THEME 1

4 for 1000 and Soil Carbon

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INTRODUCTION

The French Government launched the "*4 per 1000 Initiative: soils for food-security and climate*", because an average annual growth rate of 0.4% in the global soil carbon stocks would make it possible to stop the present increase in atmospheric CO_2.

Atmospheric CO_2 levels are increasing at 2 ppm per year. The level of CO_2 reached a new record of 400 ppm in May 2016. In order for the *4 per 1000 Initiative* to achieve its objective to stop the present increase in atmospheric CO_2, agricultural systems would have to sequester 2 ppm of CO_2 per year. Using the accepted formula that 1 ppm CO_2 = 7.76 Gt CO_2 means that 15.52 Gt of CO_2 per year needs to be sequestered from the atmosphere and stored in the soil as SOC.

Fig. 1: The same soil under different management systems: The soil on the left has more SOC than the soil on the right due to 16 years of organic agriculture ©Rodale Institute

Fig. 2: The same soil under different management systems. The soil on the left has more SOC, is more stable, absorbs and holds more water and nutrients: It has sequesterd 57.500 kgs per hectare of CO2 in that time ©Rodale Institute

OBJECTIVES

The objectives are to use examples of agricultural systems that have published studies documenting their increases in SOC and to extrapolate the data to see how much CO2 could be sequestered per year, globally to meet the aspirational goals of the 4 per 1000 Initiative to stop the present increase in atmospheric CO2.

It is not the intention of this paper to use these types of generic exercises of globally extrapolating data as scientific proof of what can be achieved by scaling-up these systems. These types of very simple analyses are useful for providing a conceptual idea of the considerable potential of agriculture to sequester CO2 on a landscape scale.

MAIN RESULTS

Agricultural systems that use techniques such as longer rotations, cover crops, green manures, legumes, compost, organic fertilizers, organic agriculture, agro forestry, agroecology and intensively managed grazing systems can increase soil organic carbon (SOC). These systems are starting to come under the heading of Regenerative Agriculture because they regenerate SOC.

Examples of Agricultural Systems: The Farming Systems Trial conducted by the Rodale Institute in the USA, showed that CO_2 was sequestered into the soil at the rate of 3,596.6 kg of CO_2 per hectare per year. Aguilera *et al.* (2013) found that the organic systems sequestered 3559.9 kilograms of CO_2 per hectare per year.
When extrapolated globally across agricultural lands, this system would sequester 17.5 Gt of CO_2 per year.

Total Agricultural Land:
4,883,697,000 ha.
Source: FAO, 2010

3,596.6 kg CO_2/ha/yr × 4,883,697,000 = 17.5 Gt of CO_2 /yr.

CO_2 was sequestered into the soil at the rate of 8,220.8 kg per hectare per year in the Rodale Compost Utilization Trial and when extrapolated globally, would sequester 40 Gt of CO_2/yr.

Machmuller *et al.* 2015: reported an increase of 29,360 kg of CO_2/ ha/yr in three farms converted to management intensive grazing.

If these regenerative grazing practices were implemented on the world's grazing lands they would sequester 98.5 gt CO_2/yr.

Grasslands: 3,356,940,000 ha (FAO, 2010) × 29.36 = 98.5 gt CO_2/yr

CONCLUSION

The above examples show that there are agricultural systems that could sequester enough CO_2 and store it as SOC to meet the aspirational goals of the *4 per 1000 Initiative*.

The key issues are:

- Urgent research should be commenced to understand how and why these systems sequester significant levels of CO_2 and then look at how to apply the findings for scaling-up on a global level in order to achieve a significant level of GHG mitigation;
- The signatories the *4 per 1000 Initiative*, including governments and international organizations, should start programs training farmers in the regenerative agriculture systems that increase SOC;
- Further research can improve the rates of sequestration.