



Effect of Cover Crops on Soil Respiration and Organic Matter in South Texas

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Highlights

- More decomposing materials near surface area has slowly increased organic matter levels.
- Significant difference in organic matter levels and soil respiration after 4 winter cover crop seasons indicate benefits may have begun accumulating

Introduction

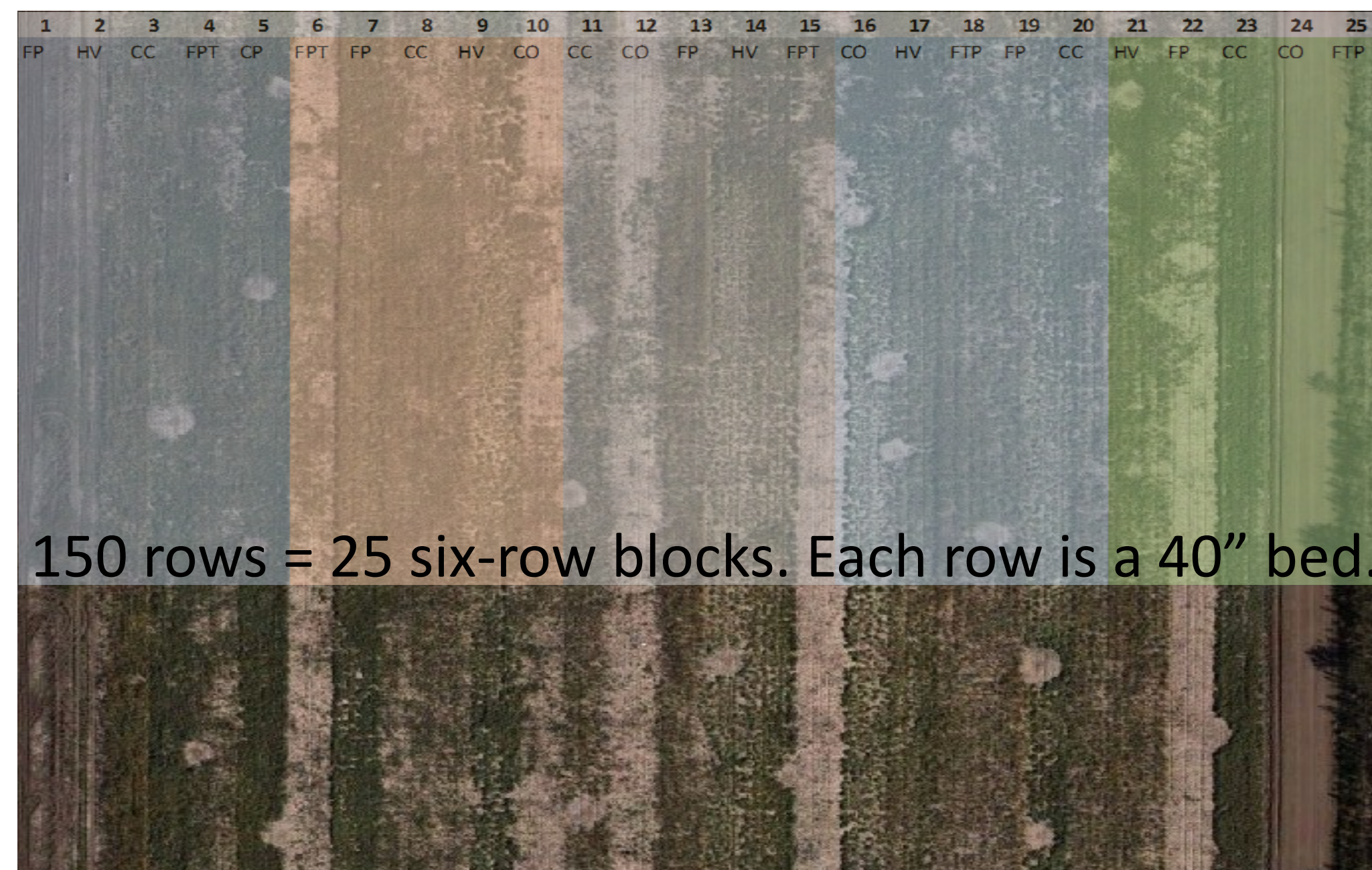


Figure 1. Aerial Imagery of Hilltop Gardens, Block 15 - M. Kutugata 2019

- Cover crops are a heavily-promoted soil health management tool that suppress weeds & improve soil health.¹ Yet, adoption rates in South Texas remain low due to concerns over moisture usage by cover crops
- To determine effective ways to implement cover cropping, we conducted a 4-year multispecies cover crop trial in an organic grain sorghum dryland farm in Lyford, Texas. Since economic benefits of cover-cropping yield over prolonged periods of time (> 6 years), we observed patterns of soil respiration, an important indicator of soil health during the cover crop seasons to determine differences in respiration in cover cropped vs non-cover cropped areas.
- Our findings show that over 4 seasons, cover cropping benefits may have begun accumulating, which would warrant continuation of cover cropping to reap long term soil health benefits.

Methods and Materials

- 12-acre dryland grain sorghum plot in Lyford, TX
- Complete randomized block design
 - 4 cover crop treatments + control
- Years 1-4: Measured soil respiration with LICOR 6400xt weekly during cover crop season (N=25 per week)
- Soil samples for organic matter (LOI) collected before cover crop planting in year 1 and 4.
- Average efflux rates before termination when biomass was collected were selected for statistical analysis
- One-way ANOVAs in JMP for comparison amongst each treatment within the growing season for soil respiration and biomass
 - Post-hoc Tukey test
- Participatory research with farmer-influenced cover crop selection



Figure 2. Students collecting biomass.

Cover Crop History & Seeding Rates (lbs./acre)

	T1	T2	T3	T4	CO
Year 1	Field Pea (120)	Crimson Clover (15)	Hairy Vetch (15)	Field Pea (50), Triticale (50)	Control
Year 2	Cowpea (24), Buckwheat (20), Collards (4)	Guar (5), Proso Millet (8), Tillage Radish (4)	Sunn Hemp (9), Safflower (6), Rapeseed (6)	Tillage Radish (6), Black Oats (50)	Control
Year 3	Sunn Hemp (45)	Tillage Radish (10), Hairy Vetch (10), Black Oats (5)	Sunn Hemp (20)	Mustard (20), Tillage Radish (20), Cowpea (17), Sunn Hemp (17)	Control
Year 4	Cowpea (40)	Sudangrass (20)	Sunn Hemp (20)	Sunn Hemp (15), Cowpea (15), Sudangrass (10)	Control

Results

Table 1. Organic matter levels before (2017) and after (2020) cover crops (n=20) compared to control (n=5).

	% Organic Matter		
Date	Control	Cover Crop	P value
Nov. 2017	2.052	1.922	0.265
Sept. 2020	2.280	2.477	0.166
Difference	0.228	0.555	0.042

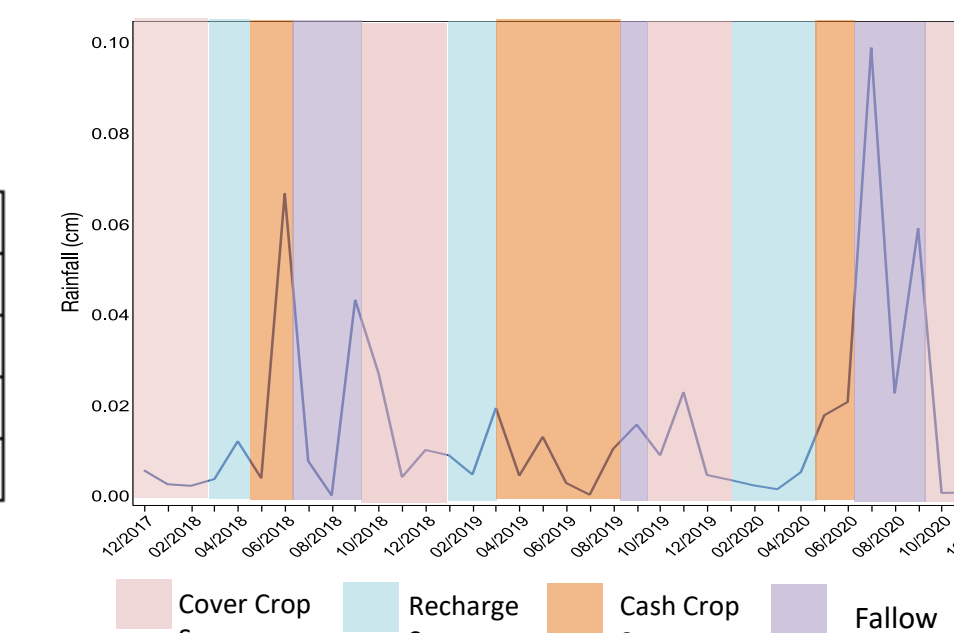


Figure 3. Rainfall patterns throughout the cover crop study.

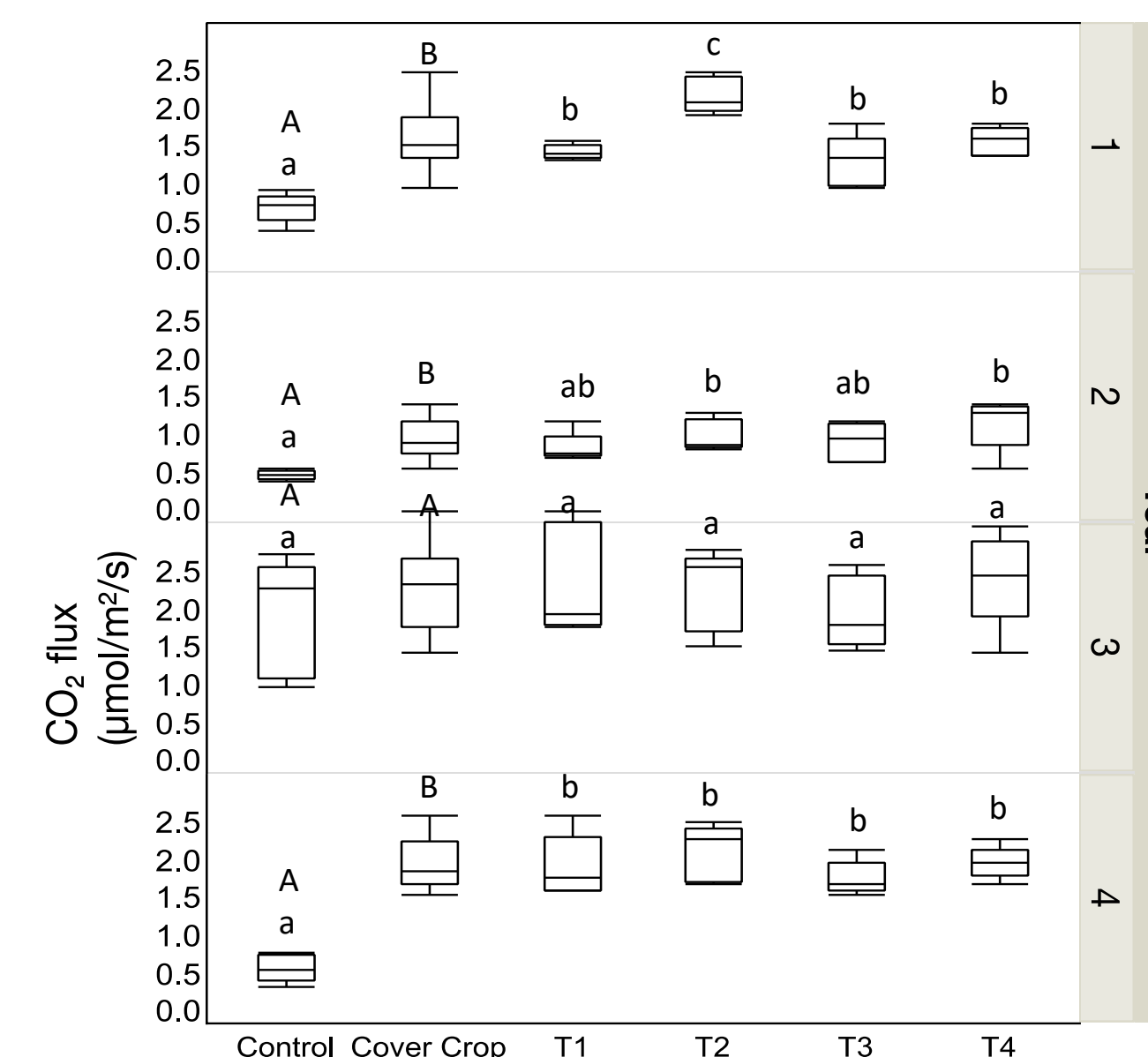


Chart 1. Soil respiration rates before termination.

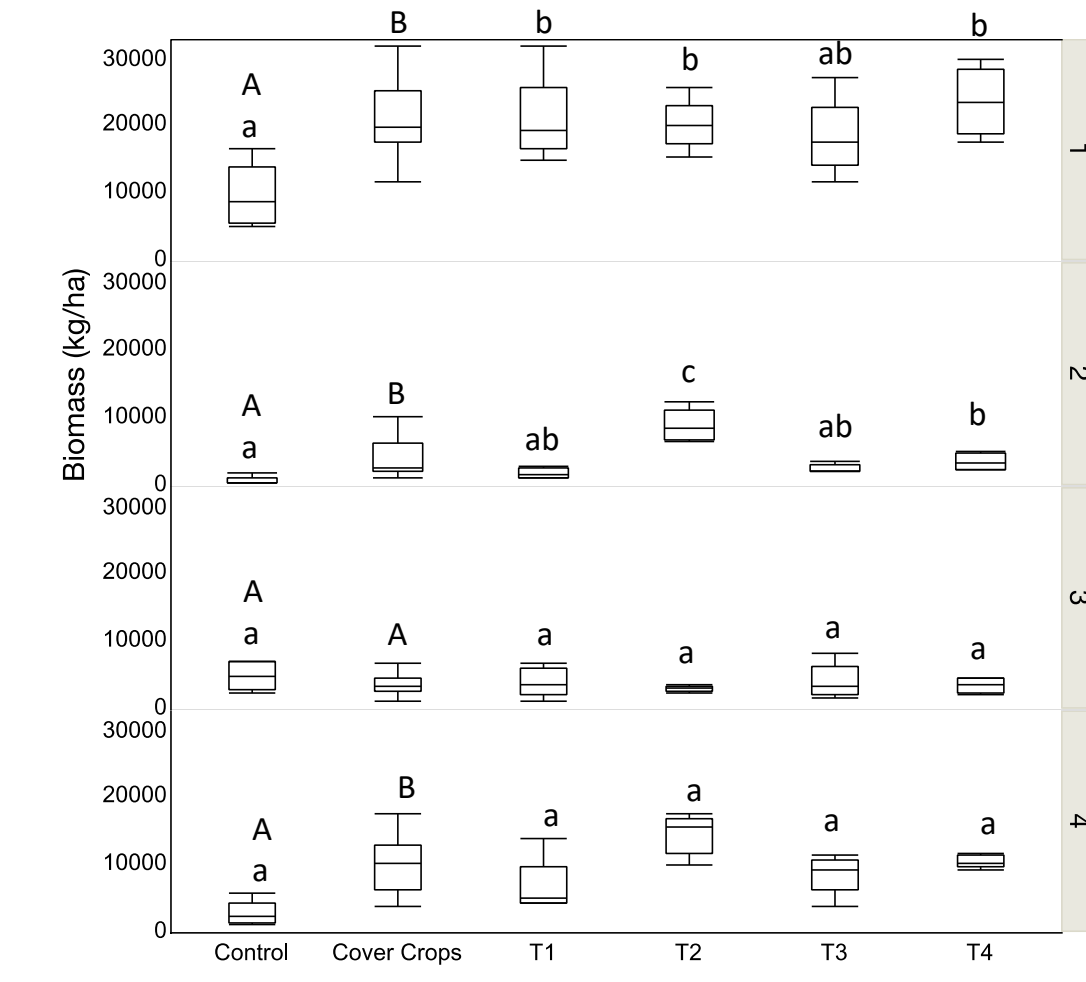


Chart 2. Total above and below ground biomass.

Discussion & Conclusions

Consistent Living Roots Promotes Soil Respiration

- Years with less rainfall (year 1, 2, and 4) showed significantly higher respiration rates compared to fallow ground
- Return of investment of higher seeding rates needs further analysis

No-Till Organic Termination a Challenge in Subtropics

- Reduced tillage can protect surface cover of crop residue and allow microbes to decompose materials
- No-till organic termination options (crimper-rollers and mower) have issues with cover crop regrowth

Short-term Costs vs Long-term Benefits

- Over time, cover cropping may increase organic matter and provide benefits to water holding capacity
- Short-term costs, including risk of cash crop failure due to moisture limitation, can be difficult for many farmers to justify
- The cover cropped areas had increased soil respiration during a cover cropping season and throughout the 4-year period. There were also differences between cover crop species mixes.

Join the Cover Crop Demonstration Program and Get Paid to Build Healthy Soil!

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References & Acknowledgements

¹ J.W. Doran, E.T. Elliott, K. Paustian, Soil microbial activity, nitrogen cycling, and long-term changes in organic carbon pools as related to fallow tillage management, *Soil and Tillage Research* 49:3-18.

² Nielsen et al. (2016). Cover crop effect on subsequent wheat yield in the Central Great Plains. *Agron. J.* 108: 243-256.

The Subtropical Soil Health Initiative is supported by the Conservation Innovation Grants program of the USDA NRCS, under grant #69-3A75-17-281 with additional funding from an NRCS Soil Science Collaborative Research Grant. Special thanks to our farm collaborators at Hilltop Gardens in Lyford, TX.