Effect of Agronomic Practices on Soil Health and Water Quality

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WRMG, LLC

Can Healthy Soil Harvest More Rain?
Horse Creek, WI
March 23, 2022

Presentation Topics

1. Project Overview
2. Methods: Rainfall Simulation and Soil Health
3. On-Farm Results
    1. Conventional / Intensive Tillage
    2. Conservation Tillage
    3. Strip Tillage
    4. No-Till
4. Horse Creek Plot Data
5. Future Work

“Covering ground: investigation of cover crops for soil health in the Great Lakes Region”

NRCS On-Farm CIG

United States Department of Agriculture
NRCS
Natural Resources Conservation Service

Collaborating Watershed Groups

Ohio: Ohio Farm Bureau
Illinois: Soil and Water Health Coalition
Michigan: River Raisin Watershed Council
Wisconsin:

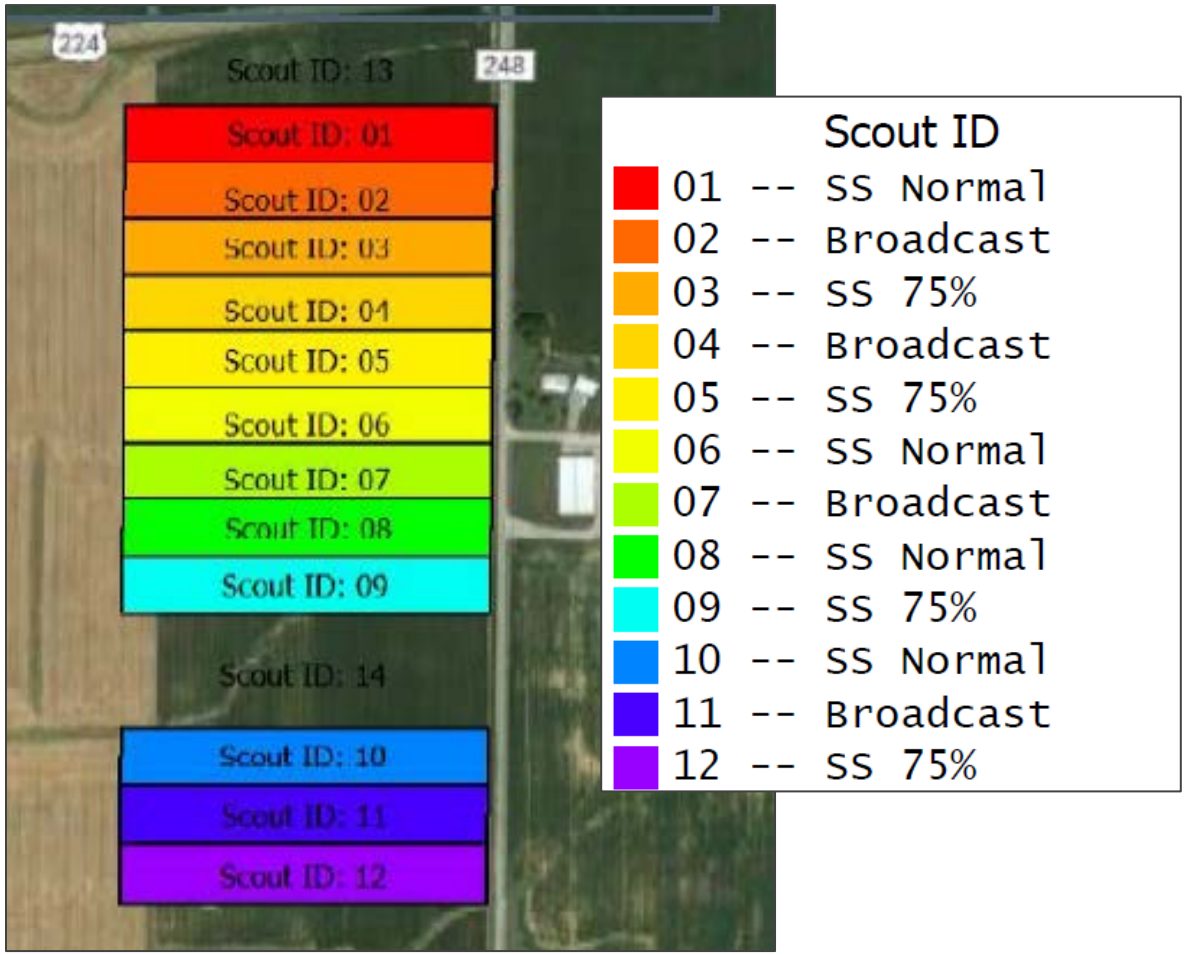
- Clean Farm Families
- Grant County Watershed Pride
- Horse Creek Area Farmer-Led Watershed
- Lafayette Ag Stewardship Alliance

Major Project Activities

- On-Farm Demonstrations / Evaluation
  - Replicated Plots or Paired Basins
  - Water Quality (rainfall simulation, edge-of-field runoff)
  - Resiliency (rainout shelter, rainfall simulation)
  - Soil Health Evaluation
  - Social Evaluation
  - Economic Evaluation
- LWG Incentive Programs to Encourage Adoption ($10k/year x 3 years)
- Outreach and Education Conducted by LWG ($5k/year x 5 years)

Blanchardville Watershed Demonstration Farm

Impact of Fertilizer Placement and Rate Evaluations: Rainfall Simulation & Soil Health



Illinois Soil and Water Health Coalition
Greg Thoren Farm

Impact of Cover Crops

Paired-Basin

Edge-of-Field Runoff Monitoring

Illinois Soil and Water Health Coalition
Greg Thoren Farm

Field Plots
Cover Crop Mixes
Corn Row Spacing 30” and 60”

Control:
Conventional Tillage, No Cover Crop

Treatments (4 replications):
1. No-till, No Cover Crop
2. No-till, Black Medic
3. No-till, Radish/Turnip/Brassica
4. No-till, Vetch

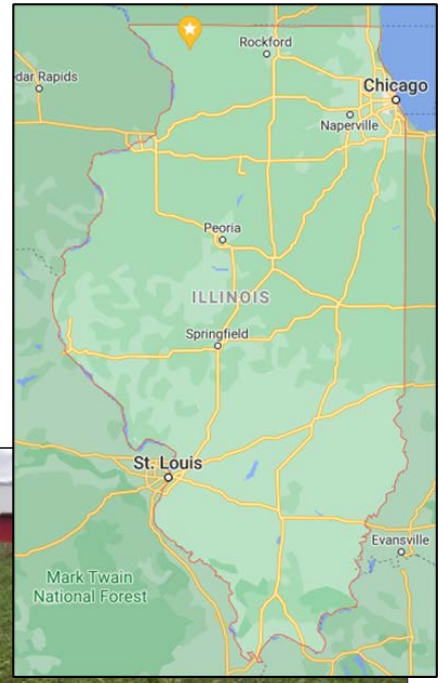
Illinois Soil and Water Health Coalition
Hawley Family Farm

Interseeded Cover Crops in 30’ and 60” Row Corn

Replicated Field Plots / Rainfall Simulation & Soil Health

Illinois Soil and Water Health Coalition
Koester Organic Acres

Grazing Systems versus Harvested Crop
Replicated Plots / Rainfall Simulation & Soil Health



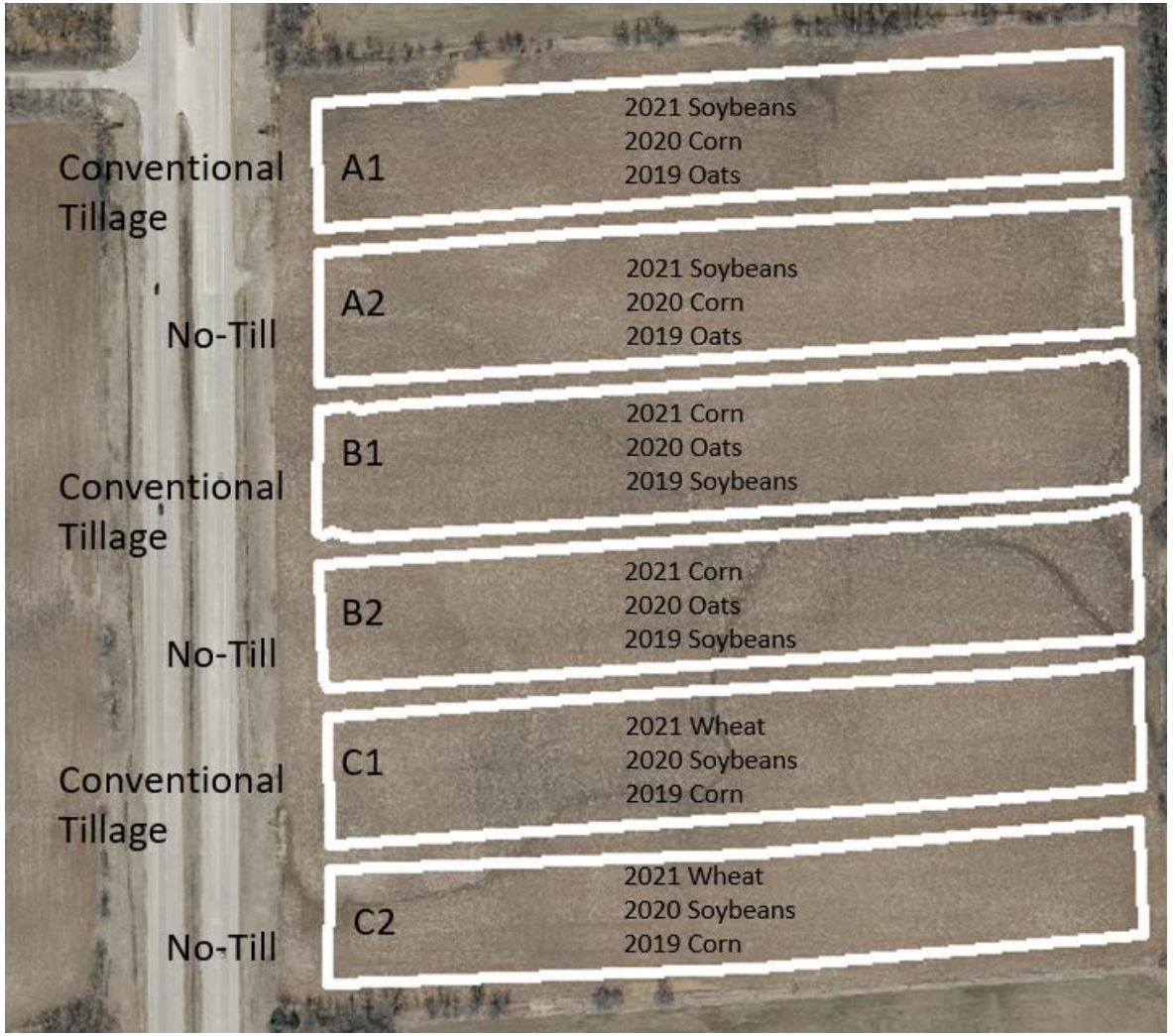
Michigan River Raisin Watershed Council

- Edge-of-Field Runoff
- Wetland Treatment Train

Milwaukee River Watershed
Clean Farm Families

Highway 57 Plots

- Replicated Plots
  (Corn, Oats, Soybean)
- Conventional Tillage
- No-Till



Grant County Watershed Pride

Stone Front Dairy

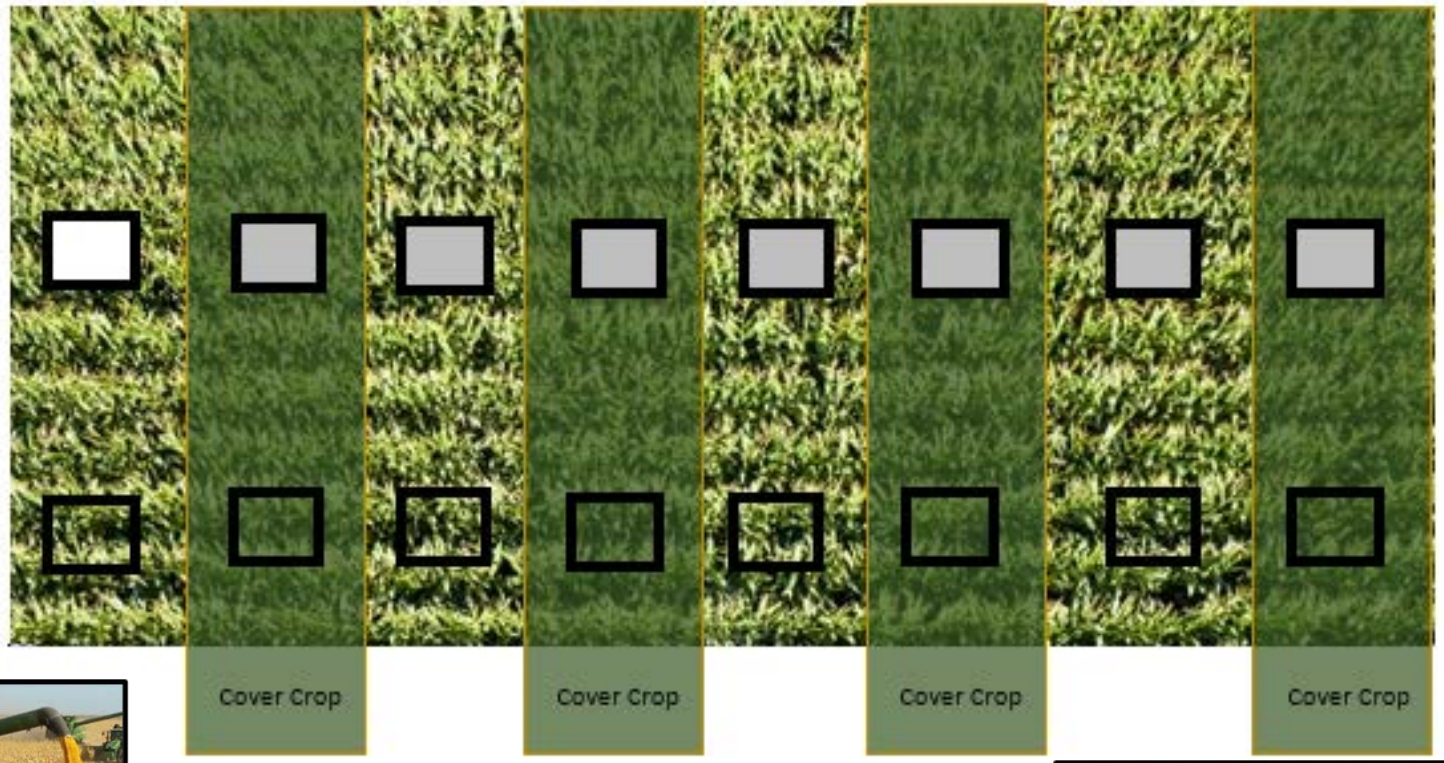
- Edge-of-Field Runoff
- Paired Basins

Lafayette Ag Stewardship Alliance

Multiple Locations

- Berget Family Farms
- Darlington Ridge Dairy

Broadcast Manure
Strip Till Cropland
With and Without Cover Crop



Lafayette Ag Stewardship Alliance

Highway Dairy Farms

- Edge-of-Field Paired Bas
- Broadcast Manure
- Conventional Tillage
- With Cover Crop
- Without Cover Crop

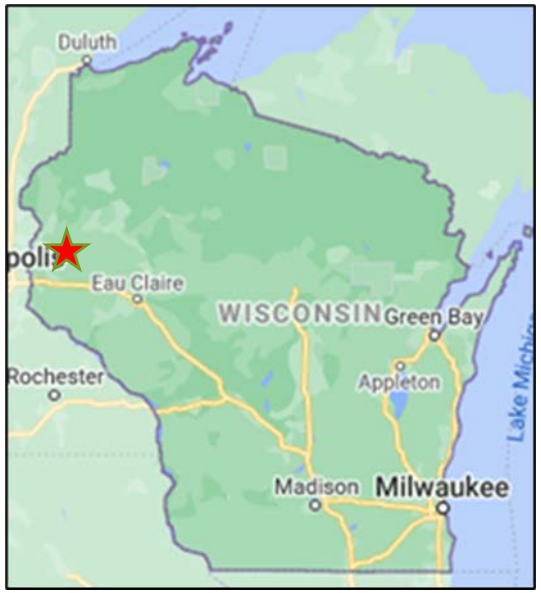
Peak Forage, LLC

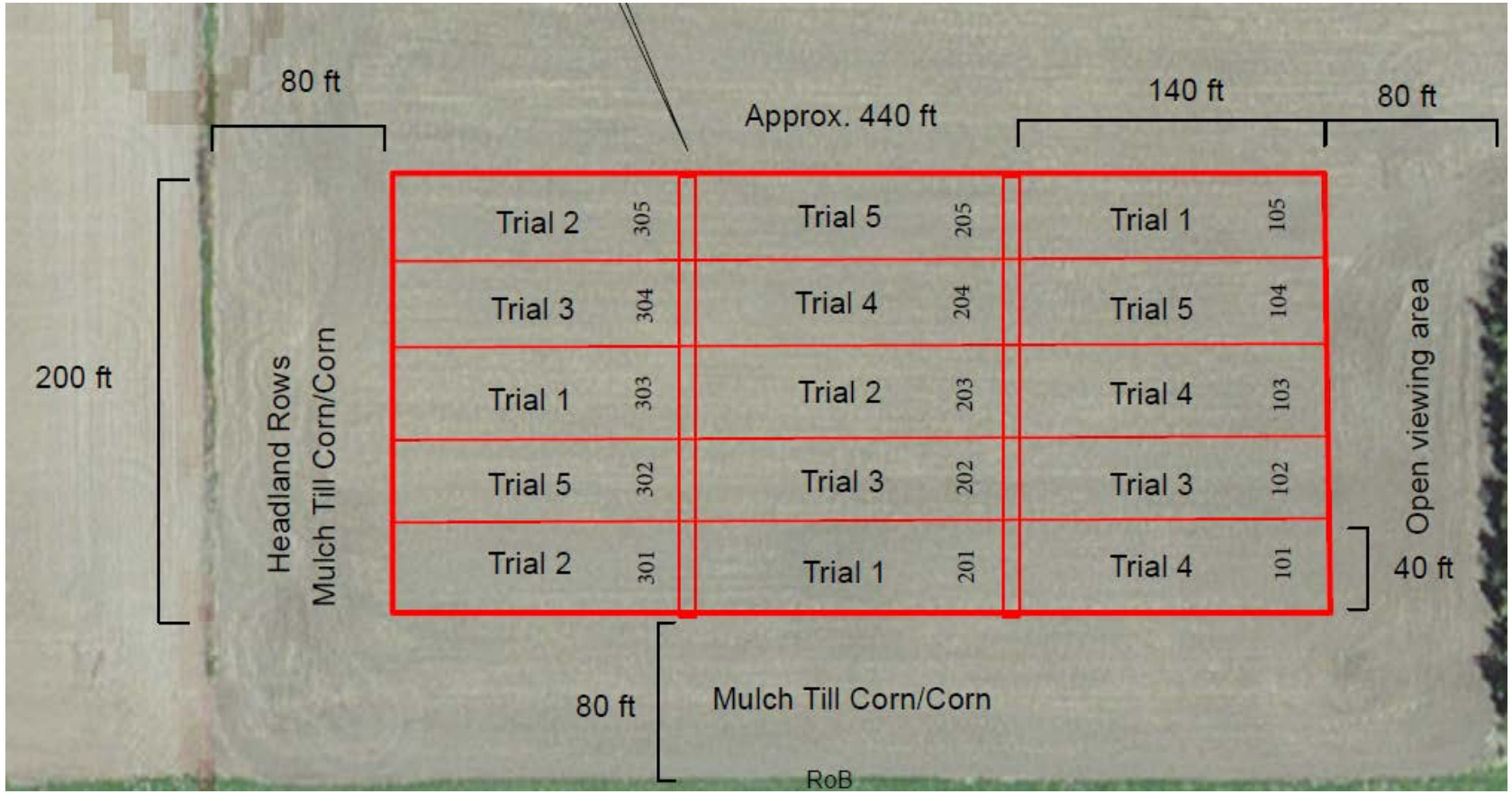
Replicated Plots

Cover Crop Evaluations

- Seed Mixes
- Time of Establishment

Horse Creek Area Farmer-Led Watershed Council





Replicated Field Trial

Treatments:
No-Till without Cover
No-Till Multi Species Cover
No-Till Cereal Rye Cover
Conventional Till Cereal Rye Cover
Conventional Till No Cover

Rainfall Simulations

- Raindrop splash and displacement of soil particle
- Raindrop 1 – 7 mm diameter
- Up to 20 mph
- Splash up 3 -5 ft
- Up to 90 T/ac. Heavy Rainstorm

Iowa State Univ. Extension and Outreach.

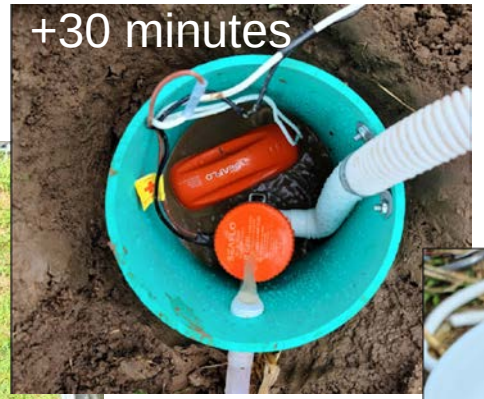
How to reduce potential soil erosion early in the spring.

Source: USDA Natural Resources Conservation Service

Rainfall Simulation

- Designed for development of phosphorus index (P-Index)
- Mimic Natural Rainfall
- 10’ x 10’ x 10’
- Representative Area of Field
- Sloping Ground

Rainfall Simulation



National Research Project for Simulated Rainfall
National Phosphorus Project

Cross-Site Comparisons

- Conventional Intensive Tillage
- Conservation Tillage
- Strip Tillage
- No-Till With Rye Cover Crop
- No-Till Corn w/ Interseeded Clover

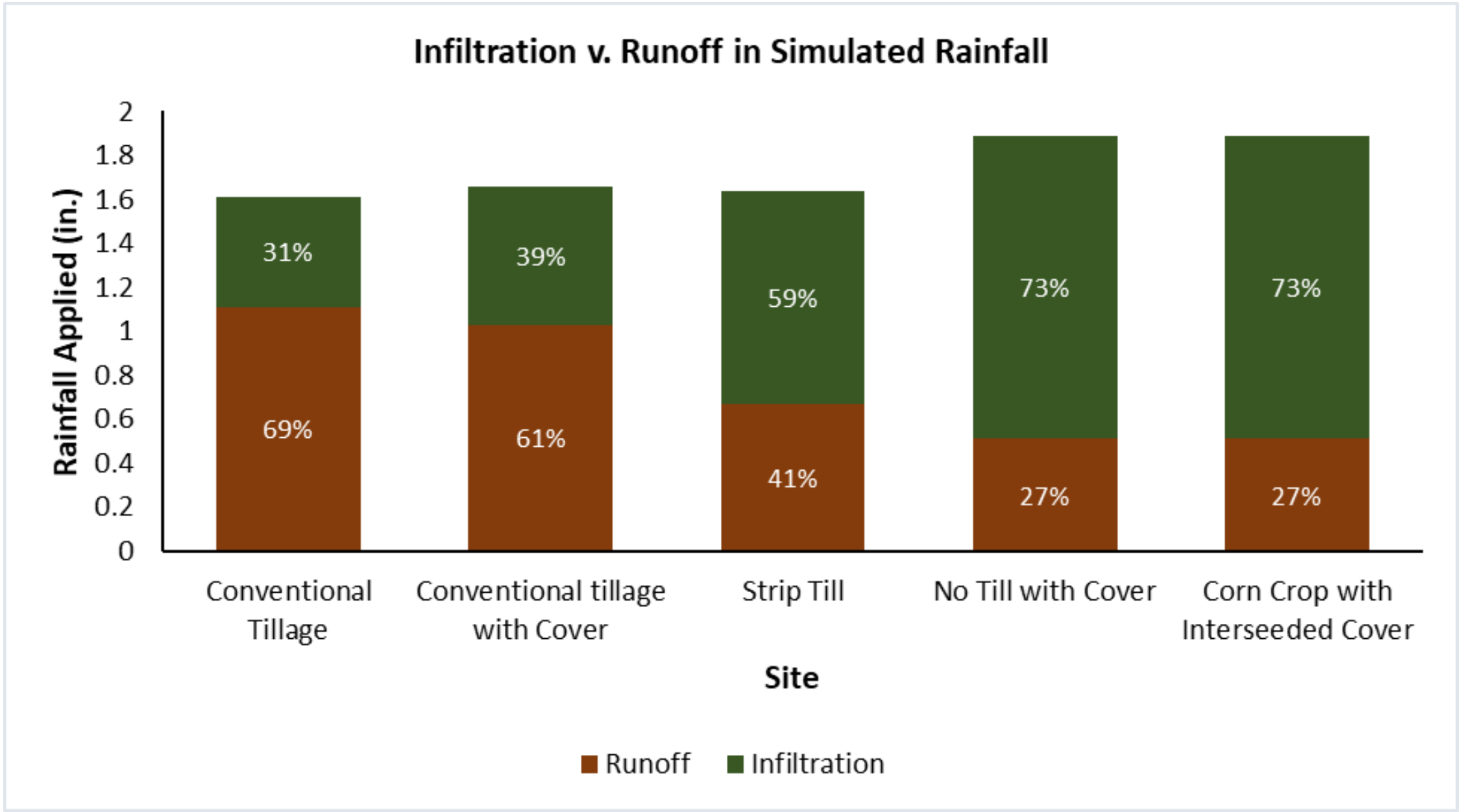
Conventional Tillage
Injected Manure
No Cover Crop

Conservation Tillage
Low-Disturbance Injected Manure
Rye Cover Crop

Strip Tillage
Sweep Injected Manure
Rye Cover Crop

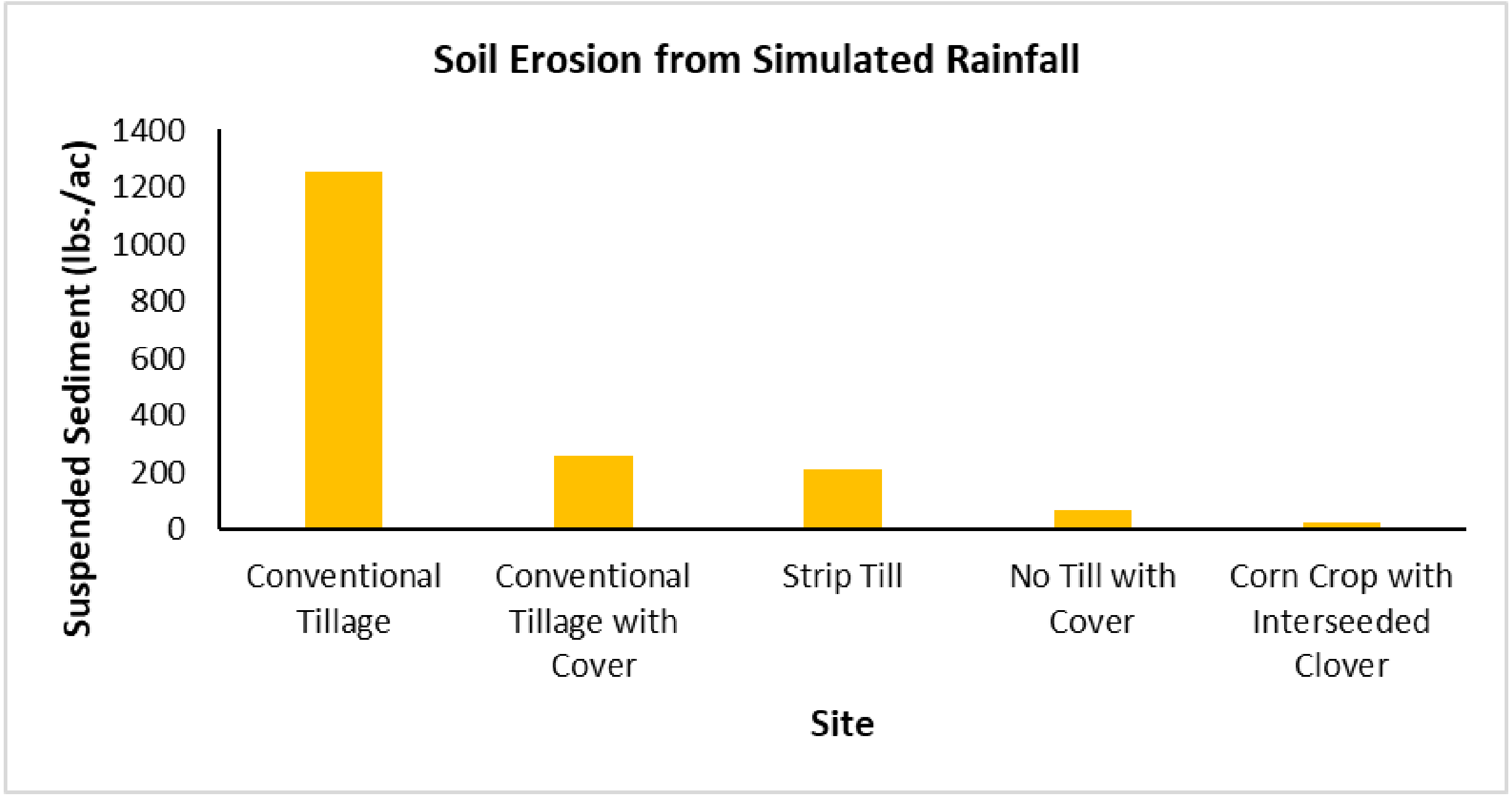
No-Till
Rye Cover Crop
Terminated Post Planting

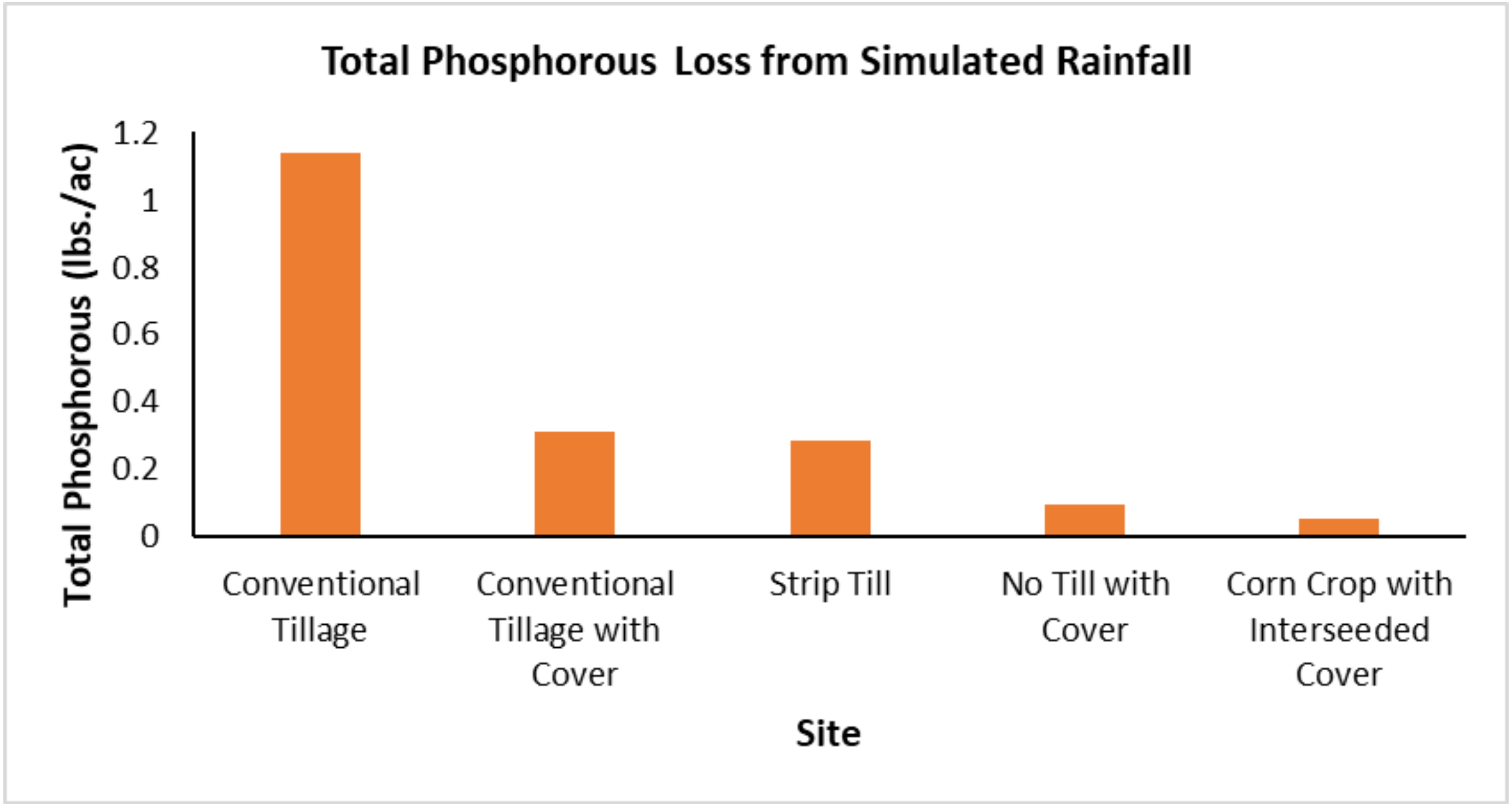
No-Till
Broadcast Manure
Rye Cover / Interseeded Clover


Infiltration v. Runoff in Simulated Rainfall
Rainfall Applied (in.)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
31%
69%
39%
61%
59%
41%
73%
27%
73%
27%
Conventional Tillage
Conventional tillage with Cover
Strip Till
No Till with Cover
Corn Crop with Interseeded Cover
Site
Runoff
Infiltration

Collected Samples

1. Conventional Tillage
2. Conventional Tillage w/ Cover
3. Strip Tillage
4. No Till w/ Cover
5. Interseeded Cover


Soil Erosion from Simulated Rainfall
Suspended Sediment (lbs./ac)
1400
1200
1000
800
600
400
200
0
Conventional Tillage
Conventional Tillage with Cover
Strip Till
No Till with Cover
Corn Crop with Interseeded Clover
Site


Total Phosphorous Loss from Simulated Rainfall
Total Phosphorous (lbs./ac)
1.2
1
0.8
0.6
0.4
0.2
0
Conventional Tillage
Conventional Tillage with Cover
Strip Till
No Till with Cover
Corn Crop with Interseeded Cover
Site

No Till With Cereal Rye Cover Crop

Rainfall Simulations

Water Data

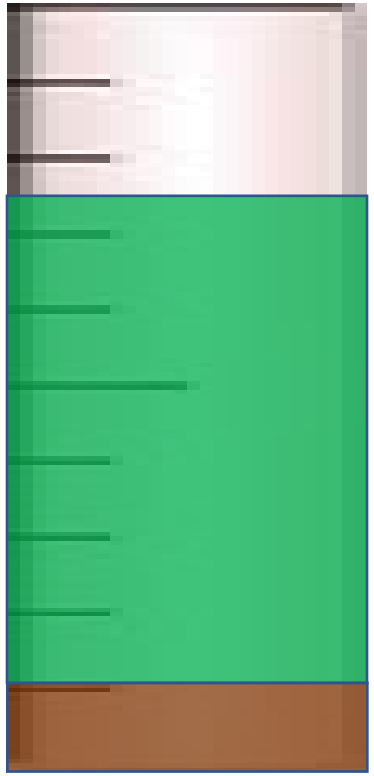
1.5 in. Applied

1.3 in. Infiltration (90%)

0.2 in. Runoff (10%)

Total Solids Loss: 2 lbs./ac

Total P Loss: 0.0072 lbs./ac



Johnson/Plots 102,202,304/No Till/Cereal Rye Cover/Fall 2021

United States Department of Agriculture
NRCS
Natural Resources Conservation Service

No Tillage Without Cover Crop

Rainfall Simulations

Water Data

1.45 in. Applied

1.1 in. Infiltration (79%)

0.3 in. Runoff (21%)

Total Solids Loss: 5 lbs./ac

Total P Loss: 0.0166 lbs./ac

United States Department of Agriculture
NRCS
Natural Resources Conservation Service

No Tillage With Multi Species Cover Crop

Rainfall Simulations

Water Data

1.5 in. Applied

0.7 in. Infiltration (48%)

0.8 in. Runoff (52%)

Total Solids Loss: 18 lbs./ac

Total P Loss: 0.0449 lbs./ac

United States Department of Agriculture
NRCS
Natural Resources Conservation Service

Johnson/Plots 203,301,305/No Tillage/Multi Species Cover/Fall 2021

Conventional Tillage With Rye Cover Crop

Rainfall Simulations

Water Data

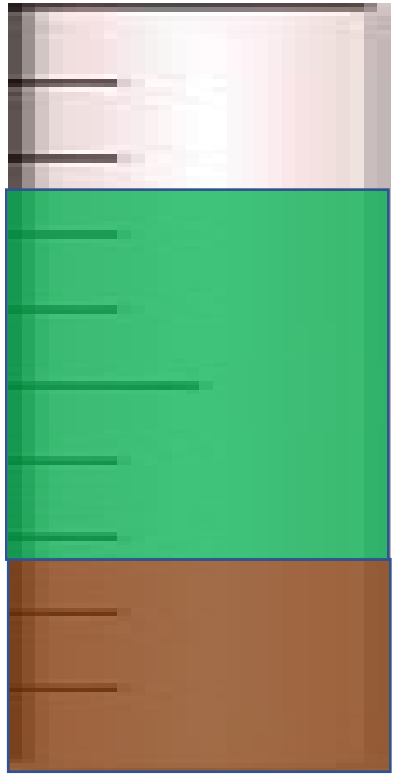
1.5 in. Applied

1.0 in. Infiltration (67%)

0.5 in. Runoff (33%)

Total Solids Loss: 27 lbs./ac

Total P Loss: 0.0359 lbs./ac



United States Department of Agriculture
NRCS
Natural Resources Conservation Service

Johnson/Plots 101,103,204/Conventional Tillage/Rye Cover/Fall 2021

Conventional Tillage No Cover Crop

Rainfall Simulations

Water Data

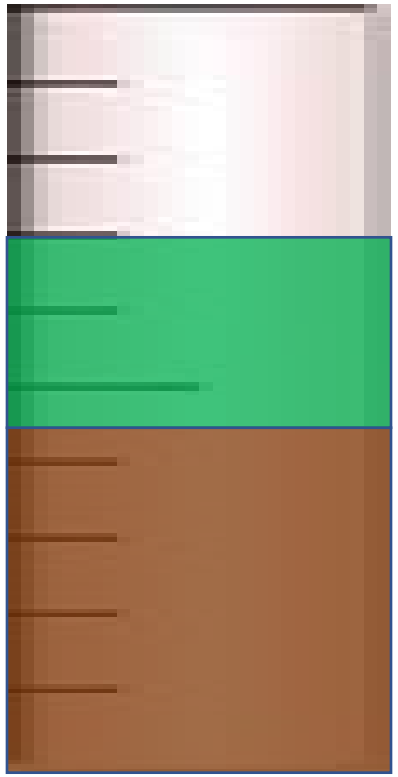
1.4 in. Applied

0.5 in. Infiltration (34%)

0.9 in. Runoff (66%)

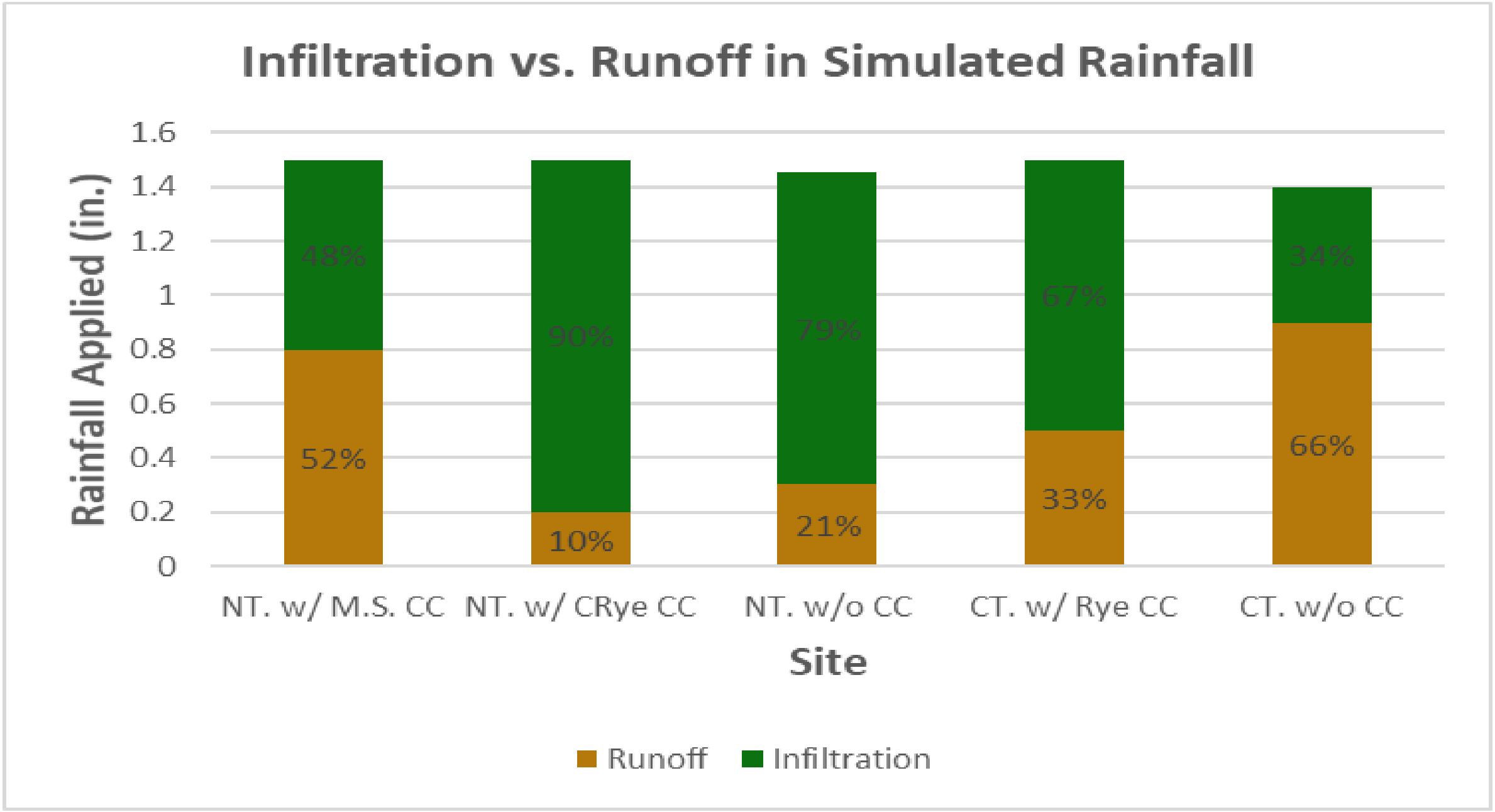
Total Solids Loss: 97 lbs./ac

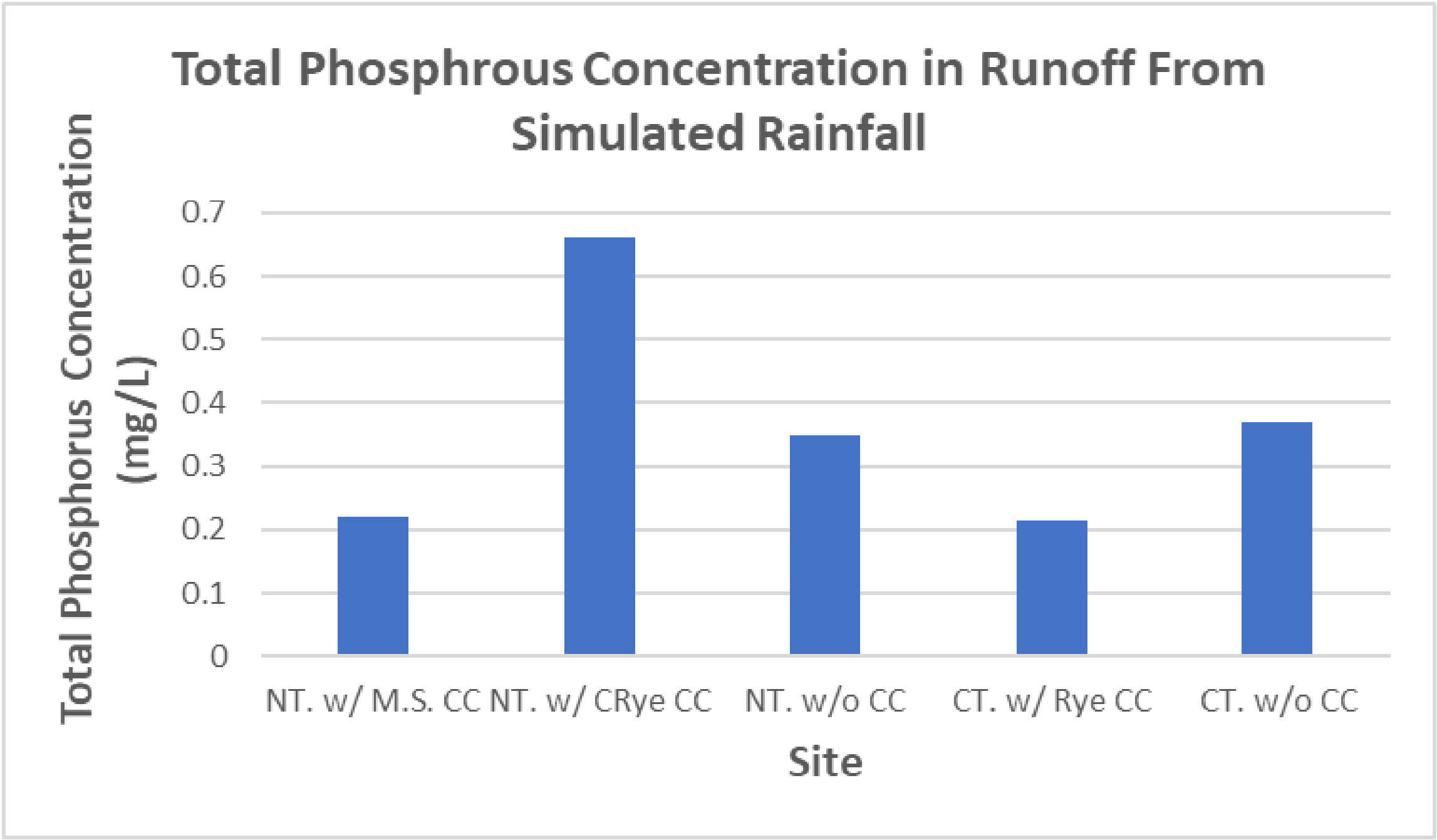
Total P Loss: 0.0667 lbs./ac

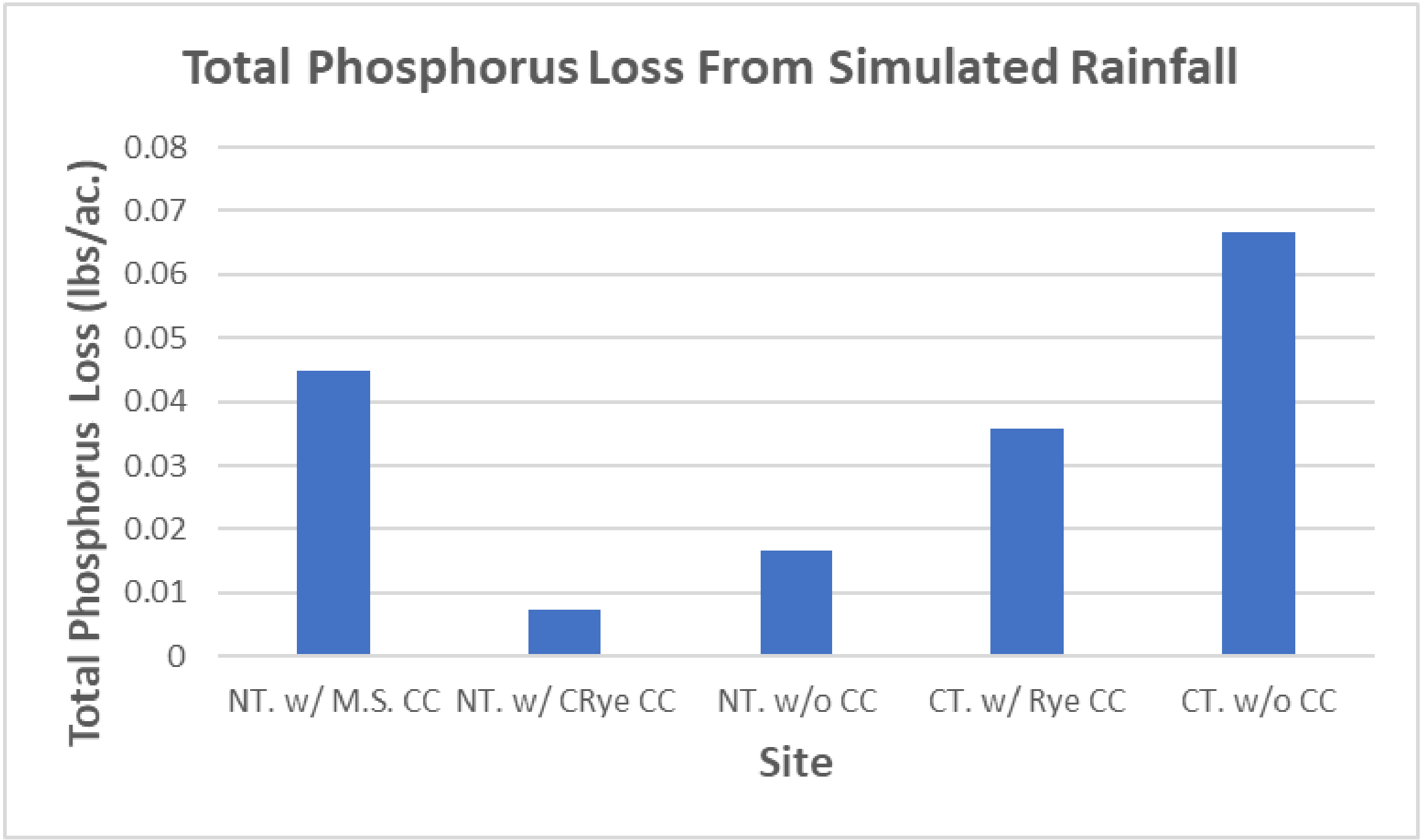


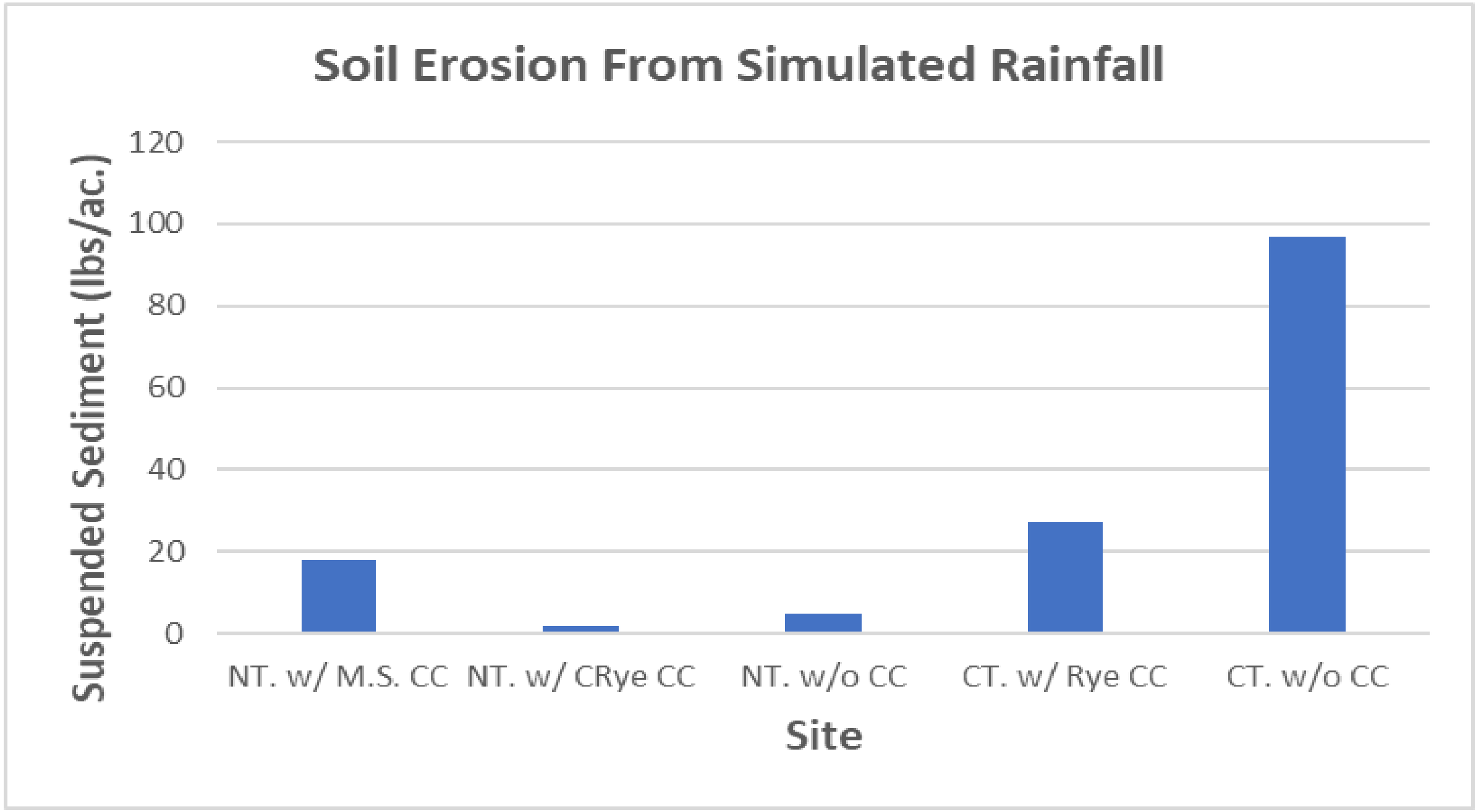
United States Department of Agriculture
NRCS
Natural Resources Conservation Service

Johnson/Plots 104,205,302 /Conventional Tillage/No Cover/Fall 2021


Infiltration vs. Runoff in Simulated Rainfall
Rainfall Applied (in.)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
48%
52%
90%
10%
79%
21%
67%
33%
34%
66%
NT. w/ M.S. CC
NT. w/ CRye CC
NT. w/o CC
CT. w/ Rye CC
CT. w/o CC
Site
Runoff
Infiltration


Total Phosphrous Concentration in Runoff From Simulated Rainfall
Total Phosphorus Concentration (mg/L)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
NT. w/ M.S. CC
NT. w/ CRye CC
NT. w/o CC
CT. w/ Rye CC
CT. w/o CC
Site


Total Phosphorus Loss From Simulated Rainfall
Total Phosphorus Loss (lbs/ac.)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
NT. w/ M.S. CC
NT. w/ CRye CC
NT. w/o CC
CT. w/ Rye CC
CT. w/o CC
Site


Soil Erosion From Simulated Rainfall
Suspended Sediment (lbs/ac.)
120
100
80
60
40
20
0
NT. w/ M.S. CC
NT. w/ CRye CC
NT. w/o CC
CT. w/ Rye CC
CT. w/o CC
Site

Goals of Incentive Program

OFB: Demonstrate and evaluate *cover crops with minimal tillage* in cold climate production systems.

SWHC: Improve soil health through *perennialization of the landscape* and/or increased diversity through integrated crop-livestock production systems.

LASA: Improve soil health within *confined livestock feeding operations* through minimal tillage/soil disturbance and split manure application to growing cover crops.

GCWP: Improve soil health within *confined livestock feeding operations* through minimal tillage/soil disturbance and split manure application to growing cover crops.

MRCFF: Demonstrate and evaluate the *Penn State Interseeder* which combines multiple agronomic activities (spraying, sidedressing, and interseeding) into a single pass across the field.

HCFLWC: Improve soil health within livestock and cash grain operations through *minimal tillage/soil disturbance and split manure and fertilizer applications* to growing cover crops.

RRFLWC: Determine *nutrient reductions achieved via treatment trains*.

Support Provided By:

- Horse Creek Farmer-Led Watershed Council
- USDA Natural Resources Conservation Service On-Farm Research Conservation Innovation Grant
- Water Resources Monitoring Group, LLC

Thank You.

Questions?