Canonical redundancy analyses quantifying land-use, compost addition, correlated soil organic carbon and other soil properties

Dr Jane Aiken[1], Mr Eli Sandala[2], Dr Peter Bacon[3]
[1]Consulting & Environmental Services Pty Ltd, [2]Tweed Shire Council, [3]Woodlots & Wetlands Pty Ltd

Agricultural producers in the Tweed Valley of north coast New South Wales participated in a program to assess change in Soil Organic Carbon (SOC) using locally sourced composts applied in addition to the current soil management practice. The project was funded by the Australian Government and Tweed Shire Council.

The program involved 30 farm producers representing six land use types; sugar cane, sweet potato, vegetables, beef, dairy and perennial horticultural (nut tree, avocado, banana) production. The hypothesis was that compost addition would increase SOC stocks.

Land-use was the principle factor of 'replication' of 4 to 6 farms each with 3 plots that received annual applications of 0, 10 or 20 wet T of compost/ha. The 2012 (pre-treatment) and 2015 (post-treatment) measured attributes, included SOC %, bulk density and calculated mass of SOC (T/ha) from all 30 sites * 3 organic amendment rates * 3 depths (0-10, 10-20 and 20-30 cm).

Conventional statistical analyses suggested trends in the data, but there were few statistically significant results. Alternative statistical computation using non-parametric canonical and redundancy analyses were used to quantify land-use, compost addition and correlated association for SOC and other soil properties.

In this study all compost had been applied to soils where nitrogen totals were above adequate. Under these conditions SOC increases were not significant, with differences more notably as soil organic carbon decreases. The implication for this study was that generally, SOC was being reduced and not being sequestered. At 10 t/ha compost applied there was no correlation. Correlation was in the zero and in the 20 t/ha compost applications. This result suggests that soil carbon draw-down occurred under elevated levels of nitrogen and with the 20 t/ha compost application. We identified that soil nitrogen was a significant factor in determining the response of SOC stocks to organic amendment addition.