Washington State University
Mount Vernon
Northwestern Washington Research & Extension Center

Alternative Tillage in Raspberry Alleyways to Reduce Costs and Improve Soil Health

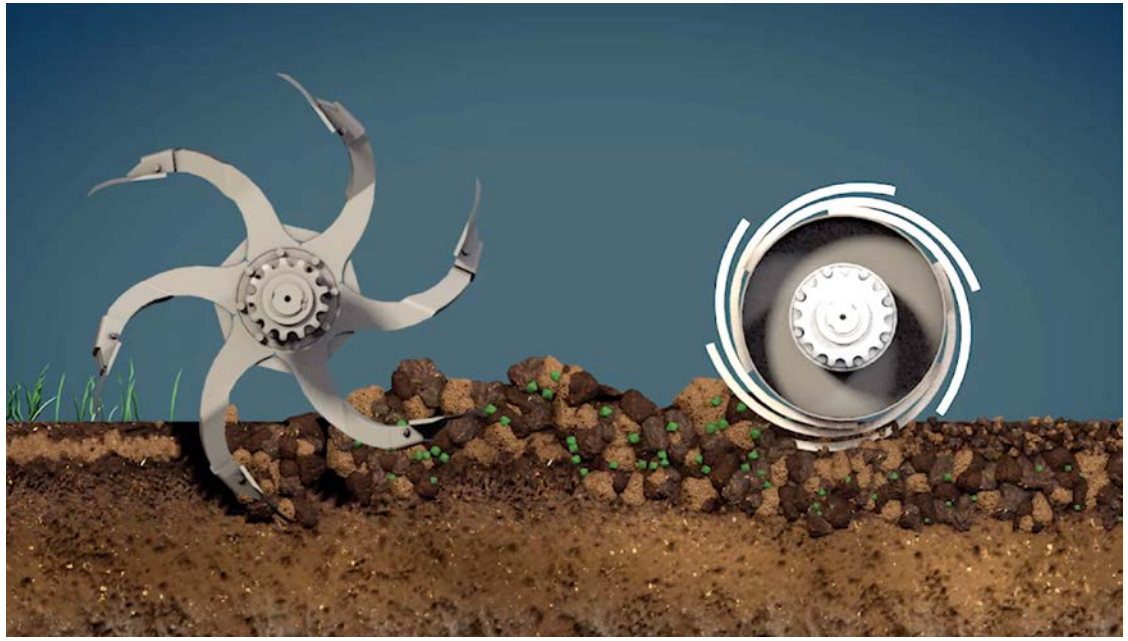
Deirdre Griffin LaHue, Toby Una, Betsy Schacht,
Chris Benedict, Gabriel LaHue, Lisa DeVetter

Red raspberry alleyway management

- Compaction management
- Weed and volunteer primocane management
- Cover crop incorporation in spring & seed bed prep in fall
- Can represent a lot of labor and fuel costs

Rotary spader as a possible alternative

- Described to incorporate residues and biomass in one pass
- Described to reduce creation of plow pans with spader mechanism
- Different series based on depth, soil texture, and HP



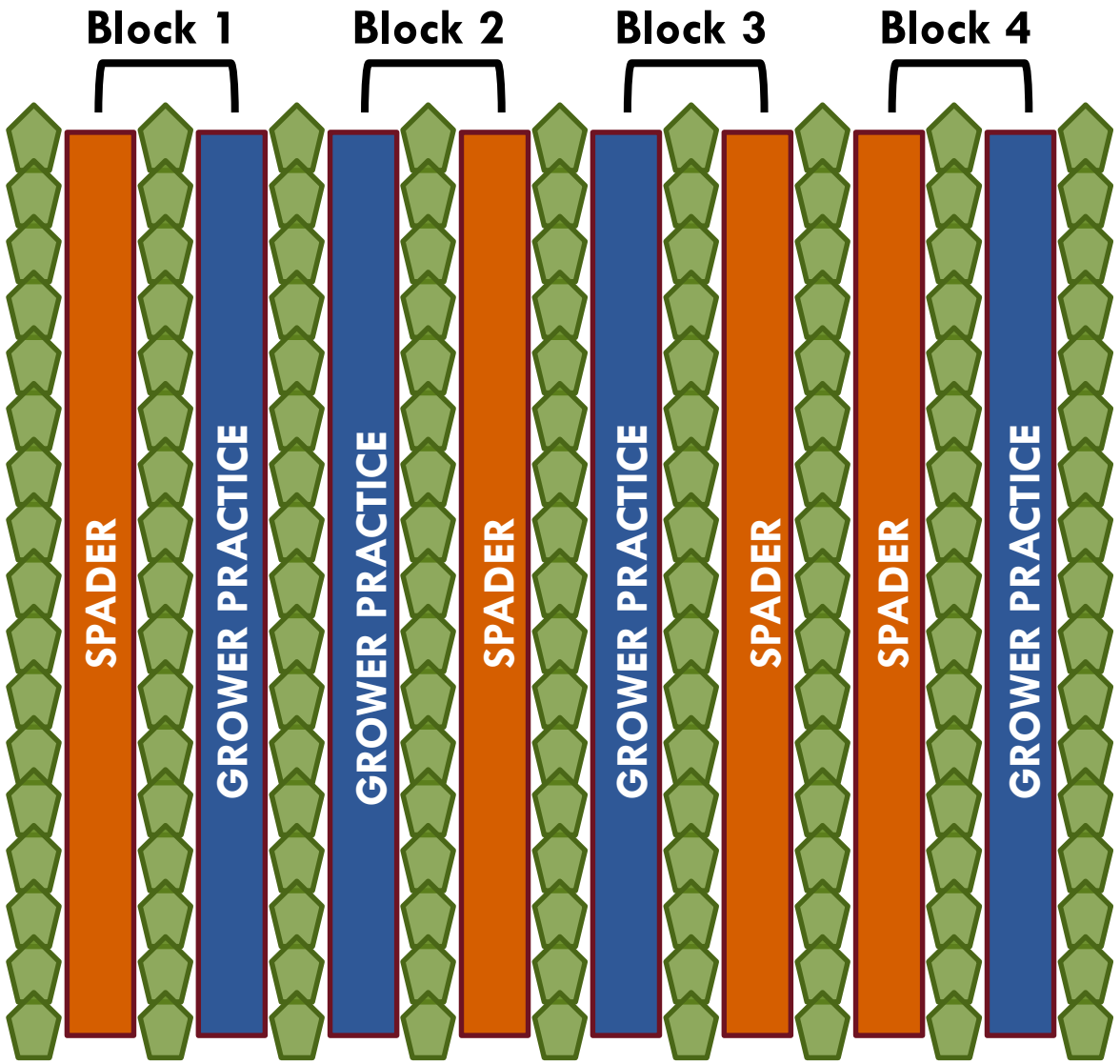
Images: Imants, c/o Ag West Implements

Research questions

- Can a rotary spader **save time & money with reduced labor** compared to typical tillage practices?

- How do tillage treatments affect soil **compaction,** water **infiltration,** and soil **organic matter cycling**?

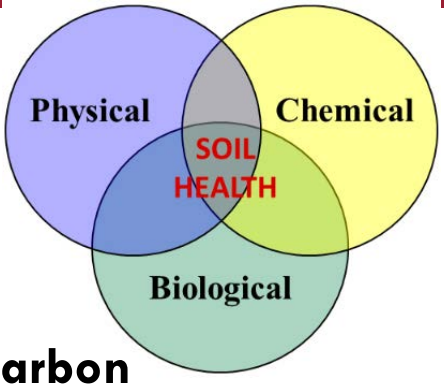
Details on our study - Design



	Treatment 1 (Grower practice)		Treatment 2 (Spader)	
	# passes	Implement	# passes	Implement
Fall	1	Subsoiler	1	Spader*
	1	Rototiller		
	1	Chisel plow		
	1	Cultivator		
Spring	1	Cane chopper	1	Cane chopper
	1	Chisel plow	1	Spader
	1	Rototiller		
	1	Chisel plow		

***Spader:** Imants Rotary Spader 40 Sx series

Details on our study - Measurements



Compaction

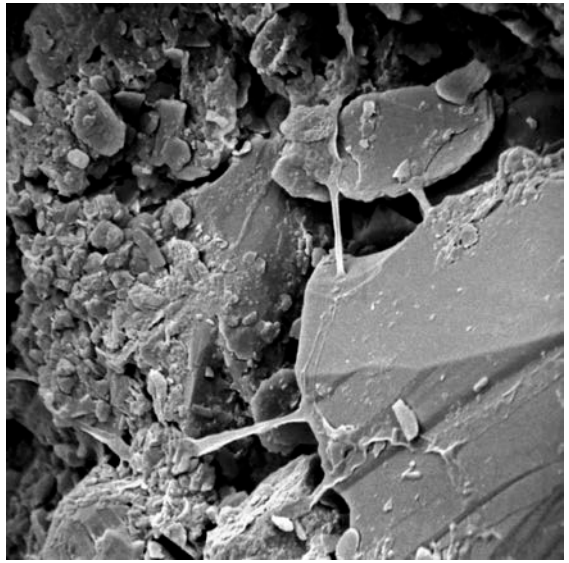
Water infiltration

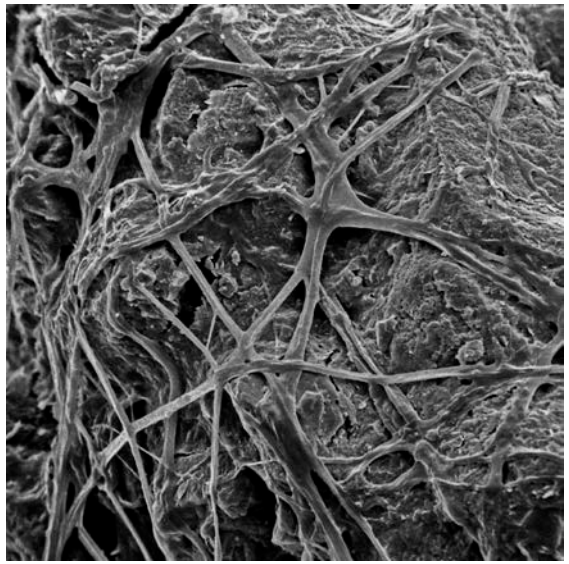
Active carbon

Photos (L-R): Specmeters.com; Betsy Schacht; dl.sciencesocieties.org

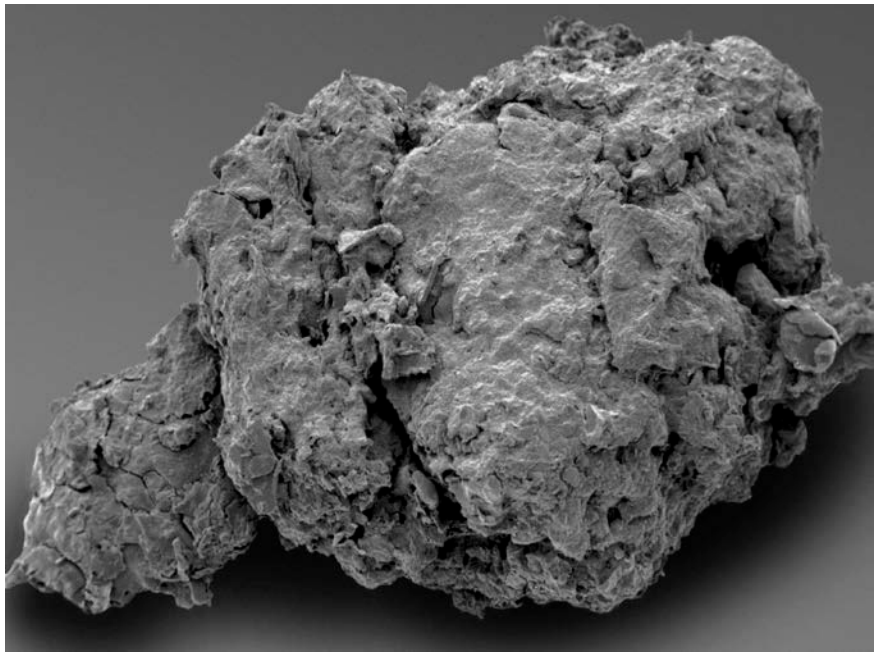
Connections between biological and physical soil health

Microbial activity

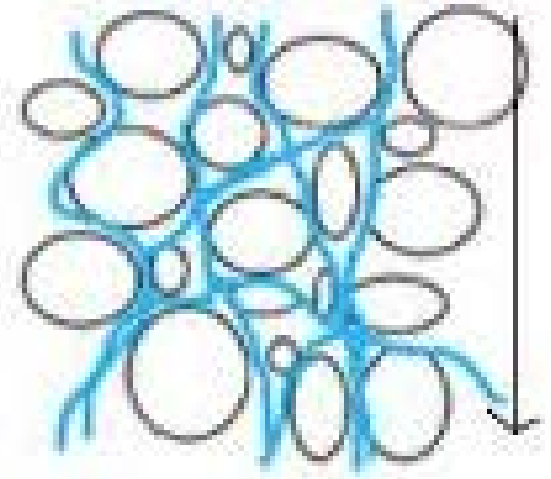




Soil aggregates

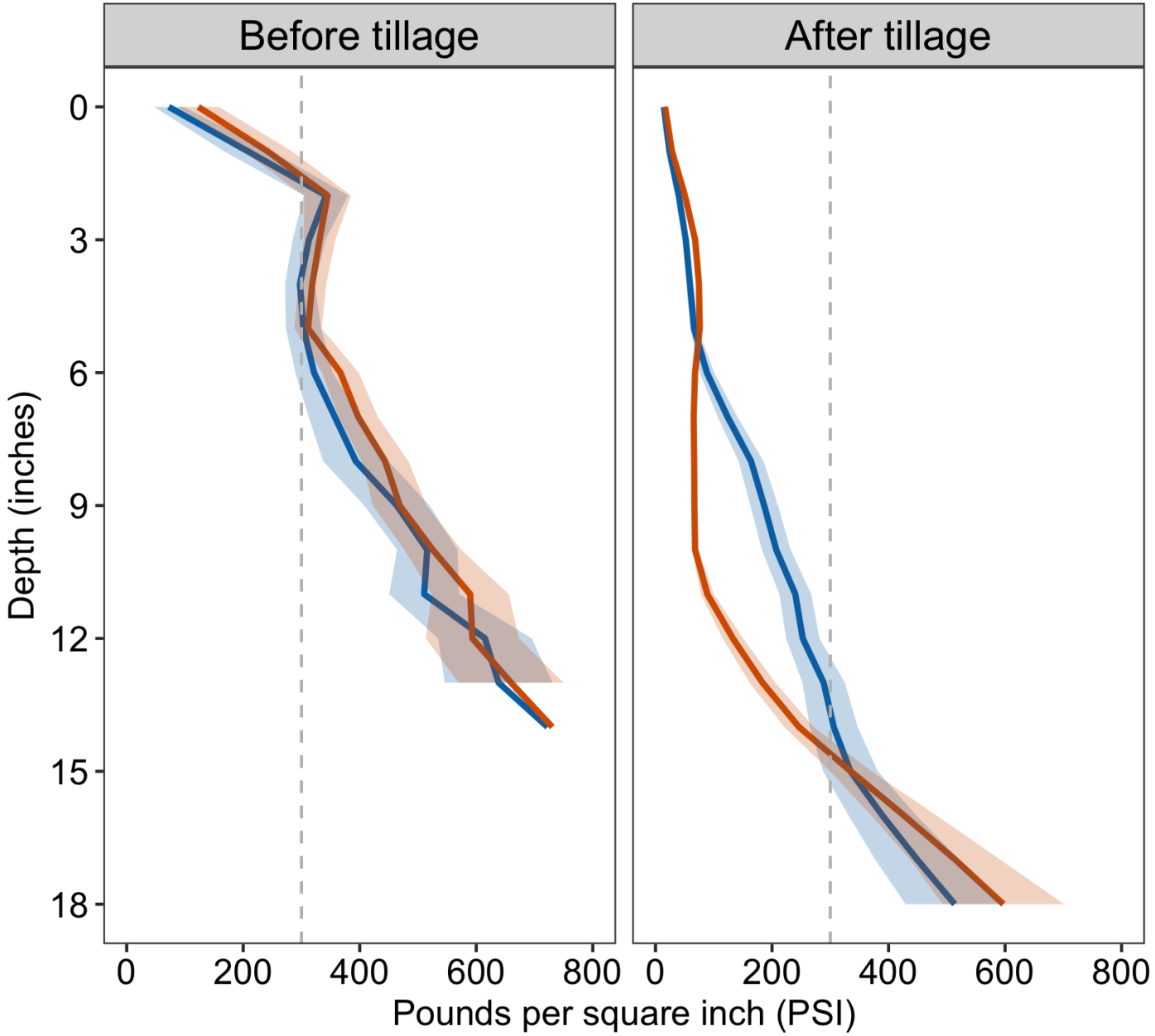


Water movement, aeration, workability



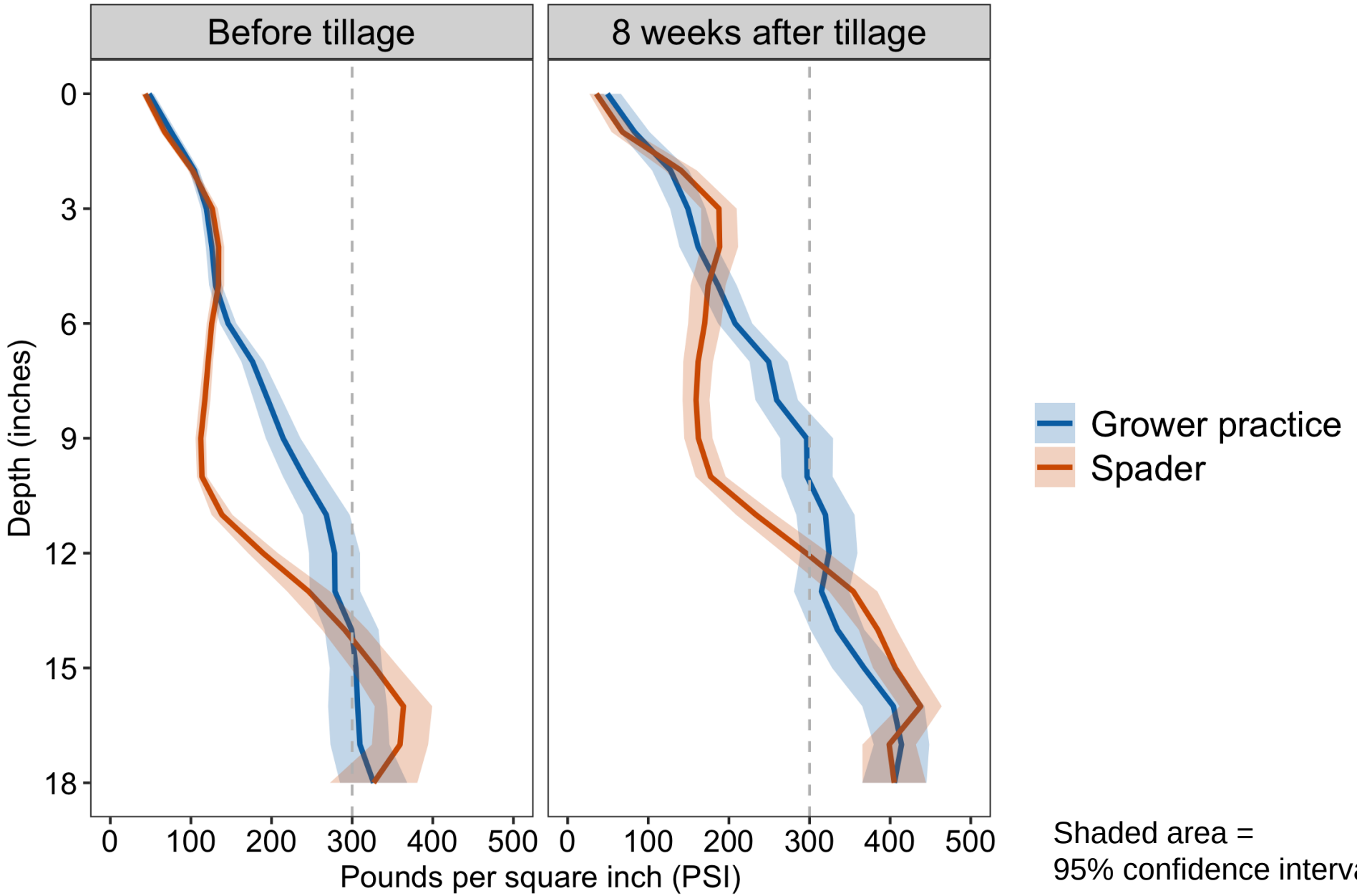
SEM images: www.microped.uni-bremen.de; Water movement: Cornell Univ. Extension

Alleyway soil compaction – Fall 2018



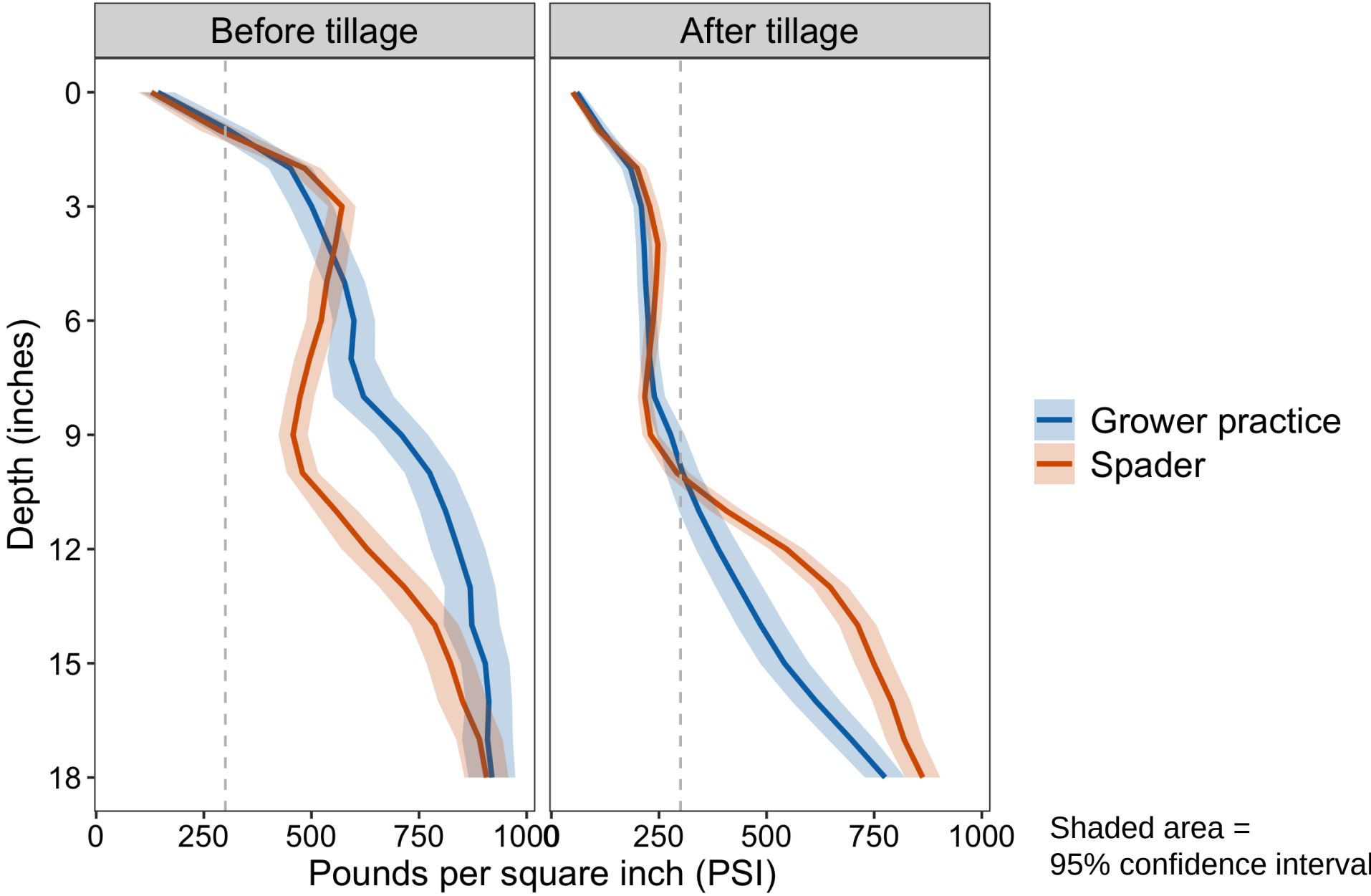
Shaded area =
95% confidence interval

Alleyway soil compaction – Spring 2019



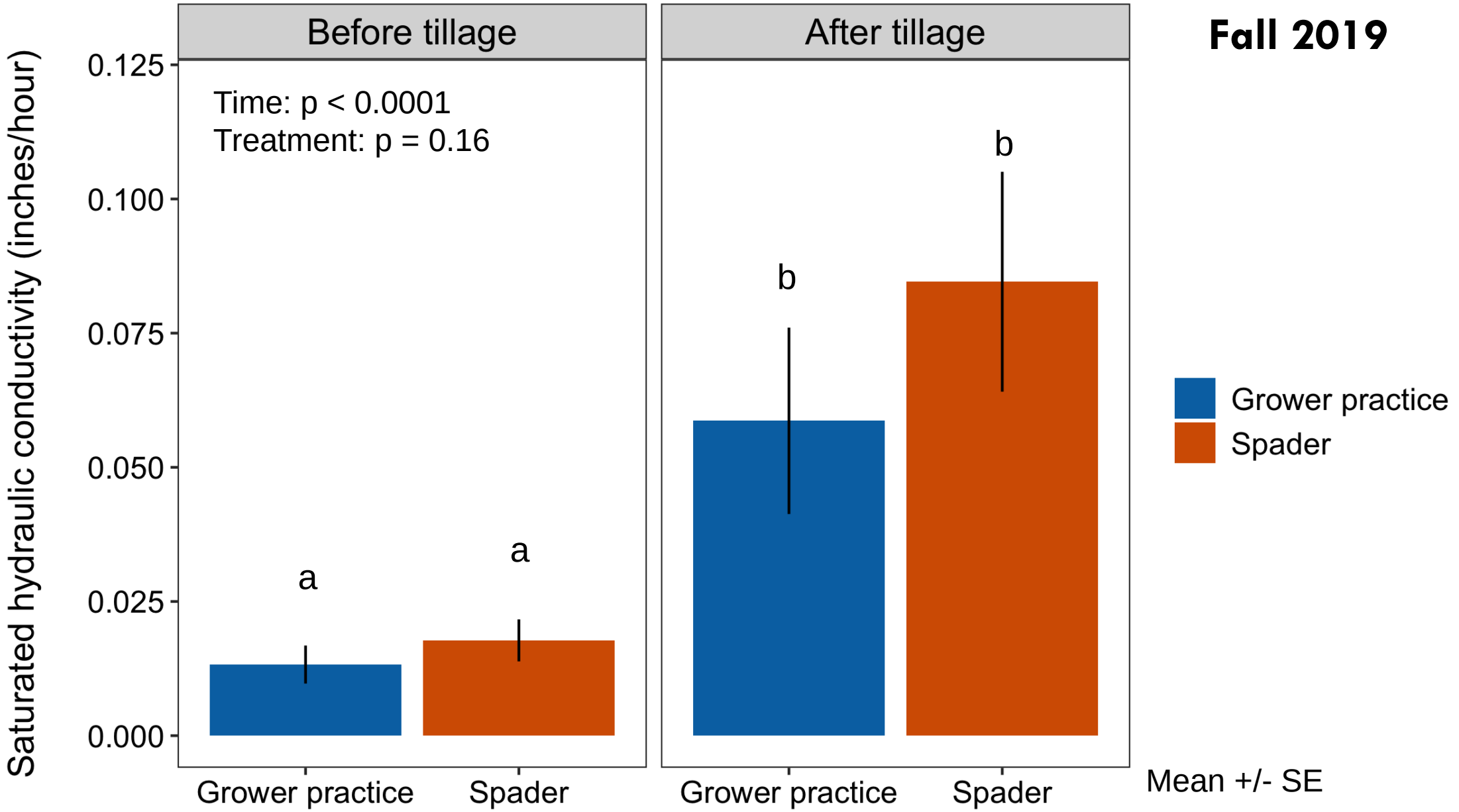
Shaded area =
95% confidence interval

Alleyway soil compaction – Fall 2019

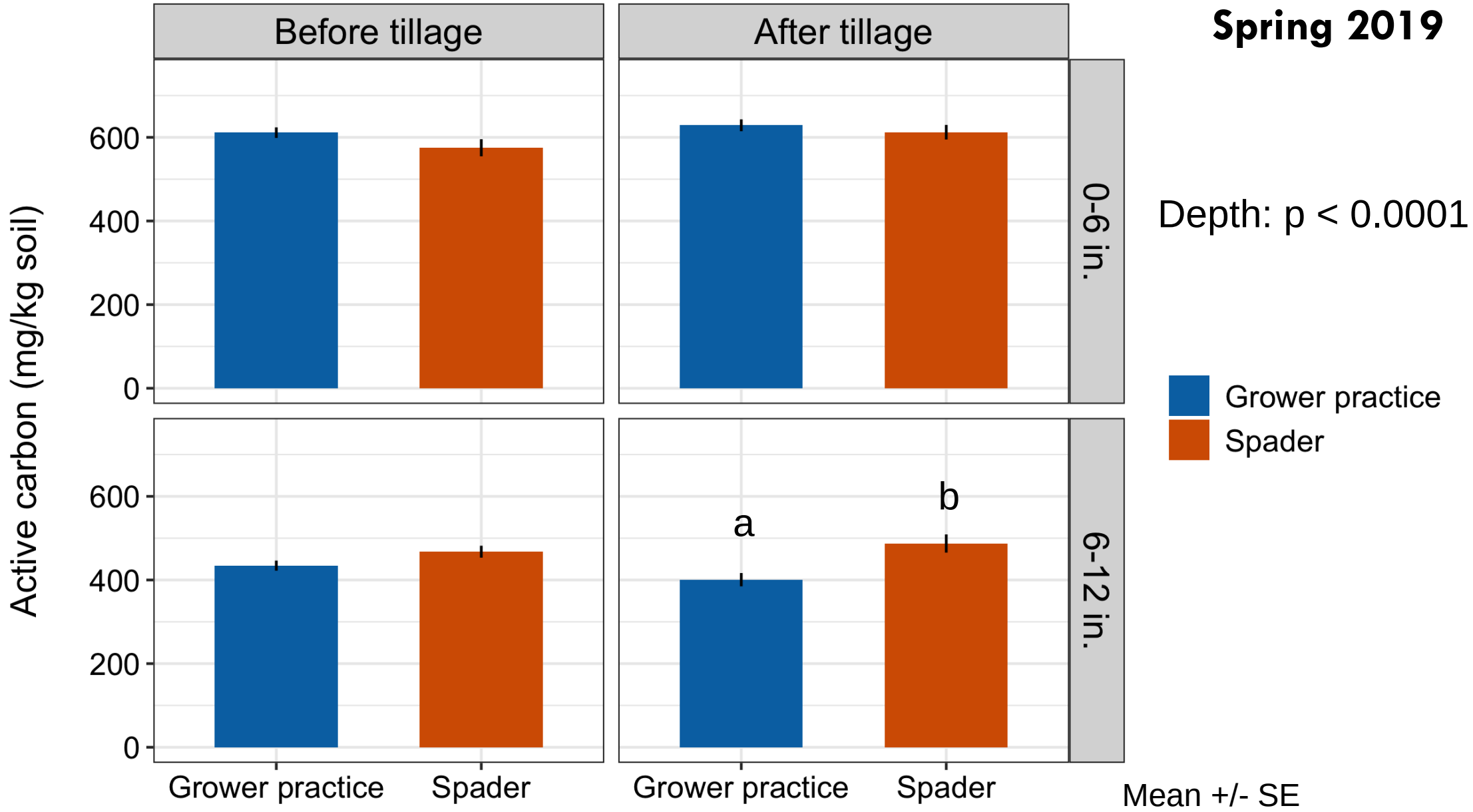


Shaded area =
95% confidence interval

Water movement affected by tillage but not implement



Active carbon is most affected by soil depth



Cost calculations (Preliminary)

Cost calculations (Preliminary)

	Grower practice	Spader
Fall	1x Subsoiler 1x Rototiller 1x Chisel plow 1x Cultivator	1x Spader
Spring	2x Chisel plow 1x Rototiller	1x Spader

Cost calculations (Preliminary)

Recommended spader speed: 0.5 – 1.6 mph (*1.0 mph*)

Typical rototiller speed: 1.0-1.2 mph (*1.0 mph*)

	Grower practice	Spader
Fall	1x Subsoiler 1x Rototiller 1x Chisel plow 1x Cultivator	1x Spader
Spring	2x Chisel plow 1x Rototiller	1x Spader

Cost calculations (Preliminary)

	Grower practice	Spader
Fall	1x Subsoiler 1x Rototiller 1x Chisel plow 1x Cultivator	1x Spader
Spring	2x Chisel plow 1x Rototiller	1x Spader

Recommended spader speed: 0.5 – 1.6 mph (*1.0 mph*)

Typical rototiller speed: 1.0-1.2 mph (*1.0 mph*)

Labor cost: $17 per hour*

*Galinato and DeVetter, Enterprise budget, WSU Extension, 2016

Cost calculations (Preliminary)

	Grower practice	Spader
Fall	1x Subsoiler 1x Rototiller 1x Chisel plow 1x Cultivator	1x Spader
Spring	2x Chisel plow 1x Rototiller	1x Spader

Recommended spader speed: 0.5 – 1.6 mph (*1.0 mph*)

Typical rototiller speed: 1.0-1.2 mph (*1.0 mph*)

Labor cost: $17 per hour*

Labor savings: ~$11/acre per event

Fuel and maintenance costs not currently included

*Galinato and DeVetter, Enterprise budget, WSU Extension, 2016

Cost calculations (Preliminary)

	Grower practice	Spader
Fall	1x Subsoiler 1x Rototiller 1x Chisel plow 1x Cultivator	1x Spader
Spring	2x Chisel plow 1x Rototiller	1x Spader

Recommended spader speed: 0.5 – 1.6 mph (*1.0 mph*)

Typical rototiller speed: 1.0-1.2 mph (*1.0 mph*)

Labor cost: $17 per hour*

Labor savings: ~$11/acre per event

Fuel and maintenance costs not currently included

Difference in equipment costs: $13,000*

*Galinato and DeVetter, Enterprise budget, WSU Extension, 2016

Cost calculations (Preliminary)

	Grower practice	Spader
Fall	1x Subsoiler 1x Rototiller 1x Chisel plow 1x Cultivator	1x Spader
Spring	2x Chisel plow 1x Rototiller	1x Spader

Recommended spader speed: 0.5 – 1.6 mph (*1.0 mph*)

Typical rototiller speed: 1.0-1.2 mph (*1.0 mph*)

Labor cost: $17 per hour*

Labor savings: ~$11/acre per event

Fuel and maintenance costs not currently included

Difference in equipment costs: $13,000*

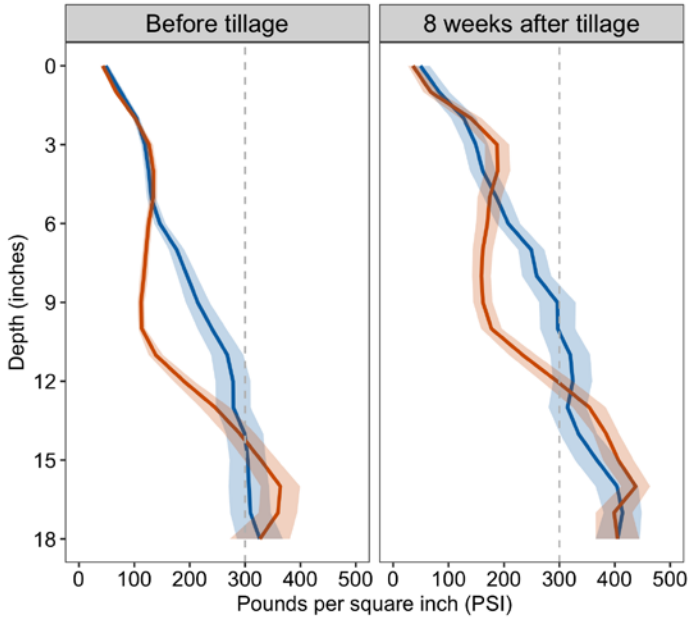
# Acres farmed	Years to recover difference in cost
100	5.9
500	1.2
1000	0.6

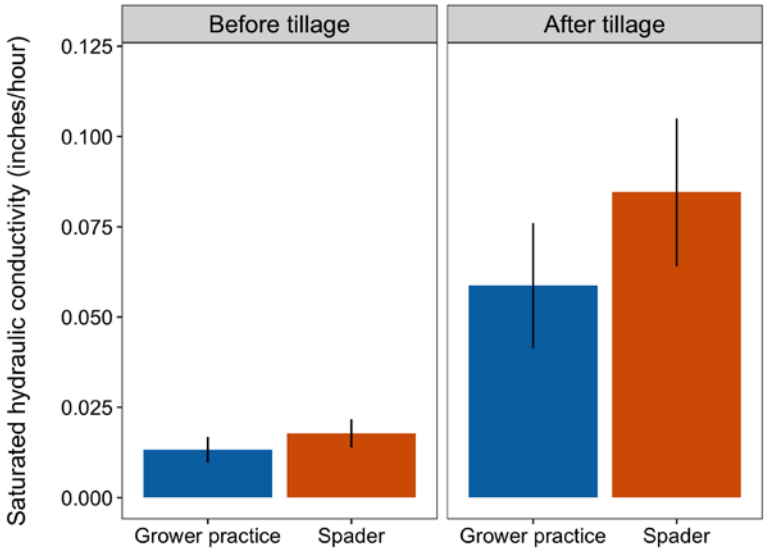
Assuming 2 tillage events per year

*Galinato and DeVetter, Enterprise budget, WSU Extension, 2016

Conclusions

- The spader reduced **compaction** from 6”-14” compared to standard grower practice
- **Water infiltration** was impacted by tillage occurrence but not (significantly) by implement
- Anecdotal evidence of **void spaces** created by spader that may require another pass
- Post-tillage, **active carbon** was slightly higher with spader than grower practice at 6-12” depth
- **Cost savings** from reduced passes can offset higher cost of spader in 1-2 years in high acreage operations





Acknowledgements

- **Funding:** Washington Red Raspberry Commission
- Grower Cooperators
- Ag West Implements for demoing the spader
- Research team

Deirdre Griffin LaHue

Assistant Professor, Soil Quality and Soil Management

WSU NWREC Mount Vernon

d.griffin@wsu.edu