

Stubble retention and soil carbon in long-term no-till farming systems

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Soil Organic Carbon (SOC) is strongly linked to soil health, plant-available water holding capacity and many other important productivity factors, so removing stubble from cropping paddocks can have significant long-term effects.

Stubble retention in no-till farming systems is normal practice, although growers may be tempted to remove stubble to help control foliar disease, herbicide resistant weeds and problematic pests.

The potential effect of stubble removal on SOC storage was investigated over a four-year period at two sites in South Australia. The experiment was designed to assess several effects of stubble removal (Figure 1).

Both trial paddocks, at Wirrabara and Maitland, had been under no-till management with full stubble retention for approximately 20 years when the research began.

The rotation at the Wirrabara site for the duration of the trial, from 2008 to 2011, was wheat - canola - malting barley - faba bean. At the Maitland site the rotation over the four years of the research was malting barley - lentil - canola - wheat. Both sites were initially sown using no-till equipment but zero-till (disc) seeding equipment was adopted on both farms over the course of the trial.

Soil from 'stubble retained' plots and soil from 'stubble removed' plots was regularly collected from both sites and measured for SOC content. These soil analyses revealed significantly lower SOC levels in 'stubble removed' soils than in 'stubble retained' soils, indicating removal of stubble reduces SOC levels. (Figure 2).

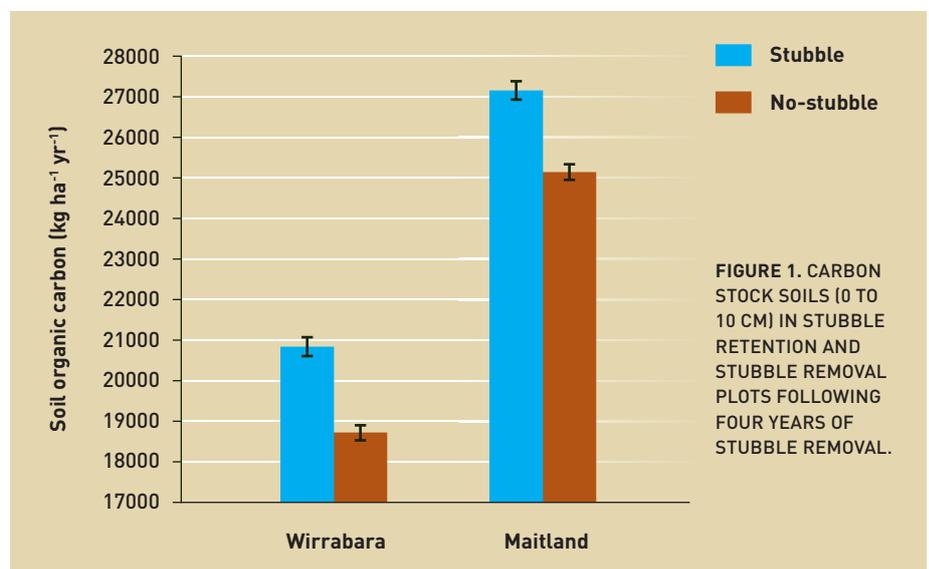
The average annual carbon loss from the top 10 cm of soil due to stubble removal was estimated to average 587 kg/ha/year at Wirrabara and 509 kg/ha/year at Maitland.

Loss mechanism

It seems likely that, where stubble is retained, soil micro-organisms consume fresh carbon contained in the decaying plant matter rather than carbon from other sources, so the decomposition of pre-existing SOC is delayed.



FIGURE 2. RAKING THE STUBBLE AWAY AT MAITLAND, SA.



In a stubble-removal system where the plant matter is removed or burnt before it can be consumed by soil micro-organisms they obtain their energy needs from pre-existing SOC.

As a result, SOC levels are relatively higher in a stubble retention system than in a stubble removal system.

Additional information:

Retained stubbles increase Water Use Efficiency; G. Butler, SANTFA No-Till Journal, 2010, Vol 7 No 1, Page 28 – 30.

References:

1. Anderson G. 2009. The impact of tillage practice and crop residues (stubble) retention in the cropping system of Western Australia. Department of Agriculture and Food, Government of Western Australia.
2. Sanderman J, Farquharson R and Baldock J 2010 Soil Carbon Sequestration Potential: A review for Australian agriculture. CSIRO.

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