International Virtual Experts Meeting on Promoting Sustainable Agriculture Development in Drylands

Riyadh, Kingdom of Saudi Arabia 10th August 2020

Plant breeding and better crop selection for improved dryland stress resistant varieties development to enhance productivity

Breeding for diversified cropping systems

Example of sorghum based systems in Central North zone of Burkina Faso

Dr. Myriam ADAM

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Urgent need to introduce greater diversity to cropping systems

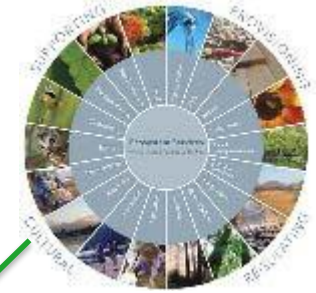
Soil

Climate

Management

Risk management

Multipurpose



Ecosystems services

Environmental variability

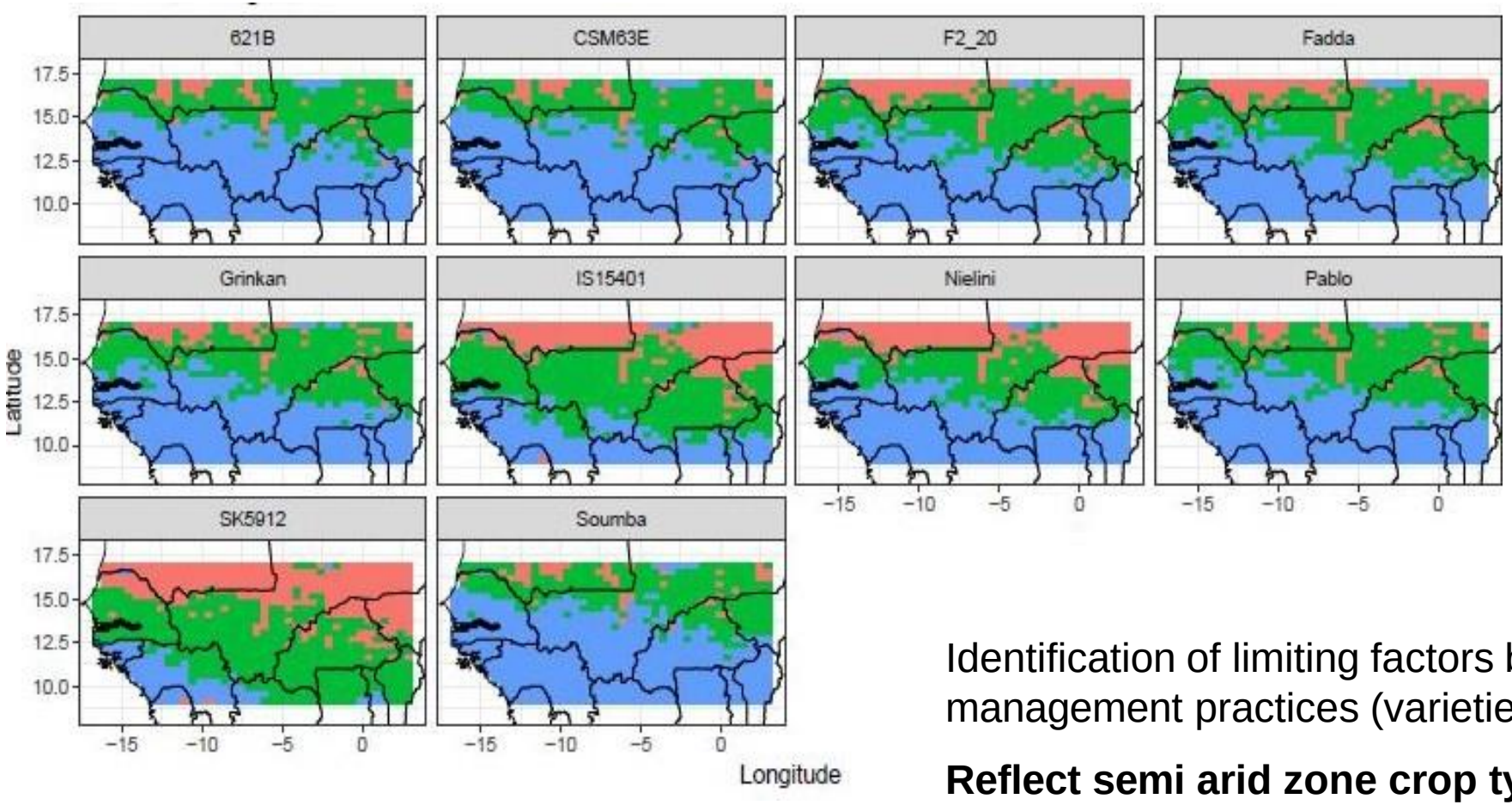
Farmers

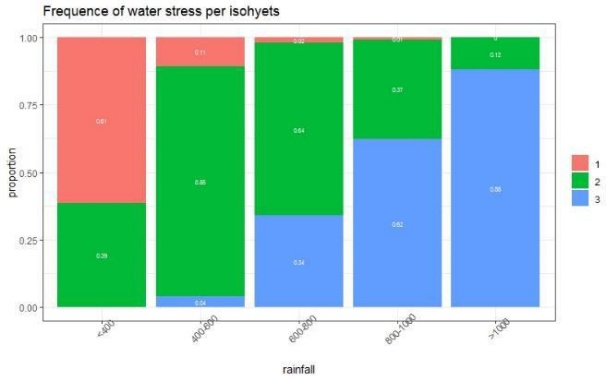
Sustainability
Multi-functionality of the cropping systems

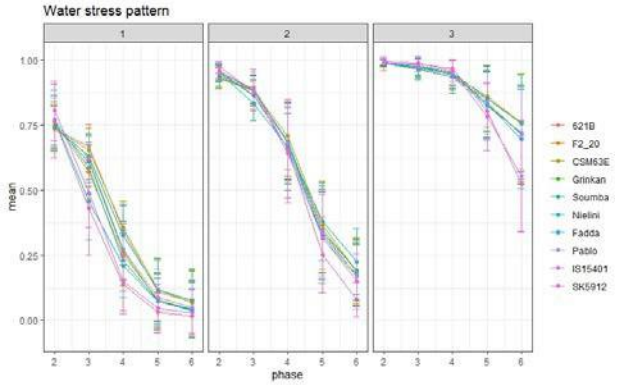
Functional understanding of the systems

Going from ideotype to ideo-mixes up to ideo-systems

Environmental variability
Target Population Environments







Identification of limiting factors by models according to different management practices (varieties, fertilisation, sowing density…)

Reflect semi arid zone crop types/ environments/ situation

- ⇒ **Optimization of crop management**
- ⇒ **Target traits to guide breeding**

Environmental variability
Coordination of plant breeding at the regional and national levels

ABEE project-West Africa Breeding Networks and Extension Empowerment

- 20 varieties from the 5 speculations evaluated in the 5 countries since 2018
- Standardisation of phenotyping methods
- Harmonized database (BMS)

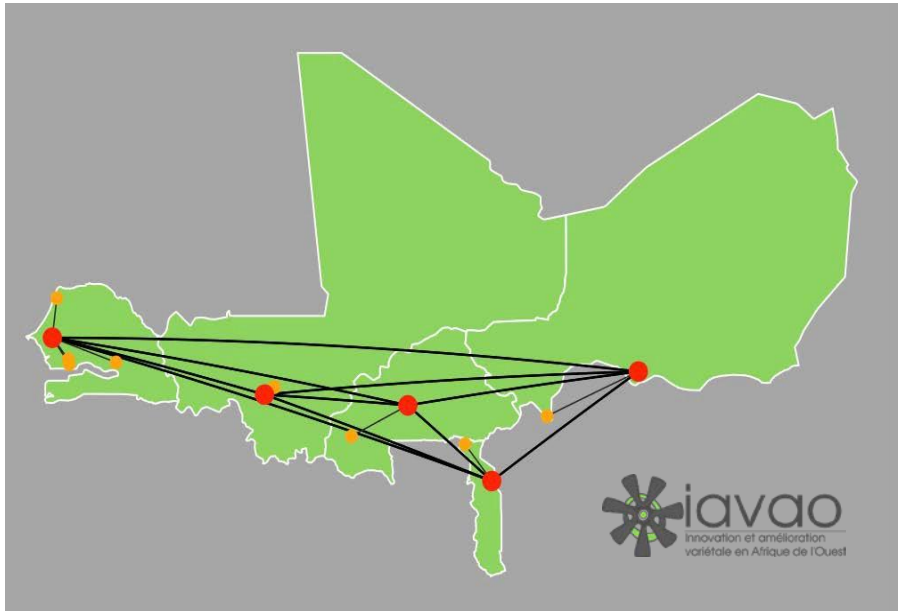
5 countries (Burkina Faso, Mali, Niger, Sénégal, Togo)

Breeding

Phenotyping

Genotyping

IBM



sorghum millet cowpea peanut fonio sesame

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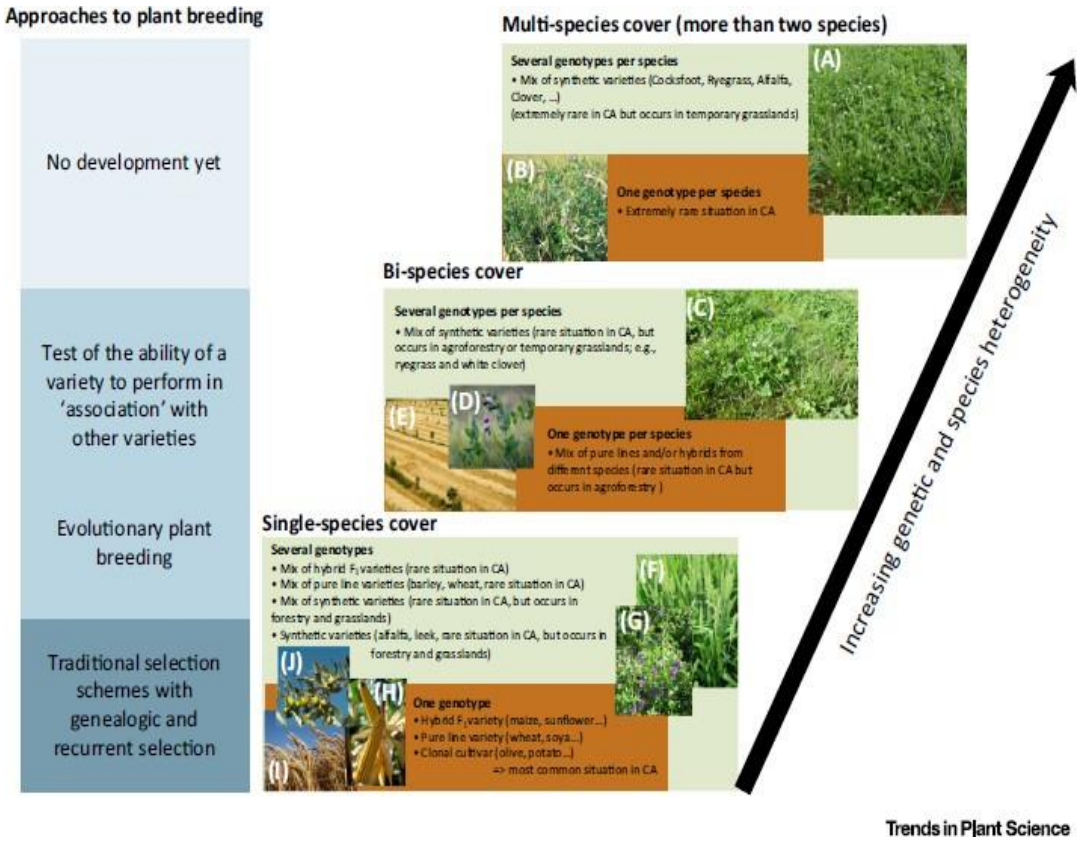
Regional concerted network of breeders

Sustainability
Multi-functionality of the cropping systems



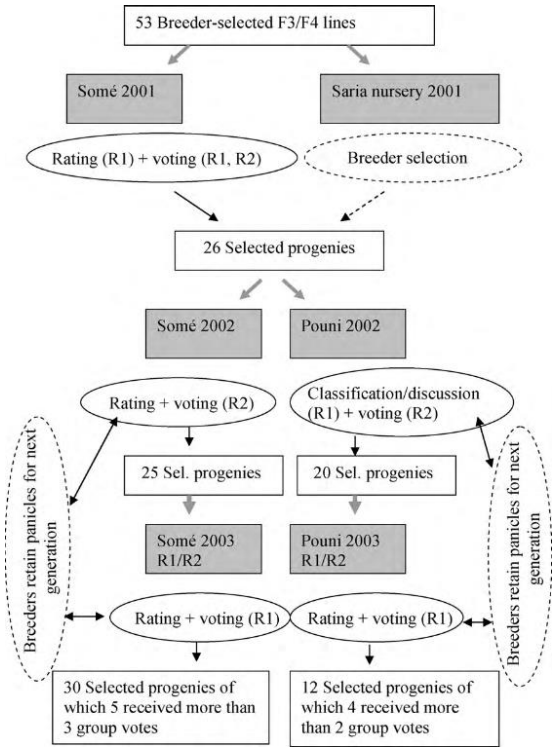
→ **In semi arid zone of Burkina: sorghum based systems and mostly intercropped**

Litrico and Violle, 2015

Need for breeding programs to include diversity in their program

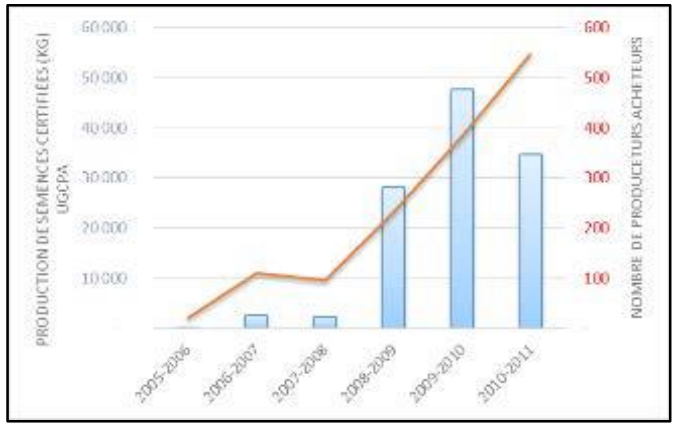
Single species cover: « Traditional » selection schemes

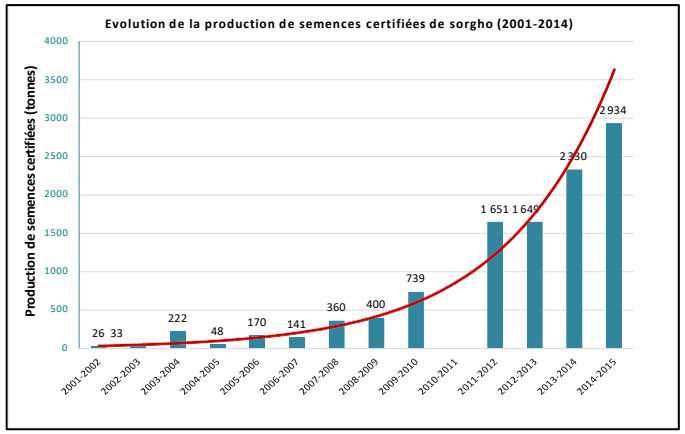
Conventional breeding goals (for sole crop) should evolve to innovative decentralized and participatory selection scheme (done for sole crop in Burkina Faso)



Vom Brocke et al. 2010

Define varietal type according to farmers needs and their production systems





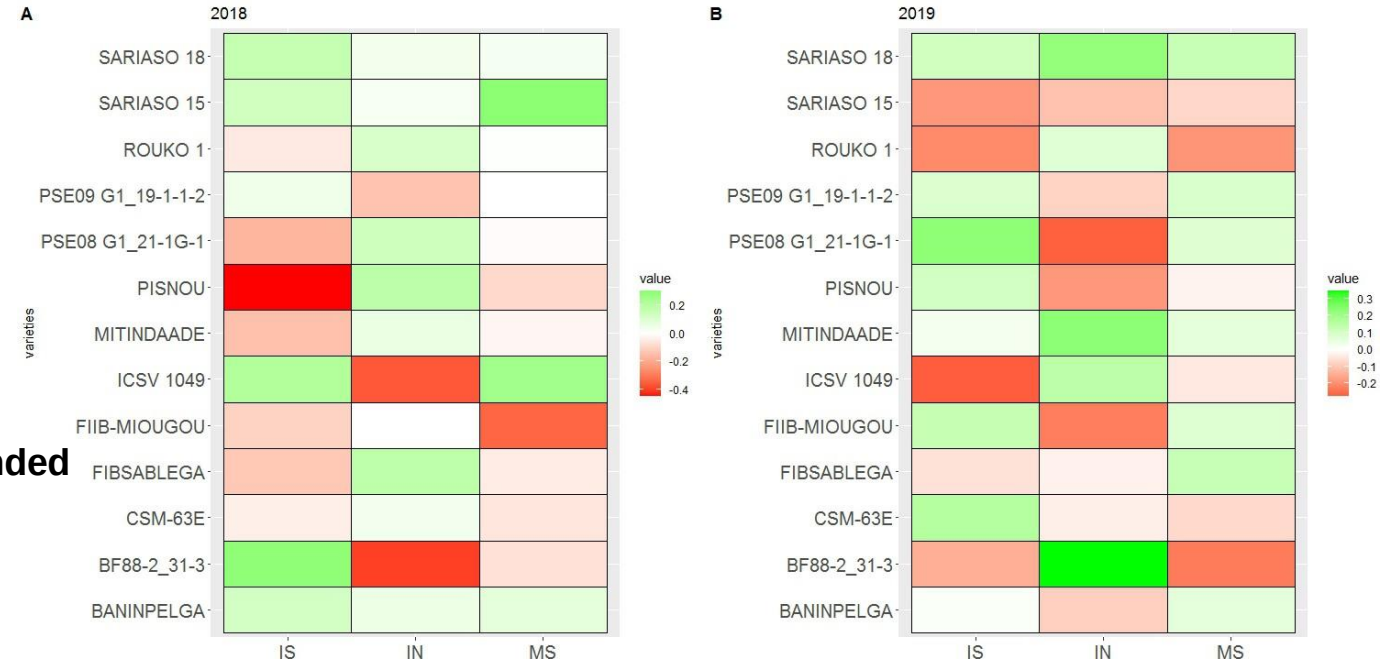
Training of farmers to produce locally quality seeds
Partnership with farmers' organization to enhance seeds access

Bi-species cover: Test the ability of variety to perform in association with others

Building on farmers' knowledge to improve sorghum-cowpea systems in North Central Burkina Faso
→99% of farmers practices intercropping in the Central Nord zone of Burkina

Farmers' practice: in the same hill

Researcher recommanded practice: inter-row



→System resilient to climatic variability
→Performance of varieties different according to the cropping systems

Importance to optimize **agronomic traits in breeding programs, but for intercropped systems, there is a need to look at other traits** (showing the ability to live and perform well with other plants)

→ functional traits related to resource-use = **interaction traits**

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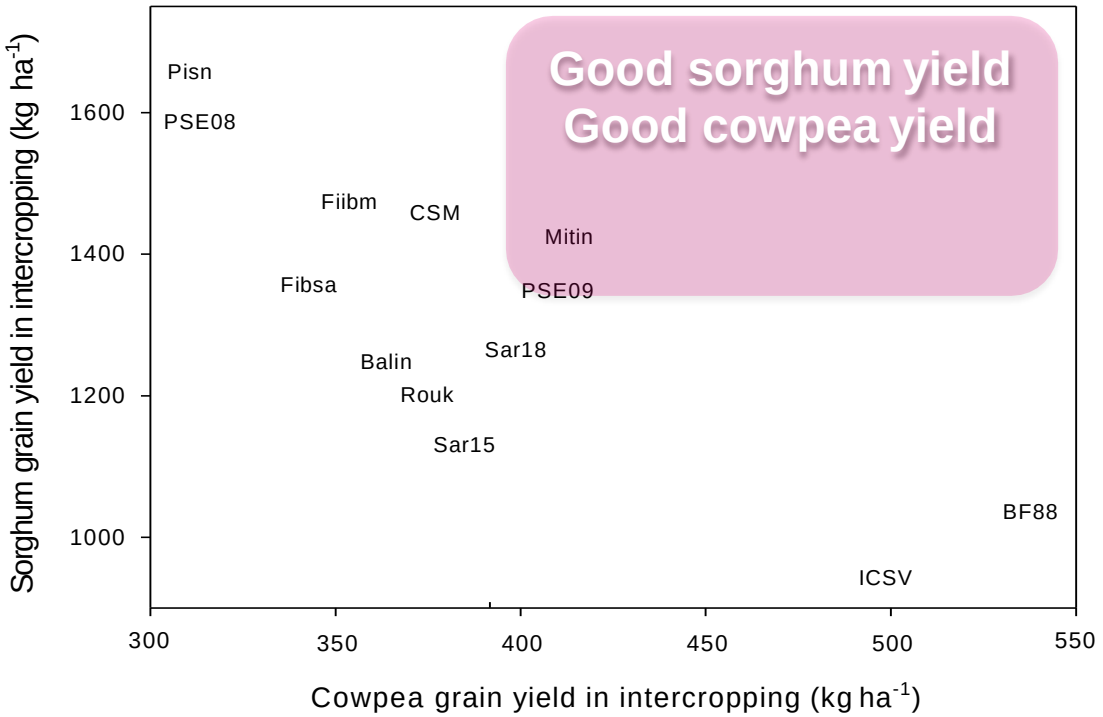
Performance of a genotype in pure culture ≠ its performance in mixed culture

Bi-species cover: Test the ability of variety to perform in association with others

Define plant traits that are important for intercropped systems

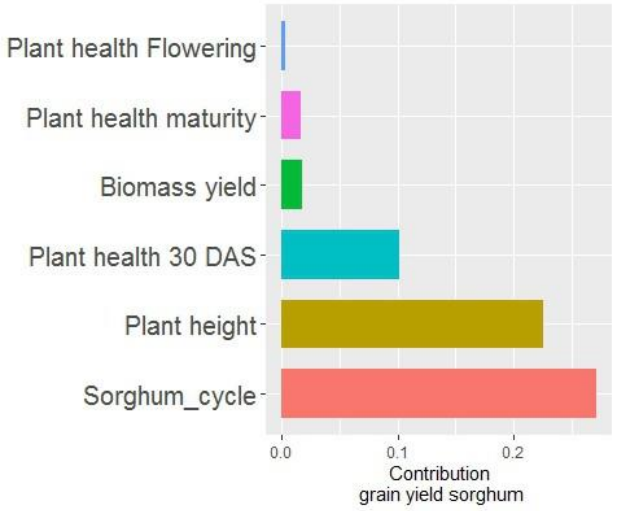
Agronomic traits



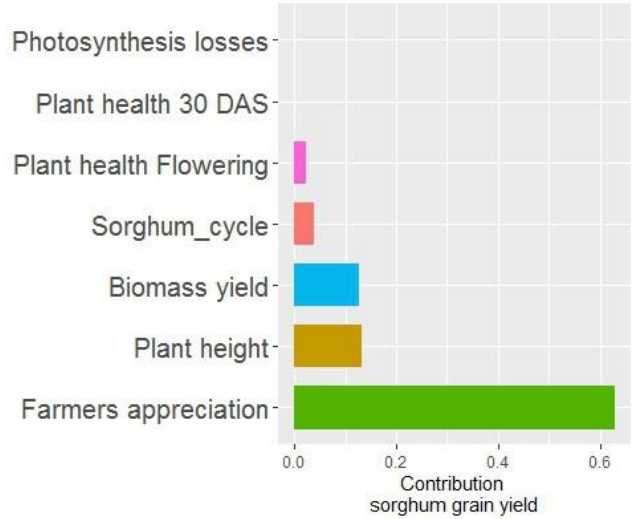
Interaction traits (variance decomposition)

Plant traits contributing to sorghum yield

Intercropped



Sole crop



Importance of phenology and plant height for intercropped systems (complementary traits)

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Optimize the mean value of agronomic traits and the variance of interaction traits

In semi arid zone of Burkina: sorghum based systems, mostly intercropped

Environmental variability

- Modeling to guide varietal selection in the South (better target)
- Regional concerted network of breeders
- Need for breeding programs to include diversity in their program

Sustainability

- Importance of farmers perspective and involvement
- Performance of a genotype in pure culture ≠ its performance in mixed culture
- Optimize the mean value of agronomic traits and the variance of interaction traits

Breeding for diversified cropping systems

Single-species → Bi-species → Multi-species

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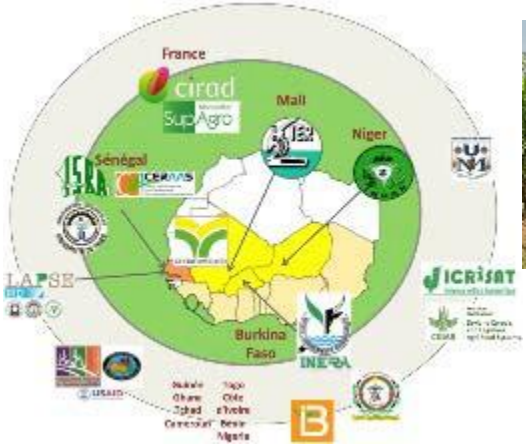
Conclusions : premises of breeding for bi-species cover *(let alone multi-species)*

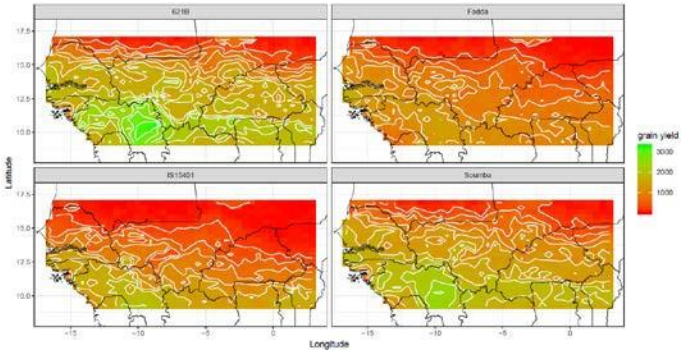
In West Africa, for crop selection for improved dryland stress resistant varieties development to enhance productivity we have

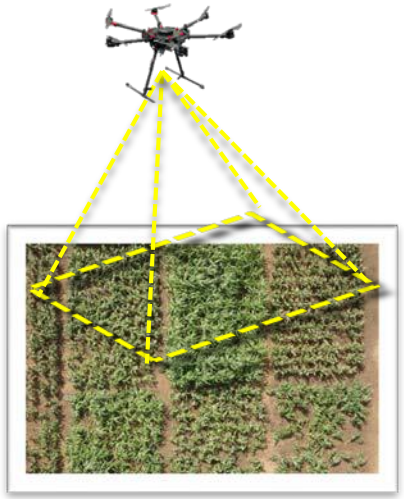
1. A network of concerted breeders working together
2. Tools (models and imagery/phenotypage) to characterize the diversity of environments and better target the stress of interest

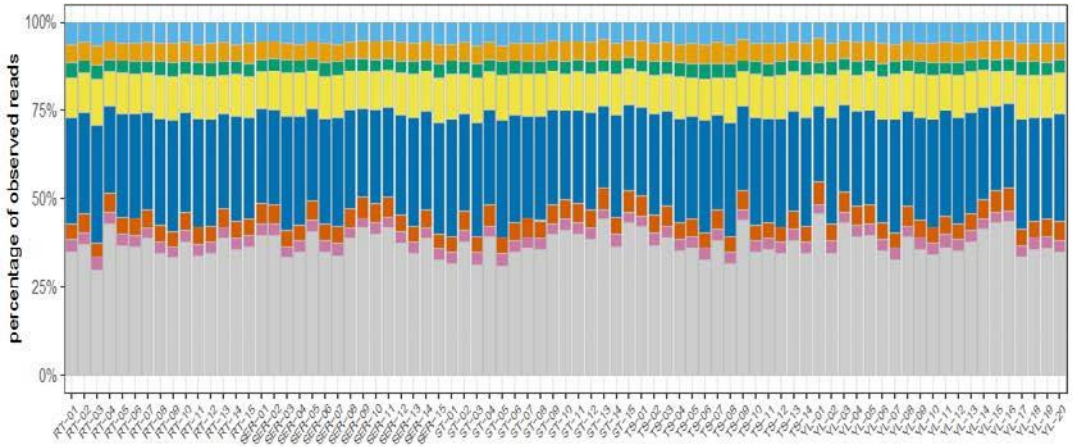
→ There is a need to further strengthen these approaches for intercropping systems

3. Use of 1 and 2 for intercropped systems (not only pure crop): initial work in Burkina Faso (collaboration INERA-CIRAD)
4. Include soil microbiology for evaluation « in situ » of soil diversity versus legumes endophytes symbiose









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Proposal for International Virtual Experts Meeting on Promoting Sustainable Agriculture Development in Drylands

Riyadh, Kingdom of Saudi Arabia
10th August 2020

Thanks for your invitation

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Photos: Rik Schuiling/ TropCrop -TCS