ for each).

In trial 2, 2,970 Ross 708 male broiler chicks were raised to 28 days of age on one of 10 treatments outlined in Table 2.

Similar to trial 1, removal of the coccidiostat increased mortality during an NE challenge, but birds fed 225-275 ppm of copper as copper hydroxy plus 120 ppm of zinc as zinc hydroxy performed similarly to those fed a coccidiostat in terms of bodyweight gain, feed conversion and mortality (Table 2).

Other combinations of copper hydroxy and zinc hydroxy were also effective at maintaining various performance attributes during the NE challenge, notably 275 ppm of copper as copper hydroxy plus 80 ppm of zinc as zinc hydroxy.

These trials demonstrate that in the absence of coccidiostats, feeding 200-275 ppm of copper as copper hydroxy plus 120 ppm zinc as zinc hydroxy maintains broiler performance despite an NE challenge.

Since various levels of copper and zinc hydroxy were effective at maintaining performance, producers can optimize their feeding strategy with consideration of mill efficiency. For example, since broilers are typically fed 80 ppm of zinc to meet their nutritional requirements, a potential solution to address an NE outbreak would be to solely increase the copper concentration to 275 ppm when coccidiostats are not available. Because copper is commonly supplied to the diet from its own micro-bin, this intervention strategy would require little additional effort if already feeding functional levels of copper.

The bottom line? When coccidiostats are not available or not desired, feeding higher concentrations of copper and zinc hydroxy minerals can improve performance of broilers exposed to an NE challenge.

References

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1. Trial 1 setup and results

	Treatment								
	1	2	3	4	5	6	7	8	9
Added copper (ppm/form)	—	125 CS	125 CS	125 CH	125 CH	125 CH	200 CH	200 CH	200 CH
Added zinc (ppm/form)	—	60 ZO/30 ZS	60 ZO/30 ZS	90 ZH	120 ZH	150 ZH	90 ZH	120 ZH	150 ZH
Coccidiostat*	—	+	—	—	—	—	—	—	—
NE challenge**	—	+	+	+	+	+	+	+	+
Mortality, %	0.0[c]	0.5[c]	23.8[ab]	30.8[a]	31.1[a]	24.5[ab]	17.6[b]	19.0[b]	18.2[b]
Weight gain, kg	1.462[bc]	1.535[a]	1.421[c]	1.451[bc]	1.457[bc]	1.435[c]	1.474[bc]	1.500[ab]	1.470[bc]
Feed conversion ratio, mortality adjusted	1.340[a]	1.311[bc]	1.323[ab]	1.311[bc]	1.310[bc]	1.319[abc]	1.321[ab]	1.297[c]	1.311[bc]
Lesion scores	0.00[e]	0.53[e]	2.80[bc]	3.53[a]	3.84[a]	3.27[ab]	2.29[cd]	2.05[d]	2.38[cd]

Abbreviations used: CS = copper sulfate; CH = copper hydroxy; ZO = zinc oxide; ZS = zinc sulfate; ZH = zinc hydroxy.
[a,b,c,d,e]Data with different letters are significantly different ($P < 0.05$).
*Narasin/nicarbazin (Maxiban) supplemented to diet at 72 g/ton.
**Challenge consisted of 5x HatchPak at day 10 and *C. perfringens* at day 17.

2. Trial 2 setup and results

	Treatment									
	1	2	3	4	5	6	7	8	9	10
Copper hydroxy, ppm	125	125	175	175	175	225	225	225	275	275
Zinc hydroxy, ppm	80	80	80	120	160	80	120	160	80	120
Coccidiostat*	—	+	—	—	—	—	—	—	—	—
NE challenge**	—	+	+	+	+	+	+	+	+	+
Mortality, %	8.60[a]	0.37[d]	4.12[bc]	4.94[bc]	5.89[ab]	3.33[bcd]	2.53[bcd]	1.40[cd]	1.87[cd]	1.91[cd]
Weight gain, kg	1.417[c]	1.493[a]	1.438[bc]	1.448[bc]	1.459[ab]	1.444[bc]	1.492[a]	1.472[ab]	1.460[ab]	1.501[a]
Feed conversion ratio, mortality adjusted	1.351[a]	1.306[d]	1.331[b]	1.327[bc]	1.316[bcd]	1.319[bcd]	1.318[bcd]	1.309[cd]	1.306[d]	1.311[bcd]
Lesion scores	1.86[a]	0.36[e]	1.12[bc]	1.34[b]	1.38[b]	0.74[cde]	0.58[de]	0.86[cd]	0.86[cd]	0.80[cd]

[a,b,c,d,e]Data with different letters are significantly different ($P < 0.05$).
*Narasin/nicarbazin (Maxiban) supplemented to diet at 72 g/ton.
**Challenge consisted of 1x CocciVac at day 0 and *C. perfringens* at day 17.