

# Alternative management tools to protect groundwater quality from nitrate contamination

## Background

In areas where the groundwater is vulnerable to nitrate contamination, following nitrogen fertilizer best management practices (BMPs) may not be enough to reduce the amount of nitrate leaching into groundwater to meet water quality goals. In these cases, the Minnesota Department of Agriculture (MDA) encourages farmers to consider practices and activities that go beyond traditional nitrogen fertilizer BMPs. In many cases these practices are developed and used by farmers and implemented in ways that are relevant for local conditions and opportunities. The MDA will work with the local agricultural community to encourage and incentivize their use. The MDA will also continue to work toward providing technical and financial resources regarding the effectiveness of these alternatives.

## Details

Below is a list of practice examples arranged by general categories. It is not intended to be an all-inclusive list, but rather to provide examples of activities the MDA may consider as alternative practices. There may be other practices that MDA would consider on a case-by-case basis.

Farmers have many choices of alternative practices that may fit into their operation. All of these have one thing in common: they are potential science based solutions that can prevent and mitigate nitrate in groundwater.

### 1. Alternative cropping systems, low nitrogen input crops, or continuous cover

Alternative cropping systems or low nitrogen input crops can reduce nitrogen input needs and/or increase uptake of nitrogen. Increasing continuous cover can be accomplished by diversifying crop rotations, adopting perennial cropping systems and incorporating cover crops.

- Crops with low nitrogen application needs and land cover
  - Perennial forage (alfalfa, clover, grass pasture and others)
  - Pasture and hayland
  - Crops with relatively low nitrogen requirements, such as small grains (e.g. wheat, oats, rye, barley, triticale) and canola
  - Cover crops
  - Perennial grains
  - Other multiple cropping rotations such as double cropping, relay cropping, inter cropping
  - Forever Green crops and other innovative crops and cropping systems that have the potential to be the next generation of low nitrogen input or nitrogen management crops.
- Set-aside programs – continuous cover
  - Conservation Reserve Program (CRP)
  - Conservation Reserve Enhancement Program (CREP)
  - Reinvest in Minnesota Program (RIM) (conservation and wellhead protection easements)
  - Land swapping to relocate high-intensity crops from vulnerable areas to a less sensitive location
  - Land retirement

## 2. Advanced nitrogen fertilizer management

- Precision agriculture is a method of farm management that uses site specific information on soils, crops, nutrients, pests, and/or moisture to adjust practices to reflect in-field variability. It encourages better management of nitrogen fertilizers and other inputs. Aspects of precision agriculture that improve nitrogen management include:
  - Variable Rate Technology (VRT) - also called precision application or prescription nutrient application
  - Soil grid sampling (generally acceptable for non-coarse textured soils)
  - Selection of lower nitrogen requiring seed and adjusting seeding density
  - Field or sub-field scale nitrogen requirement prediction tools
  - Data gathering and analysis (e.g. weather stations, soil moisture, crop stress evaluation, yield data)
- Variable rate irrigation water management
- Crediting nitrogen from irrigation water
- Conservation tillage or residue management
- Other university and industry adopted tools and programs

## 3. New technologies that can increase nitrogen use efficiency

- Equipment – robots, highboys, drones, others
- Data gathering and interpretation software and equipment
- Use of crop sensors to determine nitrogen crop needs
- Seed hybrids – through selection of crop varieties that have been shown to use nitrogen more efficiently, or allow greater nitrogen uptake
  - reduced nitrogen input varieties,
  - drought tolerant varieties,
  - new varieties with traits that can increase nitrogen uptake (e.g. expanded root systems, nodulation)
- Use of soil, plant and/or fertilizer amendments that have been demonstrated effective under similar cropping and climatic conditions

## 4. Enrollment in the Minnesota Agricultural Water Quality Certification Program (MAWQCP)

A combination of practices protecting water quality is normally required to be certified through the MAWQCP. Obtaining certification is therefore considered adequate and appropriate as an alternative practice.

The MDA will identify opportunities to collaborate with other agencies, industry, and non-governmental organizations through existing programs and develop new partnerships to foster the development and establishment of alternative practices that address nitrogen fertilizer management.

### Additional Information

For additional information visit:

[www.mda.state.mn.us/chemicals/fertilizers/nutrient-mgmt/nitrogenplan/nitrogenmgmt/9.aspx](http://www.mda.state.mn.us/chemicals/fertilizers/nutrient-mgmt/nitrogenplan/nitrogenmgmt/9.aspx)

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