Yes you can produce biogas from swine manure!

Doug Hamilton
Waste Management Specialist
Oklahoma Cooperative Extension Service

Last summer, while attending the North American Manure Expo in Wisconsin, I had the opportunity to tour the Dane County Community Digester. The Dane County Community Digester produces methane from manure collected from three dairy farms housing a total of 2,500 cows. The manure is mixed with fat and grease from restaurants in nearby Madison. The mixture is fed to three complete mixed digesters. The biogas produced by the digesters is enough to run a 2 Megawatt electric generator. I ran a few calculations in my head as I sat on the bus back to Baraboo. I figured the digesters produce half the methane from manure and half from the waste grease.

Two people were talking in the seat ahead of me. One said to the other, "That was impressive. Too bad it's not possible to produce methane from pig manure." My first impulse was to jump up and shout, "NO! NO! THAT'S NOT TRUE!" But not wanting to prove I was rudely listening in on their conversation, I kept to myself.

My fellow passengers were wrong of course. Pound for pound swine manure produces just as much methane as any other manure. The specific methane yield of swine manure (or the volume of methane produced per mass of organic matter) runs anywhere from 0.10 to 0.40 m^3 CH_4/kg VS, depending on feeding phase and manure "freshness". Our digester in Stillwater produced an average of 0.35 m^3 CH_4 per kg VS added. The average specific methane yield for dairy manure is around 0.25 m^3 CH_4/kg VS. Beef cattle manure generally runs a little lower. It all depends on the energy content of the feed. Although finisher hogs are incredibly efficient feed converters, some of their high grain diet passes through the animal.

What the fellow in front of me should have said was, "Because we handle swine manure as a liquid, its low wet mass methane potential makes it difficult to digest economically." Wet mass methane potential is the volume of methane you can expect to produce from a given mass of manure as it is fed to the digester.

Figure 1 ranks the wet mass methane potential for a number of manures and co-digestion products. A co-digestion product is something you add to a digester to boost gas production – like the restaurant grease from Madison. These values were measured at the Iowa State University Agricultural Waste Management Laboratory. This is not a definitive list of all potential manures and co-digestion products; it is merely a snapshot of many samples tested in Ames.

As you can see from Figure 1, swine manure ranks pretty low in wet mass methane potential compared to other manures. To make matters worse, this sample was taken from a deep pit hog barn and had a total solids content of 2.5%. Manure flushed from pull plug barns usually runs less than 1%

total solids. The dairy manure sample ranked higher mostly because its total solids content was 12%. More concentrated manure means more biogas per volume fed to the digester.

So, it's the way we handle swine manure that makes it difficult to convert to biogas. Liquid swine manure is easy to move, but we pay for ease of handling with low wet mass methane potential.

Had the complete mix digesters at the Dane County project been fed an equivalent volume of 1% swine manure, each digester would be as big as a lagoon. It should be no surprise; therefore, the most common form of digester on swine farms is a covered lagoon. It is possible to use a higher tech digester with swine manure (See OSU Factsheet BAE 1750, *Anaerobic Digestion of Animal Manures: Types of Digesters)*, but the UASB, ASBR, and Fixed Film digesters used with flushed swine manure are expensive and can be complicated to operate.

All is not lost for the hog farmer. There is a flip side to Figure 1. All of the materials below swine manure on the chart will boost biogas production if added to a swine manure digester. You could thicken swine manure with beef manure, slaughter facility sludge, poultry litter, or oat hulls. The thick mixture added to a digester would produce lots of gas.

You could even add a small amount of food grease to an ASBR digester and really make gas. Remember how I calculated half of the methane from the Dane County Digester came from manure and half from food grease? The influent to the Dane County digesters was 10% grease and 90% dairy manure. You could increase biogas production six fold by adding 10% food grease to an ASBR digester.

It is easy to get carried away with Figure 1. It cannot be over emphasized that these results were achieved under perfect laboratory conditions. They are not a good predictor of how the co-digestion product will behave in an actual digester. A co-digestion product may be toxic in higher doses than the small amount used in the laboratory. It is wise to determine maximum feeding rate of a co-digestion product using an Anaerobic Toxicity Assay. It is also a good idea to pilot test – simulate a large digester using a smaller reactor – before making any major decisions regarding a digestion system.

Using co-digestion products, estimating toxicity to digesters, and more can be found in the Anaerobic Digestion of Animal Manures factsheet series available at http://osuwastemanage.bae.okstate.edu.

I am also in the process of writing a chapter for the *Pork Industry Handbook* on anaerobic digestion for pork producers. Next time I hear someone say you can't make methane from pig manure, I can hand him the book.

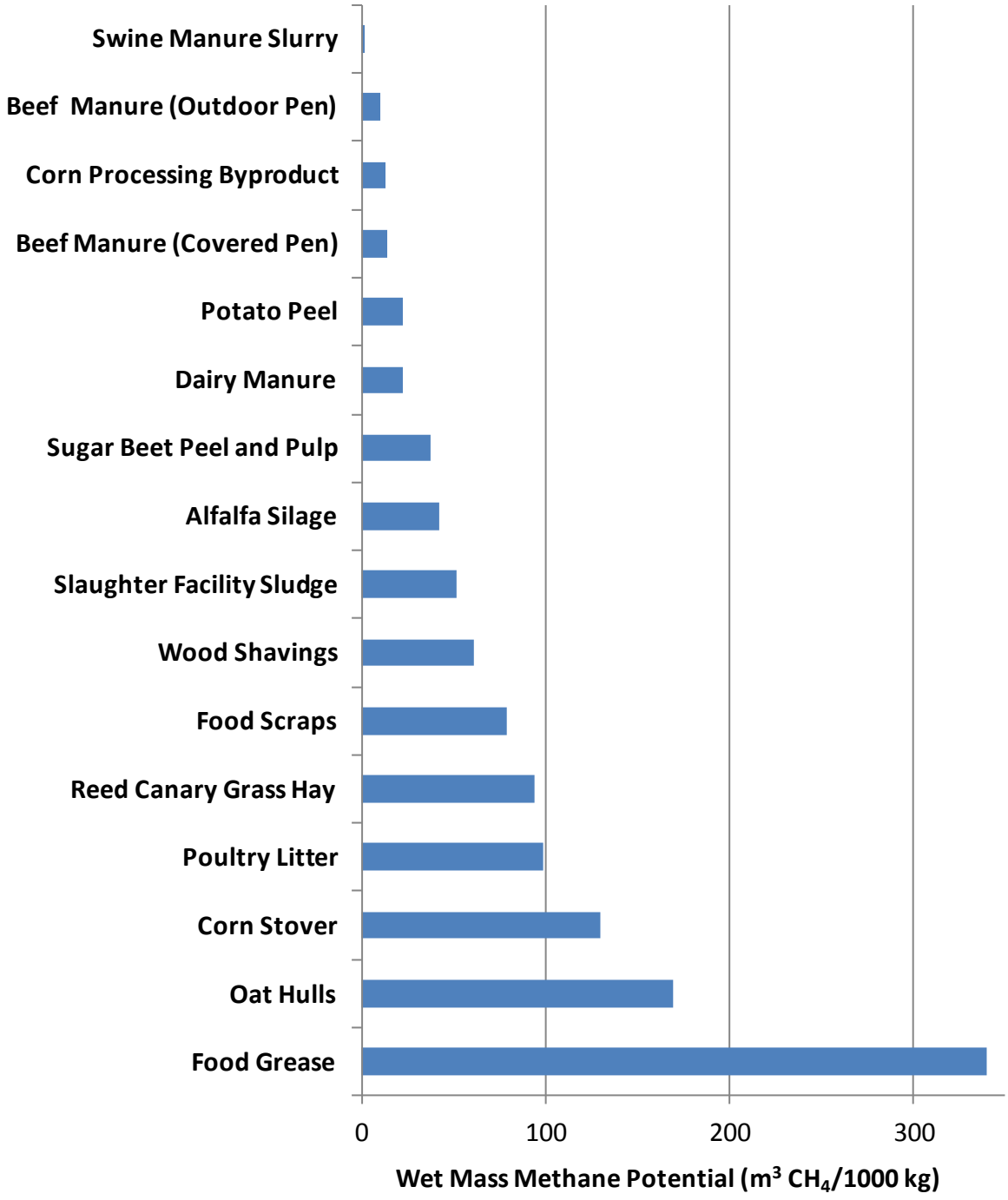

Figure 1. Ranked Wet Mass Methane Potentials of Selected Manures and Co-Digestion Products, from Anaerobic *Digestion of Animal Manures: Methane Production Potential of Waste Materials, BAE 1762.* Oklahoma Cooperative Extension Service.