PASA 2018 SOIL HEALTH BENCHMARK STUDY Example Farm

Thank you for participating in PASA's 2018 Soil Health Benchmark Study. In 2018, 59 farms contributed to this citizen-science research project. Together, we are documenting that PASA farmers are forging new frontiers in the art and science of growing healthy soils. This report is a summary of your farm's 2018 soil health outcomes. If you have any questions about any aspect of this report or want to provide feedback or suggestions, please contact:

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HOW TO USE THIS REPORT

1. Review the "benchmark" tables and graphs to see what's typical, and possible, for soil health outcomes among your peer farmers.
2. Review the results of your Cornell Soil Health tests. These tests identify the strengths and constraints of your soils and also provide general management recommendations.
3. Connect with a learning community. This research will guide a series of PASA field days, webinars, and conferences that will bring farmers together to share insights and develop new management ideas. The farmers contributing to this research are a tremendous resource, and through this project, PASA can help connect you with a peer farmer who is tackling similar challenges.
4. Share the infographic marketing resources with your customers and help them understand the great work you are doing for soil health and sustainable farming.

REPORT CONTENTS

METHODS

This research draws from two data sources: 1) field soil samples and 2) farm management records. Our methods were developed with input from participating farmers and scientists at PASA, Penn State University, and Cornell University.

PASA sta consulted with participating farmers to choose three study fields that spanned typical rotation practices on that farm. For instance, if a farmer practices a three-year vegetable rotation involving fall brassicas in one year, to tomatoes and peppers in the next year, to a full year of cover crops, we would choose one field in each of these phases for sampling. We also chose fields that represented typical soil types and topographic positions on each farm.

In October and November of 2018, PASA sta and collaborating farmers collected soil samples from each field. For farms participating in the project for the first time, PASA sta collected the sample. For most farms continuing with the study from 2017, farmers collected their own samples. We subsampled from five locations in each field, homogenized the samples, and submitted them to the Cornell Comprehensive Assessment of Soil Health. Cornell runs a battery of tests, evaluating ten di erent physical, biological, and chemical indicators of soil health.

Throughout the growing season, participating farmers maintained logs of farm operations in the selected fields, either using template excel spreadsheets provided by PASA, farmOS software, or failsafe paper notebooks. Records included: 1) tillage, cultivation, and any farm operations involving soil disturbance or compaction; 2) planting and termination dates for crops and cover crops, and 3) application dates and quantities for all fertilizers and soil amendments.

Over the winter months, participating farmers shared their soil management records with PASA. PASA sta scientists organized these data and generated three additional management indicators: 1) days of living cover, 2) tillage intensity, and 3) organic inputs. These indicators provide a snapshot of some of the farm management practices that most influence soil health.

BENCHMARKS: Cornell Comprehensive Assessment of Soil Health Indicators

Table 1. Measurements and peer comparisons for the Cornell Soil Health Test Indicators. This table shows measured values for your fields, compared to the min, max, and median for peer vegetable farms in the PASA study.

	Your Fields			Peer Fields		
Soil Health Indicator	A	B	C	Min	Median	Max
Available Water Capacity (g/g)	0.2	0.2	0.2	0.1	0.3	0.4
Aggregate Stability (%)	15.8	12.3	12.6	6.2	20.8	86.8
Organic Matter (%)	3.8	3.4	3.3	1.8	3.9	11.6
Soil Protein Index	4.3	4.5	4.2	3.7	6.7	33.8
Respiration Index	0.4	0.4	0.4	0.3	0.6	1.4
Active Carbon (ppm)	499	501	452	272	584	1351
pH	6.5	7.1	7.1	5.6	6.9	7.6
Phosphorous (ppm)	14.5	14.6	13.1	2	16	400
Potassium (ppm)	121	67.3	65	43.8	180	446
Magnesium (ppm)	85.8	138	159	69.7	146	507
Iron (ppm)	1.4	0.8	0.8	0.1	1	6.7
Manganese (ppm)	2.8	3	3.2	1.4	4.1	32.1
Zinc (ppm)	1.4	0.8	0.7	0.2	1.1	130

Table 2. Ratings and peer comparisons for the Cornell Soil Health Test Indicators. This table shows ratings for your fields, compared to the min, max, and median for peer vegetable farms in the PASA study.

	Your Fields			Peer Fields		
Soil Health Indicator	A	B	C	Min	Median	Max
Available Water Capacity	85	84	71	30	94	99
Aggregate Stability	19	14	15	8	28	99
Organic Matter	81	67	61	13	84	100
Soil Protein Index	24	27	23	19	52	100
Respiration Index	22	24	26	16	45	99
Active Carbon	49	50	39	9	66	99
pH	100	100	100	14	100	100
Phosphorous	100	100	100	0	66	100
Potassium	100	92	90	66	100	100
Minor Elements (Mg, Fe, Mn, & Zn)	100	100	100	56	100	100
Overall Score	68	66	62	51	72	95

OPTIMAL (80-100)
EXCELLENT (60-80)
AVERAGE (40-60)
LOW-LEVEL (20-40)
CONSTRAINED (0-20)

More detail on how each indicator is measured, and potential management approaches to remedy constraints, are included in your Cornell reports, which have been shared with you as a separate document. The Cornell Soil Health manual is also an excellent resource for deeper learning about this soil health test (https://soilhealth.cals.cornell.edu/training-manual/).

To help orient you to the tables, here is a quick summary of what each indicator measures and what it can tell you about your soil's health.

Physical Soil Health Indicators

Available water capacity is a measure of the amount of water accessible to plant roots relative to the total amount of water the soil can hold under saturated conditions. It is measured in units of grams of water per grams of dry soil.Soils with greater available water capacity allow plants to perform better under drought conditions.

Aggregate Stability is a measure of the extent to which soil structure can hold up to wind, rain, and other stresses. Aggregate stability is measured as the percentage of soil aggregates that hold together through a standardized rainfall simulation. Good aggregate stability helps promote germination and root growth.

Biological Soil Health Indicators

Organic matter is measured as the percent of total soil mass that contains carbon compounds derived from living or once-living biomass. Organic matter is a core measurement of soil health. Organic matter is the foundation of soil life, contributes to the formation of stable soil aggregates, helps to improve available water capacity, and provides a slow-release supply of nutrients.

Please note that in 2018, the Cornell Soil Health Lab made an error in the laboratory standard curve they use to calculate organic matter levels. As a result, the original Cornell reports we shared in February showed organic matter levels typically **0.5% lower** than the correct value. **The tables and figures in this benchmark report show**

the correct organic matter levels, but you may notice a descrepancy with the reports generated by Cornell. Cornell has fixed this problem moving forward.

The **Soil Protein Index** tells you the amount of protein contained in soil organic matter. Proteins contain a lot of nitrogen, and microbes in the soil can break down these proteins and make the nitrogen available to plants. Soil protein is measured as mg protein extracted per gram of soil.

Soil Respiration measures the abundance and activity of microbial life in the soil. Soil microbes work to break down plant residues in the soil and cycle nitrogen and other nutrients from organic matter into plant-available forms. As they break down organic matter, microbes release carbon dioxide (CO2), so microbial activity can be measured by capturing the carbon dioxide produced by soil microbes over a four-day incubation period in the lab. Respiration is expressed in units of mg CO2 per gram of soil.

Active Carbon is a measurement of the small portion of soil organic matter that can serve as an easily available food source for soil microbes, thus helping maintain a healthy soil food web. It is measured in parts per million (ppm). Active carbon is a good leading indicator of biological soil health and tends to respond to changes in management earlier than total organic matter content.

Chemical Soil Health Indicators

pH is a measurement of how acidic the soil is, which controls how available nutrients are to crops. If pH is too high, nutrients such as phosphorus, iron, manganese, copper and boron become unavailable to the crop. If pH is too low, calcium, magnesium, phosphorus, potassium and molybdenum become unavailable. The value is presented in standard pH units, and rated using a hump-shaped curve, with a pH between 6.2-6.8 optimal for most crops.

Phosphorus (P) is an essential plant nutrient and is used by plant cells to build DNA and regulate metabolic reactions. At high levels, P can become a risk to water quality and at very high levels it can interfere with plant uptake of micronutrients including iron and zinc. Note that Cornell scores P measurements using a hump-shaped curve, such that both low and high parts per million (ppm) values get ratings towards zero. Optimal ppm values for P vary based on the texture and geology of individual soil types, but ratings above 30ppm are typically considered excessive.

Please note that in 2018, the Cornell Soil Health Lab adjusted the laboratory standard curve they use to calculate P levels. Compared to their previous standard curve, the new standard curve results in lower P values reported for samples with very high phosphorus levels (>500ppm). **So if your fields showed very high P levels in 2017, you may notice a substantial drop in 2018**. However, because the adjustment to the standard curve only a ected samples with very high readings, the change is unlikely to influence interpretation of the test results (i.e. these fields still have excessive P).

Potassium (K) is an essential plant macronutrient that contributes to heat and cold tolerance and promotes fruit development in horticultural crops. It is measured in parts per million by mass.

Minor Elements including Magnesium (Mg), iron (Fe), manganese (Mn), zinc (Zn) are essential for various plant biochemical reactions but are required in small quantities. If any minor elements are deficient, this will decrease yield and crop quality, but toxicities can also occur when concentrations are too high. Cornell provides individual measurements in ppm for each of these four minor elements, but aggregates all four into a composite minor element rating.

The **Overall Score** is a simple average of the ratings for the set of ten chemical, biological, and physical indicators in the Cornell Comprehensive Assessment of Soil Health. The overall score can be a useful general summary, but individual indicators will be more useful in identifying strengths or management challenges for a specific field.

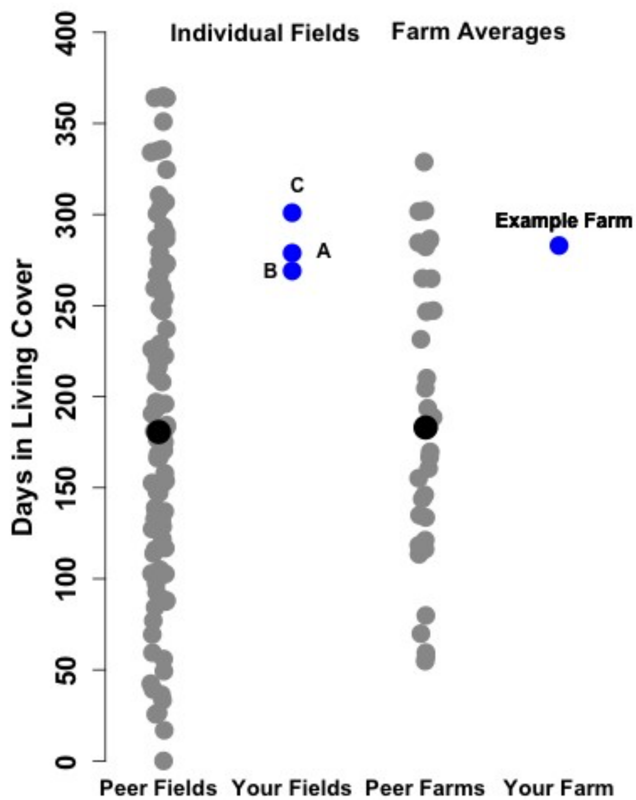
BENCHMARKS: PASA Management Indicators

How to Read These Graphs: We collated farm management records from participating farms to generate 3 key indicators of soil health management: days in living cover, tillage intensity, and o -farm organic matter inputs.

For each indicator, we've plotted results from your farm relative to results from peer farms. Because di erent phases of a vegetable rotation often have very di erent management practices, we've plotted each indicator for the collection of individual fields, and for values for each farm averaged across the 3 study fields. In each figure, the **gray dots** show peer fields and farms, the large **black dot** shows the median values, and the **blue dots**, show your fields and farm. You can use these figures to think about the range of possible outcomes for separate phases of a vegetable rotation and for a rotation as an integrated unit.

Days of Living Cover

Living vegetation protects soil from wind and water erosion while also supplying the soil with fresh organic matter. Linking together crops and cover crops to maximize days of living cover is a fundamental soil building practice. The "Days of Living Cover" score is the days between crop or cover crop seeding (or transplant) and termination (or winter kill). For each field, we weighted the days of living cover for di erent crops and cover crops by the area planted and then summed over all the crops and cover crops. Your farm averaged **283 days**, while the median value for peer vegetable farms was **183 days**.



Tillage Intensity Index

Tillage can degrade soil structure and organic matter, but it can also be a valuable tool for weed management and incorporating cover crops. The tillage intensity index uses data from a Natural Resources Conservation Service soil erosion model to assign a soil disturbance score to all farm operations that can compact or disturb soil (Table 3). We weighted the cores for each machinery operation based on the area covered and then summed over the season. For context, NRCS assigns a single pass with a moldboard plow a score of 65, a disc harrow gets a score of 19.5, and a grain drill gets a score of 2.4. Below the figures, you can see a table of the implements and tillage scores we assigned for your fields.

Your farm averaged **149** units on the NRCS tillage intensity scale, while the median value for peer vegetable farms was **110.9** units.

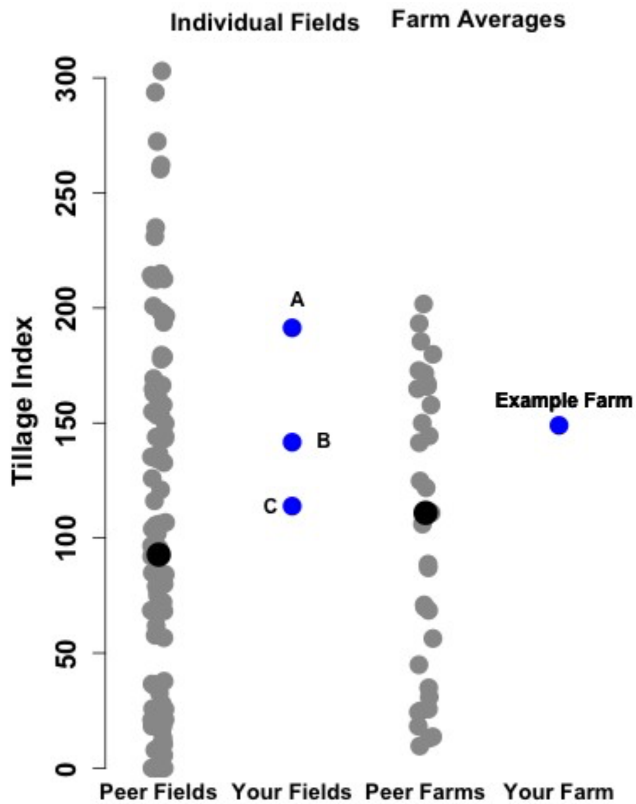


Table 3. Field operations and tillage intensity values. This table lists the field operations and implements you listed for each of your fields, along with the closest matching operation we could find in the NRCS tillage intensity index tables, and the corresponding tillage intensity value.

Field	Operation	NRCS Match	Tillage Index
C	molboard plow	Plow, moldboard	65
C	Field Cultivator	Cultivator, field with spike points	31.2
C	spader	Spader	18.2
C	plastic layer	Plastic mulch applic. 40 inch beds 100 percent cover	1.6
A	molboard plow	Plow, moldboard	65
A	Field Cultivator	Cultivator, field with spike points	31.2
A	Interrow Cultivation	Cultivator, field with spike points	31.2
A	plastic layer	Plastic mulch applic. 40 inch beds 100 percent cover	1.6
B	molboard plow	Plow, moldboard	65
B	Field Cultivator	Cultivator, field with spike points	31.2
B	spader	Spader	18.2
B	plastic layer	Plastic mulch applic. 40 inch beds 100 percent cover	1.6

Organic Matter Inputs

Organic matter inputs including composts, manures, and straw mulches can jump-start the formation of soil organic matter, add microbiology to the soil, and supply macro and micro nutrients. However, continuous inputs can also contribute to soil health challenges, such as excessive phosphorus levels. This organic input score shows the total organic inputs (composts, manures, and mulches) into each field, in units of tons per acre. This indicator only looks at inputs from "outside" the study field, and doesn't include manure deposited by animals grazing in that field or biomass generated by crops and cover crops.

Your farm averaged **5.3 T/A**, while the median value for peer vegetable farms was **2 T/A**.

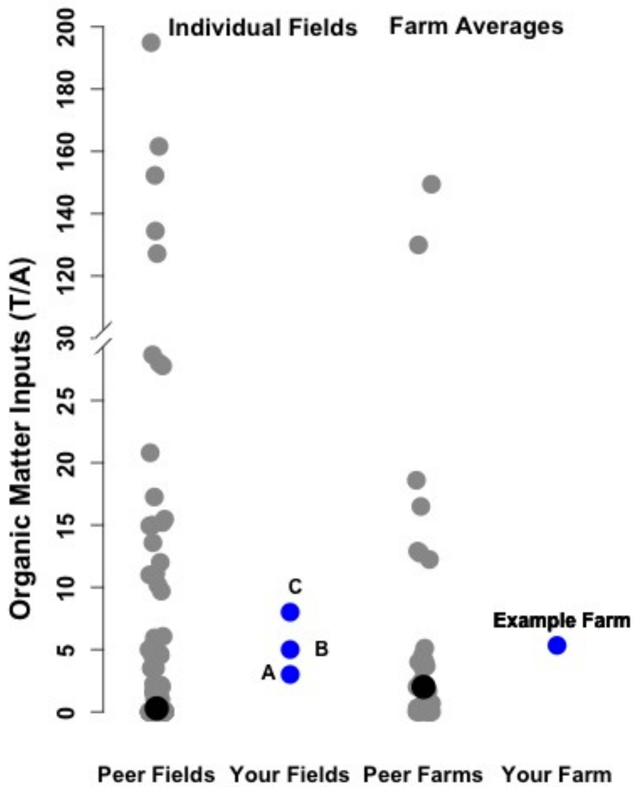


Table 4. PASA management indicators, 2018. This table shows the values for your fields, compared to the min, max, and median for peer vegetable farms in the PASA study.

	Your Fields			Peer Fields		
Management Indicator	A	B	C	Min	Median	Max
Days of Living Cover	278.9	269	301	0	181.1	365
Tillage Index	191.4	141.6	113.9	0	95.5	303
Organic Matter Inputs (T/A)	3	5	8	0	0.4	194.9

2017-2018 TRENDS: Tough Weather is Tough on Soil

For farms continuing in our study from 2017, we can show year-over-year changes for the soil health indicators. In the tables below, we show year-on-year changes for each of your study fields (if you participated in the 2017 study), along with median 2017 and 2018 values for vegetable and row crop farms (because grazing dairies were new to the 2018 study, we can't show change for this cohort).

Table 5. 2017 and 2018 measurements for the Cornell Soil Health Test indicators.

	Your Fields					
Soil Health Indicator	A , 2017	A , 2018	B , 2017	B , 2018	C , 2017	C , 2018
Available Water Capacity (g/g)	0.2	0.2	0.2	0.2	0.2	0.2
Aggregate Stability (%)	45.3	15.8	37.9	12.3	38	12.6
Organic Matter (%)	4.2	3.8	4.1	3.4	3.9	3.3
Soil Protein Index	4	4.3	4.7	4.5	4	4.2
Respiration Index	0.6	0.4	0.8	0.4	0.8	0.4
Active Carbon (ppm)	433.1	498.8	500.8	500.6	477.1	452.1
pH	6.2	6.5	6.7	7.1	6.8	7.1
Phosphorous (ppm)	29.8	14.5	61.2	14.6	32	13.1
Potassium (ppm)	162	121.4	92.9	67.3	95.1	65
Magnesium (ppm)	97.7	85.8	146.8	138	172.2	159.4
Iron (ppm)	1.3	1.4	0.8	0.8	0.8	0.8
Manganese (ppm)	11.6	2.8	11	3	12.1	3.2
Zinc (ppm)	1.6	1.4	1.3	0.8	1	0.7

Table 6. 2017 and 2018 median values for Cornell Soil Health Test Indicators on vegetable and row crop fields.

	Vegetables (Median)		Row Crops (Median)	
Soil Health Indicator	2017	2018	2017	2018
Available Water Capacity (g/g)	0.3	0.3	0.3	0.3
Aggregate Stability (%)	44	20.8	53	20
Organic Matter (%)	4.3	4.2	4	3.9
Soil Protein Index	6.9	6.6	4.8	5.8
Respiration Index	1	0.6	0.9	0.6
Active Carbon (ppm)	672	642	556	529
pH	6.7	7.1	6.7	6.8
Phosphorous (ppm)	55.7	23.5	11.9	13
Potassium (ppm)	194	199	143	134
Magnesium (ppm)	188	173	130	156
Iron (ppm)	1.4	1	0.8	0.8
Manganese (ppm)	23.9	4	21.3	3.3
Zinc (ppm)	2	1.3	1.3	0.8

Comparing 2017 and 2018 values, a few important trends jump out.

Aggregate Stability

Many vegetable and row crop fields showed a pronounced drop in aggregate stability from 2017. This drop was probably caused by the interaction of frequent, intense rainstorms last summer and fall with machinery tra c and soil disturbance. Wet soils are particularly vulnerable to compaction and degradation from cultivation and planting and harvesting equipment.

If aggregate stability dropped on your farm, you may find it encouraging to know that past research indicates that stable aggregates are a pretty resilient soil property and can be regenerated through cover cropping and crop rotation. Overwintering crops and cover crops with fibrous root systems, such as cereal rye or triticale may be particularly helpful in rapidly rebuilding stable aggregates.

Organic Matter

Soil organic matter is a fairly slow change soil-property, and boosting organic matter levels by a full percentage point can often take a decade of slow, steady progress on working forms. In both vegetable and row crops fields, we saw a slight decline of around 0.1% organic matter between 2017 and 2018. This change may just reflect unavoidable sampling or measurement variability, or it could point to a slight decline in organic matter levels related to the drop in aggregate stability. Stable aggregates help soils resist erosion, and erosion may have been higher with last year’s rainfall. Since organic matter is often concentrated near the soil surface, increasing erosion could overtime lead to a decline in organic matter. We’ll be watching the organic matter numbers closely in coming seasons and hopefully starting to chart overall improvements as farmers continue to practice better soil stewardship.

Active Carbon

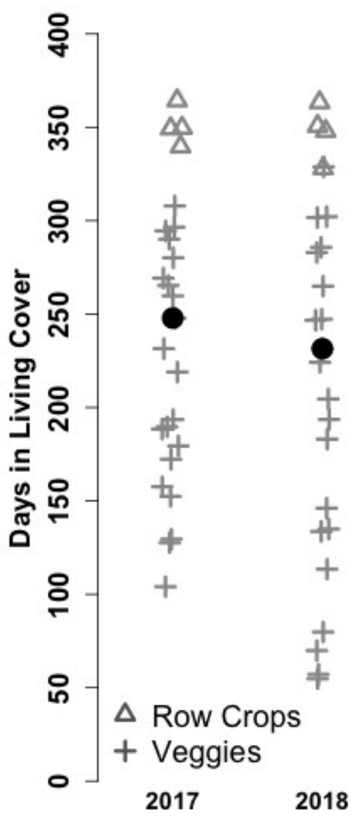
Active carbon is a measurement of the amount of fast-turnover organic materials that can be easily brokendown by soil organisms. While total organic matter is usually a slower change variable, active carbon can be a more dynamic, leading indicator of soil organic matter change. When active carbon levels are low, microbes may set to work on more stable organic materials, leading to a longer-term drop in total organic matter levels. When active carbon is higher or increasing, this indicates that microbes have plenty of easy to access food, with surplus that can contribute to the build-up of more stable organic matter.

Most of our participating farms showed a drop in active carbon levels from 2017-2018, suggesting a possible longer term challenge for feeding healthy microbe populations and building organic matter. If your fields showed a major decline in active carbon, you can often boost active carbon levels by cover cropping or adding manure, compost, or mulches.

Cover crops

Cover crops are a powerful technique for addressing problems with aggregate stability, organic matter, active carbon, and many other soil health indicators. Unfortunately, we observed a substantial drop in "days of living cover" between 2017 and 2018, especially on vegetable farms. This change can largely be attributed to challenging weather in the fall of 2018, leading to unsuccessful or missed cover crop plantings on several farms. In this figure, the **black dot** shows the median value for 2017 and 2018, and the **gray symbols** show the values for individual farms. Weather conditions like those in 2018 may become more common in the future.

If you had success with fall cover crops last year, we'd love to hear more about techniques that worked for you.

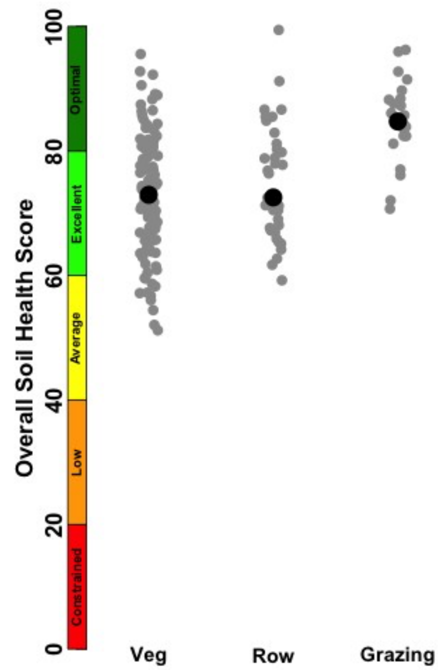


INSIGHTS: Comparing Farm Systems

PASA's 2018 Soil Health Benchmark Study included a wide diversity of farm types, including our 3 cohorts of diversified vegetable farms, row crop farms, and grazing dairies. Although within each cohort we had a range of farm scales, farmer experience levels, and management systems, we did observe some consistent di erences between the cohorts. The following figures contrast key soil health indicators across the di erent cohorts, with the **black dot** showing the median value for each cohort, and the **gray dots** showing the values for individual farms.

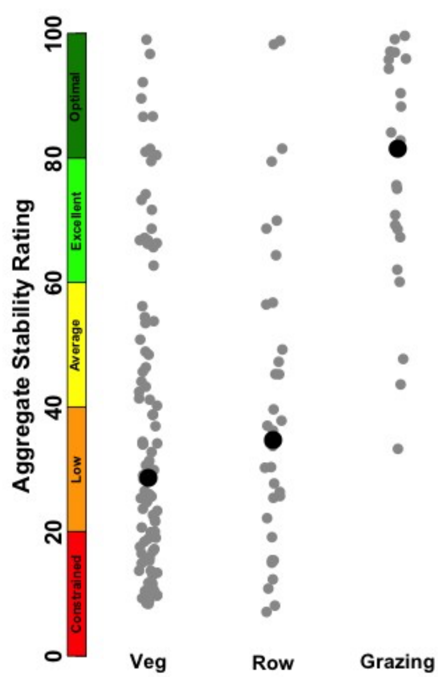
Overall Soil Health Scores

Across the board, grazing dairies tended to have the highest scores for almost every rating, speaking to the power of long-term, perennial systems. In terms of overall soil health scores, grazing dairies had the highest median rating, with several fields achieving a near perfect rating. At the same time, it's encouraging to see that almost all of our farms, in all three cohorts, showed "excellent" or "optimal" overall scores. Clearly, collaborating farmers in our project are practicing a high level of soil stewardship.



Aggregate Stability

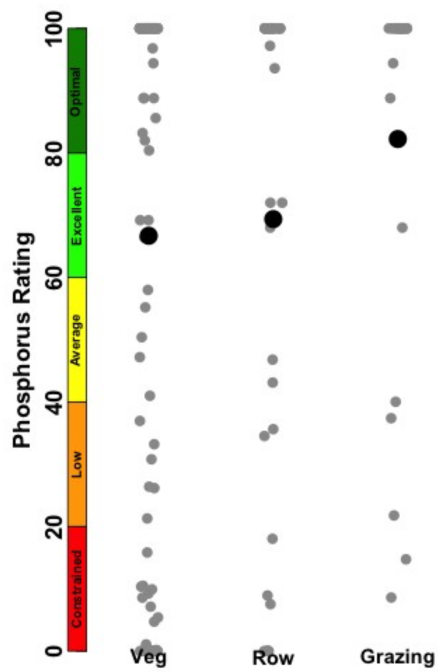
Maintaining aggregate stability has emerged as a key challenge among vegetable and row crop farms. We observed low aggregate stability on many farms, including some long-term no-till row crop farms. With weather conditions as challenging as those encountered in 2018, heavy machinery tra c even on no-till soils can degrade stable aggregates. Aggregate stability problems were most pronounced on vegetable farms. Many farmers may have felt strong time contraints to use plows, cultivators, and heavy machinery on fields during less-than-optimal conditions.



Phosphorus

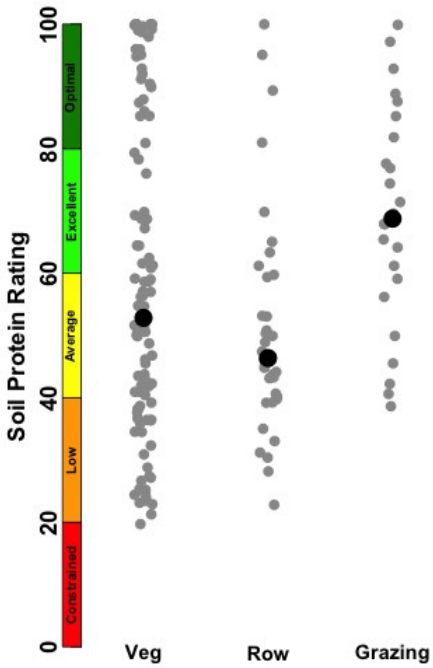
Many vegetable farms and some row crop farms struggle with excessive phosphorus levels (leading to low phosphorus ratings in the Cornell system). In most cases, high phosphorus levels could be attributed to a prior legacy of heavy manure or compost applications. For farms relying on manure or compost as a nitrogen source, phosphorus is typically supplied in excess of crop needs. Excessive phosphorus is a long-term problem; in some cases, we know that farmers sharply dialed-back their compost or manure applications years ago, but still show very high phosphorus soil test levels.

For vegetable and row crop farms the distribution of phosphorus ratings tended to be very polarized. Many farms had either developed a fertility program that balances phosphorus inputs with other crop nutrient needs, or they were dealing with a long-term excessive phosphorus challenge. Taking a careful look at the nutrient needs of your crops and the soil concentrations of phosphorus and other nutrients can be helpful in developing a balanced fertility plan.



Soil Protein Index

Relative to grazing dairies, we saw substantially lower soil protein levels on vegetable farms, with row crops tending even slightly lower. Soil proteins are an indicator of the amount of nitrogen “banked” in soil organic matter. Farmers can boost soil protein levels by growing legume cover crops or adding manure or compost as appropriate. On many farms with high soil protein levels, we noticed that farmers were also applying generous amounts of synthetic nitrogen fertilizers or OMRI-approved concentrated nitrogen fertilizers. If your fields shows “excellent” or “optimal” soil protein ratings, you might consider dialing back your normal nitrogen fertilizer applications in some test plots and observing any changes in yield or crop performance.

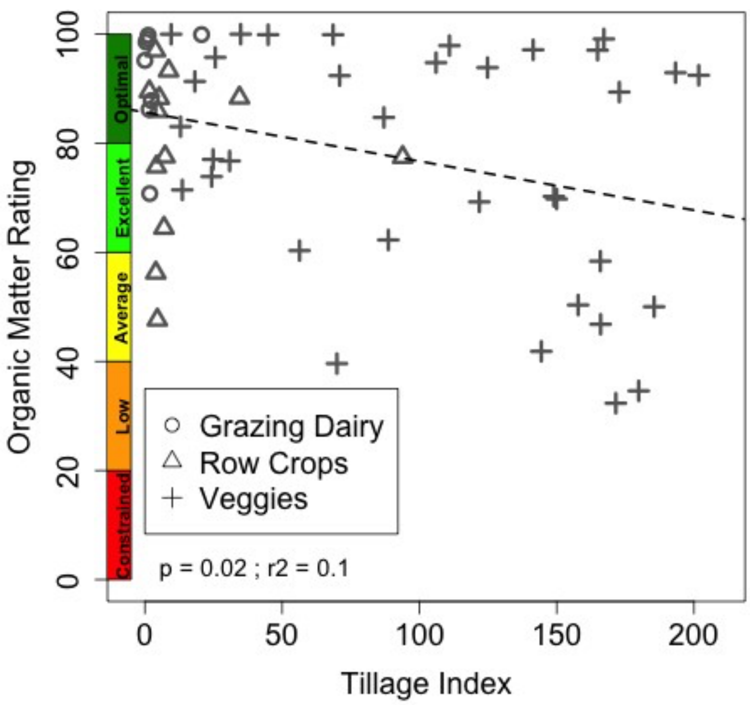


INSIGHTS: Connections between Management and Soil Health

In many ways, organic matter is the central soil health indicator. Organic matter influences the formation of stable aggregates, provides long-term slow release soil fertility, and provides fuel and habitat for beneficial microorganisms. Viewed through the lens of of soil organic matter, our 2018 data shows that **di erent farms are finding di erent paths to soil health**.

Tillage Instensity and Oganic Matter

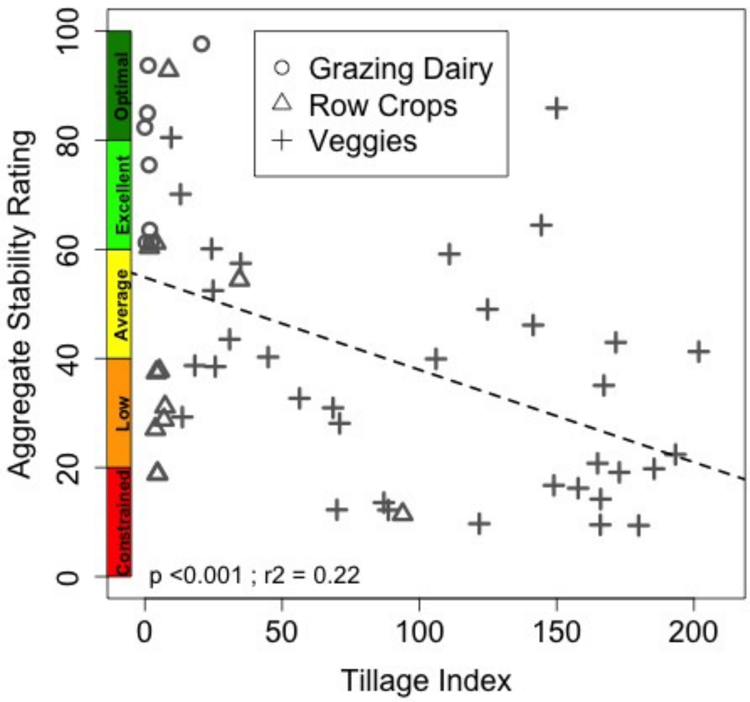
For instance, previous research suggests that tillage and cultivation can severely deplete soil organic matter by disturbing soil structure and exposing soil to fresh air (oxygen stimulates microbes to metabolize or burn up organic materials). However, our data set shows that across a wide span of tillage practices, many farms are finding ways to grow and maintain high soil organic matter levels. While we did observe a significant negative relationship with tillage intensity and organic matter, the correlation is very “noisy,” and we also observed many farms with more intense tillage reporting “optimal” organic levels. In fact, we’ve observed many cases of “optimal” organic levels across perennial grazing fields, long-term no-till row crop fields, and organic vegetable farms using moldboard plows.



How is it possible to balance soil health with tillage and cultivation? While our dataset doesn't point to any single strategy, organic vegetable farms are using a mix of strategies to counter the soil depleting e ects of tillage with soil building processes. These include consistent over-winter cover crops; rotations that include grazing, forage crops, or cover crop fallow periods; carefully timed tillage operations for when soil conditions are appropriate (i.e. not "too wet"); and fine-tuning crop fertility and pest management so that healthy, thriving crops can contribute as much as possible to soil organic matter and biology.

Tillage and Aggregate Stability

Of course, tillage and soil disturbance aren't without negative consequences. While we observed only a slight negative relationship with organic matter and overall soil health scores, we did find a sharp negative correlation between tillage intensity and aggregate stability, especially on vegetable farms. This relationship was much more pronounced in our 2018 dataset (versus our 2016 or 2017 studies), perhaps indicating the compound threats from weather and soil disturbance to aggregate stability in 2018. Moving forward into a changing climate, farms using tillage and cultivation may face extra challenges balancing the benefits of steel in the field for weed control and field preparation with degrading e ects on soil structure.



MARKETING RESOURCES:

Healthy soils improve air and water quality, grow more nutritious products, and help ensure an abundant food supply for future generations. Farmers that practice excellent soil stewardship therefore deserve a better price and bigger markets for their products. We designed the customized infographic included with this report to help you tell your customers and stakeholders about the important work you are doing to improve and protect your soil resources. Each infographic has been tailored to your farm's soil health data, and shows your farm averages for three key statistics:

Cornell Soil Health Scores, compared to the average soil health score for all soils in the Cornell database, which is set to 50 in their scoring system.

% Organic Matter, compared to the % organic matter estimated by the NRCS Soil Survey for the soil types sampled on your farm.

Days of Living Cover, compared to a Pennsylvania benchmark for a corn and soybean rotation planted without cover crops. Estimates for corn and soybean days of living cover were taken from planting and harvest dates reported by the National Agricultural Statistics Service (NASS). Recent estimates from the Census of Agriculture report that only 13% of PA cropland acres are cover cropped, so the benchmark of no cover crops is a fair assessment of the status quo.

You can add these infographics to your farm's website, or share print copies with your wholesale buyers, at your farm stand, or in CSA boxes. These marketing resources are a new experiment for PASA. If you do share your farm's infographics with your customers, please let us know if you have suggestions for how we can improve them or create additional resources to support you in marketing your soil health stewardship to your customers.

NEXT STEPS

As our project continues in 2019 and beyond, the data you and peer farms are contributing will provide an enormous resource for benchmarking trends in soil health and uncovering common challenges, and highlighting specific solutions. This fall, PASA will also publishing three "Case Studies" highlighting how the Soil Health Benchmark Study data and peer learning groups have been applied on a vegetable, row crop, and grazing dairy farm. As the season winds down, we'll also be organizing conference calls and workshops to further explore the data and learn from the collective experience of our 59 contributing farmers. **In October, we'll be gearing up for another round of this project, so please check your email and mailboxes for information on collecting and submitting your 2019 soil samples and management records.**

Save the Date!

- December 6-7, **Farmer Collaborator Meeting**, Harrisburg Area Community College

Join us for a in-depth review of PASA's apprenticeship and research programs and take advantage of a valuable opportunity to network with other experienced farmers.

- February 5-8, **29th annual PASA Conference**, Lancaster County Convention Center Programming will feature dozens of workshops on soil health, cover crops, and much more.

Event information is available at www.pasafarming.org/events or call 814-349-9856.