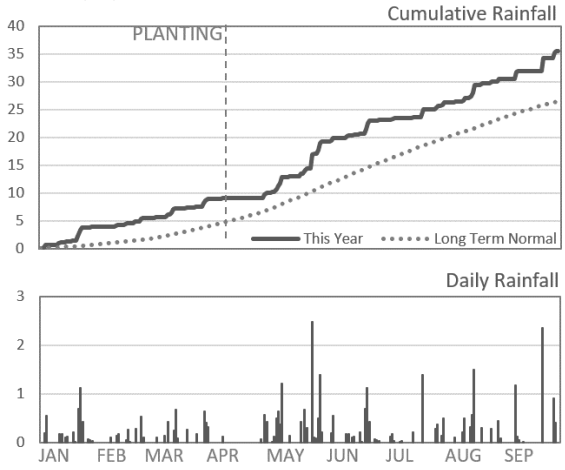
Non-irrigated Corn Following Winter Terminated and Winter Hardy Cover Crop

Study ID: 0656127201901
County: Nemaha
Soil Type: Judson silt loam 0-2% slope; Judson silt loam 2-6% slopes
Planting Date: 4/10/19
Harvest Date: 9/19/19
Seeding Rate: 33,000
Row Spacing (in): 30
Variety: Pioneer® P0688AM™
Reps: 7
Previous Crop: Wheat
Tillage: No-Till
Herbicides: ***Pre:*** 40 oz/ac Resicore®, 32 oz/ac Buccaneer® 5 EXTRA, 16 oz/ac Detonate® on 4/2/19 ***Post:*** 3.2 oz/ac Meso Star and 32 oz/ac Buccaneer® 5 EXTRA on 6/5/19
Foliar Insecticides: 3.84 oz/ac Lambda-Cyhalothrin 1 EC on 7/28/19 aerial applied
Foliar Fungicides: 6.4 oz/ac AzoxyProp Xtra on 6/5/19 with herbicide; 10.5 oz/ac AzoxyProp Xtra on 7/28/19 aerial applied

Fertilizer: 150 lb/ac NPSZ (18 lb/ac N, 67.5 lb/ac P, 7.5 lb/ac S, and 1.5 lb/ac Zn), 75 lb/ac potash, and 7 lb/ac boron 15% on 2/5/19; 150 lb N/ac as 32% UAN on 4/2/19; 6.4 oz/ac N-TENSE™ on 6/5/19; 46 lb N/ac as 46% urea on 6/27/19
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 is the third year of this study. The two treatments, the use of winter terminated cover crops and the use of winter hardy cover crops, will be used in this multi-year study (2016-2021). The cover crops were drilled August 1, 2018. The winter terminated treatment was a mix of 30 lb/ac oats and 1 lb/ac turnip. The winter hardy treatment consisted of 30 lb/ac cereal rye and 1 lb/ac turnip. This study had no cover crop control. Cattle were put out on the cover crop on November 1 and taken off on November 26. For uniformity, both cover crop mixes were sprayed with herbicide to terminate the cover crops on April 2, 2019. Baseline soil health measures (one per treatment) were collected on October 19, 2016 (Table 1). This is the third year of this study for yield data collection. On these treatment strips wheat was planted in 2018 and soybeans were planted in 2017.

Table 1. Soil physical, chemical, and biological properties for winter hardy and winter kill cover crops.

	Bulk density (g/cm^3)	Total pore space (%)	Water Holding Capacity - pores filled (inch H_2O/ft)	Soil moisture (%)	Soil resp[1]	Soil temp (F)	Infiltration (inch/hr)
2016 *(1 composite sample collected for all replications of a treatment; samples collected on Oct. 19, 2016)*							
Winter hardy	1.22	53.84	3.56	-	2.0	59	1.30
Winter terminated	1.32	50.22	3.94	-	2.0	59	1.12
2018 *(1 composite sample collected for all replications of a treatment; samples collected on Oct. 31, 2018)*							
Winter hardy	1.25	52.84	3.27	-	3.5	49.67	0.69
Winter terminated	1.24	52.27	3.18	-	3.4	50.33	0.89
2019 *(1 sample per treatment replication, n=4 per treatment; samples collected on Oct. 24, 2019)*							
Winter hardy	1.19 A			22.6 A	2.88 A	48.83 A	0.72 A
Winter terminated	1.26 A			26.4 A	2.38 A	48.98 A	0.62 A
P-value	0.284			0.195	0.308	0.638	0.599

[1]Soil respiration (Modified Solvita burst).

Table 2. NRCS field assessments of soil health.

	Structure	Structure Type	Soil Surface	Soil Mgmt	Soil Pores	Earth-worm	Soil smell	Biological activity	Overall indicator[2]
2016 *(1 composite sample collected for all replications of a treatment; samples collected on Oct. 24, 2019)*									
Winter Terminated	2.0 A	1.5 A	2.5 A	2.5 A	3.0 A	3.0 A	2.5 A	2.5 A	2.44 A
Winter Hardy	2.0 A	1.5 A	2.5 A	2.5 A	3.0 A	3.0 A	2.5 A	2.5 A	2.44 A
P-Value	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

[2]Score 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 3. Normalized difference vegetation index (NDVI) values from aerial imagery for the corn crop following winter hardy and winter terminated cover crops.

	June 27	July 10	July 14	July 27	Aug 9	Aug 17	Aug 27	Sept 13
Winter Terminated Cover Crop	0.462 A*	0.496 A	0.481 A	0.428 A	0.451 A	0.445 A	0.416 A	0.296 A
Winter Hardy Cover Crop	0.449 A	0.478 A	0.472 A	0.411 A	0.443 A	0.430 A	0.414 A	0.304 A
P-Value	0.345	0.363	0.368	0.351	0.385	0.324	0.485	0.188

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

Table 4. 2019 corn stand counts, test weight, moisture, yield, and net return for winter hardy and winter terminated cover crop treatments.

	Stand Count (plans/ac)	Test Weight (lb/bu)	Moisture (%)	Corn Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Winter Terminated Cover Crop	29,952 A*	57 A	17.7 A	217 A	805.04 A
Winter Hardy Cover Crop	29,429 A	57 A	17.8 A	214 A	792.55 A
P-Value	0.207	0.552	0.891	0.277	0.216

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $3.83/bu corn, $12/ac winter terminated cover crop seed mix, $13.80/ac winter hardy cover crop seed mix, and $14.40/ac drilling cost.

Summary: In 2019, there were no differences in corn population, moisture, test weight, yield, or net return. These observations are in agreement with the crop vigor calculated throughout the corn growing season that showed no differences between the two cover crop treatments.

Summary of Previous Years (Year 1 and 2)

In year one, cover crops were drilled on September 29, 2016. The winter terminated treatment was a mix of oats, turnips, and common rapeseed, whereas the winter hardy treatment consisted of cereal rye, turnips, and common rapeseed. For uniformity, both cover crop mixes were sprayed with glyphosate on April 12, 2017. This terminated the winter hardy treatment and controlled weeds and brassicas, which had overwintered in the winter terminated cover crop treatment. In 2017, soybeans had no difference in yield, test weight, moisture, or net return following the winter terminated and winter hardy cover crops.

Table 3. 2017 soybean stand counts, test weight, yield, and net return for winter hardy and winter terminated cover crop treatments.

	Soybean Stand Count at Harvest (plants/ac)	Soybean Test Weight (lb/bu)	Soybean Moisture (%)	Soybean Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Winter Terminated Cover Crop	102,178 A*	56 A	10.6 A	62 A	518.84 A
Winter Hardy Cover Crop	102,178 A	56 A	10.6 A	61 A	516.42 A
P-Value	1	0.4886	1	0.7345	0.735

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 13% moisture.
‡Marginal net return based on $8.90/bu soybean and $30.07 cost for cover crop seed and drilling in both treatments.

In year two, following soybean harvest in 2017, the two cover crop treatments were drilled in the same locations. In 2018, wheat was planted in this area. No yield measurements were made for the winter terminated and winter hardy cover crop strips.

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