

# Utilizing Wild Relatives in Alfalfa Breeding

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Alan Humphries is the curator of the Australian Pastures Genebank, a collection of some 80,000 accessions representing 2600 temperate and tropical pasture legumes and grass species, collected from 178 countries. He is also an experienced alfalfa breeder, with a 24-year history of leading the SARDI-Barenbrug lucerne program in Australia.

From its centers of origin, alfalfa (*Medicago sativa* L.) and wild relative populations have evolved to survive in highly diverse environments, with extremes that include the Arctic Circle, the desert areas of Kazakhstan and Western China, and the arid, Mediterranean areas of South Europe and North Africa. Alfalfa has further been disseminated anthropogenically, initially by ancient armies as a fodder source for horses, and in later European conquests to support emerging agriculture.

Here we demonstrate the use of Genesys, an online platform for housing information on global plant genetic resources, to identify a subset of alfalfa accessions collected from environments with bioclimatic variables linked to extreme drought, heat, and cold tolerance. The subset includes 28 alfalfa accessions originating from environments with an average monthly temperature range of -44–46 °C, 0–3,414 m elevation, up to 68.25 °N latitude and as low as 153 mm average annual precipitation (checked with satellite imagery to confirm no obvious supplementary water). The *M. sativa* subsp. represented in the subset include 14 subsp. *sativa*, 4 nothosubsp. *varia*, 1 subsp. *caerulea* and 9 subsp. *falcata*. The subset also contains 2 *M. sativa* subsp. *falcata* accessions collected from the extreme mildest winter temperature for this sub species, where the minimum temperature of the coldest month was at least 3 °C. The alfalfa climate adaptation subset, which is available for request from <https://www.genesys-pgr.org/subsets/0367d084-95c8-4d26-85d1-c14b98ebbb7b>, will now be characterised for key phenotypic traits and molecular diversity. The alfalfa and wild relatives assembled in this subset provide important unique diversity for a range of abiotic traits that can be introgressed into alfalfa to support carbon neutral farming and extend or maintain the range of alfalfa production for environments with changing climates.