Influence on soil aggregation by mycorrhizal inoculation of maize on a sandy soil

V. Schwarz, R. Oprea, K. Deiglmayr
Faculty of Agricultural Science and Landscape Architecture, University of Applied Sciences Osnabrück

Introduction
In agricultural practice, stable aggregation is of growing importance in times with higher frequencies of droughts. Well-aggregated soils can improve water infiltration and water holding capacity. Biological processes are responsible for the formation and persistence of aggregates but vary in time, and therefore aggregation varies. The aim of the presented study was to monitor how aggregation varies over time and to test whether inoculation of arbuscular mycorrhizal fungi (AMF) can improve the formation of water-stable macroaggregates of sandy soils.

Material and Methods
From mid of April until the end of July 2018, a randomized field experiment with two variants (+ mycorrhiza (myc), - mycorrhiza (con)) and four replicates was set up on a sandy soil field (So to Su2) in Hollage, Lower Saxony. Inoculated maize seeds were coated with propagules of AMF, a mix of Rizoglomus irregulare (53%), Funneliformis mosseae (27%), and Funneliformis candidum (20%) to guarantee mycorrhizal colonization of the maize roots. Whereas the frequency and intensity of AMF colonization were studied within maize roots (Fig 1), water-stable macroaggregates, soil organic carbon, microbial biomass, and respiration were analyzed within pooled soil samples of the upper 10 cm.

To include soil texture as an explaining variable of soil aggregation, soil samples were taken from a second field, consisting of more loamy material (SI4 to LS4) in Belm, Lower Saxony.

Fig 1: Roots colonized by arbuscular mycorrhizal fungi (left hyphae and arbuscules, 100-times of magnification, right hyphae, arbuscules, and vesicles, 40-times of magnification), the figure shows different states of intensity by mycorrhizal colonization.

Discussion and Conclusions
No effect of inoculation on mycorrhizal colonization was observed. Probably native AMF on the sandy soil field was as strong as the inoculated one or even more assorative than inoculated AMF. The presented data can not clarify exactly.

Although no differences in inoculation occurred, the study indicates a significant influence of mycorrhizal frequency on soil aggregation. Fungi stabilize soil aggregates with their hyphal network, and especially AMF foster aggregation due to the production of glues and substances like glomalin related soil proteins. 2018 was a warm year with low precipitation. The strong effect of decreasing water content could overlay the effect of AMF on aggregation. Besides that, decreasing water content can influence the release of glues extracellular substances and higher their concentration during desiccation (Ritz & Young, 2011). Therefore desiccation can affect aggregate stability via soil microbiology.


Contact: Volker Schwarz | University of applied sciences Osnabrück | E-Mail: v.schwarz@hs-osnabrueck.de