Interseeding Cover Crops

Variability in Establishment
Interseeding Cover Crops

**Opportunities**

Ability to incorporate mixtures of diverse species of cover crops

Earlier planting so better establishment in fall

Time & flexibility

**Challenges**

Establishing cover crop in dense corn populations prior to canopy closure

Establishing cover crop in narrow rows (30" or less)

Establishing cover crops shortly after herbicide applications

Seed depth and moisture
Cover Crop Diversity – Maximizing Function
Everleaf Oats and Groundhog Radish

Winter Rye, Milvus Clover, T-Raptor Brassica

Soil Builder: TriCal Triticale, MOI and KB Supreme Ryegrass, Crimson Clover, Hairy Vetch, Daikon Radish

Prince Brand Rye Grass and Milvus Clover

Indy Mix: Tillage Root Max Ryegrass, Crimson Clover, Tillage Radish
Planting Date, Cover Crop & Spring Cover

- Oats
- A. ryegrass
- Radish
- W. rye

Spring soil coverage (%)

- 0
- 10
- 20
- 30
- 40
- 50
- 60
- 70
- 80
- 90
- 100

Dates:
- 24-Aug
- 7-Sep
- 19-Sep

Crop Varieties:
- Oats
- A. ryegrass
- Radish
- W. rye
Cover Crop Interseeding
Late Season Interseeding

Penn State Interseeder
FLEXIBILITY - Spring Management of Cover Crops
Interseeding Cover Crops

• **Challenges**

• Establishing cover crop in dense corn populations prior to canopy closure

• Establishing cover crop in narrow rows (30” or less)

• Establishing cover crops shortly after herbicide applications

• Seed depth and moisture

• Still need time to grow once corn chopped
RESIDUAL HERBICIDES

- Used in many of our major crops
- Usually soil applied – but not always
- Generally provide 8 to 12 weeks of weed control
- If half-life too short - lack of residual weed control (performance reduced)
- If half life too long - carryover to following crop
- Interseeded cover crops are particularly vulnerable
HERBICIDE PERSISTENCE

- **Half-life**: the amount of time needed to degrade half of the herbicide present.

<table>
<thead>
<tr>
<th></th>
<th>50%</th>
<th>25%</th>
<th>12.5%</th>
<th>6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,4-D</td>
<td>1 day</td>
<td>14 days</td>
<td>28 days</td>
<td>35 days</td>
</tr>
<tr>
<td>Atrazine</td>
<td>60 days</td>
<td>120 days</td>
<td>180 days</td>
<td>240 days</td>
</tr>
</tbody>
</table>
# Grass Herbicides: Risk of Interseeded Cover Crop Injury

<table>
<thead>
<tr>
<th></th>
<th>A. ryegrass</th>
<th>R. Clover</th>
<th>Annual Ryegrass Red Clover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual II Mag 7.64 EC 1.67 pt IX</td>
<td>NO</td>
<td>Maybe</td>
<td>NO</td>
</tr>
<tr>
<td>Zidua 85 WG 2.5 oz IX</td>
<td>NO</td>
<td>Maybe</td>
<td>NO</td>
</tr>
<tr>
<td>Outlook 6 EC (\frac{1}{2}) pt (\frac{1}{2})</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>Outlook 6 EC 1 pt</td>
<td>Maybe</td>
<td>OK</td>
<td>Maybe</td>
</tr>
<tr>
<td>Harness 7 EC 1 pt (\frac{1}{2})X PRE</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>Harness 7 EC 2 pt 1X PRE</td>
<td>Maybe</td>
<td>OK</td>
<td>Maybe</td>
</tr>
<tr>
<td>Prowl H2O 3.8 CS 1.5 (\frac{1}{2})X PRE</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>Prowl H2O 3.8 CS 3 pt 1X PRE</td>
<td>NO</td>
<td>Maybe</td>
<td>NO</td>
</tr>
</tbody>
</table>

**Potential High Risk Products**

- containing Dual: Acuron, Bicep/Cinch, Camix, Expert, Halex GT, Lumax/Lexar, Zemax
- containing Zidua, Anthem

---

*Penn State Extension*
# Broadleaf Herbicides: Risk of Interseeded Cover Crop Injury

<table>
<thead>
<tr>
<th></th>
<th>A. ryegrass</th>
<th>R. Clover</th>
<th>A. Ryegrass &amp; C. Clover</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resolve 25 DF</strong></td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
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<tr>
<td><strong>Resolve 25 DF 1 oz</strong></td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td><strong>Atrazine 1 pt</strong></td>
<td>OK</td>
<td>Maybe</td>
<td>Maybe</td>
</tr>
<tr>
<td><strong>Atrazine 2 pt</strong></td>
<td>Maybe</td>
<td>Maybe</td>
<td>Maybe</td>
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<tr>
<td><strong>Atrazine 3 pt</strong></td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td><strong>Metribuzin 4 oz</strong></td>
<td>NO</td>
<td>OK</td>
<td>Maybe</td>
</tr>
<tr>
<td><strong>Sharpen 1.5 fl oz</strong></td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td><strong>Sharpen 3 fl oz</strong></td>
<td>Maybe</td>
<td>Maybe</td>
<td>Maybe</td>
</tr>
<tr>
<td><strong>Balance Flex 2 SC</strong></td>
<td>Maybe</td>
<td>Maybe</td>
<td>Maybe</td>
</tr>
</tbody>
</table>

**High Risk:** Callisto 4 SC 5.4 fl oz 1X PRE containing Callisto: Acuron, Camix, Halex GT, Instigate, Lumax/Lexar Rights O, Revulin, Resicore, Zemax containing >1.5 lb atrazine: Expert, Bicep/Cinch Magnum
Yields and GDDs for long and short season corn 2011-2019

Corn yield data from long and short season trials 2011-2019. 2019 weather data from Borderview Research Farm, Alburgh, VT.

Approximate GDDs needed for each RM from University of Minnesota Extension: https://extension.umn.edu/corn-hybrid-selection/selecting-corn-hybrids-grain-production
<table>
<thead>
<tr>
<th>Year</th>
<th>Date</th>
<th>Vergennes</th>
<th>Newport</th>
<th>Enosburgh</th>
<th>Alburgh</th>
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<tr>
<td>2017</td>
<td>31-Aug</td>
<td>1735</td>
<td>1398</td>
<td>1585</td>
<td>1670</td>
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<tr>
<td>2017</td>
<td>30-Sep</td>
<td>2183</td>
<td>1737</td>
<td>1989</td>
<td>2123</td>
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<td>2017</td>
<td>15-Oct</td>
<td>2317</td>
<td>1846</td>
<td>2206</td>
<td>2280</td>
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<tr>
<td>2018</td>
<td>31-Aug</td>
<td>2049</td>
<td>1732</td>
<td>1849</td>
<td>2085</td>
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<tr>
<td>2018</td>
<td>30-Sep</td>
<td>2473</td>
<td>2058</td>
<td>2233</td>
<td>2512</td>
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<tr>
<td>2018</td>
<td>15-Oct</td>
<td>2511</td>
<td>2058</td>
<td>2266</td>
<td>2584</td>
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<tr>
<td>2019</td>
<td>31-Aug</td>
<td>1744</td>
<td>1512</td>
<td>1625</td>
<td>1858</td>
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<tr>
<td>2019</td>
<td>30-Sep</td>
<td>2080</td>
<td>1776</td>
<td>1940</td>
<td>2194</td>
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<tr>
<td>2019</td>
<td>15-Oct</td>
<td>2155</td>
<td>1826</td>
<td>2296</td>
<td>2282</td>
</tr>
</tbody>
</table>
Harvest Date 90 to 95 RM Corn

Base 50°F from 15-May to 15-October

Growing Degree days (Base 50°F)

Alburgh
12-Sep

Enosburgh
30-Sep

Weather data from Borderview Research Farm, Alburgh, VT.
Variety Selection – New Focus

• Hybrid ear type
  – flex, semi-flex, semi-determinate or determinate

• Plant structure
  – upright, semi-upright, semi-pendulum or pendulum leaves

Upright corn leaves maximize photosynthesis when high populations are planted in narrow rows. Pendulum leaves are suited for lower populations to decrease water loss by evapotranspiration while maintaining photosynthetic activity. Pendulum-leaf hybrids flop out and intercept sunlight like solar panels, capturing light before it gets down low.
Flex Characteristics of Corn

• Girth (G): Flex in girth occurs from planting to V6.

• Early Length (L1): Flex length takes place between V6 and VT.

• Late Length (L2): Flex in length occurs from VT to R4.

• Depth (D): Flex in kernel depth takes place between R4 and R6.
## 2020 – Corn & Conservation Variety Trials

<table>
<thead>
<tr>
<th>Variety</th>
<th>Test Weight lbs bu⁻¹</th>
<th>Crude Protein</th>
<th>Fat %</th>
<th>Fiber</th>
<th>Starch</th>
<th>Falling number</th>
<th>DON ppm</th>
<th>LSD (p = 0.10)</th>
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</thead>
<tbody>
<tr>
<td>Abenaki</td>
<td>61.4</td>
<td>13.0</td>
<td></td>
<td></td>
<td></td>
<td>65.1</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>Bronze Orange</td>
<td>57.4</td>
<td></td>
<td>13.1</td>
<td></td>
<td></td>
<td>284</td>
<td>1.00</td>
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<tr>
<td>Cascade Ruby-Gold</td>
<td>60.0</td>
<td>11.8</td>
<td></td>
<td></td>
<td></td>
<td>62</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Dakota White</td>
<td>61.1</td>
<td>12.8</td>
<td></td>
<td></td>
<td></td>
<td>65.6</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>Early Riser</td>
<td>60.9</td>
<td>10.9</td>
<td></td>
<td></td>
<td></td>
<td>65.4</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Elliot's White</td>
<td>57.5</td>
<td>10.2</td>
<td></td>
<td></td>
<td></td>
<td>65.6</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Flint's Flint Corn</td>
<td>61.3</td>
<td>12.4</td>
<td></td>
<td></td>
<td></td>
<td>65.6</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Minnesota 13</td>
<td>59.0</td>
<td>9.7</td>
<td></td>
<td></td>
<td></td>
<td>65.6</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Oaxacan Green</td>
<td>57.8</td>
<td>11.3</td>
<td></td>
<td></td>
<td></td>
<td>65.6</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Osage Brown</td>
<td>56.7</td>
<td>10.4</td>
<td></td>
<td></td>
<td></td>
<td>65.6</td>
<td>65</td>
<td></td>
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<tr>
<td>Roter Tessinmais</td>
<td>62.7</td>
<td>11.8</td>
<td></td>
<td></td>
<td></td>
<td>65.6</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Wapsie Valley</td>
<td>61.6*</td>
<td>11.3</td>
<td></td>
<td></td>
<td></td>
<td>65.6</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td><strong>Trial Mean</strong></td>
<td><strong>59.8</strong></td>
<td><strong>11.5</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>64.8</strong></td>
<td><strong>233</strong></td>
<td><strong>0.623</strong></td>
</tr>
</tbody>
</table>

*LSD (p = 0.10) 1.27

100 to 120 bushel
Interseed Timing & Variety Selection

![Graph showing PAR infiltration (%)](image)

- Long Flex
- Long Fixed
- Short Flex
- Short Fixed

Key:
- V2
- V4
- V6

Timeline:
- 3-Jul
- 6-Jul
- 12-Jul
- 20-Jul
- 30-Jul
- 8-Aug
- 17-Aug
- 24-Aug
- 31-Aug
- 13-Sep
- 24-Sep

PAR Infiltration (%)
**MATERIALS & METHODS**

Location: *Borderview Research Farm, Alburgh, VT*

Plot size: 20 x 30 ft.

Corn variety: *Syngenta NK8618 (86 RM)*

Corn planting date: 30-May 2019

Cover crop planting date: 5-Jul

Corn harvest date: 30-Sep 2019

Cover crop sample date: 27-Sep 2019

**Treatments**

- 30" row with 30,000 seeds acre$^{-1}$ (*30_30*).
- 30" row with 34,000 seeds acre$^{-1}$ (*30_34*).
- 60" row with 49,000 seeds acre$^{-1}$ (*60_49*).

Randomized complete block design with 4 replicates.
Cover crop mix in 60” (left) compared to 30” (right).

Cow pea (left) and summer solar mix (right) in 60” rows.

Borderview Research Farm, Alburgh VT 2019
Figure 1. Percent light infiltration under corn canopy by row spacing, Alburgh, VT, 2019.
Cover crop dry matter yield (lbs ac⁻¹) by treatment (row spacing + population), Alburgh, VT, 2019.
Cover crop dry matter yield (lbs ac⁻¹) by cover crop type, Alburgh, VT, 2019.
RESULTS

Figure 5. Corn yield at 35% dry matter (ton ac\(^{-1}\)) by treatment (row spacing + population) and by cover crop type, Alburgh, VT, 2019.

Treatments that share letters performed statistically similar to one another.

† - annual ryegrass, tillage radish, red clover
Corn dry matter yield (lb ac⁻¹) by treatment (row spacing + population), Alburgh, VT, 2019.
On Farm

Farmers at two sites in Franklin County, VT planted corn with row widths of 60” in 2019.

Cover crop was interseeded late June.

Farmers measured yield and dry matter at harvest.

<table>
<thead>
<tr>
<th></th>
<th>Machia’s</th>
<th>Manning’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover crop planting date:</td>
<td>28-Jun</td>
<td>27-Jun</td>
</tr>
<tr>
<td>Cover crop mix</td>
<td>Annual ryegrass (85%), radish (15%)</td>
<td>Annual ryegrass (80%), clover (15%), radish (5%)</td>
</tr>
<tr>
<td>Rate (lb/ac)</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Herbicide application</td>
<td>Acuron (high rate)</td>
<td>Round Up (high rate)</td>
</tr>
</tbody>
</table>
On Farm
Pictures of 60" corn at Machia's farm
On Farm

60" rows at harvest (11-Oct. 2019).

Pictures of 60" corn at Machia's farm
On Farm

60° corn rows before (left) and after (right) harvest at Nick Manning’s.
Comparing corn yields in 30" vs. 60" row width.

Lower yield & dry matter in 60" rows.

• Wet field conditions where 60" corn was planted
Challenges/Things to Consider

Planting corn in 60” rows needs refining to be a viable solution for farmers

• Studies done in Midwest (Gailans et.al. 2018) (Nelson, 2014) (Gailans et.al. 2019) have shown mixed results in terms of improved corn yield & cc biomass production in 60” rows compared to 30”. If this method can be refined, wide row corn has the potential for:
  • Improving corn yield & cc biomass production
  • Improving soil fertility by growing more legume (cow pea) cover crop
  • Grazing livestock on cc after corn harvest
Cover Crop Termination & Soybean Yield

![Image of a field with cover crops and soybeans]

Bar chart showing soybean yield (bu/acre) for Tillage, Pre-Herbicide, and Post-Herbicide treatments.
Cover Crop & Soybean Yield

![Graph showing the relationship between cover crop biomass (lbs/acre) and soybean yield (bu/acre). The graph compares WR/RC/TR, WR/V, and WR treatments. The cover crop biomass increases with soybean yield, with WR/RC/TR showing the highest yield and biomass, followed by WR/V and then WR. The graph highlights the significant interaction between cover crops and soybean yield.]
Cover Crop Termination & Soybean Yield

![Cover Crop Field](image)

![Graph showing Soil nitrate-N (NO₃⁻, ppm) with data points for Soil samples (2019)]

- **Tillage**
- **Pre-spray**
- **Post-spray**

**Soil nitrate-N (NO₃⁻, ppm)**

- Late May
- Early June
- Mid-Late June
- Early-Mid July

**Dates**

- 10-May
- 8-May
- 27-May
Grazing Cover Crops: Ideas and strategies from across the country
We aren’t currently seeing a lot of cover crop grazing in Vermont. Can we get inspired by farmers from other regions?
“Livestock grazing on cover crops can bring a whole new dimension of cropping systems.” – Jim Isermann, Illinois farmer

Left: Oat and radish cover crop pre-grazing.
Right: Turnip and oat cover crop post-grazing. Photos courtesy of Jim Isermann.
Opportunities

Feed savings for livestock producers
or
an additional enterprise for crop producers
“Logistics will be one of the biggest barriers to grazing more cover crops. Fence, water, mineral feeders and handling facilities must all be planned.” – Jim Isermann, Illinois farmer
Gabe Brown, Brown’s Ranch – North Dakota
5,000 acres of cropland, 350 cow/calf pairs, 200-600 stockers

Images courtesy of Chelsea Green
Mark Schleisman, M & M Farms – Iowa
2,000 acres cropland, 1,300 acres cover crops, 360 cow/calf pairs

Cover crops interseeded between August 15 and 31

Triticale base with radish, turnip and/or rapeseed, 22% CP in forage

**Economic example from Practical Farmers of Iowa study:** 3.8 tons of dry matter per acre of above ground biomass on a 150 acres field, equating 570 tons of dry matter. Cattle to graze 85% of the forage, consuming 484.5 tons dry matter. If cattle received the same amount of dry matter in the form of hay (assuming hay was purchased, cost $80 per ton, and contained 85% dry matter), this would have cost Mark $44,574 or $297.16 per acre.
Practical Farmers of Iowa – extensive resources and economic data on cover crop grazing

In a Nutshell
- Planting cover crops, then grazing or harvesting them, is a practical way to effectively reduce nutrient pollution, plus provide economic benefits to cattle owners.
- This represents a win-win for livestock producers and water quality for Iowa.

Key Findings
- Four farmers in northwest Iowa reported that in the fall and winter of 2015, cover crops provided 0.07 to 3.74 tons of dry matter per acre.
- Grazing this cover saved farmers $1,306 to $22,301 in hay or other stored feed expenses.

Methods

Staff Contact:
Meghan Filbert - (515) 232-5661
meghan@practicalfarmers.org

Cooperators:
- Ben Albright - Lytton
- Wesley Degner - Lytton
- Bill Frederick - Jefferson
- Mark Schlesman - Lake City

Funding By:
Iowa Dept. of Agriculture and Land Stewardship’s Water Quality Initiative

Web Link:
Another way to add value: Rental agreements for cover crop grazing

Many producers who grow cover crops may not currently graze or do not plan to graze, but can still obtain income from this crop as a potential feed resource.

Considerations:

• Infrastructure
• Fair payment and rates
• Responsibilities of each party
Key questions to answer when negotiating a lease

Resources available from Practical Farmers of Iowa and from the University of Nebraska – Jay Parsons, Dept. of Agricultural Economics

- What is the latest agreeable planting date? What species will be planted? Who will pay for establishment?
- How and when will cover crop be terminated?
- Will permanent or temporary fence be used? Long term lease with grazer if grazer installs more permanent fence?
- Is a reliable water source present? How will water be delivered to animals?
- What is the emergency feed source?
- Will livestock owner provide liability insurance?
- What’s the start date for grazing? What’s the grazing period? What is stocking rate and is it appropriate?
- What is contingency plan? If inadequate forage, how is livestock owner compensated? Or if not grazed, will forage be harvested? By whom?
- What are the crop insurance requirements?
Got grazing? New online matchmaking tool in South Dakota

This Grazing Exchange website thru the South Dakota Soil Health Coalition connects forage producers and livestock producers within the state to put vegetation to work.
2021 ANNUAL MEETING

Burlington, VT