
Soil carbon day hosted by the Stellenbosch Institute for Advanced Study (STIAS)

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Carbon sequestration is seen as one of the most important ways to counteract climate change and promote soil quality. Improving our understanding of carbon management will promote sustainable management of our irreplaceable soil resources. A workshop was held at the Stellenbosch Institute for Advanced Study on 15 February 2013. The aim of this workshop was to share the latest scientific advances in soil carbon research. The workshop was supported by the NRF, German-South African Year of Science programme and STIAS.

The day was opened by Professor M. Karaan, Dean of Agriculture at Stellenbosch University. He discussed the government's short term plans for a better next generation aimed to be reached by 2030. Those plans include education; health; rural development and land reform; and fixing capability of governmental state. These plans should result in creation of decent jobs for a growing economy. Karaan stated that many businesses, including the agricultural sector, are practicing in a non-sustainable manner and that we should lower our carbon economy and build a green economy by measuring carbon intensity.

The research and development (or science and technology) sector should perform adaptive, incremental research. Research output should be measured from one year to the next to be able to perceive what progress has been made. He concluded by saying that the experts at the soil carbon day may have a massive contribution to the short term plans set by the government.

The soil organic carbon session was opened by Prof Y. Kuzyakov from Göttingen University in Germany with his talk on 'why soil carbon?'. Kuzyakov stated soil has the most carbon sequestered of the global carbon cycle amongst other significant proportions in the atmosphere, plants and fossil fuels. He focussed on the biophilic elements, carbon and nitrogen. High carbon and nitrogen levels in soil supply chemical energy to microbes, increase activity of microbes and are a source of nutrients available to plants. These functions of soil carbon and nitrogen lead to fertility. He also stated that sustainability is not different from fertility over a long period. He shared some of his research results on the contributing proportions of roots, plants, and microbes to soil carbon and interesting findings on the trade of carbon for nitrogen in soil.

He concluded that carbon has vital functions in soil and provides ecosystem stability; rhizospheric microbial activity is very high at certain ‘hotspots’ around the roots which lead to accelerated microbial activity and soil organic matter turnover.

Dr Anthony Mills, from Stellenbosch University and C4 EcoSolutions, spoke about soil carbon on the international market. Trading with soil carbon may trigger changes in land-use. There are currently two markets for carbon. Firstly the compliance market regulated by the Kyoto protocol (UNFCCC), but this does not make provision for soil carbon. The second, voluntary market (VCS system) does, however, make provision for trading of soil carbon. The VCS system was the first approved in 2012, providing a system to trade with soil carbon. He stated that the VCS system holds promise but poses some challenges. One of the major challenges is the slow carbon return initially and farmers will need to rely on corporate-social responsibility budgets. He also raised a very controversial topic that ploughing leads to higher carbon levels deeper in the soil, and if one considers the whole soil profile’s carbon content, no-till does not have an enhancing effect on soil carbon sequestration. This evoked a discussion about the whole effect of no-tillage and conservation agriculture versus that of conventional tillage.

Prof T. Seifert from the Stellenbosch University gave his talk on ‘Green Landscapes: A spatial decision support system for the integration of carbon sequestration in holistic land use planning’.

He supplied information about a research programme that was launched to modulate a spatial decision support system – a work in progress.

Mr M Back of Backsberg Wines spoke about the approach he followed to turn his farm into the first carbon-neutral farm in South Africa. Back said it is very satisfying; one should be careful, observant and look for opportunities. Just as Karaan did with the opening of the carbon day, he urged farmers to take on carbon neutral farming. Prof B. Glaser from the University of Halle in Germany, opened the biochar session (biochar is a stable solid, rich in carbon which is created by pyrolysis of biomass, similar to charcoal) Glaser gave a clear background of biochar, its functions and biochar technologies. Glaser stated that there is a worldwide hype about biochar, but we do not really know if it is beneficial as a soil amendment technique since there are definite critical topics or risks, but also benefits. These uncertainties provide vast research opportunities. One major benefit of the use of biochar is that it waste is converted into a value-added product for the potential use to the benefit of the environment.

Dr AG Hardie from Stellenbosch University gave insights on the applications and prospects of biochar in the Western Cape. Hardie shared the research findings of the past few years showing that biochar has potential to improve carbon sequestration, aggregate stability, nutrient and water retention, crop growth and microbial activity. Seasonal application of small amounts with fertiliser might be economically more feasible.

Prof R. Sikora from the University of Bonn, Germany, opened the soil health session with his talk on rhizosphere soil-microbial interactions and plant health in a hostile environment. Sikora stressed the importance of integrated pest management to increase crop yield. One of his most important statements was that timing of organic matter application is vital to ensure efficient crop growth and minimize the negative effects of pathogens. Sikora showed results on very interesting methods to control plant parasitic nematodes by endophytic bacteria or fungi.

Dr A Rozanov from Stellenbosch University stated that we need knowledge on the seasonal and long-term carbon dynamics of soil organic matter under native vegetation within given environment before we can make definite conclusions on the effects of cropping systems. Rozanov gave thought-provoking insight on why high soil organic matter levels are not necessarily beneficial. Storage of soil organic matter at a very high rate is counteractive, because the soil does not have the ability to decompose and release nutrients to plants and microbes. Rozanov stated that soil quality in its broader understanding needs to be institutionalized, which is the responsibility of the government. Soil quality assessments need to be standardized and a system needs to be developed to that will urge farmers to follow eco-friendly and sustainable farming practices.

Mr Stephanus Malherbe from ZZZ, South Africa, spoke about natural farming by ZZZ and soil organic matter management. Compost production is one of their key technologies and they have large production systems. Malherbe stated that quality control is very important in compost production. He shared some of the benefits of compost: it is a carrier of microbial life; a refuge for microbes; a source of nutrients and is a soil conditioner (providing soil structure). Malherbe then elaborated about three myths of compost production which provided valuable and practical information.

The first myth is that working with compost is easy. Calibrating machines, setting crop yield targets and balancing nutrients is complex and different in every environment. The second myth is that more compost is better. One of the costly lessons they had learned was that one should build soil organic matter slowly, since more compost were inefficiently utilized by plants and resulted in uneconomical farming practices. The last myth was that one can use compost everywhere and anytime. He showed principal component analyses of a large database they build over the years, which showed that application of high levels of compost, high levels of manure, and high levels of nitrogen in combination with a heavier soil resulted in lowered crop quality. One has to consider the impact of organic matter, climate and textures' interactions on the crop. Organic technology will not make up for bad farming practices.

