



Soil Structural Stability and Extracellular Polymeric Substances (EPS): transient binding agents affected by land-use.

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Structural stability in agricultural soils is said to be maintained through production of 'biological binding agents', including temporary binding agents (fungi, roots), transient binding agents (EPS), and persistent binding agents (of less certain origin). We sampled soils from a long-term field trial, comprising previous grassland, arable and fallow land-uses in factorial combination with current land-uses of the same type: previous 3 land-uses x current 3 land-uses = 9 treatments (Redmile-Gordon et al., 2020). Total soil organic carbon (SOC), EPS (including protein, and polysaccharide fractions; Redmile-Gordon et al., 2014), and mean weight diameter (MWD) of water stable aggregates (Le Bissonnais, 1996) were quantified.

Both EPS and MWD were correlated, and were both strongly influenced by current land-use (implemented 2.5 years before sampling), but not by previous land-use (implemented > 50 years ago, terminated 2.5 years before sampling). While exopolysaccharides were significantly correlated to the soil's structural stability ($p = 0.027$), proteinaceous EPS were more closely related to the associated gains in soil aggregate stability ($p = 0.002$).

In contrast to EPS and soil stability, total soil organic carbon (SOC) was strongly influenced by previous land-use. Importantly, this indicates that any capacity for relatively stable organic matter to contribute to the soil's structural stability is overwhelmed by temporary/transient effects owed to current land-use. This is cause for optimism, as it seems the physical quality of soils might be improved by short-term application of managements that favour EPS production. This approach would represent a qualitative step beyond that of building total SOC, which can be difficult for land-managers to achieve. This study is the first to simultaneously assess the effects of land-use on proteinaceous and polysaccharide content of EPS, and link this to the structural stability of soils. Further understanding surrounding the ecology of EPS production, and disentangling the contributions of temporary (largely physical) vs. transient (biochemical) binding agents is hoped to contribute to the development of more efficient land-management strategies.

References:

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