Alternative Management Tool (AMT)
Intermediate Wheatgrass (Kernza)

November 22, 2022

Alternative Management Tools (AMTs) *are specific agricultural practices and solutions, other than nitrogen fertilizer best management practices, to address groundwater nitrate problems. AMTs are described in the Groundwater Protection Rule and approved by the Commissioner of Agriculture.*

Introduction

In areas where groundwater is vulnerable to nitrate contamination and in highly vulnerable drinking water supply management areas (DWSMAs), an effective strategy for reducing nitrate leaching losses from cropland is planting intermediate wheatgrass (*Thinopyrum intermedium*).

Intermediate wheatgrass is a perennial deep-rooted grass that has been domesticated as a grain crop. The processed grain of some varieties of intermediate wheatgrass is trademarked by The Land Institute as Kernza®. It typically is grown for grain for up to three years. The grain can be harvested and used for human consumption much like wheat and the vegetative parts of the plant can be grazed by animals or harvested for feed. Additional benefits of intermediate wheatgrass include wildlife habitat, erosion control, improving soil structure and increasing soil organic matter.

AMT substitution for a Nitrogen Fertilizer Best Management Practice (BMP)

See the BMP/AMT matrix (www.mda.state.mn.us/nitrogenamts) for more information about how this AMT substitutes for nitrogen fertilizer BMPs.

Water Quality Benefits

Planting intermediate wheatgrass can reduce nitrate leaching losses compared to annual row crops. Intermediate wheatgrass is a cool-season grass and has a longer growing season than annual crops. (Hunter et al., 2020a,b, Jungers et al., 2018). The resulting uptake of nitrogen (N) and water during the leaching-prone spring and fall periods reduces nitrate leaching losses. Perennial crops also produce more overall root biomass and roots extend deeper into the soil, enabling the crop to take up nitrogen more effectively and below the rooting depth of annual crops (Dietzel et al., 2015, Jungers et al., 2019). The nitrogen fertilizer rate for intermediate wheatgrass is lower than many annual crops such as corn, wheat, and potatoes, and this lower overall N rate also reduces nitrate leaching losses (Jungers et al., 2017, 2019). The current N fertilizer recommendations for corn after corn and corn after soybeans are 175 lb. N/ac and 140 lb. N/ac, respectively, (Kaiser et al., 2022) while it is 80 lb. N/ac for intermediate wheatgrass.

Research trials in Minnesota have demonstrated intermediate wheatgrass' ability to reduce nitrate leaching losses. In a three-year study with trials in Waseca, Lamberton and Crookston, Jungers et al. (2019) compared nitrate leaching between continuous corn and intermediate wheatgrass. The fertilizer rates were 142 lb. N/ac for corn and between 107 and 142 lb. N/ac for intermediate wheatgrass. The

fertilizer rate for corn followed the University of Minnesota guidelines at the time, while the nitrogen rate for intermediate wheatgrass was 50% higher than the currently recommended N rate. The average annual leaching at these fertilizer rates were 24 mg nitrate-N/L from corn and 0.3 mg nitrate-N/L from intermediate wheatgrass. The average annual nitrate-N load lost under corn was estimated to be 19 lb. N/ac and under intermediate wheatgrass it was 0.2 lb. N/ac.

In a four-year study at Staples, MN during 2018 – 2021, Jungers et al. (2021) and Reilly et al. (2022) compared nitrate leaching losses between a soybean-corn-soybean-corn rotation and intermediate wheatgrass. Intermediate wheatgrass received urea at rates of 71, 89, and 89 lb. N/ac in May 2018, 2019, and 2020, respectively. This rate is near the rate of 80 lb. N/ac recommended by the University of Minnesota. Urea was split-applied to corn at 125 and 71 lb. N/ac in May and June for a total of 196 lb. N/ac for the growing season. This rate is below the University of Minnesota recommended nitrogen rate of 210 lb. N/ac for irrigated corn. Soybean was not fertilized. Under intermediate wheatgrass, soil solution nitrate averaged 4.3, 0.8, 0.3, and 0.6 mg/L, for years 1-4 respectively. Under the soybean-corn-soybean-corn rotation, nitrate concentration averaged 19, 22, 7.8, and 13 mg/L for years 1-4, respectively.

Requirements to Qualify for Intermediate Wheatgrass AMT

General requirements to qualify for the intermediate wheatgrass AMT are:

- Intermediate wheatgrass can replace traditional row crops or can be used in a rotation with other crops,
- Seed bed preparation, seeding rate and spacing must be adequate to ensure good establishment of the intermediate wheatgrass crop and be based on the technical resources listed below,
- After establishment, the intermediate wheatgrass crop should remain in the field for at least one full growing season, but will typically remain in the field for three years or longer,
- Nitrogen application from fertilizer and manure must follow guidance from the University of Minnesota and not exceed 80 lb. N/ac per growing season. If additional N is needed, in-season soil or plant testing or other adaptive management technologies verified by MDA can be used to document and quantify this need and additional nitrogen can be added (see: AMT Precision Agriculture: Precision Nitrogen Management for information about verified technologies).
- Since Intermediate wheatgrass is considered a perennial crop, it is exempt from the fall nitrogen fertilizer application restrictions under the Groundwater Protection Rule (1573.0030 Subp. 3).

Recordkeeping

The cultural practices of growing intermediate wheatgrass should follow published guidance from the University of Minnesota or The Land Institute. Guidance from other organizations is acceptable provided it is based on documented demonstration projects. Records should indicate what guidelines were used and include seeding date and rate, nitrogen fertilizer application timing, source and rate, and termination date. Supporting information such as photos, yield data, biomass estimation or similar is encouraged, but not required.

Technical Resources

The MDA recognizes there still is active and ongoing research related to agronomic aspects of growing intermediate wheatgrass and the development of agronomic best management practices is ongoing. Producers should adopt best management practices as they become available.

Agronomic information about intermediate wheatgrass is available from the University of Minnesota Extension at https://kernza.org/growers/. Additional information from the University of Minnesota Forever Green Initiative is available at forevergreen.umn.edu/crops/kernza-intermediate-wheatgrass. A list of scientific documents related to intermediate wheatgrass is available at https://sustainablecropping.umn.edu/kernza-0

The Land Institute has additional guidance related to growing intermediate wheatgrass at https://landinstitute.org/interested-in-growing-kernza/.

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