# Circular Agronomics

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*Circular solutions for carbon and nutrient management*

## Challenge

Food management of carbon (C), nitrogen (N), phosphorus (P) and potassium (K) in agriculture is crucial to maintain a fertile and healthy soil and allow adequate plant growth. Every year we apply millions of tonnes of nutrients to our soils to grow our food. And yet, it is currently estimated that for every five tons of nitrogen entering the EU agri-food chain, only one ton is converted to finished products for human consumption. The case is similar for phosphorus and potassium. These low nutrient use efficiencies, combined with poor soil management practices, are leading to a loss of organic carbon and nutrients from soils which is having a significant negative impact on soils, water and air, leading to unacceptable health and environmental costs.

Moving towards a circular system of nutrient management can help us overcome these challenges. It is imperative that we find ways to improve nutrient use efficiency at the farm level, and recover and reuse nutrients that remain in manure and food waste. Circular agronomics is working with 19 partners to test innovative ways of increasing nutrient use efficiencies and recovery to contribute to a more circular system of agriculture in Europe.

## Project approach

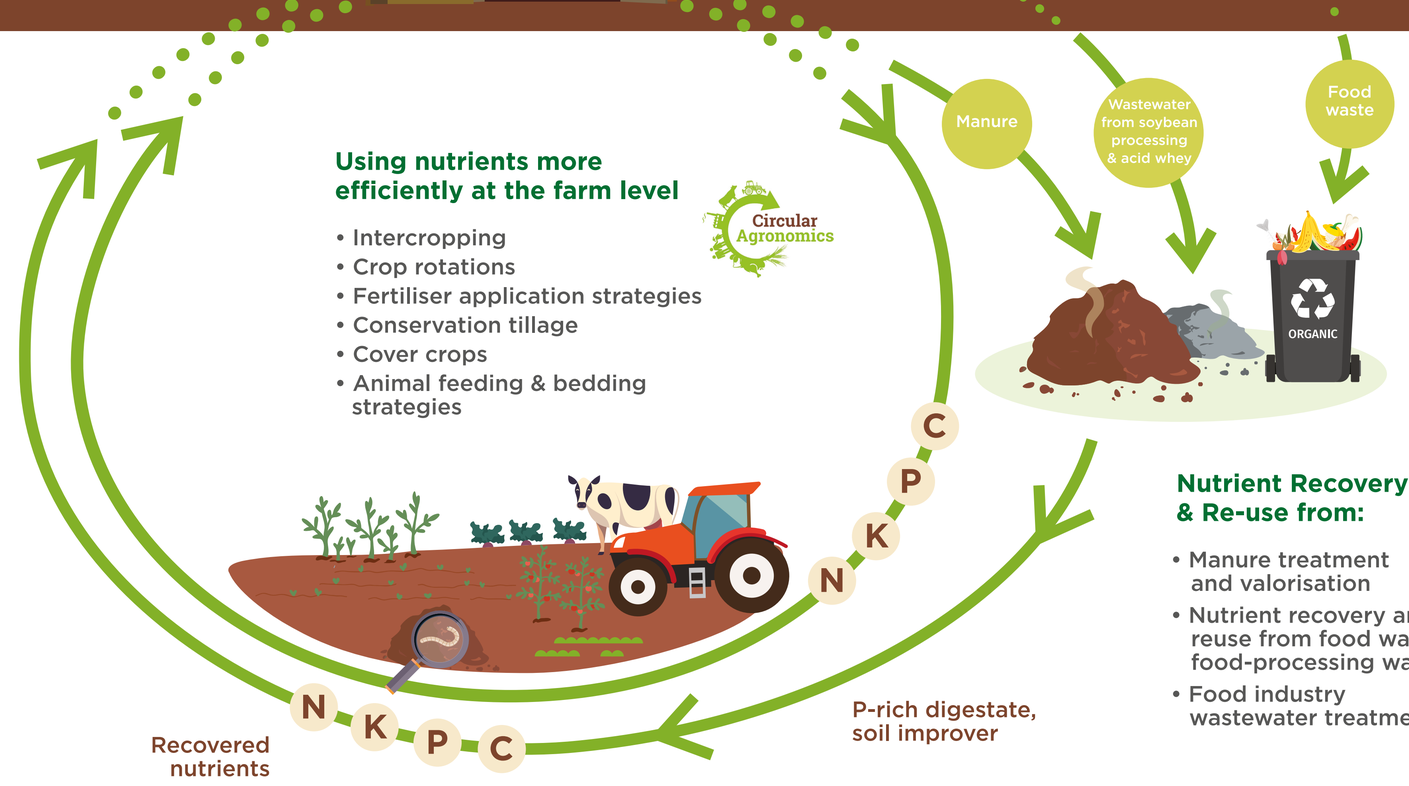
### Linear economy

Current challenge




### Circular economy

Circular Agronomics approach




**Using nutrients more efficiently at the farm level**

- Intercropping
- Crop rotations
- Fertiliser application strategies
- Conservation tillage
- Cover crops
- Animal feeding & bedding strategies

**Nutrient Recovery & Re-use from:**

- Manure treatment and valorisation
- Nutrient recovery and reuse from food waste & food-processing waste
- Food industry wastewater treatment

**POTENTIAL BENEFITS**

- Fewer emissions to air and water
- Less eutrophication and greenhouse gas emissions and $NH_3$ emissions
- Improved use of resources
- Reduced use of mineral fertilisers
- Increase of soil organic matter

## Project solutions

The project is investigating a wide range of measures to improve nutrient and carbon fluxes in the EU, including :

- Production of novel soil organic amendments from agricultural and industrial by-products to decouple C, N and P streams and facilitate soil C sequestration, reducing N & P losses and GHG emissions, and enhancing N and P use efficiency.
- Cropland and grassland management practices to optimise N & P nutrient cycling and minimise losses, including precision farming, conservation tillage, crop rotation, stimulating soil biodiversity, fertiliser application strategies, plant genotypes for enhanced nutrient use efficiency, agricultural residue management and fertigation.
- Livestock management to minimise GHG emissions and optimise manure characteristics, including feeding strategies and feed additives.
- Multiple manure, digestate and food waste valorisation techniques for fertiliser recovery, including: N recovery via ammonia stripping with vacuum degasification; N recovery as ammonium sulphate solution; co-digestion; S/L separation; post-treatment of the liquid fraction; solar and thermal drying and acidification of solids; phytase addition to solid food waste or food wastewater to increase the soluble phosphate fraction; P depletion of food waste/wastewater and recovery as struvite.
- Food industry wastewater treatment for recovery of C-rich compounds (cellulose, lignin and proteins) for re-use on farms.

These solutions are being reinforced by an exhaustive environmental assessment (by means of life cycle assessment tools), exploitation plans for industrial partners, and dissemination towards different stakeholders from science, policy, industry and directly to the farmers.

## Case studies

The project is testing these measures at six case study sites in Europe. These cases represent a variety of biogeographic scenarios and environmental challenges typical of the EU agricultural sector.

1. Catalonia, Spain
2. Brandenburg, Germany
3. Lungau, Austria
4. Emilia-Romagna, Italy
5. Gelderland, the Netherlands
6. South Moravia, Czechia




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