



BOUNCE BACK FAST: CULTIVATING CROP RESILIENCE THROUGH SOIL HEALTH

Featuring Dr. Dianna Bagnall

Research Soil Scientist, Soil Health Institute

DJ May:

Welcome to the Decode 6 Podcast, where we take your questions about carbon and ecosystem services and match them to the experts with the answers. I'm your host, DJ May. And this week our big question is this, how can soil health make cropping systems more resilient? Answering that question is our fantastic expert, Dianna Bagnall. Dianna is a research soil scientist at the Soil Health Institute. In her work as a soil physicist, she's developed functions that show how soil carbon impacts plant available water. She's helped select the most effective soil health indicators for the North American continent and analyzed a lot of on-farm interviews discussing economics and soil health. And that's just to name a few of her accomplishments. Welcome, Dianna. It's great to have you here.

Dianna Bagnall:

Yeah, it's great to be here. Hi, DJ.

DJ May:

Well, we're going to dive right in. So our big question today, how can soil health make cropping systems more resilient? And just start out with that resilience aspect. What do you mean by resilience?

Dianna Bagnall:

So I've been a lot of thinking about this and I really have two big picture categories. One is what actually happens in the soil and how does that really physically make our soils more resilient? What's going on? So there's one area, and then the other side of this is, of course, the purpose of growing crops in a cropping system is so that we harvest that crop and we have a yield. And so we want to look at the economic outcomes of resilience. How do we have maybe more reliable crop yields from year to year or resilience to weather, things like that.

DJ May:

Perfect. Start with the soil. Let's go from the ground up.

Dianna Bagnall:

Well, excellent, no pun intended. I'm sure when we think about management and how we make our soils more resilient, I like to always go back to the idea of the different soil health principles. So things like when we're keeping our ground covered and we're reducing disturbance. When we have more living roots in our soil and when we look to biodiversity above ground. All these things are going to result in physical changes and biological changes in our soil. So our soils are able to form aggregate soil structure, and that leads to porosity. And those pores are really the kind of highways and bridges, they're bringing in water and nutrients and air for the microbiology of the soil. And so in building those aggregates and those structure, as we improve our soil health, that's going to get us to a place where we can capture more water.

So when it rains, we're able to have more of that water infiltrate as opposed to runoff. And when we do that, at the same time as we're changing the infiltration of our soils and improving it, we're also improving our soil's ability to store water. And that's essentially giving us a bigger bucket. So every time it rains, we can capture more of it, and we're able

to store that. And that's really a big piece of the foundation of the biophysical resilience of our soils and we really linked that in recent work to soil carbon. That's something that when we're able to see that we're storing more carbon in our soil due to improved soil health management, that we're also able to capture more water.

DJ May:

I love that imagery of the bigger bucket, getting yourself physically a bigger bucket. I think that's a great way to think about it. So you have that on the soil side. What's happening economically as you improve soil health?

Dianna Bagnall:

So when we're able to think about our economics and we've improved our soil health, there's broadly two components. We think about how are we saving money and how are we maybe making a little more money? And so we just talked about water storage and having more plant available water for our crops, that's going to help us with maybe boost our yield or make our yield more resilient. And that's going to result in the opportunity to make more money because we are selling more of our main purpose, our crop yield. But we also have the chance to be able to not spend as much money as we might otherwise have. So when we go back to those soil health management principles, they might include things like maybe not doing so much tillage. And that's going to reflect in reduced fuel and reduced hours on your tractor and the opportunity to save electricity in some cases, and to save on labor.

And so what we found in our analysis when we've done partial budget economics on quite a few farms now. We've done a hundred in corn and soy and we're now really undertaking that work in cotton. And so what we found is that about half of the value is improved yield, and about half of it is reduced costs. And that comes from reduced soil amendments that we're having to put out because we have better nutrient cycling. The improved water that we've already talked about can lead to reduced irrigation and then those time components and those inputs. So I think when we talk about resilience on economic level, spending less and then maybe making a little more of both components of how soil health improves our economics.

DJ May:

There's a lot to think about there. If you were talking to someone who maybe hasn't made these changes yet or was concerned about maybe seeing a yield decrease or taking on different practices, I guess, what kind of advice would you give and what sort of timing does it take to see resilience as you described it?

Dianna Bagnall:

That's a really interesting question. So I think one of the really common things that successful farmers have told me is that they start small and they experiment to find out what works for them. So they make sure that they have an opportunity to try it, because we know that yield is really locally resilient. Farmers know which of their fields yield differently and that's kind of the same with soil health. Different fields have different capacities to have healthier soil, even though all soils can be healthy. And so I think starting small, trying some things I've heard anecdotally that a lot of people are like, "Let me give cover crops a go before I start reducing my tillage." So some folks really think that that living roots component is really important, probably because of the things about soil structure that we were just talking about really being able to build our soil.

So those are components. When we looked at folks who were already using these practices and were seeing the benefits, they had been using them for about five years. And so I don't know that that's a really hard line in the sand. Because I think things like reducing your cost, they're going to start to benefit you immediately. If you're not paying for

fuel, you immediately have that money back in your pocket. Things like the biophysical stuff we were talking about earlier where we're building our soil structure, probably going to take a little bit longer and that's where we often want to look to that three- to five-year range. And then I guess this kind of takes us into another area that's really interesting to me, which is that not all folks see the same benefits. We certainly saw in our study that some saw relatively more net farm income benefit and some saw less.

I think time was a component. So those folks who'd really honed our system seemed to be able to see a little bit more benefits. And those who were in a situation where they saw increased yields also were those that tended to be maybe more on the higher end. So hopefully that's a little bit of good advice. But maybe the best thing I can say is that if you're able to find a person who has experimented with this locally, they're a really good resource. So it's good to have to do some reading. It's good to maybe talk to someone who or to learn from opportunities like Decode 6. But I think that really finding some mentorship from a successful producer is the single most valuable thing that you can do. And it doesn't always have to be somebody close, sometimes building off somebody even in a different region. I've had farmers in Texas tell me that they got some really good ideas from producers in Arkansas, and they implemented some new things that worked there. So finding out what's worked for others is a really good place to start to.

DJ May:

Well, I can tell you it's always nice to be able to phone a friend, bounce some ideas off of people who've been through it. I guess sort of one last little curve ball question. Sometimes there's this mismatch between research that I see come out about soil health and the experiences I've heard from people on the farm. Do you think there's any reason that maybe sometimes we talk past each other or we're not quite on the same page with research and practice?

Dianna Bagnall:

That's a fantastic question. I've thought about this a little bit, and one of the things I would say, I was thinking about this morning, and I was thinking to myself. We have to understand what we want out of statistics or what we want out of data sometimes. So for example, let me take a human health example because I think soil health and human health can be helpful to compare. When we went and we looked at all these farmers who were successful, you could say, "Well, not everyone's successful." And that's true in terms of maybe some haven't had as much success when adopting soil health management systems. Comparable human health question would be like, less than 1% of Americans have run a marathon. So if you just looked at the numbers and you'd be like, "How likely am I to run a marathon?" It's pretty low and not that it's in my plans either, I can tell you that.

But if I asked the question, but can I run a marathon? It's a very different question. And the answer is probably most people with some effort and some training and some time just like the soil health example could be able to do this. So I think it's really nice to ask ourselves, what is the potential or what's the opportunity for me to do something that really works well? Whether it's human health goal that's going to take a lot of dedication or it's a soil health goal that takes a plan and training and dedication to achieve it. So I think there's a lot of use in not just looking at what was the average, but in saying, how well can I do? And I think when we think about managing our individual properties, probably how well can I do is a more useful question.

So that's one reason that I think maybe some things that come out of research might be a little different because in research, we're often looking at, well, was this successful everywhere or did everyone come out with the best results? Another thing is there's just different goals. So when we think about a researcher, all the plots that we're working on really need to be uniform. They need to be planted at the same time. They need to get the same amount of fertilizer at about the same time every year so that we have the consistency we need to produce our primary output, which is research knowledge. If you compare that to a producer, they're really interested in how can I make the best yield for me

in this situation this year? So they might change planting date or the fertility that they're using year to year to optimize for yield.

And we do see that there's a distinction between the benefits of yield when you're asking somebody whose primary goal is to get better yield as opposed to someone whose primary goal is uniformity and maybe to try a lot of things. So I think those two ideas, one asking yourself, what do I want out of this information? Do I want to know on average how well do people do? Or do I want to know if I try hard, how well will I do? And then the second idea of we just have different goals in managing for research sometimes. It's still important because we want to know that information, but it might not be the same as what I'd be looking at when I have maybe a more dynamic opportunity to get the best yield I can each year.

DJ May:

No, that's fantastic. I love that framing of, I mean, I think the marathon runner is a great example because it's baby steps. You don't start by running 26 miles. You start with, "Well, I guess I better go for a walk around the block and see how that is first and then build up from there."

Dianna Bagnall:

That's right.

DJ May:

That's awesome. Well, I just want to zoom out one last time and kind of hit on this concept of resilience again. But why do you think having more resilient cropping systems is useful? Why the focus on this now of all times?

Dianna Bagnall:

I mean, I think there's some respects in which it's probably always been important, but we also do see weather variability that's really concerning. We see input prices that are high, and I think that both of those constraints are really things that make us want to ask how can we maybe do a little more with less? And how can we be adaptive to the fact that we have an environment that's really unpredictable. Farmers have always been dealing with unpredictable weather, but I do think there are regions that are seeing patterns that they just haven't. I just saw some drought data out of the panhandle of Texas, and of course I work with a lot of cotton growers there, and they had a really awful year last year as they had just unprecedented drought. And soil health doesn't necessarily fix a drought.

We can't make it rain, but we want to find those winds when we can maybe have a system that in our discussion, for example, about capturing available water is going to give us a better outcome because we're more prepared. And so I think really both the constraints on inputs and the need to adapt to this changing environment and a dynamic environment are reasons that resilience are particularly important.

DJ May:

Well, any final thoughts, Dianna?

Dianna Bagnall:

I think that just recognizing there's a lot of diversity in how these practices get implemented in what is going to work for a particular individual and honoring that it's not an easy thing. Going back to our marathon example, I think it's

something that really is a challenge, but has a lot of benefits. And so just having an understanding that things vary by geography and by farm type and by what's going to work for individuals is a way to have an open mind and just have an attitude of experimentation that's going to lead to the outcomes we want to see.

DJ May:

Excellent. Well, thank you so much for your time today. It was great to have you on.

Dianna Bagnall:

It was a pleasure to be here. Thanks, DJ.

DJ May:

If you want to read up on soil health and crop resilience, check out our show notes. And if you're curious about carbon and ecosystem services or if you have questions that you'd like an expert to answer, come visit us on decode6.org.