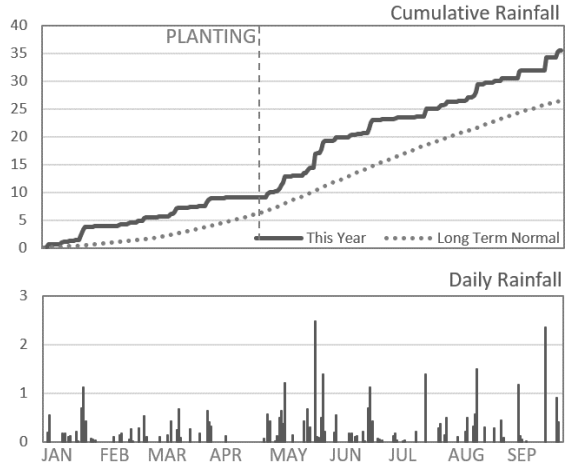
Non-irrigated Soybeans Following Winter Terminated and Winter Hardy Cover Crop

Study ID: 0656127201902
County: Nemaha
Soil Type: Judson silt loam 0-2% slope; Judson silt loam 2-6% slopes
Planting Date: 4/26/19
Harvest Date: 9/26/19
Seeding Rate: 140,000
Row Spacing (in): 30
Variety: Pioneer® P23A32X
Reps: 7
Previous Crop: Corn
Tillage: No-Till
Herbicides: ***Pre:*** 6 oz/ac Sonic®, 24 oz/ac Metalica, 16 oz/ac 2,4-D LV6, and 32 oz/ac Buccaneer® 5 Extra with 6.4 oz/ac Absorb 100 on 4/9/19 ***Post:*** 16 oz/ac Metalica, 16 oz/ac Shafen Star, 8 oz/ac Se-CURE EC, and 32 oz/ac Buccaneer® 5 Extra with 9.6 oz/ac Absorb 100 on 6/19/19
Foliar Insecticides: 3.84 oz/ac Lambda-Cyhalothrin 1 EC aerial applied on 8/15/19
Foliar Fungicides: 10.5 oz/ac AzoxyProp Xtra aerial applied 8/15/19
Fertilizer: 100 lb/ac NPSZ (12 lb/ac N, 45 lb/ac P, 5 lb/ac S, and 1 lb/ac Zn) and 100 lb/ac potash on 2/5/19
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. 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). This is the third year of this study. The cover crops were drilled September 15, 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 did not have a no cover crop control. Cattle were put out on the cover crop on November 1 and removed November 26. For uniformity, both cover crop mixes were sprayed with herbicide to terminate the cover crops on April 9, 2019. Baseline soil health measures (one per treatment) were collected on 10/19/16 (Table 1).

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

Treatment	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	1.43	46.2	3.82	-	-	-	-
Winter terminated	1.15	56.6	3.14	-	-	-	-
2018 *(1 composite sample collected for all replications of a treatment; samples collected on Oct. 31, 2018)*							
Winter hardy	1.204	56.3	2.53	-	3.0	49.0	0.86
Winter terminated	1.375	48.7	3.15	-	3.0	49.5	1.71
2019 *(1 sample per treatment replication, n=4 per treatment; samples collected on Oct. 24, 2019)*							
Winter hardy	1.30 A	-	-	25.7 A	2.9 A	49.5 A	2.00 A
Winter terminated	1.34 A	-	-	22.95 A	2.5 A	48.8 A	9.94 A
P-Value	0.299			0.302	0.520	0.007	0.258

[1]Soil respiration (Modified Solvita burst).

Table 2. NRCS field assessments of soil health.

Treatment	Soil resp[1]	Structure	Mgmt	Soil pores	Earth worm	Soil smell	Biological activity	Overall indicator[2]
2018 *(1 composite sample collected for all replications of a treatment; samples collected on Oct. 31, 2017)*								
Winter hardy	3.0	1.5	2	3	3	3	3	2.31
Winter terminated	3.3	1.5	2	3	2	3	3	2.19
2019 *(1 sample per treatment replication, n=4 per treatment; samples collected on Oct. 24, 2019)*								
Winter hardy	2.88 A	2.13 A	2.50 A	3.00 A	2.88 A	2.63 A	2.63 A	2.48 A
Winter terminated	2.50 A	2.13 A	2.50 A	2.88 A	2.88 A	2.50 A	2.50 A	2.44 A
P-Value	0.520	1.0	1.0	0.391	1.0	0.391	0.391	0.2152

[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 soybean 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	0.283 A*	0.424 B	0.459 B	0.455 B	0.495 B	0.508 B	0.493 A	0.408 A
Winter Hardy Cover Crop	0.286 A	0.433 A	0.468 A	0.460 A	0.497 A	0.510 A	0.494 A	0.416 A
P-Value	0.513	0.048	0.015	0.016	0.011	0.059	0.283	0.102

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

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

	Stand Count (plants/ac)	Test Weight (lb/bu)	Moisture (%)	Soybean Yield (bu/acre)†	Marginal Net Return‡ ($/ac)
Winter Terminated Cover Crop	100,519 A*	56 A	12.6 A	84 A	652.21 A
Winter Hardy Cover Crop	93,884 B	56 A	12.9 A	86 A	670.35 A
P-Value	0.099	0.629	0.447	0.693	0.719

*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 $8.10/bu soybean, $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 soybean yield, moisture, test weight, or net return between the winter terminated and winter hardy cover crop. Soybean stand counts taken at harvest were lower for the soybean following winter hardy cover crop.

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, wheat was planted and no measurements were made on the winter terminated and winter hardy cover crop strips. No yield measurements were made to compare wheat yield on the two treatments.

In year two, following wheat harvest, winter terminated and winter hardy cover crops were drilled in the same strips on August 1, 2017. The winter terminated treatment was a mix of 30 lb/ac oats, 1.5 lb/ac canola/rapeseed, and 1 lb/ac turnip. The winter hardy treatment consisted of 30 lb/ac cereal rye, 1.5 lb/ac canola/rapeseed, and 1 lb/ac turnip. Both cover crop mixes were sprayed with herbicide to terminate the cover crops on April 4, 2018. Corn was planted in April 2018 and measurements on the corn following the winter hardy and winter terminated cover crop are in Table 3.

Table 3. 2018 corn stand counts, test weight, yield, and net return for winter hardy and winter terminated cover crop treatments.

	Stand Count (plants/ac)	Test Weight (lb/bu)	Moisture (%)	Corn Yield† (bu/ac)	Marginal Net Return‡ ($/ac)
Winter Terminated	29,710 A*	56 A	20.7 A	243 A	759.43 A
Winter Hardy	29,515 A	56 A	20.9 A	240 A	748.71 A
P-Value	0.677	0.226	0.516	0.281	0.283

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture for corn.
‡Marginal net return based on $3.23/bu corn, $12.48/ac winter terminated cover crop seed mix, $12.45/ac winter hardy cover crop seed mix, and $14.40/ac drilling cost.

In 2018, corn planted after winter terminated cover crops had no difference in yield, test weight, moisture, or net return.

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