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Treating Poultry Litter with Aluminum Sulfate (Alum)

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Definition:

Aluminum sulfate (alum) is added to poultry litter in the poultry house to reduce ammonia volatilization.

Purpose:

Over half of the nitrogen excreted by chickens is lost to the atmosphere as ammonia before the litter is removed from poultry houses. Research has shown that alum additions to poultry litter greatly reduces ammonia emissions. Lower ammonia levels in poultry houses due to alum additions result in heavier birds, better feed conversion and lower mortality. Alum additions to poultry litter also precipitates phosphorus into a form which is not water soluble. This greatly reduces phosphorus runoff from fields fertilized with poultry litter, as well as phosphorus leaching. Alum additions also reduce the number of pathogens in litter

How Does This Practice Work:

Alum should be applied to poultry litter at a rate equivalent to 5-10% by weight (alum/manure). For typical broiler operations growing six week old birds, this is equivalent to adding 0.1 to 0.2 lbs alum per bird or 1-2 tons of alum per house per flock if 20,000 birds are in each house. The reduction in ammonia emissions is due to the acid produced when alum is added to the litter. This acid converts ammonia to ammonium; which is not subject to volatilization. The reduction in litter pH also causes pathogen numbers to decrease. Aluminum from alum reacts with phosphorus to form an insoluble aluminum phosphate compound that is far less susceptible to runoff or leaching.

Where This Practice Applies and Its Limitations:

This practice applies to all poultry operations that have dry litter (broiler, breeder and turkey houses). There are no known limitations of this practice.

Effectiveness:

Alum additions result in less nitrogen being lost due to ammonia volatilization. Ammonia fluxes from alum-treated litter have been shown to be 70% lower than normal litter (Moore et al., 2000). This results in a higher nitrogen content of the litter, which boosts crop yields. Lower ammonia levels in the rearing facilities also improve poultry production and make the environment safer for agricultural workers.

Reducing atmospheric ammonia emissions will also result in less air pollution, such as fine particulate matter (ammonia is a precursor to fine particulate matter), acid precipitation, and atmospheric nitrogen deposition. Treating poultry litter with alum is also one of the most effective methods of reducing phosphorus runoff from fields fertilized with litter. Alum applications to poultry litter have been shown to reduce phosphorus runoff by 87% from small plots (Shreve et al., 1995) and by 75% from small watersheds (Moore and Edwards, 2007).

The long-term effects of applying alum-treated litter to land have indicated that this practice is sustainable (Moore and Edwards, 2005; 2007). Soluble phosphorus levels in soils fertilized with alum-treated litter are significantly lower than that in soils fertilized with normal litter. Hence, there is less phosphorus leaching with alum-treated litter (Moore and Edwards, 2007). Long-term studies conducted by Moore and Edwards (2005) showed that exchangeable aluminum levels in soils fertilized with normal and alum-treated litter are low (less than 1 mg Al/kg soil) and are not

significantly different, whereas plots fertilized with the same amount of nitrogen from ammonium nitrate have very high exchangeable aluminum (up to 100 mg Al/kg soil). Moore and Edwards (2005) also showed that tall fescue yields from long-term studies were highest with alum-treated litter, followed by normal litter and lowest with ammonium nitrate.



Cost of Establishing and Putting Practice in Place:

Treating poultry litter with alum is a cost effective best management practice, due to the economic returns from improved poultry production and reduced energy costs. Alum costs about \$250/ton. As mentioned earlier two tons of alum should be applied to a typical broiler house after each flock. Moore et al. (2000) showed that the economic returns from this practice were \$308 for the grower and \$632 for the integrator (company), for a combined return of \$940. This is almost twice the cost (\$500) to treat the house, resulting in a benefit/cost ratio approaching 2.

Operation and Maintenance:

Alum is normally applied between each flock of birds. Dry alum can be applied with a number of different spreaders, such as de-caking machines, fertilizer spreaders, manure spreaders or drop spreaders. Applicators should always wear goggles for eye protection and a dust mask to avoid breathing alum dust. Gloves should also be worn to prevent skin irritation. To insure the chickens do not consume the granules of alum, it is best to till the product into the litter. This can be done with a litter de-caker or with any other device that physically mixes the alum into the litter. Liquid alum is normally only applied by a certified professional applicator. There are two types of liquid alum - normal liquid alum (48.5% alum) and acid alum (36.5% alum). Acid alum is preferred in situations where the litter is very dry, since it activates quickly. To add the equivalent of one ton of dry alum, 370 gallons of liquid alum or 512 gallons of acid alum is needed.



References:

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For Further Information:

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Or you can contact your local conservation district, USDA-NRCS or Cooperative Extension Service office.

This practice falls under the NRCS Conservation Practice Standard 591 (Amendments for Treatment of Agricultural Waste)