Section 4: Manure Management

Greenhouse Gas Benefit

Beef manure is largely composed of carbon, nitrogen and other organic materials. The main greenhouse gases emitted from manure are carbon dioxide, nitrous oxide and methane. Methane is formed during the anaerobic (in the absence of oxygen) decomposition of manure. The amount of methane emitted from manure is influenced by various management strategies (e.g. stockpiling, composting, storage and spreading). Feed management strategies, as well as animal size, impact both the amount of manure and the amount of methane produced. Because nitrous oxide is the most potent greenhouse gas emitted by livestock operations, appropriate manure management is an important consideration. Specific management practices can ensure the nutrients in the manure make their way into the soil where plants can use them rather than have them volatilize into the atmosphere.

For detailed information on manure management, obtain a copy of *Beneficial Management Practices: Environmental Manual for Alberta Cow/Calf Producers* and/or *Code of Practice for Responsible Livestock Development and Manure Management* from Alberta Agriculture and Food Ag-Info Centre: 310-FARM (310-3276) or Publications: 1-800-292-5697 (www.agric.gov.ab.ca).

Recognize the nutrient value of manure

Greenhouse Gas Benefit

Not only can proper manure management capture the value of manure as a resource, but it also reduces nitrogen loss. Nitrogen is a valuable component of manure, and the less that is volatilized, the more that remains available for growing crops and pastures. When manure is properly applied, improvements are seen in soil tilth, structure, aeration and water-holding capacity. In turn, plant production increases and more carbon is sequestered. Manure is a source of nutrients that can be used to replace some of the commercial fertilizer an agricultural operation may be required to purchase. However, if livestock manure is stockpiled, stored in liquid form or submerged during snowmelt or times of high precipitation, the lack of oxygen forces the decomposition process to produce methane.

For detailed information on nutrient content of livestock manure, obtain a copy of *Code of Practice for Responsible Livestock Development and Manure Management* from Alberta Agriculture and Food Ag-Info Centre: 310-FARM (310-3276) or Publications: 1-800-292-5697 (www.agric.gov.ab.ca).

Credit: Alberta Agriculture and Food

Fertilize tame pastures using manure or compost

Greenhouse Gas Benefit

To maintain or increase forage production, both manure and compost are recognized as valuable sources of nutrients. Inorganic fertilizers can be utilized as well. Fertilization increases both plant growth and the amount of plant cover, increasing the amount of carbon retained in the soil profile. Other environmental benefits from improved soil fertility include reduced soil erosion, a reduction in opportunities for invader species and decreased soil moisture losses.

In well-managed grazing situations cattle will evenly spread the manure around the pasture, potentially reducing the cost for any additional fertilizer and minimizing greenhouse gas emissions. To encourage this even distribution, manage livestock for uniform grazing, control watering sites and utilize salt, mineral, shade and shelter as tools to regulate cattle lounging in a particular area for extended periods of time.

To minimize greenhouse gas emissions and maximize the time and financial investment of fertilizing pastures with manure, compost or inorganic fertilizer, consider the following:

- Before beginning any fertilizer program, take samples of both soil and manure for nutrient analysis. Properly managed pastures have lower fertilizer requirements that forages used for hay or silage as more nutrient cycling occurs in a grazing situation; and
- The timing of fertilizer application is crucial. To reduce nitrous oxide emissions, apply manure or fertilizer when pastures are actively growing. It is during this active growth period that plants will most effectively use the available nitrogen and emissions (losses) due to volatilization will be minimized.

To obtain a copy of *The Manure Composting Manual*, contact Alberta Agriculture and Food Ag-Info Centre: 310-FARM (310-3276) or Publications at 1-800-292-5697, and request Agdex #400/27-1 or download a copy at (www.agric.gov.ab.ca).

Current Research

The best approach for reducing nitrous oxide emissions is to avoid surplus plant-available N, by precisely matching available N to plant needs. A variety of tools are available to help meet this objective: soil testing, precision farming, nutrient budgeting, reducing summerfallow and others...[47]

Timing *of N application is often as important as the* amount *of N applied in controlling nitrous oxide emissions emissions. For example some N fertilizers and manures are applied in fall, after crop uptake has ceased, leaving the N susceptible to losses throughout winter and early spring. Eliminating fall applications may appreciably reduce nitrous oxide emissions though this may result in higher costs for fertilizer and problems associated with manure storage.*[48]

Practices that reduce nitrous oxide emissions often also result in more efficient use of nitrogen, an input that is expensive and also a source of carbon dioxide (during fertilizer manufacture). Consequently, some of these mitigation practices may also have economic and other environmental benefits.[49]

Encourage healthy populations of beneficial insects that breakdown manure

Greenhouse Gas Benefit

Dung pats that have not broken down represent a loss of soil nitrogen as well as grazing area. When the dung is incorporated back into the soil, the nitrogen is available for plant growth rather than volatilized into the atmosphere in the form of nitrous oxide and carbon dioxide. Although several other factors play a role in pat degradation (e.g. foraging by birds, trampling by cattle, frost, rain and vegetation), insects are important components of the recycling process.[50] Benefits of manure breakdown include:

- nutrient recycling including significant amounts of nitrogen
- increased grazing and forage production
- soil aeration, water retention, root penetration and reduction of run-off
- reduced pest flies and parasitism
- reduced disease
- cost savings

To encourage healthy populations of beneficial insects, choose agricultural and animal health products recognized to be safe for dung inhabiting insects and determine the safest time of year to apply them.

Credit: Kevin Floate, AAFC

Carefully select wintering sites:

- **Feed rations over a large area;**
- **Frequently move the bedding pile or area;**
- **Feed on level ground or gentle slopes; and**
- **Ensure adequate protection from the elements.**

Greenhouse Gas Benefit

Livestock wintering sites include the feeding area, a sheltered area and the water source. On many operations, livestock movement is minimal during the winter resulting in the buildup of manure in specific areas. This can lead to increased greenhouse gas emissions and the potential contamination of nearby water sources. If winter rations are fed over a large area and the winter bedding pile/area is frequently moved, it is easier for the elements, insects and microbes to break down the manure (including feces, urine soaked straw and bedding) when the weather warms. The nutrients derived from the breakdown of manure will improve soil health, increase organic matter and ultimately increase soil carbon levels. Feeding on level ground or gentle slopes will reduce manure runoff or run-on and minimize the greenhouse gas emissions associated with the nitrogen loss. In addition to providing another tool for manure management, adequate natural or man-made (preferably portable) windbreaks help to reduce the amount of feed required by livestock to maintain body condition. Supplying more feed or nutrients than are needed results in unnecessary rumen methane emissions and increased manure output.

For detailed information on site management, obtain a copy of *Beneficial Management Practices: Environmental Manual for Alberta Cow/Calf Producers* from Alberta Agriculture and Food Ag-Info Centre: 310-FARM (310-3276) or Publications: 1-800-292-5697 (www.agric.gov.ab.ca).

Current Research

It can be concluded that environment, particularly ambient [immediate surrounding area] temperature, should be considered as a factor that could be causing variation in methane emissions from cattle during the year in locations within Alberta and Canada.[51]

[When] feeder calves and/or over wintering cows are exposed to wind during cold winter months the result is average to below average feed conversion and average daily gain as more feed is used by the animal for maintenance and growth. [Adequate shelter] allows more feed to be converted to body mass with less given off as methane and manure.[52]

Credit: Jeannette Austin