Soil Microbes and Salt Tolerance: Exploring Nature-Based Solutions for Climate Change Adaptation in Agriculture

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Rethinking Farming in Salty Soils: How Microbes Could Help Coastal Agriculture Adapt to Climate Change

Climate change is putting growing pressure on agriculture, especially in coastal areas. Rising sea levels and more frequent seawater flooding are making soils saltier, which penalise crop functions, their yields and threatening the long-term future of farming in these regions.

But there's a natural ally we might be overlooking—**soil microbes**. These tiny organisms play a big role in keeping soils healthy. They help regulate nutrients, support plant growth, and may even help crops handle stress, including high salinity. By improving root function, boosting plant resilience, and maintaining soil structure, microbes could be key to helping plants survive in salty conditions.

As climate challenges intensify, using the natural power of soil microbes could lead to more resilient and sustainable farming systems. Blending microbial solutions with existing land management practices opens up exciting possibilities for low-impact agriculture.

This presentation shares preliminary results from two EU co-funded projects (Interreg North Sea Region and EJP-Soil co-funded by the Norwegian Research Council) exploring how soil microbial communities can adapt to salinity. These studies suggest that microbial populations develop what's called **Saline Induced Community Tolerance (SICT)**—essentially becoming more tolerant to salt over time. This is strongly corelated with the saline irrigation regime maintained in a field experiment (>8 years consecutive treatment). But this is a competence they seem to lose as soon as the stress is relieved (saline irrigation terminates). If these salt-tolerant microbes also help plants become more salt-resistant, we could harness this relationship to improve crop resilience in tough conditions, by forcing a Darwinian selection process to push soil biological communities to become increasingly tolerant of saline conditions by the process of adaptation. This could be especially important in areas where farmers are turning to brackish water for irrigation—a growing necessity in regions facing water shortages and rising salinity.

By understanding how microbes adapt and interact with plants and soils in salty environments, we can build smarter, more sustainable farming systems. These nature-based solutions can reduce the need for costly inputs, protect long-term soil health, and support both food security and environmental goals in coastal, salt-affected areas.