

Using Manures to build Soil Health in Tillage Systems

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Soil health refers to the status of a whole set of soil physical, biological and chemical indicators which affect a soil's capacity to function as a living ecosystem that supports crops, animals and ultimately humans for the present and future generations.

Can I build soil health on my farm, and hand it on in better condition than I got it?

To a 20 cm depth, one hectare of soil weighs approximately 2400 tonnes. So the answer is yes, but it takes time and is done by building practices that improve soil health into your system over your career as a farmer and steward of the land. Just as soil health is built incrementally over a career and many of the benefits are reaped over the long-term. Adding organic manures to soil is an excellent way you can build soil health.

What are the key components of Soil Health?

There are three pillars of soil health; the physical, the biological and the chemical (Figure 1). Only by focusing on all three can the reward of top yields and health soil over the long-term be achieved. To highlight the benefits of manures I will describe an example of how manure can positively affect each of the three pillars of soil health

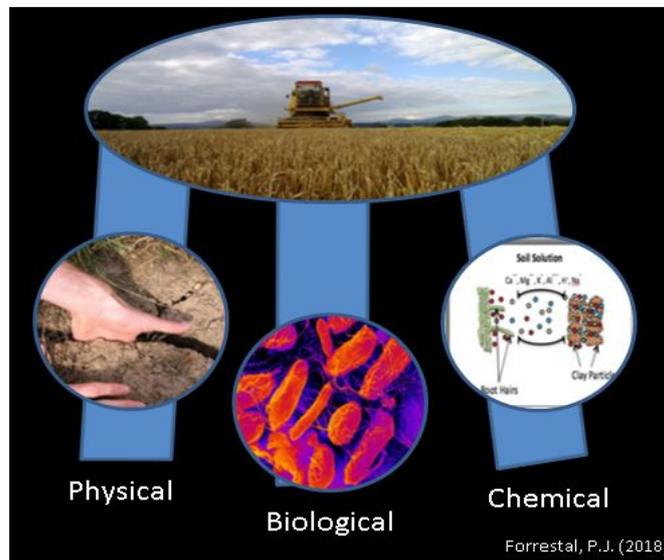


Figure 1. The three pillars of soil health

How can manures improve my soil physical health?

Soil physical health is concerned with how the sand, silt and clay fractions come together to maintain good soil structure. This is important because it affects what happens soil structure and aeration when soils get wet up or machines travel over them. Manures can help here because addition of manures as part of a system over the long-term will build soil organic

matter levels. This organic matter provides energy for soil microbes which secrete organic polymers. These polymers will coat silt and sand particles allowing them to bind into water stable packets which can better support machine traffic. The effect of organic matter on soil structure and aeration on wetting can be seen in Figure 2.



Figure 2. Effect of organic matter on soil structure after wetting

How can manures improve soil biological health?

In a spoon of healthy soil there can be more life than all the humans that have ever lived on earth. Just like us, this soil biological and microbiological life needs to be fed to function. Keeping a living growing commodity or cover crop on the land throughout the year and adding manure are two of the best way to provide the carbon rich energy compounds that soil life needs. As an example Figure 3 shows how soils with organic manure addition have much greater earthworm abundance than soils not receiving manure.

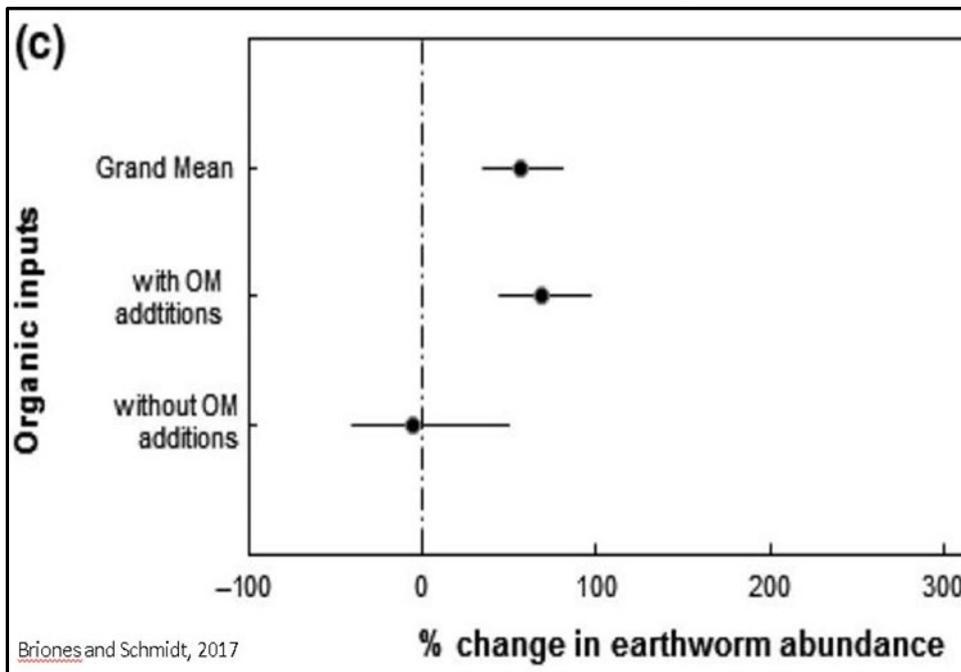


Figure 3. Effect of organic manure (OM) addition on earthworm abundance

How can manures improve a soil's chemical health?

The N, P, K content of organic manures are often used to estimate their value. However, you have seen above that there are physical and biological benefits to using manure which also have a value. Manures can be a cost effective way of getting nutrients and building soil chemical fertility. Bear in mind that nutrient variability can be high so make sure you get an analysis, it's worth it. You wouldn't spread bagged fertiliser without a label, why do it with manure?

Manure has a benefit over bagged mineral fertiliser in that it contains more than just N, P & K. Figure 4 shows that a 22m³/ha application of cattle slurry delivers significant amounts of other nutrients like S, Mg, Ca for example.

The most striking is the amount of Carbon applied which far exceeds all the other nutrients. Of course not all the Carbon applied will be retained in the long-term. Research has shown that where manure is added as part of a system about 14% of the carbon is retained in the long-term.

Talk to your Teagasc advisor about making manure part of your tillage system. Including manure in your system can help to build a healthy soil that will pay you dividends over the long-term as well as the short term. You will also have the satisfaction, in time, of handing the land and soil on to the next generation in better condition than you received it.

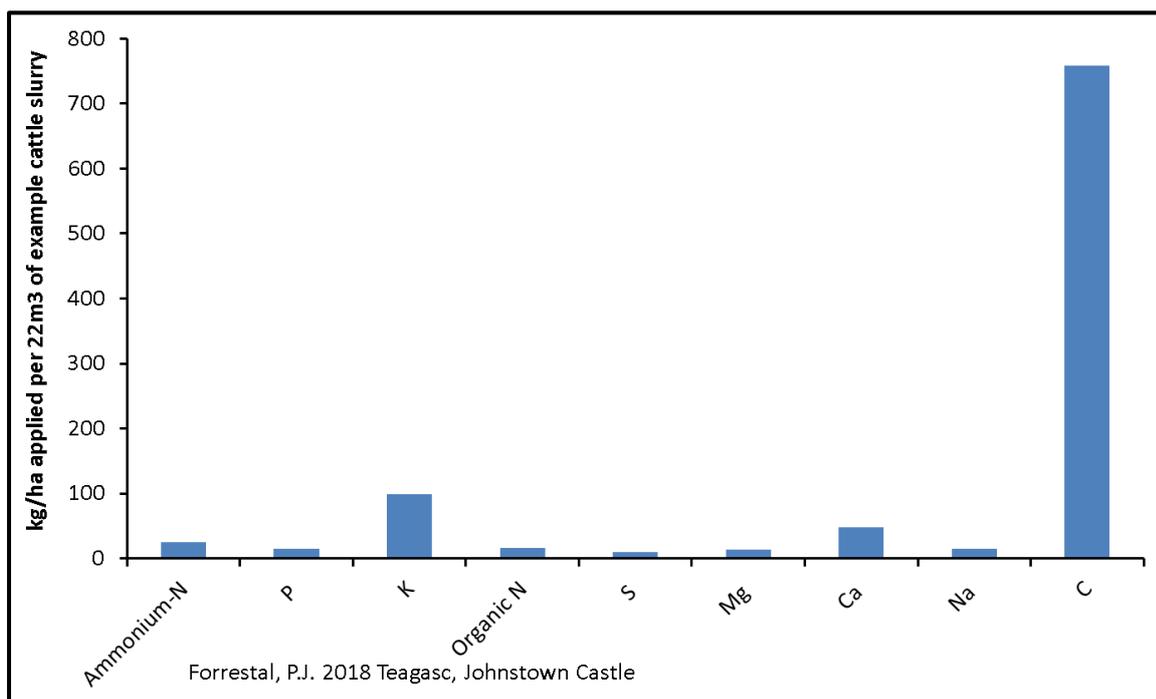


Figure 4. What is in an example 22m³/ha application of slurry including carbon (C)?