Manage carbon to sustain soil structure

Soil organic carbon plays a critical role in the biological, chemical and physical health of a soil. But little is known about how crop management impacts on soil organic carbon levels and thus soil health. This article describes how a new approach to understanding this relationship could help farmers better manage soil organic carbon.

by **Jan Skjemstad,**
CSIRO LAND AND WATER AND
CRC FOR GREENHOUSE ACCOUNTING

In a world first, CSIRO scientists have developed a new approach to soil analysis which will enable farmers to better predict how crop residue management could impact on soil structure, nutrition and biological activity.

Previously, farmers could only determine the total organic carbon content of their soils.

But this has proven a poor indicator of soil properties because the different pools which make up soil organic carbon vary considerably.

The new method enables total soil organic carbon to be broken into three major fractions based on their biological availability — active, humic and inert.

Soil carbon fractions

The active organic carbon fraction consists of recent organic matter inputs such as stubble residues, roots and faeces.

The humic carbon fraction is formed when soil microbes decompose organic matter, producing polysaccharides and humic compounds which hold small soil particles together forming aggregates and pore spaces.

The humic fraction is the main source of nutrients for the crop.

The third organic fraction is inert carbon such as charcoal. This fraction has little known function in the soil and plays a relatively small part in crop production.

Depending on the proportion of active, humic and inert carbon, soils with similar total carbon contents can behave very differently in terms of structure, nutrient supply and resilience (see Figure 1).

At a glance

- A new approach to soil analysis will help farmers better predict how residue management can impact on soil structure, nutrition and biological activity.
- The new method enables total soil organic carbon to be broken into three major fractions based on their biological availability.
- Scientists will use the new soil analysis to develop a range of simple residue management guidelines for different soil types.

CSIRO Land and Water

The research will enable farmers to better predict how crop residue management could impact on soil structure, nutrition and biological activity. Soil organic matter is critical for structural stability. The loss of soil organic matter (pictured) has resulted in a degraded soil with poor physical structure.

Residue management guidelines

With the aid of a computer model, scientists can use the new soil measurements to develop a range of simple residue management guidelines for different soil types.

The guidelines will illustrate how residue management practices and soil type interact to affect soil properties such as water-holding capacity, cation exchange capacity and structural stability.

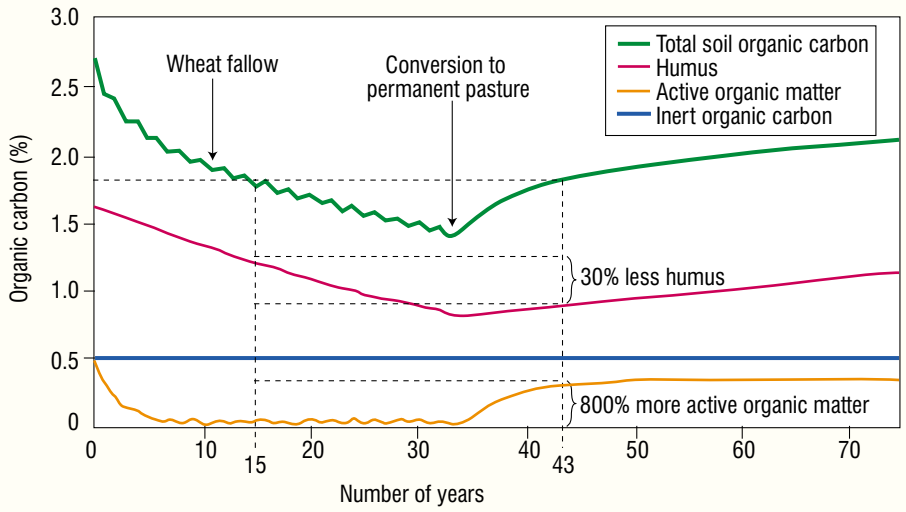
Farmers could use the guidelines to predict how practices such as stubble burning, intensive cropping or periods of fallow impact on soil resilience.

This will enable remedial action to be taken before a cropping soil loses significant structural stability.

For more information contact Jan Skjemstad by email on jan.skjemstad@csiro.au, phone (08) 8303 8427 or fax (08) 8303 8505.

CSIRO

FIGURE 1 Impact of management on soil carbon fractions



Computer modelling based on actual data reveals predicted changes in the content of active (orange line), humic (red line) and inert organic carbon (blue line) fractions following conversion (after 33 years) from a wheat–fallow rotation to a permanent pasture. Total organic carbon, which is made up of all three fractions combined, is shown in green. While the total organic carbon content of the soil is the same at 15 and 43 years, the actual amount of the various organic fractions is very different. This means the soils will be very different in terms of soil structure, nutrient delivery and cation exchange capacity.

Source: CSIRO Land and Water.