

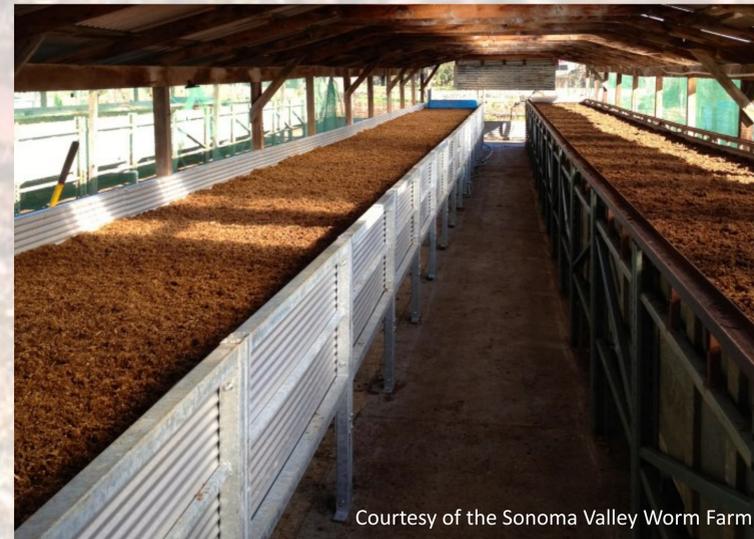
Let's Make it Rich: Vermicomposting Dairy Manure in Stearns County, MN

By: Mary Wood

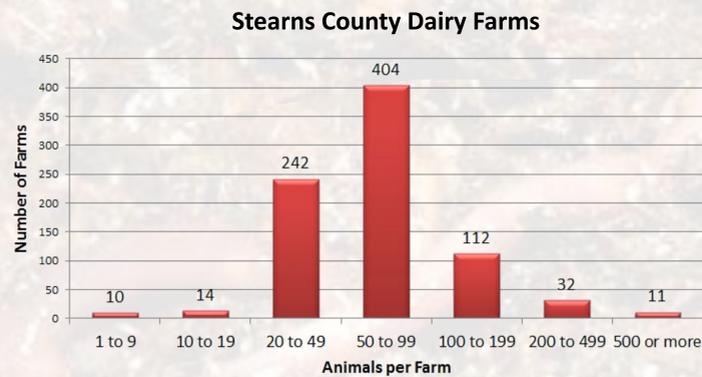
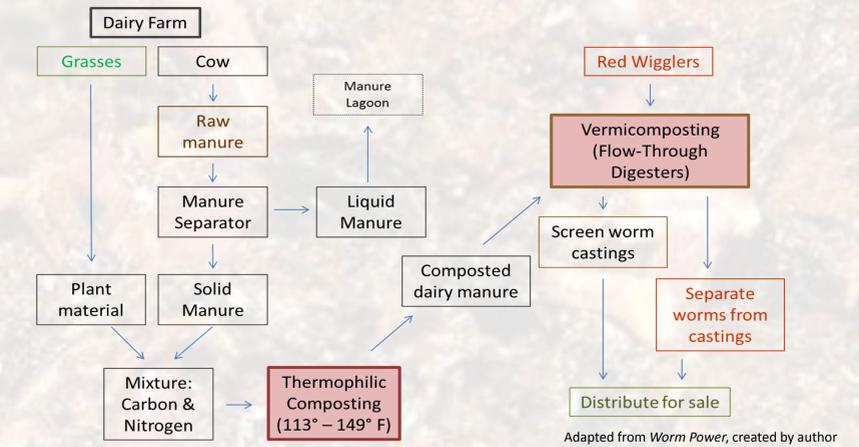
Faculty Advisors: Dr. Jean Lavigne and Diane Veale Jones

Abstract

Lactating dairy cows produce about 120 pounds of manure every day; this results in about 1.5 million tons of manure produced annually in Stearns County, the capital of Minnesota's dairy industry. Concentrated dairy manure is typically stockpiled, applied to crops or captured for energy. The quantity of manure in confined areas on large dairy operations exceeds the land's ability to absorb the nutrients, causing environmental problems such as air and water pollution. Vermicomposting, or worm composting, reduces the overall volume of waste and creates a nutrient rich material for plants to grow healthier and stronger. Vermicomposting is a potential manure management treatment practice on dairy farms in Stearns County. For my research, I investigated two case studies from California and upstate New York where vermicomposting dairy manure has proved to be a successful industry. I then used the gathered information to determine the feasibility of a vermicompost operation in central Minnesota. Local climate is the largest barrier in the success of a vermicompost operation in Stearns County due to the small temperature range that the *Eisenia fetida*, red wiggler worms, require to survive.



The Process of Dairy Manure to Vermiculture Marketable Products

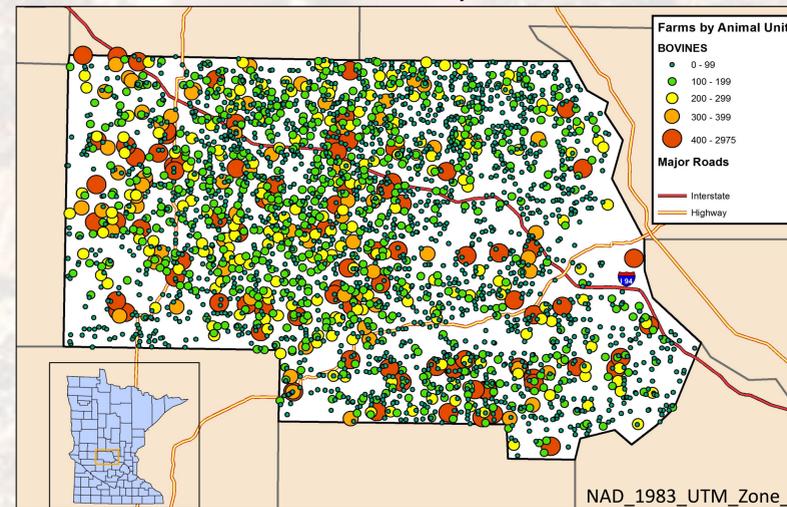


Methods

My interest in composting sparked the investigation of vermicompost's potential in central Minnesota. While conducting initial research on industrial sized vermicompost operations, it was apparent that the experts in the field of vermicompost are Clive Edwards, Norman Arancon, Rhonda Sherman, and farmer Jack Chambers. Jack is one example of large scale dairy manure vermicompost success stories in the United States out of the Sonoma California Worm Farm. These success stories provide the framework to determining how to make a vermicompost facility possible in Stearns County. Government documents from the USDA and MPCA provided useful data on feedlots and manure handling techniques. An interview with Rhonda Sherman provided clarification from a leader in the field of vermiculture. And a Stearns County dairy farm tour provided a first hand account to how dairy farms operate and handle manure.



Stearns County Bovine*



Created by: Mary Wood

*Cattle, Bison, or other animals in the Bovine Subfamily

Vermicomposting

Vermicomposting, more commonly referred to as worm composting, is the process in which earthworms break down organic material; this produces nutrient rich material that, when added to soil, has many benefits. Earthworms work along with microbes present in the organic matter to break down the manure into a rich byproduct used as a soil amendment. *Eisenia fetida*, or red wiggler worms, are the most common worm species for vermicomposting. As epigeic species these worms live on the upper most layer of soil breaking down the newly introduced material. Flow-through digesters are commonly used for large scale vermicompost operations. Built about two feet off of the ground, these beds house roughly 1 million red wiggler worms which turn manure into a usable byproduct in sixty days. A mechanical breaker bar on the bottom of the bed is used to cut the bottom layer of worm castings to send it through the screen to the floor of the barn. Once dried, this material is collected and ready to be applied to plants.

Estimated Costs of Vermicompost System in Stearns County

Number of cows	Annual Manure Production	Daily Manure Production	Number of Flow-through reactors (roughly 3 tons/day)	Building size (estimated)	Annual Energy cost (Natural Gas \$10.52/million BTU)	Initial number of worms (based on number of reactors)	<i>Eisenia fetida</i> \$25/pound
50	1250	3.42	1	110 x 12 x 14	\$561.27	300-400 Thousand	\$7,500-10,000
100	2500	6.85	2	110 x 24 x 14	\$1,000.25	300-400 Thousand	\$7,500-10,000
200	5000	13.70	4	110 x 40 x 14	\$1,551	600-800 Thousand	\$15,000-20,000
400	10000	27.40	9	110 x 40 x 14*	\$3,102	900-1200 Thousand	\$22,500-30,000
600	15000	41.10	13	110 x 40 x 14**	\$4,653	1200-1600 Thousand	\$30,000-40,000

* Two buildings of this size

** Three buildings of this size

Conclusion

A centralized vermicompost operation is an option for Stearns County. Due to the high density of dairy farms, farmers can come together in a cooperative system to turn manure into vermicompost. This will allow for a multiple flow-through reactor system in one building, maximizing the product produced while minimizing operational costs. The initial purchase of worms and annual energy cost will be the most significant financial barrier. The farmers will be able to make a profit from the worm castings, vermicompost tea, and the worms. Many farms in Stearns County use manure as cropland fertilizer. Therefore, there is less excess manure than in other places, such as Otter Tail County. Therefore Stearns may not be the best county in Minnesota to have a centralized operation. A small scale system is still possible if a farmer is interested in vermiculture.