Department of
Primary Industries and Regional Development
GOVERNMENT OF WESTERN AUSTRALIA

Soil organic matter - frequently asked questions (FAQs)

Compost

The Department of Primary Industries and Regional Development provides some answers to frequently asked questions from growers and advisors about soil organic matter, soil biology and the relationship to other topics such as nutrient cycling, stubble management and water repellence.

Soil organic matter – general questions

What is the difference between soil organic carbon (SOC) and soil organic matter (SOM)?

Soil organic carbon is a component of soil organic matter. Organic matter is primarily made up of carbon (58%), with the remaining mass consisting of water and other nutrients such as nitrogen and potassium. Carbon is the largest and easiest component of organic matter to measure and as a result SOC is typically measured and reported in a standard soil test.

What is the difference between soil organic carbon and total carbon in soil?

SOC is the carbon component of organic matter that is measured in soil that passes through a 2 mm sieve. Organic matter (and the carbon it contains) that does not pass through a 2 mm sieve is not sufficiently degraded to be considered as part of the SOM; they are either surface or buried organic residues.

What is the current status of soil organic carbon in WA and how rapidly does it change?

Western Australian soils are ancient and inherently low in SOC. Following the conversion of native vegetation to agriculture many have experienced a loss of SOC over the past 100 years.

Globally SOC is generally between 0.5–4.0% in dryland agricultural soils. In Western Australian soils under broadacre grain production, the range is typically between 0.8–2% in surface (0–10 cm) soils, or the equivalent of 8–20 tonnes of carbon per hectare (t C/ha) assuming a bulk denity of 1.0 g/cm^3.

The amount of carbon added or lost from soils varies widely. Measurable changes in SOC typically take place over decades, though there are some examples where losses can occur rapidly (for example, erosion, soil engineering). Farming systems, where managed optimally are likely either just maintaining or in some cases adding up to 0.3 tonnes of carbon per hectare each year against the background of an existing 8–20 tonnes of carbon per hectare in the top 10 cm.

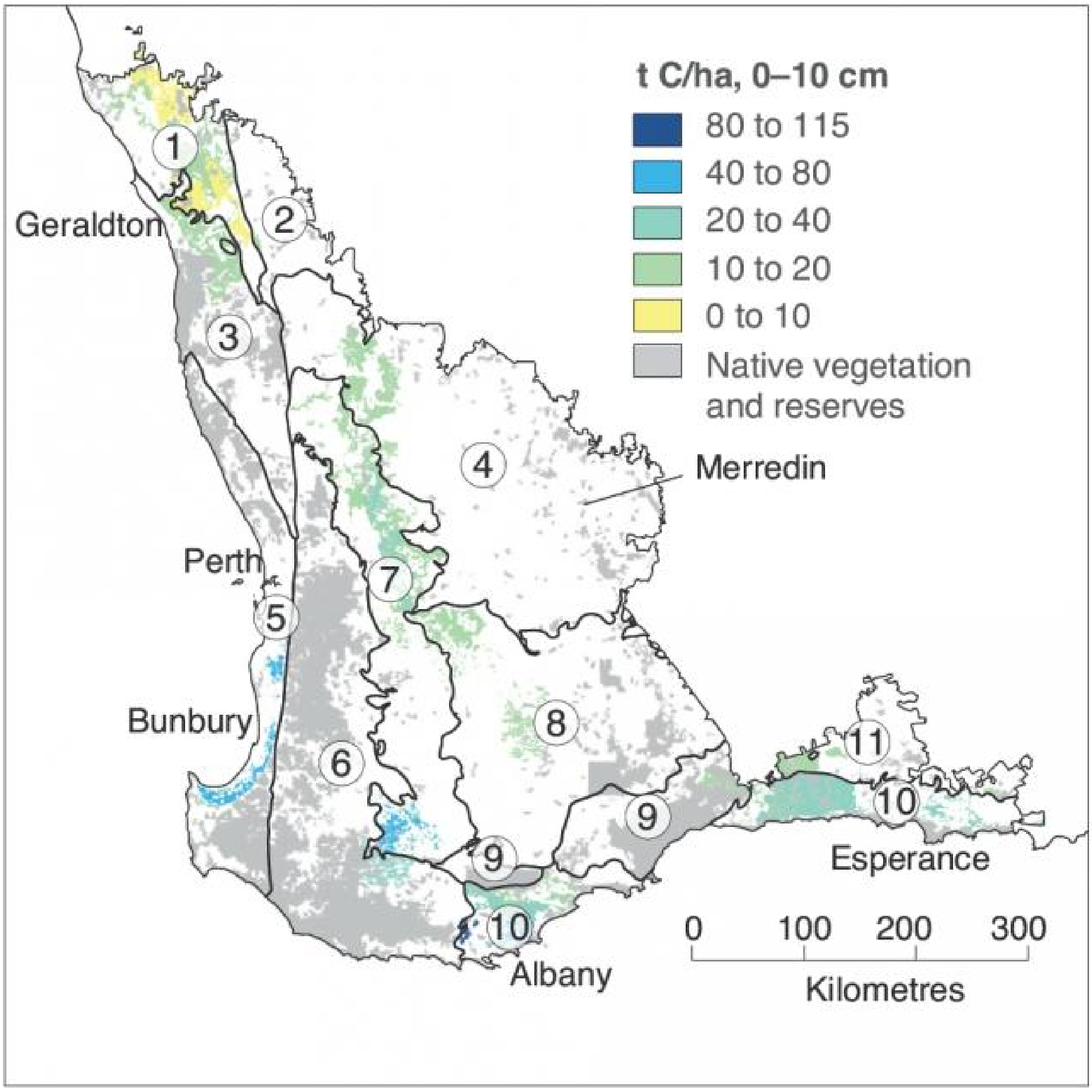

Figure 1 Soil organic carbon (SOC, tonnes per hectare) stocks in surface layer (0-10cm) for south-west Western Australia. Areas of low confidence masked out in white. Grey is remnant vegetation. Lines constitute agricultural zones (Griffin et al. 2013)

From what I heard, a 1% increase in SOC is massive, but it still has little effect on soil water holding capacity – is that right?

A 1% increase in soil organic carbon equates to about a 2% increase in water holding capacity. So a soil with a water holding capacity of 200 mm will hold an additional 4 mm of water. This assumes the increase in SOC to be consistent for the profile of interest.

How much is available and how many times you have access to this extra water will determine how effective this water is in producing extra yield. For example, if it was available at five times that were critical to plant development that were otherwise dry it could make a significant contribution. If it is a wet year, then it is unlikely to have an effect.

Remember the 1% can take decades to achieve, so it is not an overnight approach.

Will water repellence result from an increase in SOC?

Yes, on susceptible soils. Sandy soils with less than 10% clay are more likely to develop non-wetting due to their low surface area – though not all soils will develop or exhibit non-wetting properties. Where present, the severity of repellence has been linked to increasing amounts of soil organic carbon.

Legume residues tend to have a higher proportion of waxes that contribute to water repellence. For further information see Soil water repellence - overview .

If I build my soil organic matter, how will it affect plant available nutrients?

Adding new organic matter with high carbon to nitrogen ratios (for instance, incorporating cereal stubble) can lead to short-term nitrogen deficiencies as micro-organisms break down the organic matter. In the longer term, organic matter converts to soil organic matter (SOM), which breaks down, releasing nutrients.

The SOM pool turns over at a rate of approximately 3% per year. Many agricultural soils in WA have a store of between 10–25 t C/ha in the top 10 cm. This would mean a turnover of 0.3–0.75 tonnes of C and a release of between 25–65 kg N, 5–15 kg P and 5–11 kg S.

Organic matter residues (plant and animal materials bigger than 2 mm in size) also turnover and release nutrients, supplying additional nutrients. For further information see Influence of soil organic matter on nutrient and water availability .

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Am I better off managing for SOM than for production and yields?

It is hard to separate the two approaches, but soil changes to promote production and remove soil constraints are likely to result in increased SOM. As you improve production efficiency and yields you are inherently supporting the potential for greater amounts of residue return. Where crop or pasture residues are retained, the result will be greater organic inputs into soil, supporting a slow incremental build up of organic matter.

By optimising plant production and managing soil constraints you should at the very least not be degrading SOM. The capacity of a soil to build up SOM is typically defined by soil type, environment and to a lesser extent management (Figure 2).

Managing your soil resource to maintain profit and sustainability is the key. If you have significant constraints at the site of interest there is no gain in managing organic matter until these constraints are first addressed.

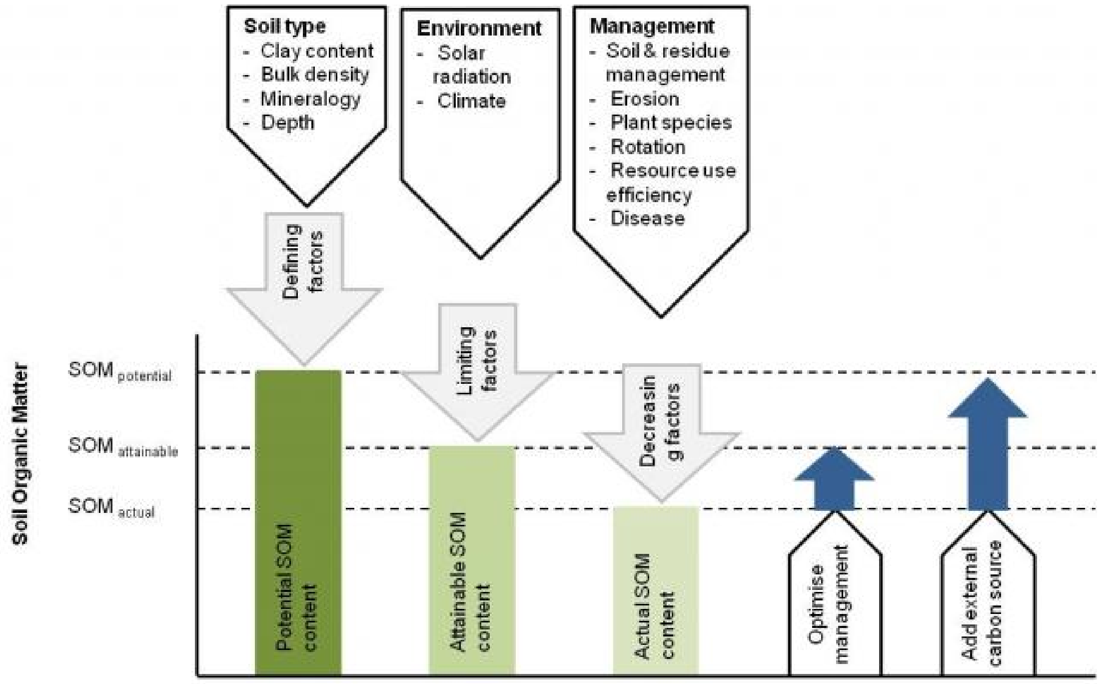

Figure 2 The influence of soil type, climate and management factors on potential soil organic matter content (after Ingram and Fernandes, 2001)

Some farmers have reported a 1% increase in SOC in just two years - can you explain this?

Simply put, it is not possible in our environment (the south-west of Western Australia).

To achieve this level of increase you would need to add close to 100 tonnes of organic matter per hectare. This is in addition to the organic inputs already taking place. Most reports can be attributed to sampling errors such as:

- Not adjusting the carbon stock for an equivalent mass of soil, in which case you might not actually be comparing the same depth/weight of soil (that is, you need to adjust for bulk density). For further information see Measuring and reporting soil organic carbon .
- Not adjusting SOC for the amount of gravel in a soil sample. Your laboratory results are from a 2 mm sieved soil sample and if there is any gravel or stone content in your soil then your SOC needs to be decreased to account for the volume of this material.
- A change in the distribution of carbon in the profile or inaccurate representation of planted versus unplanted areas of a paddock (that is, how many samples were taken from below plants versus in between plants or on the row compared to off the row).
- Sometimes it is just representative of variability within a paddock. Ensure suitable sampling methodology is used.

For futher information refer to Measuring and reporting soil organic carbon .

A realistic rate of change for WA is between 0.0-0.3 t C/ha. As an example, in a soil with a bulk density of 1.3 g/cm^3 and initial SOC% of 1.20 to a depth of 10 cm, the addition of one year's worth of carbon from a typical WA grain production system would increase SOC from 1.20% to between 1.21 and 1.23%.

How do I measure SOC?

Measurements of SOC are typically included as part of a soil nutrient analysis provided by a commercial laboratory and reported as a percent value.

There are two commonly used methods:

- The Walkley-Black chromic acid wet oxidation method. Oxidisable matter in the soil is oxidised by 1 N K_2Cr_2O7 solution. The reaction is assisted by the heat generated when two volumes of H_2SO_4 are mixed with one volume of the dichromate.
- Dry combustion method at high temperatures (1000°C) for soils without carbonates. Carbon dioxide (CO_2) formed by this method is trapped and weighed, and the SOC % is estimated based on the carbon content of CO_2 (27% by atomic weight).

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Should we be weighing the bag when we soil sample? What else should I be wary of when soil sampling?

Having a measure of the mass of soil for a given volume (that is, core, exhaust pipe) can be used to estimate bulk density and calculate SOC stock (t C/ha). So yes, knowing the mass of the bag filled with soil can be helpful so long as you know how many cores are in the bag and the volume of each core. It probably only provides a small degree of error though compared to the error in soil sampling accurately so it is not essential.

If you are able to, record the time, location and depth of sampling, how many cores or samples were taken and the total weight of soil for each sample (needs to be dry weight). If you have the measurements of the core used to take the sample you can calculate an estimate of soil weight per unit volume (or bulk density). This allows sampling over time as you can readjust your SOC stock to the same soil weight. For futher information see Measuring and reporting soil organic carbon .

What happens to roots that pass through a 2mm sieve? Are they included as SOM when soil sampling?

Any roots that pass through a 2mm sieve are included as a component of SOM. These should pass through the sieve naturally and without force.

When measuring SOC stocks in a paddock it is important to take the correct number of samples on-row and off-row to represent the spatial location in a paddock. Taking samples only under plants will overestimate the SOC stock over the entire paddock.

How do livestock come into it? Are they better or worse than crops in relation to building SOM?

Livestock can have a variable effect depending on management. Erosion caused by overgrazing can cause a significant loss of SOM. When overgrazing is avoided and pasture is well managed SOM can be increased.

Essentially there is a component of the organic residues that will be eaten by stock depending on stocking rate and duration of grazing, some of which will be recycled into other organic products. This may tend to be concentrated in certain areas so can introduce greater spatial variability in SOC.

Livestock manure and by-products such as compost can be purchased and spread as an organic amendment, although there are many other considerations that would need to be taken into account beforehand, most notably the costs and benefits of doing so.

I remember being told that pastures were the way to build SOM, is this still the case?

There is a direct relationship between net primary productivity (plant biomass) and SOM, so when pastures are well managed and are not constrained by soil or climate then yes, the opportunity to build SOM is increased.

Farming systems that maximise the number of days in a year where plants are present and growing will support a greater potential for SOM build up. This principle applies to both pasture systems and grain crop rotations.

Perennial systems are often used in higher rainfall areas (where grain crops don't grow well due to waterlogging) and thus have a greater capacity in these environments to produce more plant biomass.

If 60% of SOM is in the top 10 cm what happens when you mouldboard plough?

Many attributes of the soil profile will change after mouldboard ploughing, some of which include:

- Most of the SOM-rich surface layer will be buried deeper than 10 cm. Soil strength and soil bulk density is markedly reduced by mouldboard ploughing.
- Changes in soil bulk density and location of SOM require a change in sampling to accurately estimate SOM following mouldboard ploughing.
- Soil disturbance from ploughing can increase the breakdown of SOM in the short term.
- SOM is one of the factors causing water repellent soils – mouldboard ploughing buries this water repellent soil and improves water infiltration.
- Production is increased by mouldboard ploughing on water repellent soils, which can in turn increases the amount of biomass available for building SOM.

After a mouldboard plough year what is the most effective way to build SOM?

Optimising your production system is a good way to start. Essentially, the more biomass (crop) produced the more organic matter will be put back into the system. The exact approach will vary depending on your soil type, rainfall and farming system, but may include undisturbed perennial pastures, pasture/cropping systems and/or the usage of winter grain crops and summer active pastures if the environment in question is also capable of supporting plant growth during summer. Any build up in SOC is likely to be slow (decadal).

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Why doesn't the department test new, alternative or novel products?

Past experience has highlighted that there are a huge number of products on the market that can appear and disappear quickly and very often there are problems with publishing data and results for a number of reasons.

On-farm testing in your own environment is the best solution if you're considering using a new product. It is important when you do this to strip test (preferably at least three times with nil treatments as a comparison) and test/measure the response. If a product says it will increase P supply for example, analysing your plant P uptake might be a good way to see if the product makes a difference.

Ask questions about the evidence base that does exist for the product and where/what environment it has been tested in.

A general understanding about how biology functions in soils and application of this knowledge to assess whether the product is likely to have a benefit will also help.

What about directing exhaust fumes into the soil, as some have done in the wheatbelt, what are the merits in that?

There is currently no evidence to suggest that this is an effective or reliable method to increase SOC.

Soil organic carbon and stubble management

Standing stubble in a pasture paddock

In a wheat fallow system, when should I manage stubble, knowing I want to leave it standing as long as possible?

It depends on your farming system and soil conditions.

The smaller the pieces of crop residues and the closer contact they have with soil the quicker they will breakdown. No decomposition will occur if soils are dry.

A large amount of the soluble carbon and nutrients will have moved out of the stubble with 5-10mm of post harvest rain, so what is left standing is the less decomposable forms.

Poor quality residues require at least 6-8 weeks of decomposition before the nitrogen will start to cycle through the system again, which is an important consideration during the early growth stages. If soils are very low in soil nitrogen the breakdown of organic matter will be constrained. Residues with higher nitrogen content (legumes) will break down more quickly. For further information see Immobilisation of soil nitrogen in heavy stubble loads.

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What is the best time for the breakdown and incorporation of stubble to occur? Specifically in relation to nutrient supply?

Stubble only needs to be incorporated where it poses a risk to the grower. This might be associated with disease risk, or the mechanics of getting through a heavy stubble load.

If you are on a non-leaching soil, then early incorporation of stubble will increase the potential for decomposition but also exposes soil to greater risk of erosion. No decomposition will occur if soils are dry.

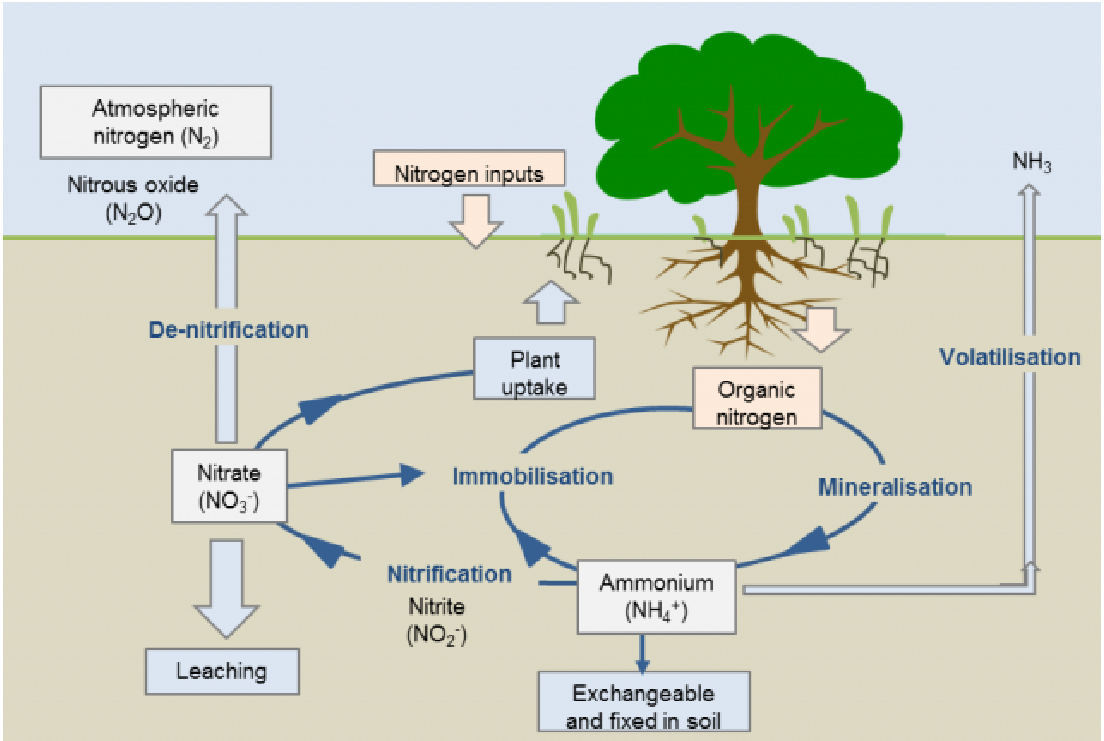
If you are on a soil subject to leaching, then consider the risk of summer rainfall moving your nitrogen profile deeper and limiting capture once a crop is planted.

Most of the soil supplied nitrogen will be coming from the SOM pool, with only a small (if any) component from stubble residues.

When I soil test paddocks with good production of medics, they perform much better than the adjacent paddock. Is this sustainable?

Well managed pastures often have higher SOM and a greater capacity for soil N cycling. There are a number of factors that could be associated with the difference between the two paddocks, so it would be hard to attribute this to organic matter alone.

Soil organic matter, plant nutrition and soil biology



The soil nitrogen cycle

What is the relationship between SOM and N mineralisation?

As organic matter breaks down, nitrogen is released. In WA farming systems between 100-200kg N/ha is often measured as being cycled through soils per annum, only a part of which is plant available through mineralisation, the other part is non-available due to immobilisation (consumption by microbes).

If I have a storm in January how does that affect the decision to incorporate stubble? What about the effect on mineralisation?

With every 10°C increase in temperature the rate of organic matter mineralisation doubles. At temperatures of 30-40°C, nitrogen can be mineralised at a rate of 10-15kg N/ha per day in moist soils.

Microbial activity is typically limited in summer but is very responsive to summer rainfall and measureable activity is underway in only 15 minutes after a rainfall event.

The impact of mineralisation on a N budget and fertiliser decisions depends on a range of factors such as the timing of mineralisation, the quality and quantity of the stubble load, the soil type, rainfall, crop choice and existing levels of soil N. For further information see Immobilisation of soil nitrogen in heavy stubble loads .

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What does C:N mean and why does it matter?

C:N is an abbreviation for the carbon to nitrogen ratio. The ratio indicates how many units of carbon are present in material for every unit of nitrogen present. The ratio is often used to describe the quality of crop stubble.

Low quality stubbles such as wheat stubble have a wide C:N ratio (for example, 120:1) whereas microbes have a C:N ratio of approximately 12:1. The C:N ratio of residues determines whether soil nitrogen is immobilised (not plant available) or mineralised (supplied) during organic matter breakdown.

The general rule of thumb is that below a C:N ratio of 22, nitrogen can be released from organic matter and made plant available.

What are the merits of adding microbial products to the soil?

Micro-organisms that live within the plant root (for example, endophytes, rhizobium) are far more likely to survive than those added to the bulk soil.

Soil moisture conditions and availability of labile carbon (food for the microbes) will impact greatly on their survival.

There are six billion micro-organisms in just a handful of soil, so you need to consider whether the product is providing a function that is not already supported by those that are already present in your soil.

Apply strips of products as compared to normal paddock management and observe whether a measureable benefit is obtained as well as measuring the change induced by applying the product/s (see question below for further information).

Can I improve soil biology by inoculation with a microbial brew?

There are a huge variety of products on the market, many of which have not been extensively tested. Ask for local trial evidence that there is a benefit and ask what it is attributed to? If the trial data is from elsewhere consider how different environments may influence the results. For example, WA and Queensland environments (climate and soil) can be very different so the results from one area are not always relevant to the other.

Consider what the product is providing in terms of a function. If you have sufficient nitrogen in your soil for crop production then applying a product that effectively gives you the same function will likely have little to no benefit. Similarly, if you have no pathogens present then a pathogen control agent will probably have little to no benefit.

While there is what sounds like a large number of organisms in these products, users must take care in following the requirements for storage and use. Organisms may not survive if products are not stored and used properly or there may be a change in the composition of the product. In a handful of soil there are over six billion micro-organisms, so put the product in context, it may sound like a lot in there but compared to what you already have in the bulk soil will it make a difference?

Micro-organisms that are capable of entering and residing in plant roots (for example, endophytes) are more likely to survive after introduction to the soil/plant whereas microorganisms introduced into the bulk soil have to compete for food and avoid predation.

Many of these products are brewed and are moving from a moist, nutrient rich and warm environment into a dry, hostile environment lacking suitable food substrates. How long will they survive for? If they are able to do their job in a short period of time then you may have more likelihood of seeing a response than those that are required to survive for a longer period of time.

Consider why you are seeing a response. In some cases it is possible you are just seeing a nutrient response to the product or to a turnover of nutrients when the microorganisms within the product die.

Ask for a free sample to trial and remember to strip test it against your normal paddock practice to determine whether there is a benefit. Ensure that there is a treatment comparison where soil is adequately supplied with nutrients.

How do we know biological products do that what they tell us they do?

The best way to assess the response to products is to strip test them against your normal management in a paddock (best done with repeated strips with non-treated areas between).

Ask for trial data to support claims and where it was done. Consider how the response might change from one environment to another. For example, a Queensland environment is very different to a WA environment.

The most likely success stories are going to be associated with micro-organisms that live inside plant roots or those that only need to be active for a very short time. Some of the responses we have observed have largely been associated with a turnover of the microbes themselves and the subsequent release of nutrients.

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What is the effect of pesticides on microbes?

Most effects tend to be relatively short lived. Different chemistry can influence the impact on microbes. A greater impact is incurred when specific soil functions are lost. In general there is less impact of herbicides than there is from insecticides, which again have less impact than fungicides, which typically have the most detrimental impact on microbes. Their impact will also depend on how the input is applied (whether to crop or soil) and the target organisms. Consult your agronomist for advice.

Is an increase in microbes associated with an increase in yield?

The activity and biomass of microbes is supported by increasing amounts of plant production where organic matter inputs are retained. Increasing amounts of biological activity can then be associated with a healthier soil, greater resilience to pathogens and more nutrient supply. The relationship between microbes and plant production is very cyclical.

There is evidence of a link between microbial biomass, biological soil N supply and yield, though it is not the primary driver.

What about nitrogen-fixing microbes? What is their contribution to the system? What about termites?

Free living nitrogen fixation has largely been modeled in a WA environment but is determined to be in the range of 5-15kg N/ha per year. In the context of the N being supplied from the SOM pool it is a relatively small contributor to the N budget.

Rhizobium and other micro-organisms associated with N fixation in soils require inoculation of the most effective strain and may require re-inoculation over time.

Termites are relatively unique in that they support internal free living nitrogen-fixers to help them break down the high carbon materials (for example, wood, straw) they consume. When termites and other biota die, their cellular contents (which include nutrients) are released. It is unlikely that termites would supply more than 2kg N/ha per year.

If SOM has little effect on water repellence, then why is there better growth in dry areas with more organic matter?

Increasing amounts of SOM can be associated with increasing severity of water repellence. This is predominantly associated with soils with less than 15% clay but is not evident on all soils.

The influence of organic matter can be associated with water and nutrient retention, cation exchange, biological activity and other soil characteristics.

Often areas which have an accumluation of SOM, such as windrowed strips, are associated with concentrated nutrient supply (particularly potassium), moisture buffering of soil and other beneficial attributes which support crop growth.

Does biology drive production or does production drive biology?

There are feedback mechanisms operating in both directions. Increasing SOM increases the capacity to support biological activity, and increasing biological activity leads to more nutrient cycling.

A more resilient microbial population can result from a more diverse rotation and this can help control pathogens which constrain yield, buffer soils from stress and increase nutrient cycling which can increase plant productivity. Biology and production are intricately linked and there are many feedback mechanisms.

If microbes oxidise all SOM anyway, why not just burn?

Over the long term (10 years or so) the amount of carbon retained in soils may not be significantly different (assuming you have kept the ash on the paddock) but the quality of the carbon is different with less carbon available to support biological activity when stubble is burnt. Remember that carbon is composed of different fractions which have different roles in the soil. In general burning results in less microbial activity and potential for N cycling.

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Does adding microbes result in increased biodiversity in my soil?

Most farming systems which have a diverse rotation will have a huge diversity of microorganisms. Adding microbial products is unlikely to result in a measureable change to biodiversity in the soil.

What is the effect of livestock on soil microbes?

Unfortunately there has been little work on this in WA soils. It is likely that the impact is small, aside from obvious exceptions such as stock camps where large quantities of animal manure have accumulated, in which case it may even support higher populations.

What is the effect of different agricultural inputs and crop rotations on soil microbes? What about atrazine?

The effects are vast and varied depending on the input, the soil type, the existing microbial population and a range of other factors. Increasing the diversity of rotations helps build a more diverse microbial community and provides different residue qualities which impacts mineralisation rates and population dynamics amongst the soil microbes.

Atrazine can have a short term impact but is unlikely to knock out specific soil functions performed by microbes.

For more information refer to Impacts of pesticides and fertilisers on soil biota .

Will potash and certain types of fertilisers kill microbes?

With the exception of copper fungicides, it is likely that any impact of fertilisers on microbes is related to a short term change in the soil environment surrounding the fertiliser - such as a decline in pH, which may result in a decrease in microbial activity.

Any impact is generally temporary (less than eight weeks) and may not have an influence on soil function, depending on how specific the link is between microbial populations and a particular soil function.

If there are no legumes in the system what will happen to SOM and N supply? Will it continue to decline?

The impact on soil N supply will depend on a range of other factors such as fertiliser regime, crop choice, soil type and other aspects of agronomy. In terms of SOM, the absence of legumes will limit the range of carbon substrates (the food source) available to microbes which will in turn decrease microbial diversity, particularly if no other break crops are used in the rotation.

How we do we get more nutrients out of organic matter?

SOM, and in particular the humus pool, has a fairly constant carbon to nutrient ratio. For every tonne of carbon in this fraction of SOM there is approximately 85kg N, 20kg P and 15kg S.

The organic matter pool turns over at approximately 3% per year.

So if you had 2% organic matter (1.2% organic carbon) and had a soil bulk density of 1.5g/cm^3 (1500 tonnes soil per 10cm layer) = 0.54t C/ha per year which supplies 46kg N/ha, 11kg P/ha and 8kg S/ha. Not all of this is necessarily plant available.

How do we promote microbial activity for biological supply of nutrients given the unpredictability of rainfall?

In WA microbial activity is often limited by soil moisture. Dry soil results in little to no biological activity, as well as limited availability of labile carbon (the food source for microbes).

We don't yet have the knowledge or ability to manipulate biological processes that govern nutrient availability such as the supply (mineralisation) and microbial demand (immobilisation) so that it occurs at the same time as peak plant demand. We can stimulate microorganisms to become active by supplying water and labile carbon but this only lasts as long as these conditions exist without having to artificially add a suitable food substrate.

Often when we stimulate microbial activity in summer this leads to increased decomposition of SOM and nutrient release at a time when there is no crop available to take up the released nutrients. In lighter textured sands these nutrients are then at risk of becoming inaccessible to the plant with further rainfall moving these nutrients ahead of the rooting depth for crops or pastures sown in autumn.

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How much N is available from SOM?

SOM can be estimated using a measure SOC and using a conversion factor. The SOM pool turns over at about 3% a year and for every tonne of carbon in soil there is between 50-100kg N supply. Not all of this will be plant available.

How quickly does N volatilise? How is this affected by pH?

Alkaline soils are more prone to N losses through volatilisation. Typically you would not expect losses of inorganic fertiliser through volitisation to be higher than 30%. Only about 5mm of rain is required to wash fertiliser in and stop further volatilisation.

Soil organic matter and water repellence

A non-wetting soil

What is the relationship between SOM and water repellence?

Increasing amounts of plant organic matter are associated with an increasing severity of water repellence (non-wetting soils). Soils with increasing clay content require a higher amount of SOM to induce a similar level of non-wetting on sandy soils. Sandy soils with a high proportion of legumes in the rotation are more likely to induce non-wetting since grain legumes such as clover, medic, lucerne and lupins contain higher amounts of plant waxes which are more likely to form water repellent compounds. High amounts of standing stubble can offset the negative effects of water repellence by providing preferential pathways for water entry into soil.

Should people be trying to increase carbon in soil when it is related to an increase in non-wetting soils? Has SOC just caused another problem?

Plant residues contain organic waxes which can be associated with the development of non-wetting soils. This is only really a problem where the waxes are not broken down and effectively coat soil particles with water repellent waxes causing water repellence.

Increasing inputs of plant biomass into the system generally reflects a higher productive capacity and high yields. Increasing the diversity of plant residues through diverse crop rotations can support greater diversity in soil biota and the microorganisms capable of breaking down plant residues and associated waxes.

Do different parts of the plant have a different contribution to water repellence?

While all plant components have waxes in them, the highest concentration of plant waxes is on the leaf surface (as it provides a mechanism against water loss from leaves to the atmosphere). Fungal hyphae can also produce compounds which contribute to water repellence.

We are still working on the mechanisms that induce water repellence so there is still a lot to learn.

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My SOM has increased in the cropping system and water repellence has also increased. I have added lime, so what's going on?

The first step would be to make sure you are comparing apples with apples. This means you need to make sure you are comparing SOC for the same volume and depth of soil in both instances. There may have been a shift in bulk density with the move to cropping given more machinery traffic. For further information see http://soilquality.org.au/calculators/gravel_bulk_density where you will find an online calculator to help you adjust raw soil analyses for measurements of bulk density.

SOC is a balance between inputs (retained organic matter) and losses (largely decomposition). In many instances where pastures have not been optimally managed in comparison to the cropping rotation, the amount of biomass grown may be comparitively lower and would therefore reflect a system which is losing more organic matter than it's producing.

Water repellence may just be more evident having moved out of the pasture system. Cultivation for cropping can compromise soil structure and result in the loss of preferential pathways for water flow into the soil. However it may also just be reflective of more organic matter inducing a greater severity of water repellence.

There is not a strong evidence base for lime as an ameliorant for managing water repellence.

Why can't I just solve water repellence by burning organic matter on the soil surface?

Unfortunately burning organic matter does not get rid of the waxes. Like a candle they liquify when heated then reform upon cooling.

If water repellence is a problem, how should I manage stubble loads?

There are known benefits to water entry into a repellent soil with standing stubble, which acts as a preferential pathway for infiltration into the soil.

Stubble can act as a buffer for soil moisture loss where ground cover is sufficient (>80%).

The decision to manage stubble also depends on the implications for the broader farming system such as whether fungal infections carried on stubble or trash handling during seeding is going to be a problem.

See Also

Soil acidity - frequently asked questions (FAQS)
What is soil organic carbon?
Managing soil organic carbon on Western Australian farms
Measuring and reporting soil organic carbon
Soil organic matter influence on nutrient availability
Soil organic carbon and carbon sequestration in Western Australia

Links

Managing soil organic matter: A practical guide book
Soil quality website
Report card for Western Australia: current state of knowledge on soil organic carbon levels. 2.8MB PDF

All Page Links
[1] https://www.agric.wa.gov.au/sites/gateway/files/styles/original/public/question%201%20-%20SOC%20FAQS_0.jpg?itok=GQMKoWNl
[2] https://www.agric.wa.gov.au/water-repellence/soil-water-repellence-overview
[3] https://www.agric.wa.gov.au/measuring-and-assessing-soils/soil-organic-matter-influence-nutrient-availability
[4] https://www.agric.wa.gov.au/sites/gateway/files/styles/original/public/figure%201.7.jpg?itok=A9olxo9M
[5] https://www.agric.wa.gov.au/soil-carbon/measuring-and-reporting-soil-organic-carbon
[6] https://www.agric.wa.gov.au/sites/gateway/files/styles/original/public/hoyle_stubble_0.JPG?itok=wF6Lg1an
[7] https://www.agric.wa.gov.au/soil-carbon/immobilisation-soil-nitrogen-heavy-stubble-loads
[8] https://www.agric.wa.gov.au/sites/gateway/files/styles/original/public/Soil%20Nitrogen%20Cycle_1.png?itok=IKSdiD1S
[9] http://era.deedi.qld.gov.au/1296/1/Seymore_ImpactPesticidesFertilisersSoilBiota-sec.pdf
[10] https://www.agric.wa.gov.au/sites/gateway/files/styles/original/public/Slattery_Nonwetting%20May%202011%20036%20%283%29%20-%20D.%20Bakker.jpg?itok=orPMrQzb
[11] http://soilquality.org.au/calculators/gravel_bulk_density
[12] https://www.agric.wa.gov.au/soil-acidity/soil-acidity-frequently-asked-questions-faqs
[13] https://www.agric.wa.gov.au/measuring-and-assessing-soils/what-soil-organic-carbon
[14] https://www.agric.wa.gov.au/soil-carbon/managing-soil-organic-carbon-western-australian-farms

[15] https://www.agric.wa.gov.au/climate-change/soil-organic-carbon-and-carbon-sequestration-western-australia
[16] http://www.grdc.com.au/Resources/Publications/2013/07/Managing-Soil-Organic-Matter
[17] http://www.soilquality.org.au/au/wa
[18] https://researchlibrary.agric.wa.gov.au/cgi/viewcontent.cgi?filename=6&article=1013&context=books&type=additional

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This print version was generated at 8:50am on the 30th of September, 2022.
The original document was last revised at Mon, 17/05/2021 - 11:07am