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MULTI-PARENTAL GENOMIC PREDICTION FOR IMPROVING BARLEY YIELD IN HARSH MEDITERRANEAN ENVIRONMENTS

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In the sector of cereal crop breeding, projected climate change along with the need of higher crop productivity are imposing the adoption of new tools and technologies for accelerating the release of better varieties that can fulfil farmers' needs. In this context, genomic selection, along with other predictive analytics tools, has the potential to improve breeding operations and reduce costs, as there is growing evidence that for complex traits this methodology outperforms pure phenotypic and marker assisted selection. Moreover, truncation selection based on "Genomic Estimated Breeding Values" (GEBVs) has the advantage to shorten breeding cycle duration, as the genetic merit of each individual is estimated at the seed level, making unnecessary the organization of large field trials to phenotype plant lines of late filial generations for the traits of interest.

In the framework of the iBarMed project, we are applying genomic prediction for selecting high-yielding barley lines for the Po valley and for a target population of hot and dry Mediterranean environments using different sets of genetic materials. Specifically, beyond using collections of unrelated individuals for computing GEBVs, in this work we report an innovative use of MAGIC populations to combine genomic prediction models with QTL mapping using multi-parental training sets. Computing GEBVs using different genomic prediction models that include environmental co-variates, we found that the model accuracies, expressed as the correlation between predicted and observed phenotypes, can reach the value of 0.7 in the Po valley trials, and that genomic prediction with multi-parental training sets outperforms models trained with unrelated panels of barley accessions.

Overall, our findings point out that genomic prediction models with multi-parental training sets could be utilized for developing efficient plant breeding schemes to improve the selection of better barley lines to cope with projected climate change.