Interseeding Cover Crop in White Corn

Ohe·láku and UW-Madison Plant Pathology

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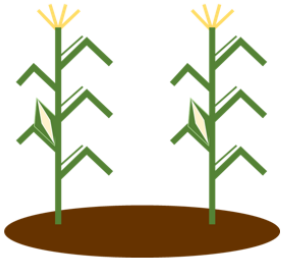
Project Goal and Rationale: The goal is to establish a long-term land management plan for growing White Corn that improves soil health, increases plant diversity, and enhances ecosystem function, drawing upon Traditional Ecological Knowledge.

Cover crops range in their impacts on soils and can have many beneficial impacts. Cover crops grown in between White Corn will reduce the need for cultivation by suppressing weeds, thus reducing erosion and improving soil quality through maintaining and potentially increasing organic matter in soil. Cover crops can also benefit soil ecology, biology, and nutrient cycling. **Overall, we want to select cover crops that do not compete with the White Corn and suppress weeds.**



White Corn with no cover crop

White Corn with cover crop

Methods:

We are using a 6-field rotation, where each 1.5 acre section will be under constant cover through different cover crop mixtures. A soil building cover crop mixture previously planted is worked into the soil through mowing and tillage. White Corn is planted at 30” rows on a 4-row planter. Fertilizer inputs and cover crop seeding dates can be seen in the table below.

Year	White Corn planting date	Cover crop seeding date	Inputs
2021	May 26th	June 12th	45 lb/ac N (15-0-0), 125 lb/ac K2O and 45 lb/ac S (0-0-50-18S)
2022	June 10th	June 28th	112.5 lb/ac N and 15 lb/ac K2O (15-0-2) and 15 lb/ac P2O5 (0-3-0
2023	May 18th	June 22nd	112.5 lb/ac N and 15 lb/ac K2O (15-0-2) and 15 lb/ac P2O5 (0-3-0)

Results: In 2021, we had a low fertility rate in soil due to a poor recommendation on N and P along with a high weed pressure. However, we saw all cover crop treatments reduced weed pressure around corn in comparison to weedy plots (Figure 1). The low nutrient environment allowed weeds to further impact corn yield as seen in the weedy control (Figure 2). The treatments of just clover and just winter wheat did not differ statistically from the White Corn monoculture and showed high yields in some cases (Figure 2). Overall, this first year showed promising results despite nutrient deficiencies in the field.

In 2022, this 1.5 acre section of the field had higher soil fertility due both better nutrients recommendations and the field being under a diverse soil building cover crop mixture the previous year. Weed pressure was still high and the mixture with all 3 cover crops did suppress weeds better than all other cover crop treatments. This differs from last year's results as mixtures with more cover crops potentially added more biomass along with weeds to compete with White Corn. We were not able to collect yield data for this year's trial, but anecdotally the White Corn looked healthier and yield was not visibly affected by weeds as seen in 2021.

2023 presented a challenging drought all across the Midwest. We had to wait 5 weeks after planting for a solid rain forecast to sow cover crops. However, this allowed us more time to lightly cultivate to better manage weeds before planting. The drought continued to impact cover crop and weed performance as biomasses are significantly lower than previous years. Besides winter wheat, all cover crops lowered weed biomass compared to the unmanaged weedy plots (Figure 4). Due to adequate nutrients, we expect corn yield in cover crop plots to not be drastically different than the plots without cover crops. Corn yield was higher overall than 2021 due to better soil fertility. We found that there are significant differences between all cover crop treatments and control (Figure 6).

Key Findings:

- Timing of seeding cover crops is a very important factor. We usually seeded cover crops around 3 weeks after planting White Corn and other Indigenous

heirloom varieties. Droughts can delay cover crop seeding, but always ensure there is a forecasted rain before seeding.

- Ensuring adequate soil fertility is important, especially when needing to regenerate land that has been under conventional management. Investments may need to be made in fertilizer until the land builds organic matter and soil biology, allowing for better function with respect to nutrient cycling
- The selection of cover crops is important. Certain cover crops complement the White Corn in more beneficial ways by enhancing the weed suppression in the system without competing with the corn, such as winter wheat and dutch white clover. Mixtures of cover crops may be more effective to suppress weeds while enhancing the overall diversity in the system, thus positively contributing to ecosystem function.

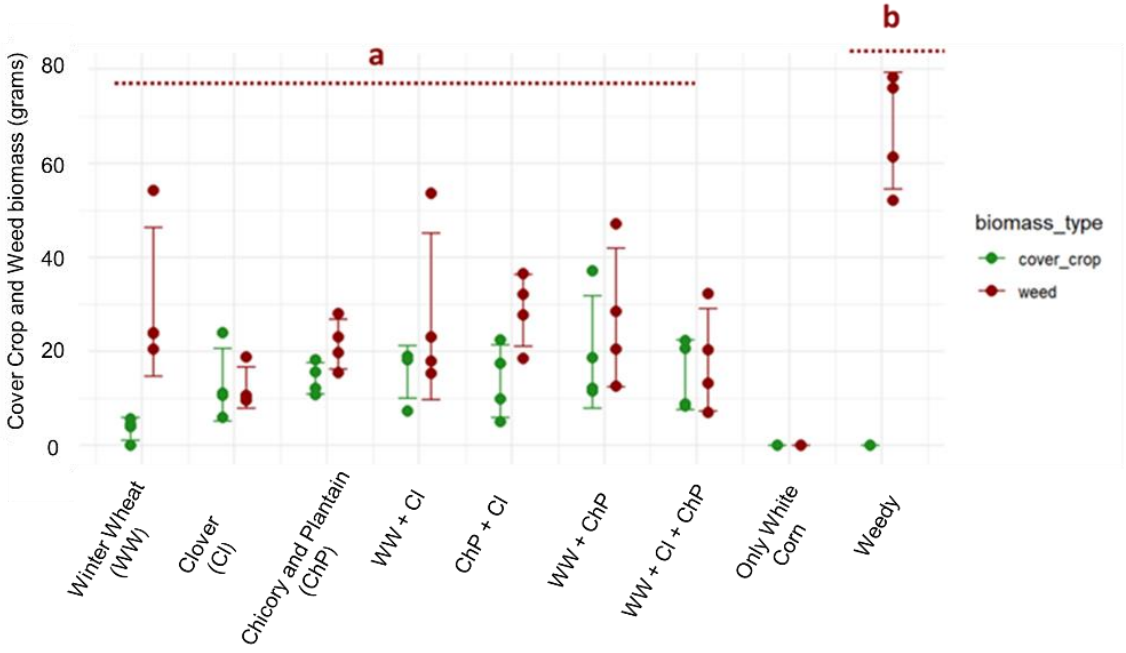
Table 1. Cover crop varieties and seeding rate

Cover Crop	Function	Seeding rate (lbs/acre)	Variety
Winter Wheat	C4 grass	80	Gore Soft Red Beardless
Dutch White Clover	legume	18	Nitro Coat OMRI
Chicory	Leafy forb	8	Endure Chicory
Plantain	Leafy forb	12	Boston

Table 2. List of cover crop mixtures and controls for experiment

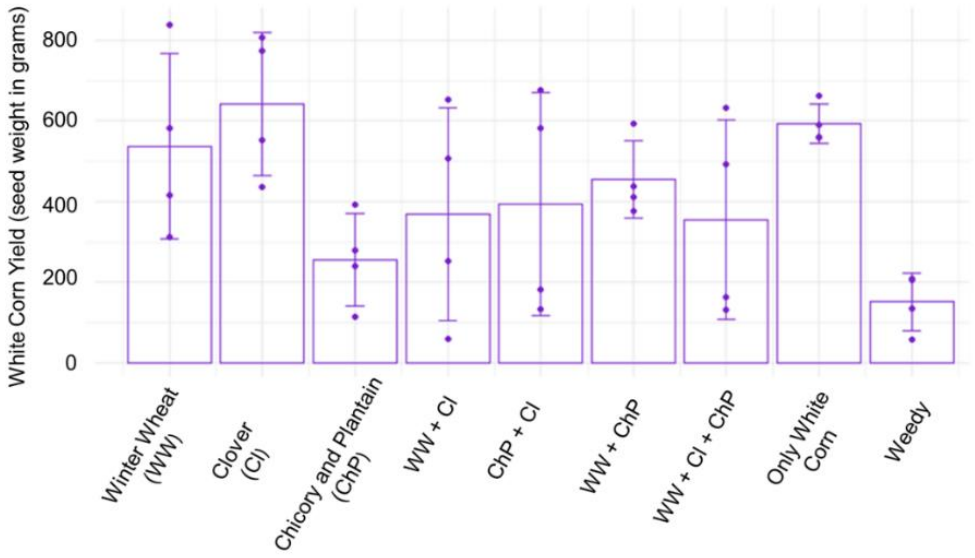
Treatment	Cover Crops
1	Winter Wheat (WW) monoculture
2	White Clover (Cl) monoculture
3	Chicory and Plantain (ChP) monoculture
4	WW + Cl
5	Cl + ChP
6	WW + ChP
7	WW + Cl + ChP
8	Weeded (White Corn monoculture)
9	Left Weedy

Figure 1. Cover Crops reduced weed pressure compared to weedy plots 2021



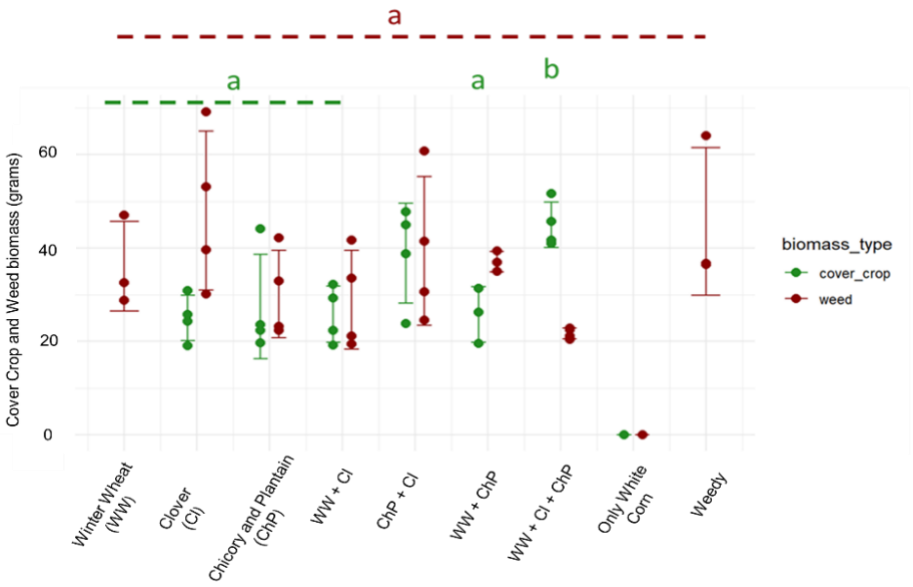
Cover crops and weeds sampled between rows near corn harvest at 110 days using a 43.76 cm X 57.15 cm quadrant and separated for drying. Red ‘a’ and ‘b’ indicate how other weed biomasses are lower statistically than the weedy plot using Dunnetts test ($p < 0.01$)

Figure 2. Clover and Winter Wheat do not reduce from yield compared to just White Corn in 2021



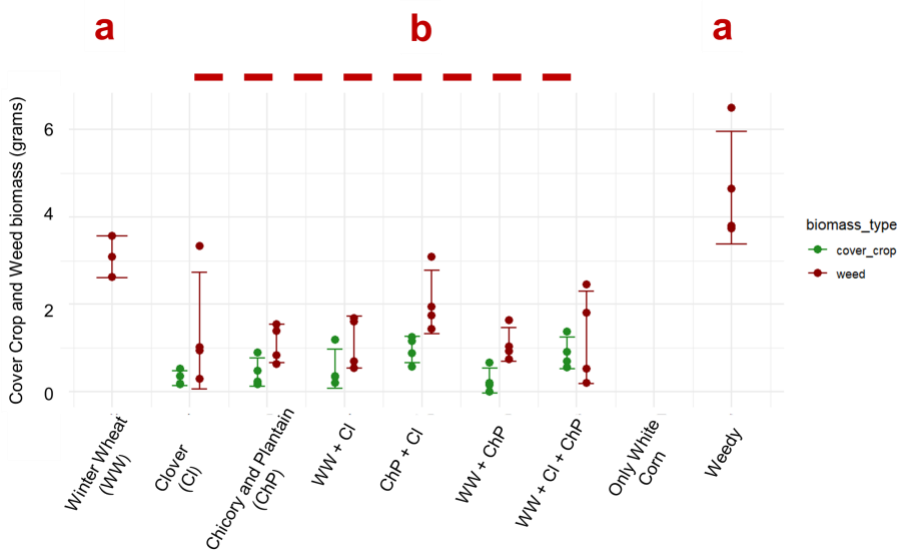
Corn yield taken from 10x12ft research plots for drying and weighing. Dunnett's Test ($p < 0.01$) show Winter Wheat monoculture and Clover monoculture yields higher than weeded control. All other treatments were not different compared to both controls.

Figure 3. Higher composition cover crop mixtures did suppress weeds in 2022



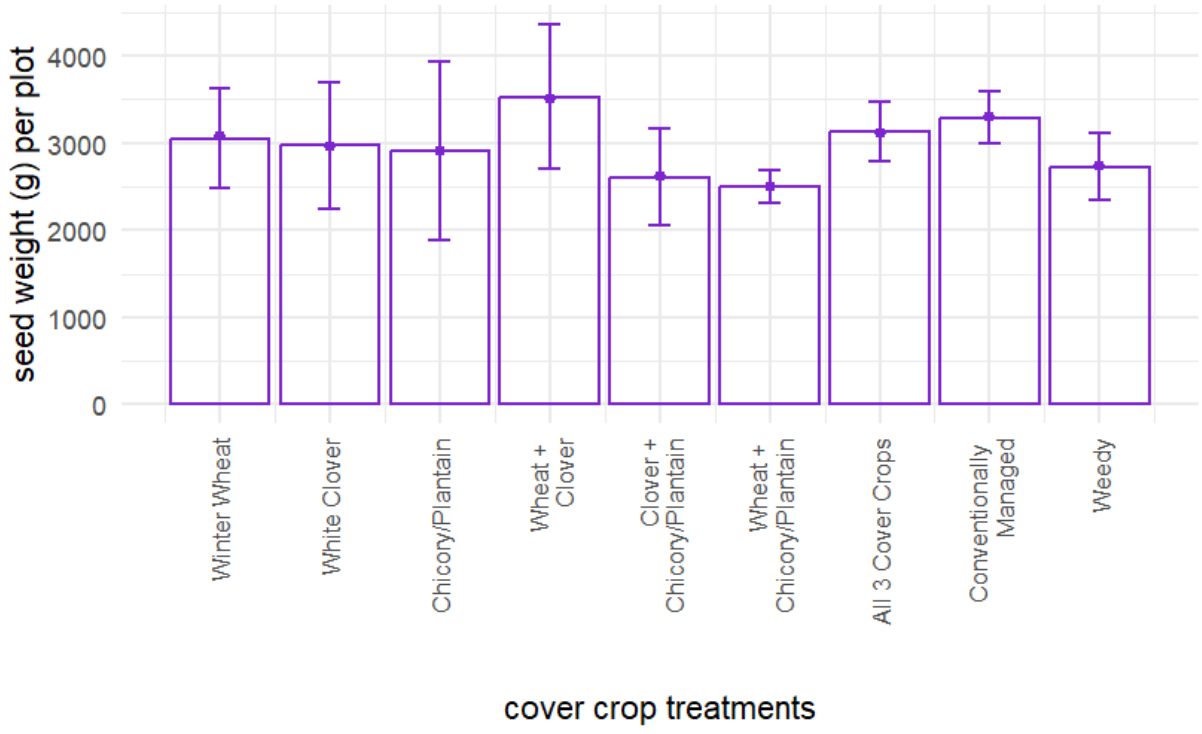
Cover crops and weeds sampled between rows near corn harvest at 110 days using a 43.76 cm X 57.15 cm quadrant and separated for drying. Red 'a' and 'b' indicate how all weed biomasses are the same compared to the weedy control using a Dunnet's Test ($p<0.01$). Green 'a' and 'b' show differences in cover crop biomasses as WW+CL+ChP has highest compared to other cover crop treatments using ANOVA ($p = .079$).

Figure 4. Cover crops still reduce weed pressure even in drought for 2023 experiment



Cover crops and weeds sampled between rows near corn harvest at 110 days using a 43.76 cm X 57.15 cm quadrant and separated for drying. Red ‘a’ and ‘b’ indicate how only winter wheat plots has same weed biomass as weedy control using ANOVA test ($p < .001$)

Figure 6. Cover crops treatments had no impact on yield compared to both weedy and managed plots in 2023



Corn yield taken from 10x12ft research plots for drying and weighing. Dunnett's Test and ANOVA ($p = 0.52$) indicate no overall differences between cover crop treatments and controls.

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