BMP OPPORTUNITIES – AN OVERVIEW

Some BMPs reduce GHGs, but may contradict soil and water conservation practices.

As we've noted, practical improvements to production, nutrition, product quality and safety, waste management, crop production and water protection translate into greenhouse gas reductions.

In terms of inputs, livestock sources of greenhouse gas are usually the result of production and nutrient inefficiencies. Small changes can have significant effects, as well as improve production, save money, and benefit water quality.

In terms of outputs, manure and other waste management BMPs – whether as is or fine-tuned – will lower greenhouse gas levels.

To get us started, here's a brief match-up of gases with practices.

GHG	TO REDUCE EMISSIONS	TO REDUCE ATMOSPHERIC LEVELS
METHANE CH_4	✔ improve rumen fermentation efficiency ✔ improve manure management ✔ generate biogas from manure and other materials ✔ improve soil quality and drain wet cropland	✔ improve soil quality to fix methane ✔ keep natural areas such as wetlands and woodlands
NITROUS OXIDE N_2O	✔ improve livestock nutritional balance ✔ reduce anaerobic conditions in solid manure ✔ improve nutrient use efficiency (NUE) for nitrogen	
CARBON DIOXIDE CO_2	✔ improve livestock production efficiency and health ✔ reduce soil quality degradation – with less tillage ✔ conserve energy on the farm	✔ increase soil organic matter levels ✔ increase acres of forage, trees and shrubs, other perennials

An experimental vaccine exists that reduces methane emissions from ruminants.

To reduce energy use in your operation, begin by conducting an energy audit. Also investigate the suitability of alternatives for your operation.

REDUCING METHANE (CH_4) EMISSIONS FROM LIVESTOCK AND POULTRY PRODUCTION SYSTEMS

GHG-BMPs	IMPACT
IMPROVE PRODUCTION EFFICIENCY	• increases production per unit of greenhouse gas emitted • lowers methane emissions from ruminants (belching) • reduces manure volume with improved efficiency ➧ lowers emissions
IMPROVE LIVESTOCK NUTRITION	• improves nutrient utilization • lowers methane emissions from ruminants (belching) • reduces manure volume with improved efficiency ➧ lowers emissions
USE FEED ADDITIVES TO IMPROVE NUTRIENT EFFICIENCY	• lowers methane emissions from ruminants (belching) • reduces manure volume with improved efficiency ➧ lower emissions
CHOOSE THE MOST EFFECTIVE TYPE OF MANURE STORAGE (SOLID, LIQUID)	• lowers methane emissions when manure is stored at lower temperatures and with better aeration
DIVERT RUNOFF AND WASHWATERS	• lowers emissions because less liquid means less anaerobic conditions
REMOVE MANURE FREQUENTLY	• reduces methane emissions by reducing unnecessary anaerobic conditions in bedded yards and housing
COVER MANURE STORAGE	• lowers methane emissions from manure stored at lower temperatures
USE ADDITIVES TO MANURE TO REDUCE EMISSIONS	• lowers methane emissions with the inhibition of methanogenesis (microbial methane production in anaerobic conditions)
USE BIOGAS AS A FUEL SOURCE WITH ANAEROBIC (METHANE) DIGESTION	• eliminates methane emissions in closed system where methane is captured and used for electrical energy production
DON'T BURN GARBAGE	• eliminates methane emissions
IMPROVE SOIL DRAINAGE	• lowers methane emissions by reducing anaerobic conditions in soil

Fine-tune ruminant nutrition to reduce methane.

Convert a large liquid manure storage to an energy-generating anaerobic digestion system.

REDUCING NITROUS OXIDE (N_2O) EMISSIONS

GHG-BMPs	IMPACT	
REDUCE N CONTENT IN MANURE AND URINE ✔ improve feed efficiency ✔ improve nutrient balance ✔ improve amino acid balance ✔ reduce crude protein	• reduces ammonia emissions – which can convert to nitrous oxide when returned to soil • reduces nitrous oxide emissions from stored and applied manure	 **Improve nitrogen nutrition and feed practices in all livestock to reduce nitrous oxide emissions.**
REDUCE ANAEROBIC CONDITIONS IN SOLID MANURE ✔ improve ventilation ✔ keep facilities clean ✔ change bedding frequently ✔ keep stored manure dry	• reduces ammonia emissions – which can convert to nitrous oxide when returned to soil • reduces partial anaerobic conditions and nitrous oxide emissions from solid manure • reduces methane emissions as well	 **Reducing anaerobic conditions in manure reduces methane from liquid manure and nitrous oxide from solid manure.**
REDUCE N-LOSSES WHEN APPLYING MANURE ✔ don't apply in wet conditions ✔ don't apply in fall and winter ✔ incorporate manure ✔ don't leave manure on surface in reduced tillage systems	• reduces ammonia emissions – which can convert to nitrous oxide when returned to soil • reduces nitrous oxide emissions from soil and applied manure (by reducing denitrification) • makes more N available to growing crop	
IMPROVE NUTRIENT USE EFFICIENCY (NUE) FOR NITROGEN ✔ test soils for all nutrients ✔ account for organic N-sources ✔ apply what a crop needs – when needed ✔ don't apply fertilizer N if wet ✔ don't apply urea fertilizer if dry ✔ use catch crops and other cover crops	• reduces nitrate levels in soil during the off-season • reduces nitrous oxide emissions from soil and applied manure (by reducing denitrification) • makes more N available to growing crop	 **NUE means making better use of soil-based and added crop nutrients.**
IMPROVE SOIL AERATION AND QUALITY ✔ drain wet cropland soils ✔ increase soil carbon levels ✔ reduce tillage ✔ reduce erosion and runoff ✔ rotate with forages – hay and pasture	• reduces nitrate levels in soil during the off-season • reduces nitrous oxide emissions from soil and applied manure (by reducing denitrification) • makes more N available to growing crop • reduces methane emissions as well	 **Improve soil physical conditions with improved tillage and subsurface drainage systems.**

REDUCING CARBON DIOXIDE (CO_2) EMISSIONS AND INCREASING SEQUESTRATION

GHG-BMPs	IMPACT		
REDUCE SOIL ORGANIC CARBON LOSS ✔ reduce tillage ✔ establish erosion control structures and practices ✔ water table management in organic soils	• soils are disturbed less – so less organic carbon is converted to carbon dioxide		**Conserve soil – reduce tillage to save energy and soil carbon levels.**
INCREASE SOIL ORGANIC CARBON LEVELS WITH PLANT MATERIALS ✔ rotate crops with forages and ploughdowns ✔ grow cover crops ✔ improve pasture lands ✔ increase soil cover with crop residues ✔ grow crops that return large amounts of biomass (corn, sorghum, rye, etc.)	• live plant material (carbon) is converted to soil organic matter (sequestered) • root biomass is converted to soil organic carbon • dead plant material (crop residue) adds to soil organic carbon levels when left on surface		**Reintroduce forages into your operation – forages as hay or pasture sequester carbon, reduce methane loss, and improve NUE for nitrogen.**
INCREASE SOIL ORGANIC CARBON BY ADDING ORGANIC NUTRIENTS ✔ add solid or liquid manure ✔ add composts ✔ add biosolids	• organic sources of nutrients contain organic matter as well as nutrients – this is converted to soil • organic carbon		
INCREASE SOIL ORGANIC CARBON BY CONVERTING CROPLAND ✔ to pasture ✔ to permaculture crops – orchard, vineyards, nut trees, Christmas trees ✔ to wildlife habitat – grasses, trees, shrubs, wetlands ✔ to forest land – trees as crops	• soils are undisturbed – very little organic carbon is converted to carbon dioxide • soil organic C levels build up to near-natural conditions		**Look for opportunities for planting trees to sequester carbon and beautify and add value to your property at the same time.**