PROJECT: GAIN3Dseed

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PROJECT TITLE

Genetic architecture of grain characteristics from three-dimensional single seed reconstruction in amaranth

CONSORTIUM

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SUMMARY OF THE REPORT

The seed is one of the most important organs in grain crops and seed traits like seed size, loss of seed shattering and seed color were under selection during domestication of many crop species. Grain amaranth is an ancient pseudocereal from the Americas which is gaining attention due to the high nutritional quality of its seeds. The grain amaranth species *Amaranthus cruentus* represents a regionally important crop in South Mexico and Guatemala. Despite its long history of cultivation, grain amaranth produces very small seeds, impairing its agronomic use.

Here, we investigated the genetic control and architecture of various seed traits in the ancient grain crop A. cruentus. The project was developed in collaboration with Robert Koller and Gregor Huber from IBG-2 of the Forschungszentrum Jülich, as access providers of the phenoSeeder platform. Our three major objectives of the project were, (1) to evaluate the heritability of seed traits; (2) to evaluate correlations between seed traits and other agronomically important traits and (3) to investigate the genetic control of seed traits. To accomplish our objectives, we utilized the phenoSeeder platform to phenotype various seed traits of 557 recombinant inbred lines (RILs) from a mapping population derived from diverging *A. cruentus* inbred lines. We combined measurements of seed traits with phenotypic assessments in the field and whole-genome sequencing of each line. The identification of trait correlations will help to identify potential constraints for selection that could have contributed to the repeated incomplete domestication of amaranth. By combining sequencing data from a large number of RILs with detailed phenotypic measurements using the phenoSeeder platform, we will have high statistical power to identify even small effect QTL. Estimation of heritability and the identification of the genetic architecture of seed traits in *A. cruentus* could aid future improvement of the underutilized crop species.