GENETICALLY-INFORMED ENVIROTYPING TOOLS TO BETTER MATCH TEST AND TARGET ENVIRONMENTS

Ann E. Stapleton1, Weijia Xu2, and Silvia Liverani3

University of North Carolina Wilmington Department of Biology and Marine Biology

Texas Advanced Computing Center, Data Mining and Statistics Group

Queen Mary University of London, School of Mathematical Sciences

Better matching of test environments to target production environments is key for efficient crop breeding. We are optimizing PreMiuM Bayesian clustering-based envirotyping analysis and developing publicly accessible known-truth genotype-environment simulations. We will combine PreMiuM profile regression covariate variable selection with standard linear model selection and fit methods to create a combined analysis workflow that will allow breeders to fit SNP and environment variates to their data. To illustrate these new analysis methods and inform our breeding program modeling, we will analyze real crop datasets with our improved PreMiuM and PreMiuM+model selection workflow and make spatial results maps to visualize the results in an easily interpretable field context.

To leverage better envirotyping within breeding programs, we need modeling tools that allow exploration of program design constraints. We have begun development of accessible breeding simulation models that incorporate realistic environment covariate features of test and target environments and flexible, extensible specifications of genetic gain within an open-source, widely used web-accessible modeling system that supports both student training and advanced breeder modeling. Modeling tools and better envirotyping tools will support breeders in allocating effort. Breeders will be able to determine optimal germplasm exchange programs for maximum genetic gain by using PreMiuM results to inform setup of test and target environments.

This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2017-67013-26188.