

Methane recovery and agronomic values of anaerobically digested solid beef cattle manure in St. Albert and Lethbridge, Alberta

Ben W. Thomas¹, Xiyang Hao¹, Valentine Nkemka¹, Virginia Nelson², Xiaomei Li³

¹ Agriculture and Agri-Food Canada, Lethbridge Research and Development Centre

² Alberta Agriculture and Forestry, Farm Stewardship Centre, Lethbridge

³ XY-Green Carbon Inc., Edmonton

Ben.thomas@AGR.GC.CA

Solid beef cattle manure is a good anaerobic digestion feedstock for methane production, but few studies have quantified the potential methane recovery and the agronomic values of the anaerobic digestion co-products. Methane recovery was quantified by methane potential batch testing. Potential methane recovery from forage-based beef cattle feedlot manure was 0.350 m³ kg⁻¹ dry matter. In St. Albert and Lethbridge, AB, over four growing seasons, we tested the N and P supply to barley forage from 1) anaerobically digested solid beef cattle manure (digestate), 2) separated solids from the digestate (separated solids), 3) pelletized separated solids (pellets – St. Albert only), and 4) undigested solid beef cattle manure (cattle manure) that were applied at target rates of 1× and 2× the local recommendation. Non-amended soils were included as controls. In Lethbridge, a fifth year was included to test the residual effect. In St. Albert, digestate led to 31 to 50% greater barley forage yield than other co-products and cattle manure, while in Lethbridge digestate led to 24 to 26% greater barley forage yield than cattle manure and separated solids. In St. Albert, the apparent N recovered from digestate (19%) was 8.5-fold greater than pellets (2%), and two times that of the separated solids (9%) and cattle manure (10%). In Lethbridge, the apparent N recovery was 22% for digestate but only 12% for cattle manure and 9% for separated solids. Digestate led to greater barley forage P uptake in St. Albert, while having a significantly lower risk of soil test P accumulation than the other co-products and cattle manure at both field sites. We conclude that management practices developed for solid beef cattle feedlot manure can be used for separated solids, but not digestate. Digestate has a lower risk of soil test P accumulation, when applied at N-based rates, than cattle manure and separated solids. Liquid dairy cattle manure may be the most similar amendment to anaerobically digested solid beef cattle manure given its ammonium to total N ratio and high water content.

Key Points:

- Potential methane recovery from feedlot manure was 0.350 m³kg⁻¹ dry matter.
- Anaerobically digested cattle manure had high NH₄-N to total N ratios.
- 19 to 22% of N from anaerobically digested cattle manure was recovered by barley.
- 9 to 12% of N from undigested cattle manure and separated solids was recovered by barley.
- Digested separated solids can be managed similar to cattle manure.
- Anaerobically digested cattle manure had less soil test P buildup than cattle manure.