

# Soil Management for Potatoes: What does the Centre for Sustainable Cropping tell us?



The James Hutton Institute

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## Centre for Sustainable Cropping Balruddery (CSC)

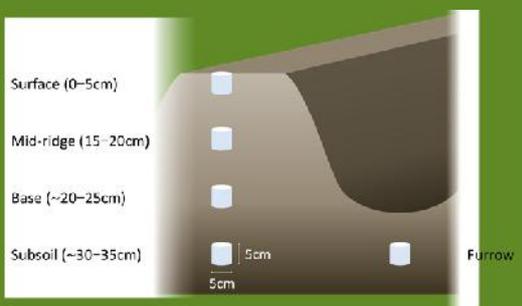
Potatoes grown in a 6 year rotation under conventional and sustainable management regimes. While the sustainable regimes receives less nitrogen fertilizer than the conventional, the main difference for soil management is that the sustainable receives 35 t / ha of compost each year prior to tillage while the conventional receives none. Tillage for potatoes is the same for both regimes, but for other crops non-inversion tillage is used for the sustainable treatment while ploughing is used for the conventional.



## Quantifying soil conditions

Soil samples were collected from different fields under potatoes in 2013, 2014, 2015 and 2016. The soil was sampled at different crop stages and at multiple depths. Sampling times were: Pre-potatoes, Post-planting, Pre-harvest, and Post-harvest.

Sampling from beds and before and after bed-forming.



## Methods

Multiple measures of soil physical quality were determined on the samples. These were based on the limitations to root proliferation of water availability, mechanical impedance or soil strength, aeration and the stability of the soil structure in water. The measures ranged from simple traditional measures such as bulk density (BD), through available water to the least limiting water range index (LLWR) that combines a range of stresses to root growth, the Dexter "S" index that quantifies the diversity of pore spaces within the soil and wet-sieving to assess the soil stability (WSA).



Pressure chambers for water retention



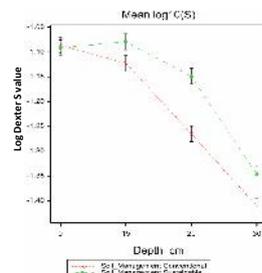
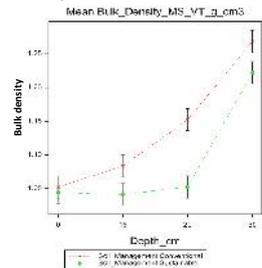
Micro-penetrometer for mechanical impedance to root growth



Wet-sieving for aggregate stability (WSA)

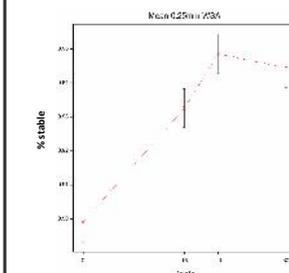
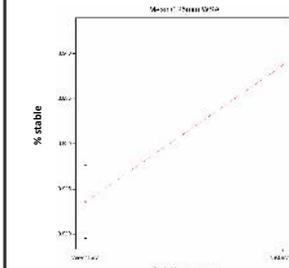
## Results: soil in potato beds

Soil bulk density and S in the potato beds is affected by both management and depth but there was no significant effect of sampling time. The soil in the sustainable treatment provides a better and more homogenous environment for root growth and tuber expansion.



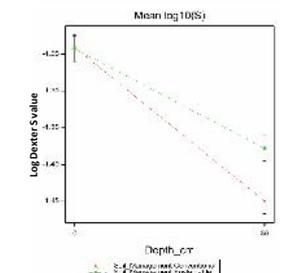
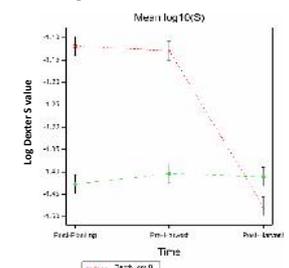
## Results: soil stability (WSA)

Despite the large variation between years and fields the soil was more stable under the sustainable management than under conventional management. Surface soil was least stable presumably due to greater disturbance.



## Results: soil post-harvest

The quality (S) of the surface soil is decreased post-harvest but no effect is seen at depth where soil in the sustainable regime is consistently of marginally better quality. Data are still being analysed to determine the persistence of changes caused by harvesting.



## Conclusions

- Soil quality indicators (e.g. bulk density & S) show that during potato growing the soil in the beds and even in the sub-soil is better under the sustainable management.
- The better soil quality is probably associated with the structure in the beds pre-harvest being more stable under the sustainable management.
- Immediately after harvest there is a decrease in soil quality at the surface, but no change at depth.
- Over the season (from post-planting to post-harvest) there was no change in the subsoil under either management but throughout the sustainable management had better soil quality.
- We need to investigate ways to improve the resistance and resilience of soil to harvesting operations.