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Genome Wide Association Studies Targeting Adaptive Traits for Low Phosphorus Soils in West African Sorghum

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Abstract

An important impediment to agricultural crop production in sub-Saharan Africa is low phosphorus (P) availability in soils which affects about 75 % of the available agricultural land. Sorghum (*Sorghum bicolor* L. Moench) is one of the most widely grown crops in the region with the grain being important for food security and the stover increasingly used for livestock feed. Plants possess many mechanisms for adaptation to low P availability, including physiological traits, root morphology and mycorrhizal symbiotic relationships. Understanding the genetic basis and role of these traits is important for their consideration in breeding programmes targeting improved P acquisition in P deficient soils. Objective of the present study was therefore to dissect the genetic basis of sorghum adaptation to low P soils using genome wide association mapping. Association mapping is a powerful technique for high resolution mapping of loci underlying quantitative traits.

A total of 188 West-Central African sorghum lines were phenotyped at 38 days after planting for traits such as mycorrhizal root colonisation, crown root architecture, shoot biomass and shoot P content in a pot trial using low P soil (5.6 ppm Bray-1 P) at ICRISAT-Mali. We observed significant genotypic differences for these traits. Their relationship to sorghum growth and yield performance under low P field conditions is presently being investigated. Furthermore, the 188 sorghum lines were genotyped with 308 000 SNPs through genotyping-by-sequencing (GBS). Currently we are associating the phenotypic data with the genotypic data to identify possible quantitative trait loci (QTL) and specific candidate genes for these adaptive traits for low P soils. We will present our findings and discuss the possible future use of these traits and markers in different breeding programs. Identified gene loci and markers derived from this study are expected to facilitate effective sorghum breeding strategies and possibly enhance sorghum productivity under low-input conditions in West Africa.

Keywords: Adaptation traits, association studies, breeding, low phosphorus soils, mycorrhiza, sorghum

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