EJP SOIL
European Joint Programme

TARGET STAKEHOLDERS

Plant–soil synchrony in nutrient cycles: Learning from ecosystems to design sustainable agrosystems

REDESIGN AGROSYSTEMS

Cropping systems can be improved by incorporating the level of **synchrony** between soil supply of soluble nutrients and plants demand for those nutrients

SYNCHRONY SYSTEMS

There are **four synchrony systems** that co-occur on a system. However, these are dependent on the pedoclimatic context, plant functional type and biodiversity level

MANAGING SYNCHRONY

Knowing when and how to **enhance synchrony** is key for taking appropiate management decisions, to make the changes needed for a sustainable productive agrosystem

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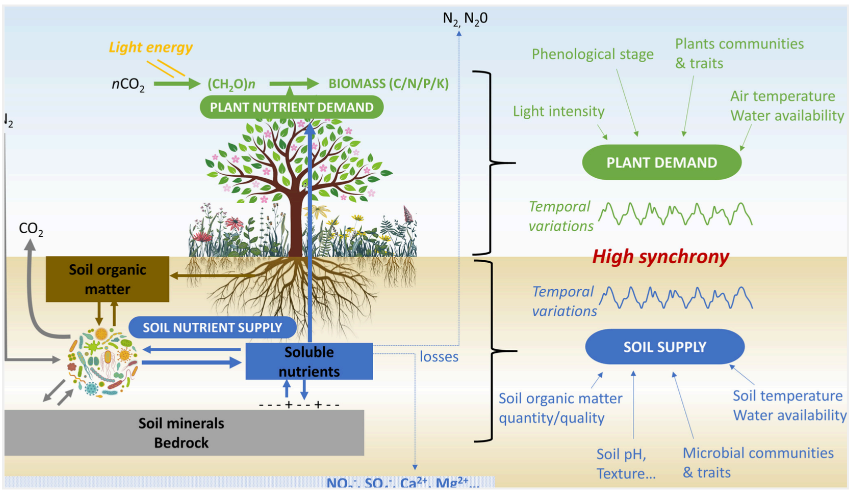

AN INTEGRATED FRAMEWORK TO DESIGN SUSTAINABLE AGROSYSTEMS

The **proposed framework** is using the knowledge on how natural ecosystems have a **synchronized biochemical functioning**, in order to create more sustainable agrosystems.

With the **analysis of the synchrony systems**, researchers have been able to:

- **Select** the types of **synchrony systems** that should be promoted based on the *pedoclimatic conditions.*
- **Recommend** different **management practices** that could *enhance the synchrony systems in the cropping systems.*

EJP SOIL INNOVATION HIGHLIGHTS

Synchrony	Conditions of synchrony	Combination of practices to set up for promoting the targeted synchrony
Sync-MAOM	-Acquisitive plant species -Continuous activity of microbes M & I -Reserve of MAOM in soil	- Use/breed acquisitive species with strong capacity of stimulating microbial mineralization/immobilization, e.g. high C rhizodeposition - The carbon:nutrient ratio of plant species or organic residues must be high enough to induce nutrient immobilization. Ideally, the different plant species have contrasting carbon:nutrient ratios (a, c, I, j, k) - Maintain a continuous cover of active plants fueling microbes in energy-rich C (all pictures but e) - Recycle organic nutrients at local scale (farm-watershed) to preserve soil organic reserve on the long-term (d, e, f) - Inoculate with immobilizing and mineralizing microbes in highly degraded soils
Sync-FreeOM	-Conservative plant species -Mycorrhizal fungi -Reserve of FreeOM in soil	- Use/breed conservative species producing recalcitrant litter with reactive compounds fixing organic nutrients (e, f)* - Amend with recalcitrant organic residues harboring reactive compounds more or less charged in organic nutrients (e) - Recycle organic nutrients at local scale (farm-watershed) to preserve soil organic reserve on the long term (d, e, f)
Sync-Inorganic	-Plant symbiosis with mycorrhizal fungi & N_2 fixing bacteria -Nutrients stored in bedrock, soil minerals and/or precipitates	- Use/breed species with strong capacity of mobilizing nutrients from rock and soil minerals, e.g. mycorrhized roots exerting strong mechanic pressure on minerals, secreting high amount of organic acids & ligands - Use of plant with deep roots colonizing bedrock (g, h, i) - Use of legumes (a, c, k) - Inoculate with mixed mycorrhizal fungi & N_2 fixing bacteria in highly degraded soils
Sync-Market	-Plant species with complementary nutritional needs -Common mycorrhizal networks	- Mix plant species with different nutrient acquisition strategies and carbon:nutrient ratios (a, c, I, j, k) - Promote perennial plants (f, g, h, I, k) and/or permanent plant cover (all pictures but e) to fuel mycorrhizae in energy-rich carbon - No or limited use of soil tillage (b) and pesticides to preserve mycorrhizae networks - Inoculate with mixed mycorrhizal fungi in highly degraded soils
Increasing overall synchrony	-Synchrony systems adapted to pedoclimatic context -Complementary synchrony systems -Plant plasticity & reserve	- Analyze the soil profile and climate, defining the proportion of the different synchrony systems to promote accordingly - Mix plant species with different nutrient acquisition strategies (a, c, I, j, k) - Breed crops species for their suitability to association - Promote perennial plants with high reserve and organ plasticity (f, g, h, I, j, k)

TOWARDS CLIMATE-SMART SUSTAINABLE MANAGEMENT OF AGRICULTURAL SOILS

EJP SOIL is a European Joint Programme on Agricultural Soil Management addressing key societal challenges including climate change and future food supply. https://ejpsoil.eu/

The goal is to improve the understanding of agricultural soil management by finding synergies in research, strengthening research communities and raising public awareness.

1100+ experts, 24 countries, addressing multiple aspects of soil management across different European agroecosystems.

EJP SOIL FUNDED PROJECT

AGROECOSeqC

Aims to investigate the underlying mechanisms promoting the synchrony between plant demand and nutrient supply by soil microbiome, with the purpose to build sustainable agricultural systems where plant, soil fauna and microbial diversity are key drivers to reduce nutrient losses, GHG emission, and increase C sequestration in soil.

PROJECT COORDINATOR

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TARGET EJP SOIL EXPECTED IMPACT AND EU MISSION SOIL OBJECTIVES

Fostering understanding of soil management and its influence on climate change mitigation and adaptation, sustainable agricultural production and environment. Develop and demonstrate region- and context-specific fertilization practices (soil, water and pedo-climatic conditions) **Mission SOIL**: conserve soil organic carbon stocks, prevent erosion, improve soil structure to enhance soil biodiversity

Applicability:
all climatic zones according to Metzger et al. (2005)
https://doi.org/10.1111 j.1466-822X.2005.00190.x

HIGHLIGHT FACTS FROM:

EJP SOIL funded project:
AgroecoseqC

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