Horse Creek Area Watershed Cover Crop Test Plot

2020 Harvest Results

The 2020 harvest season brought an end to the sixth year of the Horse Creek Area Watershed Council's cover crop test plot. This was our third year of soybeans which is the end of the third round of our corn-soybean rotation. The test plot continues to test five different trials looking for potential differences resulting from changes in tillage practices and the use of cover crops. Soil type within the plot is Rosholt sandy loam with 2-6% slope. All other agronomic practices are the same in each plot. These trials are randomly placed and triplicated in the plot. The five trials are as follows.

Trial 1. No-till without cover crop
Trial 2. No-till with a multispecies cover crop
Trial 3. No-till with cereal rye cover crop
Trial 4. Conventional till with cereal rye cover crop
Trial 5. Conventional till without cover crop

Conventional tillage is simulated with a rotovator type attachment. Rows are planted with a no-till planter with 30-inch row spacing.

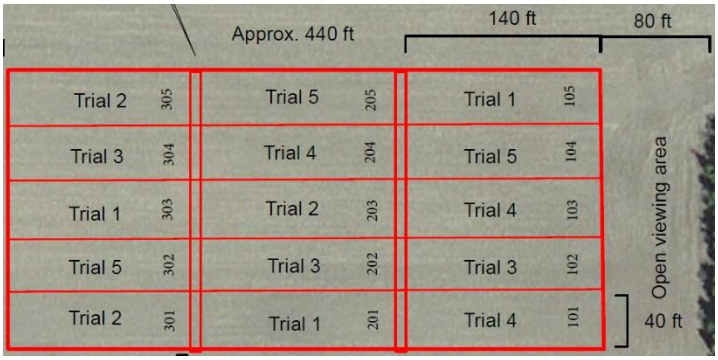

Figure 1: Plot Layout

Soybeans were planted on May 15th at 140,000 seeds per acre. The herbicide program consisted of pre- and post-emergence applications and included herbicides that provide residual weed control. The cover crop was terminated prior to planting. Data was collected on June 5th to document surface residue cover. Differences in surface residue cover can be seen in Figures 2, 3, and 4. On June 23rd plant population counts were conducted. Differences in plant development stage were observed on June 5th and June 23rd. On June 5th the conventional plots were at the early V1 (first trifoliate leaf unfolded) growth stage while the no-till plots were at VC (first trifoliate curled up) growth stage. These differences can be seen in Figures 5 and 6. On June 23rd the conventional plots were at V4, and no-till plots were at V3. Some of the plants in the conventional plots had just started to flower while no flowers were observed in the no-till plots. This difference in plant maturity could be driven by a variety of factors including faster emergence due to warmer soil temperatures or slightly shallower seeding depth. Difference in plant development were also observed in 2019.

Figure 2: Conventional Plot

Figure 3: No-Till, Cereal Rye Plot

Figure 4: No-Till, No Cover Plot

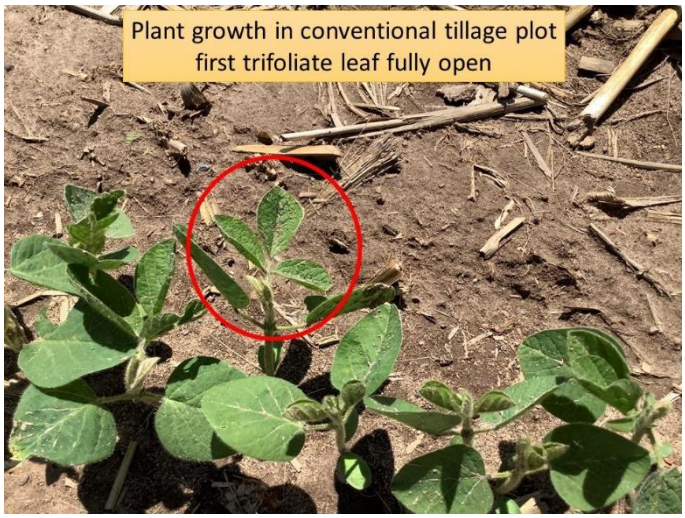

Figure 5: Conventional Plot 6/5/2020

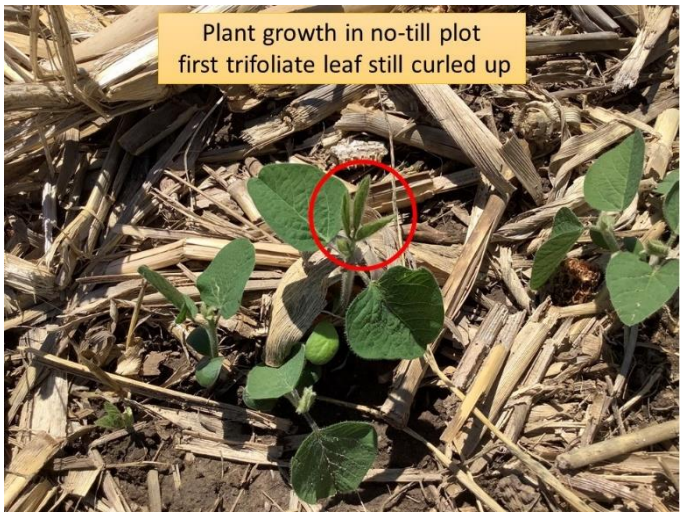

Figure 6: No-Till Plot 6/5/2020

Differences in soybean plant development continued throughout the growing season and were noticeable as plants began to mature and drop leaves. Figure 7 was taken on September 4th when the cover crop was planted. The conventional plots were turning yellow and starting to drop leaves. The no-till plots were still green. Figure 8 compares plant development 6 days later, September 10th, showing conventional plots having reached full maturity while the no-till plots were at full-seed or just beginning maturity.

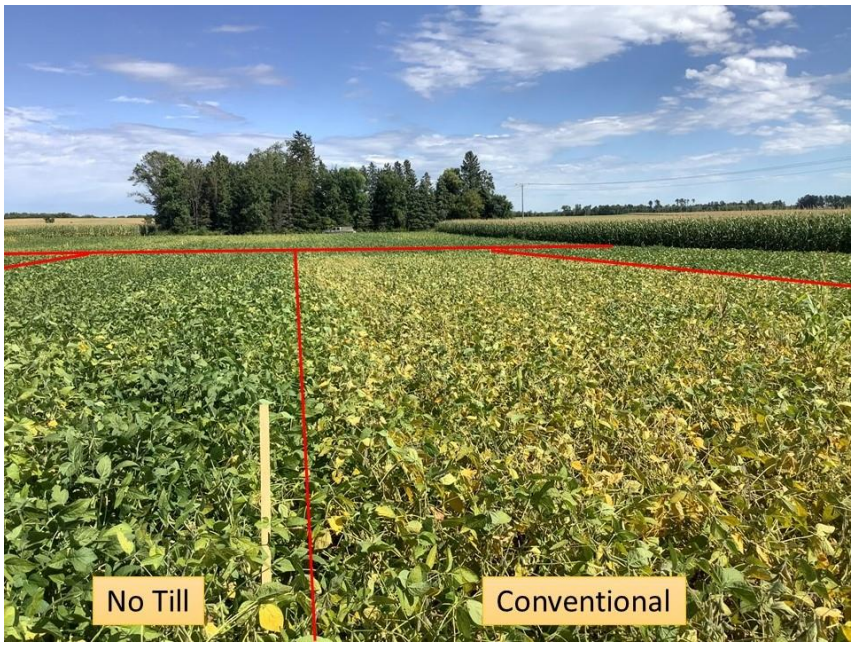

Figure 7: Plant development at cover crop planting 9/4/2020

Figure 8: Plant Development Conventional vs no-till 9/10/2020

2020 Data Analysis

Plant Population, percent residue cover, and yield data are presented in the following 3 tables. Table 1 summarizes trial averages for plant population, residue cover, and yield. Individual plot yield data is shown in Table 2. Individual plot data is displayed in Table 3 with the data color coded from highest value (green) to lowest

value (red). The plots are shown ranked from highest yield to lowest yield. Finally, all six years of yield data is highlighted in Table 4.

Looking at plant population we found statistical differences between the treatments. Overall, the plant population in the conventional plots were statistically higher than the plant population in the no-till plots. There was also a statistical difference in plant population between the conventional, cereal rye and the conventional, no cover plots. Soybean plant population in previous years show a mix of results. In 2016, no-till plots had a statistically higher plant population. In 2018, trials 1, 2, 3, and 4 were statistically similar with trial 5 (conventional, no cover) being statistically higher than the other trials.

The test plot continues to show differences in surface residue (Figures 2, 3, and 4). The conventional plots had an average surface residue cover of 17.5% with the conventional, cereal rye treatment having 1.9% more residue than the conventional, no cover treatment. The differences in residue in the conventionally tilled plots were not statistically different. The no-till plots averaged 91.4% residue cover. The multi-species mix added 4.7% residue and the cereal rye added 6.9% more residue than the no-till, no cover plots. These increases in residue in the no-till plots are significantly different.

	Plant Population (Plants/Acre)	**Residue Cover (%)**	**Yield Average (Adjusted to 15.5% Moisture)**
Trial 1 – no till, no cover	89,000	87.6	55.7
Trial 2 – no till, multi species cover	94,556	92.3	55.0
Trial 3 – no till, cereal rye cover	88,111	94.5	57.1
Trial 4 – conventional, cereal rye cover	100,000	18.4	59.1
Trial 5 – conventional, no cover	111,333	16.5	62.1
Cover Crop *(Trials 2, 3, and 4)*	94,222*	52.0*	57.1
No Cover Crop *(Trials 1 and 5)*	100,167*	68.4*	58.9
No-Till *(Trials 1, 2, and 3)*	90,556	91.4	55.9
Conventional *(Trials 4 and 5)*	105,667	17.5	60.6
No-Till – Cover Crop *(Trials 2 and 3)*	91,333	93.4	56.1
No-Till - No Cover Crop *(Trial 1)*	89,000	87.6	55.7
Conventional – Cover Crop *(Trial 4)*	100,000	18.4	59.1
Conventional – No Cover Crop *(Trial 5)*	111,333	16.5	62.1

Table 1: Trial and Treatment Data **includes conventional and no-till treatments*

The plots were harvested on October 9th. Each trial plot was harvested individually and grain from each plot was weighed in a weigh wagon. Grain moisture and test weight was also recorded (see Table 2). Grain moisture ranged from 9.1% to 10.2%. Test weight ranged from 57 to 58 pounds per bushel. Yield was calculated to a standard moisture of 13%. Individual plot yields ranged from a low of 52.4 bu/ac. to a high of 64.8 bu/ac. The range in soybean yield (12.4 bu/acre) was the largest difference in soybean yield we've seen in the study. The range in previous soybean years was 3.3 bu/acre in 2016 and 8.0 bu/acre in 2018. Based on the trial averages, conventional, no-cover resulted in the highest yield, while no-till, multi-species resulted in the lowest yield. Statistically the only significant difference in yield occurred between the no-till, no cover and the conventional, cereal rye plots. All other trials were statistically the same.

Even though we only had one statistical difference in yield, we still have a large numerical difference between the plots. When we rank all fifteen plots from highest to lowest yield (Table 3), we see that all six conventional plots are in the top seven for yield. Of these six plots, five of them are also in the top seven for plant population. We

see a similar correlation between plant population and yield when we look at the lowest yielding plots. Three of the five lowest yielding plots were also in the lowest five for plant population. We can conclude that low plant population was a factor in low plot yield and that the tillage practice played a roll in the low plant population. However, that difference in yield can't be statistically attributed to any of the plot treatments. Prior years soybean data suggests that tillage practice cannot consistently be attributed to higher plant population or differences in yield.

Plot #	Tillage	Cover Crop	Moisture (%)	Test Weight	Yield (Wet)	Adjusted Yield (13 % moisture)
101	Conventional	Cereal Rye	10.2	57	57.3	59.2
102	No-Till	Cereal Rye	9.2	58	56.8	59.3
103	Conventional	Cereal Rye	10.2	58	56.5	58.4
104	Conventional	No Cover	10.0	58	56.0	58.0
105	No-Till	No Cover	9.7	57	52.7	54.7
201	No-Till	No Cover	9.6	58	54.7	56.9
202	No-Till	Cereal Rye	9.4	57	55.5	57.8
203	No-Till	Multi-species	9.4	57	50.3	52.4
204	Conventional	Cereal Rye	9.1	58	57.3	59.9
205	Conventional	No Cover	9.5	58	61.0	63.4
301	No-Till	Multi-species	9.4	58	54.2	56.5
302	Conventional	No Cover	9.4	57	62.3	64.8
303	No-Till	No Cover	9.3	58	53.2	55.4
304	No-Till	Cereal Rye	9.2	58	51.9	54.1
305	No-Till	Multi-species	9.3	57	54.0	56.3

Table 2: Individual Plot Harvest Data

Plot #	Treatments		Plant Population*	Residue*	Yield*
302	Conventional	No Cover	113,333	17.3	64.8
205	Conventional	No Cover	108,667	19.8	63.4
204	Conventional	Cereal Rye	95,333	19.8	59.9
102	No-Till	Cereal Rye	106,333	96.7	59.3
101	Conventional	Cereal Rye	98,000	18.5	59.2
103	Conventional	Cereal Rye	106,667	17.0	58.4
104	Conventional	No Cover	112,000	12.3	58.0
202	No-Till	Cereal Rye	76,000	92.2	57.8
201	No-Till	No Cover	86,000	86.8	56.9
301	No-Till	Multi-species Blend	101,333	92.3	56.5
305	No-Till	Multi-species Blend	90,667	95.8	56.3
303	No-Till	No Cover	84,333	86.7	55.4
105	No-Till	No Cover	96,667	89.2	54.7
304	No-Till	Cereal Rye	82,000	94.7	54.1
203	No-Till	Multi-species Blend	91,667	88.7	52.4

* Each column above is color coded from highest value (green) to lowest value (red)

Table 3: Individual plot data

2020 completed our third full rotation of corn-soybean. Table 4 shows average yield for each year in the study. Yield for each year is color coded with highest yield in green and lowest in red. Based on our six years of yield data, no trial has consistently had the highest or lowest yields. The only statistically significant differences in yield occurred in 2015, the first year of the study, and this year where we saw a yield difference between Trial 1 and Trial 4. Other observations are that the addition of cover crops in either tillage system is adding surface residue. This surface residue helps reduce erosion and adds organic matter to the soil. The cover crop should also be feeding the soil biology and improving soil characteristics with its root structure. Whether or not this eventually has in impact on yield has yet to be seen. We are also seeing variations from year to year in plant population. The plant population in corn years has been very consistent with no statistical differences. Plant population in soybean years has been more variable with no consistent treatment leading to higher plant population.

		Harvest Year	2015	2016	2017	2018	2019	2020
		Crop	Corn	Soybean	Corn	Soybean	Corn	Soybean
Trial #	Treatment		Yield Average (Bu/Acre)*					
Trial 1	No-Till	No Cover	187.2	66.5	194.0	45.2	188.0	55.7
Trial 2	No-Till	Multi-species Blend	184.3	66.3	186.1	45.8	190.9	55.0
Trial 3	No-Till	Cereal Rye	184.6	66.3	189.9	45.7	187.8	57.1
Trial 4	Conventional	Cereal Rye	191.8	65.3	194.5	43.5	182.1	59.1
Trial 5	Conventional	No Cover	194.8	66.5	191.8	41.9	186.8	62.1

	2015	2016	2017	2018	2019	2020
High	197.2	67.9	205.0	49.1	196.6	64.8
Low	166.7	64.6	181.0	41.1	177.3	52.4
Mean (average)	190.6	66.2	191.3	44.4	187.1	57.8
Standard Deviation	8.5	0.9	7.8	2.6	5.5	3.3
Median	193.6	66.0	188.4	44.2	186.2	57.8
Range	30.5	3.4	24.0	8.1	19.3	12.4

Table 4: Yearly Trial Average Yield and Statistics