Climate and Fall Shoulder Cover Crops: Where Do They Intersect?

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Background

➢Spring in Manitoba presents significant water management challenges that adversely affect soil trafficability.

➢These challenges are driven by the region's climate and the unique characteristics of its soils.

➢Cover crops offer a potential solution by removing excess water through transpiration and enhancing water movement through improved infiltration and percolation.

Objective

To determine if fall rye can improve soil moisture and contribute to soil resilience in Manitoba

Study site

➢ Rural Municipality of Roblin (49.160127 °N, 99.301516 °W)
- Cool subhumid boreal climate
- Average annual rainfall: 544 mm
- Average annual snowfall:168 cm
- Average annual temperature: 3.9°C
- High spring relative humidity (80.5%)

Table 1: Soil characteristics

Name	Darlingford
Texture	Clay loam
Permeability	Medium to moderately slow
Topography	Gentle slope
Soil order	Chernozemic
Subgroup	Orthic black
A, B, BC, C horizons	Clay loam

Figure 1: Soil prifile of Darlingford clay loam

Materials and Methods

➢Historical data from 2015-2023: To determine fall rye establishment

➢Criteria for fall rye establishment
- Daily average temperature above 10°C
- Minimum of four consecutive weeks
- Anthesis stage: 309 fall growing degree days (GDD)

➢Plot experiment
- Set up as a randomized complete block design
- Treatments: Fall rye and no cover crop
- Treatments were replicated four times

Statistical analysis

Data was analyzed using a Type III ANOVA in PROC GLIMMIX (SAS version 9.4) to evaluate the treatment effects on soil water flux

Results

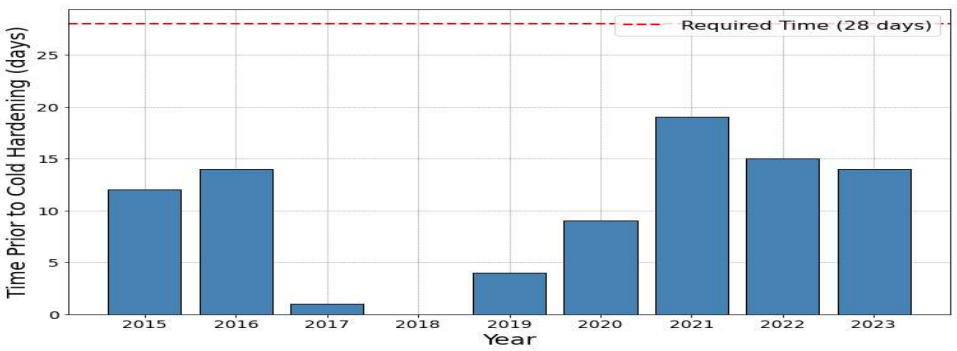

Figure 2: Fall rye establishment

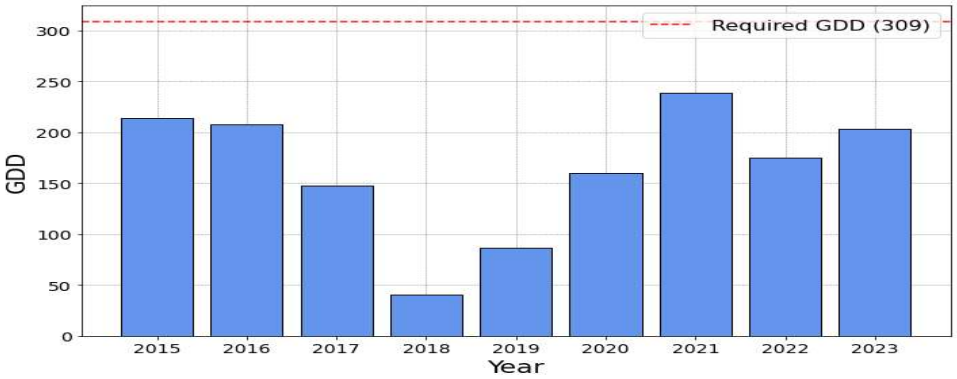

Figure 3: Fall rye establishment based on GDD

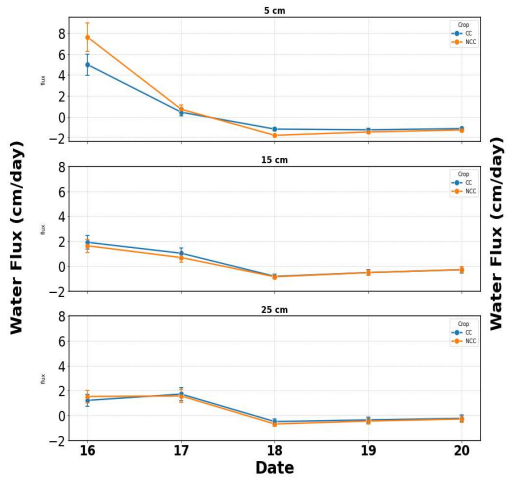

Figure 4: Water flux over time in the topsoil prior to cover crop termination

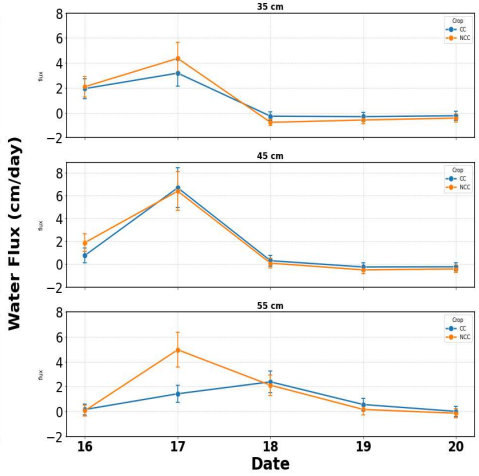

Figure 5: Water flux over time below the topsoil prior to cover crop termination

Figure 6: Study plot (prior to spring)

Figure 7: Study plot (late in April prior to termination)

Key findings

➢ Criteria for successful fall rye establishment were not met in any of the years (2015-2023)

➢ Fall rye failed to achieve the required GDD for successful establishment in all years

➢ Due to the poor establishment of fall rye, water movement in the soil under the fall rye treatment was slow, with a maximum rate of 1.24 cm/day in the 0 - 25 cm layer and 0.78 cm/day below the top 0 - 25 cm layer

➢ Likelihood of creating a water bath with lower flux below the topsoil

Strategies to adapt

➢ Leverage cover crops throughout the year via intercropping, underseeding, and using shoulder crops

➢ Adopt surface and subsurface drainage systems
- Understanding your soil profile is essential for its effective implementation

➢ Implementation of different agronomic practices
- Reduce row spacing of cover crops
- Introduce living mulch as an alternative to stubbles

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References

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