Genetic variability of the sensitivity of grain number to drought and high temperature in maize

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Selected talk

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With climate changes, crops will be subjected to more frequent episodes of drought and high temperature. Plant breeders attempt to maintain or increase grain yield in spite of these conditions. We have considered the possibility that data originating from a network of field experiments may serve for estimating the genetic variability of the sensitivity of yield to temperature and water deficit, provided that they are combined with data originating from a phenotyping platform and with detailed environmental characterization of each field. Here, we have developed a method for deriving the sensitivity of each genotype to temperature and soil water deficit by performing a joint analysis of phenotypic and environmental data. We have analyzed a population of maize hybrids generated by crossing a common flint parent with 250 dent lines. Lines were genotyped with 650K SNPs. Hybrids were phenotyped for grain yield and components in 27 combinations of site x year x treatment involving contrasted water regimes in Europe. Phenology and growth traits of the same hybrids were also measured in the PhenoArch platform. The growth cycle of each hybrid was divided into time intervals from plant emergence to maturity, based on leaf number and ear morphogenesis whose relations with thermal time were established in the phenotyping platform for each hybrid. We have then established the response curves of yield to mean temperature or soil water potential in each time interval for each hybrid. Sensitivities to temperature and water potential were estimated as the slope of these response curves, and analyzed via genome wide association mapping. This study will allow better understanding of mechanisms involved in tolerance to drought and high temperature. It may give way to novels indicators of GxE interactions that might be used in breeding programs to improve the tolerances to conditions associated with climate changes.

Keywords: Maize (Zea mays), yield, association mapping, drought, temperature