Planned for oral presentation in session 7, 4:30-6PM

Integrative biology and modelling of biomass sorghum growth to support its genetic analysis and ideotype conception

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Sorghum genetic diversity offers the opportunity to develop multipurpose genotypes combining high grain, ligno-cellulosic biomass and/or sweet juice productions. It provides a large spectrum of adaptive traits, particularly to drought, essential for ensuring production stability in an increasingly fluctuating climatic context. Sorghum is thus a crucial crop to breed for and contribute to meet future expectations regarding food, feed and bioenergy productions, while minimizing resource and land use competition.

Accordingly, ideotypes must be developed combining appropriate developmental, morphogenetic and biochemical traits depending on targeted cropping contexts (eg. dedicated vs. intermediate crop, water availability) and end-uses (eg. energy, feed). Trait impact on plant phenotype construction must be first quantified, considering possible linkages and trade-offs among them that can appreciably modulate their respective benefits depending on the genotype and the environment.

With this respect, ecophysiological modelling plays an original role since, by formalizing experimental knowledge on individual processes, it helps analyzing their trade-offs and impacts on resulting plant phenotypic variability, across genotypes and environments. Supported by appropriate mathematical tools, it can help quantifying elemental traits within a range of genetic diversity, in a way not accessible experimentally, toward their genetic study and the *in silico* optimization of their combination for a given context.

This approach is currently set-up in two companion projects aiming to develop multipurpose sorghum for both Mediterranean and semi-arid, drought prone environments. Field trials were carried out to identify traits controlling vegetative biomass production, composition and expressing variability across genotypes and water situations, at tissue, organ and plant level. Accordingly, the plant growth model *Ecomeristem* is progressively adapted to capture key processes controlling such phenotypic variability.

Recent progresses and future developments will be presented, highlighting how modelling enables to analyze trait compensations and impacts on grain and biomass production and finally define ideotypes depending on targeted contexts.