SOUTH AFRICAN SUGARCANE RESEARCH INSTITUTE

Advances in Labile Soil Carbon Testing

Labile carbon, also known as fresh carbon, refers to a portion of soil organic carbon that is easily decomposable and readily available for microbial activity. Fresh carbon in soils can be measured either by a chemical oxidation method (using potassium permanganate oxidizable carbon) or a physical fractionation method (particulate organic carbon). Each method has specific applications, advantages, and limitations. The permanganate oxidizable carbon (POXC) method is frequently used due to its practicality and relevance. SASRI has just recently completed a project on refining soil sampling and POXC analytical method for routine laboratory use.

Importance of fresh carbon

Fresh carbon is important for several reasons related to soil health, agricultural productivity and environmental sustainability. In agricultural management, it is significant because it focuses on a specific active fraction of soil organic carbon. As one of the soil health indicators, fresh carbon serves as a primary energy source for soil microbes. Measuring fresh carbon is important for understanding and managing soil health, fertility and sustainability.

Effect of management factors on fresh carbon

One of the longest trials in the world, the Burning and Mulching Trial (BT1) at SASRI, seeks to promote soil management practices such as conservation and accumulation of organic matter. Preliminary analyses from this trial were used to test the method and to check the method's sensitivity in tracking changes in soil carbon. Soil samples were collected from a depth of 0 – 5 cm from fertilized plots vs no fertilizer plots on treatments of burnt cane & residues removed (Bto), burnt cane, residues retained (Bt) and mulched (M).

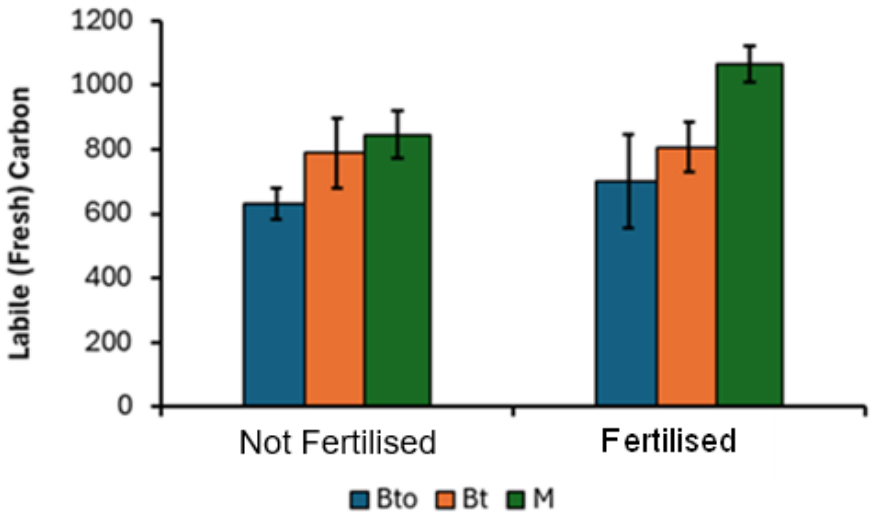

Figure 1: Effect of management practices on fresh carbon at 0 - 5 cm depth

The highest amount of fresh carbon was extracted from the mulch (M) treatment from both fertilized and not fertilized plots (Figure 1) while the lowest amounts of fresh carbon were extracted for treatments where no organic matter was returned following harvesting (Bto). There were no differences (values similar) for the burnt cane with residue retained treatment (Bt) for both fertilized and not fertilized plots. Mulch with fertilisation resulted in the highest fresh carbon. The burnt with tops retained management option yielded significantly less carbon at a depth of 0 - 5 cm compared to the no burning option with all residues retained.

Effect of soil texture on fresh carbon

Higher amounts of carbon will be stored in soils richer in clay content (Figure 2).

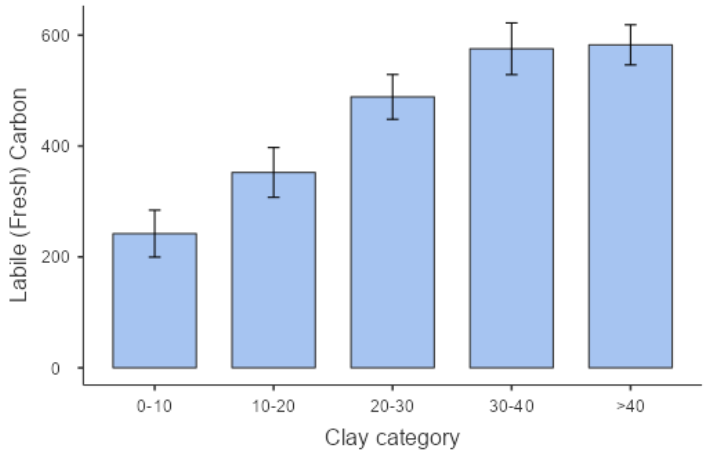

Figure 2: Effect of texture (clay) on fresh carbon

The fresh carbon differed in sensitivity to the sampling depth. The 0 - 5 cm depth showed high amounts of fresh carbon as compared to the 0-20 cm depth. The effect of management practices on fresh carbon was most evident in the 0 – 5 cm soil layer. In the 0 - 20 cm depth there were no differences in treatments, and this was attributed to the dilution of the first 5 cm depth over the deeper sampling depth of 0 - 20 cm. (Figure 3).

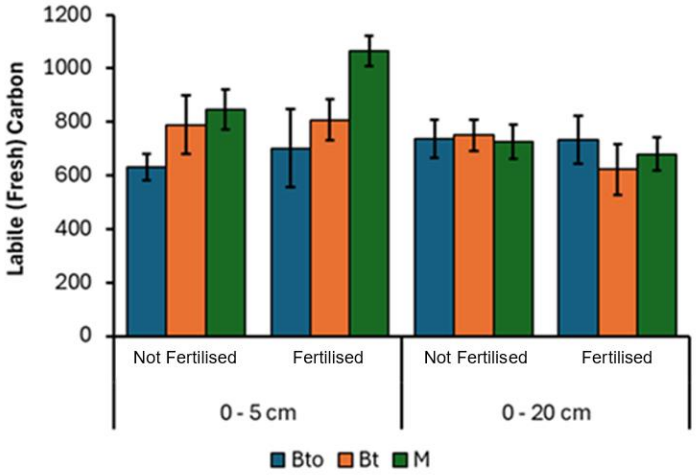

Figure 3: Effect of management practices on fresh carbon at 0 - 5 cm and 0 - 20 cm soil depths

Practical applications:

a) Soil testing and monitoring: Regularly measuring fresh carbon as part of soil routine tests helps to track changes in soil health over time and guide management decisions.
b) Sustainable land management: Integrating fresh carbon measurements into sustainable land management practices ensure that soil health is improved and supports long term agricultural productivity.
c) Conservation Programs: Fresh carbon data could help inform policy makers and programs that are aimed at promoting soil health, carbon sequestration and sustainable agriculture.