

Organic matter in European soils: Solution for food security and climate change mitigation?

Renske Hijbeek, PhD candidate Plant Production Systems, Wageningen University & Research, the Netherlands

Soils give structural support for roots, hold water and make nutrients available. In the current discourse soils are seen as valuable natural resource on which human kind depends for its survival. This is a useful transition from previous times in which soils were only seen as a substrate for plant growth or a place for waste disposal.

Current policies support the maintenance or increase of soil organic matter. In Europe for example, this happens in the Good Agricultural and Environmental Conditions (GAEC) within the Common Agricultural Policy¹. Last December the 4/1000 initiative was launched as part of the climate change negotiations in Paris (UNFCCC 2015)². Objectives are to increase food security by improving crop yields and to mitigate climate change by storing C in soils. In my PhD thesis I analyse the first relation (soil organic matter and crop yields).

Fig. 1 shows the results of a meta-analysis of 20 long term experiments in Europe in terms of the effect of organic inputs on attainable crop yields. In these experiments mineral fertilisers (N, P, K) are always added so macro-nutrients are not a limiting factor for crop yields. The results show that the increase in attainable crop yields is very small (0-2%), and depending on type of organic input often not significantly different from zero. For very sandy soils, very wet climates and spring sown cereals however, there are small increases in attainable crop yields³

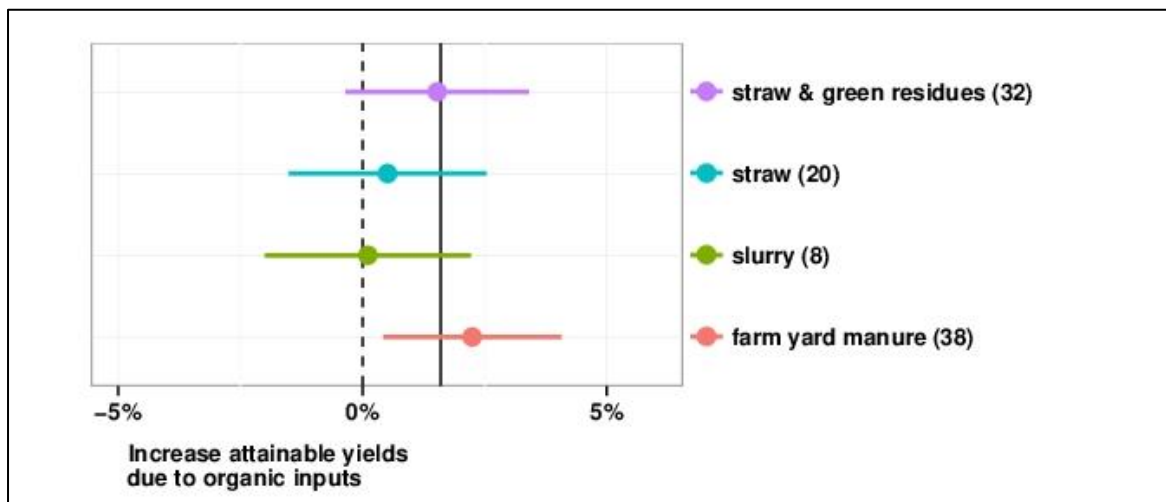


Fig. 1: Increase in attainable crop yields when organic inputs are added to mineral fertilisers. Based on a meta-analysis of 20 long term experiments in Europe³. Points are group means with the 95% confidence interval. Black line is the overall mean (1.4%).

¹ EC (2013) Annex II, rules on cross-compliance pursuant to article 93. Regulation (EU) No 1306/2013 of the European parliament and of the council on the financing, management and monitoring of the common agricultural policy. . Official Journal of the European Union, Brussels.

² UNFCCC (2015) Join the 4/1000 Initiative. Soils for Food Security and Climate. Lima- Paris Action Agenda

³ Hijbeek R, van Ittersum M, ten Berge H, Gort G, Spiegel H, Whitmore A (2016) Do organic inputs matter—a meta-analysis of additional yield effects for arable crops in Europe. *Plant and Soil*: 1-11.

Fig. 2 shows the results of a farm survey among more than 600 farmers in five European countries. These farmers were asked to indicate their percentage of soil organic matter and if they perceive a shortage of soil organic matter. Only at very low percentages of soil organic matter (depending on soil texture, less than around 1%), all farmers perceive a neutral to very high shortage of soil organic matter on their fields (red area, Figure 2). Such low soil organic matter percentages almost do not occur in Europe, but do often in more tropical climates as higher temperature cause faster decomposition and often less crop residues are returned to the fields. Overall, 18% of the farmers in the farm survey indicated they perceived a high or very high shortage of soil organic matter in their fields. At the same time, this also means that for most of the European farmers that we have contacted, low soil organic matter is not an issue.

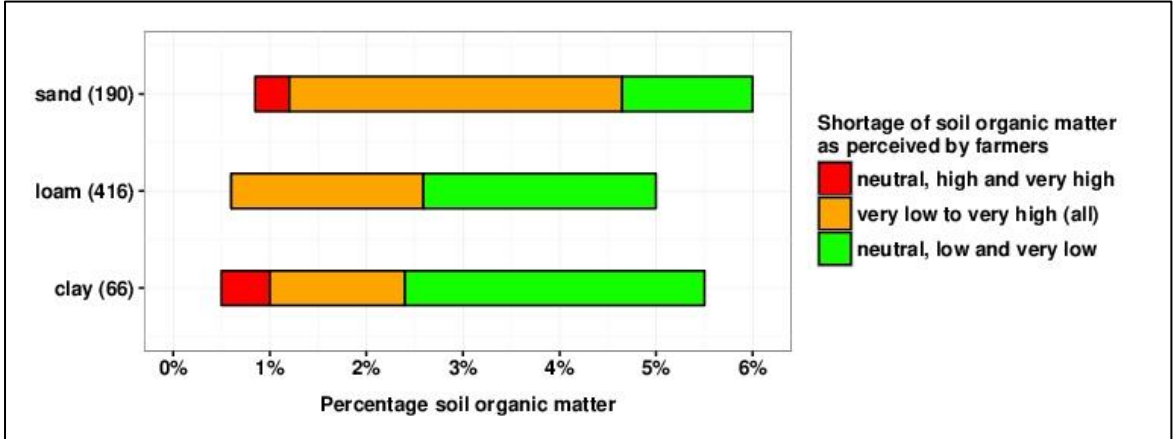


Fig. 2: Perceived shortage of soil organic matter by farmers related to their soil organic matter content. Based on a survey among more than 600 farmers in 5 European countries.

Crops need a place to grow, water and nutrients. In some cases soil organic matter can help, but in other cases irrigation and mineral fertilisers can offer more. The results of this research show that more soil organic matter or organic inputs do not always lead to more crop yields. In any case not in European climates and when farmers have access to mineral fertilisers. Increasing crop yields however always leads to more organic material being available and – if not used for cattle feed or biofuels – to a positive input on the soil organic matter balance. Focussing policy measures on crop yields to generate organic inputs, which can lead to storage of C would therefore give more guarantee in achieving both policy objectives (Fig. 3).

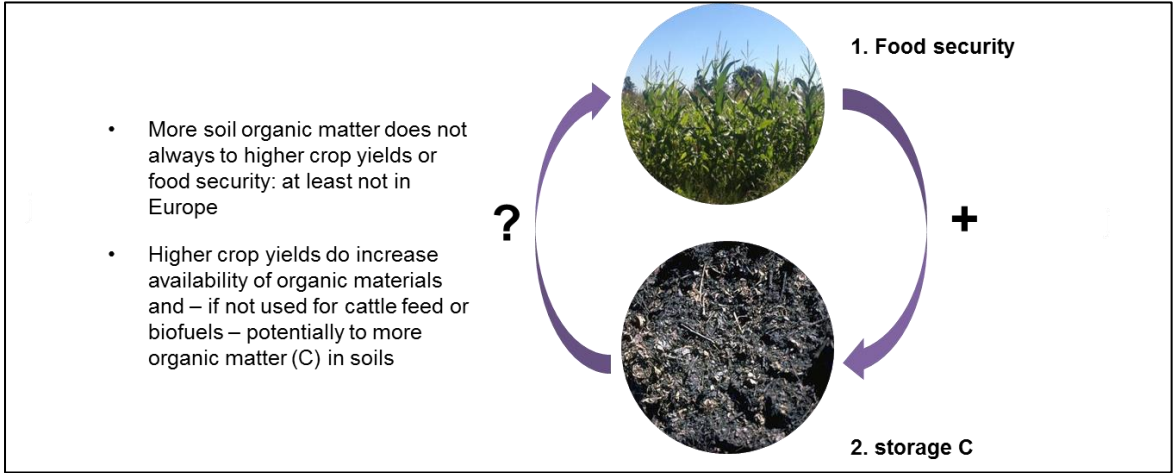


Fig. 3: Relations between food security (in this case only crop yields), climate change mitigation (in this case only storage of C) and soil organic matter.

This work was financially supported by the European Commission under the CATCH-C project (Grant Agreement No. 289782) within the 7th Framework Programme for Research, Technological Development and Demonstration. Its content does not represent the official position of the EC and is entirely under the responsibility of the authors. Contact: renske.hijbeek@wur.nl