LegumeLegacy

NEWSLETTER

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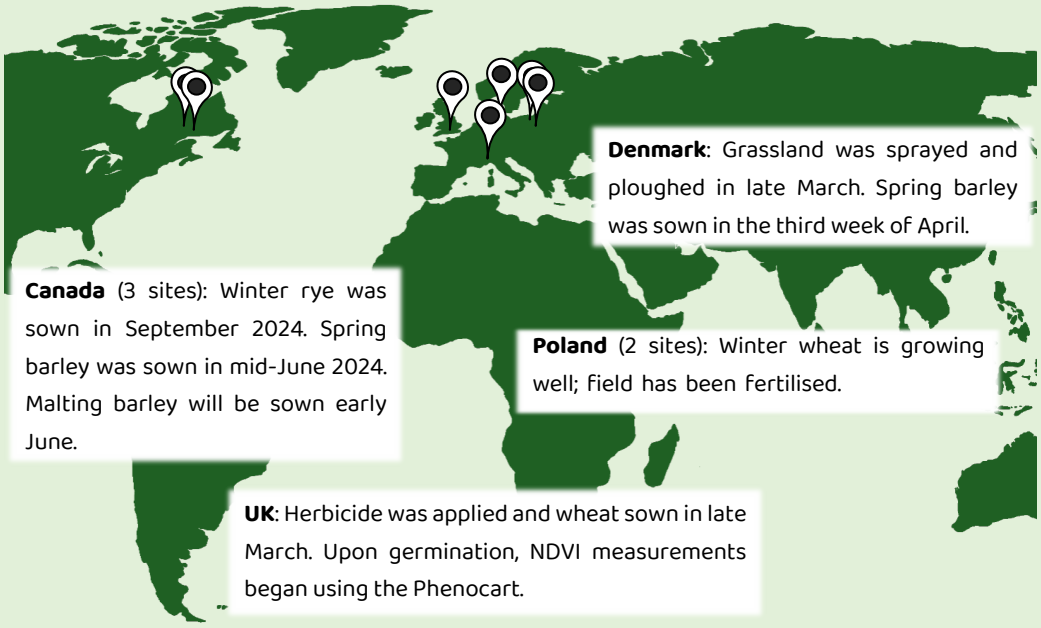
THIS ISSUE

- The cereal phase begins for LegumeLegacy sites! Updates from our Swiss partner Agroscope.

- Prasanth dives into the science behind nitrogen legacies and explores how high-tech PRS probes mimic plant roots to measure nutrient availability in soil.

- New LegumeLegacy Paper Published!

The LegumeLegacy experiment enters the follow-on crop phase after at least 18 months of grassland phase



Canada (3 sites): Winter rye was sown in September 2024. Spring barley was sown in mid-June 2024. Malting barley will be sown early June.

Denmark: Grassland was sprayed and ploughed in late March. Spring barley was sown in the third week of April.

Poland (2 sites): Winter wheat is growing well; field has been fertilised.

UK: Herbicide was applied and wheat sown in late March. Upon germination, NDVI measurements began using the Phenocart.

Tracing nitrogen's legacy in Swiss soil

At Agroscope, Switzerland, a follow-on wheat crop was established after terminating the previous grasslands using herbicide treatments and direct seeding of the wheat. This method allows establishing the cereal without disturbing the soil. This is crucial at this specific site, as a key objective of the Swiss study is to assess at what soil depth grasslands deliver residual nitrogen. Now, as the research moves into the cereal phase, there's keen interest in measuring the 'legacy effect' – how the preceding grassland influences the wheat's nitrogen nutrition. Exciting measurements using PRS probes and 15N isotopes are planned to quantify soil nitrogen availability and the amount of fertilizer-derived nitrogen taken-up by the wheat. Understanding this nitrogen contribution is crucial because residual nitrogen from the grassland can decrease the need for costly external nitrogen fertilizer. This can ultimately enhance yields and provide advantages for soil health, climate sustainability, and farmer profitability.

Prasanth Bendalam

Figure: Emergence of wheat as follow-on cereal crop after the grassland phase.

DELVING INTO PRS PROBE TECHNOLOGY & NEW PAPER PUBLISHED

Delving into PRS Probe Technology

As farming is a complex balancing act, to grow healthy and productive crops, farmers need to provide them with the right amount of nutrients, like nitrogen, phosphorus, and potassium. But knowing exactly how much nitrogen is available in the soil is a real challenge. It is therefore important to estimate the influence of the previous crop on soil nitrogen availability when calculating the fertilizer needs of the current crop. In order to solve this challenge, PRS probes are used as one of the tools designed to be inserted directly into the soil, allowing to measure the soil's capacity to supply nutrients. A PRS Probe consists of an ion exchange membrane held within a plastic support. These membranes are the key to their functionality.

There are two main types of PRS Probes, each designed to capture specific types of nutrients (Western AG innovations, https://www.westernag.ca):

1. **Anion Probes**: Anion probes are positively charged membranes that are initially saturated with bicarbonate (HCO_3^-) ions. A fascinating process begins after installing the probes in soil. As existing soil ions start to displace the counter-ions on the membrane, bicarbonate (HCO_3^-) ions in the membrane gets exchanged (attraction and adsorption) by existing negatively charged nitrate (NO_3^-) ions in the soil. The rate at which this displacement occurs is directly related to the nutrient content and movement of those ions within the soil.
2. **Cation Probes:** Similarly cation probes have negatively charged membranes that are initially saturated with sodium (Na^+) ions. After inserting these probes in to the soil, sodium (Na^+) ions in these membranes gets exchanged (attraction and adsorption) by existing positively charged ammonium (NH_4^+) ions in the soil and thus gives us an idea about soil nitrogen availability.

The quantity of ions captured by the PRS Probe over a specific period provides a comprehensive overview on soil nutrient availability. They can be used to quantify the nutrient availability at different depths or track changes over time. By providing a deeper understanding of soil nutrient dynamics, PRS Probe technology helps in making informed decisions about optimized fertilizer use, and promote sustainable agricultural practices. This translates to reduced input costs, increased crop yields, and a healthier environment for all.

Prasanth Bendalam

Photo credits- Ron Lyseng, Western Producer

New LegumeLegacy Paper Published

I'm happy to share that my first paper from my doctoral research has just been published in Plant and Soil. The paper, titled "Grasses, legumes and forbs respond differently to compound drought-heatwave events during establishment", is based on the climate-controlled growth chamber experiment carried out in Hohenheim last year.

It's been a great collaborative effort, and I'm especially grateful to Petra Högy, Carsten Malisch and Jørgen Eriksen for their support!

If you're curious to dive into the findings, you can read the full paper here:

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https://link.springer.com/article/10.1007/s11104-025-07440-4

Thanks for reading!

Sophia Philadelphi

LegumeLegacy

LegumeLegacy is an MSCA Doctoral Network

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

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