

Energy Generation on the Farm:

Anaerobic Digestion



Introduction

Electricity and Heat Production

The production of electricity and heat from biogas is very effective. Using a methane-powered generator, 300 animal units can produce up to 750 kWh/day, enough electricity to power 30 homes;

with more than 300,000 Btu/day of heat production. The electricity produced on the farm is fed into the electrical grid. The addition of organic rich substrates can increase biogas production by more than 4 times.

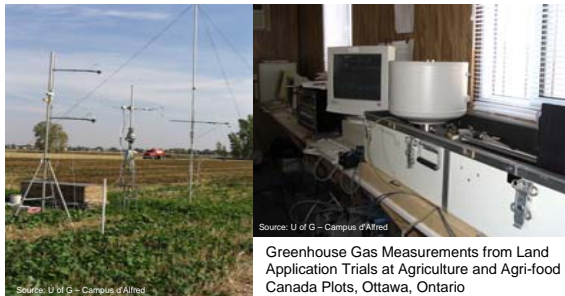
The use of various feedstocks (e.g. corn silage) to enhance biogas production from manure is being investigated.



Generator and Hydro Connection at Fepro Farms, Cobden, Ontario

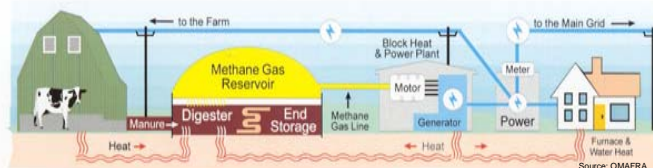
Greenhouse Gas Reductions

Greenhouse gas emissions can be significantly reduced when manure is anaerobically digested. Methane (CH₄) emissions from a farm digesting its manure can be less than half of the emissions from a farm with no digestion system. Reductions in ammonia (NH₃) and nitrous oxide (N₂O) gas emissions are observed after the land application of digested manure when compared with un-digested manure. Field trials comparing gas emissions from the land application of un-digested manure versus digested manure are being conducted at the AAFC-Ottawa site.



Greenhouse Gas Measurements from Land Application Trials at Agriculture and Agri-food Canada Plots, Ottawa, Ontario

Anaerobic digestion is the microbial breakdown of organic material in the absence of oxygen. The biogas produced by the digestion process consists primarily of methane and carbon dioxide. The biogas can be collected and used in a generator to produce electricity and heat, or can be burned directly as a fuel. Liquid and semi-liquid manures are ideal feedstocks. The addition of organic rich materials to the manure can significantly increase biogas production.



Project Objectives:

Conduct a complete life cycle evaluation of anaerobic digestion at the medium-sized dairy farm, which includes:

- Assessing energy and heat production
- Assessing fate of nutrients and pathogens (plants, soil & water)
- Evaluating greenhouse gas emissions

Project Partners:

- Dairy Farmers of Canada
- University of Guelph – Campus d'Alfred
- Agriculture and Agri-Food Canada (AAFC)
- Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)
- Thunder Bay Agricultural Research Station (TBARS)
- Fepro, Terryland and Pinehedge Farms and EEC Energy Corp.

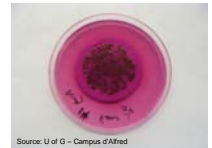


Böhni Anaerobic Digester System at Fepro Farms, Cobden, Ontario

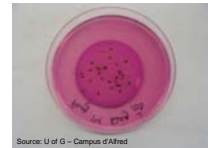
Pathogen and Odour Reduction

Anaerobic digestion of manure will typically reduce pathogen numbers in manure by 99% (2 log reduction). The factors affecting pathogen reduction include the operating temperature of the digester (the higher the temperature the greater the reduction in pathogens) and the amount of time the manure stays in the digester.

The digestion process will also significantly reduce odours from manure as odorous compounds, such as volatile fatty acids (VFA's), are broken down into methane gas. VFA's have been shown to be reduced by more than 93% in the Fepro Farms digester.



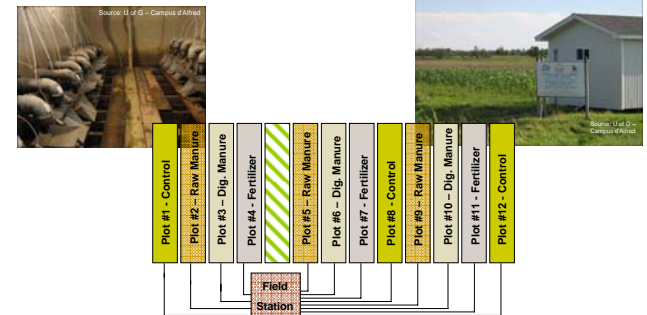
E. coli Colonies in Fepro Farms Un-digested Dairy Manure



E. coli Colonies in Fepro Farms Digested Dairy Manure

Environmental Impacts on Soil and Water

Improperly managed manure and over application of manure to soil can lead to runoff and infiltration of nutrients and pathogens into surface waters and groundwater. Anaerobic digestion can reduce pathogen numbers in manure and could reduce the risk of water contamination from land applied manures. Anaerobic digestion transforms organic nitrogen to ammonia, which is more available for plant uptake. The impacts of applying digested manure on crop yield as well as on soil and water nutrient and pathogen levels are being investigated at experimental plots at UofG - Campus d'Alfred, AAFC-Ottawa and at the Thunder Bay Agricultural Research Station.



Acknowledgements

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