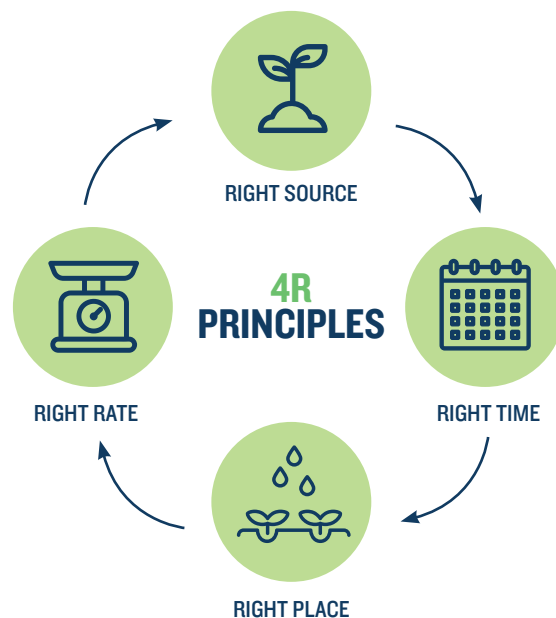


PRACTICING 4R NUTRIENT STEWARDSHIP

Fertilizer is an important crop input and responsible use can help mitigate GHG emissions. This section details BMPs that follow the 4R principles for nutrient stewardship – right source, right time, right rate, right place. In addition to reduced GHG emissions, there are many environmental benefits to using these approaches, including reductions in soil erosion, reductions in energy use, and improvements in recycling of crop nutrients from crop residues and livestock manures.



RIGHT SOURCE

ORGANIC AMENDMENTS

Selecting organic amendments for your fields like manure or compost, over commercial fertilizers, can offer advantages when it comes to managing soil health. Organic amendments are proven to improve soil structure, texture and aeration, increase water retention abilities and stimulate healthy root development. It's important to test manure and or other organic amendments for nutrient content to ensure your crop nutrient needs are met. It may be necessary to supplement crop needs with commercial fertilizers but making organic amendments a priority is preferential.

B -



Reduced GHG emissions



Carbon sequestration



Improved soil health



Enhanced biodiversity



High



High

Implementation Tips

- Conduct regular soil testing to confirm crop nutrient needs.
- Nutrient test organic amendments, like manure.
- Consult an agronomist or agrologist to develop a nutrient management plan for your soil and crop management needs.



When dairy manure is applied on a field in consecutive years, there may be a higher level of secondary and micronutrients available to the growing crop, as soil microbiology will release nutrients from the previous year's application of organic material (manure). With proper management, secondary and micronutrients will reduce fertilizer purchases.

— Richard Halopka, a crops and soils agent at University of Wisconsin Extension



RIGHT SOURCE

ENHANCED EFFICIENCY FERTILIZERS

Enhanced efficiency fertilizers (EEFs) are innovative formulations that control fertilizer release or alter reactions that lead to less nutrient loss. Enhanced efficiency fertilizers such as a nitrification, urease or double inhibitor can reduce nitrogen loss that typically occurs from leaching, immobilization and volatilization. These fertilizers can include additives, physical barriers or different chemical formulations which allow for increased fertilizer efficiency and availability in the soil. EEFs help protect against environmental damage, increase crop productivity, and provide potential cost-savings over time.

Implementation Tips

- Use an enhanced efficiency fertilizer to reduce nitrogen losses.
- Work with an extension educator to develop split trials on your fields, monitor harvest data and conduct data analysis to determine which EEF works best for your crop and soil conditions.
- Consider rate, timing and placement and choose an EEF that best complements your operations.
- Choose to implement EEFs in parts of the field, such as low spots or poorly drained areas, that are prone to saturation in the growing season.

BENEFITS



Reduced GHG emissions



Enhanced soil health : Low



Improved crop quality : a ++

RESOURCES

Webinars : 4R Nutrient Stewardship, Fertilizer Canada (dfc-plc.info/RS1)

Fact sheets : proAction Environment Resources, Dairy Farmers of Canada (dfc-plc.info/RS2)

Manuals : Forage BMP Manual, Canadian Forage and Grasslands Association (dfc-plc.info/RS3)

Webinars : When do enhanced efficiency fertilizers make sense? Canola Digest (dfc-plc.info/RS4)

Research papers : Yanni, S.F., Laporte, A.D., Rajsic, P., Wagner-Riddle, C., Weersink, A., 2021. The environmental and economic efficacy of on-farm beneficial management practices for mitigating soil-related greenhouse gas emissions in Ontario, Canada. *Renewable Agriculture and Food Systems* 36, 307–320. (dfc-plc.info/RS5)



RIGHT TIME

Get the best value out of your fertilizer by optimizing application timing over the growing season. This helps to avoid losses and increase agronomic value. Optimal timing may vary for different regions of Canada, but always avoid applying any fertilizer, including manure, on frozen, snow-covered or saturated soil across Canada. There is no agronomic value in applying manure in these conditions and the potential for surface water contamination increases significantly because the soil cannot absorb the applied nutrients.

Implementation Tips

- Change from fall or spring fertilizer application to a sidedress application.
- Try implementing a split nitrogen application to avoid providing all the crop's nitrogen requirements with a single treatment prior to, or at, planting.
- Avoid applying manure or fertilizer on frozen, snow-covered or saturated soil.
- Incorporate manure within 24 to 48 hours of application.
- Incorporate mineral fertilizer (granular or liquid) rather than broadcasting it on the surface.

B



Reduced GHG emissions



Enhance efficiency of fertilizer application to reduce GHG emissions



Quantify fertilizer application efficiency to reduce GHG emissions

R

Website : 4R Nutrient Stewardship, Fertilizer Canada (dfc-plc.info/RT01)

Fact sheet : proAction Environment Resources, Dairy Farmers of Canada (dfc-plc.info/RT02)

Manual : Forage BMP Manual, Canadian Forage and Grasslands Association (dfc-plc.info/RT03)

Website : When do enhanced efficiency fertilizers make sense? Canola Digest (dfc-plc.info/RT04)

Research paper : Yanni, S.F., Laporte, A.D., Rajsic, P., Wagner-Riddle, C., Weersink, A., 2021. The environmental and economic efficacy of on-farm beneficial management practices for mitigating soil-related greenhouse gas emissions in Ontario, Canada. Renewable Agriculture and Food Systems 36, 307–320. (dfc-plc.info/RT05)



RIGHT RATE

By optimizing the rate of fertilizer applied over the growing season, you are taking into consideration the availability of nutrients from all sources (crop residue from previous crops, cover crops, the use of legumes and any nutrient applications). Be sure to account for available nutrients already in the soil before applying additional sources by conducting regular soil testing.

Implementation Tips

- Work with an agronomist or agrologist to conduct regular soil testing to confirm how much nitrogen crops need.
- Use precision technology such as variable rate application and GPS.
- Reduce the rate of fertilizer application over the growing season by matching the nitrogen fertilizer application rate to crop requirement.
- Adjust fertilizer rates depending on whether the crop requires fertilizer placed near or with the seed as this may impact the rate of starter fertilizer needed and make sure you are accounting for all nutrients that you are applying.

Resources

Webinars : 4R Nutrient Stewardship, Fertilizer Canada (dfc-plc.info/RR01)

Fact sheets : proAction Environment Resources, Dairy Farmers of Canada (dfc-plc.info/RR02)

Manuals : Forage BMP Manual, Canadian Forage and Grasslands Association (dfc-plc.info/RR03)

Webinars : When do enhanced efficiency fertilizers make sense? Canola Digest (dfc-plc.info/RR04)

Research papers : Yanni, S.F., Laporte, A.D., Rajsic, P., Wagner-Riddle, C., Weersink, A., 2021. The environmental and economic efficacy of on-farm beneficial management practices for mitigating soil-related greenhouse gas emissions in Ontario, Canada. Renewable Agriculture and Food Systems 36, 307-320. (dfc-plc.info/RR05)

BENEFITS



Reduced GHG emissions



Emissions : **High** to **Low**



Quality : **Low** to **High**





RIGHT PLACE

Injecting amendments directly into the soil or band spreading (using dribble bars to place manure in rows within the soil) are two options that can improve fertilizer placement when compared to broadcast application. These methods place the fertilizer below the soil surface where they can be taken up by growing roots when needed and can reduce the risk of nutrient loss from runoff. Respect recommended setback distances for nutrient application near waterways.

BENEFITS



Reduced GHG emissions



Economic Low fertilizer costs



Quality Improved soil health
Increased crop yield

IMPLEMENTATION TIPS

- Apply manure using injection, band spreading or dragline application.

RESOURCES

Webinar : 4R Nutrient Stewardship, Fertilizer Canada (dfc-plc.info/RP01)

Fact sheet : proAction Environment Resources, Dairy Farmers of Canada (dfc-plc.info/RP02)

Manual : Forage BMP Manual, Canadian Forage and Grasslands Association (dfc-plc.info/RP03)

Webinar : When do enhanced efficiency fertilizers make sense? Canola Digest (dfc-plc.info/RP04)

Research paper : Yanni, S.F., Laporte, A.D., Rajsic, P., Wagner-Riddle, C., Weersink, A., 2021. The environmental and economic efficacy of on-farm beneficial management practices for mitigating soil-related greenhouse gas emissions in Ontario, Canada. Renewable Agriculture and Food Systems 36, 307-320. (dfc-plc.info/RP05)



We've pioneered dragline application of manure. We have a pressurized supply line that goes out to the field to pump the manure and inject it directly into the soil. Then we don't have nutrient loss, especially nitrogen. We use a 1200-foot flat rubber hose with an 8-inch mainline and a 5-inch dragline. You can go up to two miles, but you need a pump every mile to ensure an adequate flow. It can cover 40 acres of land with one set up and can be rolled up and stored when not in use. We always do a fall application and sometimes in the spring as well. We're looking to try some in-crop application. Getting it into the soil and sealed there, that's the secret. We've had some exceptional growth in areas that wouldn't have grown much otherwise.

— Blaine, a dairy farmer in Saskatchewan