BIOSORG

BIOSORG - Diversifying and opimizing biomass sorghum value chains for Mediterranean and Semi-arid environments: an integrative approach merging biological sciences, biomaterial development and socio economic assessment.

ABSTRACT

To face global warming and fossil fuel depletion crisis, plant biomass will provide a renewable source of energy, materials and chemicals. Accordingly, agriculture will have to adapt not only to avoid competition between food-feed and non-food non-feed uses but also to ensure the economical sustainability of these productions.

Keywords : Developing the plant of the future, Quality, Plant, Genomics, Varietal improvement, Agro industry, Demand, Transformation, Breeding, Gene expression, Systemic approach, Value chain, Sorgho

Year : 2013
Project number : 1301-010
Type of funding : AAP CARIPLO
Project type : AAP
Research units in the network : F&S
Start date : 2014-02-26
End date : 2017-02-25
Flagship project : no

Project leader : David Pot
Project leader's institution : CIRAD
Project leader's RU : AGAP

Budget allocated : 248520 €
Total budget allocated (including co-financing) : 522260 €
Funding : Labex

GOAL

the aim of the BIOSORG project is to develop an integrative strategy to reinforce the biological and economical relevance of multipurpose biomass sorghum for both Mediterranean and tropical semi-arid conditions (West Africa).

The specific objectives are :
• The development of a Plant to cell model allowing predicting biomass sorghum yield and composition in various environments and supporting ideotype exploration
• The development of breeding tools with a large spectrum of applications, not only in terms of breeding populations targets but also in terms of phenotypic traits of interest
• A clear decision guide to identify the most relevant value chains according to the regional context
• A new process to produce polypropylene sorghum biocomposite with the identification of the biomass properties that affect its durability

ACTION

WP1 : develop a model based plant, systems biology approach to unravel the genetic and physiological

bases of C allocation to organs, tissues and plant components under contrasted water supplies;
WP2, develop breeding tools for biomass yield and composition and merge current breeding efforts for grain yield and quality with biomass quality related traits in the West African context;
WP3, evaluate the relevance of biomass/multipurpose sorghum at the socio economic level in Mediterranean and West African contexts;
WP4, develop new polypropylene sorghum biocomposite neither available on the market nor developed in known research projects.

RESULTS

WP1 : Agromorphological, ecophysiological, biochemical and histological characterizations of several genotypes submitted to contrasting water treatments have been performed. Integrative analysis of the different scales (whole plant down to the cell level) is on-going, and is supported through the development of the EcoMeristem model. Gene expression analysis (Whole Transcriptome and Targeted approach) have been implemented and allowed the detection of key regulator of the cell wall establishment and response to drought stress.

WP2 : A panel of Non photoperidic genotypes have been characterized over two growing seasons in well watered and water deficit treatments. Genotyping by sequencing allowed the detection of more than 500 000 SNP that are currently used for GWAS analysis. The phenotypic charaterization of a multiparental design developped in Mali regarding stem composition is on-going and should allow accelerating the identification of the genes if interest and provide relevant varieties.

WP3 : Value chains involving energy use of sorghum (through anaerobic digestion) in association with animal feed emerged as the most relevant schemes at this stage. In the Midi Pyrénées region. Surveys of the perception of the sorghum crop and energy crops in the same region is on-going.

WP4 : suitable processing and mixing conditions have been set up to produce polyethylene sorghum biocomposite. Several fibre characteristics were identified as being key parameters for the production and in service-life performances of sorghum based composites: particle size distributions, cellulose crystallinity, thermal stability and mechanical behavior in controlled environmental conditions