Research Proposal

Abstract:

This data analysis study will stem from a larger dynamic soil property study currently being done in conjunction with the Natural Resources Conservation Service (NRCS). Where I will observe soil aggregate stability under three tillage practices throughout a series of Hidalgo sandy clay loam soils; Conventional, intermittent and strip tilled agricultural field soils will undergo a wet aggregate laboratory analysis which will ultimately reflect which level of agricultural land management can reproduce a stronger aggregate stability within hidalgo sandy clay loam soils.

Background:

Currently, agriculture is responsible for the degradation of soils in over 24 million acres of land in the name of global food production (University, 2019). While soil is arguably one of the most valuable resources it is continuously under various methods of anthropogenic land management in order to meet our growing populations demands (Blanco-Canqui & Lal, 2008). When a soil is prepped for cultivation, tillage is often required. However, there are biological indicators within the soil that can reflect repercussions of land management with time. Soil aggregates being one of them that with time become less stable therefor interfering with the lands ability to resist erosion, water and gas movement, infiltration, surface crusting, and soil compaction (*07_AgStab_Fact_Sheet_040517-2id12e5.Pdf*). In a 2015 study from the Food and Agriculture Organization of the United Nations it was noted that in the past 40 years we have already lost a

third of our food production soils due to diminished soils (*Home | Food and Agriculture Organization of the United Nations*). All of which is very relevant to a healthy future agriculture system in the Rio Grande Valley.

Importance/Broader Impacts:

As farmers, it's important to evaluate the role and influence we have on the soils we cultivate. Understanding the link between soil disturbance and food production is the difference between choosing irreversible soil degradation or implementing conservation tactics to preserving soil health while also strengthening our current food system.

Methods:

Method	Description
Wet Aggregate Stability: KSSL Method.	Wet Aggregate Stability soil test will measure the if soil aggregates resist falling apart when hit by rain drops or wetted. Unstable aggregates will fall through the sieve and what is left as the stable aggregates will indicate the percentage of stability for that given soil.

Planned Analysis:

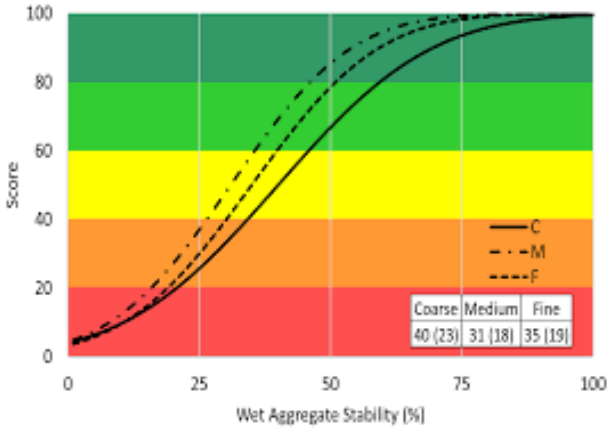
As soil aggregates go through a series of applied water pressure, they will either stick together or begin to break apart- reflecting stability or instability. Basic statistical analysis of this data through python will ultimately help me determine which land management tillage practice produces the strongest soil aggregate stability through a percentage system and shedding light on my hypothesis. Equation used: **(%)={{(WR−SW)/{[IW/(AD/OD)]−Sw}}x100**

Data: Extracted from Python CSV file.

Management	Iw	Wt1	Wt2	WR	Wt3	Wt4	Sand
Interim	6.00	468.40	468.07	0.33	468.11	468.07	0.04
Interim	6.01	187.03	186.22	0.81	186.28	186.22	0.06
Interim	6.02	385.77	385.17	0.60	384.67	384.65	0.02
Interim	6.01	384.29	384.22	0.07	384.37	384.22	0.15
Interim	6.02	468.50	468.30	0.20	468.54	468.30	0.24
Interim	6.03	186.35	186.23	0.12	186.23	186.22	0.01
Conv.	6.00	185.67	185.50	0.17	185.54	185.46	0.08
Conv.	6.02	384.20	384.22	-0.02	384.32	384.65	-0.37
Conv.	6.02	195.50	185.44	0.06	185.45	185.40	0.05
Conv.	6.01	187.07	185.48	1.59	185.48	185.48	0.00
Conv.	6.02	185.49	185.45	0.04	185.48	185.47	0.01
Conv.	6.00	185.47	185.40	0.07	185.47	185.45	0.02
Strip Tilled	6.02	186.75	186.23	0.52	186.45	186.23	0.22
Strip Tilled	6.00	187.41	186.23	1.18	186.25	186.23	0.02
Strip Tilled	6.00	468.87	468.30	0.57	468.41	468.30	0.11
Strip Tilled	6.00	187.00	185.48	1.52	185.49	185.48	0.01
Strip Tilled	6.00	190.72	186.22	4.50	186.23	186.22	0.01

Tillage Strategies Under Analysis
Conservation/strip tillage: minimizes the use of constant soil disruption and only tills on the portion of the soil that will be seeded.
Intermittent tillage: Tillage done throughout the growing season as needed but less frequently that conventional tillage.
Conventional tillage: Most common within agriculture- constant disturbance of the soil in an effort to control weeds and produce fine soil ready for planting.

Python Analysis: Cornell Figure 2 (*07_AgStab_Fact_Sheet_040517-2id12e5.Pdf*).



Hypothesis/Research Questions:

Soils that have been strip tilled will have a stronger soil aggregate stability than soils that have been conventionally or intermittently tilled.

Timeline:

Spring 2021	Laboratory Assessment:	Research Proposal Development:	Data Analysis:	Research Submission:
March	➢	➢		
April		➢	➢	
May		➢		➢

Sources:

1. Blanco- Canqui, H. & Lal, R. (2008). *Principles of Soil Conservation and Management* (2008th ed.). Springer.
2. *Home | Food and Agriculture Organization of the United Nations*. http://www.fao.org/home/en/. Accessed 3 Apr. 2021.
3. University, Stanford. "Reduced Soil Tilling Helps Both Soils and Yields." *Stanford News*, 6 Dec. 2019, https://news.stanford.edu/2019/12/06/reduced-soil-tilling-helps-soils-yields/.
4. *07_AgStab_Fact_Sheet_040517-2id12e5.Pdf*. https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/f/5772/files/2016/12/07_AgStab_Fact_Sheet_040517-2id12e5.pdf. Accessed 3 Apr. 2021.