AGG-Maize Year 3 Major Achievements and Next Steps

Yoseph Beyene

CIMMYT-Regional Maize Breeding Coordinator and AGG Maize Project Leader

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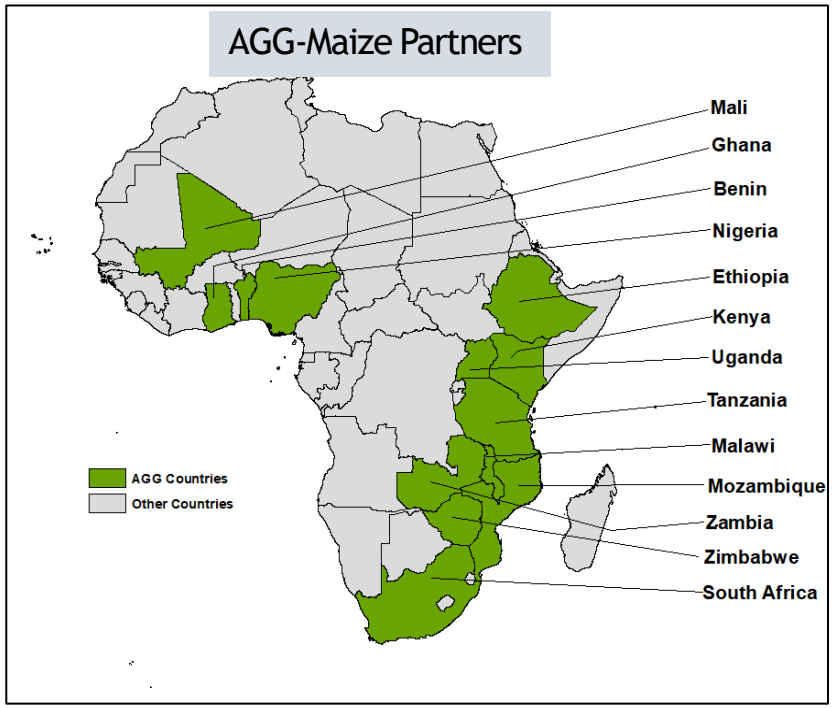
Accelerating Genetic Gains in Maize and Wheat

CIMMYT International Maize and Wheat Improvement Center

The AGG-Maize Project has Two Objectives

- Support the CIMMYT and IITA maize breeding programs to accelerate genetic gains;
- Support the modernization of breeding by NARS partners in sub-Saharan Africa.

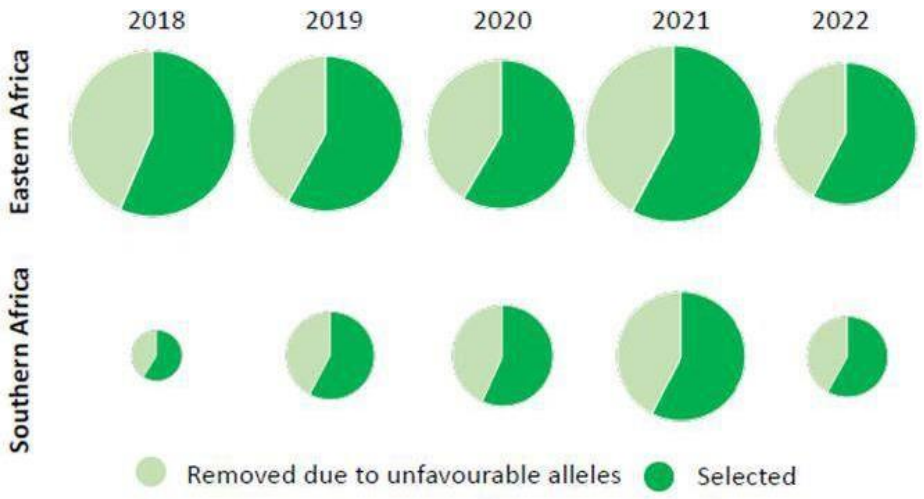


The project aims to facilitate the production and adoption of over **150,000 metric tonnes** of multiple stress-tolerant maize seeds on an annual basis in 13 target countries in SSA, planting an estimated area of **6.17 M ha** and benefiting over **64 million people.**

Spillover countries include Angola, Lesotho, DRC, Eritrea, Somalia, Cameroon, Burkina Faso South Sudan, Rwanda, Burundi

PO1: Optimization of innovative breeding tools and methods

- Forward breeding for **MSV and MLN** prior to field phenotyping enabled the elimination of **13,351** susceptible lines, saving an estimated US$ **52,070.**
- In West Africa, forward breeding for **Striga resistance** was initiated and leading to the selection of over **80% of the 4,500 lines** carrying favorable alleles.
- QC/QA: 1,400 lines were genotyped and **96%** of the lines were found to be genetically pure.
- RCGS was implemented in **Eastern Africa and West Africa product pipelines**



	KASP marker		
Number of lines	snpZM00179	snpZM00185	snpZM00186
Resistant allele	3918	3911	3501
Susceptible allele	408	286	724
Heterozygous	40	249	228
Unused	143	63	56
Total	4509	4509	4509

Key Achievements: DH line production development

Product profiles/Organization	# of populations submitted	# of DH lines delivered
Product profiles		
EAPP2	50	15478
EAPP1	52	17048
EAPP3	13	1683
SAPP1	15	2213
SAPP2	6	870
	136	37292
Partner organizations		
IITA	2	771
NARO-Uganda	6	696
KALRO-Keya	20	1178
IIAM-Mozambique	3	1218
EIAR- Ethiopia	2	465
DR & SS-Zimbabwe	3	85
Egypt	8	2151
Advanta	4	1018
Western Seed Co	6	957
	54	8539

The average # of DH lines per population is 241.

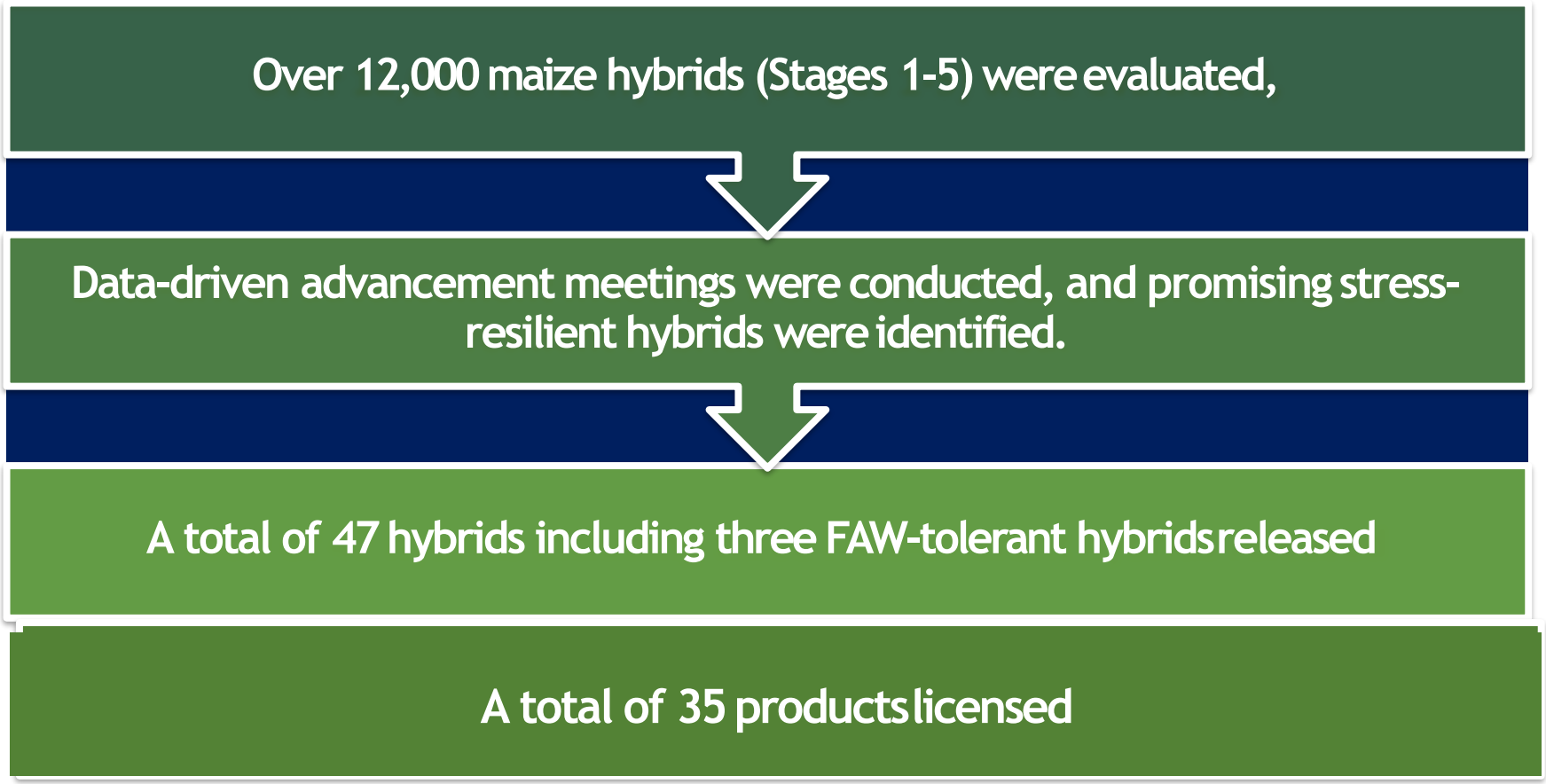
Managed drought

Artificial MNL inoculation

PO2: Multiple stress-tolerant and input-responsive varieties developed across product profiles

Pipeline Code	Target Countries	Est. Area (M ha)
EA-PP1	Ethiopia, Kenya, Uganda, Tanzania (Northern)	3.17
EA-PP2	Ethiopia, Kenya, Uganda, Tanzania (Southern)	3.38
EA-PP3	Ethiopia, Kenya, Uganda, Tanzania (Southern)	1.75
SA-PP1	Mozambique, Zimbabwe, Malawi, Zambia, Tanzania (Southern); drought-prone smallholder farm areas in South Africa	3.74
SA-PP2	Zimbabwe, Malawi, Zambia, Tanzania (Southern), drought- prone smallholder farmers, about 2-3% of total maize area)	2.03
WCA-PP1	Benin, Burkina Faso, Cameroon, Chad, Mali, Nigeria, Senegal	2.74
WCA-PP2	Benin, Burkina Faso, Cameroon, Chad, Mali, Nigeria, Senegal	3.1
WCA-PP3	Benin, Burkina Faso, Cameroon, Chad, Cote d'Ivoire, DR Congo, Ghana, Guinea, Mali, Nigeria, Senegal, Togo	5.49
WCA-PP4	Cote d'Ivoire, DR Congo, Ghana, Guinea, Liberia, Nigeria, Sierra Leone, Togo	4.34
Total	**29.74**	

Key Achievements: Germplasm evaluated, announced, and released in 2022



Genetic gains in CIMMYT/IITA breeding pipelines were positive and ranged from 1.1 to 4.5% under different management

Key Achievements: Responding to emerging threats: FAW-tolerant hybrids

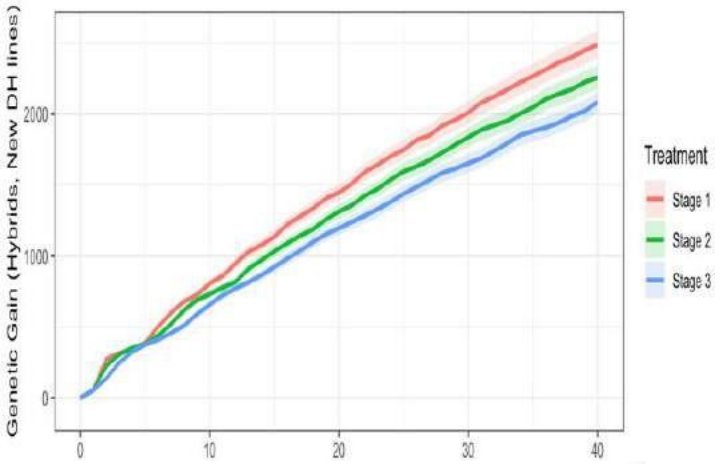
Vegetative stage

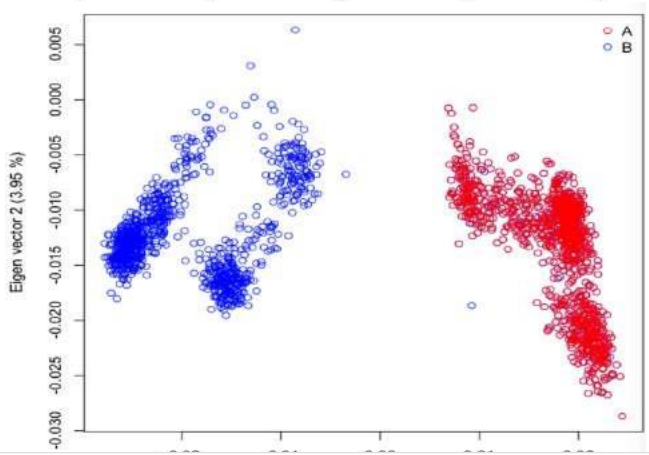
Reproductive stage

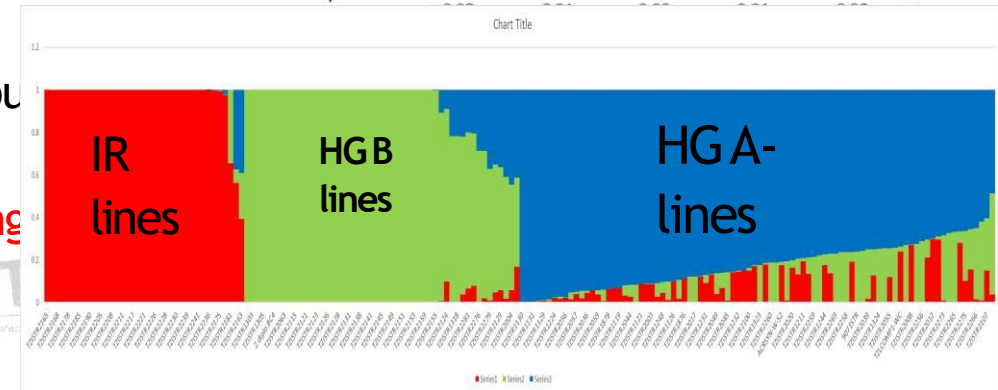
Harvest

Key Achievements: Breeding Schemes Optimization in AGG -Maize

- Recycling lines at an early stage of testing (reduced from 6 yrs. to 4 yrs.)
- Implemented suitable selection indices for parental selections (DESIER software)
- Identify an optimum number of testing locations and testers for recycling (implemented in selected PPs)
- Sparse testing and sparse genetic test crossing (implemented in selected PPs)
- Use of genomic selection (all stage 1 lines being genotyped with medium-density markers)
- Estimate predicted genetic gain (done in selected PPs)
- Incorporation of ex-PVP lines into tropical lines improved yield potential (ongoing)
- Refining and strengthening heterotic grou (ongoing)
- Responding to emerging threats (ongoing



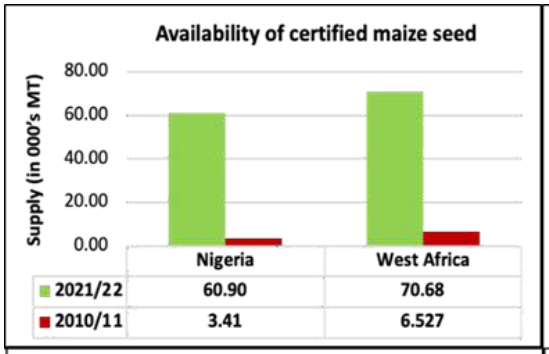


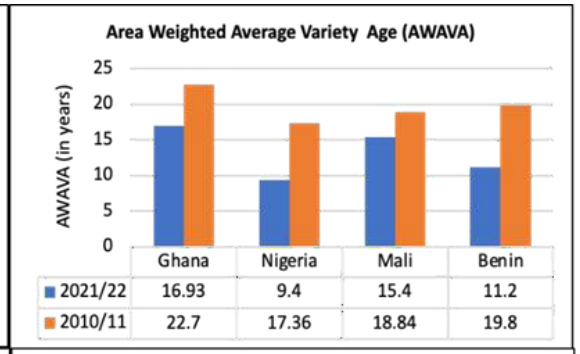


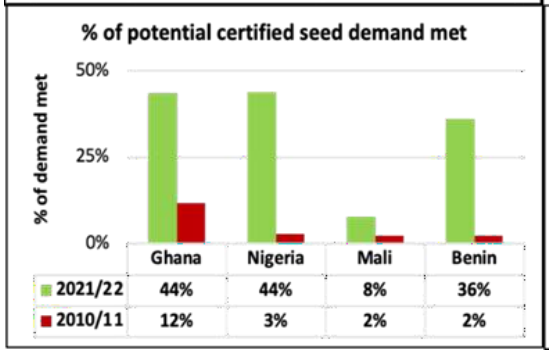
Accelerating Genetic Gains in Maize and Wheat

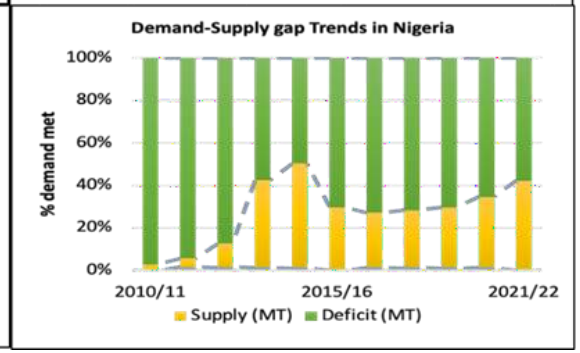
PO3: Accelerated varietal turnover and wider adoption, particularly among women farmers

- The area-weighted average variety age (AWAVA) of improved maize varieties in farmers' fields declined
  - From 14 years in 2014 to 10 years in 2021 in ESA.
  - From 19.6 years in 2010/11 to 13.2 years in 2021/22 in WA
- This progress in maize varietal turnover in SSA could be attributed to
  - Strengthening of seed systems, including the release of better genetics
  - Intensive deployment through public-private partnerships.
- However, the certified seeds demand and supply gap remains high, especially in West Africa.









An example M&E indicators based on data collected in 2020 and 2021 in West Africa

Accelerating Genetic Gains in Maize and Wheat

IITA CGIAR

CIMMYT International Maize and Wheat Improvement Center

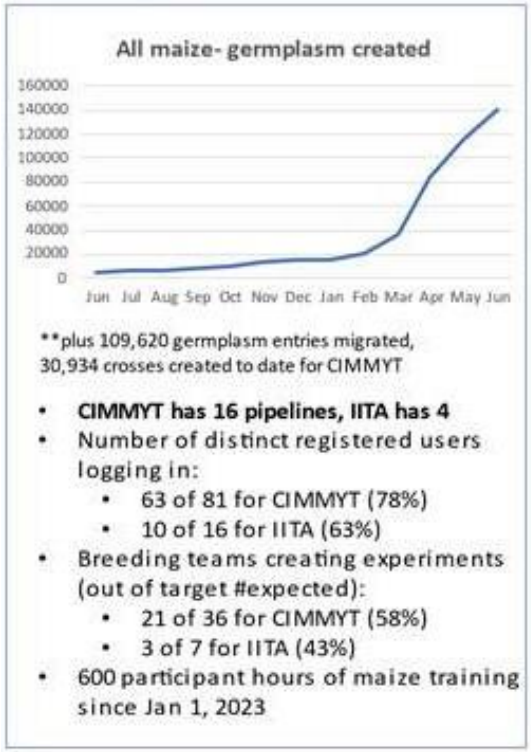
PO4: Regional Collaborative Maize Breeding and Seed Systems Network formalization

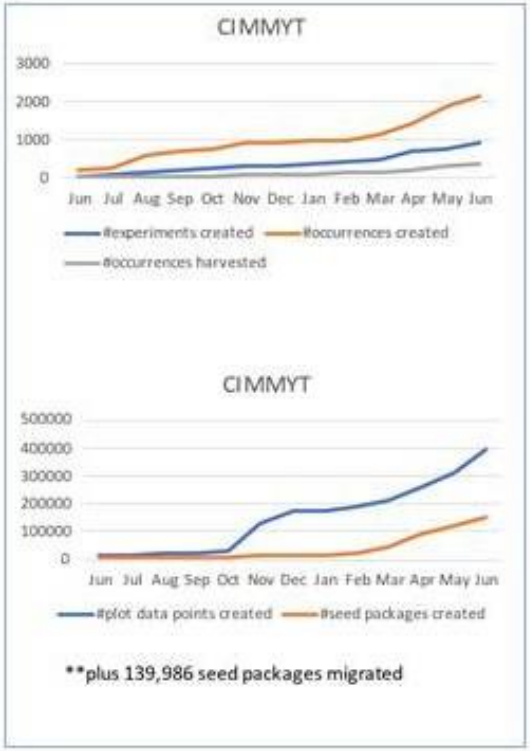
- Retrospective **genetic gain analysis** of historical trial data is undertaking
  - Uganda; DR&SS of Zimbabwe; KALRO-Kenya
- **Financial support** has been given to maize breeding programs in 13 countries to strengthen their breeding capacity
- **Digitization equipment** ordered through CtEH support delivered to Zimbabwe, Zambia, Tanzania, and Ghana
- The **Senior Maize Breeder training course** was organized face to face in Kenya total of **39 (11 female, 28 male)** participants attended
- **CIMMYT and IITA scientists supervised 23 students** (16 Ph.D.; 7 MSc of which 6 are females)
- The **AGG Mid-Term Review and Planning Meeting** was conducted on 25-28 July 2022.

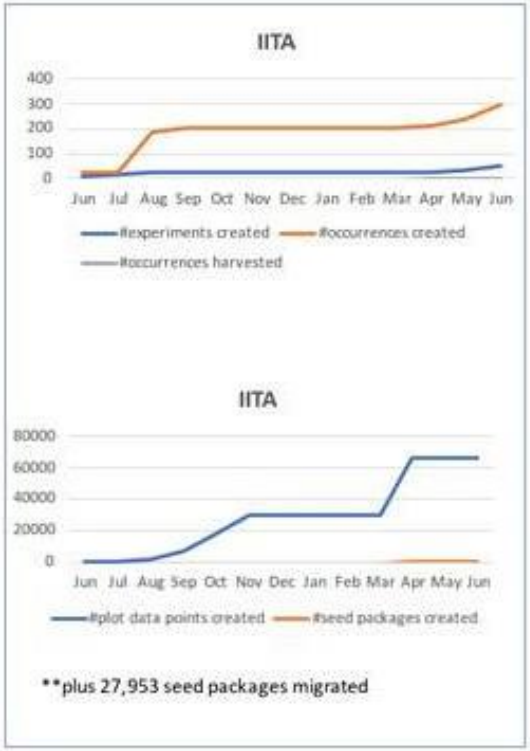
Accelerating Genetic Gains in Maize and Wheat

PO10: Implementing improved data management, experimental designs, and breeding methods

Adoption Dashboard - Maize June 15







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Tool to generate sparse phenotyping design, on-farm design, and selection index and developed and being used

Next steps in AGG-Maize

1. **Focus on continuous improvement for increasing genetic gain**
   - Reducing the breeding cycle to 3 years
   - Implementing sparse phenotyping/sparse test crossing in all product profiles to sample TPE
   - Estimation of realized genetic trend using on-farm data
2. **Facilitate accelerated variety turnover in the target countries**
   - Identify bottleneck for adoption of new improved varieties hybrids
   - Provide high-quality breed seed
   - Scale out QA/QC for SMEs
3. **Strengthened NARS -CG breeding network**
   - Updates product profiles to align across CG, NARS, and SMEs
   - Continue joint CG and NARS annual stage-gate advancement meetings
   - Increase the level of integration of DH in breeding pipelines
   - Adopt EBS a primary breeding data management system in CG-NARS breeding programs

Thank You

Breeding progress for MLN resistance