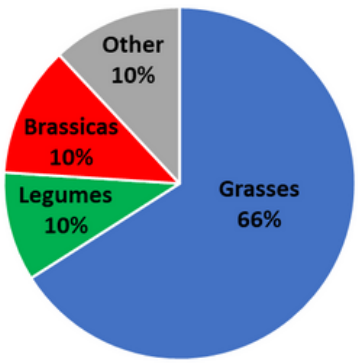
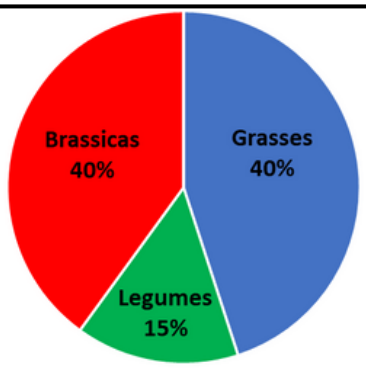

Graphic credit: Claire Benning

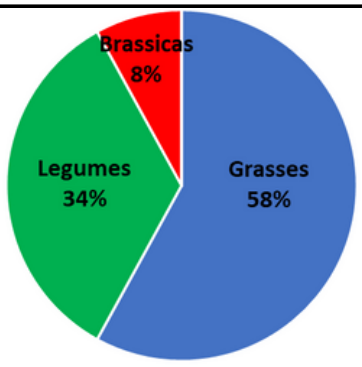
## Why this project?

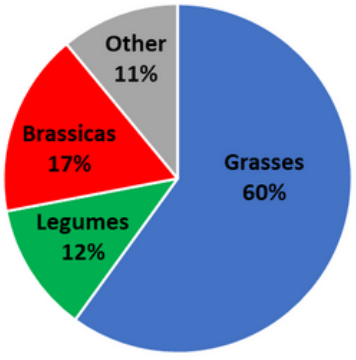
Interseeding cover crops into corn is an opportunity to expand cover crop acreage in the Upper Midwest in an otherwise limiting growing season. We seek to understand how different combinations of interseeded cover crops compare in weed suppression, cover crop biomass, and corn grain yields.

| Touchdown Mix | Green Carpet Mix | Marathon Mix | Mix 1 |
|---|---|---|---|
| Oats<br>Flax<br>Crimson Clover<br>Annual Ryegrass<br>Dwarf Essex<br>Rapeseed<br>Buckwheat<br>Radish<br>Turnip<br>Red Clover | Oats<br>Radish<br>Crimson Clover<br>Rapeseed<br>Turnip<br>Dwarf Essex | Oats<br>Crimson Clover<br>Red Clover<br>Rapeseed<br>Italian ryegrass | Oats<br>Annual Ryegrass<br>Radish<br>Buckwheat<br>Red Clover<br>Cowpea<br>Sunflower<br>Soybean |




## METHODS

**Planted Corn on May 31st.**

*Variety: Blue River 30K84*

*Seeding rate: 32,000 seeds/ac*

**Rotary hoe and field cultivation passes prior to interseeding cover crops.**

**Cover crops interseeded at V4 corn growth stage on June 20.**

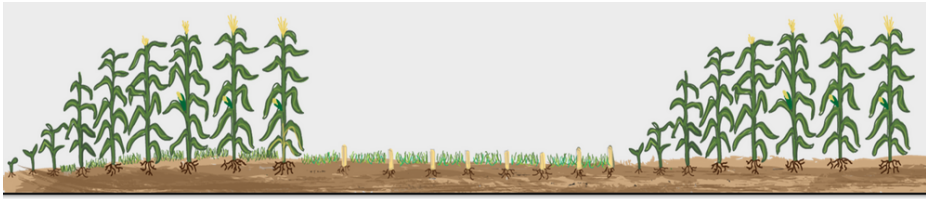
Research and Data analysis by: Ben Brockmueller, Erin Silva

# INTERSEEDING COVER CROP INTO CORN

Ongoing research from the University of Wisconsin, Madison

## Why this project?

Interseeding a cover crop mix into standing corn has shown promise as an alternative practice to extend the cover crop growing season, allowing for more species diversity beyond the rye that is often planted in the fall after crop harvest.



Graphic credit: Claire Benning

## Cover crop composition

| Species | % |
|---|---|
| Crimson Clover | 4% |
| Daikon Radish | 4% |
| Dwarf Essex | 4% |
| Flax | 8% |
| medium red clover | 2% |
| Oats | 60% |
| Seven Top turnip | 2% |
| Tetraploid annual ryegrass | 8% |
| Trophy Rape | 4% |
| Buckwheat | 4% |
| **Total** | **100%** |

## Method - at each site

1. Corn planted at desired population with usual fertilizer and chemical program, choosing 30" and/or 60" row spacings.
2. Cover crop interseeded at V3 stage (drilled or broadcast) at 25#/ac
3. A control pass (no cover crop) left next to cover crop area to compare.
4. Soil samples collected in spring and fall.
5. Corn plant populations recorded at V5
6. Cover crop biomass samples collected prior to harvest.
7. Corn grain or silage yields recorded with yield monitor or by hand if necessary.

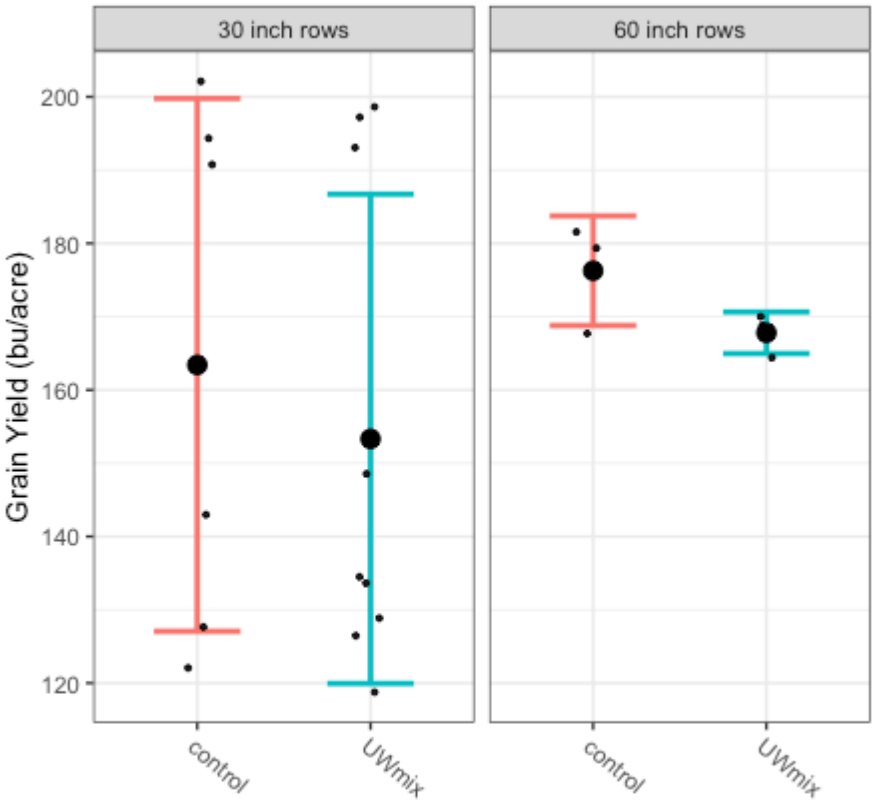
## Main take-aways! Tables and Figures on the back.

- **No obvious yield penalty** with interseeding in the 2021 and 2022 data.
- There is **no detriment to feed quality** in the silage analyses with interseeding,
- Cover crops establishment is **much more successful in 60" row spacing** than 30" row spacing

Research and analysis by Anne Pfeiffer and Erin Silva

# 2022 PRELIMINARY DATA

## GRAIN




## GRAIN

*bu/ac by treatment*

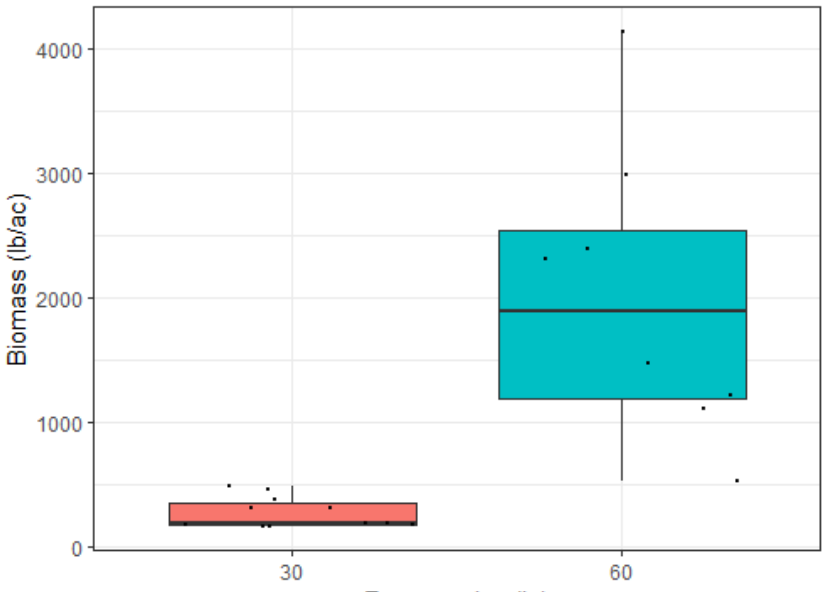
| CC and Row Spacing (inches) | Mean | SD |
|---|---|---|
| UWmix | | |
| 30 | 153.3 | 33.4 |
| 60 | 167.8 | 2.8 |
| control | | |
| 30 | 163.4 | 36.4 |
| 60 | 176.3 | 7.5 |

## SILAGE

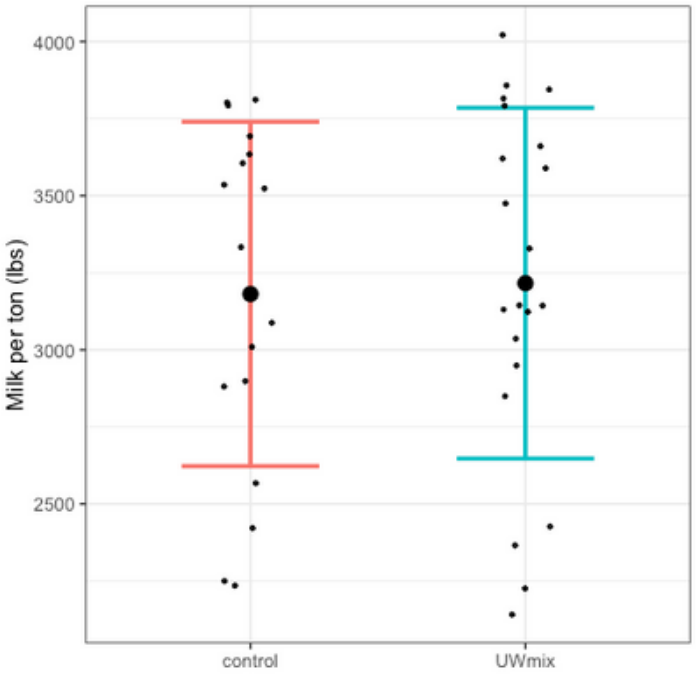
*ton/acre by treatment*

| CC and Row Spacing (inches) | Mean | SD |
|---|---|---|
| UWmix | | |
| 30 | 8.9 | 2.7 |
| 60 | 9.7 | 1.3 |
| control | | |
| 30 | 8.9 | 2.7 |
| 60 | 9.9 | 1.0 |

## COVER CROP BIOMASS




## MILK PER TON



# VARIETY TRIALS: SUNFLOWERS

Ongoing research from the University of Wisconsin, Madison

## Why this project?

Oilseed sunflowers are a relatively drought tolerant crop that fit well in a diversified organic rotation. As the Midwest is presented with demand for oilseeds, it is important to look at basic sunflower agronomy for organic systems. Here, we look at several different early and mid-maturing varieties of sunflowers and differences in yield. Can organic sunflowers be profitably grown in Wisconsin?

| Early Maturing | Mid Maturing |
|---|---|
| 1. Cobalt II | 1. CP455E |
| 2. N4H302E | 2. CP4157E |
| 3. P32D23 | 3. N4H470CLP |
| 4. P40W24 | 4. P42N21 |
| 5. CP455E | 5. Hornet |

## METHODS

Sunflowers planted on May 31st.

- 26,000 seeds/ac
- 2" seeding depth

Standard tine weeding, rotary hoe, and field cultivation practices for weed control

CP455E was the highest yielding early maturing sunflower variety, while P42N21 was the highest yielding late maturing variety.

Research and analysis by Ben Brockmueller, Erin Silva

## 2022 Early maturing sunflower variety yields

| Sunflower Variety | Yield | Test weight | Plant stand |
|---|---|---|---|
| | lb/ac | lb/bu | plants/ac |
| CP455E | 1636 a | 27.7 b | 21217 a |
| P32D23 | 1282 ab | 25.2 c | 18386 a |
| N4H302E | 924 b | 25.9 bc | 21290 a |
| Cobalt II | 818 b | 31.1 a | 18422 a |
| *CV* | *20.0* | *3.02* | *7.96* |

## 2022 Late maturing sunflower variety yields

| Sunflower Variety | Yield | Test weight | Plant stand |
|---|---|---|---|
| | lb/ac | lb/bu | plants/ac |
| P42N21 | 1938 a | 29.1 a | 19566 ab |
| CP455E | 1742 ab | 28.7 a | 19403 ab |
| P46W21 | 940 bc | 27.5 a | 11664 b |
| N4H470CLP | 784 c | 29.4 a | 22016 a |
| *CV* | *20.0* | *3.00* | *25.1* |

# PLANTING INTO RYE: DRY BEANS

Ongoing research from the University of Wisconsin, Madison

## Why this project?

There is increasing interest in planting cash crops into roller crimped cover crops for weed suppression benefits and other ecosystem services. These systems have been demonstrated to be effective when planting soybeans. Can these systems effectively be expanded to other crops?

| Treatment or materials | Method or material details |
|---|---|
| Rye planting date | Sept. 23 |
| Rye variety and seeding rate | ND Gardener @ 3 million seeds/ac |
| Dry bean planting date | June 7 |
| Starter Fertility | 25 lb/ac of N at planting using 8-2-2 |

## PROJECTS AND OBJECTIVES

**Interrow Mowing Experiment**

Interrow mowing to control weed breakthroughs either 1) once early in the season, 2) once late in the season, 3) multiple passes to control weeds as needed, and 4) no interrow mowing

*Research Question*:

Does timing of management and number of management practices influence weed biomass and grain yield.

**Black Bean Seeding Rate Experiment**

Examines 5 black bean seeding rates ranging from 60,000 to 300,000 seeds/ac

*Research Question*:

Will increasing black bean seeding rates enhance weed suppression and crop production?

## Preliminary Observations:

Planting dry beans into roller crimped rye has been effective.
Increasing dry bean seeding rate seems to improve weed suppression.
Interrow mowing can suppress weed growth, especially of annual broadleaf weeds

Research and analysis by Ben Brockmueller, Erin Silva

# PLANTING INTO COVER CROP: STRIP TILLED CORN INTO ALFALFA AND RED CLOVER

Ongoing research from the
University of Wisconsin, Madison

Photo credit: Cecylia Richards

## Why this project?

Developing reduced tillage organic corn systems has proved challenging. Living mulches offer an alternative to roller crimped systems. This project seeks to explore agronomic management of living mulches to manage competition with corn during the growing season.

### Treatments

1. No Management
2. Forage Harvest (FH)
3. Inter-row Mowing (IRM) 2x
4. FH + 2x IRM
5. Tilled Control

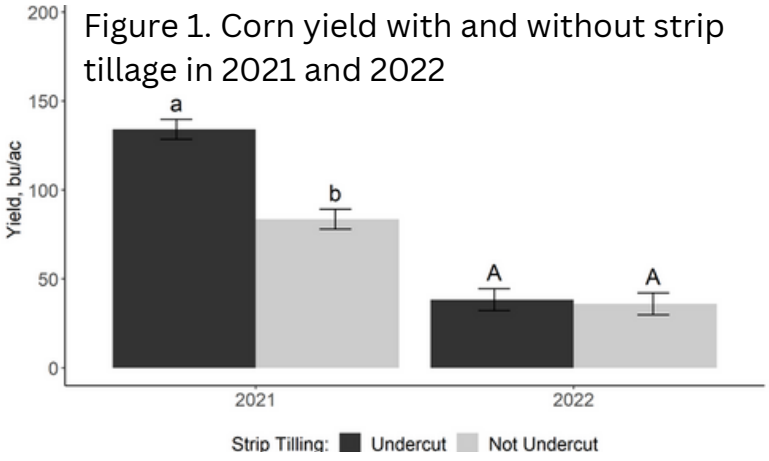



Figure 1. Corn yield with and without strip tillage in 2021 and 2022

### METHODS

- Corn strip tilled prior to corn planting
- Corn (Blue River 14A91) seeded at 38,000 seeds/ac

- Cover crop was flail chopped prior to planting in some treatments (FH and FH + 2x IRM)
- Interrow mower was used at the corn V2 and V4 growth stages in some treatments (IRM and FH + 2x IRM)

**Main take-aways! Tables and Figures on the back.**

Living mulch system limited by drought conditions.

Need to manage living mulch to reduce competition with corn.

Interrow mowing improved corn vigor.

Research and analysis by Ben Brockmueller, Erin Silva

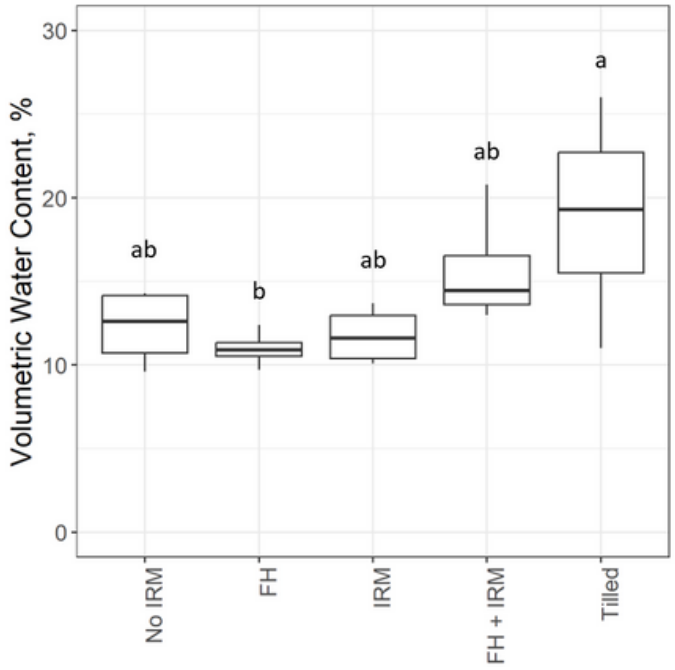



Figure 2. Volumetric soil water content, % at 8" depth measured on August 11th in the alfalfa living mulch system.

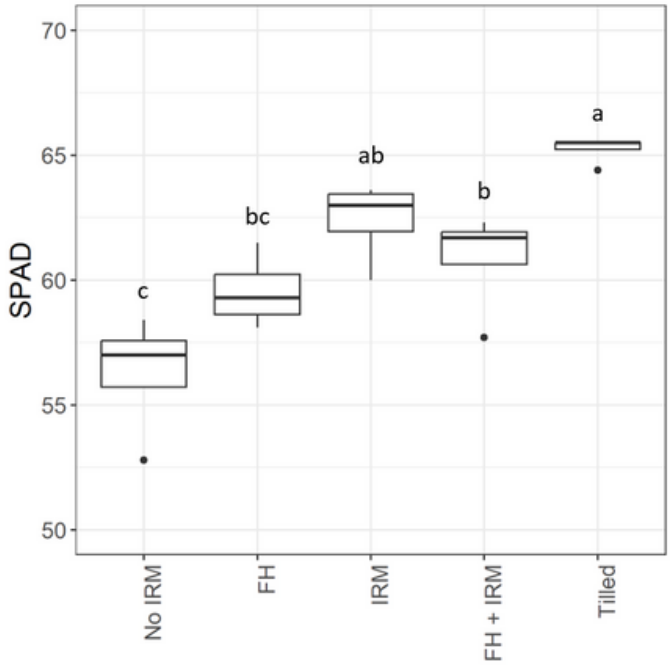



Figure 3. Corn SPAD readings measured at corn tasseling on August 25th in the red clover living mulch system .

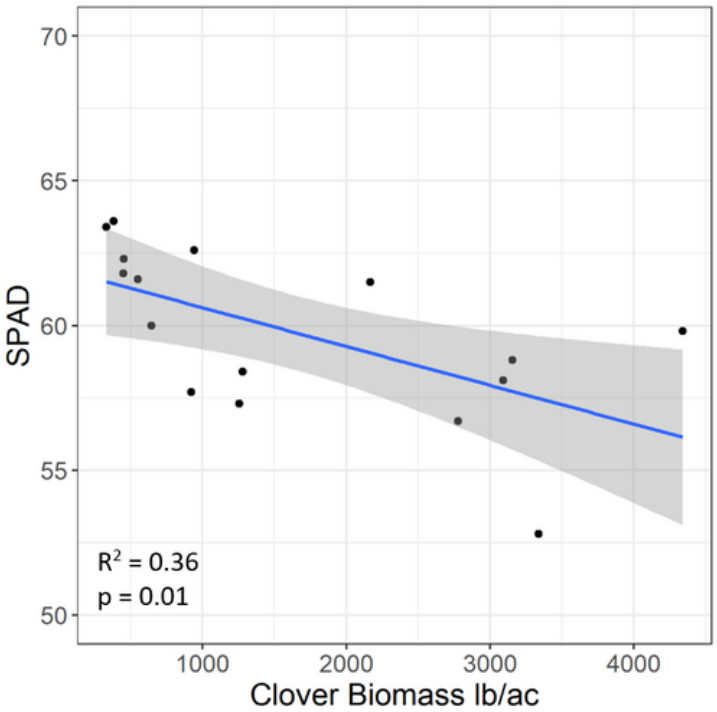



Figure 4. Relationship between corn SPAD readings with clover biomass measured at the corn V6 growth stage.

| Treatment | Corn Growth Stage | Corn Growth Stage |
|---|---|---|
| | Corn V4 GS* | Corn V6 GS |
| | Alfalfa Living Mulch | |
| No Management | 4.28 ab | 5.48 bc |
| Forage Harvest (FH) | 3.63 b | 4.78 c |
| Interrow Mowing (IRM) 2x | 3.63 b | 6.63 b |
| FH + 2x IRM | 3.88 b | 6.53 b |
| Tilled Control | 5.18 a | 8.80 a |
| | Red Clover Living Mulch | |
| No Management | 3.93 B | 6.48 B |
| Forage Harvest (FH) | 4.33 B | 6.63 B |
| Interrow Mowing (IRM) 2x | 4.10 B | 6.85 B |
| FH + 2x IRM | 4.55 B | 7.35 B |
| Tilled Control | 6.38 A | 10.7 A |

* GS – Growth Stage

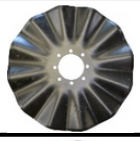
Table 1. Corn growth stage when measured at the corn V4 and V6 growth stages in the alfalfa and red clover living mulch cropping systems.

# NO-TILL SOYBEANS INTO RYE: COULTER EXPERIMENT

Ongoing research from the
University of Wisconsin, Madison

## Why this project?

Cereal rye residue helps provide season long weed suppression. However, thick mulch layers may inhibit good seed to soil contact at planting lowering soybean emergence. This experiment examined different coulter types to determine their influence on soybean emergence.

| Coulter Type | |
|---|---|
| Straight |  |
| Ripple |  |
| 13-wave |  |
| 8-wave |  |
| Tilled Control w/ no coulter | |

## METHODS

**Cereal rye establishment:**
Aug 11 -- Liquid manure application (12,000 gal/ac)

Sept 23 -- Cereal rye (ND Gardener) seeded at 3 million seeds/ac

**Soybean management:**
Jun 7 -- Winter rye terminated with front mounted roller crimper. Rear mounted planter seeded soybeans (Viking O.1706N) at 225,000 seeds/ac using 500 lb of planter down force.

**Main take-aways! Tables and Figures on the back.**

1) Planting in dry conditions into thick mulch layers is challenging and reduces soybean emergence.
2) Improved emergence rates can promote higher yields and lower seeding rates
3) Placement of soybean seed strongly contributes to emergence rates.

Research and analysis by Ben Brockmueller, Erin Silva

Fig 1. Relationship between rye biomass with soybean a) emergence and b) grain yield across 9 years and locations of no-till soybean data.

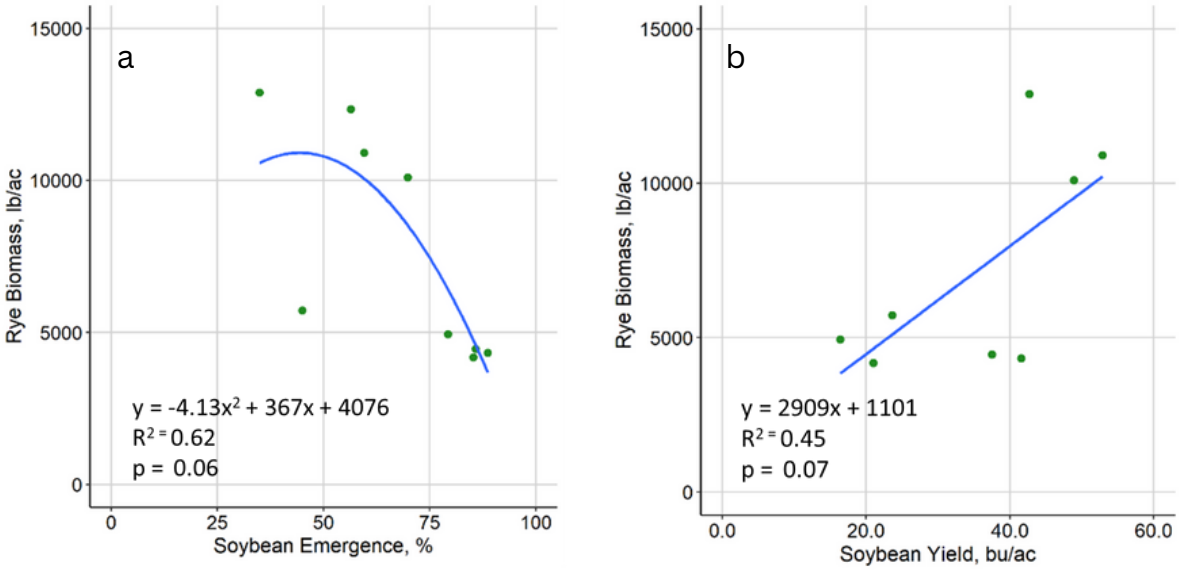



Table 1. Average rye and weed biomass with soybean emergence and grain yield across 8 years and locations of no-till soybean data

| Site-Year | Rye Biomass | Weed Biomass | Soybean Emergence | Soybean Yield | Correlation values | |
|---|---|---|---|---|---|---|
| | --------lb/ac-------- | | % | bu/ac | r-coefficient | p-value |
| 2019 AARS | 10913 | 418 | 59.6 | 52.9 | 0.45 | <0.001 |
| 2019 Walworth Co. | 4452 | 928 | 85.8 | 37.5 | 0.07 | NS |
| 2019 Adams Co. | 4178 | 991 | 85.3 | 21 | 0.15 | NS |
| 2019 Rock Co. | 4328 | 652 | 88.7 | 41.6 | 0.13 | NS |
| 2020 AARS | 12886 | 418 | 34.9 | 42.7 | 0.48 | <0.001 |
| 2020 MARS | 4944 | 2000 | 79.3 | 16.4 | 0.20 | NS |
| 2020 Rock Co. | 5725 | 1237 | 45.0 | 23.6 | 0.05 | NS |
| 2021 AARS | 10104 | 273 | 69.8 | 48.9 | 0.35 | 0.05 |

Table 2. Effect of coulter type on soybean seeds on soil surface, emergence, and plant stand at the Arlington Agricultural Research Station, 2023.

| Coulter Type | Seeds on soil surface | Soybean emergence* | Soybean plant stand |
|---|---|---|---|
| | % | | plants/ac |
| Tilled – no coulter | NA | 57.2 a | 128,583 a |
| Straight | 32.9 ab | 36.1 a | 81,166 b |
| Ripple | 27.4 ab | 32.7 a | 73,500 b |
| 13-wave | 26.5 b | 31.8 a | 70,250 b |
| 8-wave | 53.4 a | 28.7 a | 64,583 b |

*When soybeans were hand planted into mulch to ensure "perfect" seed placement, emergence rates averaged **86.2%** across plots

# Interseeding Cover Crops in Organic Corn


## Exploring the agroecosystem benefits of single and mixed species applications

The goal of this project is to address challenges and barriers associated with organic cover crop establishment in the Upper Midwest including:

1. Short window of time in the fall to establish cover crops.
2. Nutrient management.
3. Weed management.
4. Yield effects on current and subsequent crops.

## Methods

**Phase One:**

- Corn (Blue River 30K84) planted at 32,000 seeds/acre for silage harvest
- Cover crops drill interseeded at corn V3 stage
- Canopy cover and soil nitrate levels taken at 30 days after interseeding (DAI)
- Cover crop biomass, weed biomass, and soil nitrate levels measured at corn silage harvest
- Annual ryegrass and Red Clover left to overwinter
- Winter rye is planted immediately following corn harvest in WR plots

**Phase Two:**

- Canopy Cover, cover crop and weed biomass, and soil nitrate levels taken at cover crop termination in spring
- Cover crops are terminated with tillage

## Treatments:

| Species | Seeding Rate lbs/ac |
|---|---|
| Annual Ryegrass (AR) | 20 |
| Red Clover (RC) | 10 |
| Oilseed Radish (OR) | 10 |
| AR + RC | 10 + 10 |
| RC + OR | 10 + 2 |
| AR + OR | 15 + 2 |
| AR + RC + OR | 10 + 8 + 2 |
| Winter Rye (WR) | 60 |
| Cultivation | N/A |
| Control | N/A |

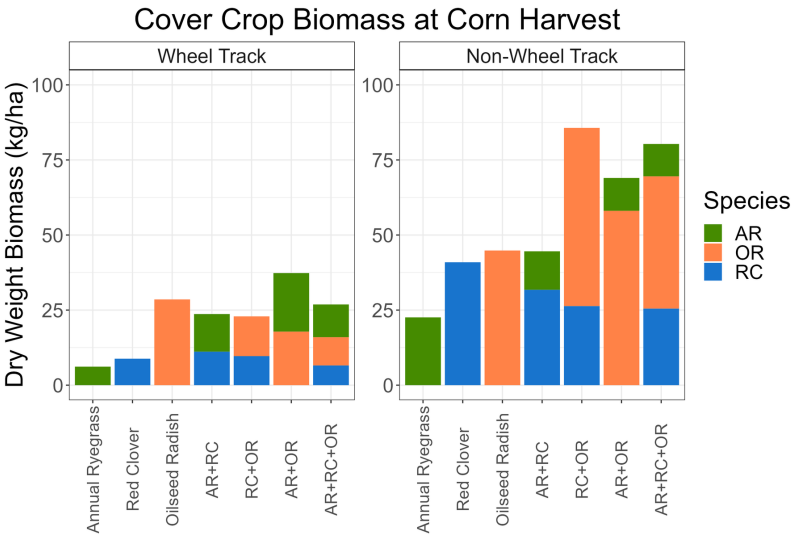
## TAKEAWAYS

- Cover crops suppressed weeds similar to in season cultivation with no effect on in season soil nitrate levels or corn silage yield.
- Cover crops suppressed spring weed growth.

| | Corn Yield | Soil Nitrate (ppm) | |
|---|---|---|---|
| | tons/ac | 0" - 12" | 12" - 24" |
| AR | 23 | 20 | 15 |
| RC | 25 | 27 | 16 |
| OR | 23 | 23 | 13 |
| AR + RC | 23 | 28 | 16 |
| RC + OR | 22 | 20 | 13 |
| AR + OR | 25 | 18 | 13 |
| AR + RC + OR | 24 | 16 | 15 |
| Cultivation | 24 | 21 | 13 |
| Weedy Control | 20 | 16 | 4 |

**Table 1. Corn Yield and Fall Soil N Levels**
Cover crops did not have an effect on corn silage yield or soil nitrate levels. The weedy control plot had a decrease in soil nitrate levels at 12"-24" and a lower yield in comparison to cultivation and cover crop treatments.

**Figure 1. Cover Crop Biomass at Corn Harvest.**
Cover crops established poorly in wheel track rows in comparison to non-wheel track rows. Mixtures containing oilseed radish had more biomass than single species treatments and mixtures without oilseed radish.



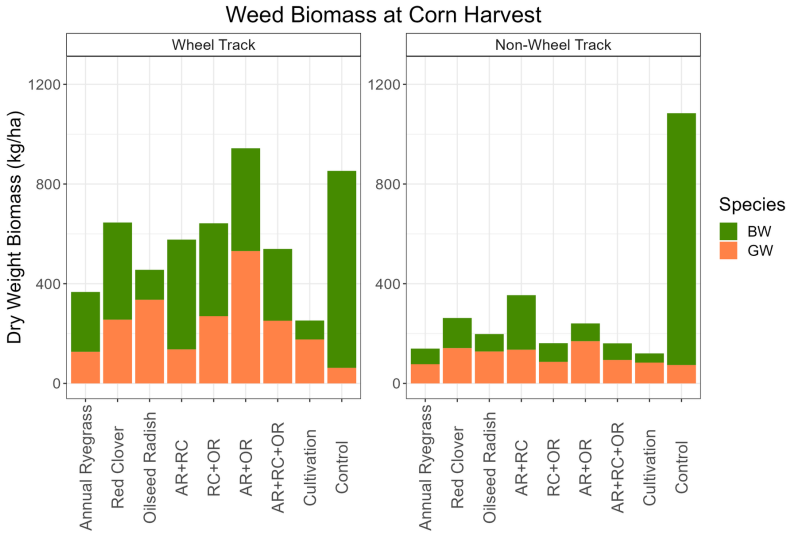
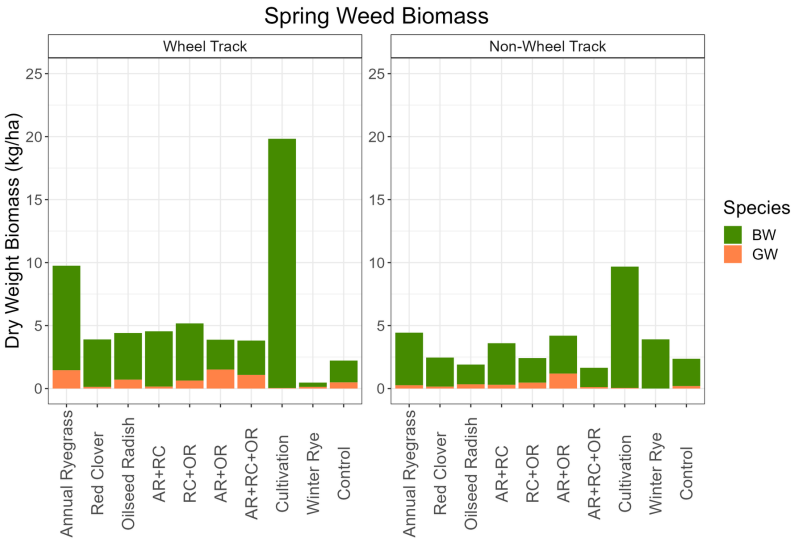




**Figure 2. Weed Biomass at Corn Harvest**
Weed biomass was collected and separated into broadleaf (BW) and grass weed (GW) species. When cover crops established successfully in non-wheel track rows they suppressed weeds similar to in season cultivation. The weedy control had a higher proportion of BW in comparison to the cover crop treatments.

**Figure 3. Spring Weed Biomass at Cover Crop Termination**
Weed biomass was again collected and separated into broadleaf (BW) and grass weed (GW) species. Cover crop treatments suppressed spring weeds better than the cultivation treatment. None of the treatments received any spring cultivation.




Research, analysis, and graphics by Claire Benning