BE CAREFUL WHAT RAINBOWS YOU CHASE

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by Matt Hagny

“Truth does not change according to our ability to stomach it.” —Flannery O’Connor, author (1925-1964)

Am I dead wood? I certainly don’t think so, but some of the ‘New Age’ agriculturalists might be of that opinion of me—those who are putting cattle on cropland in warm climates, eliminating fertilizers & herbicides, and doing radical things with cover crops. I’m certainly not in love with my expertise on fertilizers and herbicides. Times change, we move on. At some point in the rather near future, much of my knowledge-base and judgment will be subsumed by Artificial Intelligence (technically, Machine Learning) anyway.

And if you really do think I’m biased against some of these things, you should review some of my previous writings. ‘Leveraging Biology’ in Leading Edge, [scroll down] for instance. And I was a staunch proponent of cover crops long, long before they were in vogue. I’m really stoked about the intercropping/polyculture/companion-cropping that Derek Axten and cohorts are doing (e.g., growing two crops in the same field at the same time in alternate rows, both for harvest). I’ve *always* preferred biological solutions to problems vs chemicals or engineering—there’s such beauty in the way organisms and ecology work. Anytime we can get nature to do something for us, that labor force will work tirelessly and for cheap. But not always does nature do what we want, or where and when we want—in those cases, we need to intervene (in a way that causes the least collateral disruption of the ecosystem). After all, we’re in farming to make a profit. What good does it do if you’ve done everything perfectly for the land and the environment, but go broke farming and a tillage farmer takes over your land?

After hearing Christine Jones of Australia speak at a recent conference, some highly intelligent, agronomically literate, and quite successful no-tillers went home thinking they had to change nearly everything about their farming operation—including eliminating pop-up fertilizer as a practice because it hindered mycorrhizae and made roots lazy. But I suspect her comparison photos of roots with and without pop-up were atypical and deceptive—the poor ones were probably conventionally farmed (possibly with tillage, or very new to no-till, possibly with no crop rotation and no cover crops, or had nematode problems), while the good examples were grown in killed sod or at least something with good species diversity. The roots are almost always going to look far better in killed sod [1] because of the dramatically better soil structure (because perennials put nearly twice as much into root biomass as do annual species, plus there’s no implements being ran thru the soil to mess up the structure), as well as higher mycorrhizae levels (wild or forage species are usually more mycorrhizal than intensively bred grain cultivars).

In checking with a sharp Aussie agronomist of a less radical persuasion, he says that he routinely sees the ‘dreadlocks’ (see photo) on crop roots that’ve been grown using pop-up fertilizers, fungicides, etc. He mostly only sees the lack of dreadlocks on fields with bad nematode problems (a big issue in Australia). Indeed, this is what we also see in the USA: long-term no-till under good management, but using pop-up fertilizers, is typically supporting decent levels of mycorrhizae, as

the following photo shows.

This young wheat plant shows strong colonization by mycorrhizae, as evidenced by the 'dreadlocks' of soil particles clinging to them. This wheat was seeded with pop-up fertilizer as well as seed-applied fungicide and insecticide. However, it was in long-term no-till with very low soil disturbance, and lots of plant diversity via crop rotation. This plant was representative of that field and several more fields of this farm operation's, although some of their other fields displayed less dreadlocking (the hypothesis is that fields more recently in alfalfa had the greater dreadlocking—which prompts the thought that maybe we should be planting some clover seed along with the wheat crop). Central KS, Feb 2018. Photo by Garrett Kennedy (Justin Knopf farm).

There would be somewhat more mycorrhizae without abundant P, but we also must keep in mind that mycorrhizae are not the end-goal. They're only a tool. We may or may not have more profit with more mycorrhizae. We may or may not be more sustainable with more mycorrhizae (you can have the healthiest soil in the world and still go broke farming—how sustainable is that?). Dwayne Beck, PhD, has an instructive if flippant question for farmers: "When was the last time you sold a truckload of mycorrhizae?" This from a guy who probably has higher mycorrhizae levels on his research farm than 99.9% of farmers, and knows full well their value, yet he also recognizes the problem of worshipping the wrong benchmark (i.e., getting fixated on a single gauge on your instrument cluster and ignoring the others until you crash the plane). And he darned sure runs pop-up and is a strong proponent of the practice.

Within an established no-till system with lots of plant diversity (from rotating cash crops, but even more so from cover-crop mixes), we often continue to see substantial gains in yield and crop vigor/earliness from pop-up fertilizer, even if that is only from a small amount of N (and perhaps other nutrients) to get the plant off to a good start, especially in heavy-mulch conditions or certain rotational sequences where N availability is very low (winter wheat right after soybeans, for

instance; or corn into heavy wheat/cc pearl millet stubble). I highly doubt we're ever going to stop doing this—the advantages are just too great. Besides, due to the way that modern crop breeding is done, some of our crops such as modern wheat varieties just aren't very mycorrhizal. And it's not easy to go back in time to older varieties because rust and other leaf diseases have evolved. Oh, you won't have any leaf diseases if you get the ecology just right? You care to bet the farm on that? Sure, improving plant health will confer better resilience, but there are limits. If a hungry bear is after a trapped goat, it doesn't matter how healthy that goat is.

We also hear a lot from farmers who are doing extremely low-input practices and appear quite successful financially, but often there's more to the story—quite a bit more. Often they're making up for low productivity by doing some value-added practice, identity-preserved sales, etc. Not everyone is going to be able to squeeze thru that gate. Or they might be applying a lot of manure or poultry litter that they neglect to tell you about.

At a recent conference that heavily emphasized grazing on cropland, some attendees who didn't own cattle (and probably shouldn't, due to aptitude) were nearly beside themselves with angst that they weren't going to get the 'soil health' in their pure grain operation. While it may be true that grazing causes major root changes that increase soil OM, it is also true that any grazing on annual species is destroying the mulch cover that protects that soil (and the OM it houses) from raindrop impact, sun, and erosive forces. It also causes a lot of compaction right at the soil surface—the exact spot where we need *maximum* infiltration lest runoff and erosion occur. How healthy will a soil be if it's gone? You would kill the patient to cure it? I have yet to see grazing on annual species implemented in Kansas that doesn't result in worse erosion (except perhaps on river or creek bottoms). I'm not even sure it's sustainable until you get to *much* cooler climates and better soils (N. Dakota, Canada). How often do you actually have excess mulch cover? Hardly ever, except in those very cool climates when you grow back-to-back grass crops. But we probably should be rotating grazed *perennials* on annual cropland (the old Argentine system) for improved soil quality, prevention/mitigation of saline seeps, and recovering nutrients from deeper than what annual roots can reach—but this doesn't generate profits as good as grain crops, unless you're an expert grazier *and* selling beef for a premium (grass-fed, etc.).

I'm continually amazed at how resilient our long-term no-till with high plant diversity is. We need far fewer interventions than ever. We can get by with far lower P levels than I ever thought possible. That doesn't seem to be the case with N, and certainly not for S, Zn, etc. I'm happy to entertain ideas on how to cut inputs even further, even some 'crazy' ideas. But not bet the whole farm on them. One of the non-local speakers at the conference, whom I respect, suggested that farmers begin by cutting their fertilizer rate by 50%. I sure hope he meant that the farmer should try this on a couple acres for several years before making any farm-wide changes, but I don't think he did.

I realize that sometimes the purpose of having some of these New Age agriculturalists at the conferences is to stretch our imaginations as to just what is possible. In our efforts to become the most profitable, sustainable producers, we are continually tasked with finding out just how much we can produce with the fewest inputs possible (hopefully this is also done in a sustainable manner), i.e., being the lowest-cost producer (while still having enough scale to be viable as a business enterprise—we can all be very low-cost producers with hand labor on an acre or two, but you're not going to have much of a lifestyle that way). All I can say is that we need some sober scientific-minded folks to actually prove these things can be done, rather than everyone going off chasing unicorns of 'organic' (or near-organic) farming. After all, there are some farmers who attempted these things, and were the poster-children for them, but they went broke farming long before their more staid neighbors did. Just because our current system is broken (as set

forth by Allan Savory) doesn't mean that any change is for the better. It is indeed possible to jump from the fryin' pan into the fire.

Of course, on this or anything else, you can believe whatever you want—but that doesn't make it true. Beliefs that translate into actions (or inactions) that are at odds with the way things actually work in nature will have consequences: Reality bites back.

[1] Assuming that overall nutrient levels are adequate for vigorous crop growth—nutrient-deficient plants have smaller root systems, not larger.

For more on grazing on cropland, see my past newsletter.