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METABOLOMICS-ASSISTED BREEDING FOR LOW ALKALOID CONTENT IN *LUPINUS ALBUS* L.

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White lupin (*Lupinus albus* L.) is a grain legume from the Mediterranean area, rich in good quality proteins (34-43% on dry weight), with a significant percentage of lipids (5-10%), an interesting percentage of crude fibre (14-16%) and a good ratio of omega 3/omega 6 fatty acids (0.4-0.6). Since long time, its seeds are used as human food and animal feed.

Lupin contains significant amounts of toxic alkaloids, which give bitter and undesirable taste to seeds, that can be consumed only after deamarization. Edible lupins are referred as "semi-sweet" and "sweet" because they contain smaller amounts of alkaloids than the bitter lupin varieties. Since 1988, only one semi-sweet variety of white lupin, called "Multitalia" was obtained, with medium sized seeds but limited development and modest productivity.

Through a 15-year cross breeding program, we obtained four new sweet lupin lines adapted to fall seeding, tolerant to pH greater than 6.5, with large seeds and high productivity. Sweet lines were selected using the Dragendorf test, coupled with direct tasting of the seeds. The obtained lines present much lower alkaloid levels, higher productivity and larger seed size than "Multitalia".

Quinolizidine alkaloids were profiled in the parental lines, the improved ENEA ones, and "Multitalia" through high-resolution liquid chromatography / mass spectrometry (Orbitrap). The ENEA lines were richer in lysine (the precursor of quinolizidine alkaloids) and free amino acids, and contained up to 35-fold less alkaloids with respect to bitter and semi-sweet genotypes. Some of the alkaloids showed further decrease with respect to the parental sweet lines used in the cross, probably as a result of the selective pressure applied during the breeding process.

These new lines could improve the diffusion of this species in our country, particularly in Central and Southern semi-dry areas, where they could represent a viable alternative to soybean production.