

Online Postgraduate course on "Participatory Plant Breeding & Resilient Seed Systems: Options for Stakeholder Engagement and Benefit Sharing
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Sorghum breeding for grain and stover quality through a farmer-researcher network in West Africa: case of Mali

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Outline

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- Context of West African agriculture

02

- Organization of the sorghum breeding program in West Africa

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- Role of farmers' network in the sorghum improvement process: case of Mali

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- Conclusion



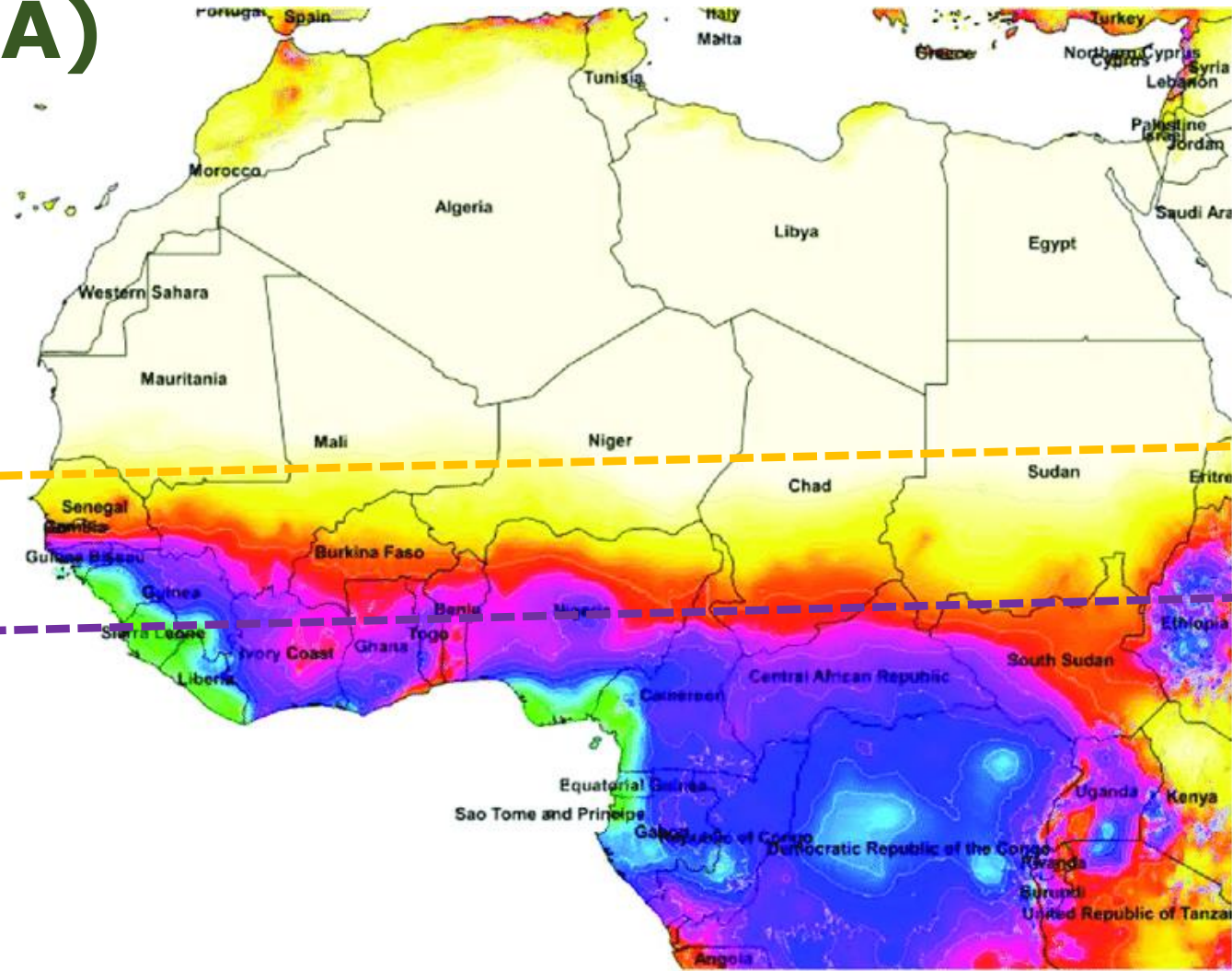
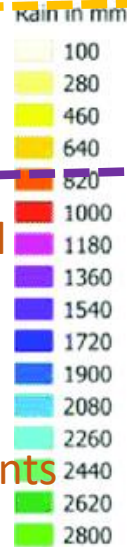
Context West Africa (WA)

- Sorghum production WA: 5.5 m tons 1980 to over 13 t 2017 (FAOSTAT, 2017)
- WA: 31% of world area and 45% of Africa total area
- Nigeria, Burkina Faso, Mali~ 60% of WA sorghum

Sorghum production zone (500-1200 mm)

Diversity:

- Environmental
- Cultural/uses
- Social
- Economic
- Biotic constraints



Context West Africa

- Sorghum grown by smallholder farmers as staple food crop (grains)

- Stover for livestock feeding

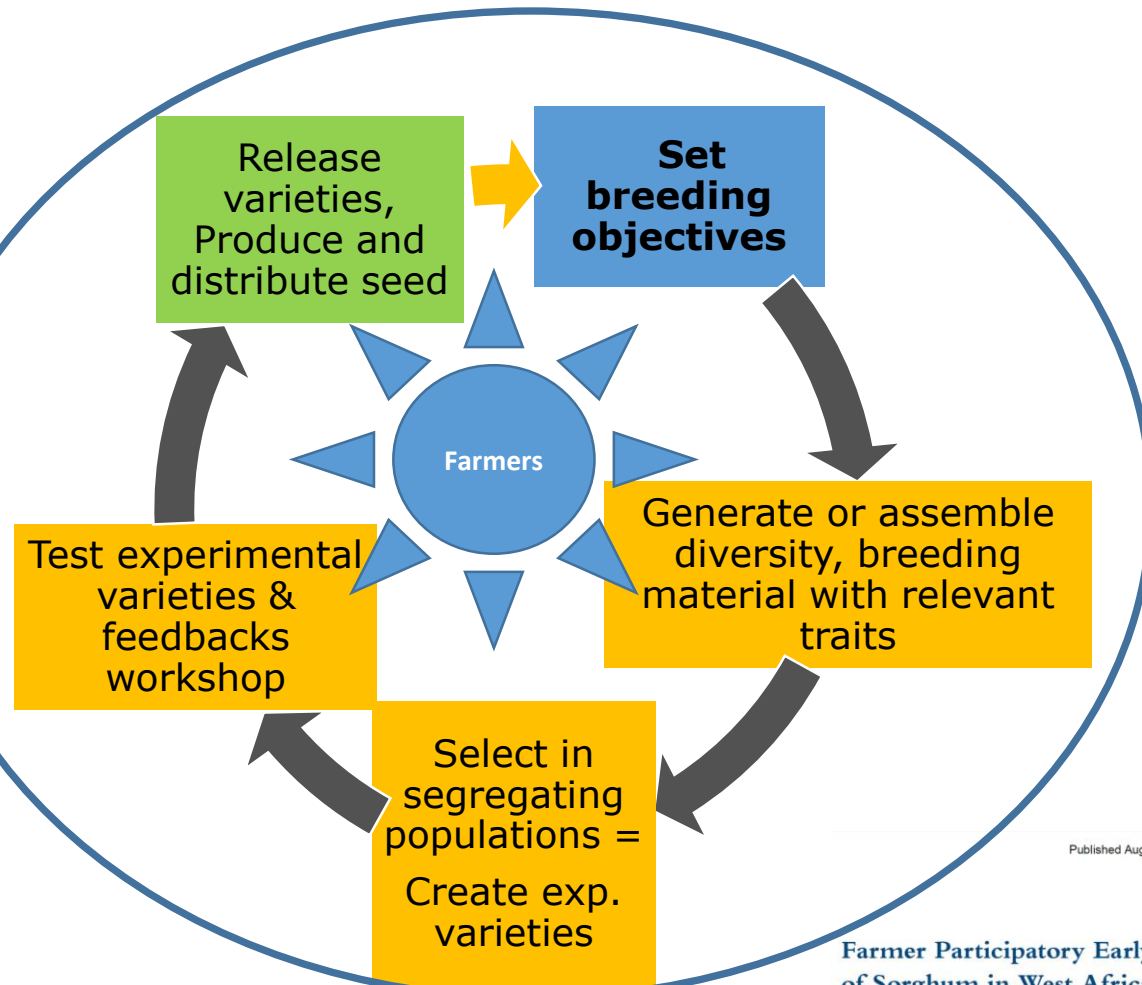


What type of varieties?
Which characteristic of grains?



Organization of the breeding program

Use of farmer-research network



Source: Adapted from Weltzien et al. 2003

Published August 30, 2016

RESEARCH

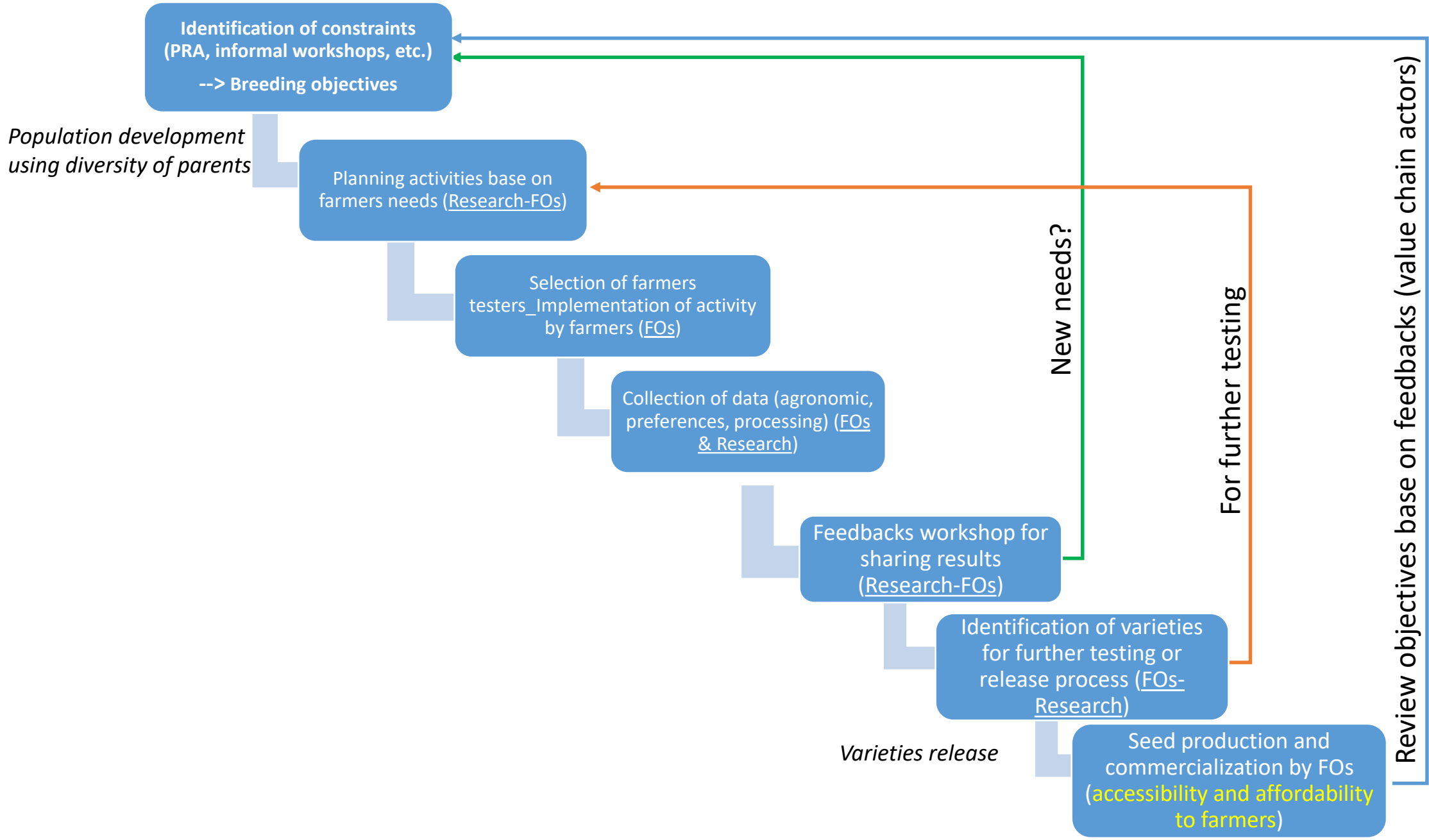
Farmer Participatory Early-Generation Yield Testing of Sorghum in West Africa: Possibilities to Optimize Genetic Gains for Yield in Farmers' Fields

H. Frederick W. Rattunde,* Sebastian Michel, Willmar L. Leiser, Hans-Peter Piepho, Chiaka Diallo, Kirsten vom Brocke, Bocar Diallo, Bettina I. G. Haussmann, and Eva Weltzien

- Involvement of farmers at each stage to ensure their needs are considered/colearning
- Farmers fields represent targeted environments and give good coverage of environmental, socio-economic, conditions
- Farmers involvement eases technology up take/adoption



Organization of the sorghum breeding program in West Africa/farmers' role



Data collection in the field (farmers evaluation and yield data)

Tester farmer

- Seedling vigor (scores 1-5)
- Flowering time (scores 1-5)
- Panicle appreciation (1-5)
- Appreciation of grains (1-5)
- Global appreciation (1-5)

Groups evaluation

- Field visit to identify important traits
- Group discussion (men and women in different groups)
- Prioritization of traits (3 to 4 traits)
- Evaluation using scores and comments

Individual voting

- Use of cards with different colour
White = Good;
yellow = fair;
red = bad/reject
- Calculation of preferences (Men, women, and global)

Cards used for voting

XXXXXXXXXXXXXX	Women
	Men
XXXXXXXXXXXXXX	Women
	Men
XXXXXXXXXXXXXX	Women
	Men

- Research facilitate discussions and the process
- Yield data collected by research and farmers organizations

Breeding material evaluation by farmers

Group (women; men) appreciation



Individual voting



Stover quality, new priority trait

■ *How do farmers measure the stover quality*

number of leaves

stem and leaves greenery (stay green)

proportion of plant and total stover upaked by animals (after harvest): now lignin and sweetness of the stem

■ *How to consider stover quality in the breeding?*

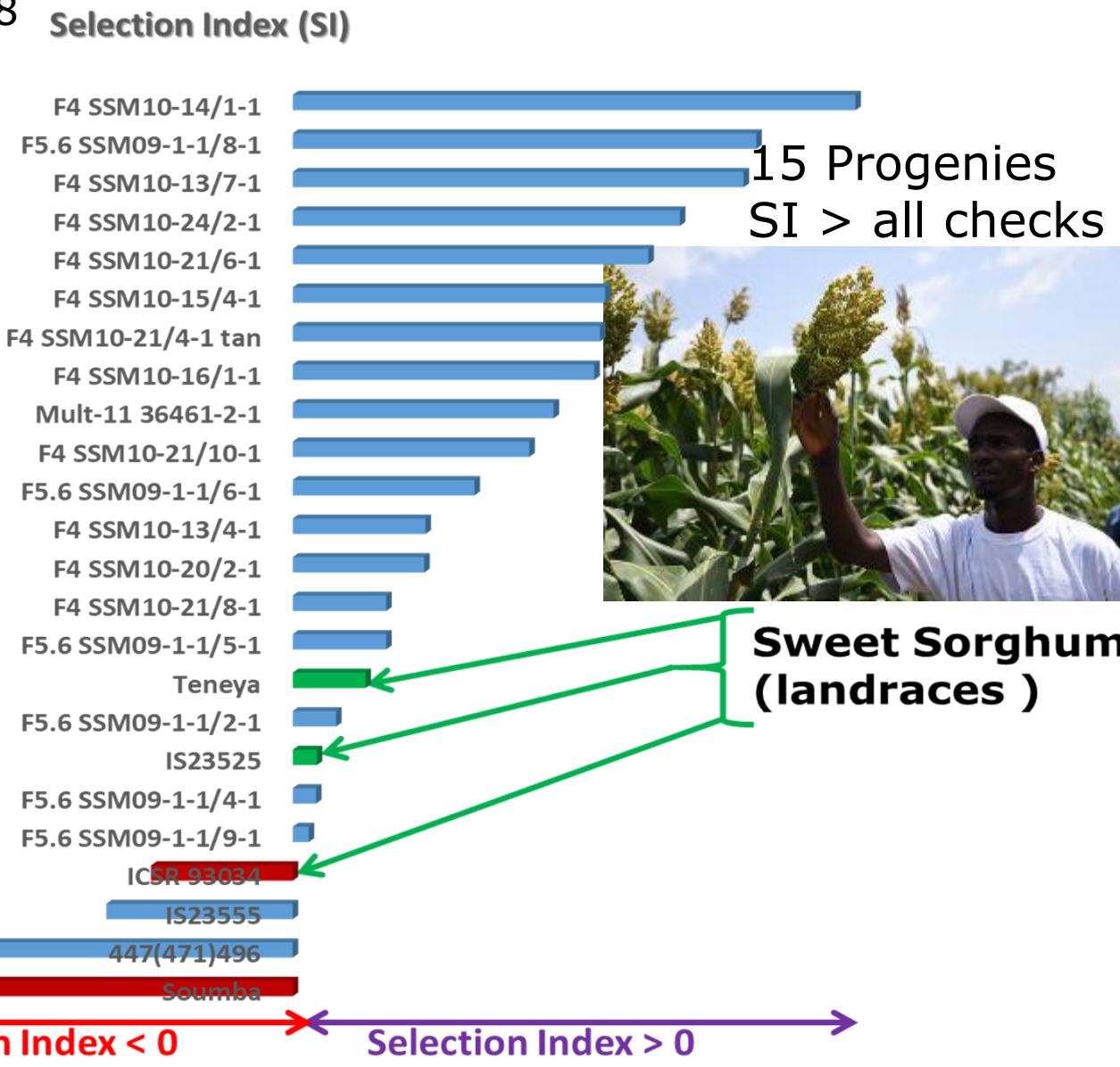


Integration of stover yield and quality in breeding program: Dual purpose varieties

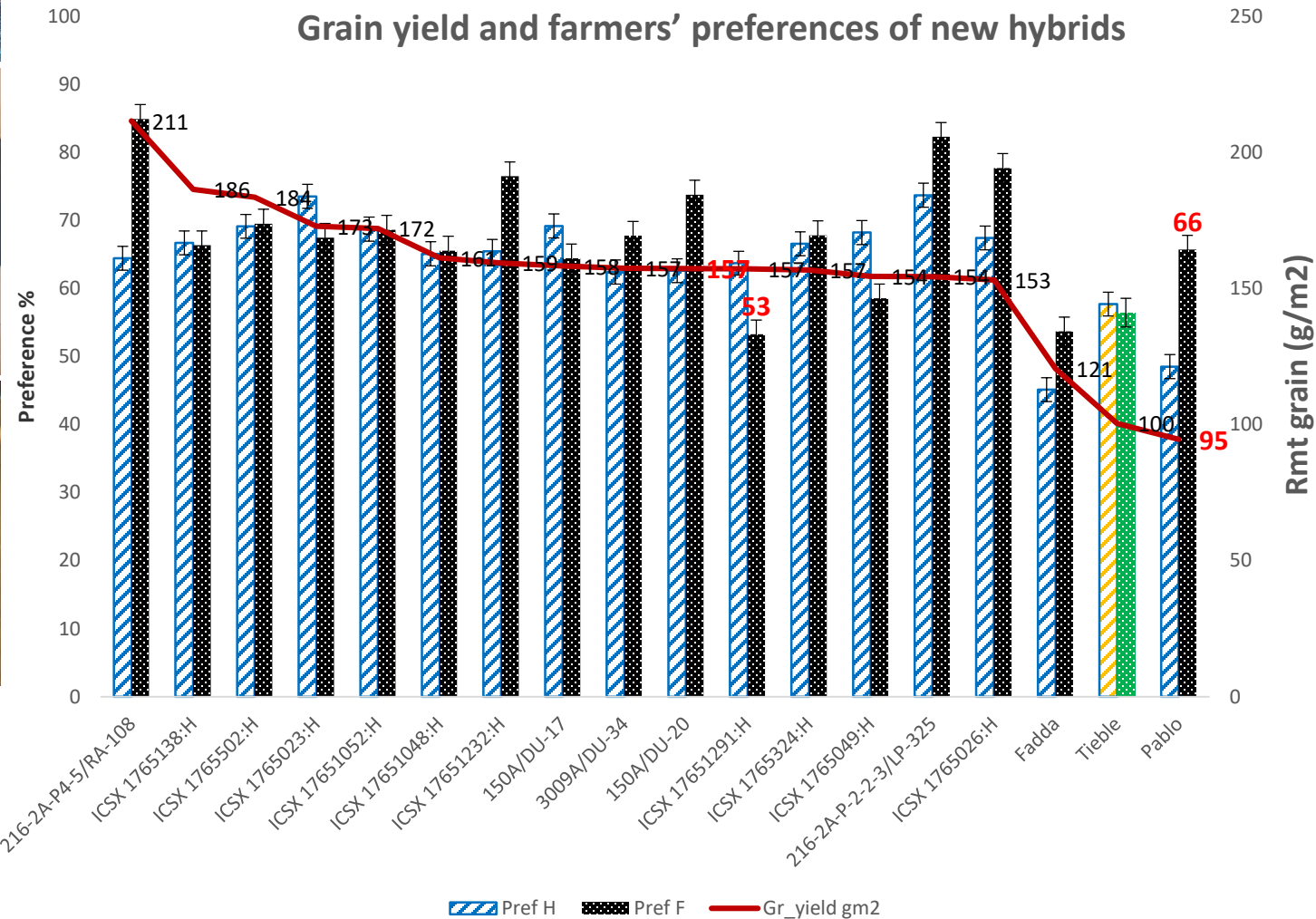
- Grain yield = 2 to 4t/ha vs check Soumba (1.8 t/ha)
- Stover yield = 14 to 27 t/ha vs Soumba (12 t/ha)

How to identify varieties combining both grain and stover?

- ✓ Use of selection index (SI) with St_Grain yield; St_Vitrosity; St_Stover yield ; St_%Green leaves ; St_Sugar yield
- ✓ $SI = X1 * St_Grain \text{ yield} + X2 * St_Vitrosity + X3 * St_StoverY + X4 * St_StayGreen + X5 * SuY$
- ✓ Values of X1; X2; X3; X4 depends on the socio-economic importance of the targeted traits
- ✓ 15 multi-purposes sorghum lines identified with high SI (0.24 to 1.44) vs Soumba (SI = -1.28)



Feedback on data from field (agronomic data and farmers preferences)

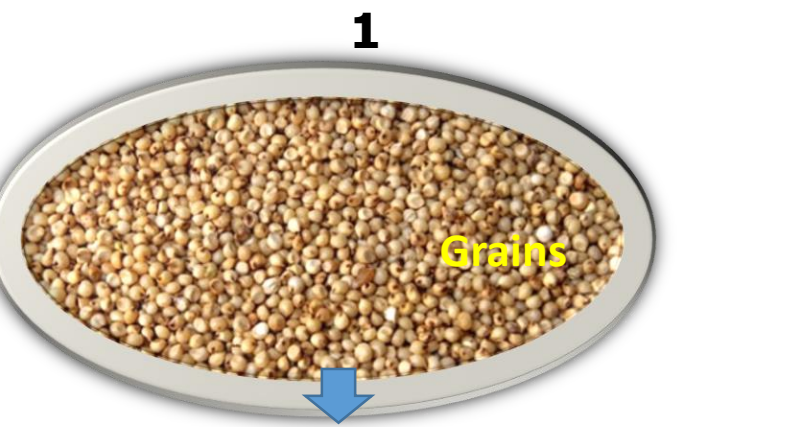


Importance of farmers' participation in varietal selection, revealed here:

- ✓ Hybrids with high yield but not chosen by farmers: Plant architecture? Grain quality/colour? Stay green? = **farmers' groups evaluation**
- ✓ Case of Pablo with low yield ($\sim 1\text{t/ha}$) in the trials but preferred by farmers (Women preference = **66%**)
- ✓ New hybrid (ICSX 1761291:H) with good yield ($\sim 1.6\text{ t/ha}$ = **60% yield advantage** compared to Pablo) but recorded low preference of women (**53%**)

Sensory evaluation/Culinary test: Best 4 varieties from field selection+ best local check for food

✓ Grain processing ability (1 & 2)



- Evaluation of grain processing decortication ability (women)
- Grain by-products (bran, flour, grit) yields

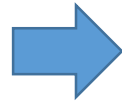


✓ Food cooking ability and yield



- Time for cooking
- Food yield

Appreciation of food quality: colour, taste, consistency, global



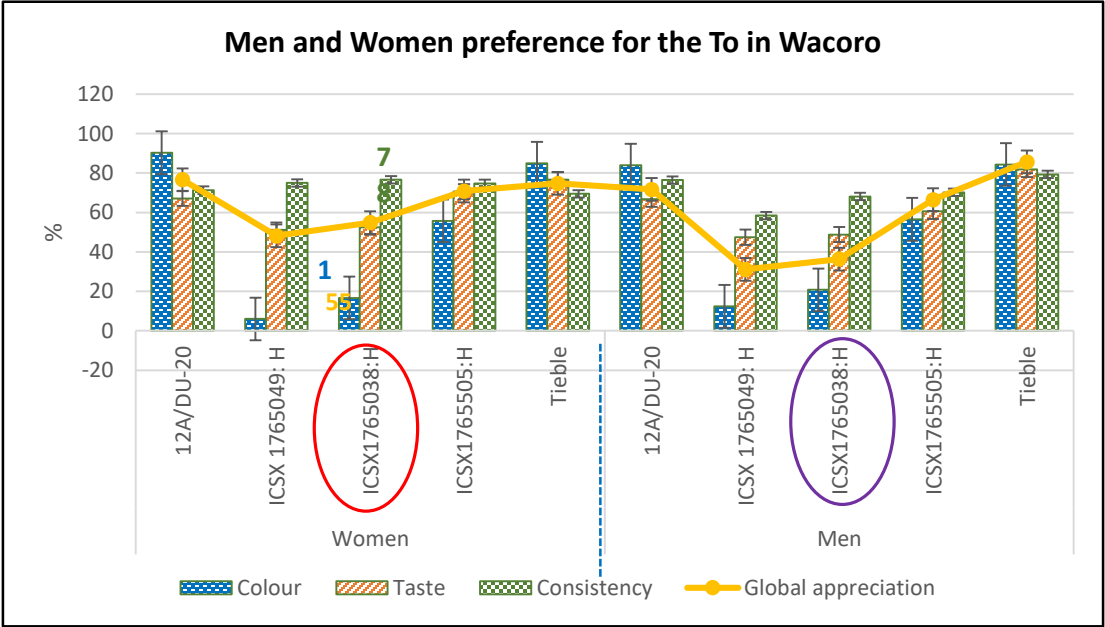
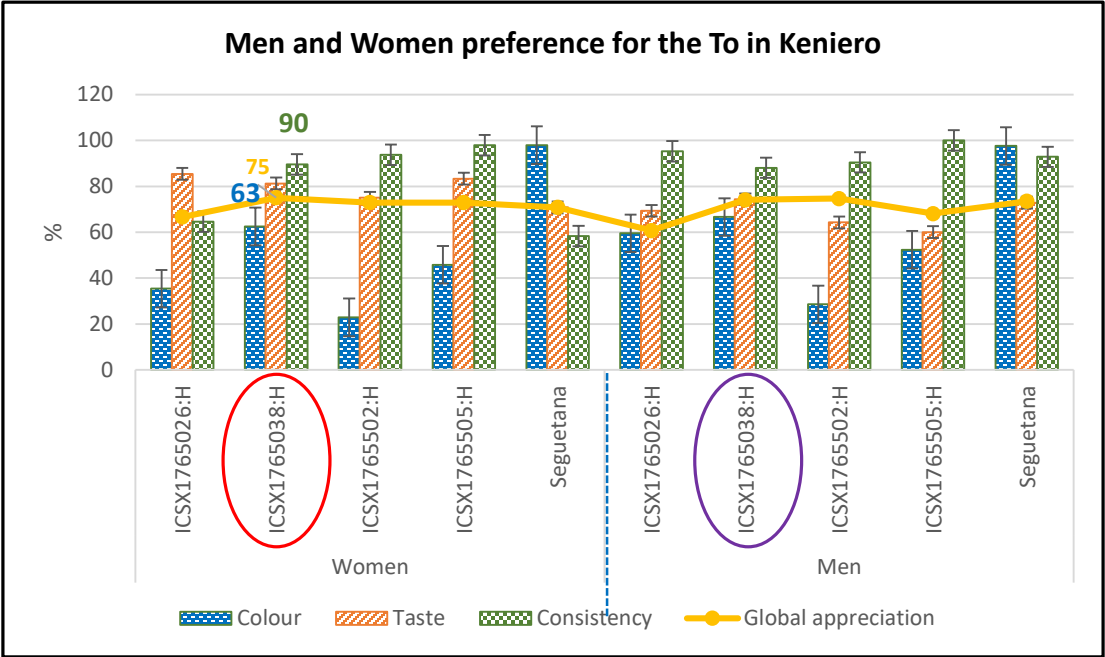
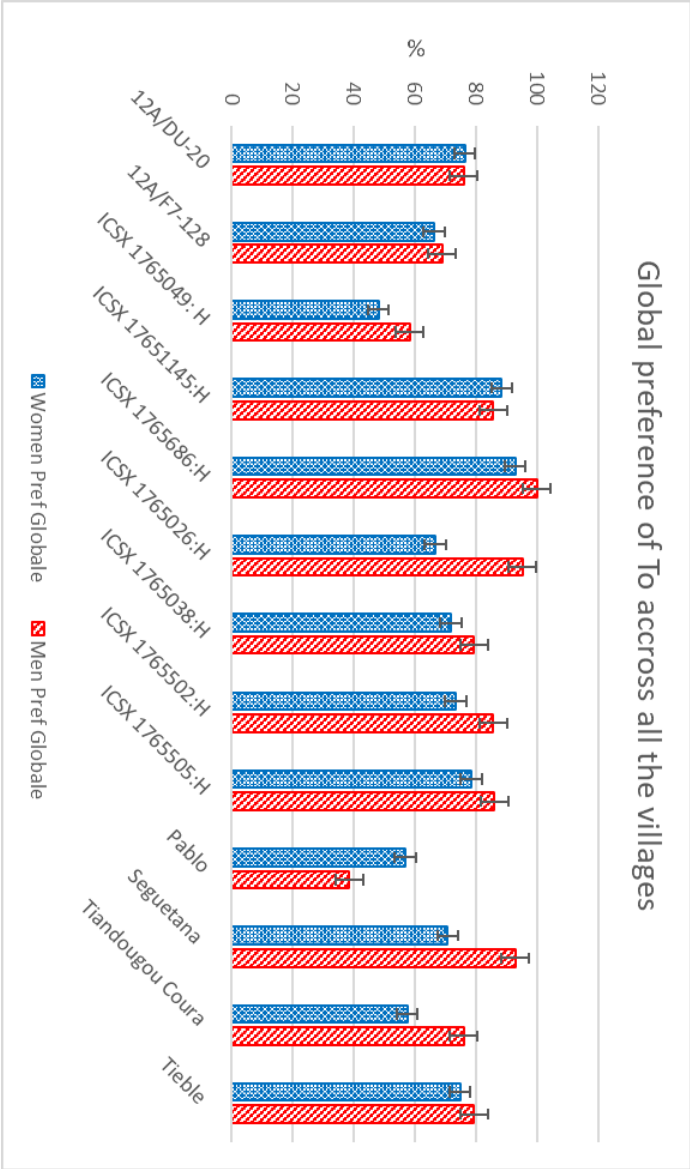
Ranking by research and final decision of farmers



Decision of farmers to:

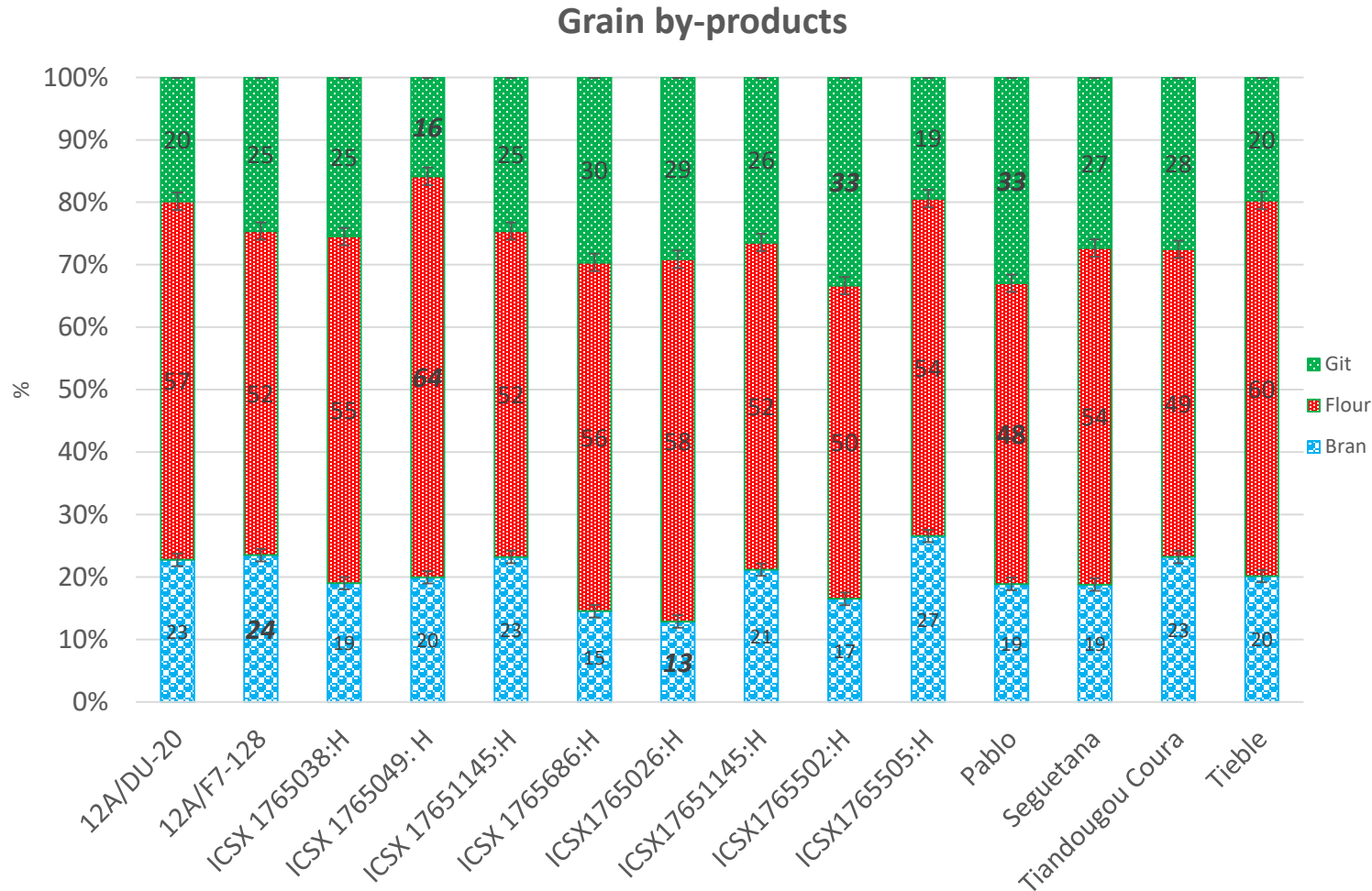
- *reject variety*
- *retain variety for farmers evaluation/release*

Example of farmers appreciation to (colour, taste, consistency, global)



Important to consider the context (same hybrid appreciate in Keniero and not in Wacoro)

Importance of different by-products from grains



Grit: for food (called sorghum rice in specific zones)

Flour: use to make the most popular food called tô in West Africa

Bran: for animal feeding (pigs, ships, cows, etc.)

The importance of different by-products depends on:

- Food consumption habits (more **tô** versus more **Yanyanki = sorghum rice**)
- Type of farmers (with versus without animals)
- Bran is an important product for women with pigs and small ruminants

Conclusion

- Farmers network plays key role in sorghum variety/hybrid development in West Africa
- The variability of conditions is captured through participatory breeding
- Breeding objectives are regularly reviewed with farmers implication
- *Farmers to be considered as partners and not only beneficiaries*
- Farmers organizations are playing major role in variety release and seed systems -> accessible by farmers



Farmer-Research
network in West Africa

Thank you
Merci

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