European legume breeding is taken to next level for competitive seed market and sustainable protein production

Enhancing the competitiveness and sustainability of the European legume breeding activities and output is the goal of the BELIS innovation project launched in October 2023. The project's key objectives are to develop cost-effective breeding tools, improve the economic and regulatory environment for legume breeding, and ensure efficient innovation transfer through a collaborative platform for public private partnership.

BELIS project has its annual meeting from 9-11 sept at the premises of the Institute of Field and Vegetable Crops (IFVC) in Novi-Sad, Serbia. *The meeting is gathering together all the project partners to present advancements achieved so far, to plan for next activities and to reflect on some of the key avenues for improving and innovating in legume breeding. The programme will also include an open day for the BELIS Network stakeholders to hear about and discuss on the BELIS approaches and advances and to visit the IFVC legume experimental fields and a commercial farm.*

A unified approach to legume breeding

Legumes, both for grain and forage production, play a crucial role in agriculture by providing essential proteins for human and animal consumption and offering environmental benefits mostly related to symbiotic nitrogen fixation. Despite their potential, legume cultivation in Europe has been limited due to a lack of high-yielding and resilient varieties, resulting in a high import rate for legume grains and nitrogen fertilizers into Europe. BELIS aims to bridge the gap by leveraging advanced breeding methodologies and fostering collaboration among research and industry stakeholders.

The European Union's Horizon Europe program launched this ambitious project, **'Breeding European Legumes for Increased Sustainability'**, in October 2023, to build a firm base for the legume breeding community in research and industry across Europe. With a consortium of 34 partners from 18 countries, including research institutes, plant breeders, seed companies, registration offices and advisory services, BELIS is poised to tackle some of the most pressing challenges in legume breeding research and varieties production.

Overall, the project is focusing on **seven forage crops** (lucerne, red, white and annual clovers, sainfoin, birdsfoot trefoil and vetches) and **seven grain crops** (pea, faba bean, soybean, white lupin, lentil, chickpea and common bean) representing a major part of the diversity of legume species cultivated in Europe.

Innovative research and breeding techniques to enhance genetic progress

BELIS is at the forefront of integrating **cutting-edge technologies into legume breeding** for optimizing the genetic progress to get to new varieties. In the Meeting, important preliminary results will be presented and discussed, for example on KASP (a simplified methodology for genotyping polymorphisms at specific markers) outcomes in chickpea, or a set of new protocols for disease, pest and quality traits measuring and estimation, or in the use of drone images to phenotype forage legumes in breeding trials. A legume multi-species SNP array is under development, and we hope it will be ready for being applied by researchers and breeding industry on the next years. More advanced protocols and techniques on phenotyping and genotyping are in course to cover more crops and crops stress contexts (drought, waterlogging or different pests and diseases), as well as quality traits on nutritional value or technological components of the grains for processing industries. All these will

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help for adapting and improving high throughput methods and techniques to make germplasm screening and characterisation and breeding programmes to run faster and to be more precise.

Improving variety testing and registration

BELIS is also dedicated to providing the best conditions for delivering genetic progress achieved on legumes to farmers. For the registration of varieties to the national Catalogues, innovations and ideas are tested to provide farmers with more useful information on the seeds value for cultivation and use (= VCU), such as **adapting criteria of the official variety testing systems and designing multi-country official tests**. In the BELIS meeting, a comparison of VCU protocols across countries will be presented, and there will be a presentation of a lucerne VCU trials that is part of a network of 8 locations in Serbia, Italy and France.

It is also expected that the project proposes **recommendations for the use of varieties**. Existing information from registration and post-registration tests will be collated and made available. For example, a modelling approach is used to estimate the forage yield potential of different types of lucerne varieties in Europe, under the current and future climates and various managements. Results will be concluded later on the project as this part of the work is still ongoing.

Organization and cooperation of legume breeding actors, and the BELIS Network

New ideas to **improve the organization and cooperation models for legume research and breeding** are being proposed and analyzed through **case studies run in different countries**, trying to discern collaborative ways for different actors to complement research and development efforts and to better achieve varieties release to the market and boost the availability of adapted legume seeds for farmers. Interesting preliminary results have been achieved, for example in the German white lupin breeding sector.

BELIS emphasizes the importance of collaboration and knowledge exchange. The project is creating a **network that brings together public and private breeders, researchers, extension services, registration offices, and the seed, food, and feed industries**. This network aims at facilitating business collaborations, technical training, and policy advocacy to support legume breeding activities. The Meeting 2nd day will be the occasion for Serbian actors to know and discuss in presence the project advancements and to visit the project trials run by IFVC, while other countries stakeholders may also follow the sessions on line. The sister project Legume Generation, funded under the same call as BELIS, will also present a key result. Regular exchanges between the projects are organized.

Farmers, researchers, and policymakers are encouraged to join the BELIS network, stay informed about the project's progress, and contribute to shaping the future of legume breeding in Europe.

The Institute of Field and Vegetable Crops (IFVCNS), a National Institute of the Republic of Serbia, actively contributes to the implementation of the international BELIS project, with the aim of enhancing legume breeding programs through the development of advanced tools and approaches. Within the scope of the project, IFVCNS is developing protocols for abiotic stresses, working on phenotypic and molecular breeding as proofs of concept, improvement of Value for Cultivation and Use (VCU) tests and protocols and contributing to the variety recommendation on EU level for various legume crops.

For more information, visit the BELIS website and subscribe to the BELIS newsletter.

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