FARMING PRACTICE
ORGANIC FARMING SYSTEMS

IMPACT: SOIL NUTRIENTS

Reference 14

Kopittke, PM; Dalal RC; Finn D; Menzies NW 2016 Global changes in soil stocks of carbon, nitrogen, phosphorus, and sulphur as influenced by long-term agricultural production. Global change biology 23, 2509-2519 10.1111/gcb.13513

Background and objective

Information regarding changes upon land-use conversion is important for assessing the effects of long-term agricultural production on soil stocks of C, N, P, and S as required for the sustainable management of these lands and for the increasing production of food required to feed the human population. The aim of this study was to compile a large body of data in order to examine long-term changes in soil stocks of N, P, and S as related to changes in C. First, consideration was given to the conversion of native vegetation to either cropping or pasture. Next, three different management options were examined for their potential to increase stocks in conventionally managed cropping land, being 'no-till' systems, organic agriculture, and organic amendment. Here, only results on the effects of organic agriculture on soil nitrogen are reported.

Search strategy and selection criteria

An extensive data set was obtained from the peer-reviewed literature by searching ISI Web of Science and Google Scholar, with the final date of searching being June 2016. 1)The studies had to report on the impacts of long-term changes in land use (≥15 years in all instances other than for organic agriculture for which a cut-off of ≥5 years was used due to the low numbers of long-term studies available), 2) concentrations of SOC were reported in addition to at least one of the three nutrients of interest (total N, total P, or total S) (concentrations of P were recorded even if SOC concentrations were not, as discussed later), and 3) the depth(s) within the profile from which the soil was collected was stated.

Data and analysis

The stocks of N were corrected to an equivalent soil mass for the two land uses in order to avoid bias due to different bulk densities. All areal concentrations (stocks) reported hereafter are corrected for differences in mass calculated from bulk density and depth of sampling. Specifically, to correct for differences in mass, the depth of the soil profile included in calculations was altered to account for changes in bulk density, such that the mass of soil was equal. Effect sizes are reported only as boxplots.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
102	Long-term studies (minimum 5 years) assessing the performance of organic systems in comparison to conventional systems.	'Organic agriculture': a cropping system in which inorganic fertilizers are largely replaced with organic amendments (including farm yard manure and green manure) and in which synthetic pesticides are generally not used (overall practices vary widely, depending upon local guidelines).	Conventional systems	Metric: Stock of Nitrogen, Phosphorous and Sulfur in soil (kg m-2); Effect size: Effect size: Difference (or relative change as %) of the considered metrics between organic systems and conventional systems.	43.75

Results

- Median change in N stock was +0.053 kg m−2 (+8.3%) for conversion from conventional cropping to organic agriculture.
- Median relative change in the C:N ratio was −0.08% for conventional cropping to organic agriculture
- NULL
- NULL

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

Organic systems increase soil nitrogen stock by 8%, compared to conventional systems. However, the result is rated as uncertain, due to the lack of statistical tests.