

Poultry Litter Amendments

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Litter Amendments

- National Chicken Council: Maintain ammonia <25 ppm at bird height
 - Higher ammonia levels reduce bird performance & welfare
- Reduce ammonia formation in poultry litter and/or its release
 - Mechanisms may be physical, chemical, & microbiological or their combination
- Could also reduce ammonia emissions

Litter Amendments

- Litter being reused due to high shavings prices & disposal challenges
- Applied prior to bird placement but also with birds in the house (some amendments)
- Require no modifications to houses & minimal management changes
- Importantly, may improve bird performance & provide ancillary benefits
- Reasonably priced

Types of Litter Amendments

1. Acidifiers
2. Alkaline material
3. Adsorbers
4. Inhibitors
5. Microbial & enzymatic treatments



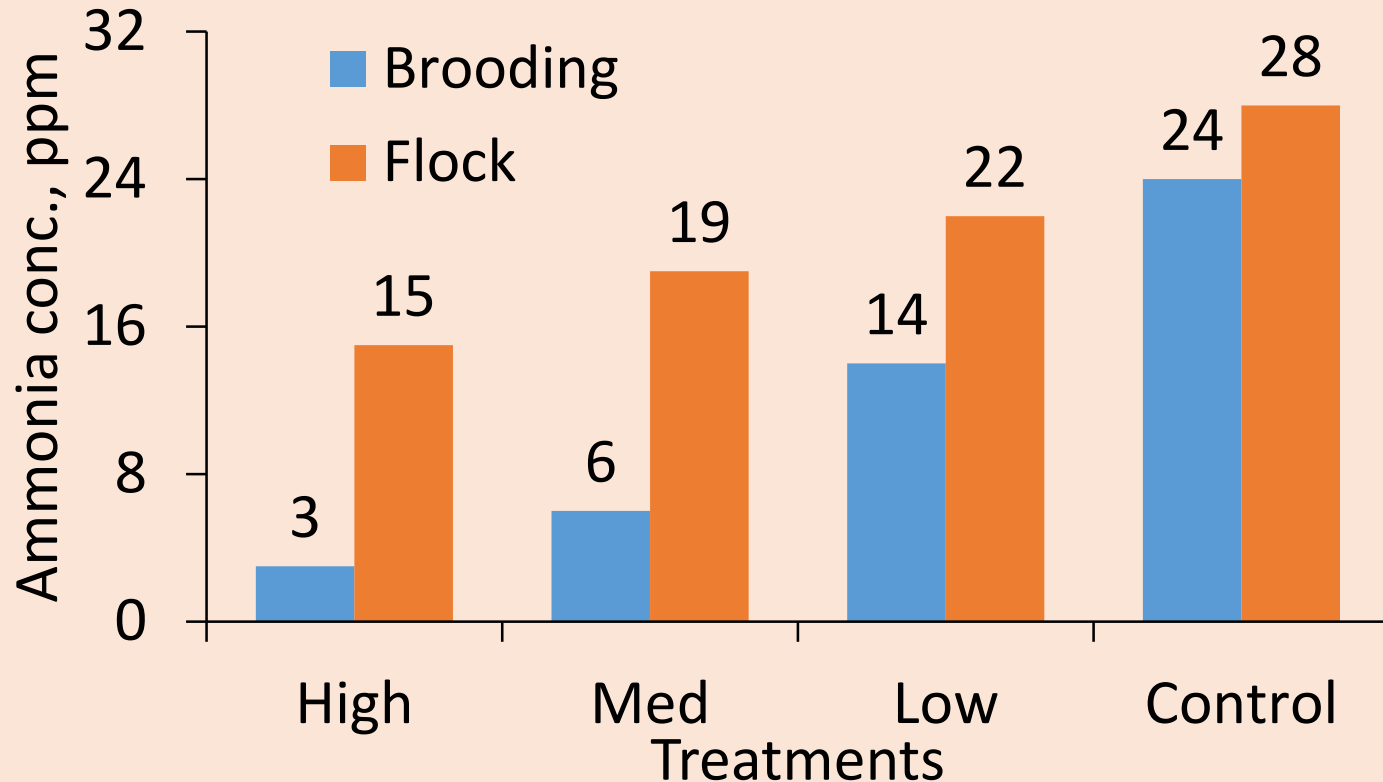
Acidifiers

- Acidic salts or acids that reduce litter pH to reduce conversion of ammonium to ammonia
 - Also inhibit microbes & enzymes that form ammonium
- Examples of popular acidifiers:
 - Al+Clear[®] A7 (aluminum sulfate+sulfuric acid), liquid
 - Al+Clear[®] (aluminum sulfate), dry
 - PLT[®] (sodium bisulfate), dry
 - Poultry Guard[®] (sulfuric acid+clay), dry
 - Citric acid

Acidifiers

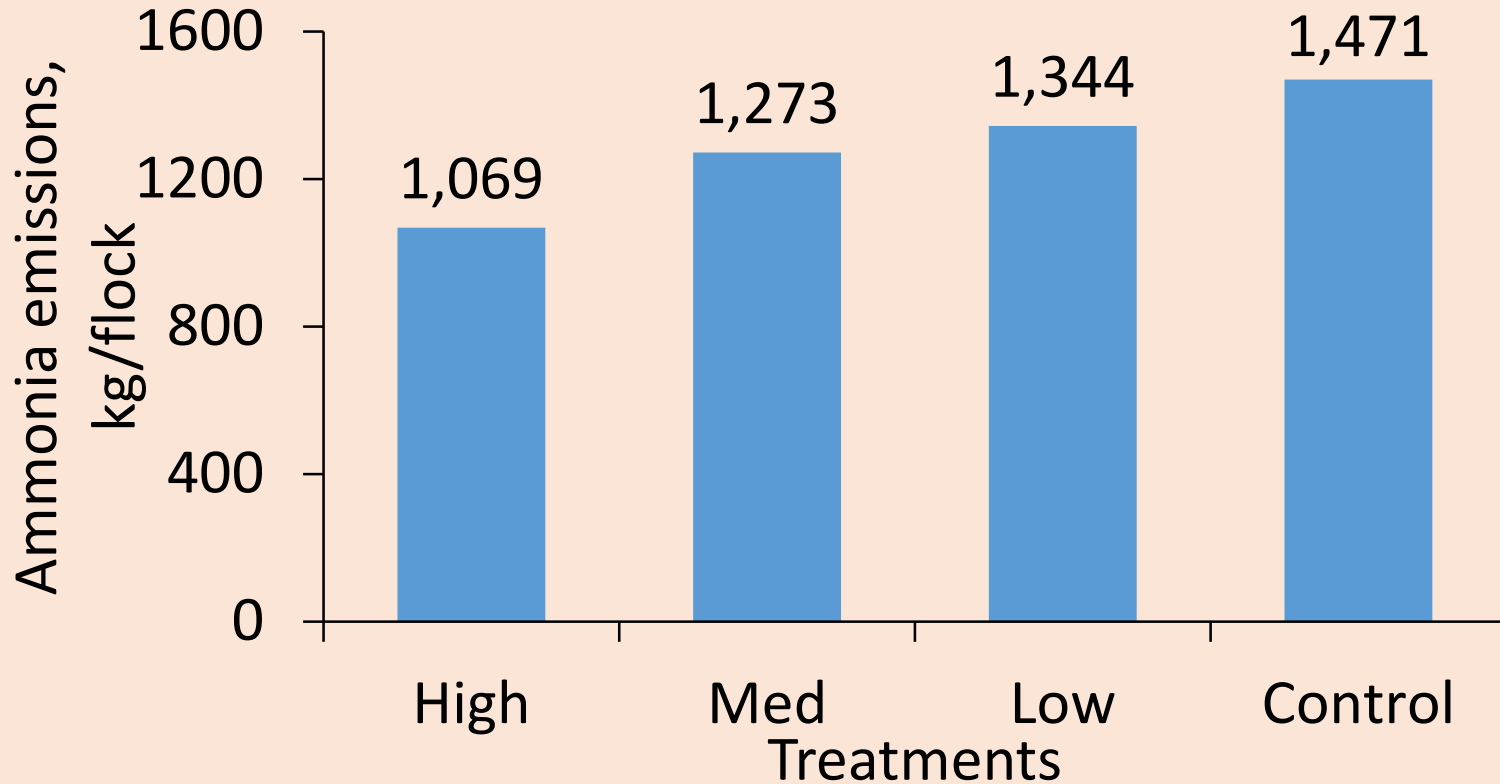
- Cheapest additives
- Some acidifiers approved for NRCS EQIP cost-share – varies by state
- Dry products typically applied at 50 to 125 lb/1000 ft² few hours prior to bird placement
- Split applications also effective
- Higher application rates provide longer-term ammonia control
 - Ammonia control most beneficial early in the flock, particularly in winter (low ventilation rates)
 - Also increase litter N

Average indoor ammonia concentrations in 21,000-bird roaster houses with 63-day flocks (average of 6 flocks) receiving different levels of PLT



High PLT (300 lb/1000 sf), Med. PLT (150 lb/1000 sf), and Low PLT (100 lb/1000 sf) to whole house. Control (100 lb/1000 sf) to the brood chamber only.

Average ammonia emissions from 21,000-bird roaster houses with 63-day flocks (average of 8 flocks) receiving different levels of PLT



High PLT (300 lb/1000 sf), Med. PLT (150 lb/1000 sf), and Low PLT (100 lb/1000 sf) to whole house. Control (100 lb/1000 sf) to the brood chamber only.

Acidifiers – Bird Performance & Ancillary Effects

- Improved bird performance (e.g., weight, mortalities) in several studies
 - In our (large) study, bird performance unaffected (due to ventilation rates?)
- May reduce heat energy use (due to reduced ventilation needs?)
- Reduce litter pathogen levels
- Reduce darkling beetle levels
- Some acidifiers can reduce dissolved phosphorus & trace metal (As, Cu, Fe, Zn) losses in runoff

Alkaline Materials

- High pH materials (e.g., ag lime, burnt lime) used to cook off ammonia prior to bird placement
 - Ammonia emissions increased
- May reduce bird performance
- Unaware of recent use in poultry production

Adsorbers

- Adsorb ammonia/um, physically or chemically
- Some examples:
 - Zeolite
 - Barn Fresh[®] (diatomaceous earth)
 - Activated Barn Fresh[®] (with citric acid)
 - Peat (too expensive)
 - Biochar (blended with bedding)
- Zeolite offers potential to reduce ammonia & improve performance
 - Need larger, longer studies

Adsorbers

- Barn Fresh & Activated Barn Fresh approved for use in organic poultry production
 - Lack of data involving birds
- Biochar not effective for ammonia control if not acidified

Inhibitors

- Inhibitors (e.g., dicyandiamide) inhibit conversion of urea into ammonia
 - Used to reduce N losses in high-value crops
- Too expensive as repeated applications (weekly?) may be required
- Lack of studies with birds

Microbial & Enzymatic Treatments

- Widely used in solid waste treatment
- Mostly proprietary, so limited knowledge about mode of action and how to optimize
- Usually marketed for ability to immobilize ammonia
 - Would be ideal if ammonia converted to microbial biomass
 - Even conversion to nitrate might be acceptable
- Efficacy limited

Critical Research Questions

- Need benefit-cost ratios of acidifiers based on comprehensive analyses
- Need effective amendments for organic production
- Need effective microbial & enzymatic products
 - Even lack of nitrification in houses surprising
- Alternative amendments (e.g., wastewater treatment plant residuals, chitosan) may require larger-scale evaluation

Critical Research Questions

- Need litter amendments for reducing overall odor emissions (focus on reduced sulfur gases)
- Account for N conserved due to litter amendments on whole farm basis, not just house
- Air quality impacts on workers?

Summary

- Litter amendments, specifically, acidifiers most effective ammonia control measure in US poultry production
- Acidifiers fully accepted by integrators & producers due to bird performance & ancillary benefits
- Use amendments to reduce ammonia emissions, not just manage indoor ammonia
- Need amendments for other odorous gases