Drought Resistance in Oat for a Changing Climate: High-Throughput Phenotyping as a Foundation for Systems-Level Insights

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Climate change is intensifying drought stress, threatening crop productivity and food security. Oat (*Avena sativa*), valued for its nutritional and sustainability benefits, remains sensitive to drought. *DROAT* employs the FitnessSCREEN high-throughput phenotyping platform at Helmholtz Munich to generate high-resolution morphological and physiological datasets from a genetically diverse oat panel, including elite cultivars, landraces, and wild relatives. Controlled drought experiments, combined with 3D multispectral imaging, will capture growth dynamics, canopy architecture, biomass allocation, water use efficiency, yield components, and stomatal density from early vegetative to grain-filling stages.

All phenotyped lines possess reference-quality genomes from the international PanOat initiative. Time-resolved phenotypic data will be integrated with transcriptomic, metabolomic, proteomic, and epigenomic profiles to identify resilience-associated traits, regulatory circuits, and biochemical pathways, with a particular focus on subgenome-level regulation in this complex polyploid crop. This approach bridges the gap between molecular understanding and agronomic performance, providing a foundational resource for trait–omics correlations, biomarker discovery, and the targeted breeding of climate-resilient oat varieties—contributing to sustainable cereal production under future drought scenarios.