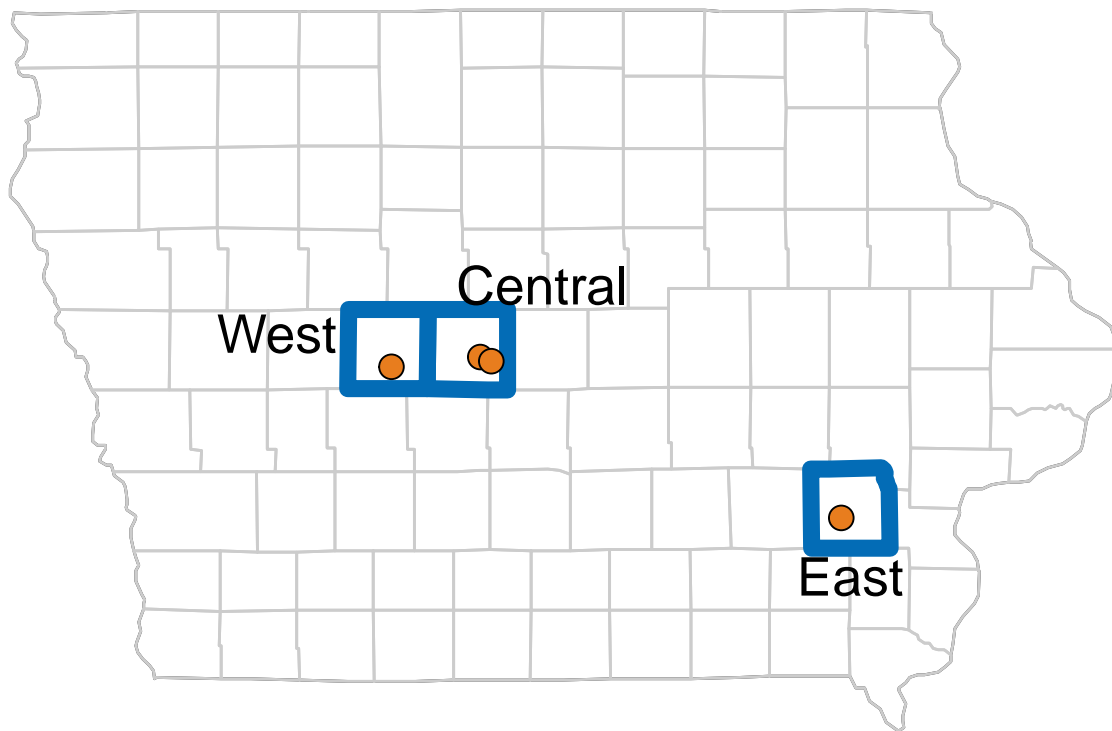


Supplementary Material for ‘Winter Cover Cropping Effects on Soil Water-Holding Capacity Vary by Site’

Nichols et al. 2021

6/15/2021

Map of sites



General Site Management Summary

Table 1: General Site Description

| Site Description | General Location | Treatment Description | Year of Initiation | Crop Planted in 2019 | Number of Treatment Replicates | Sampled in 2019 |
|------------------|----------------------------|----------------------------------------------------------------------|--------------------|----------------------|--------------------------------|-----------------|
| Central Grain | Boyd Farm, Boone, field 44 | maize/soybean grain rotation, with and without rye cover crop | 2009 | maize | 5 | Y |
| | Boyd Farm, Boone, field 42 | maize/soybean grain rotation, with and without rye cover crop | 2009 | soy | 5 | Y |
| Central Silage | Boyd Farm, Boone, field 44 | maize silage/soybean grain rotation, with and without rye cover crop | 2002 | maize silage | 5 | Y |
| | Boyd Farm, Boone, field 42 | maize silage/soybean grain rotation, with and without rye cover crop | 2002 | soy | 5 | N |
| West | Jefferson, IA | maize/soybean grain rotation, with and without rye cover crop | 2008 | maize | 4 | Y |
| East | Washington, IA | maize/soybean grain rotation, with and without rye cover crop | 2009 | soybeans | 4 | Y |

Table 2: 2018-2019 Herbicide Use

| Site Description | Herbicides Used in 2018 Growing Season | Herbicides Used in Fall 2018 | Herbicides Used in Spring 2019 |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Central Grain | glyphosate 1 week before soybean planting | none | glyphosate 1 week before maize planting; metalochlor, atrazine, and mesotrione at planting |
| Central Grain | glyphosate 1 week before maize planting; metalochlor, atrazine, and mesotrione at planting | none | glyphosate 1 week before soybean planting |
| Central Silage | glyphosate 1 week before soybean planting | none | glyphosate 1 week before maize planting; metalochlor, atrazine, and mesotrione at planting |
| Central Silage | glyphosate 1 week before maize planting; metalochlor, atrazine, and mesotrione at planting | none | glyphosate 1 week before soybean planting |
| West | glyphosate before planting; glyphosate and fluthiacet-methyl at planting | none | glyphosate before planting; glyphosate and fluthiacet-methyl at planting |
| East | glyphosate and acetochlor before planting (April 15), atrazine, acetochlor at planting (May 14); acetochlor and glyphosate after planting (June 15) | none | chlorimuron-ethyl, flumioxazin, pyroxasulfone, and glyphosate before planting, dicamba and acetochlor after planting |

Table 3: General Management

| Site Description | General Herbicide Regime | General Date of Cover Crop Termination | General Date of Crop Planting | Inorganic Fertilizer Used | Organic Fertilizer Used | Tillage Used |
|------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------|----------------------------------------|---------------------------------|-------------------------------------------------------------------------------|-----------------|
| Central Grain | burndown, residual herbicide at maize planting | 15-Apr | 26-Apr | Y | NA | N |
| Central Grain | burndown, residual herbicide at maize planting | 25-Apr | 5-May | Y | NA | N |
| Central Silage | burndown, residual herbicide at maize planting | 15-Apr | 26-Apr | Y | NA | N |
| Central Silage | burndown, residual herbicide at maize planting | 25-Apr | 5-May | Y | NA | N |
| West | burndown, pre-emergent herbicide | 1-May | 10-May | Y | chicken or turkey manure | N |
| East | burndown, residual herbicide at planting, another application on maize at ~V6 | 1-May | 5-May | Y | liquid swine, ~3000 gal/ac every other year to entire field | N |

Cover crop biomass production over past 10 years of trials

Table 4: Historical cover crop biomass production (Mg/ha) by trial

| trial | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2019 | 2018 |
|----------------|------|------|------|------|------|------|------|------|------|------|
| Central_grain | 0.86 | 0.28 | 1.37 | 0.25 | 0.47 | 0.61 | 2.22 | 2.76 | 1.29 | NA |
| Central_silage | 1.59 | 1.72 | 3.32 | 1.26 | 0.91 | 1.76 | 4.23 | 2.21 | 2.05 | NA |
| East_grain | 2.11 | 1.46 | 0.00 | 0.92 | 0.00 | 0.36 | 0.51 | 7.30 | 0.30 | 0.19 |
| West_grain | 2.11 | 0.21 | 1.33 | 0.00 | 0.00 | 0.04 | 0.45 | 0.63 | 0.00 | 0.09 |

Statistical Results

Table 5: Statistical analysis of cover crop effect on clay

| site_sys | respvar | cc | no | contrast | est_diff | diff_se | diff_pval |
|----------------|---------|--------|--------|----------|----------|---------|-----------|
| Central_grain | clay | 27.740 | 28.000 | cc - no | -0.260 | 0.186 | 0.164 |
| Central_silage | clay | 28.751 | 29.895 | cc - no | -1.144 | 0.208 | <0.001 |
| East_grain | clay | 31.730 | 34.606 | cc - no | -2.876 | 0.208 | <0.001 |
| West_grain | clay | 27.349 | 29.511 | cc - no | -2.162 | 0.208 | <0.001 |

Table 6: Statistical analysis of cover crop effect on sand

| site_sys | respvar | cc | no | contrast | est_diff | diff_se | diff_pval |
|----------------|---------|--------|--------|----------|----------|---------|-----------|
| Central_grain | sand | 32.486 | 31.600 | cc - no | 0.886 | 0.299 | 0.003 |
| Central_silage | sand | 29.811 | 29.233 | cc - no | 0.578 | 0.335 | 0.085 |
| East_grain | sand | 12.715 | 9.837 | cc - no | 2.877 | 0.335 | <0.001 |
| West_grain | sand | 30.506 | 25.610 | cc - no | 4.896 | 0.335 | <0.001 |

Table 7: Statistical analysis of cover crop effect on organic matter, with and without sand covariate

| cov | site_sys | respvar | cc | no | contrast | est_diff | diff_se | diff_pval |
|--------------|----------------|---------|-------|-------|----------|----------|---------|-----------|
| none | Central_grain | om | 2.360 | 2.480 | cc - no | -0.120 | 0.051 | 0.02 |
| none none | Central_silage | om | 2.640 | 2.416 | cc - no | 0.224 | 0.057 | <0.001 |
| | East_grain | om | 3.575 | 3.675 | cc - no | -0.100 | 0.057 | 0.082 |
| | West_grain | om | 2.750 | 2.975 | cc - no | -0.225 | 0.057 | <0.001 |
| sand | Central_grain | om | 3.034 | 3.066 | cc - no | -0.032 | 0.082 | 0.696 |
| sand sand | Central_silage | om | 3.049 | 2.772 | cc - no | 0.278 | 0.088 | 0.002 |
| | East_grain | om | 2.290 | 2.105 | cc - no | 0.185 | 0.093 | 0.048 |
| | West_grain | om | 3.228 | 2.968 | cc - no | 0.260 | 0.096 | 0.007 |

Table 8: Mean bulk density (g/cm3) by trial

| site_name | sys_trt | crop_trt | cc_trt | bulkden_mean | bulkden_sd |
|--------------|---------|----------|--------|--------------|------------|
| Central | grain | soy | cc | 1.42 | 0.08 |
| Central | grain | soy | no | 1.37 | 0.07 |
| | silage | soy | cc | 1.46 | 0.06 |
| | silage | soy | no | 1.44 | 0.07 |
| East East | grain | soy | cc | 1.44 | 0.05 |
| | grain | soy | no | 1.49 | 0.04 |
| West West | grain | corn | cc | 1.57 | 0.14 |
| | grain | corn | no | 1.47 | 0.21 |

Table 9: Statistical analysis of cover crop effect on bulk density, with and without sand covariate

| cov | site_sys | respvar | cc | no | contrast | est_diff | diff_se | diff_pval |
|------|----------------|---------|-------|-------|----------|----------|---------|-----------|
| none | Central_grain | bd | 1.422 | 1.374 | cc - no | 0.048 | 0.010 | <0.001 |
| | Central_silage | bd | 1.464 | 1.436 | cc - no | 0.028 | 0.011 | 0.012 |
| none | East_grain | bd | 1.437 | 1.488 | cc - no | -0.050 | 0.011 | <0.001 |
| none | West_grain | bd | 1.573 | 1.472 | cc - no | 0.101 | 0.011 | <0.001 |
| sand | Central_grain | bd | 1.309 | 1.275 | cc - no | 0.033 | 0.013 | 0.011 |
| | Central_silage | bd | 1.395 | 1.386 | cc - no | 0.010 | 0.014 | 0.483 |
| sand | East_grain | bd | 1.653 | 1.752 | cc - no | -0.098 | 0.015 | <0.001 |
| sand | West_grain | bd | 1.493 | 1.473 | cc - no | 0.020 | 0.015 | 0.188 |

Soil moisture (%vol) at saturation

Table 10: Statistical analysis of cover crop effect on soil water at saturation, with and without sand covariate

| cov | site_sys | term | contrast | estimate | std.error | df | statistic | adj.p.value | param |
|------|----------------|--------|-----------|----------|-----------|--------|-----------|-------------|------------|
| sand | Central_grain | cc_trt | cc effect | -0.013 | 0.008 | 26.000 | -1.688 | 0.103 | saturation |
| | Central_silage | cc_trt | cc effect | 0.004 | 0.008 | 26.000 | 0.510 | 0.614 | saturation |
| sand | East_grain | cc_trt | cc effect | 0.011 | 0.009 | 26.000 | 1.271 | 0.215 | saturation |
| sand | West_grain | cc_trt | cc effect | -0.007 | 0.009 | 26.000 | -0.729 | 0.473 | saturation |
| none | Central_grain | cc_trt | cc effect | -0.016 | 0.008 | 13.050 | -1.959 | 0.072 | saturation |
| | Central_silage | cc_trt | cc effect | 0.002 | 0.009 | 14.068 | 0.246 | 0.809 | saturation |
| none | East_grain | cc_trt | cc effect | 0.002 | 0.009 | 13.050 | 0.228 | 0.823 | saturation |
| none | West_grain | cc_trt | cc effect | -0.022 | 0.009 | 13.050 | -2.430 | 0.030 | saturation |

Soil moisture (%vol) at field capacity (-100 cm water)

Table 11: Statistical analysis of cover crop effect on soil water at field capacity, with and without sand covariate

| cov | site_sys | term | contrast | estimate | std.error | df | statistic | adj.p.value | param |
|------|----------------|--------|-----------|----------|-----------|--------|-----------|-------------|----------------|
| sand | Central_grain | cc_trt | cc effect | -0.002 | 0.006 | 26.000 | -0.430 | 0.671 | field capacity |
| | Central_silage | cc_trt | cc effect | 0.012 | 0.006 | 26.000 | 2.041 | 0.052 | field capacity |
| sand | East_grain | cc_trt | cc effect | -0.002 | 0.006 | 26.000 | -0.353 | 0.727 | field capacity |
| sand | West_grain | cc_trt | cc effect | 0.012 | 0.007 | 26.000 | 1.835 | 0.078 | field capacity |
| none | Central_grain | cc_trt | cc effect | -0.004 | 0.005 | 13.044 | -0.800 | 0.438 | field capacity |
| | Central_silage | cc_trt | cc effect | 0.012 | 0.006 | 14.005 | 2.242 | 0.042 | field capacity |
| none | East_grain | cc_trt | cc effect | -0.007 | 0.006 | 13.044 | -1.317 | 0.211 | field capacity |
| none | West_grain | cc_trt | cc effect | 0.003 | 0.006 | 13.044 | 0.597 | 0.561 | field capacity |

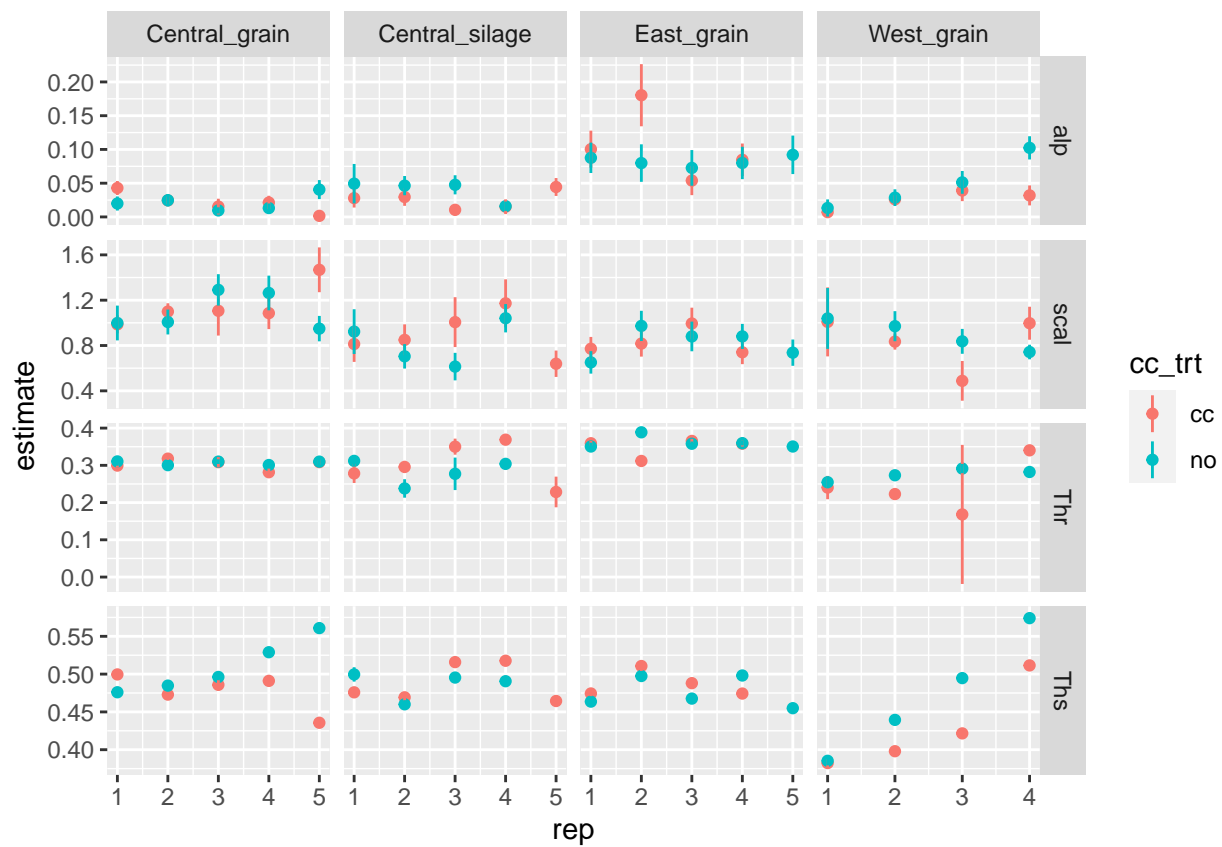


Figure 1: Non-linear model fitted parameters