

Evaluating the Impact of Monoculture Rye Cover Crop versus Multispecies Cover Crop on Subsequent Crop Yield and Soil Quality Indicators

Study ID: 0732167201901

County: Stanton

Soil Type: Alcester silty clay loam, 2-6% slopes; Moody silty clay loam, 2-6% slopes; Nora silty clay loam, 6-11% slopes; Nora silty clay loam, 11-17% slopes; Nora-Crofton complex, 6-11% slopes

Planting Date: 5/17/19

Harvest Date: 11/4-5/19

Seeding Rate: 30,919

Row Spacing (in): 20

Variety: Golden Harvest® 09Y24-3220A E-Z Refuge

Reps: 4

Previous Crop: Wheat

Tillage: No-Till

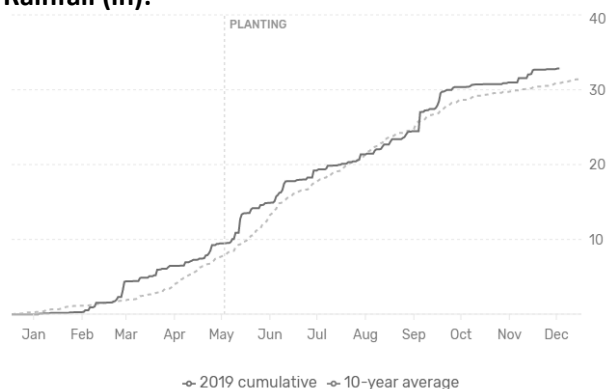
Herbicides: 8 oz/ac 2,4-D, 40 oz/ac glyphosate

Seed Treatment: Avicta® 500 FS

Fertilizer: 5 gal/ac 8-20-8-4-2 on 5/17/19; 150 lb/ac urea and 20 lb/ac AMS on 5/22/19

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. This study compares two treatments, a monoculture rye cover crop versus a cover crop mix. Soil health indicators, soil tests, and yield data are evaluated each year. This is the third year of the study. Cover crops were drilled on July 27, 2018 following wheat harvest in July 2018. The monoculture cover crop was 50 lb/ac cereal rye. The cover crop mix was 30 lb/ac cereal rye, 3 lb/ac red clover, 2 lb/ac rapeseed/canola, and 6 lb/ac hairy vetch. Cover crops were terminated on May 16, 2019 and corn was planted on May 17, 2019.

Results:

Table 1. Baseline soil health test.

	Total Bacteria	Bacteria Gram (+)	Bacteria Gram (-)	Total Fungi	Arbuscular Mycorrhizal	Saprophytes	Protozoa	Undifferentiated	Biomass, PLFA ng/g			
2017 (1 composite sample collected for all replications of a treatment; samples collected on Mar. 2017)												
Rye	1596.8	993.3	603.5	221.2	85.4	135.8	10.6	902.3				
Mix	1651.6	904.8	746.7	379.8	78.5	301.3	24.0	1808.8				
2019 (1 composite sample collected for all replications of a treatment; samples collected on May. 2019)												
Rye	2294.8	1419.3	875.5	648.6	177.4	471.2	16.7	1888.8				
Mix	1723.6	1020.8	702.9	421.4	117.9	303.6	27.1	1753.2				
	Soil pH	Buffer pH	OM %	CO ₂ -C	Total Nitrogen	Organic Nitrogen	Total Organic Carbon	Nitrate	Ammonium	Organic C:N	Soil Health Score	
-----ppm-----												
Rye	6.1	6.7	4.3	118.0	29.7	19.5	186	7.3	1.4	9.5	16.22	
Mix	7.2		4.2	128.0	22.0	15.1	159	5.2	1.3	10.5	15.27	

Table 2. Soil physical, chemical, and biological properties for cover crop and no cover crop treatments. Samples were collected on 11/5/19 (1 sample per treatment replication, 8 samples per treatment).

Treatment	Infiltration (in/hr)	Soil moisture (%)	Bulk density (g/cm ³)	Soil temp. (F)	Soil respiration ¹
Cover Crop – Rye	18.61 A*	25.63 A	1.13 A	36.24 A	3.13 A
Cover Crop – Mix	31.24 A	25.11 A	1.10 A	36.61 A	3.22 A
P-Value	0.378	0.766	0.5083	0.454	0.879

¹Soil respiration (Modified Solvita burst).

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

Table 3. NRCS field assessments of soil health. Samples were collected on 11/5/19 (1 sample per treatment replication, 8 samples per treatment).

Treatment	NRCS Field Assessment of Soil Health							Overall indicator ²
	Structure	Structure type	Surface condition	Soil pores	Earthworm activity	Biological activity	Soil smell	
Cover Crop - Rye	2.06 A	2.00 A	2.56 A	2.75 A	2.56 A	2.25 A	2.38 A	2.45 A
Cover Crop - Mix	2.10 A	2.22 A	2.29 B	2.94 A	2.45 A	2.19 A	2.42 A	2.48 A
P-Value	0.840	0.278	0.078	0.217	0.746	0.414	0.699	0.482

²Score based on field assessment. The overall indicator score is based on the sum of 8 indicators (averaged from 1-3; 1=degraded, 2=in transition, 3=healthy): soil structure, structure type, surface condition, soil management, soil pores, earthworms, biological activity, and smell.

Table 4. Corn yield, moisture, and marginal net return for cover crop mix and monoculture rye treatments.

	Moisture (%)	Corn Yield (bu/ac) [†]	Marginal Net Return [‡] (\$/ac)
Cover Crop - Rye	20.3 A	192 A	708.03 A
Cover Crop - Mix	19.9 A	179 A	655.90 B
P-Value	0.317	0.101	0.085

[†]Yield values are from cleaned yield monitor data. Bushels per acre adjusted to 15.5% moisture.

[‡]Marginal net return based on \$3.83/bu corn, \$27.33/ac for the rye seed and drilling, and \$31.34/ac for the mix seed and drilling.

Summary:

- There was no difference in corn moisture between the mix and monoculture rye cover crop.
- Yield was very close to statistically significant at the 90% confidence level, with the monoculture rye cover crop having a higher yield than the multispecies cover crop.
- The monoculture rye cover crop had a higher net return.

Summary of Previous Year (2018)

2018

In year one, cover crops were drilled in October 2016. The monoculture cover crop was 50 lb/ac rye. The cover crop mix consisted of 35 lb/ac Elbon rye, 0.5 lb/ac Bayou kale, 0.5 lb/ac Impact forage collards, 0.5 lb/ac Trophy rape, 0.5 lb/ac purple top turnip, 0.5 lb/ac African cabbage, 3.5 lb/ac hairy vetch, 30 lb/ac Austrian winter pea, and 2 lb/ac winter lentil. Cover crops were terminated on May 14, 2017 and soybeans were planted on May 25, 2017 and harvested on September 29, 2017. Wheat was planted in October 2017. Wheat yield was obtained for each treatment using yield monitor data with a 15' buffer applied to the treatments.

Results:

	Moisture (%)	Wheat Yield† (bu/ac)
Cover Crop - Rye	14.2 A*	35 A
Cover Crop - Mix	14.6 A	33 A
P-Value	0.591	0.366

†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 13.5% moisture.

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

There was no difference in wheat yield or moisture for the monoculture versus cover crop mix. The field was hailed on June 23, 2018.

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