INTRODUCTION

Winter rye (Secale cereale) is commonly used as a cover crop to improve soil health by reducing soil erosion and increasing soil organic matter following corn (Zea mays) silage harvest in WI. Alternative cool season grasses, including winter triticale (x Triticosecale) and spring barley (Hordeum vulgare) may provide other benefits and increase diversity of grower options. Cover cropping may also work with fall manure application to immobilize manure nutrients until the following spring. This soil health-promoting practice is not without potential tradeoffs, including yield drag or increased N demand.

OBJECTIVES

• Evaluate performance of cool season grass cover crops, with regards to dry matter production, soil coverage, and N uptake; and triticale forage production potential

• Measure soil NO$_3$-N (SNN) concentration changes over time to assess potential leaching reduction of cover crops

• Determine differences in corn silage yield response to N following cover crops; was there any yield drag or benefit?

CONCLUSIONS

• Cover crop production varied by site-year. Even minimal fall production (<2 Mg DM ha$^{-1}$) resulted in soil coverage >20% and fall SNN reductions up to 150 kg ha$^{-1}$ (0-60cm). WIN

• Spring measurements demonstrated high biomass production (1-8 Mg DM ha$^{-1}$), good soil coverage (>50%), and decreased SNN relative to no cover crop. WIN

• W rye and triticale reduced corn silage yields in some site-years. However, triticale forage production met or exceeded the corn silage deficit in every site-year, despite later corn planting and low SNN at planting. LOSS/WIN

STUDY DESIGN & METHODS

• RCBD; four replicates per site-year

• Whole plot factor was fall-seeded cover crop: Winter rye (W Rye), Winter triticale (Trit), Spring barley, or No cover crop (No CC)

• Following corn silage, liquid dairy manure was applied (injected or incorporated) fall 2014 & 2015 (approx.105 kg ha$^{-1}$ N available in the first year, except Marshfield: approx. 25 kg N ha$^{-1}$ available first year). Cover crop seed drilled 1-8d post manure (mid-late Sept.)

• W rye terminated in the spring using burndown rate of glyphosate

• Triticale harvested at boot stage (several weeks post W rye burndown)

• Corn drilled 1-2w following burndown. In Trit trt, corn planted within 2d.

• N was 224 kg N ha$^{-1}$ broadcast applied as urea with urease enzyme inhibitor at planting, except Hancock: 269 kg N ha$^{-1}$ urea split V4, V6, V10

• Cover crop biomass sampled at winter dormancy and prior to spring W rye termination or Trit harvest

• Images analyzed for percent green pixels using SigmaScan Pro (Systat)

• Soil sampled (0-30 and 30-60cm) for soil NO$_3$-N (SNN) at winter dormancy, spring termination, triticale harvest, and sidedress (0-30cm only).

SITES

Arlington, South Central WI

• Plano silt loam (Fine-silty, mixed, superactive, mesic Typic Argiudolls)

• Very deep, well drained

Hancock, Central Sands of WI

• Plainfield sand (Mixed, mesic Typic Udipsamments)

• Excessively drained

• Wind Erodibility Group = 1 (1 = 220 ton/ac/yr)

Lancaster, Southwest “Driftless” WI

• Fayette silt loam (Fine-silty, mixed, superactive, mesic Typic Hapludalfs)

• 2-6% slopes; well-drained, moderately eroded

Marshfield, North Central WI

• Withee silt loam (Fine-loamy, mixed, superactive, frigid Aquic Glossudalfs)

• Very deep, somewhat poorly drained

WINTER RYE SHOWS LOW RISK OF YIELD LOSS; TRITICALE MET OR INCREASED TOTAL PRODUCTION

Silage in No CC

Silage in W Rye

Silage in Triticale

Triticale forage

Error bars represent standard error.

Figure 1. Total forage production (65% moisture). Winter rye had a mild and variable effect on silage yield compared to No CC, with both slight increases and decreases apparent across site-years. There was a more pronounced trend of silage yield decrease following triticale, though not apparent in every site-year. Triticale forage consistently increased total production (triticale forage + corn silage following triticale) to meet or exceed silage production in No CC and W Rye treatments. In a concurrent study at Arlington using winter rye as forage prior to corn silage, three out of five years saw increased total production, and two of five years broke even.

This study also includes corn grain yield assessment, which suggests more prominent yield drag in grain.

Figure 2. Cover crop dry matter production and soil surface cover. Minimal fall production (1-2 Mg ha$^{-1}$) can result in variable surface coverage (20-90%) with all cover crops providing varying levels of soil erosion control. Even minimal fall establishment results in high spring production (2-8 Mg ha$^{-1}$) with good coverage/potential erosion control in W rye and Trit. Overhead images (top right) help visualize percent coverage and dry matter levels in the field.

Figure 3. Change in soil NO$_3$-N by site-year and cover crop treatment. Data is presented as change relative to No CC treatment, and is shown for the top 60 cm of soil, except as noted (0-30 cm at sidedress in all site-years, Nov. 2014 at Hancock and Marshfield, and preplant 2015 at Hancock). SNN typically decreased relative to No CC, except for 2015 at Hancock, SNN for the top 60 cm is elusive and produces variable minima (1-150 kg ha$^{-1}$) with all cover crops providing variable, or exceed silage production in No CC and W Rye treatments.

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Fall Cover Crops in Dairy Production: Who Wins, Who Loses?

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