



UNIVERSITY OF LIFE SCIENCES "KING MIHAI I" FROM TIMISOARA

"YOUNG PEOPLE AND MULTIDISCIPLINARY RESEARCH IN APPLIED LIFE SCIENCES"



"Young people and multidisciplinary research in applied life sciences"

21-22 November 2024

SOIL HEALTH AND REGENERATION: BUILDING RESILIENT AGRICULTURAL SYSTEMS

GEORGE MORAR¹, CANTEA (ANDO) ANA MARIA¹, JIGU ROXANA¹, ADRIAN SMULEAC¹, Raul PAȘCALĂU¹,
¹University of Life Sciences" King Mihai I" from Timisoara, 300645, 119, Calea Aradului, Timisoara, Romania
e-mail: raul.pascalau@usvt.ro

Abstract: Agricultural systems have historically played a pivotal role in advancing food security, yet the sustainability of such systems now contends with unprecedented obstacles, including climate change, soil degradation, and a decline in biodiversity. In light of these urgent challenges, the notion of soil health has surfaced as an essential link between ecological soundness and agricultural output. This preliminary discourse intends to clarify the varied aspects of soil health, investigating its importance not solely in boosting crop production but also in reinstating ecological equilibrium. By promoting regenerative methodologies—like crop rotation, cover cropping, and the integration of organic supplements—various stakeholders may foster a mutually beneficial relationship between soil vitality and agricultural durability. Acknowledging soil as a dynamic ecosystem filled with diverse organisms accentuates the necessity of caring for this natural asset; consequently, soil health is poised as a crucial foundation in the pursuit of agricultural systems that are sustainable and capable of enduring environmental disturbances while satisfying future food needs.

• Introduction

The decline in the health of soil engenders notable obstacles to the security of food on a global scale, mainly attributable to the mounting pressure exerted upon agricultural systems to yield greater outputs amidst a backdrop of deteriorating soil quality. An excessive dependence on traditional agricultural methods, typically marked by rampant tillage alongside the application of chemical fertilisers and pesticides, has culminated in the degradation of soil, thereby impairing its fertility and biodiversity (Eugen POPESCU et al., 2022).

• Material and method

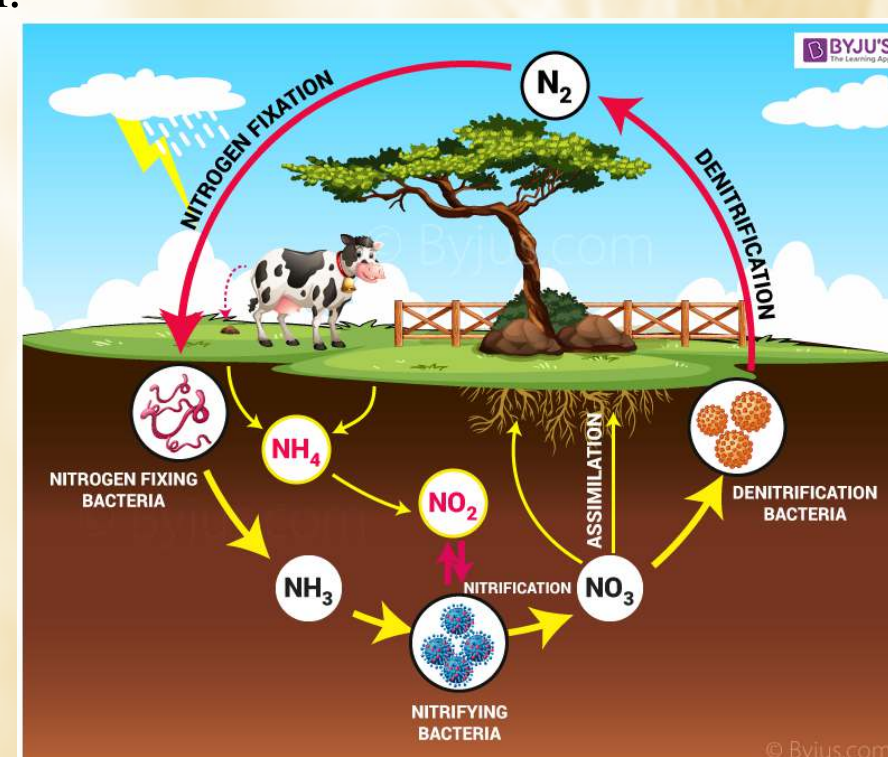
The relationship between soil health and agricultural productivity is notably complex and has become a significant subject of current scholarly inquiry, particularly due to its ramifications for food security and the sustainability of ecosystems. Soils characterised by biodiversity, sufficient organic matter, and proper nutrient cycling are essential to robust agricultural systems. In areas like Sub-Saharan Africa, the repercussions of diseases such as HIV/AIDS intensify food insecurity, as farming families, facing adversity, experience a decline in both traditional agricultural knowledge and the assets required for farming ((Wright et al., 2008). By encouraging methods that bolster soil health, for instance, through organic farming, communities are able to grow nourishing food on a local scale, presenting a feasible substitute to typically expensive pharmaceutical solutions ((Wright et al., 2008).

B. The role of soil microorganisms in nutrient cycling

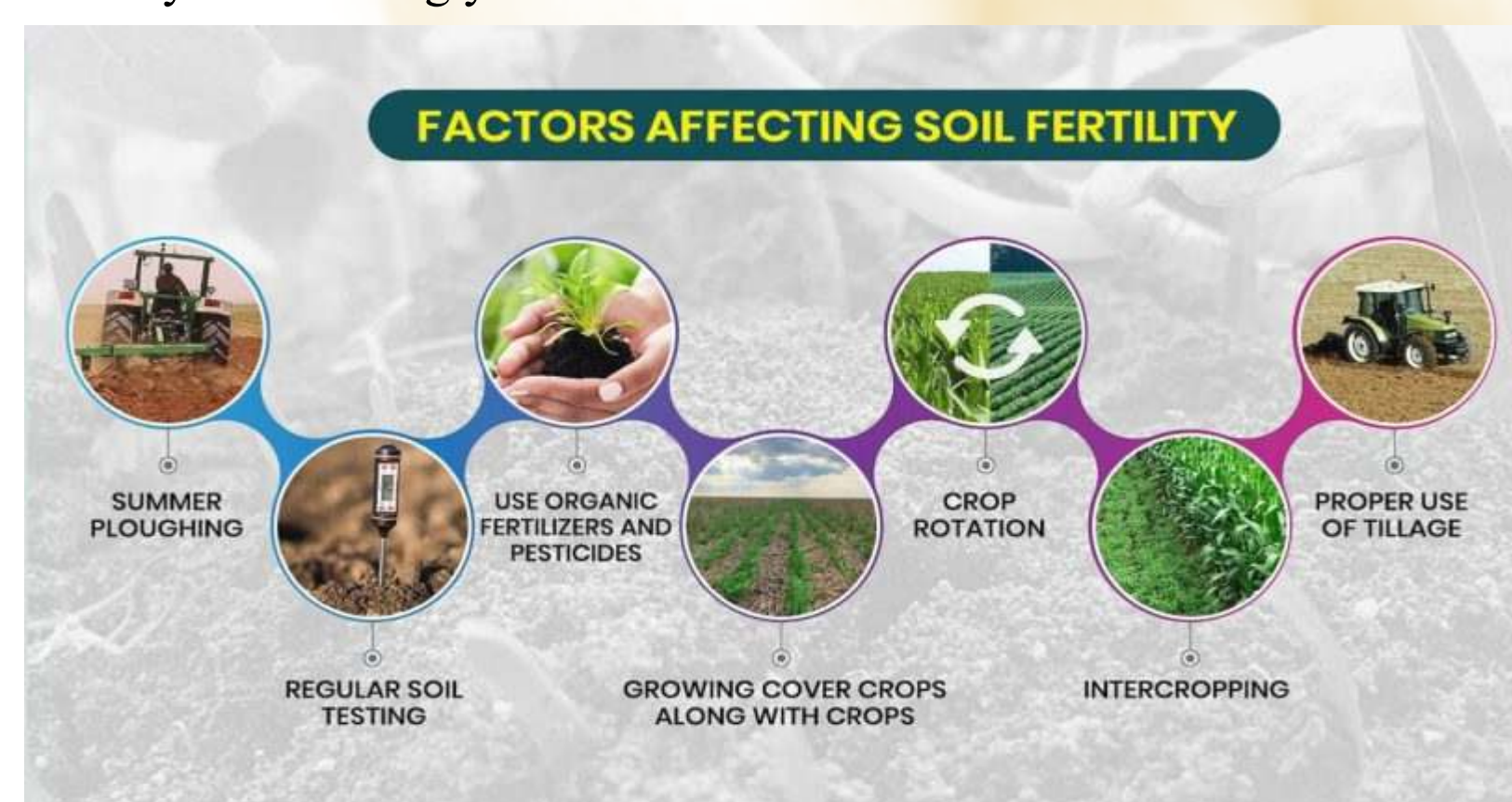
A complex and dynamic web comprising soil microorganisms holds significant importance in the cycling of nutrients, which is fundamentally requisite for the upkeep of soil health and the promotion of sustainable agricultural frameworks. Constituents of this microbial assemblage, notably bacteria and fungi, engage in the decomposition of organic substances, thus liberating essential nutrients including nitrogen, phosphorus, and potassium back into the soil matrix, hence augmenting their accessibility for plant absorption.

The impact of soil structure and composition on agricultural productivity

The structure and composition of soil exert significant influence over agricultural productivity, impacting fundamental elements such as availability of nutrients and retention of water. Soil that is well-structured, accompanied by a varied composition, serves to enhance the penetration of roots and cultivates advantageous microbial communities, which are essential for the breakdown of organic matter and the cycling of nutrients. In contrast, soils that are poorly structured may result in compaction, which limits the growth of roots and obstructs the infiltration of water, thereby diminishing yields.



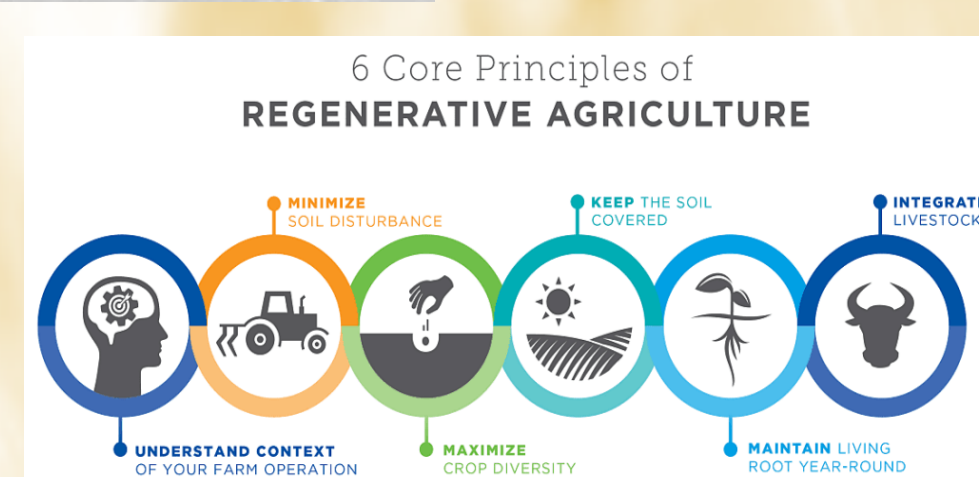
Nutrient Cycle: Definition, Examples and Importance



The impact of soil structure and composition on agricultural productivity

How to Make the Soil Fertile? Method to Improve Fertility

The Six Principles of Regenerative Farming



• Conclusions

To summarise, the quest for soil health alongside regenerative agricultural methodologies stands out as an essential strategy for addressing the varied challenges faced by modern agricultural practices. The intricate interrelations among factors such as fluctuations in climate, increases in population, and the ongoing degradation of land demand adaptive methodologies that place a premium on ecological resilience. As emphasised in earlier studies, practises including mulching, composting, and agroforestry tend to not only bolster agricultural output but also augment ecosystem services ((Ayantunde et al., 2020)). Nevertheless, the notion of regenerative agriculture, despite its hopeful potential to enhance soil health and biodiversity, requires a more thorough delineation and empirical corroboration to validate its assertions ((Ekroth et al., 2022).

• Results and discussions

Practices for Soil Regeneration

The practices deemed effective in the realm of soil regeneration assume a crucial role in the cultivation of agricultural systems that are resilient enough to endure environmental stresses. Techniques including, but not limited to, cover cropping, crop rotation, and agroforestry not only bring about improvements in soil structure but also foster an increase in biodiversity, thereby contributing to the overall health of ecosystems.



Plough to Precision: Unveiling the Benefits of Conservation Tillage

B. Cover cropping as a method to enhance soil fertility

The use of cover cropping stands as a significant method in the enhancement of soil fertility, which in turn forms a fundamental aspect of sustainable agricultural practices. The incorporation of various plant species during periods of fallow allows farmers to mend soil structure, boost organic matter levels, and improve nutrient cycling, collectively serving to improve other crop yields. This practice bears not only the potential to lessen soil erosion and diminish weed pressures but also to create a favourable habitat for soil microorganisms, which are crucial for sustaining a dynamic ecosystem.

C. Organic amendments and their role in improving soil health

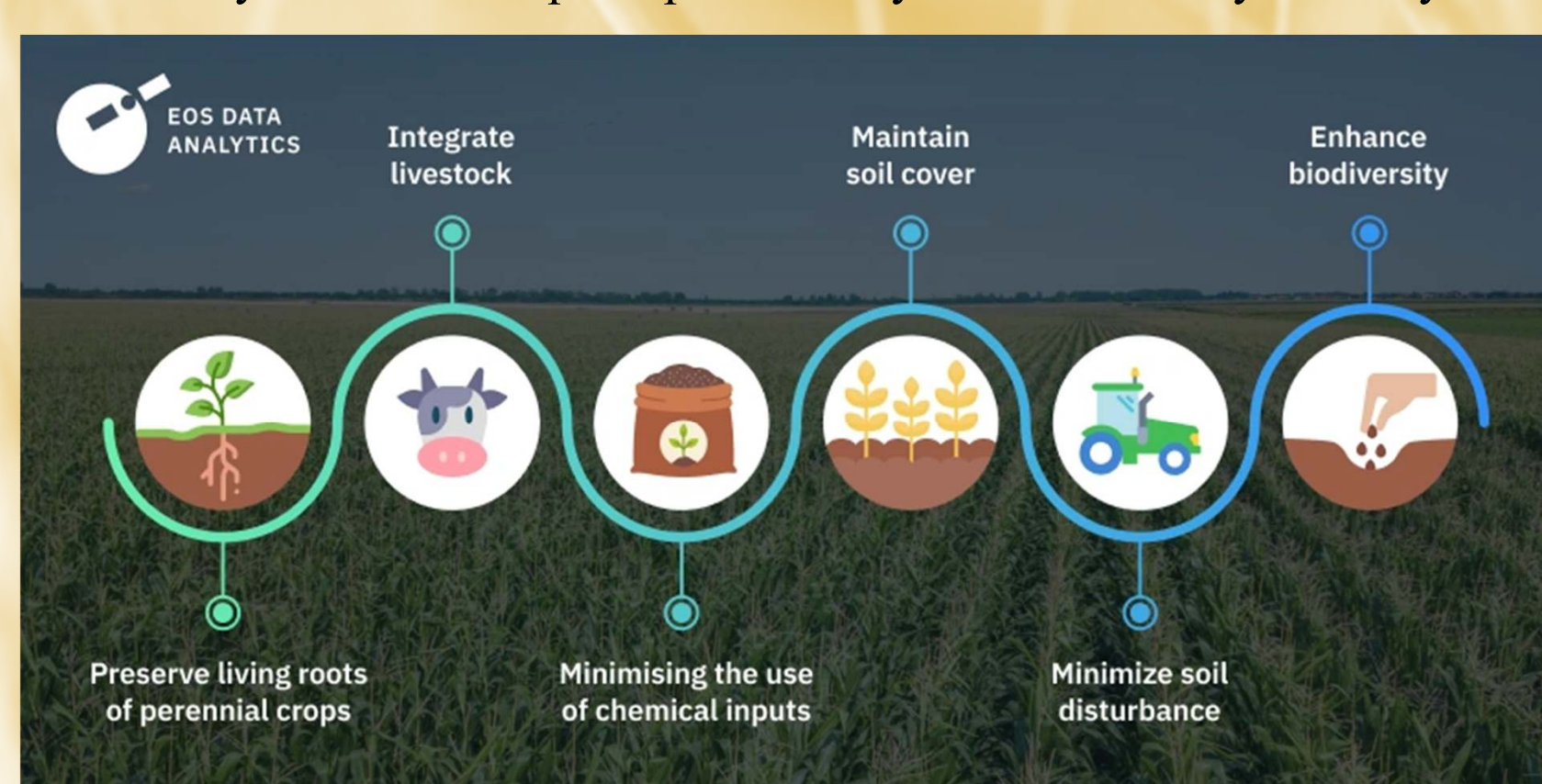
The incorporation of organic amendments within agricultural methodologies constitutes a paradigm shift aiming to bolster soil vitality and the overarching resilience of ecosystems. Such amendments encompass various materials, including animal manures, compost, cover crops, and residues from crops. These constituents not only serve to replenish vital nutrients but also assist in developing a more resilient soil structure alongside enhancing microbial diversity.



How to improve soil quality?

The importance of biodiversity in soil health and resilience

A diverse range of biodiversity within soil ecosystems is of considerable importance for the maintenance of soil health and the enhancement of resilience in light of environmental stressors. Varied microbial communities, together with assorted macroorganisms, fulfill crucial functions in the decomposition of organic matter, the cycling of nutrients, and the formation of soil structure, which collectively contribute to plant productivity and the stability of ecosystems.



Regenerative Agriculture Practices And Environmental Impacts