USDA

Why "Organic" Matters: Soil Organic Matter, Soil Health and USDA-Certified Organic Farming

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>>: Good afternoon everyone, we'll get started shortly.

>>MODERATOR: Greetings. Welcome to today's webinar entitled "Why Organic Matters, Soil Organic Matter, Soil Health and USDA-Certified Organic Farming. My name is Jen Ryan, a Natural Resources Specialist for the Natural Resources Conservation Services East National Technology Support Center. I will be your host. We will get started with the presentation in just a moment. But first a few logistical items.

This webinar is being recorded. All participates are in listen only mode and audio broadcasted through the speaker. Headphones help with the audio and volume. We want you to be able to participate in today's webinar. Type your questions or comments in the Q&A pod. You can submit your questions or comments throughout the presentation, but questions will be answered in the Q&A session. Today's webinar offers Closed Captioning. To access the Closed Captioning feature, click on the CC icon at the top of the screen.

In today's handout pod you will find a copy of today's presentation. If you wish to make adjustments to the view of the webinar, use the options in the screen share. Hover at the top of the window to see the option. You need to be in normal view to be in the Q&A pod to type in questions or comments.

Today's webinar offers CEUs. At the conclusion of the webinar use Step 2 in the "Open Conservation Webinars" window and enter your credentials and receive your certificate by e-mail. We will submit your certified CEUs on your behalf in about 30 days. Submit your conservation planner CEUs as you need to meet your local requirements.

We encourage all participants to complete the webinar using the Step 2 process. Completing the -- the on-demand recording of today's web that is available from the webinar webpage at at the Science and Technology Training Library by early next week.

I want to take a moment to remind participants: The use of trade names in our webinars is for information purposes only. Mention of a trade name does not constitute a guarantee of the product by the U.S. Department of Agriculture or endorsement by the Department or Natural Resources Conservation Service over comparable products not named. Let's begin.

Welcome Lindsay Haines, the National Organic and Pest Management Specialist for NRCS. Worked for over 30 years. She started as a conservation planner and spent most of her career as a district conservationist, leading field offices in providing technical and financial assistance. In the organic agriculture sector to work on organic farms and providing assistance to farmers and farming herself. You may now begin.

>>LINDSAY HAINES: Thank you, Jennifer. I have the distinct honor of introducing our presenter today, Mark Schonbeck. Here you will see a lengthy biography. I will not read it all, just the beginning.

Worked for 35 years as a researcher, consultant, educator and advocate for sustainable and organic agriculture. He works one-on-one with farmers and homesteaders, taking a site-specific approach to soil test interpretation and organic soil, nutrient, and week management for vegetables and other crops. In his capacity as Research Associate with Organic Farming Research Foundation, he develops research-based education materials, including a series of practical guides on Soil Health and Organic Farming. See the link there.

Leave it to the rest of you to read the rest of his many talents. On a personal note, I'll share with you he is who I consider my personal go-to expert for organic agriculture. He has a wealth and depth of knowledge unsurpassed by very few. A great partner within the CS, led many organic webinars in the science and technology library, helped with reviewing organic grant proposals. We are lucky to have his talent and dedication through our agreement with the Organic Farmer Research Foundation. I am grateful always to his assistance. With that, turn over to Mark.

>>MARK SCHONBECK: Thank you, everyone. I am going to start by looking at this word: "organic." Anyone you talk to, you get different definitions. At the grocery store, a little consumer circle that was grown without --

[SOUND/AUDIO ISSUES]

We are going to talk about what NRCS defines "organic" as the important component of the soil called "soil organic matter."

Going back into the history of the organic farming movement. Organic, as I mentioned, is carbon; but it is derived from plants and animals and natural process. Starts with photosynthesis that turns CO2 and sunlight and water into sugars and built up into amino acids and proteins. [INAUDIBLE] nitrogen and other aspect of organic is soil is a living system that transforms organic materials. I put "wastes" in quotes there. In nature nothing is really wasted. Organic residue is waste [INAUDIBLE] landfill to make more methane, which is not captured for any useful transfers into fertility. That is how soil works. Emphasizes that the organic method emphasizes building and maintaining sufficient organic matter. The core of it is all of the organic residues that accumulate on a farm go back to the land. And the other part is that most nutrient sources allowed under the natural organic farm and used in agriculture -- natural minerals [INAUDIBLE] as well. We won't dwell on those today, but they are a component.

But the whole thesis of the organic farming method is that healthy soil is the foundation of successful farming and healthy food. Now widely accepted throughout agriculture.

>>MODERATOR: This is Jen. Having a little trouble with your audio. We can hear you, but a little garbled.

>>MARK SCHONBECK: I don't know what to do about that. You are sounding clear as if you are in the room with me.

>>MODERATOR: Try to speak a little bit louder.

>>MARK SCHONBECK: The history of organic farming extends back to the turn of the 20th Century, when Tuskegee University hired George Washington Carver to help Black sharecroppers and the Black community as a whole to better feed their families and just take better care of their land and make a living at farming. A lot of the Alabama soils were already worn out through mono-cultures and excessive tillage and incomplete care of the soil. And immediately he began showing and telling the farmers in the region how to restore the soil using compost, manure, swamp muck -- which is very common organic resource in that region -- and emphasized diversifying your crops -- not just corn, cotton and soybeans. Rotate crops. Added carbon crops and food crops and southern pea. Cow pea was one. Emphasized that the farming system should mimic natural processes. A principle of [INDISCERNIBLE] culture.

[INAUDIBLE] Then during the Dust Bowl, Hugh Hammond Bennett founded what is today NRCS. He was in a Congressional hearing, voting to give funding to do soil erosion control studies and launch this, right when Washington itself -- DC was overtaken by the remnants of a bad dust storm. He said Bennett knew that organic matter was central. That the humus supply is exhausted quickly when erosion occurs. Both the most vulnerable and most important part of the soil, the practices that built humus the cover crops and making terraces from preventing erosions from taking away the topsoil. All worked together to restore soil health and slow down erosion.

History of the organic farming movement. A lot of attention to the early leaders of the '30s and '40s. Ehrenfried Pfeiffer, a student of the philosopher [INDISCERNIBLE] and brought the biodynamic method to the United States in the 1940s. And Sir Albert Howard and [INDISCERNIBLE], working in the United Kingdom. They also recognized the importance of organic matter, which they called "humus." The central role of soil itself in the success of farming.

Some of the early leaders recommended practices very familiar to all of you as part of the four principles of soil health. Did emphasize the use of compost. Composting process to convert organic residues into a more easily spread product whose nutrients more stabilized and had a higher population of beneficial organisms. Emphasized cover crops. If not growing something for profit, feed the soil. Diversify the crop rotations. We have corn in this rotation and we have lima beans. And it goes -- I don't think corn-bean rotation. Throw in other vegetables. Other specialty grains. That is one example there. And the leaders of the organic movement and Pfeiffer emphasized integrating livestock into crop production. When you have the crops and livestock integrated, there are additional benefits to soil health and nutrients are cycled more efficiently.

Coming up closer to the present, in 2002, the USDA National Organic Program adopted the standards. And you see the strong theme of soil health and soil organic matter. Fertility practices, including tillage and cultivation. It is a double-edged sword. We know [INAUDIBLE] the NOP rules require the grower to use tillage practices that maintain or improve the health of the soil and minimize erosion. And that crop nutrients and fertility are managed in rotations coverups and the use of plant and animal materials. The organic inputs. Part of the purpose of that is to keep the organic matter at a good level.

Crop rotation standard itself. Four key services that must be met in this rotation, which should be diverse and should improve cover crops. Maintain or improve soil organic matter and provide erosion control and provide for pest management. Vital. The more you get done with the rotation, the less inputs -- harmful inputs are needed.

What is organic matter? A process as well as a substance. Fascinating recent research that has shown our organic matter works. Get into that a little bit. There are four aspects or parts of the soil organic matter. This is soil life itself. There is the fresh residues on which the soil life feeds and active organic matter, which is partially broken down -- processed to some extent -- but continues to be there as the food soil life, which includes metabolized partly broken-down residues and organisms and stable organic matter, sometimes called "humus." Basically all originally derive s from plant photosynthesis and passed to microbes and products of microbial life.

What is stable soil organic matter? Until about 10, 20 years ago, generally accepted that very complex mega molecules, macro molecules called "humic acid" and "fulvic acid." Studies show in vast amounts of nature. Artifact to use to measure soil organic matter. Active organic matter is decomposing residues the part still in active positive.

The material becomes stabilized in several ways. One, it can become protected within soil aggregates. That is physically stabilization inside of an aggregate. Does protect from rapid breakdown and oxidation. Half-life is usually two years to decades. Or absorbed or adhered to the soil clays and silts. This forms mineral-associated organic matter. This is the most common and important form of stable soil organic matter. Doesn't last forever, but half-life is in the range of centuries and millennia. That is one of the myths that humic sources are believed to last forever. We have something with a gradual turnover. These are gradation, not distinct categories.

Another thing that can happen in the early hours some are soluble materials that become leeched out. Like nutrients moving into is sub soil, where eventually they will attach to minerals and become mineral associated. A deep healthy soil, more than half of the organic matter is deposited below the plow layer, below a foot.

>>MODERATOR: Mark, would you mind just silencing your audio? Keep your microphone on, but silence your speakers please?

>>MARK SCHONBECK: I don't know how to do that.

>>MODERATOR: On the top, where you have your microphone icon you have a speaker icon.

>>MARK SCHONBECK: Any better?

>>MODERATOR: Just keep talking. Thank you.

>>MARK SCHONBECK: Is that any better?

>>MODERATOR: Yes, for me it is. Thank you.

>>MARK SCHONBECK: Was that any better? I couldn't hear you.

[PAUSE]

>>MODERATOR: Mark, can you continue with your presentation? Make sure that you are not muted.

>>MARK SCHONBECK: Okay. Now I can hear you. Seemed to mess everything up when I turned the speakers off. Sorry for the interruption, everyone.

>>MODERATOR: Turn the speaker off. We will hear you as long as your microphone is on. Thank you.

>>MARK SCHONBECK: Send me a written message if it doesn't work. I will try it again.

>>MODERATOR: Thank you.

>>MARK SCHONBECK: Soil microbes convert organic inputs into SOM. One of the most important is root aggregates. It is important to have roots in the soil as much as possible and process any animal or plant residue, manure, straw etc. left on the soil or worked into the soil by tillage or larger animals. All of this input becomes part of -- first it becomes part of this living system, this myriad organisms, which then process it into a mixture of by-products. Some of it is CO2. That is important too. How nutrients are released to the plants. Some digested to release nutrients like nitrogen. Some is active organic matter, which continues to be released in this process. And some is stable organic matter. A lot of this performs at depth through deep roots and leeching. A very fascinating [INAUDIBLE]. Researchers created a microcosm completely sterile soil devoid of organic material put a tiny [INDISCERNIBLE] of living soil with microbiome of a fertile field and gave any of the forms [INAUDIBLE] plain sugar, completion aromatic compound called [INDISCERNIBLE] or a plant extract of organic matters in 16 months the soil looked like topsoil. At 1-1/2 to 2% organic matter and the chemical composition and the biological composition of the microbial community was similar to each other and the field. That's just shows the [INDISCERNIBLE] of the microorganisms and how they adapt to what they receive.

Soil and plants have -- soil life and plants have been in a partnership for 450 million years, ever since land plants came into land. Plants donate 10-30, sometimes 40% of their synthetic product to the soil life through root exit base. And in return, as the soil organisms are feeding on the abundance through the plant life, they help the plants absorb nutrients from the most important organisms involved in this exchange is a mycorrhizal fungi that go from the root out into the soil. What happens is this part of the fungus is taking some of the plant's energy, some of the plant's sugars and other products to grow more [INDISCERNIBLE]. Later [INAUDIBLE] back into the root. And the fossil records show that this evolves together.

One of the things that is beneficial for soil life and soil organic matter and soil quality is to maximize that root exudation. Turns out you can get the best root exudation at a level of water and nutrients especially nitrogen and phosphorus. This curve should be to the right. Should be still sloping up a little bit. Top row maximizes at a higher level of inputs than the root exudation formation. When you are running the crop a little bit lean -- especially on nitrogen and phosphorus -- it is not effecting photosynthetic rate by slightly slowing down top growth. As a result a surplus of carbon goes down to the root system to feed the soil life. That helps keep the soil healthy and sequesters more carbon and ensures biologically facilitated uptake of nutrients. A better quality of product. Basically little to no loss in yield as well. One way to do that is careful nutrient management, being a little conservative with the nice general and phosphorus and potassium and moisture. No drought. But [INDISCERNIBLE]. Legumes, like cow peas and southern peas, mixed in with this [INDISCERNIBLE] here and -- legumes favor the soil life. Provide a rich mixture of the amino acids and put more nitrogen into the root residues than other plants. Like soluble nitrogen fertilizers the mixture maximizes soil biology.

With grazing you want to bring your cattle in right when the grass is near the end of its rapid growth phase. When you go through the rapid growth phase you get the most food exudation from that crop. Time rotational grazing will get of give you a lot of soil organic matter and improve soil growth. If the timing is often too early or too late don't get nearly the benefit.

Organic farming practices and soil organic matter. That is the whole idea of the organic system, we want to build a soil that is healthy and has as much organic matter as it would naturally under a native echo system or as close as possible. Look at some data from some extensive studies. This is a study of about 600 organize fields and [INDISCERNIBLE] conventional fields across the United States. Total organic matter and what they call humic substances. That may have been an artifact of the [INDISCERNIBLE] extraction. In any case, there is a distinct increase that is significant. 13%. But significantly higher in the organic managed fields. And you see a much larger difference in what they call human I can substances and what this tells me is that the quality of the organic matter that is formed is different than these two systems. Whereas the human I can matter itself more of it formed in the organic systems indicates perhaps there is more [INDISCERNIBLE] or more organic matter in the physically protected and aggregates. Meta analysis around the world total soil organic carbon, which is about 0.5 times the SOM. 19% higher. When we get into the more direct indicators of microbial activity, the percentages are higher. Seeing a moderate increase in total organic matter, but a substantial increase in the biological activity on which soil health and function depend.

Another study showing comparing how much soil organic carbon accrued year to year in conventional vs. organic systems. Organic systems were a cueing substantial amounts of carbon every year, whereas the conventional only just barely keeping ahead of steady state.

Granted about 40% of that [INDISCERNIBLE] was imported and not sequesters in [INDISCERNIBLE]. So organics doesn't happen and criticized for importing large amounts of organic matter --

Can no longer see what I am doing. I have today's handouts. Thank you.

If that imported material was taken from someone else's field, if you harvested hey from next door to add as your mulch to build your organic matter or took manure that the farmer was going to spread on their own field, [INDISCERNIBLE] robbing Peter to pay Paul. However when you are taking manure that otherwise we haven't into a [INDISCERNIBLE] to make methane and water quality hazards and food waste and water fields from land fields on to fields you are preventing a substantial amount of carbon emissions. It is fair to count all of that as sequestration.

Here is a farming trial in the United States that include organic systems. A network of [INDISCERNIBLE] run through the agriculture research service and another one in Pennsylvania that has been run by the [INDISCERNIBLE] research center for over 30 years. On average the six trials that included an organic system, systems is accrued 400 to 600 more. In the Maryland trial, 300 systems. On average accruing 380 pounds more. [INDISCERNIBLE].

And when compared with the conventional till system, they really stood out as accruing a lot more. And one of the strengths of the organic systems include cover crops or organic amendments, diverse rotation. These two work together. Cover crops alone accrue a little bit of organic matter, organic methods improve quite a lit. Together they post-both organic carbon and biological activity in balanced fashion. Work together. Diverse rotations are very valuable, especially for overall resilience, including a perennial sod phase in rotation provided deep roots and long duration. They all have a moderate frequency and intensity of tillage.

Four principles of soil health. You are familiar with these. Keeping the soil covered. Diversifying the farming system in various ways. There is a high multi-species cover crop. A landscape of different

horticultural crops one after another [INAUDIBLE]. Different contrasting plant architecture and [INDISCERNIBLE].

Here is livestock grazing on a pasture. Integrated with crop rotation in various ways. Maintaining living roots. If you have a cover crop like rye grass, you see what kind of a root system you have [INAUDIBLE].

Minimizing soil disturbance. Definitely [INDISCERNIBLE] the cover crop if you can or minimize tillage. And be careful about nitrogen fertilizers and certain pesticides that are [INDISCERNIBLE] especially the [INDISCERNIBLE] can be quite harmful to soil life.

How does organic farming shape up in this one? Contrasts that have been revealed a couple of studies. One of them being the recent survey of organic farmers by the Organic Farming Research Foundation published this year as a National Organic Research Agenda 2022. Study found on average organic field crop farmers [INAUDIBLE] often or very often.

In contrast agricultural census found that conventional field crop farms only about 10% of the time. Also organic farmers tend to include a diversity of cover crop ins the rotation. Legumes, buckwheat, mixtures as well as serial grains whereas very often the non-organic farmers look at adding rye or legume ahead of a heavy feeder like corn. There was another study by schoolman and arrhythmia buckle that showed that specialty crops are cover cropped by the non-organic is 61%. But the even higher for organic 92%. They were much more likely to use the multi-species cover crops.

Let's look at chemical soil disturbance.

[LOST SOUND]

>>MODERATOR: Mark?

Good afternoon everybody. We have had a little bit of a technical issue. Mark will have to log back in. Give us just a minute. [PAUSE]

>>THELMA: Jennifer, I can take over from here for a bit, until Mark logs back on.

Hi everyone. I am Thelma, the research and [INDISCERNIBLE] manager at the Organic Research Foundation. Going to pick up on this slide with respect to the the National Organic Standards. They limit chemical disturbances. Limit the use of most synthetic materials in livestock production and allows certain synthetics for specific purposes as stipulated in the National List -- not allowed in USDA certified production. Further organic farmers must first implement cultural and [INDISCERNIBLE] and biological controls prior to using the NOP allowed pesticides. Botanical, microbial or Natural List materials. Only when cultural physical and biological fail to provide advocate control of the target pests. I will go to the next slide.

Here we are talking about synthetic inputs that hurt soil life and reduce SOM. As many of you know, using many of these synthetic inputs have a negative impact -- and I think Mark is back online. Mark, can you hear me?

>>MARK SCHONBECK: Yeah. Okay. Now I see the microphone. I was hearing you and I couldn't find the microphone. I had to leave the room. I thought perhaps I offended someone. I'm sorry if that happened. You hear me?

>>MODERATOR: Yes.

>>MARK SCHONBECK: Okay. I will go on then. And sorry about whatever happened there.

Synthetic inputs can hurt soil life and reduce soil organic matter. I would say any strong pest control -- even some allowed by the National Organic Program -- can also do some harm to the mycorrhizal fungi or other soil organisms. Earthworms are sensitive and some of the other macro invertebrates like arthropods, etc. This is an area that hasn't been studied that much. But recent meta analysis was done in another one that Pelosi, et al found that earthworms are more abundant in organic soils, even with some tillage, than in conventional soil withs pesticide use. Interestingly enough, even synthetic fertilizers -- while they are increasing aboveground biomass -- they don't actually build soil organic matter. And that's because they change the soil and microbiota in a way that reduced the rate in which soil carbon is stabilized. Maybe partly by stimulating top growth so there is less root [INDISCERNIBLE] to work with.

It is important that the organic systems make the NOP allowed pesticides a last resort. Not something that you turn to immediately at the beginning of the season. Only when the cultural and physical controls don't work.

Organic farming facing soil health challenges. The obvious one is by not using herbicides. We rely on tillage and cultivation for weed control. There are some organic herbicides -- vinegar adversely affects soil life. [INDISCERNIBLE] tillage we are familiar with that. But turns out that more and more organic farmers using reduces or shallow tillage only when needed and using vertical tillage tiles or high speed disks that mix the top without -- leaving that layer near the surface. When done properly, it does not completely -- pulverize soil [INDISCERNIBLE], if it is not done too often. Another thing is ecological based IPM for weed control reduces the amount of time you have to get in there with a cultivation tool. Broke soil aggregates and creates surface dressing.

Manure and compost for fertility builds up successful soil phosphorus. This is a big challenge. The first step is to rely more on legume cover and cash crops for a lot of the nitrogen input. If you need an extra boost of nitrogen, there are organic sources. Heather meal from the poultry industry, a by-product used as nitrogen fertilizer. Another challenge is because it is difficult to predict exactly when and how much nitrogen is released into the soil in organic systems, some organic farmers and some on the advice of [INDISCERNIBLE] or other professionals will use NOP allowed sources what have been called ago no, ma'am I can rates. Callating how much is available right now. Can take up. If it is only 10% we have to put on 10 times as much. 50% put on twice as much. This will build up excess soil nitrogen because of the biological processes work on the so called unavailable nitrogen to mine r a lize it over time. If there is too much made available at once, by being very generous with these organic inputs like chicken litter, you compromise and weaken the soil's capacity to cycle nitrogen and mineralize it from soil organic matter. There is on going research. Soils need much less nitrogen when healthy, sometimes 30, 40, 50 pounds per acre as a boost. There are studies in California on organic tomatoes. The best managed fields maintain add soil nitrate nitrogen of 5 parts per million. Compared to a threshold of sufficiency normally considered to be 16 parts per million. Yet those fields maximal yields because the area right next to the root the microbiome was so efficiently converting nitrogen into soil available nitrogen the crop was getting all it needed. A in-row boost of organic nitrogen sources like fish emulsion.

Organic practices, how do they affect microbial biomass? Microbes play a vital role in all of the functional functions of soil. We like to see a high microbial biomass. So interesting enough, a meta analysis that showed reducing tillage using this kind of non-inversion fairly shallow tillage only when needed -- judicially not too often -- that system sustained twice the microbial biomass as a [INDISCERNIBLE] employ. Where no till had no real impact. But another study, in terms of total [INDISCERNIBLE] reduced tillage shallow or rotational no till with the cover crops rolled down total organic matter went up 14%. Organic fertilizer versus regular standard nitrogen phosphorus potassium soluble, more than doubled. Very interesting and very important consideration. Use of organic [INDISCERNIBLE] not all organic farmers apply organic [INDISCERNIBLE]. But rates compatible with management builds soil organic Ma matter significantly. That is a significant increase. Crop rotation diversity and cover crops. You will get a gradual increase in your soil organic matter and the microbial biomass didn't show as large a response in the first meta analysis but it was significant. Taken together these practices, the crop diversity, the use of organic amendments and nutrient sources and reduced tillage and the cover cropping, all together will give you greater benefits over the long run.

Functions of soil organic matter.

Crop nutrition. That's primarily the active organic matter is a store [INAUDIBLE] certain nutrients nitrogen functions of soil us and sulfur bound up as an integral part of the organic matter. The active organic matter and residues are digested by the soil life, they become directly available to plants. Since the cell organisms are more abundant at the root zone, they are efficiently deliver today the plant root surface. Stable soil organic matter does not break down as fast. Not a nitrogen source. However builds the [INDISCERNIBLE] exchange capacity plague itself that has this mineral associated organic matter has a higher [INDISCERNIBLE] change capacity than just the minerals alone. That increases the soil's ability to hold potassium magnesium and calcium and some of the micro nutrients. Solublized micro nutrients from the soil minerals.

The next slide shows graphically how this cycle works. Plant residues, manure digested by soil life into active organic matter. The storehouse. [INAUDIBLE] released into the root zone. Some of them are then -- active then becomes stabilized which contribute to this cat change capacity which [INAUDIBLE]

Nutrients shown. And the soil life works directly on soil minerals. Gradually to break apart the mineral matrix and release things like potassium and micro nutrients. The crop roots a that go down deep with the soil microbiome is how it happens. How we hear about crops retrieving nutrients and the deep roots. [INAUDIBLE] phosphorus or cations.

Another major function of SOM is maintain soil structure or soil aggregation. Beneficial physical properties. Stable organic matter holds moisture and plays a role in maintaining aggregations. Although the this is mostly the active organic matter. But the [INDISCERNIBLE] by organisms of fresh residues that create the inactive organic matter and there are glue like substances and the fungi themselves that hold soil together in aggregate or crumbs and keep the surface open. And the this was meant to be the fresh residues and the roots. I originally drew a diagram of roots through the edge of this picture. [INAUDIBLE] form ma crow pores and channels important for drainage. The fresh residues are near the surface. Particularly when tillage is limited and done in a [INDISCERNIBLE] version of or there is no till. The surface residues protect the surface from crusting.

Just illustration of how when you have a porous soil and get a down pour. You need to have this surface covered with some kind of residue partially to break the force of the rain. The best soil will expose to heavy rain fall, as the climate change causes more extreme rain events the soil microbiome is forming the drum structure. The open pour structure absorbing a larger percentage of the moisture as seeps down through the soil profile. And if there is a really excessive rain fall if you are a soil profile with deep roots keeping the channels excess drain out doesn't [INAUDIBLE].

Aspect is soil organic matter functions providing habitat for soil organic organisms. [INAUDIBLE] active organic matter is more food than habitat. The stable is diversity for habitat for the micro organisms. The soil organisms themselves have to be continually reconstructing the micro and macro pores. It is a process.

One of the benefits of soil and providing microbial habitat, they reduce the -- help break the disease triangle. Like environment for pathogen, the plant pathogen and the acceptable crop. Here are seen ways to break the triangle. The high boy logical activity will increase the populations of natural enanies of these pathogens and they'll be drainage and air ration. So you don't have the habitat that is beneficial to root rots. And good crop rotation in addition to supporting the greater diversity of soil life helps reduce disease impacts. We know that soil organic matter help to stabilize the climate through [INDISCERNIBLE] sequestration and organic matter. And reduces the nitrogen input needs and nitrous oxide emissions. Me than comes mostly from cow. And air rated soils don't emit methane. And when you are recycling organic residues in the landfill, reducing methane.

Then waste management, with that word "waste" in quotes. When comes to food scraps, that all should be going home to the -- not getting my cursor anymore.

Okay. Soil organisms when there are objection toxic residues accidentally or in the form of pesticide residues or soil organisms break those down or they become bound up to the mineral associated organic matter clay complex, they'll be de-activated so not as toxic.

Here are some best management practice for building organics. I have to speed this up. Almost out of time. I apologize for all of the interruptions and getting flustered. All right.

On the top. Living plant is the No.1 tool for building soil organic matter. It is the way it's been happening for 450 million years. The carbon pipeline we want more of. You have all of the other benefits protecting the soil surface, feeding the soil life and building soil structure. Practices diversify the crop rotation. High biomass cover crops. Perennial sod crops. When there is a gap, prompt planting after a harvest even if you have to till to get rid of the weeds. Cash crops cover crops help the soil. Inter- cropping and relay planting helps the bare fallow. If you have a bare fallow, plant it tomorrow if you can't get to it today.

Animals help build organic matter. Putting them into the rotation. Enhance the microbial biodiversity. Cycle crop nutrients and provide nutrients through the manure. Some practices -- adapted to your region so you are getting that optimum [INDISCERNIBLE] growth and root [INDISCERNIBLE] livestock crop integration. Graze cover crops with crop residues or [INDISCERNIBLE] phase of a perennial rotation and silvopasture. Shade trees and open stand of trees gives shade to the livestock and improves soil health over a well managed rotational grazed pasture.

I mentioned earlier. These work together. Organic amendments + living plants. Build more soil organic matter. There is a study here two crop willing systems. One where the nutrients are provided as poultry litter tended to give a lot of [INDISCERNIBLE]. The other was a finished compost with a moderate carbon to nice general ratio. The finished compost at 11 years total SOM went up 43%. The active was up 60%. Stable is probably 20 or 30. Microbial activity was up about 35%. Good practices here compost, manure, bio char and organic mulching materials are good amendments. Keeping an eye on the nutrient balance not overloading functions of soil us. A diversity of materials. Keeping that ratio intermediate. [INDISCERNIBLE] avoid over applying nutrients and limit the concentrated low C: N organic sources. The in-row as a boost. That often can be compatible with soil health results. As your soil gets more biological active, may need very little additional readily available nitrogen to support crop yields. Sometimes not a at all . the soil is mineralizing enough to support the crop, you have to replenish what is consumed by the crop. That is can be done through cover crops and compost and [INDISCERNIBLE] ratio materials.

Reduce tillage when practical, of course. But again remember that a full width version tillage when done with the soil moisture is right and when needed is compatible with soil health outcomes. [INDISCERNIBLE] lessing the need for cultivation. And crusting occurring. Use cultivars and breeds developed for organic when available and to your region. Use NOP allowed pesticides only when all else fails. They will have a negative impact on soil life and [INDISCERNIBLE] organisms perhaps less severe on the whole. Need to use judiciously. Monitor soil health or field observations or [INAUDIBLE] specific soil assessments that are becoming more available.

Make this quick here. Sorry it got so late.

The Starting Point. This is a farm in the eastern shore of Virginia. These are areas of very sandy soils. Ultisols. Starts with a Bojac sandy loam. That initially low SOM fertility. Used a diverse rotation. No bare fallow. If you till in a cover crop or cash crop today, you get something in tomorrow. The cover crop give as short period of time to break down. But re-plants immediately. High biomass cover crops. Return all residues to the soil. Uses mushroom compost and poultry litter at moderate rates that are carefully tailored to prevent phosphorus from becoming excessive. Uses sub surface drip irrigation to promote deeper root growth that is effective. Leave it is surface high and dry. So the crop can grow. And run it is rototiller at a reduces PTO speed while driving faster. Instead of 1 mile and hour with the remote tiller beating the daylights out of the soil doing 2-1/2 miles an hour with the remote tiller on low PTO speed so a split second interval of time that allows the soil to show visible -- this is a sandy loam soil and the results, soil organic matter is increases to 2-2.2%. If you are from Iowa it is not much but good for the eastern shore. Going from 1.2 by a study from Ray wiles some years ago allowed a crop yields to recover substantially. At a 2.2%, you see visible structure. Soil phosphorus remains optimum. Has so many nitrogen mineralization no longer needs to fertilizer listels with fish emulsion. Can now rest some fields. Soil gets better every year.

And questions. I don't know whether people can stay extra. I have extra time. I apologize once again for the many glitches and my getting flustered there for a moment. Thank you.

>>MODERATOR: Mark we do have one question in the Q&A pod. I will read it out for you if you want to follow along you can read it too.

Says: Thinking of NRCS staff in the districts who are helping this new era of folks who bought or inherited a run-down farm amid all of the changing weather and contaminated runoff concerns. Are there new organic insights that might be useful?

>>MARK SCHONBECK: That is a great question. Just say you want to just do staff practices. If it is a very small farm, you can use tarps and get your tillage down to a bare minimum. Loosening with a broad board. A multi-acre scale, a the speed disk as a tillage implement. I would spend a year restoring that -- the way to jump start the soil that is really poor shape, get a soil test. If the soil phosphorus is low, be generous with manure and compost. If it is high in functions of soil us, use a moderate amount of a soil amendment such as compost. Doesn't have too much phosphorus. You want to look for a plant based compost. Another amendment I would look at is bio char. Bio char plus compost, the bio char won't give nutrients but stable carbon. The scaffold of which the soil life can build additional carbon. Main thing is get plant roots in there. If it is poor soul, look at cover crops that tolerate poor soil. Some leaders there are sun hemp and pearl millet. A land that won't grow [INDISCERNIBLE] ain't worth a darn. Soybean s are I have if. They will grow as if they are on good soil. Amazing. A few others. Rye is tolerant to assist dick conditions. Likes its nitrogen. If soil is poor and you have to do something for the low in NPK, 10, 20 pounds tons per acre of manure, work it in. Pick up newt represents. You can look at a commercial soil microbial inoculant. The research doesn't show them to be that effective. Mostly because they have been tested on soils with low to moderate fertility with organic production for years. You have all of the good bugs there anyway. They get overwhelmed by the competition. If you have a poor, dead, exhausted soil, that could be beneficial and I think perhaps something like worm castings, which will give you a diversity of organisms or high finish compost will help restore that soil microbiome. When you get into production, look at crops that are well adapted and tolerant to lower soil fertility. Like sweet potatoes. Take a fairly acid and don't produce as well in a poor as rich soil, but rather than crop failure you get half max yields. There are other ways to get into a three year rotation based on this [INDISCERNIBLE] train of thought. Reading the presenter.

>>MODERATOR: I think we have a couple more questions. We'll -- I know people have to leave. We'll ask more if you have time for two more.

When you say use integrated weed management to lessen cultivation what do you mean by cultivation?

>>MARK SCHONBECK: Start by crop rotation keep it is weed guessing. Don't be doing your speed disk and planting the time at the same time every year.

[CAPTIONER LOGGED OFF]

[CAPTIONER LOGGED ON]

>>MODERATOR: Yesterday. We'll do our best to fix and be ready for the rest of ther series. This is the first in organic webinars. Open to all of your ideas welcome to that feedback. Thank you for hanging in there. Utilize the slides and stay tuned. With that, stay tuned.

>>MARK SCHONBECK: Those notes that go with it. If you want to get in deeper into something that I have only skated over today, the presentation notes give lots of references and additional information. Thank you all.

>>MODERATOR: Thank you, Mark. I will make sure that the notes are posted again. If for for the folks that list it and don't link to those notes, I will post them on the portal page where the webinar is housed. The recording will be available early next week.

So on behalf of the USDA and the Natural Resources Conservation Service, I wanted to say thank you to Mark, Thelma and Lindsay for providing an excellent presentation today: Why "Organic" Matters Soil Organic Matter, Soil Health and USDA Certified Organic Farming.

And thank you again to everyone for attending today's webinar. Participants, don't forget to provide your feedback about the webinar. If you selected to earn CEUs, open to the open browser window to continue the process offered by Step 2 at conservationwebinars.net.

This concludes our webinar presentation.

[END PRESENTATION]