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Using Biochar for Manure Management

Whether a producer uses a lagoon, scraping and piling, bedded pack barn or a combination, biochar can help improve many aspects of manure handling:

- Biochar controls pathogens by supporting beneficial microbes that outcompete pathogens.
- Biochar controls moisture and aeration to reduce odors and emissions of ammonia, methane and nitrous oxide.
- Manure composted with biochar retains more nitrogen for greater fertilizer value.
- Manure composted with biochar has a fine, granular texture that is easier to apply to fields.
- When introduced at the beginning of the production cycle, the benefits of biochar cascade throughout the system.

In soil, biochar-manure compost has greater value than either component used alone.

Biochar Is Best Added in the Barn

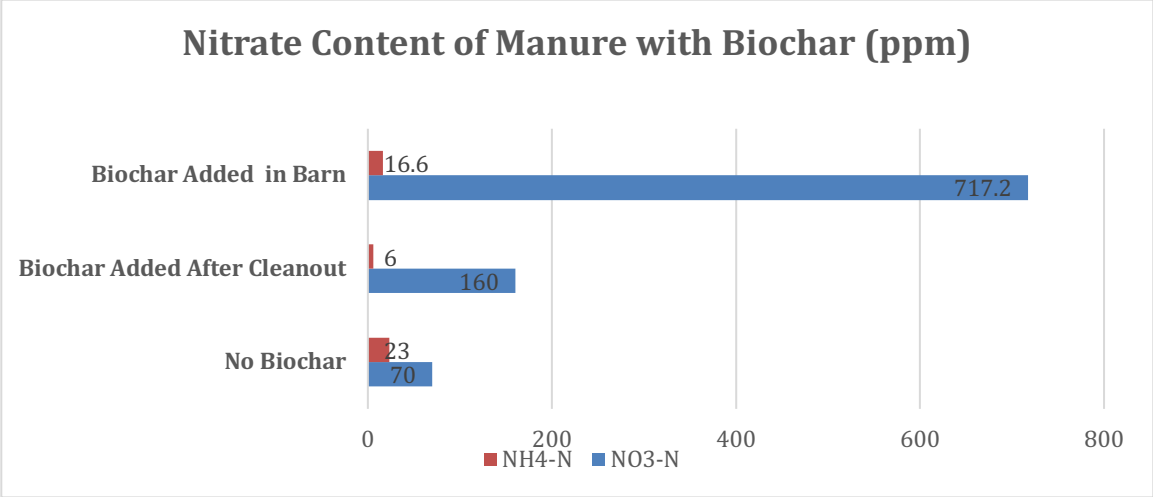
Michaels Ranch in Days Creek, Oregon (producer of grass-fed beef) tried adding biochar to manure in two ways:

1. Mixing in with manure as barn is scraped and piled (after the winter feeding period).

2. Adding to barn floor before winter feeding begins and allowing animals to mix with their hooves.

Biochar added to the winter feed barn before winter season. Cattle mixed the biochar into the manure.

The difference between the two methods was dramatic, as measured by nitrate content of the resulting compost.



Biochar for Odor and Pathogen Control in a Pack Barn

Willow Witt Ranch in Jackson County, Oregon operates a small goat dairy that accumulates a manure pack with added straw bedding. The barn is cleaned out two or three times a year. Typically, the ammonia smell is overwhelming to workers when the pack is disturbed for cleanout.

Scattering the Oregon Biochar Solutions biochar on the exposed manure pack helped to immediately reduce ammonia gasses in the air, protecting workers from exposure during barn cleanout in June 2017.

Suzanne Willow digs into the manure pack in February 2018. After seven months of biochar use, there is no longer any detectable ammonia smell.

Willow Witt Ranch scattered one five gallon bucket of biochar per 100 sf of barn floor each week. At the same time, they sprayed one quart of EM-1 probiotic solution[1] per 100 sf. The results were impressive. Ammonia smell has been eliminated and the goats have been very healthy with no coccidiosis.

In Europe and elsewhere, hospitals are spraying surfaces with lactic acid based pro-biotic solution as an alternative to disinfectants with great results in pathogen reduction.[2]

If it works in a hospital, it should work in a dairy.

The lactic acid bacteria, combined with biochar, make a one-two punch that really knocks out ammonia.

Research Literature Supports the Use of Biochar in Manure Management

Biochar Inoculated Deep Litter System

Scientists at the University of Hawaii developed a dry deep litter system for swine. The system uses at least two feet of high carbon bedding material mixed with charcoal and cinders. It is inoculated once with indigenous micro-organisms (IMO), which include lactic acid bacteria. No tilling or stirring is required. Farmers using the system report healthier animals, almost no odors and no flies. Biochar is an essential part of this self-composting manure pack which can remain in place for up to a decade before cleaning.[3]

Biochar Compost and Greenhouse Gas Emissions

Many different studies of biochar used in compost and organic waste management have shown that biochar reduces greenhouse gas emissions. By improving aeration, biochar prevents the formation of anaerobic areas in compost piles where N_2O and CH_4 gases are generated. Large reductions in methane emissions have been reported using biochar, ranging from 10% to above 80%. Nitrous oxide emissions have also been drastically reduced, ranging from 10% to 98%.[4]

Biochar Controls Nitrate Leaching

Biochar tends to store a lot of nitrate on the surfaces of its pores. The nitrate is mostly plant available, but not easily leached by water. Adding biochar to manure creates an ideal, carbon-based, slow release fertilizer that will prevent pollution of ground water and streams.[5]

Biochar as Lagoon Cover

Biochar can be used as a floating lagoon cover. Compared to straw and other materials, a lab study found that biochar absorbed more nutrients and prevented ammonia emissions.[6] Although this study did not measure methane emissions, it is likely that they were also reduced. Researchers in New Zealand added a floating biofilter made of pumice, soil, and perlite that was able to remove high concentrations of CH_4 emitted from a dairy lagoon.[7]

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[1] EM-1 is available from Teraganix https://www.teraganix.com/

[2] See: https://www.wphealthcarenews.com/minimizing-hospital-acquired-infections-can-probiotics-help/

[3] DuPonte, M. W., & Fischer, D. (2012). The Natural Farming Concept: A new economical waste management system for small family swine farms in Hawai ʻi. *LM-23. University of Hawai ʻi, College of Tropical Agriculture and Human Resources, Honolulu, HI*.

[4] Sanchez-Monedero, M. A., Cayuela, M. L., Roig, A., Jindo, K., Mondini, C., & Bolan, N. (2017). Role of biochar as an additive in organic waste composting. *Bioresource technology*.

[5] Hagemann, Nikolas, et al. "Organic coating on biochar explains its nutrient retention and stimulation of soil fertility." *Nature communications* 8.1 (2017): 1089.

[6] Dougherty, B., Gray, M., Johnson, M. G., & Kleber, M. (2017). Can Biochar Covers Reduce Emissions from Manure Lagoons While Capturing Nutrients?. *Journal of environmental quality*, *46*(3), 659-666.

[7] Syed, R., Saggar, S., Tate, K., Rehm, B. H., & Berben, P. (2017). Assessing the Performance of Floating Biofilters for Oxidation of Methane from Dairy Effluent Ponds. *Journal of environmental quality*, *46*(2), 272-280.