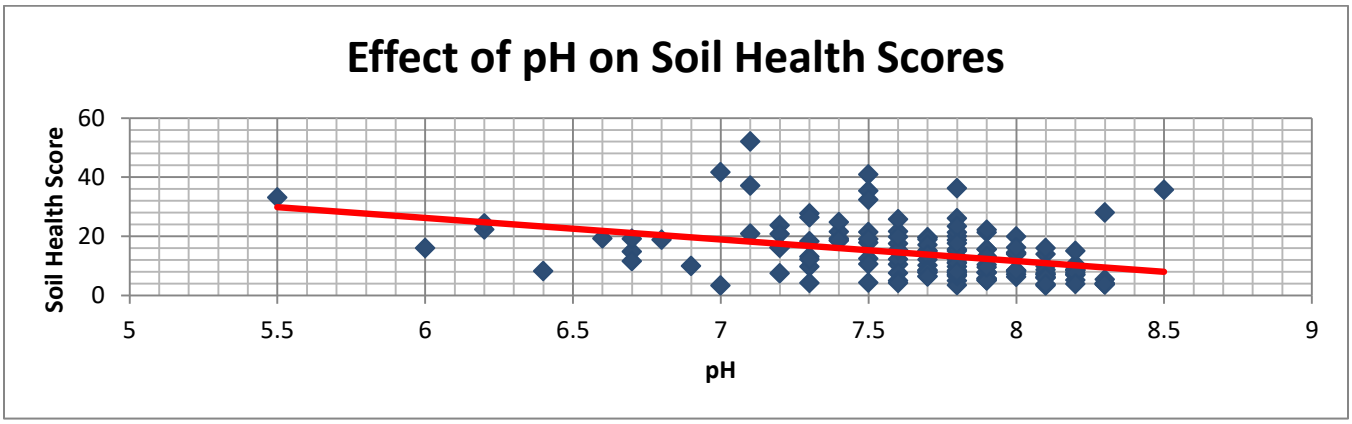
INSIGHTS FROM OUR 2020 DATA

As we have analyzed the massive amounts of data we have gathered, the challenges which CSSHP growers face when trying to improve their soil's health are becoming clearer.

pH (Acid Base Balance)

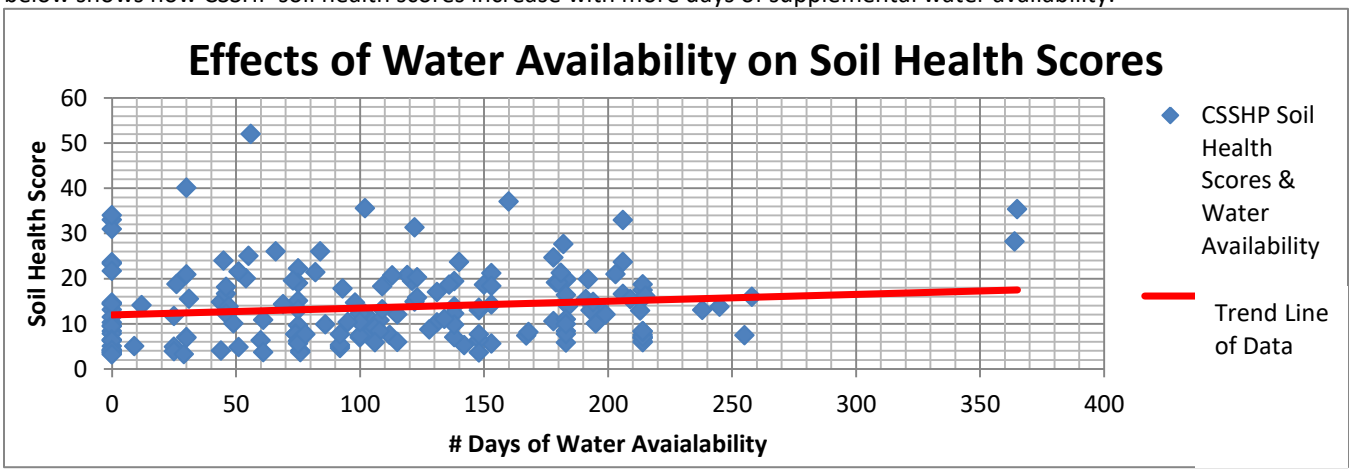
The Colorado Front Range is is known for its alkaline soils and we are certainly seeing that. The vast majority of our sites have alkaline soils, and about half of all our sites are in the "Concerning" range, with a pH bove7.7.According to Lance Gunderson of Regen Ag Lab, our high pH soil favors soil bacteria over soil fungi. One key strategy to improve soil health is to promote soil fungi by disturbing the soil less. But our high soil pH means it is doubly hard to increase soil fungi, because they don't particularly like our high pH soil. CSSHP data supports this finding. CSSHP growers with higher soil pH (alkaline soil) tend to have lower soil health scores. The red trend line in the graph below shows that as pH increases for CSSHP growers, their soil health scores tend to decrease.



It is very difficult and expensive, some say impossible, to change soil pH. Adding sulphur, organic matter or certain fetilizer formulations can help, but take many years to effect a change.

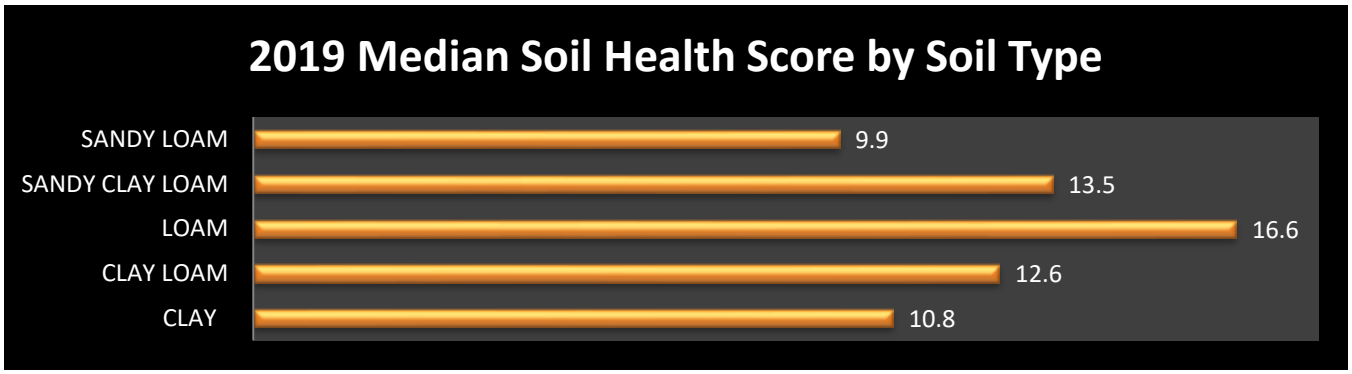
Supplemental Water Availability

Another challenge for improving soil health is decreasing water supplies and climate change induced drought. Water is life, for soil microbes as well as us, and is key to increasing soil health on the Front Range. Fall cover crops, an excellent soil remediation strategy for our short Front Range growing season, need late-season water to germinate and grow. The graph below shows how CSSHP soil health scores increase with more days of supplemental water availability.

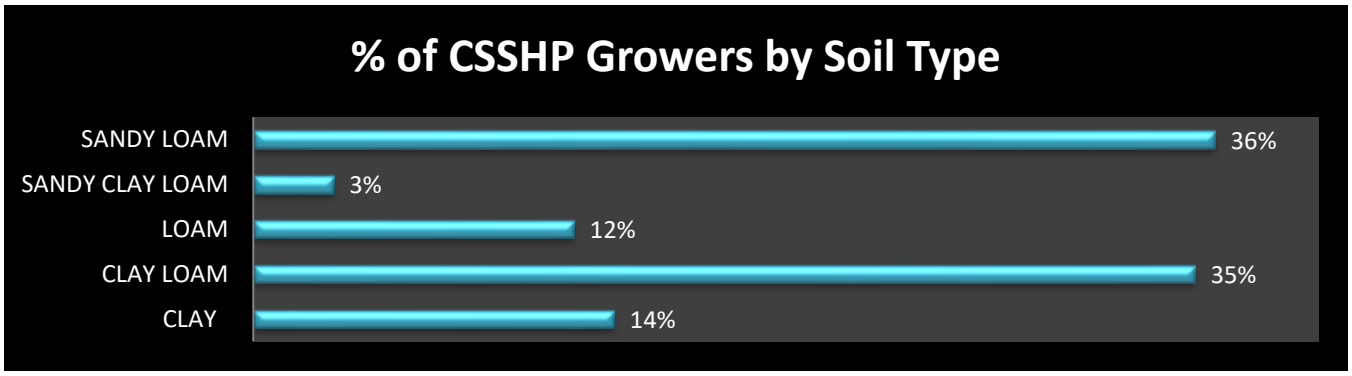


Soil Texture

Soil texture also has a large effect on soil health, and no surprise, our loamiest soils have the better soil health scores. The first graph on the next page shows the 2019 median CSSHP soil health scores of different soil types. The loamy median has the longest bar and highest median, and scores fall off above and below loam, to clay and sand which have the lowest soil health scores.

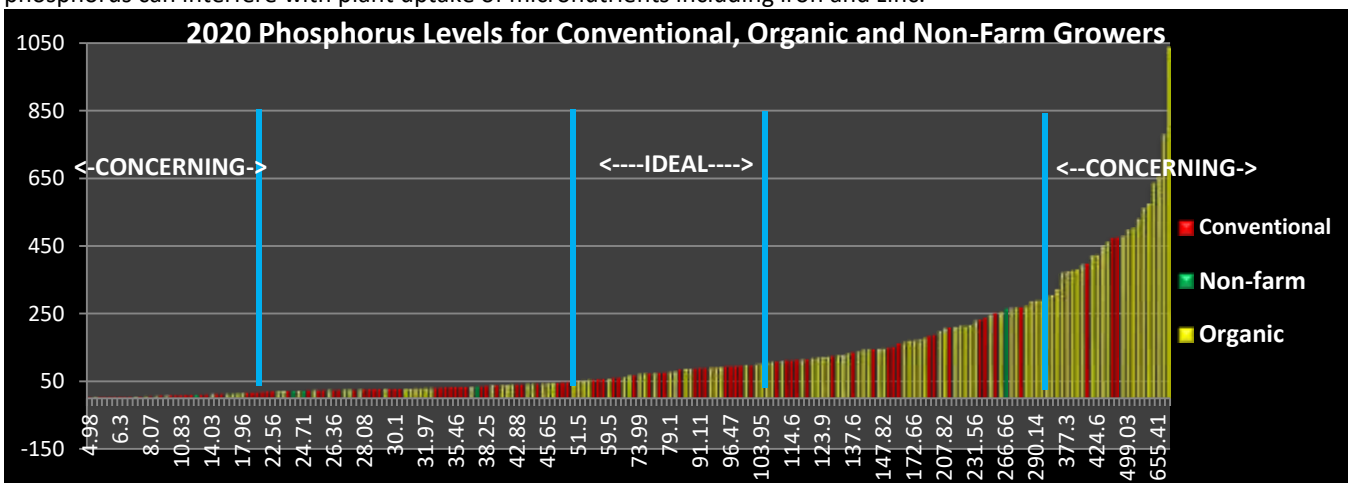


But many CSSHP growers are starting with a soil texture handicap. The next graph shows that loam soils are uncommon among CSSHP growers. Only 15% of CSSHP growers have loam or sandy clay loam soils, our two soil types with the highest soil health score medians. 85% of CSSHP growers are contending with sandy loam, clay loam or clay soils, which are less conducive to microbial life and more difficult to improve. Soil texture is impossible to change. However some of its structural problems can be ameliorated by adding large amounts of organic material, which can make clay more porous and sand more water-retentive.



Phosphorus: Too much of a good thing

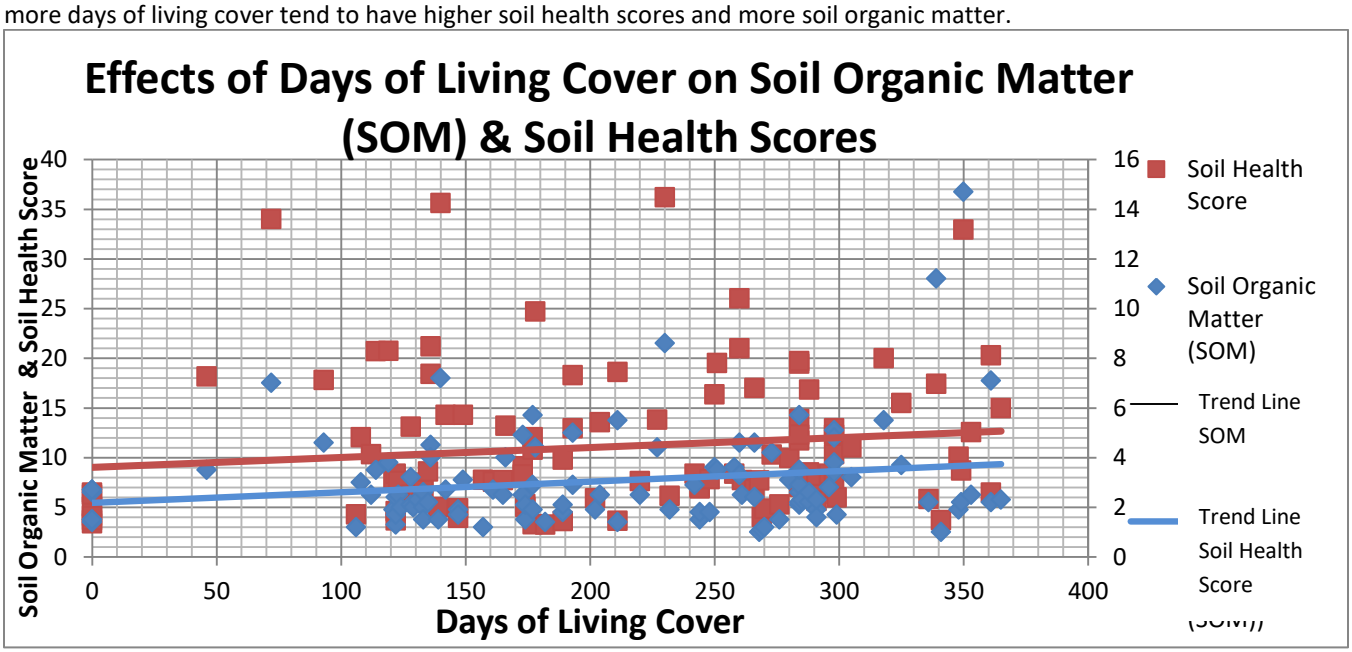
Manure and compost are go-to fertilizers for many Front Range growers, especially organic growers. Manure especially is readily available, cheap, easy to apply, and provides crops with a necessary nitrogen boost. However, manure is also rich in phosphorus, which can build up in soils over time. Phosphorus is an essential plant nutrient and is used by plant cells to build DNA and regulate metabolic reactions, but high levels in the soil can pose a risk to water quality. Phosphorus run-off into surface waters can cause algae growth, oxygen depletion and eutrophication of water bodies. At very high levels phosphorus can interfere with plant uptake of micronutrients including iron and zinc.



Excessive soil phosphorus is a common problem in organic production nation-wide and among CSSHP growers as well. Growers with very high phosphorus levels are advised to switch to low-phosphorus amendments, incorporate legume cover crops to boost nitrogen but not phosphorus, ensure adequate buffer strips along fields to slow and absorb nutrient run-off, and run plant tissue analyses for iron and zinc if deficiencies are suspected.

Effects of Days of Living Cover on Tilled Fields

Increasing the days of living cover in a tilled field through cover cropping and/or succession planting can increase soil health scores and soil organic matter, by preventing soil erosion, helping more water to infiltrate, and supplying soil microbes with plentiful root exudates and organic matter. CSSHP data supports this finding. The graph below shows the days of living cover for CSSHP growers, plotted against their soil health scores (red dots) and soil organic matter (blue dots). CSSHP growers with more days of living cover tend to have higher soil health scores and more soil organic matter.



Spring versus Fall Soil Sampling

The graph below shows how CSSHP soil health scores vary, depending on when growers take their samples. The green lines represent the soil health scores of spring samplers. The orange lines represent the scores of fall samplers. The median soil health score of spring samplers is significantly lower than the median soil health score for fall samplers. In the spring, microbial communities are just starting to build up after a long cold winter. Plants they depend on for root exudates are sending most of their nutrients to new above-ground growth. However, in the fall, plants are instead sending carbon sugars from aging foliage out through their roots to nourish soil microbes. Dying roots and decaying foliage provide microbes with even more food. This difference between spring and fall sampling conditions means that it is very important for growers to stick to the same sampling period each year, to get meaningful Haney and PLFA results. It also means that if growers test their soil and then apply a soil treatment, they need to recheck Haney tests a year after the previous test rather than 4- 6 months later, to accruately asses whether a soil treatment is having its desired effect.