Evaluation of sorghum grain quality for marker assisted recurrent selection

Diarah Guindo*, Andre Kapitan Gnimdu, Baptiste Guittton, Geneviève Fliedel, Fabrice Davrieux, Michel Vaksman, Niaba Tene, Jean-Francois Rami

*CIRAD UMR AGAP, TA 108/03 Av Agropolis 34398 Montpellier CEDEX 5 FRANCE.
e-mail: diarah.guindo@cirad.fr

INTRODUCTION

Sorghum has a wide range of use in food and feed industries, as well as in alcohol and renewable energy production. In Africa, particularly in Mali, sorghum is mainly used for preparation of traditional meals and production of traditional beer. The lack of adaptation of sorghum new varieties to these end uses remains an impediment to their adoption. In Mali, one of traditional meals prepared from sorghum is tô, a thick porridge. The characteristics of a good tô are firmness, storage capacity during an entire night keeping the firmness and without exudation of water on its surface, as well as an acceptable color (White, pale yellow, olive green, light green) and taste. Biochemical and physical characteristics of grain determine its quality for tô preparation. Developing new sorghum varieties with grain suitable for tô necessarily passes through a better understanding of the genetic control of these parameters.

OBJECTIVES

The objective of this work is to evaluate several important technological traits of sorghum grain contributing to tô quality, understand how they are genetically controlled and integrate this knowledge in a breeding program.

RELATIONSHIP BETWEEN GRAIN PARAMETERS AND TÔ PREPARATION PROCESS

The steps of porridge preparation, from dehulling to cooking passing through grinding, interact with the grain chemical and physical parameters. The physical parameters affect the dehulling which also alter the chemical components of the grain and flour (figure 1).

GENETIC MATERIAL

Two bi-parental populations connected by a common parent were used. Parents were contrasted elite varieties from different breeding programs in Mali. Genotyping was performed on 400 F3 families using SNP markers and grains of each family were used for its technological characteristics determination.

GRAIN WHITENESS AND ROUNDNESS DETERMINATION

Wavelengths specific to each trait were determined by the iPLS (interval partial leastsquares) regression method. A prediction equation was developed based on those wavelengths.

PHENOTYPING BY NEAR INFRARED SPECTROSCOPY

Whole grains of 400 families (about 5g per family) from two populations were scanned by near infrared spectroscopy (NIRS). The NIRS spectra were used with reference values obtained by conventional analysis to develop prediction equations. The sorghum core collection of CIRAD was used as a baseline in the development of equations. A suitable calibration equation was developed for each trait.

CONCLUSION

Major QTLs were detected, among them, some were already known as the major QTL for pericarp thickness on chromosome 2. Other major QTLs not previously identified, as the one for grain roundness on chromosome 7 and for endosperm texture on chromosome 4, have been detected. Several minor QTLs were also detected for different traits (grain color, thousand kernel weight, protein and lipid content…), among them there is the example of the vitreous on chromosome 1, 2, 3.

QTLs detected for all traits, including traits for grain yield have been used to define 3 ideotypes (grain quality, grain yield and both grain yield and grain quality) based on favourable alleles for the breeding objectives. This knowledge has been used to select individuals for the first breeding cycle.