Presentation A12: Green Practices in Agriculture Against Climate Change

GREEN PARTICIPATION GREEN EUROPE

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Istanbul University Laboratory of Biotechnology Researches

INDEX

Soil

What is soil?
How does soil affect us?
How do we affect soil?

Agriculture

What's happening to our Earth?
How can we change our ways?

Green Practices

How can we make agriculture more eco-friendly and sustainable?

Around 12.000 years ago, people started to practice agriculture; which ignited the fuse for the modern human society that we know and live in today.



Grave chamber of an Egyptian public official, circa 1250 BCE.

Carey, J. (2023). Unearthing the origins of agriculture. Proceedings of the National Academy of Sciences, 120(15).
Photo: public domain.

Through ages, different cultures assigned different meanings to the soil.

- **Demeter**, Greek goddess of grasses, fertile land, grains, fruit and agriculture.
- **Emesh**, Sumerian god of vegetation and the abundance of the earth.
- **Dagon**, Mesopotamian god of fertility, Earth and grain.
- **Prithvi**, Hindu goddess of Earth and soil.
- **Tlaltecuhtli**, Aztec goddess of Earth and soil.
- **Yer Ana**, Turkic goddess of Earth, fertility, agriculture, and natural balance.



And one understanding is certain amongst all the cultures of humanity:

Soil feeds us, nurtures us, takes care of us.



95% of our food is directly or indirectly produced on our soils.

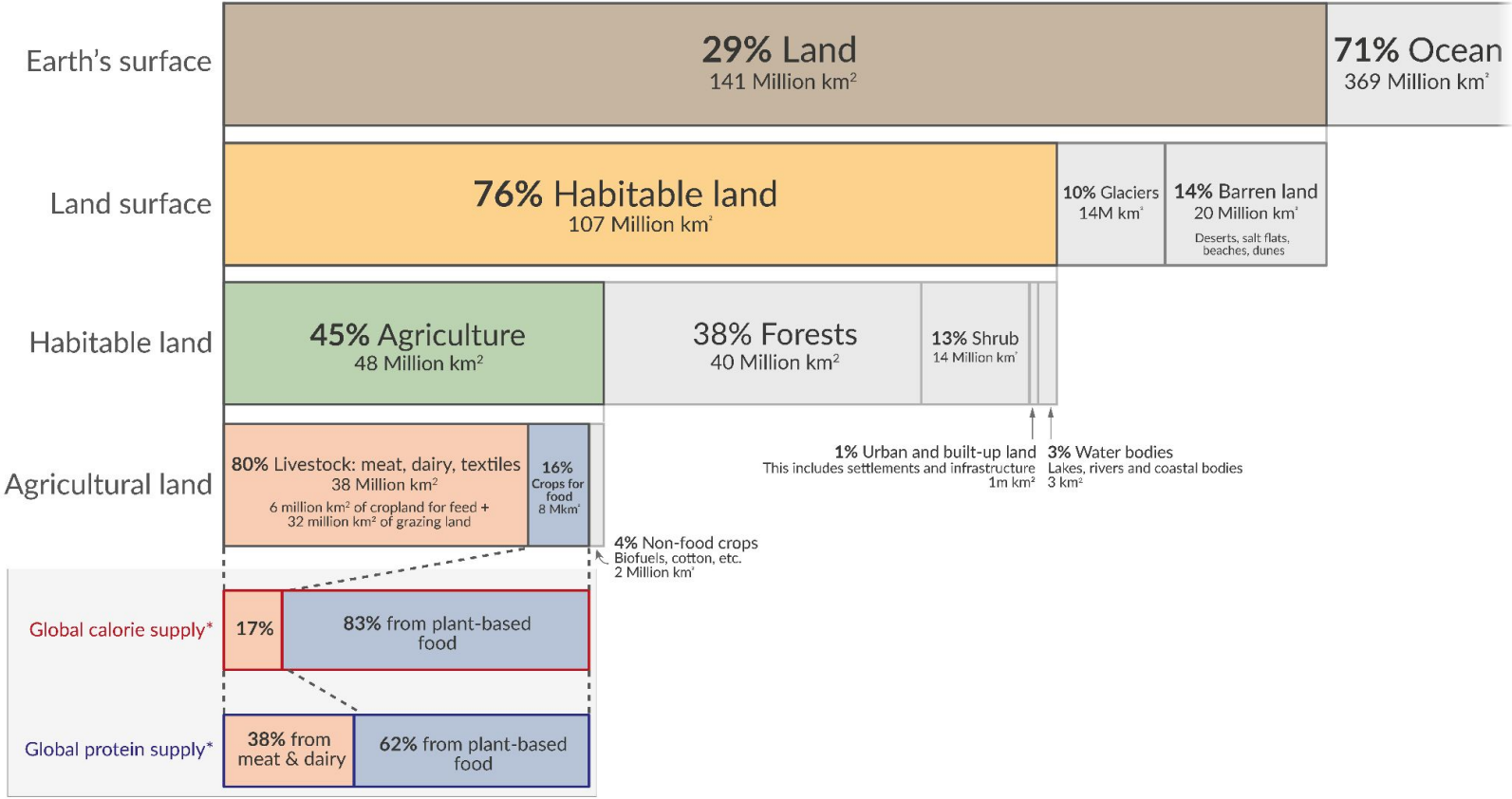


https://www.fao.org/soils-2015/news/news-detail/en/c/277682/

But how do we treat soil back?



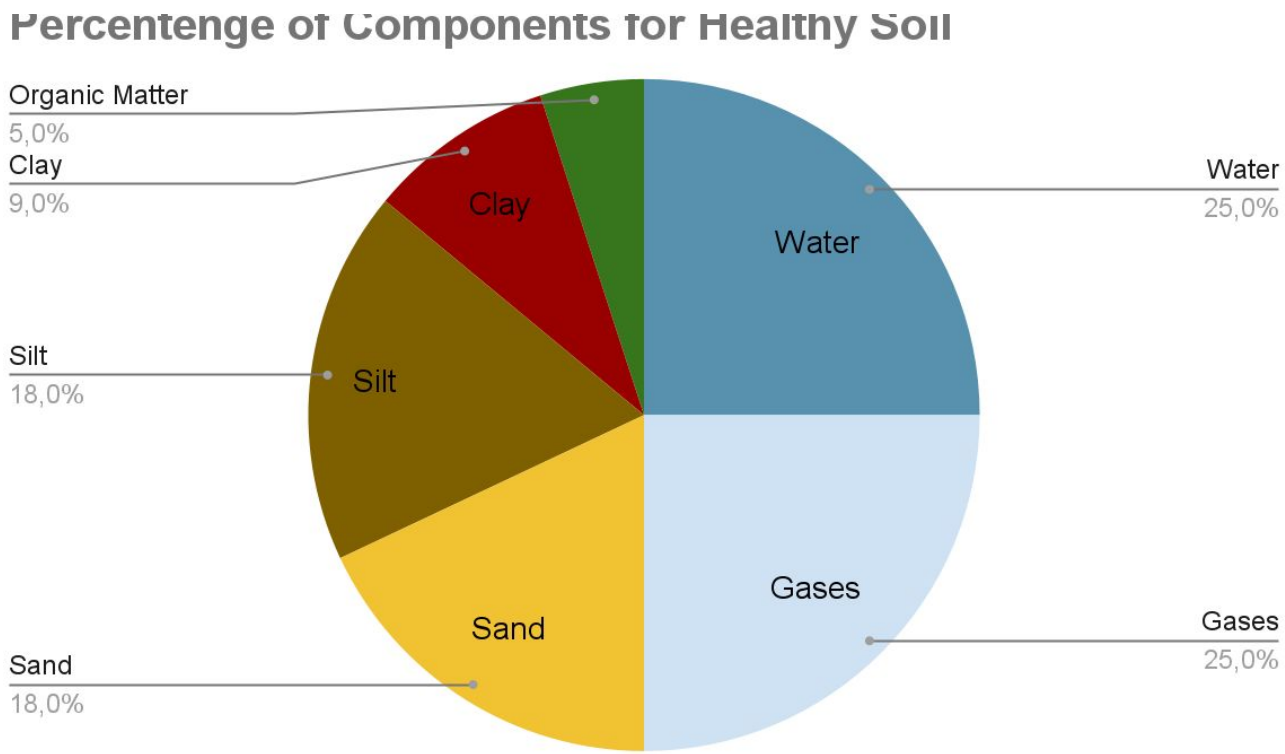
Global land use for food production

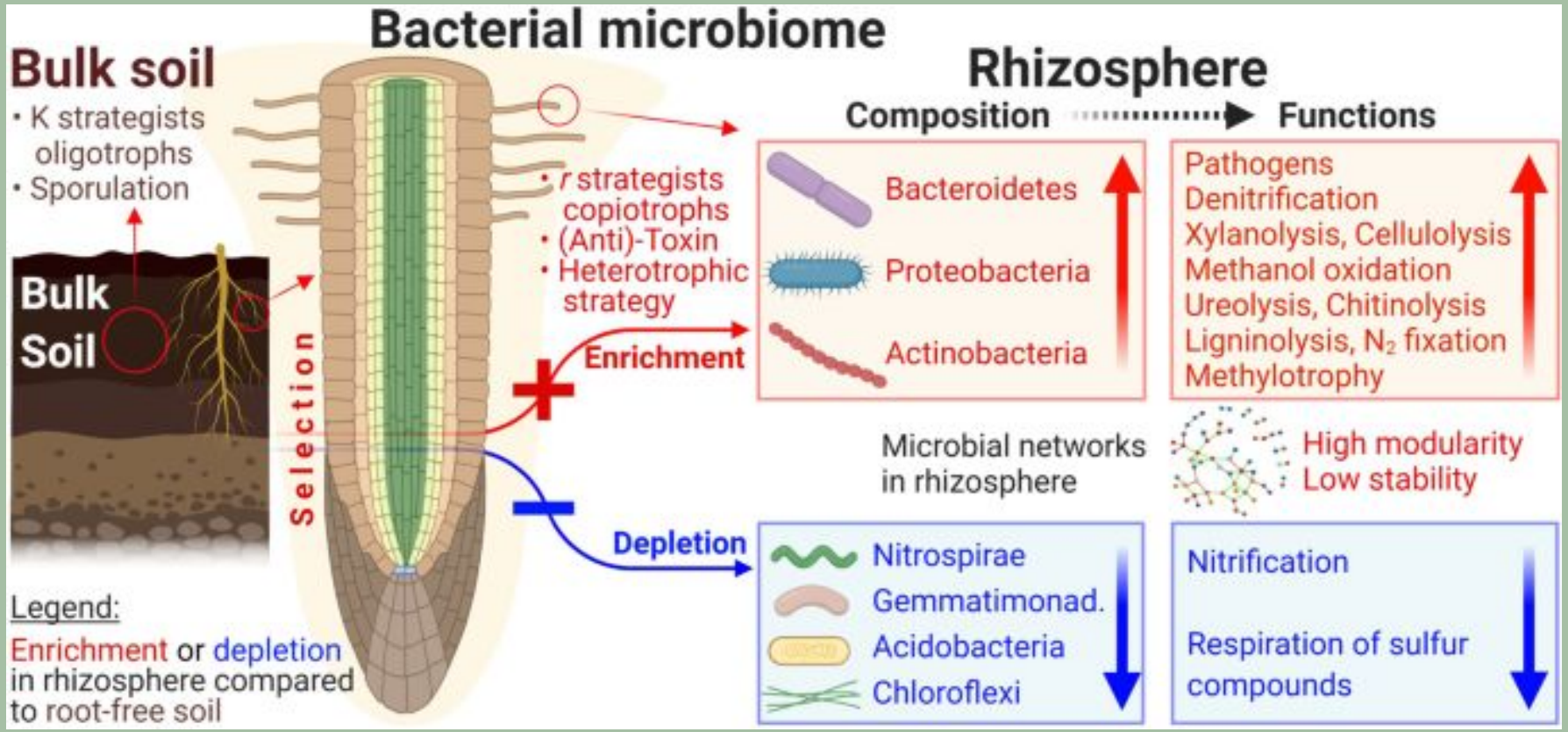


Hannah Ritchie and Max Roser (2019) - "Half of the world's habitable land is used for agriculture" Published online at OurWorldinData.org. Retrieved from: 'https://ourworldindata.org/global-land-for-agriculture' [Online Resource]

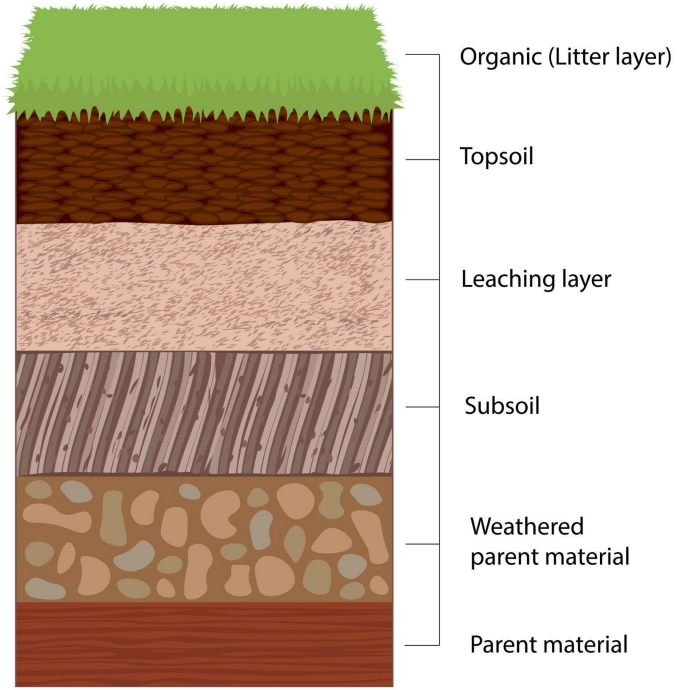
Licensed under CC-BY by the authors Hannah Ritchie and Max Roser (September 2023).

Soil is a complex mixture with several key components that contribute to its structure, fertility, and ability to support life.





Ling, N., Wang, T. & Kuzyakov, Y. Rhizosphere bacteriome structure and functions. Nat Commun 13, 836 (2022). https://doi.org/10.1038/s41467-022-28448-9



https://topsoilnottingham.net/gardening/topsoil-compost/

Topsoil is the nutrient-rich, upper layer of soil, essential for plant growth due to its high content of organic matter, nutrients, and microorganisms. Topsoil is **home to a diverse community of organisms** that aid in nutrient cycling and decomposition, contributing to soil fertility.

Typically **10-25 cm deep**, it supports root systems and helps retain water, making it **vital for agriculture** and ecosystem health.

Worsening land degradation caused by human activities is undermining the well-being of two fifths of humanity, driving species extinctions and intensifying climate change.

If we don't change the ways of our agriculture, we have less than 60 years worth of topsoil left to use, according to UN authorities.

https://www.unesco.org/en/articles/worsening-land-degradation-impacts-32-billion-people-worldwide

How can we change our ways for better?

Agriculture is the largest global consumer of freshwater, using approximately 70% of the world's accessible freshwater resources, according to the Food and Agriculture Organization (FAO) of the United Nations. In some arid regions, this percentage can be even higher, reaching up to 90% of total water withdrawals.

https://www.fao.org/aquastat/en/

We can use the water more efficiently in agriculture.

Drip Irrigation

Delivers water directly to the root zone of each plant, minimizing evaporation and reducing water use by as much as 50% compared to traditional methods.



Scheduling Irrigation

Using weather forecasts, soil moisture sensors, or crop growth stages to apply water only when needed, avoiding over-irrigation and saving resources.

Rainwater Harvesting

Collecting and storing rainwater for later irrigation, which reduces reliance on groundwater and provides a sustainable water source.



Crop Selection

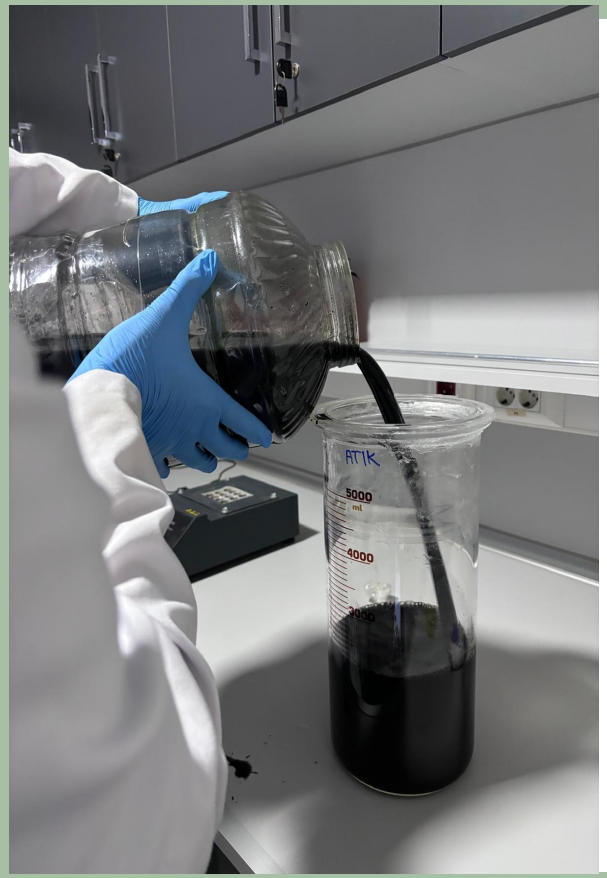
Growing drought-tolerant or native crops suited to local conditions minimizes water requirements and increases resilience during dry periods.



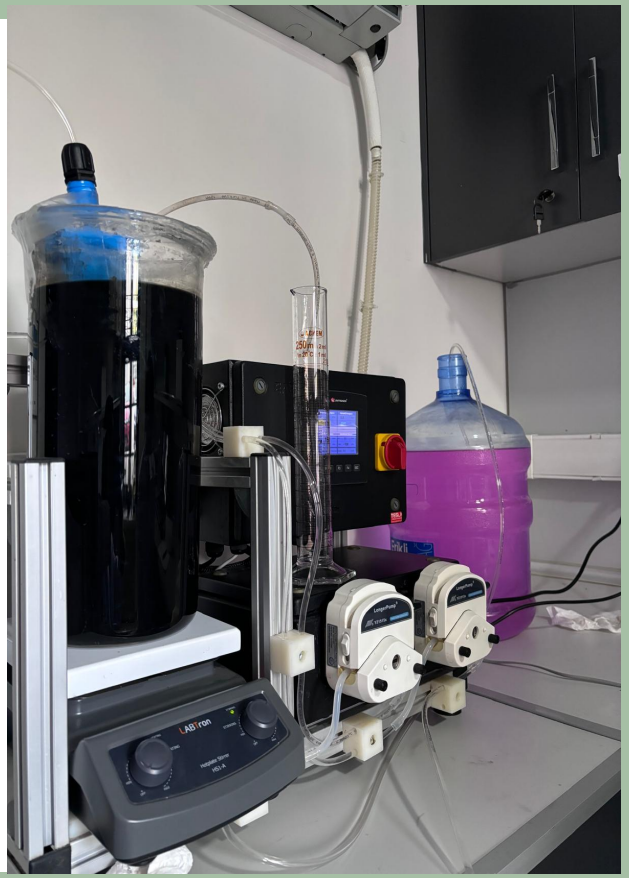
Mulching

Adding organic or synthetic cover on soil to reduce evaporation, retain moisture, and keep the soil cool.





“Improvement of the reuse of treated wastewater in agricultural irrigation to mitigate the effects of climate change”



Soil erosion is the removal of the topsoil layer, which contains the highest concentration of nutrients and organic matter. This can lead to reduced agricultural productivity and long-term soil degradation.

- **Causes of Soil Erosion**:
  - **Water Erosion**
  - **Wind Erosion**
  - **Agricultural Practices**
  - **Climate Change**



Surface runoff of topsoil from a field in Iowa during a rainstorm

Lynn Betts, photographer - U.S. Department of Agriculture, Natural Resources Conservation Service

Worldwide it is estimated that approximately 75 billion tons of fertile soil are lost from world agricultural systems each year.

Currently, about 80% of the world's agricultural land suffers moderate to severe erosion, while 10% experiences slight erosion.

Pimentel, D., & Burgess, M. (2013). Soil erosion threatens food production. Agriculture, 3(3), 443–463. https://doi.org/10.3390/agriculture3030443

What can we do to prevent erosion?

Cover Cropping

Planting crops like rye or clover during off-seasons to protect soil.



Contour Farming

Planting along natural slope contours to slow down water runoff, helping soil stay in place.



Conservation Tillage

Reducing plowing to leave crop residues on the soil surface.









Windbreaks

Planting rows of trees or shrubs to block wind and prevent soil from being blown away.

Agroforestry

Growing trees alongside crops; tree roots stabilize the soil, reducing erosion from wind and rain.

Mulching

Adding a layer of organic or synthetic material on the soil surface to protect against erosion.

We can minimize air and water pollution in agriculture through sustainable practices that reduce harmful emissions, runoff, and chemical use.



We can utilize the methods we talked earlier for minimizing the air and water pollution in agriculture.

Improve Irrigation Techniques

Drip Irrigation: Directs water to the plant roots, reducing runoff and preventing nutrient leaching into water bodies.

Use Renewable Energy and Low-Emission Equipment

Adopt Conservation Tillage and Cover Crops

Encourage Agroforestry

Planting trees around farms absorbs carbon dioxide, reduces wind erosion, and serves as a buffer for water runoff, reducing pollutants reaching water sources.

Reduce Chemical Fertilizers and Pesticides

- **Integrated Pest Management (IPM)** is an an ecological approach which uses natural predators, crop rotation, and biological controls instead of relying heavily on chemical pesticides.



Precision Fertilization

Applying fertilizers based on soil and crop needs, often with GPS-guided equipment, reduces excess fertilizer use and nutrient runoff.

Bioaugmentation

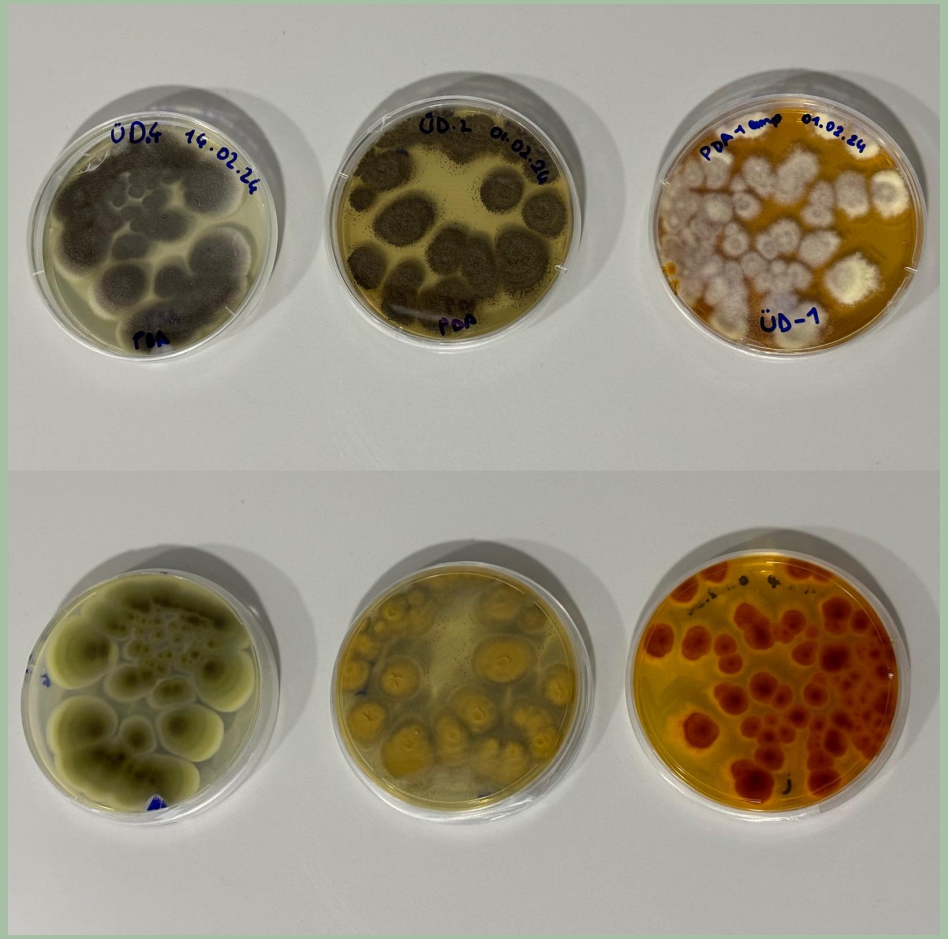
Bioaugmentation involves adding beneficial microorganisms, such as bacteria or fungi, to soil or crops to enhance nutrient cycling and make nutrients more accessible to plants.

Biostimulation

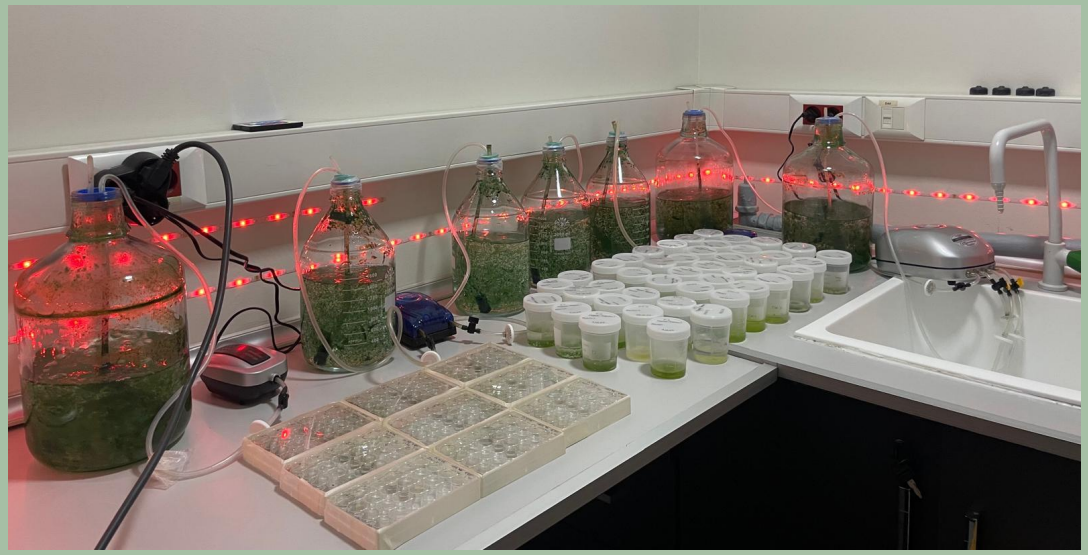
Biostimulation involves adding organic or inorganic substances (like compost, biochar, or natural stimulants) to encourage the growth of native soil microorganisms that support plant health and nutrient cycling.

By integrating bioaugmentation and biostimulation with precision fertilization practices, farmers can create a sustainable, **bio-friendly approach that improves soil fertility**, supports crop health, and reduces the ecological impact of farming.




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ÜD.2 01.02.24
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ÜD-7






S7
MP3

THANK YOU FOR YOUR TIME AND ATTENTION

And Remember, What We Do
To Earth, We Do To Ourselves.

One little quiz before you leave!

You can participate by scanning the QR code.