New tool can help increase soil carbon content and thereby improve soil fertility

December 8 2015, by Janne Hansen

Agricultural soils provide the basis for more than 90 percent of the global food production, but throughout the world there are serious threats to soil quality. Soil degradation reduces its fertility and threatens food supply in the long term.

The reasons for the deterioration in soil quality are to be found in the more monotonous crop rotations where much of the straw is often removed resulting in little return of organic matter to the soil. However, it is possible to change agricultural practices and thus maintain or increase fertility - which will also benefit the farmer's finances.

The European research project SmartSOIL, which was coordinated by Professor Jørgen E. Olesen from the Department of Agroecology, Aarhus University, has developed a decision support tool to ease decision-making. The tool is part of a toolbox located within a website that helps advisers, farmers and policy-makers to identify cost-effective methods in order to optimise yield and soil carbon stocks for different types of soil, climate and cropping systems. Check the tool and its many functions here.

In order to develop the tool, the scientists examined how changes in soil carbon stocks interact with soil fertility and how this affects yields and the input needed, especially of nitrogen fertiliser. The project also identified five methods likely to increase soil carbon contents. The methods improve soil fertility, increase productivity and reduce the need for nitrogen fertiliser, and will in many cases improve the farmer's

economy.

Carbon is crucial to soil functionality

It is crucial to ensure that soil has an adequate carbon content. But what has carbon to do with soil fertility?

- All organic material contains carbon. This also applies to organic matter in the soil, which supports all the essential functions that the soil carries out for crop growth and production. It's about supplying crops with water and nutrients (especially nitrogen) and to ensure good crop health, not least a good crop establishment, explains Jørgen E. Olesen.

Changes in soil carbon stocks also contribute to climate change. If the soil can store more carbon, there will be less increase in atmospheric carbon dioxide (CO2). This would thus mitigate the greenhouse gas effect. The effect is not permanent, however, since the soil carbon content will find a new equilibrium.

SmartSOIL website provides a reference point

It can be difficult to comprehend the full range of available options for improving soil carbon content and fertility, and there will be many local factors to be taken into account. To provide inspiration and a reference point, SmartSOIL has developed a range of information material (fact sheets, videos, case studies, etc.) that are available in a practical form on the website.

SmartSOIL has identified five general management practices that individually or in combination can help to optimise the balance between crop productivity, soil functionality and soil carbon balance. The methods primarily work by increasing the supply of plant residues or

organic matter from manure or compost.

The five management practices are:

- Crop rotation
- Residue handling
- Adding manure or compost
- Cover crops/catch crops
- Conservation agriculture, which includes reduced soil tillage, returning plant residues to the soil, permanent soil cover with - particularly - cover and catch crops and changes to the crop rotation

The management practices are described in more detail in five easy-read fact sheets that also contain information on the advantages, disadvantages, financial implications, etc., of the methods. The fact sheets can be read here.

A healthy soil brings financial rewards

Identification and analysis of the five methods and the knowledge underpinning the tool box are based on research conducted in different countries field experiments and supplemented with experiences from private farms. For Denmark this includes results from long-term experiments (up to 20 years) performed at Aarhus University's experimental station in Askov and the experiences of farmer Bjarne Hansen from Zealand.

The farmer found that his costs were reduced by 36 percent and his margin increased by approx. €360 by introducing reduced tillage, increasing the use of catch crops and incorporating plant residues in the crop rotation.

"I spend €180 less per hectare than other farmers in my area. The savings in fuel consumption were very obvious because we spent less time using the farm machinery. We also needed less nitrogen fertiliser because there was a better utilisation of nutrients in the field," says Bjarne Hansen.

You can read about all the farmers who participated in the project and their experiences here.

"It is essential that the improvement of soil fertility through better soil carbon management practices is supported by the right incentives for the farmer. SmartSOIL has therefore developed a number of recommendations to promote this, including better advisory systems, targeted subsidies through reform of the agricultural subsidy schemes and better interaction with environmental regulation," says Professor Jørgen E. Olesen.

Provided by Aarhus University