

Can Organic Farming Contribute to Carbon Sequestration? A survey in a pear orchard in Emilia-Romagna Region, Italy

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Abstract

Soil organic carbon (C) preservation in agro-ecosystems is a crucial point to maintain soil fertility and productivity and to reduce losses of CO₂ in the atmosphere. Appropriate soil management can contribute to the soil carbon sequestration and its distribution in the soil profile to mitigate the greenhouse effect. Organic farming has a positive effect on C sequestration as a result of increased root yields, higher humification rate constant, and the direct application of organic matter through organic amendments. In order to increase the level of organic C in the top layer of soil, perennial grass species are often used in organic orchards.

In this study, the effect of organic fertilization on the level of total organic carbon (TOC) in an 18-year-old pear orchard (cv. Abate Fetel) was evaluated in comparison with a conventional pear orchard (control) treated with mineral fertilizers. In both orchards, soil samples (Typic Udochrept loamy soil) were taken at two depths (0-15 and 30-50 cm) along the row (tilled and amended mainly with compost) and in the inter-row space (covered with grasses in the organic orchard, bare in the conventional orchard). The area (elevation 20 m), located in Bologna province, Emilia-Romagna region (Italy) is characterized by the following mean climate conditions (1921–2004): mean annual temperature 13.1 °C and rainfall around 750 mm.

Either in the row or inter-row the TOC was statistically higher in the top layer (0-15 cm) of the organic orchard compared to the deep one of both farms. Concentration of TOC was also statistically higher in the row versus the inter-row space of the top layer of the organic orchard versus the conventional one. This increased level of TOC can be attributed to the C annually added with organic fertilization. No statistically significant differences were found in the deep layer (30-50 cm) in the inter-row space of both orchards.

In the top layer of the row an increase of about 14 tons ha⁻¹ of TOC has been calculated after 18 years of cultivation and amendment compared to the control soil, which had received just mineral fertilization. A significant increase of TOC (about 6.3 tons ha⁻¹) was also measured in the top layer (0-15 cm) in the grassed inter-row, where this C sink is exclusively due to the cover crop.

A survey of the role of organic versus conventional farming on soil carbon sink/source is started in 2007 in the Emilia-Romagna region in order to confirm these preliminary results. Eight organic orchards and eight conventional orchards (control), located in different areas of the region, were sampled and the results will be available in 2008.