Interesting Outcomes in a Comparison of Biodynamic and Conventionally Managed Soils – Callawadda, Victoria, Australia

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1 INTRODUCTION

This article addresses two outcomes from a final year Investigation Project by John Grewar and Evan Barr as part of the completion of a Bachelor of Civil Engineering at La Trobe University, Bendigo Victoria. The Investigation Project was entitled, "Soil Carbon Sequestration – A Comparison of Agricultural Practices for Dryland Farming", completed in November 2010, and was primarily investigating soil carbon profiles anticipating that biological farming practices would sequester a greater percentage of carbon to a greater depth within the soil profile when compared to conventional farming practices . Eager co-operation was obtained from six farmers in the locality which enabled three paired studies to be conducted. Unfortunately one of the study pairs was not conducted on soils of similar classification, however, the results from the two remaining pairs produced very similar outcomes.

In keeping with earlier investigation projects the students conducted a suite of sampling and measurements to enable a holistic evaluation of the soil profiles and management practices. The results and research findings in this article have been restricted to soil carbon profiles and infiltration capabilities associated with the different farming practices for the first paired site located near Callawadda in the south eastern Wimmera. Figure 1 show the hydraulic soil coring machine in operation and the student collecting dissects of the soil cores.

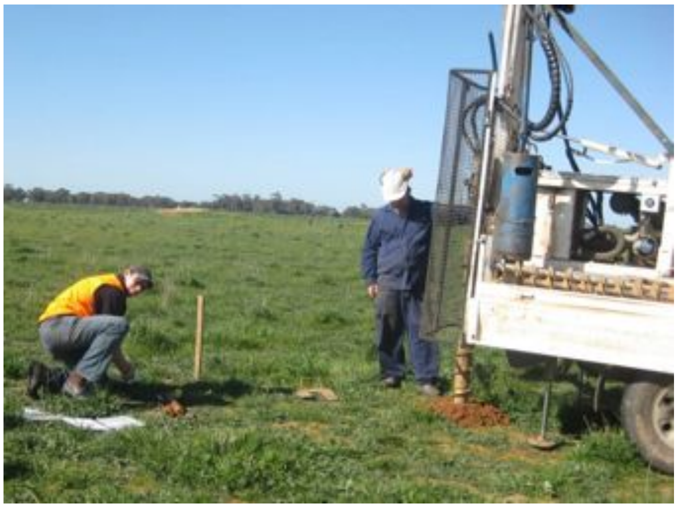

Figure 1 showing the Hydraulic Coring machine in operation and a student dissecting a soil core.

2 METHODOLOGY

The investigation was carried out using standardised physical and chemical procedures. Soil samples were taken to a depth of 1.1 metres using a hydraulic corer. There were four separate soil cores taken to make up a sample of soil. Each core was dissected to eight samples. I.e. 0-50; 50-100; 100-200; 200-300; 300-500; 500-700; 700-900; 900-1100mm and the averaged sample was analysed in the laboratory for a suite of parameters including total organic carbon using the Shimadzu Total Organic Carbon Analyser Solid Sample Module as shown in figure 2.

Figure 2 showing the Shimadzu Total Organic Carbon Analyser Solid Sample Module.

A typical soil infiltration on-site test is shown in figure 3 where the infiltration of quantities of added water are measured and recorded as a function of time which is usually in excess of one hour.

Figure 3 showing a soil infiltration test in progress.

3 RESULTS AND DISCUSSIONS

3.1 Description of Soil – a comparison

The soil is classified as Red and Yellow Sodosols. On the biodynamic managed property an uneven deepening soil profile was found as is shown in figure 4. This uneven profile was attributed to earlier deep ripping of the paddock. The conventional managed property had not been deep ripped and did not display an uneven deepened profile.

Figure 4 showing the soil profile developing into a suspected deep ripped line.

3.2 Soil Carbon Profile – a comparison

Figure 5 shows a profile of the total organic carbon with depth for the biodynamic and conventionally managed properties. It is clear that there is very little difference in the two total organic profiles to a depth of 400mm. This result was unexpected but on reflection it was considered that the previous 10 years of drought and continual farming activities on both properties would run down the soil organic matter to a minimum. [Alex Podolinsky advised to repeat the experiments as the carbon levels in the biodynamic soil profiles should quickly revert to former levels due to the recent drought breaking rains and subsequence soil and plant activity. These experiments have been repeated but the results will not be known for a few months.]

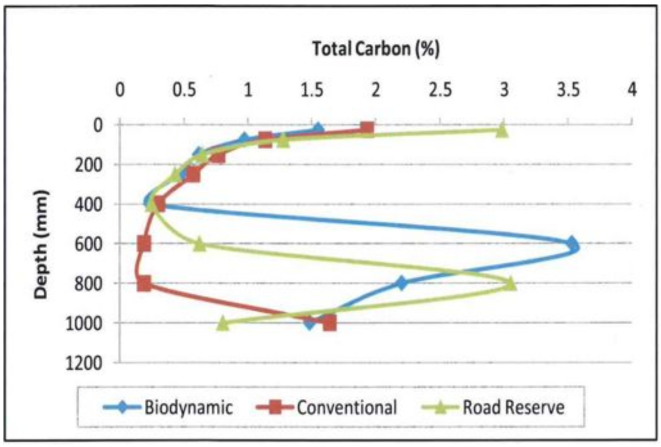

Figure 5 showing a comparison of biodynamic and conventionally managed soil profiles for dryland conditions. Note the road reserve separates the properties and the larger values of total carbon include inorganic carbon from visual calcareous deposits in the lower part of the soil profile.

Figure 6 below shows a comparison of the total organic carbon for an irrigated biodynamic and conventionally managed orchard from field experiments conducted in 2009. In this figure the total organic profile is larger and deeper for the biodynamic managed property than for the property that had been previously managed using conventional orchard management practices. It would appear in this instance the irrigation water negated the effect of 10 years of drought.

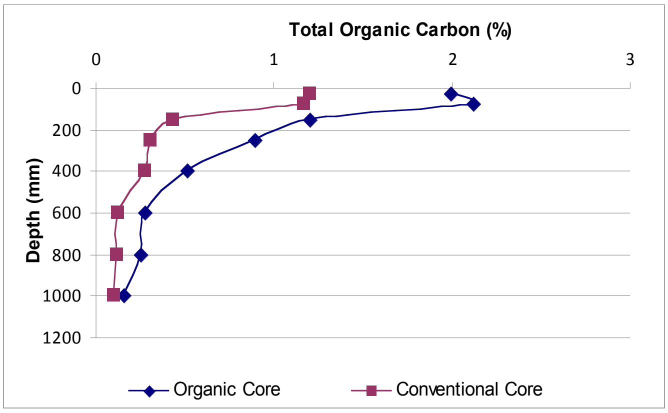

Figure 6 showing a comparison of biodynamic and conventionally managed soil profiles for irrigated conditions in an orchard.

3.4 *Infiltration Rates – a comparison*

Figure 7 below shows a comparison of the soil infiltration rates in millimetres per minute (mm min^{-1}] for a time period in excess of one hour. It is clear from this figure the biodynamically managed property has significantly higher short and long term infiltration rates than the conventionally managed property and as a consequence has a capacity to absorb significant amounts of water into the soil profile and replenish the subsurface moisture as needed. These results typify what would be expected from a well structured soil as compared with a compacted soil with little soil structure.

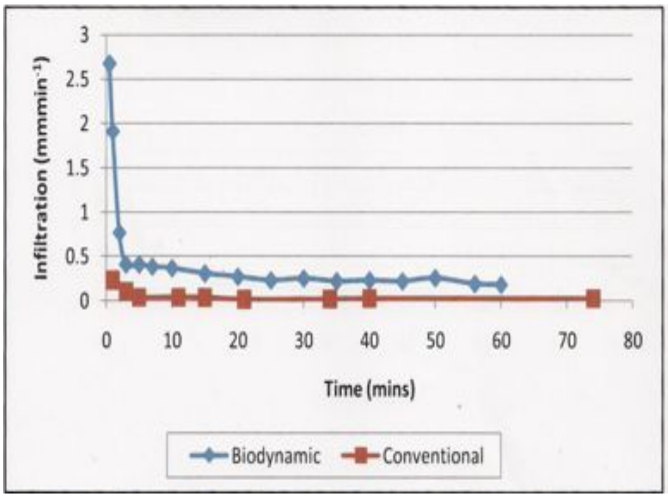

Figure 7 showing the infiltration rates.

3.5 *Soil Moisture profiles – a comparison*

Figure 8 below supports the above rationale by showing greater stored moisture in the soil profile of the biodynamic managed property. In all three paired sites it was observed the biodynamic plant roots extended to 600-700mm and were more numerous than the conventionally grown plants that extended roots to a lesser depth.

The increased water in the subsoil and its accessibility to deeper roots is perhaps one of the reasons biodynamic crops remain greener for longer compared to conventionally grown crops.

It is to be noted the experiment referred to in this article was conducted (actually delayed) by heavy rains of around 200mm in August and early September 2010 and after a fall of 40mm in early September the conventionally managed property was observed to be covered with a sheet of water whereas the biodynamically managed property had, at that stage, absorbed all the rainfall into the soil profile.

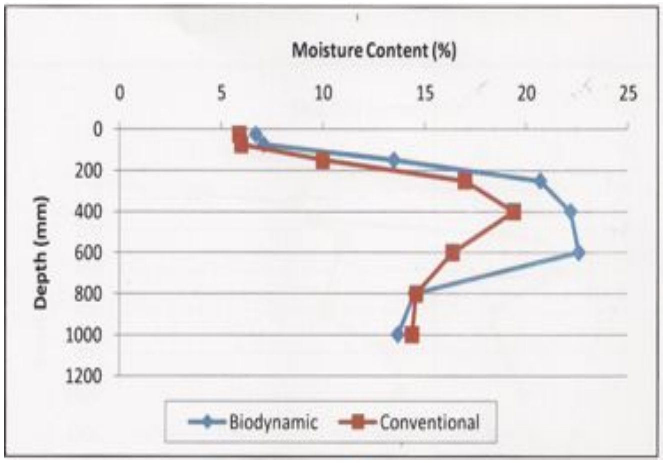

Figure 8 showing the soil moisture profile.

The implications for the above is profound as initial calculations show the difference in runoff between a farming landscape, be it biodynamic or conventional, for 100mm rainfall on a dry catchment extending over the Loddon, Avoca and Richard on Avon catchments is of the order of one million megalitres or roughly a third of the volume of Lake Eildon. It would appear the propensity for flooding is exacerbated by conventional farming practice particularly once the network of farm dams is full to capacity.

4 CONCLUDING REMARKS

1. The results from the experimentation described in this article confirms the significant difference between the physical attributes of soils managed using biodynamic or conventional farm management practices.

2. Ongoing experimentation is necessary to monitor total organic carbon levels in the soil profiles over a range of climatic conditions to assess the viability of sequestering atmospheric carbon into Australian soils.

ACKNOWLEDGEMENTS

The six farmers who were eagerly part of this study are deeply thanked for their knowledge and support. This work could not have been done without the support of La Trobe University Bendigo.