



Wrap-up of Workshop 1

Selection and genetic progress.
Which solutions to face new challenges?

David POT et Gilles TROUCHE

BREEDING AND GENETIC PROGRESS

WHAT ARE THE ACHIEVEMENTS? WHICH SOLUTIONS TO FACE NEW CHALLENGES?

Session 1

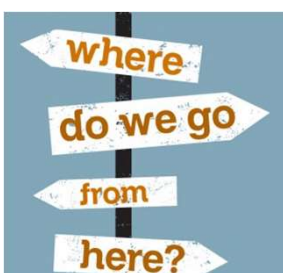
Where we are,
where we have to
go ?

Achievements and challenges
for the development of sorghum
varieties fitting the expectations
of the value chains

Session2

How do we
collectively act
for the future ?

Building collaborations on
sorghum breeding and
phenotyping in Europe



SESSION 1 : ACHIEVEMENTS AND CHALLENGES FOR THE DEVELOPMENT OF SORGHUM VARIETIES FITTING THE NEEDS OF THE VALUE CHAINS



David Jordan

- A successful « public » pre-breeding programme
- Optimizing the GXEXM equation
- Use crop Modelling to identify key traits and predict performances
- Breeding for tolerance to high temperature
- Opportunities of Genomic selection and genome editing



Walter de Milliano

- Improvement of forage sorghum for Northern Europe
- Need specific adaptation to high day length and low temperatures at seedling and flowering stages
- Significant progress on plant morphology, yield and seed set (starch content) + stem sugars



Steffen Windpassinger

- An innovative public-private partnership
- Breeding for tolerance to juvenile cold stress and pre-flowering drought
- Use of controlled experiments and field trials
- Juvenile cold tolerance is quantitative and heterotic → classical hybrid breeding based on GCA assessment and heterotic pool
- Lodging tolerance is a new challenge and need more research



André Schaffasz

- Tolerance to reproductive cold stress (flowering time)
- Genetic diversity exists for this trait → Identification of highly cold tolerant lines
- Verification of pollen viability under controlled conditions
- Identification of QTL to be used for MAS

SESSION1 : ACHIEVEMENTS AND CHALLENGES FOR THE DEVELOPMENT OF SORGHUM VARIETIES FITTING THE EXPECTATIONS OF THE VALUE CHAINS

Take home messages:

- Genetic gains have been obtained for both grain and forage sorghum
- Recent advances to extend sorghum cultivation area to Northern Europe

- More are expected !
 - Refining grain and forage ideotypes
 - Seedling vigor and tolerance to low temperatures
 - Tolerance to pre-flowering drought (grain and forage) and lodging (forage)
 - Quality components

- An integrative approach merging Genetics x Crop Management x Environment is required

- New molecular and biotechnological tools are being developed allowing a higher accuracy / efficiency

SESSION 1 : ACHIEVEMENTS AND CHALLENGES FOR THE DEVELOPMENT OF SORGHUM VARIETIES FITTING THE EXPECTATIONS OF THE VALUE CHAINS



What are the new breeding challenges to increase the performance and profitability of sorghum in Europe?

- Improving adaptation and production stability
 - Yield potential and stability
 - Tolerance to drought stress (pre or post-flowering depending areas)
 - Cold tolerance (early planting to escape reproductive drought stress and allows better grain dry down...)
 - Lodging tolerance (forage and energy sorghum)
 - New pests and diseases linked with climate change
- Improving the Quality components for the current and future end-products
 - Grain humidity at harvest (component traits include panicle exertion and grain type)
 - Seed size uniformity (sowing)
 - Fodder value (dairy cattle)
- The next steps
 - A survey of the key traits to be improved at the EU level (done for soybean)
 - Patrice Jeanson (Euralis / Prosorgho) is going to coordinate this work

SESSION2 : OPTIMIZING EU SORGHUM BREEDING EFFICIENCY



Vladimir Kovtunov

- Conservation, characterization and use of Russian genetic resources
- Impressive variability in plant morphology, grain size & color, composition and quality, sugar content...
- Identification of lines with high tolerance to juvenile cold stress
- Advances in lines and hybrids development



Paul Chege

- Accelerating variety development using doubled-haploid technology
- Identification of best tissue culture and explant organ for generating good embryogenic calli



Delphine Luquet



Alessandra Fracasso

- Impact of CC for summer crops in Europe: higher t°, lower rainfall
- Definition of multi-criteria ideotypes for adaptation, yield and quality vs target uses
- Phenotyping tools for biomass properties, drought tolerance, multi-scales issues
- Use of crops models



Ian Godwin

- Exploring sorghum diversity to develop marker assisted breeding strategies
- Focus on grain size and protein digestibility
- New targets : plant architecture / root development
- Functional validation and Breeding tools !



Quentin Devaud

- Private public partnership towards forage hybrids
- Genetic architecture of forage sorghum quality
- Steering the recombination process

SESSION2 : OPTIMIZING EU SORGHUM BREEDING EFFICIENCY

Take home messages

- Sorghum : A reservoir of genetic diversity that contains solutions for the future
- Advanced Phenotyping and modelling tools are available
 - Target trait identification
 - Spatialized performance predictions
 - Virtual test of variety ideotypes fitting the E-M contexts
- Optimization of breeding efficiency is possible
 - Marker assisted breeding
 - Biotechnology (cell culture, New Breeding technologies...)

SESSION2 : OPTIMIZING EU SORGHUM BREEDING EFFICIENCY



How to organize a sorghum phenotyping network in Europe?

- The expectations and benefits for the private companies and the public institutes:
 - Target Population of Environment (TPE) definition for sorghum at European level
 - Sharing the genetic resources (landraces), making them accessible!
 - Evaluating elite material in contrasting environments (information for each testing site)
 - Feeding crop models (predictions + target trait identification)
 - Pathogens surveys in a wide range of environmental and management conditions
- The constraints
 - IP issues regarding elite varieties and hybrids (with MTAs we can handle it !)
 - Funding the network !!!
- The next steps
 - Identifying the actors
 - Survey the phenotyping tools available at the EU level (traits, platforms...)
 - Survey the trial sites available and characterize their environments
 - Identify funding opportunities (EU...) : who ?

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SATELLITE MEETING : SORGHUM BREEDING AND PRE-BREEDING AT THE EU LEVEL: ACTING COLLECTIVELY FOR A BETTER EFFICIENCY

- **Who was there ?**
 - Mainly people from the « Genetic gains workshop »
 - Inputs from the others workshops are more than welcome now!!!
- **Objectives**
 - Validating / Enriching the key priorities for the future of EU sorghum breeding
 - Prioritizing the key actions to initiate at the phenotyping level
 - Developing genetic resource panels relevant for EU breeding and pre-breeding
 - Identifying the actions needed to optimize the communication among EU sorghum researchers and with the value chains stakeholders
- **Outputs and to do list**
 - Key priorities : Post flowering drought tolerance and cold tolerance (emergence stage) (need to define exactly the stress' strength and the stage)
 - Combination of broad based panels with multiparental populations anchored on elite recurrent genotypes
 - Organization of a « geneticists / breeders » meeting to make propositions of strategies (population types...) : **CIRAD**
 - Optimizing communication : COST (discussion networks) and ETN (PhD mobility + capacity building for specific research questions) calls to explore : **Who take that in charge ?**

THE NEXT STEPS !

- Refining the target traits : EU Survey leaded by Patrice Jeanson (Euralis / ProSORgho)
- Identifying the EU research players
- Identifying the EU sites available for testing (environmental and management contexts) and the phenotyping facilities available
- Population definition and development : CIRAD (meeting organization)
- €€€ : Experimental network + Communication / networking : EU « COST » and « ETN » ? : who ?
- A combined Worldwide – EU sorghum event would be a great idea ! Building synergies between EU and others (Africa, India, Australia, USA...)

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- Eucarpia Maize and Sorghum October 7-9th, Freising, Germany 2019
- A new opportunity to meet and to be visible in comparison with the really well organized Maize community