

EGU2020-9399

<https://doi.org/10.5194/egusphere-egu2020-9399>

EGU General Assembly 2020

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A quantitative approach of the slake test for assessing soil structural stability

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Soils are at the heart of agro-ecosystems. In various parts of Europe, soils, their structure and function are under pressure from intensive farming practices and global changes. The main consequences are a loss of biodiversity, a decrease in organic matter content, an increase in their susceptibility to erosion. In this context, some farmers are adopting innovative practices to increase the quality of their soils. Among innovative practices, those related to conservation agriculture are particularly highlighted.

Conservation Agriculture practices are based on the threefold principles of (i) minimizing mechanical soil disturbance (e.g. no tillage), (ii) permanent soil cover, and (iii) diversification of crop species grown in the plots. These practices are encouraged by the farmers who adopt them and some stakeholders (ASBLs, advisors, etc.). Some related practices raise questions (use of herbicides) and the effects of the practices on the soil are subject to debate within the scientific communities.

The physical properties of soils are traditionally estimated by a series of laboratory tests that are resource-, time- and money-intensive. We propose to present a new pragmatic approach to assess the functioning and quality of agricultural soils, the 'slake test'. In the development phase, this approach has been tested for contrasting fertilisation and tillage modalities in various long-term trials at the Walloon Agricultural Research Centre (CRA-W).

A slake test is a simple and visual experiment shown by promoters of conservation agriculture. It consists of immersing a metal basket containing a soil sample and observing how this sample decomposes. It is done qualitatively, in two glass cylinders to compare soil samples from ploughed and no-till plots. Although this test is a quick way to assess the structural stability of a soil, its protocol has not been formalized and its results objectified by a quantitative method. We developed an original approach, the ©QuantiSlakeTest, aimed at continuously measuring the disintegration of the soil sample.

This original experimental design was first tested by comparing two contrasted treatments of a long term field experiment in Chastres (Belgium). This field experiment was conducted between 2004 and 2018 by the CRA-W for comparing soil management practices. Samples were taken from plots of treatment T (tillage) and treatment NT (no-tillage) in five repetitions (10 plots). In each plot, seven samples were taken in the superficial layer using Kopecky rings. The samples were dried 48

hours at 50°C before being tested.

The application of ©QuantiSlakeTest highlights significant differences between tilled and non tilled plots. After one minute, the relative residual weight are significantly different between treatments (T: 0.76 ± 0.16 , NT: 0.95 ± 0.06 , $p < 0.001$). At stabilisation, after 20 min, samples from tilled plots have lost more than 50% of their weight, while those from no-tilled plots have lost less than 30% (T: 0.49 ± 0.32 , NT: 0.71 ± 0.22 , $p < 0.001$).

These early results confirm that ©QuantiSlakeTest is a credible approach for assessing the effect of soil management practices on soil stability, in controlled experimental conditions. We are now finetuning the protocol, trying the approach with room temperature dried samples and comparing other modalities (fertilisation, organic matter amendment).