Detection of genetic variation for heat and drought stress response in faba bean (*Vicia faba*)

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In 2022, faba beans were cultivated on about 71,000 hectares in Germany, being the second most legume crop after peas. Cultivation these beans enriches soil with nitrogen, diversifies crop rotations and bolsters domestic protein supply. Despite their benefits, faba beans are sensitive to heat and drought, especially during flowering. The anticipated increase in dry and hot growing seasons due to climate change highlights the necessity of developing adapted genotypes with effective tolerance strategies.

Here we present findings from phenotyping 80 genotypes for drought and heat tolerance. For heat stress, the genotypes were grown in two climate chambers with different temperatures (20°C vs. 28°C) during flowering. Preliminary results indicate that heat stress reduced seed yield of all tested lines but increased pod number of about 20 lines. In parallel, the same genotypes were cultivated in plantarray, a modern phenotyping platform designed for precise tracking of transpiration under tightly controlled conditions. Recording of transpiration profiles of the genotypes allowed the determination of their water uptake and transpiration efficiency. This parallel execution of experiments should disentangle heat and drought stress responses. Furthermore, we are evaluating the performance of these 80 genotypes in field trials spanning four locations. Employing diverse methodologies, we identified the genotypes demonstrating superior performance in the face of abiotic stress and selected specific genotypes for advanced screening. Currently, we are conducting a thorough evaluation of 300 RILs (F5 Population), utilizing a combination of methodologies and approaches to enhance our understanding. Afterwards, we'll map genetic regions to boost faba bean resilience.

***References:***

[1] Gutiérrez N. et al., 2023. Genome-wide association analysis for drought tolerance and associated traits in faba bean (Vicia faba L.). Frontiers in Plant Science, 14, 1091875.

[2] Mandour H. et al., 2023. Identifying physiological and genetic determinants of faba bean transpiration response to evaporative demand. Annals of Botany, 131(3), 533-544.