Soil organic matter
Rules of thumb

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USING THIS GUIDE

This rules of thumb guide provides a general outline of the functions and management of Soil Organic Matter (SOM).

The rules of thumb should be used with SOM results from soil tests, to monitor trends and to determine whether to change soil management to stabilise or improve SOM levels. If possible, SOM should be measured to rootzone depth.

To convert Soil Organic Carbon (SOC) to SOM, multiply SOC by 2. Alternatively, to convert SOM to SOC, divide SOM by 2.

WHAT IS SOM?

SOM refers to organic materials found in soil, including plant and animal residues at different decomposition stages. It is composed of a diverse array of organic compounds including carbohydrates, proteins, lipids, and lignin. Microorganisms such as bacteria, fungi, and soil fauna break down these compounds.

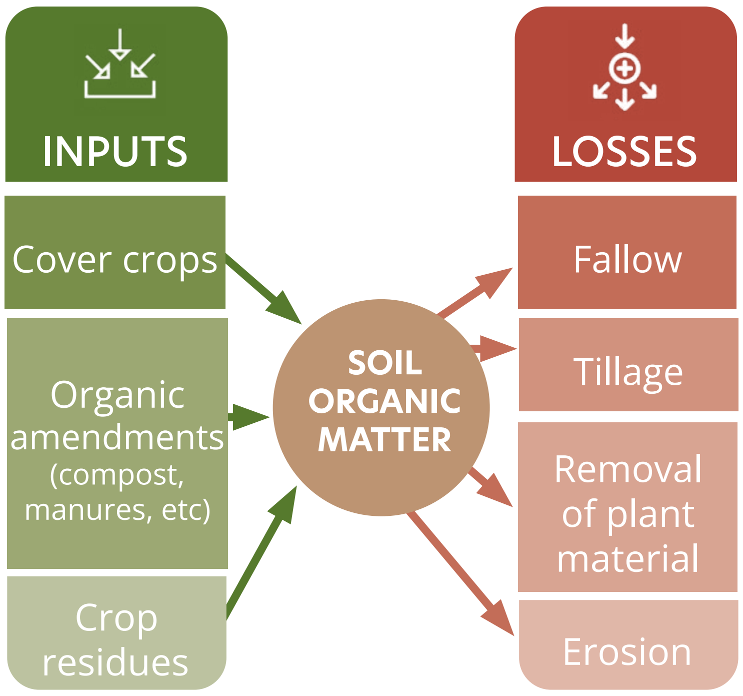
WHY IS SOM USEFUL?[1]

SOM is a vital component of soil fertility and structure that supports plant growth. SOM performs essential functions such as:

- ✓ Storing and recycling nutrients
- ✓ Supporting a diverse soil microbial community
- ✓ Improving drainage and water-holding capacity
- ✓ Reducing energy use and need for cultivation
- ✓ Improving root growth and nutrient uptake
- ✓ Sequestering carbon, helping to mitigate climate change

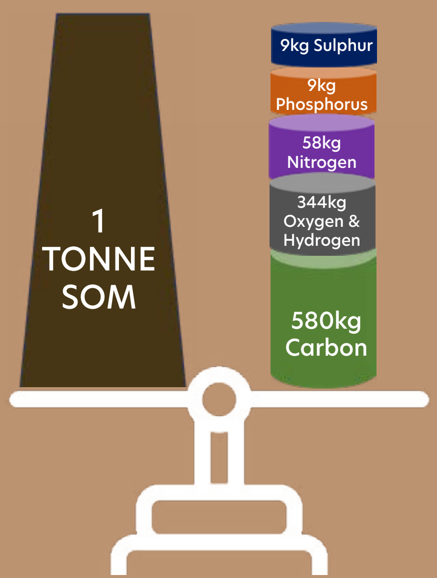
MANAGEMENT INPUTS & LOSSES[2]

The amount of SOM in your soil is dependent on management practices and other factors (e.g. climate and soil clay content). Effective management should aim to increase inputs and reduce losses.



NUTRIENTS STORED IN SOM

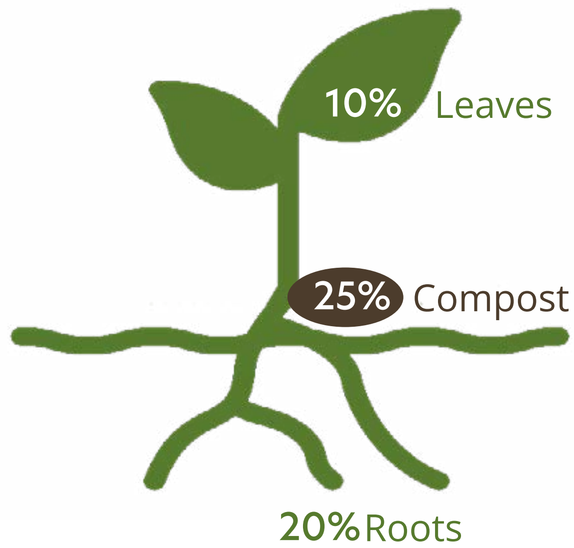
One tonne of SOM contains[3]:



Each year about 2% of the nutrients stored in SOM become plant-available[4].
Example of SOM in topsoil (0-30cm):

- 55 t/ha in a low SOM soil (1.5% SOM)
- 290 t/ha in a high SOM soil (8% SOM)

PROPORTION OF PLANT MATERIAL CONVERTED TO SOM[5]



...ends up as SOM

MICROBES CONVERT PLANT AND ANIMAL MATERIAL TO SOM[6]

Microbes can only begin the conversion once larger organic matter particles have been broken down by invertebrates. Furthermore, microbial activity is slow when the soil temperature is below 15°C.

FUNGI

- Break down organic material **slowly**[7]
- Are **more efficient** at **converting** organic material to SOM[8], **accumulate** more soil carbon, and **produce more stable** carbon compounds[5]
- Tillage breaks up fungi's physical structures (mycelium and hyphae)[9]
- By consuming nutrients in organic matter, fungi **immobilise and retain nutrients** in the soil
- Can breakdown organic material with a **high carbon to nitrogen ratio (C:N)**[7]

BACTERIA

- Break down organic material **quickly**
- Are **less efficient** at converting organic material to SOM[8]
- Organic material converted to SOM by bacteria is **less stable**[6]
- Remain largely unaffected by tillage[10]

C:N RATIO[11]

The C:N ratio of plant and animal materials can influence the speed of residue breakdown and nutrient cycling, including whether nutrients (particularly nitrogen) are released into or taken out of the soil.

Type	C:N ratio	Description
Grasses - cereal straw	30:1 - 80:1	Can scavenge N from soil. Plant residues on the surface can protect soil. The higher C:N ratio delays the release of plant available N.
Compost	30:1	C:N ratio of SOM in compost.
Legumes	15:1	Can fix N during growth. N is released as residues decompose. The low C:N ratio means residues break down quickly.
SOM	10:1 - 12:1	C:N ratio of SOM in soil.
Microbes	8:1	C:N ratio of soil microbes.
Net immobilised (tied up)	>24:1	Microbes need a diet with a C:N ratio of 24:1, using 8 parts of C for maintenance and 16 for energy. When plant material **is above** this ratio, decomposition is slow, and microbes tie up soil N to metabolise the C. If the C:N ratio **is below** 24:1, decomposition is quicker and excess N is released.
N mineralised (released)	<24:1	

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Hort Innovation

RMCG ahr applied horticultural research