LegumeLegacy

NEWSLETTER

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THIS ISSUE

Field Updates

As 2024 comes to an end, the intensive fieldwork season for the LegumeLegacy multisite experiment is slowing down, with snow and frost signalling the close of plant growth. Here's a roundup of the latest field updates:

The Netherlands

This autumn, maize was harvested at our field experiment – this was the second year of the legacy phase. I really enjoyed working with the harvesters and it was great to observe how smoothly they worked together. The maize yield was determined together with the feeding quality and new soil nitrogen measurements were done.

Ellen Baekelmans

Denmark

At Aarhus University, we finished the field work this autumn with the final cut of 5. Root washing from collected samples was performed and now the preparations are going for root scanning analysis and milling of leaf samples and data digitalization.

Meret Kaspereit

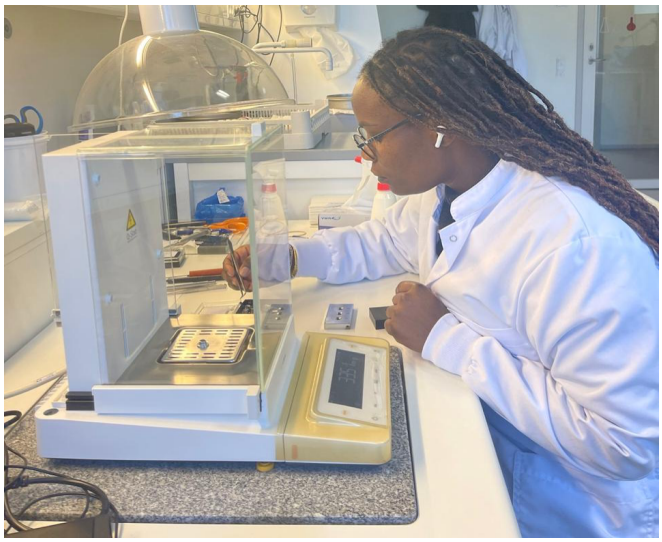
Switzerland

At Agroscope, the grassland phase was concluded with the final cut in October. Then samples for bulk density and mineral nitrogen content were taken and analysed. Going forward, short-term incubation experiment will also be conducted to further understand the nitrogen dynamics in soil as influenced by different multispecies mixtures.

Prasanth Bendalam

THE DETERMINATION OF NITROGEN FIXATION CAPACITY OF LEGUMES

Investigating Nitrogen Dynamics in Multi-Species Swards



One of the key goals of LegumeLegacy is to minimize nutrient inputs, particularly nitrogen. To tackle this, LegumeLegacy designs multi-species mixtures that include legumes (white clover and red clover), which can fix the nitrogen needed for their growth and that of accompanying species like grasses and herbs, reducing reliance on inorganic fertilizers. At Aarhus University, the nitrogen fixation capacity of legumes is determined using the 15N isotope dilution technique. This technique is based on the presence of two stable nitrogen isotopes in the soil and atmosphere: 14N (most abundant) and 15N (naturally depleted).

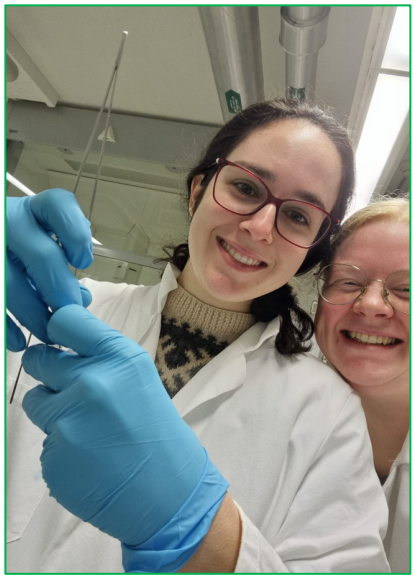
By applying a nitrogen source enriched with 15N to the soil, the 15N abundance in soil nitrogen increases. However, since legumes can fix atmospheric nitrogen to meet their own needs, they rely more on 14N, resulting in a lower 15N/14N ratio. In contrast, non-nitrogen-fixing plants (grasses and herbs) take up the enriched soil nitrogen (15N), leading to a higher 15N/14N ratio.

In grass-legume-herb mixtures, these dynamics may change due to plant interactions, where nitrogen fixed by legumes is shared with neighbouring grasses and herbs, reducing their uptake of enriched nitrogen. This decreases the need for nitrogen fertilisation, leveraging the benefits of legume inclusion in pasture mixtures. Therefore, to create a high-yielding, low-nitrogen input pasture system, it is crucial to select complementary mixtures that balance yield and maximize nitrogen fixation. While yields are easily determined at each harvest, the nitrogen fixation capacity of legumes is measured as the percentage of nitrogen derived from the atmosphere. During each harvest, the mixtures are separated into various species, dried, and milled. The milled samples are then analysed for their 15N composition and compared to plant materials not labelled with 15N. The differences indicate the nitrogen derived from the atmosphere (14N), with mixtures showing a lower 15N/14N ratio being promising for creating sustainable low-nitrogen input farming systems.

Julian Nyaga

ACADEMIC SECONDMENTS AND DIE´S PRESENTATION AT TRINITY COLLEGE DUBLIN

Academic Secondments



As the field season winds down, some of our doctoral researchers are taking this opportunity to dive into their academic secondments, further advancing their studies and collaborations.

Matej, Doctoral Researcher from PLUS (Poland), has recently started his secondment at Trinity College Dublin, Ireland. Under the supervision of Prof. Caroline Brophy and in collaboration with the statistics team, he will gain experience in statistical modelling techniques for contrasting soil environments and management strategies, which he will later on apply to his work.

Sophia, Doctoral Researcher from UHO (Germany), has recently moved to Switzerland to join the Molecular Plant Breeding group at ETH Zürich for her secondment. Working alongside Dr. Roland Kölliker and Linn Huser, they started to analyze plant root samples to explore cultivar composition through genetic data and relate this to Sophia's research on the effects of heatwaves and droughts in multispecies swards.

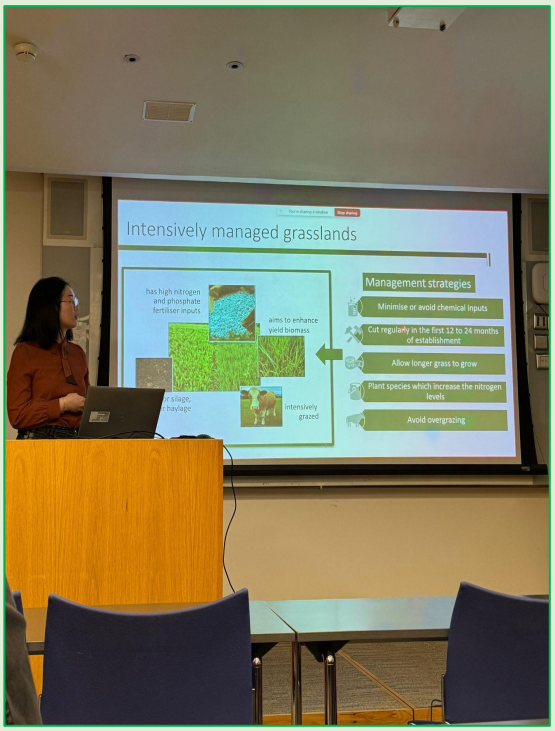
Linn Huser, Sophia Philadelphi and Matej Oreškovic

Die's Presentation in Statistics Seminar at Trinity College Dublin

Die Hu presented at the School of Computer Science and Statistics' seminar on the critical relationship between biodiversity and ecosystem functions in food production on December 5th. The talk explored how biodiversity, particularly in grass-legume mixtures, supports nutrient cycling and productivity. Using data from eight sites across three years from a previously published experiment, the study examined whether grass-legume mixtures can reduce nitrogen fertiliser use while maintaining biomass yields.

The presentation also addressed the growing importance of advanced statistical methods for understanding multifunctionality "the overall performance of multiple ecosystem functions" providing insights into how biodiversity and management strategies interact to enhance sustainability and productivity.

Die Hu



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LegumeLegacy is an MSCA Doctoral Network

https://legumelegacy.scss.tcd.ie/

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