EXPERIMENT 1

Hypothesis:

Nitrogen (N) uptake depends on weather conditions and the fertilization should be adapted to minimize losses.

Goal:

Reduce abiotic resource depletion (by optimizing the dose of mineral fertilizer) and eutrophication potential (through less emissions from fertilization surplus).

Description:

Different genotypes of winter wheat are tested for their nitrogen use efficiency when supplied with different amounts of mineral N and fertilization in 3 different weather situations.

Key insights:

The efficiency of the uptake of nitrogen varies according to the genotype. Amounts of N fertilization rates can be reduced when N-efficient genotypes are planted. Results demonstrate that under current varieties of maize and wheat no genotypic adaptation on drought is present. New genotypes show advantages over old genotypes in drought as well as moist conditions.

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Circular solutions for carbon and nutrient management

Case studies:

Brandenburg, Germany

South Moravia, Czech Republic

Case study leader :

Institute for Agricultural and Urban Ecological Projects at the Humboldt University zu Berlin (IASP)
Philippstraße 13 / Haus 16
10115 Berlin, Germany

IASP

Agro tech – Wastewater and water treatment

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EXPERIMENT 2

Hypothesis:

The timing of the slurry application and the addition of a nitrification inhibitor can increase fertilizer uptake, minimize losses and reduce direct emissions.

Goal:

Reduce potential effects on global warming, during and shortly after the application of fertilizer by adapted technique and timing; reduce emissions by an adapted release of nitrogen; decrease the potential for eutrophication.

Description:

Different slurry application techniques are tested with nitrification inhibitors in a field experiment, with maize to reduce field NH3 emissions.

Key insights:

Nitrification inhibitors should be chosen when nitrogen (not water) is expected to be the limiting growth factor. They help synchronising the supply and the demand of nitrogen when the application is to be made weeks before the main nutrient take-up. The application timing should be chosen according the expected weather. The more water is present on the field or expected as rainfall, the less time should be between slurry application and predicted time of main take-up by plants.

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EXPERIMENT 3

Hypothesis:

Conservation tillage can increase water and nutrient use efficiency and has a positive effect on soil quality characteristics (e.g., soil organic C content, soil biodiversity).

Goal:

Decrease the potential effects of global warming by reducing the losses of soil organic C caused by conventional tillage based on ploughing. Ecotoxicity was chosen as a potential trade-off indicator due to herbicide use needed for the conservation tillage systems.

Description:

Three different tillage systems, the reference system based on ploughing, the minimum and no tillage, are compared for their effects on yield, crop quality, soil quality, water and nutrient use efficiency in a winter wheat - rapeseed rotation.

Key insights:

Especially for winter crops, comparable yields can be obtained by means of conservation tillage practices, with lower energy (fuel) consumption and CO2 emissions, slightly higher use of chemicals.

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Case study:
Emilia-Romagna, Italy

Case study leader : FCSR

Collaborators : cat, ciato, NETAFIM, SAVECO

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EXPERIMENT 4

Hypothesis:
Increased nutrient valorization.

Goal:
Decrease abiotic resource depletion due to a more efficient system. As an additional indicator, eutrophication is discussed.

Description:
Tests on the use of solar-dried digestate as fertilizers in a cereal-based crop rotation and in a non-cereal-based crop rotation, comparing to the use of fresh, untreated digestate.

Key insights:
Solar drying brings together calorific power and solar irradiation to obtain a stabilized fertilizer product with a dry matter content higher than 65 % in about 10 - 30 days, depending on the solar irradiation and the temperature. This is a renewable technology that does not produce residual streams, with losses less than 1 %.

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Circular solutions for carbon and nutrient management

Case study:
Catalonia, Spain

Case study leader : IRTA

Collaborators : PORGA PORCS SL, EMA Depuració i Enginyeria de l'Aigua, slu., Fundació MAS BADIA, ECOBIOGAS

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EXPERIMENT 5

Hypothesis:

Microfiltered digestate applied by fertigation (subsurface drip irrigation – SDI) allows for reduced fertilization, due to the increase of nutrient use efficiency.

Goal:

Decrease abiotic resource depletion by using less mineral fertiliser and decrease potential effects on global warming by burning less diesel and by reducing the soil tillage.

Description:

Raw digestate is separated into solid and liquid fractions, the liquid fraction is microfiltered, and the microfiltrate is used in the fertigation of summer crops to test its fertilizer efficacy.

Key insights:

From a technical point of view, fertigation with microfiltered digestate via SDI has proved feasible at field scale, increasing nutrient use efficiency of digestate/slurry and making possible to replace (completely, or almost) mineral fertiliser.

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Circular solutions for carbon and nutrient management

Case study:
Emilia-Romagna, Italy

Case study leader : FCSR

Collaborators : corregio cat, ciato, NETAFIM, SAVECO

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EXPERIMENT 9

Hypothesis:

Precision feeding of cows may allow matching nutrients supply with animal requirements to improve animal productivity while reducing environmental pollution, the demand for N mineral fertilizer and production costs.

Goal:

Reduce abiotic resource depletion associated with feed production and decrease potential effects on global warming potential related to slurry storage; reduce abiotic resource depletion from mineral fertilizer production.

Description:

The effect of precision feeding versus conventional feeding of cows on milk production is tested to reduce mineral N fertilization. The slurry from both different feeding strategies is collected separately and used for fertilizer forage crops to test its N use efficiency.

Key insights:

Feeding dairy cows with a partial mixed ration (PMR) in the feed bunk and a mix of concentrate feed supplement in the milking parlor, according to individual needs based on individual milking performance and PMR intake, would optimize the use of dietary N and reduce NH3 emissions.

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Circular solutions for carbon and nutrient management

Case study:
Catalonia, Spain

Case study leader :

IRTA RESEARCH & TECHNOLOGY FOOD & AGRICULTURE

PORGA PORCS SL

EMA Depuració i Enginyeria de l'Aigua, slu.

Collaborators :

Fundació MAS BADIA Estació Experimental Agrícola

ECOBIOGAS

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EXPERIMENT 10

Hypothesis:

Through the extensive management in a less favourable production area, the Lungau farms practice site-adapted agriculture and, therefore, can contribute to food production in an environmentally competitive manner.

Goal:

Show the environmental performance of a set of Austrian organic dairy farms that produce milk in a less favourable production area compared to a typical Austria organic dairy farm.

Description:

The farms of the study region Lungau are characterized by an extensive management and the regional purchase of feedstuffs, animals, and seeds. They are compared to an average Austrian organically managed model dairy farm.

Key insights:

Three management parameters determining the environmental performance of milk production in a closed production cycle, (1) the stocking rate, (2) the fed concentrate, and (3) the purchased roughage. Using these inputs at moderate intensity, farms can competitively contribute to producing food and providing environmental services.

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Case study

Lungau, Austria

Case study leader :

HBLFA Raumberg-Gumpenstein Landwirtschaft

Höhere Bundeslehr- und Forschungsanstalt für Landwirtschaft
Raumberg-Gumpenstein
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Collaborators :

UNESCO Biosphäre LUNGAU

Landwirtschaftskammer Salzburg

SalzburgMilch

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