### Highlights
- Wheat biomass, yield, and protein content were not impacted by same row seeding of living mulch.
- Mulch performance was not equal across sites.

### Background
- Establishing a Living Mulch at the time of seeding a grain crop may allow for sufficient mulch growth and nitrogen fixation of legumes mulches.
- A successful Living Mulch will maintain living roots in the ground without decreasing the performance of the grain crops it is seeded with over two or more years.

### Study Objective
To study the effect of mulch species and location and their interaction on wheat biomass, wheat yield, and wheat protein.

To study which mulches produce more biomass when seeded together with wheat at each location in the province.

### Materials and Methods
- Field Studies at four Manitoba locations with different background soils and environments.
- Treatments of Living Mulch species included Red Clover, White Clover, Sweet Clover, Alfalfa, and Perennial Ryegrass.
- Experimental Design: RCB with four replications.
- Data Collected: Wheat and mulch emergence plant counts; mid summer plant counts; mid summer biomass for wheat and mulch; wheat yield; wheat protein; fall plant counts; fall regrowth biomass.

### Conclusions
- Compared to wheat controls wheat emergence, wheat biomass, wheat yield and wheat protein were not significantly affected by the presence of the living mulch, even in dry conditions.
- Establishment of living mulch species varied by site.

### Table: Seeding Information
<table>
<thead>
<tr>
<th>Spacing and Depth</th>
<th>Same row, same depth as wheat</th>
<th>140 lb/ac Total N (soil + applied)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertilizer</td>
<td>Wheat 250 pl/m2</td>
<td>Alfalfa 12 lb/ac</td>
</tr>
<tr>
<td>Seeding Rate</td>
<td>Red Clover 10 lb/ac</td>
<td>Sweet Clover 10 lb/ac</td>
</tr>
<tr>
<td></td>
<td>White Clover 6 lb/ac</td>
<td>P. Ryegrass 12lb/ac</td>
</tr>
<tr>
<td>Tillage Herbicide</td>
<td>Direct seeded</td>
<td>Glyphosate burnoff</td>
</tr>
</tbody>
</table>

### Table: Wheat Emergence, Biomass, Yield and Protein

#### Arborg
- **Wheat**
  - Emergence: 234/24/224/244/254/251
  - Summer Biomass: 7213/512/624/728/772/796
  - Yield: 60/12.4/12.0/11.8/11.0/13.4
  - Protein: 30/43/53/101/101/145
  - p-value: 0.9/0.7/0.5/0.6/0.3

#### Mélita
- **Wheat**
  - Emergence: 21/28/21
  - Summer Biomass: 588/35/21
  - Yield: 5/0.7/0.0
  - Protein: 15/0.5/0.0
  - p-value: 0.6/0.3

#### Carberry
- **Wheat**
  - Emergence: 12/12/12
  - Summer Biomass: 409/409/409
  - Yield: 2/2/2
  - Protein: 0.3/0.3/0.3
  - p-value: 0.03/0.03/0.03

### Preliminary Results

#### Arborg
- **Wheat**
  - Emergence: 391/351/368/401/374/410
  - Summer Biomass: 9786/351/882/906/838/10155
  - Yield: 20/43/15/14.2/15.1/15.1
  - Protein: 30/43/53/101/101/145
  - p-value: 0.9/0.7/0.5/0.6/0.3

#### Mélita
- **Wheat**
  - Emergence: 27/227/21
  - Summer Biomass: 695/27/959
  - Yield: 0.3/34/34
  - Protein: 0.1/0.8/0.8
  - p-value: 0.07/0.03/0.03

#### Carberry
- **Wheat**
  - Emergence: 255/225/226/226/264/280
  - Summer Biomass: 6733/7113/7212/7273/7352/6990
  - Yield: 37/38/39/39/40/40
  - Protein: 12/11/12/12/12/12
  - p-value: 0.0007/0.02/0.03/0.03/0.03/0.03

### Materials and Methods
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- Establishment of living mulch species varied by site.

### Next Steps
- Contact herbicide applied prior to seeding of Year 2 canola.
- Intention to set back mulch growth so that canola can establish, but then reestablish mulch.
- Use of Plant Root Simulator Probes to measure nitrification from spring melt through seed set.
- Biomass sampling of 15N in wheat and mulches.
- Soil measurements of nitrate and potentially mineralizable nitrogen.

### References
- More information and data can be found in the original research paper titled "Establishment of Annual Crop-Living Mulch System" by Jessica Frey and Joanne Thiessen Martens.