HUNGARY: INTEGRATING NATURE-BASED SOLUTIONS FOR SUSTAINABLE NUTRIENT MANAGEMENT

Summary

The Hungarian NBS site demonstrates how multiple nature-based solutions can be integrated into a low-input arable farming system. Compared with conventional management, the NBS approach maintained plant nutrient status, improved soil-health indicators and reduced CO_2 emissions per unit of yield, particularly in sorghum and durum wheat. While yield performance varied by crop and season, the results highlight the potential of NBS to support climate-resilient farming. The case also emphasises the importance of long-term monitoring, advisory support and farmer demonstrations for successful adoption.

The need

The Hungarian NBS site responds to the need to make intensive arable production more resilient, lower-input and better aligned with the ecological sensitivity of the Szigetköz region. The trial area is located in a productive agricultural landscape that is also part of a Natura 2000 area, with high biodiversity value, wetland habitats and complex soil and hydrological conditions. This creates a dual need: maintaining viable crop production while reducing pressure on soils, biodiversity, nutrient cycles and climate.

The site also addresses a practical adoption gap. Many individual NBS practices are already known, but farmers need to see whether they can work together as a coherent farming system under real commercial-scale conditions. The case therefore focuses not only on agronomic performance, but also on demonstrating feasibility, monitoring needs and decision-support options for farmers.

Funded by
the European Union

The benefits

- Reduced climate pressure: CO_2-emission measurements showed consistently lower or equal emissions per unit of yield under NBS, with statistically significant reductions reported for sorghum and durum wheat in the later monitoring period.
- Maintained crop nutrition: leaf analyses showed no significant differences between NBS and conventional treatments, indicating that the NBS system maintained adequate plant nutrient status despite reduced reliance on conventional inputs.
- Positive soil trends: after three years, soil analyses indicated positive trends in organic carbon, organic matter, potentially mineralisable nitrogen and total nitrogen, especially in the upper 0–30 cm layer.
- Yield potential: durum wheat performed consistently well under NBS; in 2024, the NBS treatment delivered higher yields across durum wheat, soybean and sorghum, while 2025 results were more crop- and year-dependent.
- Biodiversity relevance: the Szigetköz landscape supports high bird diversity and includes protected and highly protected species, making biodiversity-sensitive farming especially relevant.
- Better decision-making: soil, leaf, drone, satellite and CO_2 monitoring support site-specific nutrient management rather than fixed input schedules.

HUNGARY: INTEGRATING NATURE-BASED SOLUTIONS FOR SUSTAINABLE NUTRIENT MANAGEMENT

trans4num solution

The Hungarian NBS case demonstrates an integrated production system on a 20-hectare field in Kimle, comparing nature-based and conventional farming over a three-year rotation of durum wheat, sorghum and soybean.

The NBS package combines no-tillage, reduced pesticide use, poultry manure pellets, biostimulants, winter cover crops, mulching, and integrated crop and soil monitoring. Performance is assessed through soil and leaf analyses, drone and satellite imagery, NDVI, soil profiling and CO_2 measurements.
Rather than testing individual practices in isolation, the trial demonstrates that a complete NBS system can be successfully integrated into commercial farming while maintaining crop nutrient status and delivering environmental benefits. Monitoring also shows that drone imagery helps identify management zones and natural soil variability, supporting more precise field management.

The Hungarian NBS site AKIS links researchers, farmers, advisors, environmental educators and local stakeholders to support NBS adoption. Knowledge is shared through field demonstrations, workshops, questionnaires and farmer discussions. Events in Dunasziget and Mosonmagyaróvár brought together farmers, advisors and public authorities to exchange experiences and discuss implementation.

The main scaling pathway is to translate research findings into practical guidance, advisory recommendations and decision-support tools that help farmers identify where and how NBS can be successfully adopted.

What were the challenges / limitations in the implementation process?

- Soil-health improvements require long-term monitoring.
- Natural soil variability can mask treatment effects.
- Crop performance varies with seasonal climate conditions.
- NBS requires careful monitoring and technical support.
- Reduced pesticide use demands more adaptive crop management.
- Farmer adoption depends on confidence in the system's practicality and profitability.

What kind of resources do you need to implement the proposed solution?

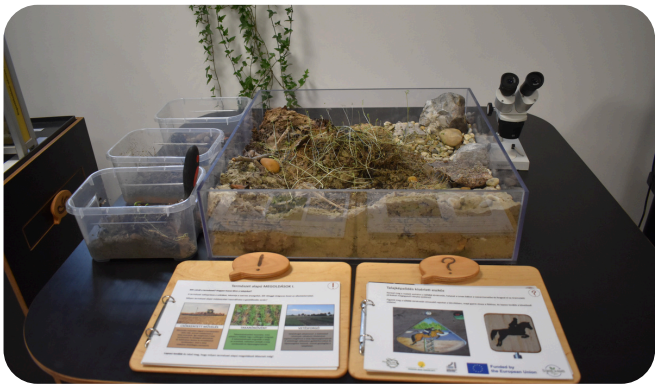
- Bio-based fertilisers and suitable application equipment.
- Knowledge of no-till, crop rotation and cover crop management.
- Soil, crop and remote-sensing monitoring tools.
- Decision-support and data management systems.
- Farmer training and demonstration activities.
- Collaboration among farmers, advisors and researchers.

HUNGARY: INTEGRATING NATURE-BASED SOLUTIONS FOR SUSTAINABLE NUTRIENT MANAGEMENT

More information

- Find more about the Hungarian NBS site
- Read more Practice Abstracts
- Explore the NBS Tools
- trans4num legacy: the Green connections project
- Exploring soil, solutions, and learning: trans4num professional day in Hungary
- Building resilient soils in Hungary animation



Learn more about the project at https://trans4num.eu/en/

@trans4num @trans4num @trans4num

@trans4num @trans4num

Funded by the European Union

Views and opinions expressed here are however those of the author(s) only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.