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Engineered soil-mycelia systems for slope stabilisation

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Landslides in granular soils are often triggered by rainfall; this phenomenon and the underlying mechanism of water infiltration resulting in increased pore water pressured (reduced soil suction) and hence lower shear strength has been well documented for natural hillslopes worldwide. Globally, up to 350 fatal landslides are triggered by rainfall each year and individual events can cause thousands of fatalities (Kirschbaum et al., 2012). In Europe, up to 3.6 million people live in landslide prone areas with 8,000 to 20,000 km of roads and railways at risk of landslides, and associated annual economic losses of ~4.7 billion Euros (Haque et al., 2016). In many regions predicted changes in climate are likely to further impact the stability of slopes, driving the need for novel approaches for their management and maintenance. This research investigates the potential of engineered soil-mycelia systems to improve slope stability.

Filamentous fungi grow in the form of hyphae, tubular structures with diameters between 2-7µm. Hyphae branch out and fuse together forming a complex network, called the mycelium. Mycelia have attractive characteristics for use in ground engineering: evidence from natural analogues indicates that they can form massive, durable mycelia with individual organisms of Armillaria sp. up to 10 km2 in size and >1,900 years old found on forest floors in N. America (Ferguson et al., 2003). Furthermore, mycelia networks are resilient; dynamically responding to the environment and damage or disruption (Fricker et al., 2008). Different fungal species have varying growth requirements and forgagng behaviour which give rise to different mycelia architecture (e.g. dense diffuse mycelia, cords, rhizomorphs).

This study investigates the ability of saprotrophic basidiomycota fungal species to contribute to slope stabilisation. In order to identify suitable fungal species a screening study was conducted which investigated the ability of a number of different UK native basidiomycota species to (i) grow in non-sterile soils, (ii) induce water repellency and (iii) bind soil particles together. These were assessed via time-lapse photography and image analysis, water droplet penetration tests and via soil aggregate stability tests. Results show that growth behaviour and resulting mycelium architecture influences the ability of fungi to bind soil particles. Basidiomycota fungi show promise for enhancing slope stability by reducing water infiltration during rainfall events, enhancing soil cohesion and improving soil resistance to erosion.

Participation

In-Person

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