

Organic breeding of white lupin for regionally produced, plant-based protein foods in Switzerland

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White lupin (*Lupinus albus* L.) yields protein-rich grains of high nutritional quality. It provides valuable ecosystem services such as nitrogen fixation, deep rooting, active phosphorous mobilisation and pollinator attraction. Therefore, it is a particularly interesting crop for organic and agroecological farming systems. It is tolerant to frost in early development stages as well as to summer drought during maturation. Because of this, it is a good alternative to soybean in the temperate zones with cooler climate in spring. However, lupin is currently underutilised due to major obstacles in crop production. The pathogen *Colletotrichum lupini*, agent of the lupin anthracnose disease, can cause severe yield reduction in regions with high disease pressure such as Switzerland. Additionally, the quinolizidine alkaloid content is highly environmental and year-dependent for most varieties, often above the accepted threshold for human consumption (<200 mg/kg). FiBL plant breeding group started its organic pre-breeding programme of white lupin in 2014 with the primary aim to develop anthracnose resistant breeding material. We continuously integrate external sources of anthracnose resistance from a wide gene pool of cultivars, landraces and breeding lines from all over the world. The genetic resources are evaluated and selected with specifically developed screening

tools and protocols under field and controlled conditions. While working with an increasingly resistant genepool, early maturation has become an important breeding goal due to the unintended integration of daylength sensitivity from the introduced material of Near Eastern or North African origin. Thirdly, we aim to develop breeding lines with stable low alkaloid content by strict selection and pyramiding of low-alkaloid genes. Pedigree selection and composite cross population (CCP) development are conducted under certified organic conditions. FiBL collaborates with gzpk, an organic, non-profit plant breeding organisation to jointly develop varieties for registration and release in Europe. In parallel, we contribute to the establishment of a network for domestic grain legumes cultivation by bringing together relevant value-chain stakeholders to build a market for the re-introduction of lupin in Switzerland.

We will present a characterization of our present genepool concerning anthracnose resistance, precocity and alkaloid content, including an overview of how this breeding initiative is nested into a seed to plate strategy.

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