



Soil Transformation of European Catchments (SoilTrEC)- Project Fact Sheet (www.soiltec.eu)

Aggregation in soils under different management

What makes aggregates stable in soils? In the SoilTrEC project hot water extractable carbon (HWC), nitrogen and fungal biomass were shown to be major aggregating agents in Icelandic (Andosols) and active fungal biomass and iron oxides in Austrian (Chernozems) agricultural sites. The organic matter was on the form of manure, green compost and urea. The organic matter provides substrate for the soil fungi, which physically stabilize soil particles into larger aggregates when fungal growth increases and hyphae enmesh soil particles. Fungi exude polysaccharides that adhere to minerals in the soil. This physically aids the association of soil particles into larger aggregates when fungal growth increases and hyphae enmesh soil particles. The organic matter provides higher microbial activity and the production of microbial decomposition products that bind soil particles into microaggregates and further into macroaggregates.

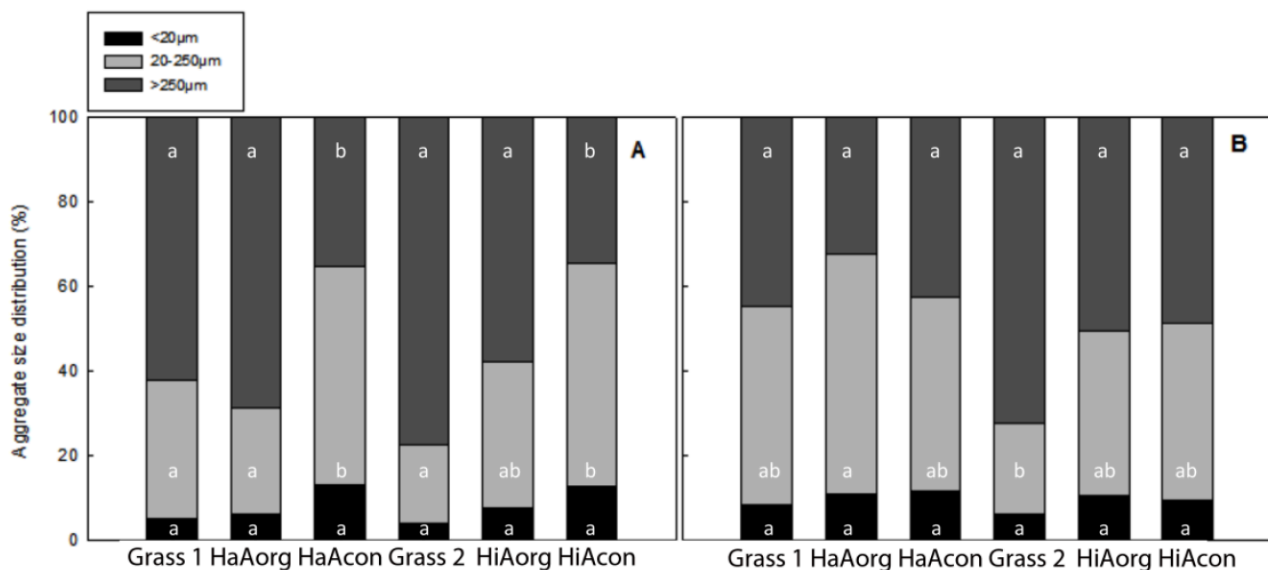


Figure 1. The distributions of micro- ($20 \mu\text{m}$, and $20\text{-}250 \mu\text{m}$) and macroaggregates ($>250 \mu\text{m}$) in soils of different glassland sites in Iceland. A 0-10 cm (topsoil), B 10-20 cm. HaA: Haplic Andosol, HiA: Histic Andosol, org: organically managed, con: conventionally managed.

What is the effect of farming approaches? Organic farms add manure, compost and often urine to their soil. Conventional farms in general add mineral fertiliser and little or no manure. In the SoilTrEC project we found that macroaggregates in Icelandic topsoils resembled unimproved grassland and macroaggregates were approximately twice as abundant in organically managed compared to conventionally managed sites (Figure 1A). Macroaggregates were the dominant aggregate fraction in organically managed topsoil in Iceland.

Which other factors affect aggregate stability? In Haplic Andosols, pyrophosphate-extractable Fe, Mn, and Al, as well as dithionite-extractable Mn were among aggregating agents. For the Austrian sites iron (Fe) oxide content correlates positively with the amount of macroaggregates and their mean weight diameter. There was little difference between the stability of aggregates in organically versus conventionally managed arable Chernozem soil. This may be due to the low quantity of organic inputs in the organically managed sites.

Aggregate stability

Soil aggregate formation and stability are fundamental for soil structure, and are essential controls of soil fertility and agronomic productivity. Macroaggregates are constructed of microaggregates, sand and particulate organic matter, bound together by transient or temporary binding agents. Transient binding agents are microbial- and plant-derived polysaccharides that decompose rapidly – whereas temporary binding agents include roots and fungal hyphae. In SoilTrEC we have found that organic input can enhance aggregation.

Importance of farming approaches

In Icelandic grassland soils we found that organic land management resulted in twice the quantity of macroaggregates in topsoil compared with conventionally managed soils. This is of interest due to the importance of macroaggregates in protecting SOM and soils from erosion. This difference was not as visible in the Austrian arable land soils; it may be due to the low quantity of organic matter added to soils by the organic farmers.

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