



Legume Generation

The Legume Generation Lupin Innovation Community LUPIC

Boosting innovation in breeding for the next generation of legume crops for Europe



Eickmeyer, Fred¹; Lohwasser, Ulrike²; Otto, Lars-Gernot²; Svobada, Thomas³; Ninou, Elizabeth⁴; Howarth, Catherine⁵; de Vega, Jose⁶; Rieu, Ivo⁷; Susek, Karolina⁸; Papa, Roberto⁹; Flüb, Helge¹⁰; Murphy-Bokern, Donal¹¹. Contact: fred.eickmeyer@eskusa-pflanzen.de

¹ESKUSA GmbH, Parkstetten; ²IPK, Gatersleben; ³BOKU, Tulln, Austria; ⁴IHU, Thessaloniki, Greece; ⁵Aberystwyth University (ABER), Aberystwyth, United Kingdom; ⁶Earlham Institute, Norwich, United Kingdom; ⁷Radboud University (SRU), Nijmegen, The Netherlands; ⁸IPG, Poznan, Poland; ⁹UPM, Ancona, Italy; ¹⁰JKI, Groß Lüsewitz; ¹¹Donal Murphy-Bokern.



"Breakthrough" - Germination of a narrow leafed lupin

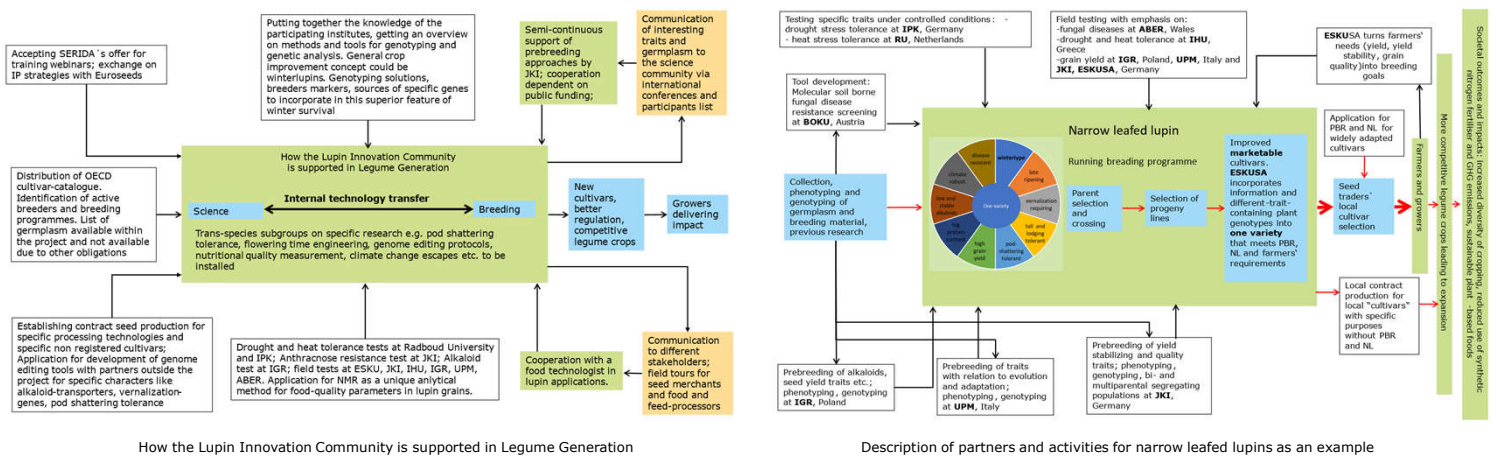
Introduction:

Breeding progress in lupin species stagnates worldwide. This is due to a very narrow gene pool of lupin forms with low alkaloid levels, so called sweet lupins. New or extended traits from bitter lupins (high alkaloid forms) can improve grain yield level and yield stability. Such traits can be found in genetic resources. However in most cases nothing is known about the genetics and inheritance of new/better traits. Basic and applied research, pre-breeding and market oriented breeding have to cooperate closer to drive innovation that delivers better cultivars that have a higher economic value for farmers.

Challenges in lupin breeding:

1. The development of over-wintering to improve resource capture and to escape summer droughts.
2. Broadening the gene pool of sweet lupins by introgression of valuable traits from bitter lupins
3. Understanding the inheritance of new traits and to carry out genetic analyses
4. Access the market by competitive cultivars

The **Lupin Innovation Community (LUPIC)** is a group of breeders and scientists that share resources and work in the development of significantly improved cultivars. We want to link science with applied breeding and cultivar development to serve farmers' needs. We are not a 'closed-shop': each of our partners has own network-activities in lupins and legumes in general. Therefore we are open to new disciplines, new researchers, new breeders that share our enthusiasm in lupin cultivar development. The figures below illustrate how we work together to boost lupin breeding.



Approaches

Selection for winter survival in four different lupin species: In field trials at different locations throughout Europe we will screen for winter hardiness in *Lupinus albus*, *L. luteus*, *L. angustifolius* and *L. mutabilis*.

Searching for valuable characters in gene bank accessions: We already found traits such as lime tolerance and a positive yield-response to a preflower cut and we will search for further agronomically important traits in genetic resources.

Analysing new traits and developing markers: The inheritance of new-found or the extended expression of traits has to be understood and genetic analyses are needed. Markers as breeding tools will be developed.

Introgression of traits from bitter into sweet lupins: Important traits have to be transferred into the advanced material of sweet lupin cultivars and have to be combined with domesticated genetic backgrounds.

Transformation of the alkaloid metabolism: By searching for mutants or by editing genes of the alkaloid metabolism, sweet forms can be directly developed from bitter lupins. An ideal goal would be a bitter high performing lupin plant with sweet kernels.

Genotype x environment interactions: In diverse field tests and under artificial conditions the developed breeding lines and populations will be phenotyped. The yield potential and yield stability of new cultivar candidates will be evaluated.

Adaptation of breeding goals: Changing environments can ask for changing breeding goals (e.g. earliness).

Sustaining the collaboration and making an impact: Breeding is a long-term activity. On the one side we need to strengthen the collaboration within our community through deepening the alliances. On the other side we have to communicate our results to the scientific community as well as to farmers, seed merchants and seed multiplication companies.



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