GROWERTALKS

Features

12/27/2010

Got Dairy Fiber?

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A material that is emerging as a growing media for plants is a byproduct from dairy farms called by various names using words connoting dairy manure + digestion or compost + fiber or solids—for example, digested dairy fiber.

Growers naturally have questions on this new material. Here is an overview of answers to those questions to help growers assess how this material fits into their own growing program. There will be more research and better answers on this material in the future. (The digestion technology mentioned here is also applied to wastes other than dairy manure, such as food wastes, slaughterhouse wastes, horse, sheep, pig, chicken or even human manure, but their end-product characteristics obviously differ from that of dairy fiber, so it's important to know the source of material.)

What is it?

Dairy fiber is essentially undigested solids in cow manure. Cow manure is run through different kinds of machines to separate different fractions in it. The gas fraction is captured as methane gas for use as energy. The liquid fraction is collected for use as a fertilizer. The solid fraction is the dairy fiber.

Why now?

Traditionally, farmers spread cow manure as such in the fields. Later, some farmers started pumping a slurry, or semi-liquid mixture, of dairy manure onto the fields. A few tried to process and produce fiber from dairy manure for use as a container growing media back in the early 1980s.

Now, more and more dairy farmers are processing dairy manure due to various factors, including limited land on which to spread the byproduct, pollution regulations, suburbanization, complaints of manure smell, and so on. Plus, governments are also promoting and supporting projects such as converting manure to energy and reducing greenhouse gas (methane) emission. Thus, more dairy fiber is becoming available.

How is it produced?

There are different types of systems that process dairy manure in different ways. Some systems separate solid and liquid fractions by mechanical separators, without any methane gas production. The separated solids are then run through a long, horizontal, rotating, drum-like vessel where the solids are composted in an accelerated way.

Some systems run dairy manure through anaerobic digesters where the manure is decomposed in tanks by anaerobic bacteria to generate methane gas, which is used on the farm or sold as electricity. The remaining liquid and solid fractions are then collected and separated.

Some of these systems operate on a continuous basis, while others process a set quantity material as a batch. How long the manure is processed and resides in a composting vessel and at what temperature it is exposed depends on the technology used. Because of these processing variations, characteristics of dairy fiber vary.

> *Pictured: In one manufacturing technology, solids in dairy manure are separated and run through a drum to accelerate composting and produce dairy fiber. Photo courtesy of Andy Tangeman.*

Is it hygienic?

Since dairy fiber is derived from manure, E. coli outbreaks come to mind and this question arises promptly. Though fresh raw manure has fecal coliform bacteria, dairy fiber has gone through an accelerated composting during which fecal coliform and other microorganisms are reduced generally by up to 99%. The actual level of reduction in microbial population depends on how high the temperature was and for how long during processing.

Temperatures during drum composting (without anaerobic digestion) can vary from 140F to 1,600F (60C to 871C) for four hours to seven days. Anaerobic digestion temperatures range from four to 30 days, depending on the system. Though these temperatures do not sterilize the material because of the conditions and time, the microorganism amount in dairy fiber is reduced substantially.

Whether the microbes that survive this processing re-grow and multiply depend on whether there is any food for them in the dairy fiber. There is also a chance of microbial contamination from fresh manure if finished dairy fiber is stored close to a barn or if the same farm equipment used on the dairy farm is also used on the finished dairy fiber.

Generally, one can expect no significant microbial hazard from dairy fiber. However, one should be prudent when using dairy fiber for growing food crops such as vegetables or herbs and test more dairy fiber samples for safety.

And dairy fiber doesn't have the same unpleasant smell of dairy manure, nor does it attract flies.

How is its air and water holding capacity?

Dairy fiber is fibrous and crumbly. Volume of air space in a dairy fiber sample, just after watering and drainage, was about 30%—very high and more than the air requirements of most crops. This high air space is due to large-sized particles in the dairy fiber sample. Majority of particles in that sample were larger than 1/16 of an inch.

Dairy fiber, like most organic materials when too dry, becomes hydrophobic and does not wet easily and may require the use of a wetting agent.

A gallon of one dairy fiber sample held about a half gallon of water just after watering and drainage. However, the water content decreased rapidly over time, in just hours. This decrease might be related to large particles in the sample, which when together form large pores that don't hold water firmly. But it's also likely due to the basic fibrous nature of the material. This low water-holding characteristic would have implications for irrigation: dairy fiber would require more frequent irrigations, especially if one wants high growth rates of plants. The low ability to maintain water for a longer time would have implications in the shelf life of plants at retail, too.

Since the size of particles in growing media influences its air and water-holding characteristics and particle sizes in dairy fiber vary in nature, dairy fiber can be sieved so as to alter its particle-size distributions for a desired air and water holding capacity.

What about pH, salt levels and ammonia?

Cow manure has a high pH— in the high 6s or 7s. Naturally dairy fiber has a high pH in the 7s. Anaerobic digestion increases pH even further, in the 8s. But some of these high pHs could even be due to barn lime mixed with the manure.

Though fresh dairy manure by itself has consistently very high salt levels, dairy fiber salt levels vary. Some dairy fibers have an EC of 1 mmho/cm while other dairy fibers have an EC of 4 mmhos/cm. This variation is related to how the manure was processed and the dairy fiber was obtained.

High EC levels in dairy fiber are generally due to high levels of potassium, phosphorus, calcium, magnesium, sulfur and sodium. However, particular salts and their levels depend on the diet of dairy cows that produced the particular fiber. Similarly, impact on plant growth from any residues of medical compounds depends on the medicines given to cows.

When salt levels in a dairy fiber are low, it's easier to manage fertilization during crop production. When salt levels are high, salts have to be leached as high levels reduce plant growth, especially that of salt-sensitive crops. Leaching also causes a runoff concern.

If salts in a dairy fiber are at medium levels, it's possible to make use of the nutrients by adjusting the fertilization. However, how the nutrients bound in dairy fiber are released due to exchange during fertilization and how significantly these nutrients contribute to plant nutrition are not known.

Does it inhibit seed germination?

Fresh dairy manure inhibits germination of some seeds, probably due to phenols or high salt levels. However, well-composted dairy fiber doesn't affect seed germination.

Is it available?

A cow can generate three to four gallons of fiber per day, but converting manure to fiber requires capital. A drum-type composter costs about $200,000. An anaerobic digester averages $1 million, so a farm has to have hundreds of cows to be economical to build a digester. But subsidies and other incentives are available, and more farmers are looking into building digesters. Some farmers may even form a co-op and establish a central site for manure collection and digestion.

Dairy fiber is light in weight (less than 10 lbs. per cubic foot) and is bulky to handle and transport. Thus, one would expect more dairy fiber to be available less expensively locally in dairy states like Wisconsin, Pennsylvania, New York and California.

The quality of dairy fiber depends on the quality of input as well as the processing technology and methods. To optimize all these variables, obtain dairy fiber from a growing media company rather than from a dairy farmer. A growing media company treats the material not as a waste, but applies growing media rules to it. They adjust the variables based on their technical knowledge, so the product becomes uniform and gives reproducible results from batch to batch. Of course, consider whether its price is attractive enough to adjust your growing. And, always trial. **GT**

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