Giessen Plant Breeding

JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

PEGASUS: Prediction and Exploitation of Genebank Accessions – A Study in Ugandan Sorghum

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Accessing exotic sorghum resources for breeding

Introduction

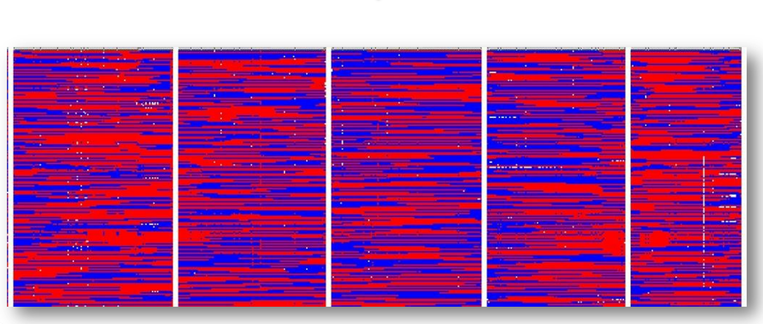
Sorghum bicolor is a multi-use crop showing huge adaptive diversity across different climate zones of the world. Its high nutrient use efficiency, combined with strong resilience to high temperatures and drought, makes sorghum a climate-ready crop that can play a key role in agriculture worldwide.

Uganda is one of only three countries in which all of the five basic races and ten intermediate races of sorghum are endemic. However, the vast diversity in the Uganda National Genebank has yet to be systematically characterised.

Uganda's broad sorghum diversity reflects the diverse environments where the crop is grown, from extremely arid and semi-arid zones in eastern and northern Uganda to the very cool highlands in the south-west. Material from the highlands possibly carries potentially useful alleles for cold stress adaptation, a major trait of interest for Germany and other temperate areas of the world, while highly diverse landraces could also enrich genome-assisted improvement of endemic sorghum varieties for small-holder farmers in Africa.

Material and Methods

~ 3000 diverse lines from Uganda National Genebank



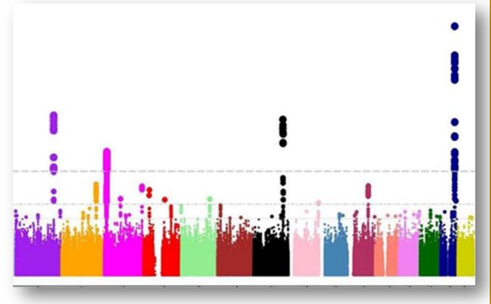
Diversity Arrays Technology

Genomic prediction for the entire population

Identification of a representative core collection

Detailed phenotyping of core collection for traits associated to cold adaptation (Germany) and yield performance (Uganda)

GWAS



Summary

Sorghum is a remarkably diverse crop with an extremely broad genetic basis. Genomic characterisation and phenotypic evaluation of major genebank collections can identify unique and important resources for breeding and tools to exploit novel diversity. We are currently genotyping the Uganda National Genebank sorghum collection using high density DARTseq markers in a case study for genomic-assisted prediction of breeding value.

The data will facilitate identification of germplasm of potential use for different international sorghum breeding programs. On the one hand, genomic predictions can help identify accessions with useful diversity to improve yield, plant architecture and resistance related traits under African conditions. On the other hand, material with potential adaptation to temperate conditions could be identified for use in European breeding under the regulations of the Nagoya protocol.

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