Compost for Cropping

An Introductory Grower Guide

SoilCQuest is undertaking compost research trials in Forbes, NSW. This is an introductory guide, it will be updated as trial results and more information comes to hand.

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Compost is made from a mixture of organic materials that are broken down by microbes and heat. Composted materials must reach a sufficient and sustained temperature to destroy harmful microorganisms and weed seeds.

The quality of the compost is a product of both the organic material and composting method that is undertaken, and it is important to recognise that not all compost is created equal.

Compost does not supply a quick source of nutrients but provides the soil with organic matter that contains a blend of nutrients that are gradually available to the crop and add to soil carbon.

The real value of compost lies in its ability to improve soil and plant health and yield. To increase the benefit of compost it's essential to use other practices that support soil health.

Grower Insights
Steve Nicholson, Forbes NSW

Steve, his wife and their two sons own and lease 3,500 ha near Forbes and grow wheat, barley, canola and occasionally legumes, long-term perennial pastures, and have 4,000 head of merino sheep.

Steve, a former agronomist, bought their land near Forbes 20 years ago and has been using compost for soil health over that time.

“Compost has helped to build up organic carbon and fire-up microbial activity in my paddocks” Steve says.

Compost combined with no-till, stubble retention, improved drainage, riparian fencing and biodiversity corridors has helped to fix the previous 100 years of poor soil management on his properties.

Steve explains that with this context of a century of soil damage to overcome, he sees compost as a long-term investment rather than a silver bullet.

“Using compost is not an overnight fix- you're looking at a minimum of five years to get gains in soil carbon and nutrient cycling through improved soil biological activity."

"It's not like using urea where you get quick instant results. It’s all about building resilience in the system and building up our average yield. This is why I am getting 20-30 bags to the acre of wheat in a good season from my paddocks when neighbouring paddocks left to conventional farming yield less than 12 bags to the acre.”

“Increased microbial activity from the application of compost helps plants to access previously untapped nutrients."

"Depending on the original state of each paddock, over 8- 15 years I have reduced my fertiliser use in half. This is because compost in conjunction with improved land management practices and application of soil ameliorants including gypsum and lime will help make soil nutrients available. In my soils for every 1kg of applied nutrients, we get 800gm of available nutrients, compared to an average of 400gm in some parts of NSW."

"In some paddocks, after 3- 4 applications of years of applying compost, we have been able to reduce our applied fertiliser applications by up to 50% because of this increased microbial activity.”

Steve Nicholson

THE BOTTOM LINE

Economics & Risk Management

Economic considerations when thinking about using compost include:

- On-farm composting costs or compost purchase costs
- Freight costs
- Application costs
- Production gains
- Additional input costs

These all vary depending on the type of compost, your location and whether you have spreading equipment. For example, liquid application at low rates reduces the amount needed and associated costs as it can be applied with existing liquid applicators.

The main factor influencing cost is the distance from the compost supplier to your field. The financial gains are greatest where the distance is short and compost can be collected using your own spreader or trailer, thereby reducing double-handling. Alternatively, depending on the outcomes you want to achieve, pelletised compost or compost for compost teas can greatly reduce transport costs.

The major economic constraint for growers is that most compost processing facilities are located in urban areas. To overcome this, more and more growers are setting up simple on-farm composting systems for their cropping systems to greatly reduce their long-term costs. And as fertiliser prices rise, the benefits of using compost become even clearer.

Farmers using compost to improve soil fertility can also earn Australian Carbon Credit Units (ACCUs) which they can sell for cash.

NATURE'S FREE INPUTS

Soil Carbon Processes

Compost produces a multiplier effect by quantitatively changing the dynamics of the carbon cycling systems and increasing the retention of carbon from non-compost sources, enabling compost to increase carbon storage by more than its own direct contribution to carbon mass accumulation.

Adding compost to a paddock results in some of its carbon being retained in the soil, but it's the way compost improves soil structure that makes it important for building soil carbon.

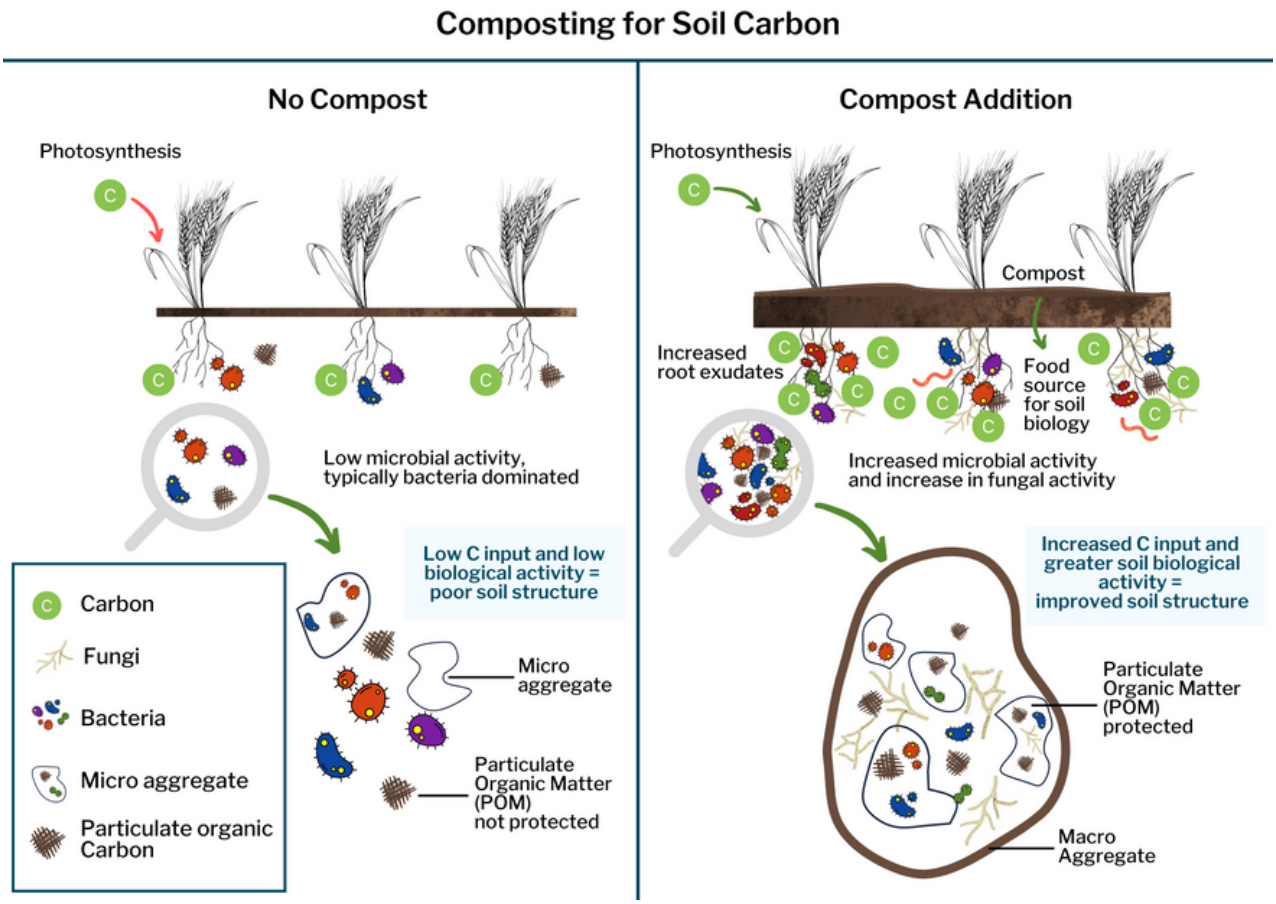
Compost improves soil structure via the following pathways:

1. Compost is rich in carbon. Because carbon is an energy source for soil microbes, adding compost to the soil feeds the existing microorganisms like bacteria and fungi and increases these populations of beneficial soil biology already found in the paddock.

2. Microbes are important for soil structure. For example, fungi are made up of hyphae- long, fine filaments that wrap around the soil and exude a sticky glycoprotein called glomalin that sticks soil particles together. This process forms soil aggregates which improve soil structure and improve the water-holding capacity of soils.

This improvement in soil structure boosts crop growth both in plant matter above ground and roots below ground. This greater biomass in turn increases carbon input during the growth stage and results in a larger volume of crop residue after harvest, both of which increase the overall soil carbon pool.

Because soil aggregates provide the physical structures that protect the carbon, more of this soil carbon pool can be sequestered for longer periods in the soil.



NATURE'S FREE INPUTS

Benefits of Compost

Soil Organic Matter

One of the greatest benefits of compost application in agricultural systems is the increase of soil organic matter that occurs. Soil organic matter serves important functions in soil including the maintenance of soil biological activity and improvements to water retention and soil structure. The ability of compost applications to increase soil organic matter and aggregate stability while reducing bulk density may over time reduce soil compaction. The increase in water holding capacity is often attributed to compost reducing the bulk density of the soil and increasing porosity. While improved water-holding capacity has been observed across a variety of soil types, the most dramatic improvements occur in sandy soils with low initial organic matter content. In addition to improved water-holding capacity, compost has been shown to reduce surface sealing, improve infiltration and reduce runoff.

Nutrient Cycling Activation

Compost provides low levels of all primary, secondary, and micronutrients, but the real value of a well-made compost is to act as a biological inoculum and enhancer of nutrient cycling.

Compost application enhances nutrient cycling by:

- Improving soil structure allowing higher water retention, supporting plant establishment and allowing for the establishment of larger root mass improving uptake nutrients.
- Buffering the soil, neutralising both acid & alkaline soils, bringing pH levels to the optimum range for nutrient availability to plants.
- Increasing the cation exchange capacity (CEC), promoting better retention of nutrients in the soil profile leading to improved fertiliser use efficiency.
- Improving the soil structure which allows soils to retain fertilisers with less run-off.

As well as enhancing nutrient cycling, compost also releases nutrients slowly over months or years, unlike synthetic fertilisers.

The nitrogen (N) added to the system via compost is mostly in the form of organic N, which is not immediately available to plants. Soil microbes mineralize the organic N over time and convert it. In this way, compost can act as a slow-release source of N to crops. Although some N becomes available over time with compost applications, most compost does not exceed 2 per cent nitrogen and is thus not considered to be a major source of nitrogen.

Between 35 and 100 per cent of total phosphorus in compost is released depending on the time elapsed after application (35% available after 1 year, 100% available after 3-5 years).

Compost applications can provide potassium to the cropping system and in some systems, compost applications have been able to replace fertiliser potassium.

Compost can provide essential micronutrients that are not provided by mineral fertilisers. These micronutrients, while required in smaller quantities than the macronutrients, are equally as important for crop development. However, the content of these micronutrients in compost varies widely depending on the original compost feedstock as well as the composting conditions.

Disease Suppression

Studies have shown compost applications can effectively suppress soilborne diseases, especially *Pythium spp, Fusarium spp, Phytophthora spp* and *Verticillium dahlia*. Disease suppression in compost is primarily attributed to microbial activity and the enrichment of specific microbial species.

COMPOST FOR CROPPING

Tips for Success

Planning

1. Start with one paddock- don't pick your worst paddock but don't pick your best paddock.

2. Don't try and do it on your own - get some people to help you and get some good advice from a soil scientist or agronomist.

3. Do soil tests before you start to get your baseline data.

This will help you to find out if compost is actually the solution to your problem- because sometimes the paddock might have a macro problem e.g. it might have a hard pan, be sodic or be acid.

If your paddock has a macro problem you can often fix it within 12- 18 months, but if you don't fix the macro it will mask any improvements you are making with small inputs like compost. Conversely, if you haven't addressed any foundational, macro problems with a paddock, you can find yourself using a lot more inputs than you would need if you fixed the foundation problem e.g. lots of inputs can mask underlying issues.

4. Find a manageable area that has the potential to be fixed- this depends on what size farm you have and what resources you have, e.g., this could be 40ha, 100ha or 300ha.

Choosing your compost

When considering compost it is important to know that not all compost is the same. The materials used to produce compost, as well as the composting procedure and length of maturation determine the quality of the compost. When sourcing compost, it's best to understand the composting process as poor-quality compost can be a source of weed seeds or pathogens.

Compost components and management vary widely, which means not all composts provide the same level of soil health improvements and plant protection. The feedstocks used to make the compost and how the compost was managed all impact the microbial diversity of the compost and the nutrients that are available for crop uptake.

- Make sure your supplier gives you an analysis of the compost: how wet it is and what is in it.
- Check that composts have been independently certified as meeting the Australian Standard. The Australian Standard for composts, soil conditioners and mulches (AS4454-2012) is the industry standard for determining compost quality.
- As well as a product that contains the Australian Standard certification tick, look for compost suppliers that can supply you with a current analysis of the compost and material safety data sheets (MSDs).
- Buy good-quality compost free of plastics, sticks & twigs (which are very slow to break down) - a premium product just like you would put in your veggie garden.

Timing

For paddocks without stubble: spread your compost as close to sowing as possible (if you leave it to dry out on a bare paddock many of the good microbes will die).

For paddocks with stubble: because stubble will help to keep the compost moist and cool and the microbes alive, you can spread your compost up to a few weeks before sowing, but immediately before sowing is best.

Rate

Apply two rates of compost: a base rate of 7- 10t/ha and a comparison of double that- up to 20t/ha- to see how much difference you can get with double and see if the economics pays off (just in two big strips is fine).

Which spreader?

Use a broad-acre spreader or a hired compost spreader.

Spreading your compost

Step 1: Do a test strip to make sure you are not trying to throw too far- just like you would with lime or gypsum- and just like with lime or gypsum, don't spread it on a hot, dry paddock with a northerly that will blow it away.

Step 2: Spread your two rates of good quality compost- a base rate of 7-10t/ha and a comparison rate of double- up to 20t/ha (the double rate can just be spread in two big strips).

Step 3: Incorporate your compost into the soil before the compost dries out. Composts give the most benefit when incorporated into the soil. Spreading compost before mulching or mowing a cover crop are two examples of how this can be done in no-till systems.

Step 4: For paddocks without stubble, tickle the compost into the soil with a "kelly-chain" so that the good microbes in the compost can get into your soil.

Step 5: Do soil tests to see what's happening so you can tweak your system accordingly.

Step 6: Reapply compost for maximum benefit.

References

Australian Organics Recycling Association- Compost for Soils Broadacre Cropping Factsheet www.aora.org.au/fact-sheets

AS 4454: 2012 – Australian Standard 4454:2012 for Composts, Soil Conditioners, and Mulches. Australian Standards, Sydney, Australia.

Martínez-Blanco, J., Lazcano, C., Christensen, T.H., Muñoz, P., Rieradevall, J., Møller, J., Antón, A. and Boldrin, A., 2013. Compost benefits for agriculture evaluated by life cycle assessment. A review. Agronomy for sustainable development, 33(4), pp.721-732.

Recycled Organics Unit, 2007. Life cycle inventory and life cycle assessment for windrow composting systems. NSW Department of Environment and Conservation. The University of New South Wales, Sydney, Australia.

St. Martin, C., & Ramsubhag, A., 2015. Potential of Compost for Suppressing Plant Diseases, CABI, (pp. 345-388).

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