

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

**Organic Agriculture  
as a Climate Change Mitigation  
and Adaptation Strategy  
09.06.22**

» I'm excited to introduce our speaker, Kathleen Delate, Ph.D, Professor in Department of Horticulture, Iowa State University, responsible for research, extension and teaching in organic agriculture. She was awarded the first faculty position in organic agriculture, at a land grant institution. She has farmed organically in Iowa, California, Florida, and

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

Hawaii, 2014, studying organic farming with some of the 48 thousand organic farmers interest. Kathleen is also named a 2022 society of agronomy fellow.

» Can people just say if they can hear me okay please? So, as we all know greenhouse gases, are GHG throughout the rest of the seminar. Can affect global warming and the most prevalent gas is CO2 carbon dioxide. Around 200 parts per million up to about 1950 and since then with continual burning of fossil fuels yes the majority of emissions does come from fossil fuels burning but some come from - - (bad audio) burning but some do come from agriculture and we'll talk about that today and the sad fact is that 60 percent of fossil fuel emissions stay in the air.

To go electric and go solar because that will help too. Fortunately, it's opportunity that I'm speaking now because there's increasing federal interest in carbon and mitigation climate for improving climate smart agriculture as they call it which want farmers to be rewarded because we want them to use these practices to mitigate climate change 2019 upper right there last year there was drought at the beginning of the field season in June 2021 but this year there was drought starting in jewel and continuing today.

So, look at the US drought monitor this was from last week, anything that's orange, red, tan or are Brown that means it's abnormal dry or - - from abnormally dry all the way to severe drought to the section of the state. So, my research site I'll talk about the data from today is now 7 inches below normal rain fall. It's amazing if you have organic matter in your soils like organic practices require there's a lot of resilience in those

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

systems so hopefully we won't be too far down our yields. So, again we are lucky that we have someone who appreciates climate smart agriculture, in US secretary Tom Vilsack. We want to be planting cover crops. We want to see 30 million acres by 2030 and he's doing good on his promise by doing the - - program. Supposed to go effective in October. I don't have a lot of details about that, I just heard details today but if any one else knows more details we would love to share this transition program will provide wonderful training and grants and I believe 2 will also support through - - NCRS. I like this quote from Natalie Winnona Laduke from the sequester your carbon from your soil. There's 2 ways to do this, they have a lot of publications now on carbon and carbon markets and I'll point out some of those to you and if you see the slides you'll see the citations. So, the - - has gas emissions but you can remove them from the atmosphere. So, one way to avoid greenhouse gas emissions is by avoiding greenhouse gas emitting synthetic fertilizers. And then carbon removal through carbon farming or soil storage, and evidence - - and carbon are measured in metric tons of CO<sub>2</sub>, which stands for CO<sub>2</sub> equivalent. All of the other CO<sub>2</sub> gases are equivalence of CO<sub>2</sub>. So, methane would be 25 CO<sub>2</sub>s, that's how you learn to deal with the carbon market metrics. This is from - - someone called him on a soil sequester. Partially decayed organic matter and soil organic matter is composed of 50 to 58 percent carbon it's a critical driver for improving physical, chemical and biological and properties of soil quality and also controls land scape and global level processes of greenhouse gas and greenhouse mitigation.

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

Also like to include the slide from Cindy - - who was a soil scientist the with the USDA and she says soil quality is the soil ecosystem to function and have the high macro and micro biodiversity and soil nutrients and the water flow and I did in of Cindy's papers. You have the link on Cindy's paper on water conventional systems and how water quality varies in those system.

What management practices are likely to increase the stock of soil carbon which is to reiterate adoption of soil conservation sequester. We kind of sequester soil carbon at observed rates of of .25 to 1 per year.

All research at Iowa state university has consistently demonstrated greater carbon soil in organic systems. This is an overview of long term ecological research site in Iowa it's a 17 acre site with 44 plots. Each plot 1 a quarter acre. It's certified organic. It's random design it's organic or random identified on the 17 acres but certified organic because we have the 30 foot buffer around every plot.

So, conventional corn soybean which is the most typical rotation in the state of Iowa compared to two organic rotation, corn soybean, oats and alfalfa for one year and then the longer rotation corn, soybean, oats alfalfa together and then alfalfa alone next year.

Presenting the results from - - and the sequestration in the rear plots, the left bar in the conventional corn soybean system and the right two bars are the organic systems. So, you can see the great organic have greater carbon in the system there.

Carbon change over 20 years in the LTAR so looking at residue carbon, that's from compost carbon. Total carbon inputs and managed the - - site in 98 was equal in all he

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

treatments in 99 and then she actually analyzed the amount of carbon in 2007 and that's the results from 23.6 versus 40.7 and the conventional.

Looking to the bottom the change in soil organic carbon over ten years was .27 in preorganic and this was again per metric tons per year and the fourth organic pre rotation ways which is the longest rotation we have out there is .53 and 0 change in the conventional system more carbon contained in organic systems. Conventional till to no—till which is the 25.7 grams per hectare.

What about soil nitrogen? Since we can't use fertilizer in organic systems we rely on organic remnants an organic crops and does that supply enough nitrogen for the next crop in sibling day showed that the nitrogen storage in the soil for the next crop was greater, and that's shown here.

What's driving this a lot is the higher amounts of beneficial soil, microbial possibilities. So, you can see 296 in the conventional corn soybean versus 344 and 361. So, having the diversity is critical in the organic system. So, 6.4 here and 6.7 in the organic and Cindy points out why we don't use synthetic fertilizer in the organic system and also higher levels of calcium in the organic system.

So, you can see here all of the cation systems were increased. All greater in the organic system compared to the convectional and Cindy said that the soil quality enhancement seen in the cation exchange, which is related to the cation capacity which is related to the nutrient availability.

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

This research just came out from crystal - - and others over time. What they did was a huge meta analysis and they looked at how soil organic carbon is changing based under years of organic management. What they concluded is that organic amendments, they increase soil organic carbon both over the short and long terms but cover crops need more time so you don't see instant response from cover crops it might take five years plus before you see that organic carbon in soil but you have to include them in your system as you all know.

So, looking at both cover crops and to say that we, along with Pennsylvania and Wisconsin have had good success with soil following no—till rye the no—till came at 37 bushels per acre compared to the regular, organic till, at 42 and, I have seen higher yields than that, higher than 37 so we continue to work on that system to try to perfect it. The organic no—till corn however was extremely challenging due to 2 reasons. The hairy vetch wants to continue to grow even if you roll it and it's pretty doubtful that you can - - at least in our part of the world - - can have a quote or gap I can corn yield to conventional corn yield with just hairy vetch you need additional nitrogen in that system. There are people continuing to work on that.

Right now we have an conservation innovation grant with USDA and NRCS. We're grateful to Lindsey - - UW Madison and Rodale Institute looking at several factors looking at them on farm and compare the Rodale there and in this case there's 6 rest for a 6 row planter. We haven't seen much difference in the two, but we've only done the research for about two years now so we'll continue it another year this year.

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

We also looked at the weed zapper and that works really well with soybeans. IE you don't do tillage you just electrocute the weeds. A weed zapper is only good if the weeds come over the soybeans.

Highlighted in yellow shows greater control of weeds, and weed zapped areas for both rodale roller and the zapper. The zapped come in at 56 and the non zapped come in at 54. More interested in the weed zapper. Hopefully we don't need it every year. We did do an economic analysis of it and the economics pan out it's not as expensive as you would have guessed. Energy however we need to do a deeper do I have into the energy spent for the zapper however we'll compare with the herbicide prevention.

Economically it comes out very well if you have escaped weeds and the no—till system used the weed zapper.

We also went to use a propane flamer with no—till corn. I mentioned that vetch controlled that we can knock it back with a propane burner it was controlled too severely. So, we don't recommend that however there's still places trying to tweak that organic no—till corn system.

One thing is clear though in all of the sites we looked at 6 sites, shared water, USDA, shown the gray - - so food quality is already higher in the organic no—till system so both microbial biomass carbon and nitrogen higher in organic NTMBC. We also looked at the experiment crops. This was a transition grant and as similar to the soybeans the vegetables did well in the no—till system and the 25 tons per acre in the tilled system compared to 24 tons per acre in the no—till system.

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

There's more details, if you're interested, and Cindy also looked at the soil quality in this experiment and the parameters that she looked at, particulate carbon, macro aggregates and first column is cover crops tilled. Cover crops no—till. The drain system and the last is really the most common system in organic vegetable farmers it's a cover crop but they still till it.

As you can see if the letters are the same, that shows that they were similar between cover crops no—till and cover crops tilled and so, leading Cindy to conclude that, a no—till is better than till. Cover crop is better than no cover crop but growing over that cover crop can reduce the negative till rage for all properties. So, that was an interesting result from this research.

Aggregates are still greater when there's no—till at all so aggregates still show the soil structure at 27 percent compared to 21.4 where the cover crops were tilled but look at the difference where there's a till and no—till there's 15 aggregates. A minimum cover crop will help soil quality and ideal no—till but don't plant the whole farm until you do some demonstration experiments before I'm going all the way.

We also did a couple years experiment with the how are university of Minnesota with the livestock cropping system and we found that enhanced nutrient cycling is preserved soil carbon with year round plant core. In this case we grazed wheat and rye pasture in the spring and found the smiles that system have a greater amount of the soil enzyme glucosidase and found very good yields following that system.

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

So, if you can integrate life stock you will definitely improve your soil carbon and there's a notation on that if you're interested in learning more about that study.

I get a lot of calls for people should I sign up for carbon markets and what's going on with this and that initiative and really it's a full time job understanding every thing out there I'm sure you get scrambled with all of these things too. We have applied for one of the partnerships for the USDA and wait to go hear if we get that because that will allow us more trainings along the lines of what I'm presenting today and also have time to set demonstration of carbon sequestering practices.

If you're interested in that I encourage you to pass the information along to them because many programs are out there but they're very complex and what some of the issues are is that most carbon credit opportunities establish the waistline for the current soil practices. If you moved to cover cropping several years ago you may not qualify for carbon programs. Those are soaking changes for current practices. Then if the carbon practices are discontinued some programs will penalize you as the farmer.

So, it's important to look at the fine lines on all of these contracts go to NRCS and PSP they have a lot of practices. If you are already certified organic there's a lot of practices, like conservation crop rotation. Residue and tillage management. Cover crops, grazing practices. Nutrient management. This is from Iowa since FY20 13 Iowa has a allocated 4 hundred thousand to or began initiative.

Then, Marina introduced me to this new exciting practice organic management. It's exciting to see and read that farmers can be rewarded by following national program of

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

required organic practices. However, I went through the standard and I can see it's a little stricter than NOP requirements. That's the baseline but there's additional criteria like this. You have to include at least one cover crop with a biomass cover crop equal to 1 ton per acre. That's easily achievable but the slide I showed you this year, we had about 12 thousand pounds, so 6 tons per acre, that's an organic no—till system.

But you would easily get more than one ton per acre at the recommended rates of planting cover crops and it's really good that NRCS will be encouraging people to have at least one cover crop every two years where the as organic program regulation reads you must have a soil weathering crop rotation that in variably includes cover crop or small grain or legume program that improves soil quality.

But some places, I'm not saying names, they might try to get by with only having a cover crop every four years and if they can prove that situation improves soil quality then they can be certified organic. However, if they want to hang on to the new practice management they have to have a cover crop at least once every 2 years. I really like this. I'm so excited about it. I encourage people to sign up for it. Call your state office and see if they participate in it and let's get some data on it. It's exciting to follow people using this data and let's see what happens to the soil quality.

California leads the way in climate smart agriculture. Of course, they're in a much more dire situation out there. I did my Ph.D. out there, I was so glad to come to Iowa, for one thing, we get 40 inches of rain a year. there's such a crisis out in California with water and fires. They have to have a cap and trade program and the income they derive from

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

that program they setup a grant program it's the first across the country and they provide resource for farmers and ranchers to adopt these practices to increase carbon storage and practices. I encourage you to look at their site and push your state to do more smart climate agriculture.

I encourage all farmers to try to calculate how much carbon they have questions on their farm. This company's ad for the carbon calculator, I think you can get a free trial of it, it's assimilation Dean ran on a hypothetical farm, it's 500 acres, conventional corn, soybean. The corn planted no-till, you have to say what your expected yields are, then it runs through the calculator and the carbon offset was determined through the organic matter content which was 618 metric tons equivalent and then from the fuels crops and inputs equaled 696.09 metric tons of carbon dioxide equivalent per year or sequestered then we can open to questions.

Overall benefits from organic practices related to reducing GHGs mitigating climate changes. Increasing soil organic carbon rewards farmers and land owners with better till, higher - - and better biological diversity to support vigorous plants and sustained ecosystems services.

Carbon trading seems to be a marketing tool that helps broaden society's appreciation for inherent value of the soil carbon as fundamental basis for sustainability.

The health of our soils is improved through farm management that increases soil organic matter and reduce reliance on fossil fuel based inputs.

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

Improved management of N<sub>2</sub>O emissions require them to go organic. So, with that we'll go to questions, thank you for your interest in organic agriculture and thank you for helping your clients learn more on organic and help us put more carbon in the soil and learn about organic and climate change. So, thank you so much.

» Thank you so much Kathleen we can open it up for questions now. If any one has questions please feel free to put them in the Q and A box, we have quite a few so first question is how does biochar play into soil health and biocarbon does it contribute to biogas?

KATHLEEN: I myself have not worked with char, it's very beneficial in areas where you don't have good soil for the soil so the soil with a lot of carbon here and all over the Midwest we are blessed with great carbon stores and I remember when I first came, some of the soil scientists should we do some experiments with bio char because that was the big thing in 9 8 and she said no. We have enough with organic crop rotation so she never let me do any bio char. So, there's a lot of research out there on bio char and it will help with retaking carbon and I know some guys looking at it at Iowa state if you need more help.

» I would have to do a deeper dive into that when they say conservation tillage because I agree with you that's a very surprising result and we have not shown that in our data. Definitely see organic improvement with no—till.

» I don't know if you know offhand what was the impinge levels for both the Ph and the calcium?

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

» No I have to look that up. I'll make a note to myself and I can send that to Marion - - I would goes it's the same in both systems. Let me find that out exactly.

» Great. We know that soil cover especially organic matter as cover crops and crop residue greatly improve soil moisture and soil loss have you looked at soil moisture and soil temperature as it relates to no—till and tilled systems.

» No, not specifically. They mentioned in the beginning, so all of my soils, it does come into association with soil scientists and anxiously expecting her replacement to come along and crank this research up again I'm seen literature that says with no—till you'll expect lower temperatures, but I can't say that I've seen that impact the yields in the organic system. If any one else has a different finding I would like to hear from you.

» I'll keep an eye out for you for any comments on that. But we'll go to the next question for now. Are tools like the farm carbon calculator because used for calculating carbon see questions for farm management or are these good enough to have carbon credits?

» Good question. I believe it's excellent use for farm management. That's my main purpose is how much carbon they sequester on their farms. I can ask them at Iowa state if this would be a good system to use for a private program. I think this is a reputable company so I believe this is one way to show your carbon sequestered rights.

» Great did you have people experience a lot of crimping? Sometimes it works sometimes it doesn't.

» Yes gosh your correct. It was challenging. It works the best, get this, when you have perfect weather, - - it would you to be perfect weather. We had 202 bushels of organic

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

corn and it's not been the same for the last five years and it's really impacted everything including organic no—till. Again it works best when you have not too much rain but enough to allow the soybean to get up and going and compete somewhat with the dying mulch underneath it. And make sure that you have enough to fill the pods and right now at the soak site they have experienced a drought.

The growth was great at the beginning of the season but then the water run off and I believe they're close to our rate of being 6 inches below normal. So, the pods are not filling out as much as they would have, is that a fault of the organic no—till system? Sort of because if you compare, as we always do, to the regularly tilled soybeans near by, they're a little fuller and they have more pod fill. So, chances are there was a little competition between the soybeans and mulch and the dying mulch so even when it's dead there's still a little competition there.

It would be great to monitor the water and soil all season. Get the organic no—till down first and then continue if you're successful. I've seen just this summer alone a huge variation with results in organic no—till. One farm, I predict they'll get 50 bushels an acre and no weeds, haven't had to use the weed zapper and normal rain fall. Compared to our site it looks great but the pods are not filling out because of no rain fall.

It's still a risky system but we still have a lot of faith in it especially the rye, adding to that, it seems like there's a lot of bonus.

» Another question on do you have an opinion about the farm carbon calculator, whether one is more user friendly or better for certain applications or regions?

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

» Again I'm not the person to ask because I'm not the soil scientist. Comet, Comet is well known as we look at livestock and - - systems and comet is what we'll use. My colleagues at university of Florida and - - university, they're big believers of comet but I myself have never used comet. I can't really comment on it compared to the carbon calculator, I've used that a lot and it's very easy to use.

» We have a question that I might answer if that's okay Kathleen. Is the conservation practice available publicly yet? The answer is yes and I can see about attaching it to the webinar, when the recording comes up other wise folks are welcome to reach out to me and I'm happy to share it. It is available though yes. We have a question about soil amendments Kathleen are compost and weeds and kitchen scraps considered organic?

» Yes they are but I remember a horrible instance in Washington State, where they had a bunch of weeds with residue of fertilizer. So, if they're organic, and you know nothing is applied to them, ideally as they say they go through the full composting process where the pile heats up to 330 degrees over 3 days. I try to think if I put weed seeds in my compost, I don't think I do because I can't say that our pile gets that hot.

Usually commercial piles do, they get that hot you can use composting seeds but like I don't do that. You don't get temperatures that high I don't risk putting seed heads in there at least cut off the seed heads before you put them in there.

Of course you don't want animal product in your kitchen compost. Many Americans bury the fish around the corn hills but you don't want to put any animal products in your compost pile, but yes both are organic sources.

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

» Do you happen to know what was the weight of the lower crimper?

» Yes I do, when you fill it with water, it weighs 2 thousand pounds so it is heavy. You do have a lot of pressure to crush that standing water. There are some others that will plant into the standing rye and by doing that you will crush a lot of - - with the planter and then coming back with the row crimper, a couple days later to crush the remaining, you can probably run them up to, I think there's 2 or 3 leaves on the soybeans you can still crimp them after that. You heard recently you can't necessarily get an advantage to plant them earlier, but again it probably depends on what state you're in.

But right now we just crimp the rye and plant the soybeans into the rye once the plant is rolled and doing it during the ideal time is important too. Is that answering your question or was there something else?

» That's it, but if there's something else feel free to right in. What are the prospects for perennial crops - - in the current system particularly those not tilled systems?

» We want people to have perennials in their system. Most farmers in Iowa have a pasture system some where. Whether they turn it into row crops it's not necessary. Having pasture around definitely adds carbon to your soil. But having a mix that's more of a study in its infancy, the grant that we applied for. The program I did in Minnesota and - - winter wheat, and winter rye, and they moved the cattle off the pasture for the summer and next summer turning the rye and wheat products into the corn and soybean and it worked great. I don't know the people who do it, but soil quality having

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

cattle on the land and having the manure composition itself seemed to raise the soil quality.

Basically forages there's other perennials out there that people are promoting like switch grass and sorghum, and - - there's a big study to use as biofuels and I'm not a big proponent of biofuels I just think there's still so much energy that goes into raising them and building them but I just don't see it panning out and plus you know how much money can a farm make on a field of a campus for example.

I'm a big proponent of perennials that are edible.

» We have a few questions in the chat, that pertain to a certain practice and I ask you to reach out to Kathleen if you have more questions but in the interest of time I think we'll go with one last question, have you heard of adding salt rock to soil?

» Yes I have, it reminds me of bio char. I channel Cindy now and say if your soil doesn't need it do not add it. Phosphorus for example you don't want to put additional phosphorus on, we already have high phosphorus soils here, I know certain degraded soils that can help but again test first before adding anything.

» Good advice, thank you Kathleen, thank you so much for speaking today and thank you to everyone who joined us today and everyone who submitted questions, that perhaps up our webinar I believe I'll pass it back to Jen to close us out.

» Thank you on behalf of the USDA and the national resource conservation services I want to say thank you to Kathleen and Marina, thank you to everyone for attending

*DISCLAIMER: This text is being provided in a rough draft format. It is not a verbatim transcript. Communication Access Realtime Translation (CART) is provided in order to facilitate communication accessibility and may not be a totally verbatim record of the proceedings*

today's webinar. Participants don't forget from stride feedback about the webinar and if you selected to get EU please open the browser window to get to the --

» Thank you very much.