Organic Poultry Production and Ammonia Control

August 22, 2019

Ammonia control in broiler houses which reuse litter has been a constant challenge, and products have been developed over the years which provide some degree of control. Acid based products which reduce pH have been widely adopted by the poultry industry. Due to the synthetic acids incorporated they have been prohibited from use in birds produced as USDA organic. This severely handicaps organic growers who want to reuse litter.

Temperature, pH, nitrogen content and moisture levels in litter dramatically affect the production of ammonia. Work began in 2017 to provide a litter amendment that reduces pH and moisture as a means of reducing ammonia production.

The acids common in ammonia control products are generally unpleasant materials and are corrosive, reducing the life of poultry house equipment and structures.

Acidified calcium sulfate (pH Shield™) is a non-corrosive powder which lowers pH and is slightly hydroscopic. Benchtop trials followed by 2 repetitions of University conducted pen tests concluded that pH Shield™ provided the same level of ammonia control as a popular product, Poultry Litter Treatment (PLT), which is prohibited for use in organic production.

Acidified calcium sulfate also adds value to the litter by adding calcium and sulfate while reducing water extractable phosphorus (WEP) (author, 2019) thus providing a more balanced fertilizer value while limiting the phosphorus subject to run off.

University of Maryland Eastern Shore (UMES) Summary Report on 1st generation pH Shield™ states, "In conclusion, we can make a strong case for additional benefits from using pH Shield™ as an ammonia control amendment. It decreases phosphorus solubility thereby reducing phosphorus loss in runoff. The pH Shield™ amendment does not reduce phosphorus uptake by plants, because acidic root exudates can solubilize phosphorus and take it up." (author, 2019)

> "We can make a strong case for additional benefits from using pH Shield™ as an ammonia control amendment."
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> *- University of Maryland Summary Report*

Field Trials were conducted to learn more about practical application considerations. A special drop spreader was designed to provide accurate, even placement of pH Shield™ and several farms were chosen as experiments to confirm results under actual production conditions.

Field trials show consistent ammonia control. Litter samples from these trials consistently show lower phosphorus and drier litter. Lab results also show higher sulfur levels in litter treated with pH Shield™.

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Field Trials

Challenges to Address:

1) Ammonia control in broiler houses who reuse litter
2) Issues with wet areas in the litter
3) Improving composting in windrow litter management
4) Corrosion caused by current popular ammonia control options (namely A7 and PLT)
5) High levels of WEP phosphorus in poultry manure which limits land application rates and contributes to surface water contamination
6) Producing litter quality acceptable to markets such as mushroom substrate ingredient

Locations:

Trial 1 is on a Lancaster County Farm with four, non-organic broiler houses. Houses have humidity monitors, electronic controls and digital recordkeeping.

- **House #1** New house with dirt floor (63 X 500) This house has Valco Waterers and is the "control" for this trial using only PLT
- **House #2** Older house with concrete floor (44 X 500)
- **House #3** Older house with concrete floor (44 X 500) This had historically been the wettest house. They have tried several different remediations to the structure with limited success.
- **House #4** New house with dirt floor (63 X 500) This house has Ziggity waterers

1) The comparison was done between house #1 and #4 because they were identical except for waterers.
2) First trial was in house 4 with 135lbs of pH Shield™ per 1000 sq feet (full rate) in the entire house. No wetting after application. This was a partial failure since some PLT had to be added later to maintain safe ammonia levels in the first 10 days.
3) The next 2 flocks in house 4 were 135 lbs of pH Shield™ per 1000 sq feet (full rate) with 2 gallons water per 1000 sq feet applied on top of the pH Shield™ application. This resulted in very low ammonia for 10 days.
4) The PLT house was purged of ammonia by preheating and running fans to remove ammonia. House treated with pH Shield™ was not purged.
5) All trials, except for the very first, included wetting product after application. Water was applied with a small sprayer attached to a four-wheeler.
6) The fifth flock has been placed with matching or better ammonia control than PLT. Composting has worked well and litter conditions are good.

Trial 2 is on a Lebanon County farm with two organic houses. Typical practice was to de-cake and add one load of shavings per house. The first trial was performed with shavings and ammonia was almost non-detectable. Based on this result, the next 2 flocks were windrowed, and pH Shield™ provided excellent ammonia control.

- Two new houses (44 x 500) with dirt floors
- No control at this location, both houses are treated with pH Shield™

1) Applied 135 lbs of pH Shield® per 1000 sq feet in the brood chamber only (approx. half the house).
2) Water applied with a pressure washer in the middle of the brood chamber by misting the air.

pH Shield ™ Application Notes:

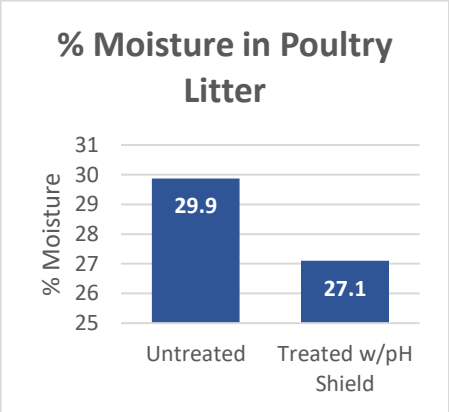
- Uniform application and product wetting are critical pieces for success with pH Shield®.
- Apply just before equipment goes down
- Purging is not necessary prior to bird placement
- In extremely hot weather, increase the amount of water applied to pH Shield since the water evaporates so quickly
- Determine correct moisture by making sure very little white powder is visible after moisture is applied

Litter Observations:

1) Full depth of the litter collected from five locations across the house and mixed together. Two samples are pulled from the mixed litter – one for the lab and one for in house pH tests.
2) When collecting litter samples, the treated areas are drier and loose and easy to mix. When picking up the litter, if you open your hand, the litter sifts right through the fingers.
3) There was no issue with dust in the treated areas, even though the litter was drier.
4) Litter from untreated areas is often crusty, lumpy etc. Litter needed to be pulverized before it could be mixed in order to get a good sample.

Results and Benefits of pH Shield™:

1) Sustained Ammonia Control
  a. Heat Savings – less fan time
    i. Lancaster Country Farm – Averaged ten seconds less fan time during the 1st 10 days. In one case fan time started at 30 seconds in 5 minutes on day one and was only up to 40 seconds in 5 minutes by day 7.
    ii. Lebanon County Farm – Grower estimates 20 – 40% less fan time during the 1st 10 days over all flocks when using pH Shield™.
    iii. Houses were not purged prior to bird placement, saving significant fuel.
  b. Air Quality & Bird Health
2) Drier and Consistent Litter Moisture
  a. Litter moistures from all treated areas averaged 2.8% less than untreated areas.
  b. Individual samples all reflected this same trend of decreased litter moisture.
3) Aids Composting
4) Environmental & Public Impression
  c. No need to pre-heat and blow off ammonia into the environment.



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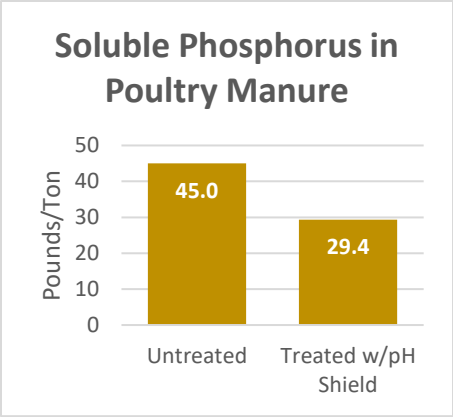
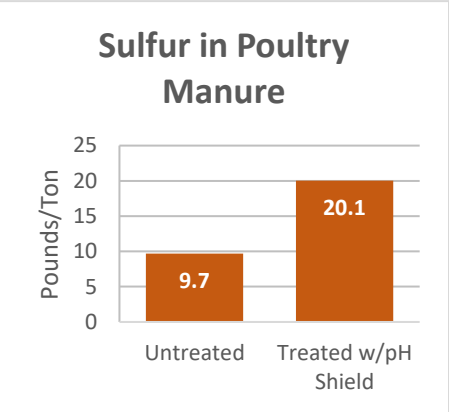
d. Nitrogen stays in the manure and can be used to grow crops instead of exhausting out into the air.
e. Less soluble phosphorus to decrease risk of watershed impact.

5) Worker Safety – doesn't burn or corrode, safe to use
6) Less Corrosion to Equipment/Facility - Longer equipment life, save costs on replacing equipment
7) Increased Nutrient Value of Litter
a. Phosphorus – less run-off, plant available form
i. WEP (soluble phosphorus) from all treated areas averaged 15.6 less pounds per ton than untreated areas. This represents a 34.6% decrease in WEP.
ii. Individual samples all reflected this same trend of decreased WEP.
b. Sulfur
i. Sulfur from all treated areas averaged 10.4 more pounds per ton than untreated areas. This represents a 107.2% increase in Sulfur.
ii. Individual samples all reflected this same trend of increased Sulfur.





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References

https://www.ars.usda.gov/research/publications/publication/?seqNo115=353789

Water extractable phosphorus (WEP) in manure and manure compost is widely used as an indicator of P release to runoff from manures and composts that are land applied.

Moreover, WEP was strongly correlated (r = 0.66) to degree of P saturation (DPS) expressed as a ratio of total P to total metals (calcium, magnesium, iron, aluminum, and manganese).

Results highlight the potential to use DPS to predict WEP in manures and composts, and point to the opportunities to reduce WEP by managing manure handling, storage, and chemistry.

Cite UMES report.

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