



Incorporation of Small Grain and Cover Crop in a Corn-Soybean Rotation, NRCS Demo Farm

Study ID: 0933053202001

County: Dodge

Soil Type: Nora silty clay 6-11% slopes; Moody silty clay loam 2-6% slopes; Belfore silty clay loam 0-2% slope

Planting Date: 5/6/20

Harvest Date: 9/27/20

Population: 140,000

Row Spacing (in): 15

Hybrid: Mycogen® 289E Enlist E3™

Reps: 4

Previous Crop: Corn

Tillage: No-Till

Herbicides: **Pre:** 16 oz/ac ZAAR™, 6 oz/ac Zidua® PRO, 43.98 oz/ac Roundup PowerMAX® on 5/13/20

Post: 31.5 oz/ac Liberty®, 7.25 oz/ac Section® Three, 5.90 oz/ac Superb® HC, 45 oz/ac Warrant®, 2 oz/ac Resource® on 6/26/20

Seed Treatment: Acceleron® E-007 SAT

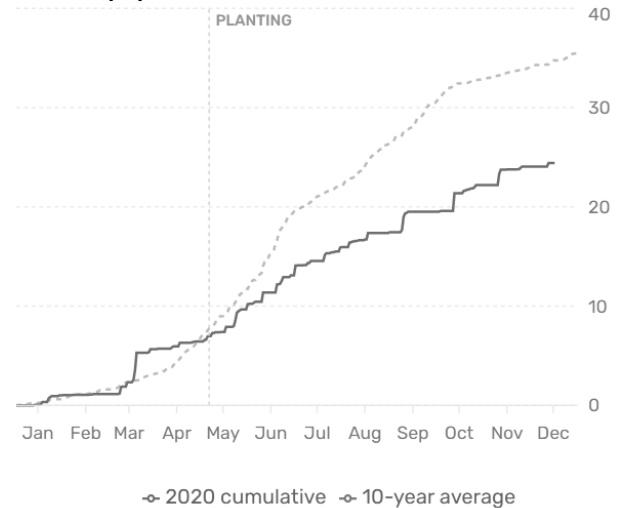
Foliar Insecticides: None

Foliar Fungicides: None

Fertilizer: None

Irrigation: None

Rainfall (in):



Introduction: This study is being conducted on a soil health demonstration farm as part of the Nebraska USDA/Natural Resources Conservation Service's (NRCS) Soil Health Initiative, and involves the farmer, the Nebraska On-Farm Research Network, and the USDA/NRCS. The traditional crop rotation for this producer is a corn and soybean crop rotation with a cover crop following soybeans and no-till residue management. There is interest in intensifying the cropping system by incorporating a cool-season cash crop such as winter wheat and increasing the amount of time living plants are growing in the field. The two treatments, a check and an intensified system, will be used in this five-year study (2017-2022). The check treatment is a corn and soybean rotation with a cover crop following corn and soybeans. The intensive cropping system is a corn, soybean, small grain rotation with cover crop following each cash crop. Both phases of the rotation (corn-soybean) are present each year. This report focuses on the portion of the field with soybean phase in 2020. For the soybean phase in 2020, wheat straw was baled and removed on July 30, 2019, and sold (intensive system plots). An 8-way mix cover crops (20 lb/ac cereal rye, 2 lb/ac radish, 3 lb/ac sunn hemp, 5 lb/ac African cabbage, 8 lb/ac winter pea, 5 lb/ac common vetch, 5 lb/ac buckwheat, and 10 lb/ac spring oats) were drilled on August 3, 2019 following wheat harvest (intensive system plots) and 65 lb/ac cereal rye on September 29 following corn harvest (check plots). Cover crop was terminated on May 13, 2020. Prior to cover crop termination, soybeans were planted on May 6, 2020, and harvested on September 27, 2020. Baseline and soil health measures were collected in 2017, 2019, and 2020 (Table 1).

Results:

Table 1. Soil physical, chemical, and biological properties for check and intensive system treatments.

Treatment	Infiltration (in/hr)	Soil moisture (%)	Bulk density (g/cm ³)	Soil temp. (F)	Soil respiration ¹	Total soil health score ²
2017 (1 sample per treatment replication, n=4 per treatment; samples collected on Nov. 14, 2020)						
Check	1.42 A	24.8 A	1.04 A	43.5 A	3.17 A	16.7 A
Intensive System	1.44 A	24.8 A	1.07 A	42.8 A	3.17 A	16.3 A
P-Value	0.12567	0.968	0.614	0.510	1.0000	0.802

Table 1 Continued

Treatment	Infiltration (in/hr)	Soil moisture (%)	Bulk density (g/cm ³)	Soil temp. (F)	Soil respiration ¹	Total soil health score ²
2019 (1 sample per treatment replication, n=4 per treatment; samples collected on Nov. 6, 2019)						
Check	2.42 A	27.4 A	1.10 A	39.88 A	4.00 A	18.5 A
Intensive System	7.90 A	25.5 A	1.13 A	39.90 A	3.88 A	19.0 A
P-Value	0.223	0.251	0.602	0.718	0.895	0.252
2020 (2 samples per treatment replication, n=8 per treatment; samples collected on Nov. 3, 2020)						
Check	22.1 A	26.1 A	1.21 A	44.2 A	3.38 A	20.1 A
Intensive System	16.7 A	26.4 A	1.15 A	44.4 A	3.00 A	20.2 A
P-Value	0.748	0.784	0.177	0.628	0.377	0.792

¹Soil respiration (Solvita® burst).

²Score based on field assessment. The overall indicator score is based on the sum of 8 indicators (1=degraded, 2=in transition, 3=healthy): soil structure, structure type, surface condition, soil management, soil pores, earthworms, biological activity, and smell. Soil assessment was not completed in 2018 as it was originally planned for every other year interval.

*Values with the same letter are not significantly different at a 90% confidence level.

Table 2. 2020 cover crop biomass and green cover for check and intensive system treatments. Cover crop biomass measured on May 5, 2020.

	Biomass (lbs./acre)	Green cover (%)
Check	358 B	10.7 B
Intensive System	896 A	22.1 A
P-Value	0.0048	0.0196

*Values with the same letter are not significantly different at a 90% confidence level.

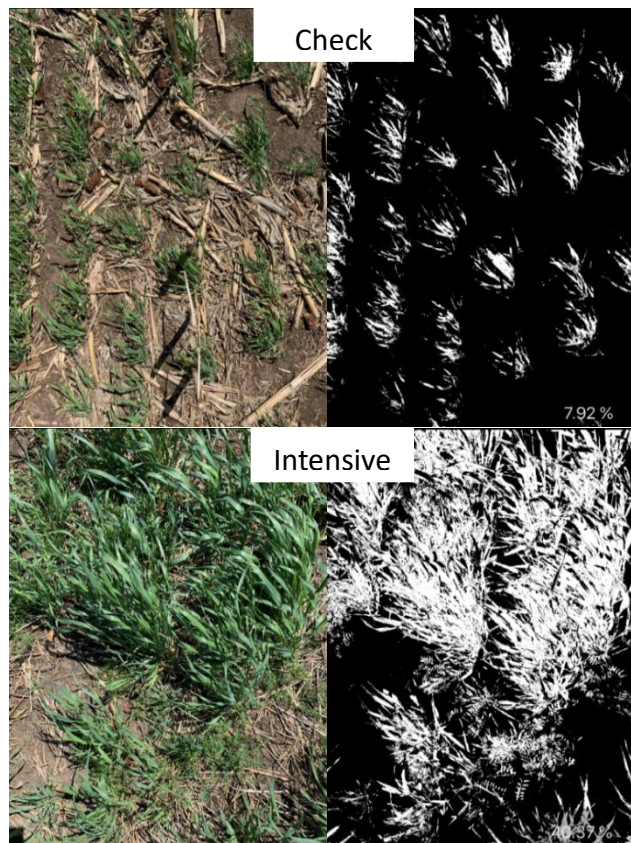


Figure 1. Cover crop green cover of check (top) and intensive system (bottom) strips displayed as true color (left) and using the Canopeo measurement tool (right). Plots where soybean was the 2020 cash crop. Samples collected on May 5, 2020.

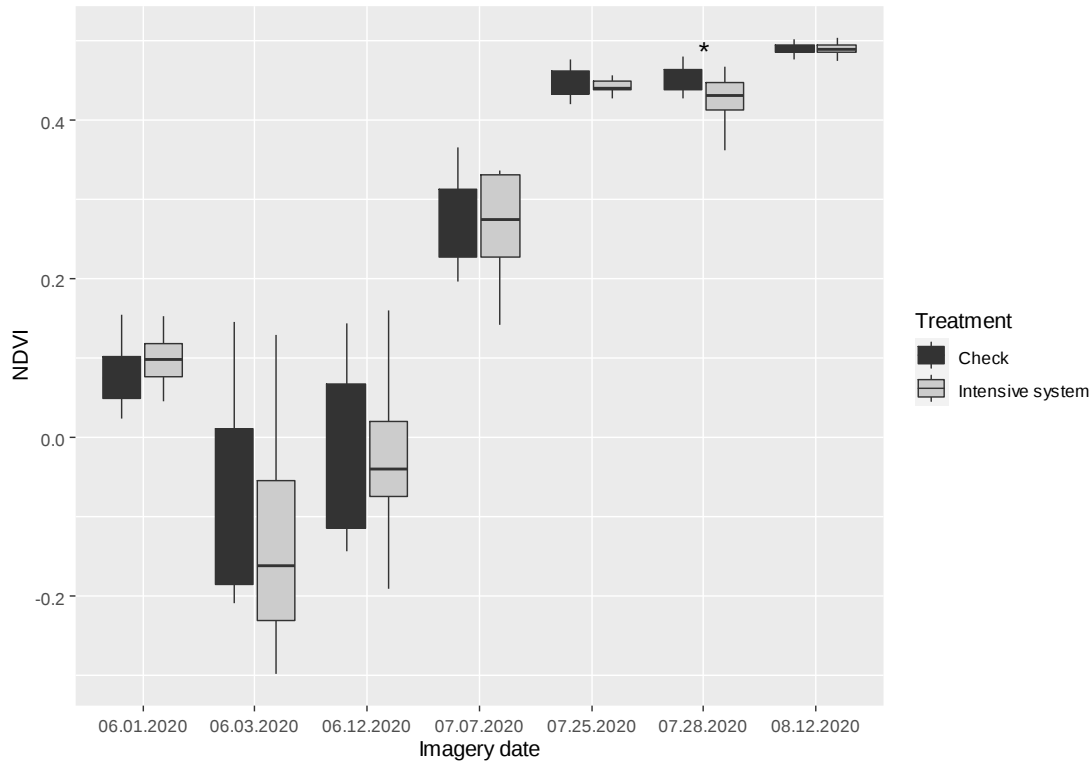


Figure 2. Normalized difference vegetation index (NDVI) values from aerial imagery for the soybean crop following check and intensive management system. Asterisk (*) within each date indicates significant difference ($p < 0.10$) between treatments at 90% confidence level.

Table 3: 2020 soybean moisture, yield, and net return for check and intensive system treatments.

	Moisture (%)	Soybean Yield (bu/ac) [†]
Check	13.5 A	35.7 A
Intensive System	12.5 A	34.7 B
P-Value	0.005	0.009

*Values with the same letter are not significantly different at a 90% confidence level.

[†]Bushels per acre corrected to 13% moisture.

Summary:

- June and July were hot, dry, and windy. On June 3, received .10"; on June 9, received .40" rain with strong southwest winds. On Jun 18, received .80" rain. July did not record any measurable rain events.
- Aerial imagery normalized difference vegetation index (NDVI) analysis showed higher values for soybeans in the check treatment on July 28 (Figure 2).
- There were no differences in soil health parameters between the treatments in 2017, 2019, and 2020. However, there is a trend of increases in infiltration rates and total soil health score over time (Table 1)
- Soybeans planted in the check system had a higher yield than the intensive system strips. These observations are in agreement with the crop vigor analysis (NDVI) that showed higher values in the check strips. Results from previous years follow.

Summary of Previous Years

YEAR ONE | In year one, cover crop (35 lbs/ac winter rye) was drilled across both, check and intensive plots, on October 4, 2016, following soybean harvest. Cover crop was terminated on April 12, 2017. Corn was planted on May 7, 2017, and harvested on October 28, 2017. In 2017, corn had no difference in yield and moisture following check or intensive system.

Table 4. 2017 corn moisture, yield, and net return for check and intensive system treatments.

	Moisture (%)	Corn Yield (bu/acre) [†]
Check	16.4 A	190 A
Intensive System	16.5 A	196 A
P-Value	0.346	0.326

*Values with the same letter are not significantly different at a 90% confidence level.

[†]Bushels per acre corrected to 15.5% moisture.

YEAR TWO | In year two, following corn harvest in 2017, cover crop (50 lbs/ac of winter rye) was drilled on November 7, 2017, in the check and intensive plots. Cover crop mixes were terminated on April 25, 2018. Soybeans were planted in both treatment strips on May 9, 2018, and harvested on October 20, 2018. In 2018, soybeans had no difference in yield following check or intensive system.

Table 5. 2018 soybean moisture, yield, and net return for check and intensive system treatments.

	Moisture (%)	Soybean Yield (bu/acre) [†]
Check	11.5 A	54.2 A
Intensive System	11.4 B	56.9 A
P-Value	0.0972	0.2136

*Values with the same letter are not significantly different at a 90% confidence level.

[†]Bushels per acre corrected to 13% moisture.

YEAR THREE | In year three in the check plots, following soybean harvest, cover crops were drilled on October 24, 2018. The check treatment was a mix of 35 lbs/ac rye, 2 lbs/ac rapeseed, and 1 lbs/ac red clover. Cover crop was terminated on April 23, 2019, then corn was planted on May 12 and harvested on November 1, 2019. In the intensive system plots, wheat was planted following soybean harvest on October 22, 2018, and harvested on July 26, 2019.

Table 6. 2019 corn and wheat moisture, yield, and net return for check and intensive system treatments.

Treatment	Crop	Moisture (%)	Yield (bu/ac) [†]
Check	Corn	17.5	167.2
Intensive System	Wheat	11.7	48.2

[†]Bushels per acre corrected to 15.5% (corn) and 13.5% (wheat) moisture.



In Partnership with:

