

Transcript of Episode 021 of the Plants Dig Soil podcast – “Supercharge the System.”

Hello! This is Scott Gillespie and welcome to the third season of Plants Dig Soil. In this podcast, you will learn how to think critically about regenerative practices as you work to incorporate them into your agricultural, horticultural, and home gardening systems.

[Transition Music]

Now that we have a way to maximize the ground cover with green plants and having living roots growing as much as the heat and the moisture will allow, we can look at ways to supercharge the system. Remember that all the additional practices are meant to enhance carbon build up. They don't build carbon in and of themselves. This is the fundamental principle that I shorten to: Plants Dig Soil.

The backbone of the system is plants creating biomass above and below ground and pumping sugars down into the soil. The sugars may be used for energy or for building soil microbes and soil fauna. The residues that all these living creatures – plants included – leave after they die will then contribute the particulate and mineral associated pools. But when there are no plants growing and there is sufficient heat and moisture in the ground carbon is being used for energy and is being released as carbon dioxide.

In the previous episode you likely noticed that I only had one species for the cover crop. Keeping it simple is backed up by a scientific meta-review of cover crop mixtures vs monocultures¹. For this study they looked took the data from as many cover crop studies as they could find and standardized the effects so that could compare monocultures verses mixes. In 9 out of every 10 studies there was no difference between the monoculture and the mixture.

In other words, in the vast majority of cases, it didn't matter what was planted or whether it was a mixture or a single species, the plants did the job they needed to do. In 10% of the studies there was a significant effect when comparing monocultures to mixtures. This is where it gets interesting. Of these studies where there was an effect the monoculture was better 83% of the time and the diverse mixture only came out on top 17% of the time.

You may have noticed that I didn't use the two most popular species there are in cover crops – tillage radish and fall rye². The reason I didn't include them is that their functionality is mostly already covered with the crops that grow in our region.

Tillage radish does indeed help to break up hard pans and with the giant roots with diameter of 2-5cm and a length of 30cm or more. They do look impressive, but their main work is in the very small roots that go a metre or deeper. In order to grow radishes that big you need moisture and a long fall growing season. Relay cropping them in June is too early – they will bolt and flower in the summer heat. Planting in August can work but you need them germinating and growing fast. This can work with irrigation but in dryland it's a challenge.

Another thing to remember is that tillage radish is very popular in areas without canola or any other brassica crop. There are advantages they see to them in their soils simply because it is a type of plant that is not commonly on their fields. Tillage radish can be tough to establish here for another reason – flea beetles. While it doesn't happen every year, if the flea beetles are in their overwintering generation³ and are bulking up for winter they can decimate a stand. For a first-person farmer

experience check out an article that was written about one my clients in Grainews last January called: “The cover crop learning curve⁴.”

I avoid fall rye on dryland because we already have crops that can serve this function. Where fall rye is so popular, they don’t typically plant winter cereals. Like the tillage radish, it’s a new functional group and can do a lot for their soils. Fall rye will take massive quantities of soil moisture from your land in the fall, and especially in the spring. It can also make a mat of roots that can be very tough to seed into if not killed early. Fall rye is a very good cover crop with irrigation following late harvested high disturbance crop such as potatoes or sugar beets. It will germinate as late as October, though it’s better if planted by late September and can sometimes stay green all winter. By March, it will be growing again.

[Transition music]

Speaking of potatoes and cover crops, I’d like to point you to a webinar in September that may be of interest to you. Spud Smart is a national potato magazine in Canada, and I’ll be talking as a part of a roundtable called: “Are Cover Crops Worth the Work?”. The link for registration⁵ will be in the transcript for the episode (or just check my social media, I’ll have it up there too).

I’ll be talking about how to look at cover crops as an investment to achieve a goal, just like any other input on the farm. Dr. Judith Nyiraneza will follow with results from her studies on potato yield, nitrogen cycling, and chemical & physical changes to the soil from her different trials testing cover crops such as pearl millet, sorghum sudan grass, brown mustard, and mixtures of legumes and grasses.

If you’re listening to this after September 9, 2021, the link should still point you to a way to listen to the replay. If it doesn’t, check future episodes as I’ll be sure to have a link. You can also check the media page on my website for a link to the recording by going to www.plantsdigsoil.com/media

[Transition music]

Mixes may be worthwhile when you want to do large acres and don’t know exactly what each acre needs. They also may be a benefit year over year as you don’t know exactly what the weather will bring. They may be best used in small areas every year to get to know which ones do best for you and to see if any up-and-coming species are good for you.

It’s almost guaranteed they will increase your seed costs. If you are putting out 10-15 species and 3-5 dominate in any one year you’ve spent money on something you don’t get a return for. You also may have planted a weed. Maybe it’s ideal time to come up will be when the next crop is establishing. Another factor not commonly talked about is seeding density.

Mixes will not be planted at the rate that is best if every species was on its own. If it’s the year when a particular species is best suited for the job, it’s not at the optimal rate. If three species dominate for the year it may not be enough for optimal growth.

The question I always have is: why not concentrate on the species that are best suited to the job and focus on them? After all, you don’t plant a mixture of every cash crop you grow on every field every year. You pick what will give you the best return on investment depending on crop rotation, machinery, labour, and market conditions. Even when people mix cash crops together in intercropping systems, they only pick two, or may be three, to grow together.

For a farmer perspective on this I'd suggest listening to the Field Work podcast where farmers Mitchell Hora and Zach Johnson talk to a cotton farmer who has made cover crops work for him. He isn't against diverse mixtures but in his experience a well picked single species or simple mixture attains his goal of weed control far better than complex mixes are able to. You can just listen to the episode with Adam Chappell⁶ but I'd suggest you start with the first one⁷ for some context. Each episode is an hour long but if you've got a long drive or will be spending long hours on equipment this may help the time to go faster.

So where do you go from here? Let's say you are meeting all your goals. Instead of the soil health goals I want you to think through physical, chemical, and biological goals. Most importantly, you are holding onto your soil. You have minimal or no wind and water erosion. You are cycling nutrients more efficiently by holding onto applied nutrients, unlocking legacy phosphorus applications, and capturing some nitrogen from the air above. You are keeping problem weeds from invading the fields. You have a diverse crop rotation and cover crops that help to break insect and disease cycles. You have got to the point that carbon is being held in the proper place in the soil to help you infiltrate water quicker and hold onto that water better for the crop to use.

Many will say that at this point integrating animals into the system is the way to supercharge it. I agree that animals have many benefits to the system, but they don't add anything more to it. They increase the cycling, but they don't inherently add to it. Grazing benefits the land by cycling the plants through an animal rather than relying on the litter making contact with the soil and letting the microbes do the job. It also benefits the land by not exporting as many nutrients off the land. Refer back to episode 018 Three Pillars Propping Regen Ag⁸ for a deeper discussion on this. The bottom line is that grazing only exports 3-5% of what a cash crops system does. There is much to be gained from animal integration, but markets still dictate what is profitable. It may be good for the soil but if you aren't getting paid it's not the way to go.

A hybrid system that I find fascinating is using wide row crops with a cover crop planted between it. The system currently being developed involves planting grain corn at 1.5m (or 60") row spacing – double that of normal corn spacing. Once the weeds are controlled a cover crop is planted. The corn rapidly shades the ground and captures the majority of the sunlight, but the low growing cover gets established and is ready to take over as the corn matures. After corn harvest the corn stalks and the cover crop can be grazed. From what I've read the usual drop in corn yield is about 10-20% but as long as you can gain this back in grazing you can be just as profitable. You may even make more back in the following year due to less cost of nutrients as you've increased the efficiency of the nutrient cycling. With a good cover you'll also be holding onto land. And this always pays.

[Transition Music]

If you don't have animals, don't want them, or have no way of getting onto your farm, then another way to supercharge the system is to grow a green manure. A green manure is simply a crop that is grown with the intention of putting it all back into the soil. This usually requires some tillage to get it into the soil. Tillage can have a place in building a healthy soil. Before you dismiss this, please check out an episode of The Agronomists where they explore this in greater detail⁹. There are times when tillage is the answer. The key is in knowing when this is the case. The link will be in the transcript.

In the Canadian Prairies and the Northern Great Plains of the United States this will typically mean taking an entire year out of production. The only time that I see this as profitable is when you are targeting a specific problem that will pay back the following year. In commodity crops this is unlikely but in high value crops it may pay.

A full season mustard crop that is chopped and disked into the soil ahead of potatoes can pay back in higher yields and/or quality due to its effect on potato diseases. In my next episode I'll be exploring this issue in greater depth. Potatoes and tillage are often seen as incompatible with healthy soil, but this doesn't have to be the case.

One way to get paid to grow a green manure is to top up your hail insurance. If it makes sense to have hail insurance to cover your risks, then when you do need to make a claim try to focus on the benefits to the soil that one year of adding biomass to the soil and not exporting nutrients will do. Gabe Brown, one of the celebrity farmers of the regenerative agriculture movement, started his journey this way. There's no doubt in my mind that a few consecutive years of hail kickstarted his system.

After this past year of extreme drought many will be looking at fallow as an option. Fallow will help to recharge the soil moisture and that may be the best thing you can do. The disadvantage to fallow is that without plant roots in the ground you are not feeding the microbes and they will in turn need to use the stored carbon in the system. I can't deny that in the short term this may make sense. You will unlock some nutrients that may help you for the following year. A way that may help you to do this without a net loss to the soil is to cover crop for part of the fallow year.

Fallow does hold onto water, but it also loses a lot of the water through evaporation. Instead of evaporation a well picked plant species can use this water and send some microbe food – sugars – into the soil. The key to making this work is to kill the plant before it uses more than evaporation will. If you do it right, the dead plant will then hold in more water, protect the surface from erosion, and help to quickly infiltrate storms that give quick and intensive rainfall. To learn more about this check out the links in the transcript to a recent podcast episode of Cover Crop Strategies¹⁰ and an exhaustive review from Crops & Soils Magazine¹¹.

Another way to supercharge the system is to bring some manure or compost onto the farm. This is not the same as having animals on the land, but it does bring some carbon, nutrients, and biology back. If the feed was grown on the field that the manure comes back to it's mostly a closed system. If you didn't grow the feed that was processed through the animal and transported to you as manure you will have a net gain. However, the field that grew the feed has a net loss as it doesn't get back what was exported.

In most areas there is not enough manure to go around¹². This is where compost extracts, commonly called teas, may have a fit. Derek Axton in Saskatchewan has been doing this for years. He applies compost to the poorer areas of the farm and uses the extracts to go with the cash crop seed so that every acre gets some microbes every year. This may be a solution worth investigating but so far I haven't seen studies that prove the efficacy of this. To me the soil biology vastly out numbers what we can add in a small stream on the seed. In some sense it's like a peeing in pool. You're a bit warmer for a few seconds but the effect quickly dissipates.

Worm castings and worm extracts also fit into this category. Overall, they have very little effect on the vast quantity of the soil. The biology in the soil will overrun it. However, if they help a developing

seedling get through an early season stress and produce more biomass and more yield because of this, they may be worth using.

Biostimulants are a whole area of regenerative agriculture that I have yet to explore. At this point I remain skeptical. I have not seen university or research organization trials that prove they are worth it. There are always individual trials that show an effect, and these are the ones that end up in the magazine ads, product brochures, and websites.

In my local area I'm excited to see the results of some research that is in it's second of three years that is testing these claims. If there is a real effect that translates to a greater payout than cost of the product, I'm for it. However, if it just pops them out faster, grows biomass faster, or greens them up a bit, and then has no statistical effect on yield, its only real effect is to transfer some of the farmers dollars to a product salesperson.

No episode on supercharging the soil system would be complete without a word on humic acids. For that I'd like to leave it to a soil scientist. This is a direct quote (as best as I could transcribe it) from the People, Nature, Food Podcast Episode 8 where the host, Tom Franklin, talks to Dr. Jocelyn Lavallee from the Natural Resources Ecology Laboratory at Colorado State University about soil organic matter. Dr. Lavallee says:

“Specifically looking to figure out what’s in the soil organic matter is ... where we’ve really taken leaps and bounds ... from the humic acid view to the more current view. [Humic acids are] not a thing in the soil, it’s a thing we create when we try to measure organic matter. So basically, if you take soil and you hit it with these crazy chemicals, they are usually really basic, you create artifacts. Obviously, that’s going to affect the soil organic matter and the chemical bonds that are there and so you can create these really big molecules that you would never find in a natural soil sample.”¹³

[Transition Music]

Remember to get local advice before acting upon this information. If you do not know who to talk to, get a hold of me and I will help you find someone. If you are in my local area and need help, contact me. It is always free to chat. If we get to the point that the scope broadens to consulting work, we can work out a plan that fits your budget.

Would you like to keep up with me through a free monthly newsletter? Go to www.plantsdigsoil.com/contact and select the newsletter option. If you have not subscribed to the podcast yet please make sure you do that in your favourite app. If you are a long-time listener – will you consider leaving me a review? This helps others discover the podcast. If you know of someone that would enjoy this, please be sure to share it with them directly or through your social networks.

If you are still listening, you are probably like me and like to know what the catch is. Why am I putting out this information for free? The reason is that I love to learn, and I love to share the information. My knowledge has been built up from experiences in my own garden, advising clients in my consulting business, and from reading the latest books and articles on agronomy and regenerative agriculture.

I have a B.Sc. (Agr.) with an agronomy focus and a M.Sc. with a focus on Plant Science. Beyond my formal education, I have attained, and maintained, my Certified Crop Advisor designation and am a member in good standing with the Alberta Institute of Agrologists.

Nearly everything I talk about is from free resources posted to university and research organization websites. Books that used to be hard to track down are available to buy or borrow for nearly anyone with an e-reader. The information is out there – sifting through it all is what takes the time.

I make my living entirely from consulting. I do not sell any products, software, or systems. I strive to be as independent and as unbiased as possible so I can provide the best advice to my clients and help as many people as possible move from conventional to regenerative agriculture.

¹ Andrew McGuire. 2020. Contrary Science; Cover Crop Mixtures, Monocultures, and Mechanisms.
<http://csanr.wsu.edu/contrary-science-cover-crop-mixtures-monocultures-and-mechanisms/>

² SARE. 2020. 2019-2020 National Cover Crop Survey.
<https://www.sare.org/news/2020-cover-crop-survey-report/>

³ Canola Council of Canada. ????. Flea Beetles.
<https://www.canolacouncil.org/canola-encyclopedia/insects/flea-beetles/>

⁴ Lee Hart (Grainews). 2021. The cover crop learning curve.
<https://www.grainews.ca/features/the-cover-crop-learning-curve/>

⁵ Spud Smart registration link for “Are Cover Crops Worth the Work?”
<https://event.webinarjam.com/register/215/94pkga96>

⁶ Field Work. 2021. How Conservation Saved a Cotton Farmer.
<https://www.fieldworktalk.org/episode/2021/05/19/how-conservation-saved-a-cotton-farmer>

⁷ Field Work. 2021. Can Cotton Drive American Ag Sustainability?
<https://www.fieldworktalk.org/episode/2021/05/12/can-cotton-drive-american-ag-sustainability>

⁸ Scott Gillespie. 2021. 018 Three Pillars Propping Regen Ag.
<https://www.plantsdigsoil.com/podcast/018-three-pillars-propping-regen-ag>

⁹ The Agronomists. 2021. Ep 34: Anne Verhallen and Marla Riekman on building soil resiliency
<https://www.realagriculture.com/2021/07/the-agronomists-ep-34-anne-verhallen-and-marla-riekman-on-building-soil-resiliency/>

¹⁰ Cover Crop Strategies. 2021. Cover Crops Good Alternative to Fallow Fields in Dryland Systems.
<https://www.covercropstrategies.com/articles/1923-podcast-cover-crops-good-alternative-to-fallow-fields-in-dryland-systems>

¹¹ Crops & Soils. 2020. Cover Crop Management in Semi-Arid Regions: Effect on Soil and Cash Crop.
<https://access.onlinelibrary.wiley.com/doi/10.1002/crso.20065>

¹² Andrew McGuire. 2017. There Is Not Enough Manure (or Compost) to Sustain Agriculture.
<https://csanr.wsu.edu/not-enough-manure-to-sustain-ag/>

¹³ The People Nature Food Podcast. 2019. Episode 8: Predicting Soil Organic Matter Dynamics-The Best Way Forward Is With POM and MAOM.
<https://www.spreaker.com/user/peoplenaturefood/som-pom-maom-final>