

Wet Fields Obstruct Operations & Soil Health at Chicano Sol Farm

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Chicano Sol Farm

This case study is part of a series on soil health challenges and innovations revealed through our Soil Health Benchmark Study, a participatory research project we began in collaboration with farmers in 2016. Each case study examines a soil health challenge a farmer participating in our study is experiencing, and considers possible solutions offered by other farmers who attended a workshop we hosted in March 2019. Find other soil health case studies at pasafarming.org.

Jarrah Cernas and her husband Augustin are first-generation farmers and owners of Chicano Sol Farm, located in Perry County, Pennsylvania. For eight years, Chicano Sol has been providing the metro Washington D.C. area with organic vegetables grown on their 17-acre diversified vegetable farm. Two years ago, they rented additional land to expand their production space to its current size

METHODS

Farmers participating in our Soil Health Benchmark Study choose three fields that span their typical crop rotation. We collect soil samples from these fields in October, which we then submit to the Cornell Soil Health Lab. The lab assesses the samples according to a set of indicators covering physical, chemical, and biological aspects of soil health—such as available water capacity, aggregate stability, and extractable phosphorus.

Cornell rates the soil samples on a 100-point scale (see chart to right) relative to thousands of other samples from similar soil types—in other words, a sandy loam will be rated according to a different set of standards than a soil high in clay.

We also collect farmers' detailed management records for each field, and generate our own indicators for days of living cover, tillage intensity, and organic matter and fertilizer inputs.

We compile both the soil health data generated by Cornell and our own measurements into a custom benchmark report for each participating farm. Our benchmark reports collate the soil health data of all of the study participants, so that farmers can see how their soil health outcomes compare to peer farms. With their benchmark data in hand, farmers can collaboratively explore ways to improve their soil health management systems.

OPTIMAL
(80-100)

EXCELLENT
(60-80)

AVERAGE
(40-60)

LOW-LEVEL
(20-40)

CONSTRAINED
(0-20)

so they could have more flexibility managing their fields and longer rotations between plantings.

One of Chicano Sol's most significant soil management challenges is working effectively and efficiently in fields that retain persistent moisture for parts of the year as a result of the farm's topography and inherent soil qualities. Last year, through funding and consulting with the Natural Resources Conservation Service, Jarrah and Augustin were able to install drainage tiles and reorient production beds in one of their original and most low-lying fields to keep the area drier. While saturated field conditions existed for much of 2018, Jarrah did notice some improvement in drainage within these fields. However, soil test results from portions of their newer ground showed some of the highest percentages of clay content not only out of Chicano Sol's own fields, but out of all 177 fields currently being monitored as part of our Soil Health Benchmark Study.

Because of the enduring moisture in these fields, Jarrah and Augustin find it difficult to prepare these fields early and efficiently in the spring. By the time the fields dry, they might need extra tillage to fully incorporate overwintered cover crops into the soil and to get bed preparations and plantings back on schedule. Still, despite the challenges, Jarrah and Augustin view cover cropping as an important way to build organic matter and improve soil health on their farm. They continually tweak their fall cover crop mixes, hoping to find a concoction suitable for their wet field conditions.

Chicano Sol's soil health test results

Chicano Sol has participated in our Soil Health Benchmark Study for the 2017 and 2018 seasons. According to Cornell University's soil health rating scale, their overall soil health score is *excellent*, which is on par with the overall soil health score of other vegetable farms in our study who share a similar soil type. Still, Chicano Sol's test results revealed several challenge areas that could result in increased erosion and lower yields, and further exacerbate the farm's persistent moisture issues.

Aggregate stability

In 2017 aggregate stability ratings varied from *low* to *excellent* in Chicano Sol's three research fields, but in 2018 all fields dropped to a *constrained* rating. Most other vegetable farms in our study also experienced a drastic decrease

in their aggregate stability rating—seemingly as a result of the near-record levels of rainfall that occurred in Pennsylvania and neighboring states during the latter season.

Soil respiration

The level of soil respiration in a field indicates its amount of microbial activity. Also likely due to the persistently wet conditions, soil respiration ratings dropped for many farms in our study between the 2017 and 2018 seasons. This rating declined in one research field at Chicano Sol, but its two other research fields maintained *low* and *average* ratings for both years.

Organic matter

Organic matter ratings for Chicano Sol also shifted between seasons. Two fields dropped from *excellent* to *average*, and one field maintained a *low* rating, all falling short of the *optimal* median rating vegetable farms in our study have collectively achieved.

TABLE: CHICANO SOL FARM SELECT SOIL HEALTH RATINGS, 2017–2018

See "Methods" sidebar on page one for details on soil health ratings.

	2017		2018	
	CHICANO SOL FARM*	VEGETABLE FARMS	CHICANO SOL FARM*	VEGETABLE FARMS
OVERALL SOIL HEALTH	70	79	61	72
AGGREGATE STABILITY	53	75	13	28
SOIL RESPIRATION	59	89	32	45
ORGANIC MATTER	58	92	46	84

*Average rating for Chicano Sol's three research fields

KEY:	CONSTRAINED (0-20)	LOW-LEVEL (20-40)	AVERAGE (40-60)	EXCELLENT (60-80)	OPTIMAL (80-100)
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Chicano Sol's soil health scores are consistent with the effects of wet field conditions, which the farm has experienced as a combination of their high-clay soil, their low-lying fields, and above-average rainfall. Jarrah and Augustin know that changing their cover crop and bed

preparation strategies could help improve both their soil health ratings and their crop rotations. They posed this soil health challenge to a group of peer vegetable farmers at a workshop we hosted, to collaboratively develop strategies for addressing this common soil management challenge.

Alternatives to the “go-to” rye cover crop

Chicano Sol has consistently used rye as an ingredient in the farm’s fall cover crop mix, but Jarrah has begun to recognize that rye may not be suitable for their wet fields. Well-known as a crop that grows aggressively in the spring, by the time Chicano Sol’s fields dry enough for bed preparation rye is often past its ideal size for timely incorporation into the soil. Many other farmers participating in our workshop expressed they struggle with this as well.

Triticale

Trey Flemming from Two Gander Farm in Chester County, Pennsylvania suggested that triticale—a hybrid of rye and wheat—may be a better alternative to rye for Chicano Sol. Though similar, triticale heads later than rye (but earlier than wheat) and grows slower in the spring. Triticale is also likely to decompose faster in the field due to its lower carbon-to-nitrogen ratio when compared to mature rye.

Austrian winter peas

Austrian winter peas is a go-to winter cover crop for Landon Jefferies of Root Mass Farm, located in Berks County, Pennsylvania. Unlike regular peas that would die in winter conditions, this particular variety successfully overwinters in much of Pennsylvania. It can be terminated earlier than rye (making it ideal for earlier plantings), and Landon mentioned it decomposes faster. Plus, Landon sells the tops of overwintered peas as tendrils to customers.

Another farmer insightfully noted that the fresher green matter and lower carbon-to-nitrogen ratio of a leguminous cover crop will likely do more to jumpstart spring soil microbial activity and, in turn, nutrient cycling for the cash crop. Rye, on the other hand, is known for trapping valuable nitrogen if it’s incorporated at a later stage in its growth.

Clover

Chicano Sol grows many late season crops, like kale and other *brassicas*, making the window for transitioning these fields into fall cover crops small—and sometimes even

nonexistent. Jennifer Glenister, manager at New Morning Farm in Huntingdon County, Pennsylvania pointed out that clover, like peas, is a much easier crop to terminate in the spring than rye. On her farm, Jennifer underseeds clover with a hand broadcast spreader after the last cultivation of all fall *brassica* crops.

Winter-kill cover crops

Strictly using cover crops that die in winter conditions is an option that farmers like Jeffrey Frank of Liberty Gardens in Lehigh County, Pennsylvania embrace. Jeffrey uses oats, which reliably winter kills except in very mild winters, and occasionally mixes in winter-kill peas. In these scenarios, the cover crop will rarely obstruct getting spring field work done. Beds can be prepared faster with less equipment and less tillage.

In order to get the maximum growth and biomass from these covers, Anne Nordell of Beech Grove Farm in Lycoming County, Pennsylvania stressed these crops must be sown early. Anne and her husband, Eric, who are well known for their cover cropping innovations, regularly plant these tender covers during August at their farm in northern Pennsylvania.



Chicano Sol Farm

A closer look at bed preparation

The constantly wet conditions of 2018 forced many farmers to make difficult decisions about when to get their tractor work done, if at all. Either they wait and hope that, despite the persistent rain, their fields dry enough before planting or preparing beds so not to damage their soil structure, or they employ their tractors on saturated fields because

otherwise the farm could experience crop delays and potential losses. At some point in the season, many farmers were forced to do the latter, which likely contributed to the drastic decrease in aggregate stability ratings that most farms participating in our study experienced. What type of equipment and bed preparation strategies might Chicano Sol—and other farmers—be able to employ to make fields more resilient and to ensure minimal crop delays during future wet weather?

Flail mower

At Chicano Sol, a standard tractor rotary mower is used for terminating cover crops. Trey Flemming from Two Gander Farm strongly encouraged using a flail mower instead. By design, a flail mower cuts smaller, more uniform pieces and evenly distributes them across the field—creating the conditions for faster decomposition. With a flail mower, Flemming can terminate his cover crops and prepare beds within just two weeks. Even if Chicano Sol chooses to work with a high-residue crop like rye, using a flail mower could still help Jarrah and Augustin get more spring field work done in a shorter amount of time, ideally with less tillage.

Plastic mulch

For years, preparing spring fields well in advance has been an important part of Jennifer Glenister's field management strategy at New Morning Farm. During any fall dry spell, Glenister applies soil amendments and lays enough plastic mulch for the first three weeks of her following planting season, which begins in early April. If plastic mulch is laid early enough, a winter cover crop can also be established in the pathways to both cover the soil and secure the plastic. Though this strategy is typically tricky for vegetable farmers to squeeze in among other fall work, it would ease the burden of spring field preparation and help farmers avoid cultivating fields when soil conditions are less than ideal.

Tarps

Laying tarps on fields to manage weeds is a trending strategy in sustainable farming circles. A farmer at our workshop noted "tarping," as it is often called, could also potentially scale back tractor use and tillage throughout the whole season. Tarping involves placing large sheets of heavy plastic, like silage tarps or greenhouse plastic, on fields to assist or replace field cultivation usually done with tractors. Tarping can preserve prepared beds, warm

the soil for planting, and kill or prevent the growth of weeds. While tarping can be impractical for farms larger than a couple acres, some farmers suggested that it could nonetheless be a useful tool for a farm like Chicano Sol to keep even just part of a field prepared for their early spring plantings, as long as the tarp was initially laid over dry ground in the fall. Tarping over the winter would take the place of planting a fall cover crop, but it may be an option worth weighing for the areas that challenge Jarrah and Augustin the most in spring.

Adapting for the future

More than ever, the spotlight is shining on soil health as a key factor for helping farmers endure the uncertainty that climate change will bring to their livelihoods. This concept is not new to farmers who strive to be good soil stewards, but determining how to overcome soil health challenges may nonetheless be daunting in the context of unpredictable weather and a complex farming operation.

Being able to clearly identify soil health strengths and challenges unique to their farm, as well as understanding the benefits and drawbacks of a variety of soil management strategies and tools, will help farmers become more nimble at adapting their production methods and business models to develop more resilient systems.

LEARN MORE

Find more information about our Soil Health Benchmark study—including how to participate—on our website at pasafarming.org.

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