

## **SORGHUM,** A KEY TO BUILD OUR FUTURE.





## **3<sup>RD</sup> EUROPEAN SORGHUM CONGRESS**



## **THE SORGHUM**

A committed industry for promising outlets

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**3RD EUROPEAN SORGHUM CONGRESS** 



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# **Genetics and Breeding : Advances since the 2018 European congress**

**David Pot, Gilles Trouche** 







## 2018 Workshop : Breeding and genetic progress. Which solutions to face new

challenges?





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

How to organize a sorghum phenotyping network in Europe?

Satellite meeting : Sorghum breeding and pre-breeding at the EU level: acting collectively for a better efficiency





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

• Improving adaptation and production stability



**Tolerance to drought stress** 





Kunrath et al. 2020. Nitrogen uptake x drought



Cold tolerance



Parra-Londono et al. 2018. Genetic determism of early cold tolerance

Schaffasz et al. 2019. Reproductive Cold Stress Tolerance genetic determinism

Patane et al. 2021. screening for cold tolerance in Fiber and sweet sorghum

Lambert et al., 2020. forage production x drought











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

- Improving adaptation and production stability
  - Lodging tolerance





Fritz SorghumID 2018



Correlations Breeding

Heritability



Wang et al. (2020). Genetic determinism of lodging in grain sorghum = f (plant height and C remobilization)

213 genomic regions involved in lodging susceptibility



#### Yield potential and stability



Velazco et al, 2020. Hunt et al., 2020 : New statistical approaches to better predict yield stability and GXE



Tack et al., 2017 : link between US breeding programme diversity and adaptation to climate change



### New pests and diseases linked with climate change

Pilot study leaded by Agropolis on Viruses in Africa







Potyviridae; Location : Worldwide Transmission: Aphid, Seed & Contact





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

- Improving the Quality components for the current and future end-products
  - Feed value (grain and fodder)





BIOMASS For the Future

Thomas et al. 2021. sorghum genetic diversity to support the energy and feed value chains



Inal et al., 2021. Nutritive Value and Fodder Potential of sweet sorghum genotypes

Buonaiuto et al. 2021. Using sorghum flour to feed Parmigiano Reggiano dairy cows

Grain humidity at harvest + Seed size uniformity

Not adressed yet but image analyses tools are available opening new avenues to tackle these challenges





## Organizing 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
- No EU Sorghum Phenotyping Network yet available ٠
  - But :
    - **MIRROR project** is starting aiming to identify recurrent stress scenarios
    - Yield prediction for biomass sorghum is available : Habyarimana and Bartelds (2021)



But such work is on-going in West Africa : DESIRA Abee project



**Florian Larue** Agronomy Workshop







**Christine Granier** 

### Satellite meeting: Sorghum breeding and pre-breeding at the EU level: acting collectively for a better efficiency

- To do list in 2018 •
  - Key priorities : Post flowering drought tolerance and ٠ cold

Combination of broad based panels with multiparental populations anchored on elite recurrent genotypes

Did not yet happened, but collaborative projects have been funded (NitroSorgh, see poster) and submitted (ORHIZON => Root focus) targeting the development of common broad based panels

traits + MIRROR's project



Nancy Terrier



Laurent Laplaze

Optimizing communication : COST / ETN ...





Did not yet happened ! It is the next step !!

Some achievements on genetic determinism of adaptive





# 2018-2021 : a great period !

- Significant advances regarding some of the key traits : drought, cold tolerance, lodging, quality...
- Increasing research efforts targeting the diversification of the sorghum-based cropping systems and the use of sorghum for food and energy
- A growing sorghum research community that would benefit of more interactions
- EU research efficiency can take advanatge of collaboration with West African, US, Australia partnerships



## Much more arriving !!!

- A global image of the the current varietal offer at EU level
- Descriptions of successful overseas breeding programmes
- A roundtable aiming to identify the key factors that contribute to breeding programmes success
- Benefits of Genomic selection
- Integrative analysis to optimize breeding
- Prospective analyses of the key future targets
- A roundtable aiming to identify what is missing at the EU level to collectively improve breeding efficiency



