



SMIL Activity Annual Report

**Oromia Agricultural Research Institute
Bako Agricultural Research Center**

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Background

- In Western Ethiopia, sorghum is grown in low to intermediate altitudes where plant diseases are major bottlenecks
- These region is characterized by climatic conditions that promote foliar and panicle diseases
- Developing disease resistant germplasm is important for the region
- Key testing locations: Bako, Jimma and Asossa

Bako Ag Research Center

- Chief collaborating center on SMIL project
- Conduct National Trials in collaboration with EIAR, & Regional Trials
- Breeding varieties for adaptation, high yield, and disease resistance
- Conduct variety verifications for possible variety release, demonstrations, and seed increases
- Characterize the core collection and other germplasm

I. Developing sorghum varieties with resistance to diseases, improved yield and broad adaptation

1. Variety Verification Trial (VVT): early maturing type

- 2 candidate varieties in VVT with standard check (Bonsa)
- **Yield advantage: 43.1, 39.1%**, respectively
- **Locations:** Bako, Gute, Bilo boshe, Chawaka and Uke
- Technical committee evaluated candidates
- **Expected output:** at least one variety will be released and registered



2. Variety Verification Trial (VVT), Medium maturity group

- **One** candidate in VVT with Bonsa and Merera as standard checks
- **Yield advantages: 18.8 %**
- **Locations:** Bako, Gute, Bilo boshe, Chawaka and Uke
- Technical committee evaluated
- **Expected output:** waiting decisions on official release & registration



II. Introgression of traits to adapted and improved varieties (Bako)

1. F₂:68 crosses generated; 64 segregants are promoted

2. Evaluation of F₄ segregating population

- 132 F₄ families evaluated in 2021 cropping season
- 65 lines with better diseases resistance promoted to next generation

3. Evaluation of F₆ sorghum lines

- Adapted varieties (Lalo, Gemedi and Geremew) were crossed with ETSL100375, PML981475, and SC283-14 to combine their desirable traits
- 62 lines evaluated in F₆ in this cropping season
- 23 best promoted to yield trial (PYT) for further evaluation

Introgression of traits (initiated at Melkassa, EIAR)

4. Evaluation of advanced segregating generation (F_4), grain mold & anthracnose resistance)

- 192 selected heads evaluated at Bako, Jimma and Asosa
- 100 heads selected will be advanced to PYT in 2022 cropping season

5. Preliminary yield trial (PYT) for grain mold resistance (Melkassa ARC)

- 44 sorghum landraces including checks (Abamelko, Dagim and Bonsa) evaluated at Bako and Jimma
- Selected grain mold resistance lines will be further evaluated during 2022

“Merera” sorghum variety



III. Demonstration & popularization of ‘Merera’

- Merera’ was officially released in 2020
- Major achievement of SMIL project
- Yield potential= 43 %
- Yield potential ~ 5.4 tones ha⁻¹
- Bird tolerant
- Stay green; dual purpose (food and forage)



Demonstration of 'Merera'

- Demonstration was conducted in East Wollega, West Shewa and Buno Bedele zones, Oromia regional state, Western Ethiopia
- Five districts (Boneya Boshe, WayuTuka, Ilu Gelan and Chawaka)
- On 40 farmers' fields
- The variety was demonstrated with 'Gemedi' sorghum variety (standard check)



Demonstration of 'Merera'...

- Training of farmers, developmental agents.....
- Demonstration activities
- Preparation of manuals, leaflets on production and management practices
- Potential '*kebeles*' from each district consisting Farmers Research and Extension Group (FREG) unit comprising of farmers were established
- Gender and youth balance in each FREG unit



Seed multiplication: 'Merera'

- Beside demonstration activity, we conducted seed multiplication
- **10 tons** of seed harvested and stored properly
- For further scaling up of the variety



Field days

- Farmers
- Seed enterprises
- Woreda expertise & DA's
- Investors
- Other stake holders

Media

- 6 - national and regional

<https://youtu.be/AUg0fLPSFSY>

<https://youtu.be/muOdEpSdH2M>

Table 1: Field days organized by Bako Ag. Research Center, 25-28 October 2021.

| No | Field days | Participants | | | | | | | | | | | |
|-------------|---------------------|--------------|----|------------------|----|----|---|-------------|---|-----------------|---|--------|---|
| | | Farmers | | Woreda Expertise | | DA | | Researchers | | Seed enterprise | | Medias | |
| 1 | Demonstration | M | F | M | F | M | F | M | F | M | F | M | F |
| | | 100 | 30 | 20 | 5 | 16 | 4 | 20 | 3 | 0 | 0 | 4 | 0 |
| 2 | Seed multiplication | 20 | 5 | 30 | 10 | 20 | 5 | 22 | 2 | 3 | 0 | 4 | 0 |
| | | 120 | 35 | 50 | 15 | 36 | 9 | 42 | 5 | 3 | 0 | 8 | 0 |
| Grand total | | 273 | | | | | | | | | | | |

Field days





FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative



USAID
FROM THE AMERICAN PEOPLE



Collaborative Research
on Sorghum and Millet

KANSAS STATE
UNIVERSITY

Merera

Enjera



'Anababero'



Future plan (2022 cropping season): 'Merera' variety

- **Scaling out and popularization**
 - Large scaling out
 - Cluster based scaling up and seed multiplication
 - Small seed pack seed distribution to reach a large number of farmers
 - Integrating seed enterprise/company and investors in popularizing variety
- **Plan is to reach > 1000 farmers through scaling out program**

IV. Characterization of Ethiopian sorghum core collection for pathogen resistance and other traits

Part of Chemed's Thesis Project

Sorghum core

- Potential sources of new sorghum varieties that combine multiple disease resistance traits, high yield potential, and adaptation
- Potential sources of new genes/alleles for desirable traits
- Genomic studies to identify disease resistance loci and other traits
- Comprehensive data captured to catalogue traits for breeding & genetics
- Foundation for future improvement and trait integration

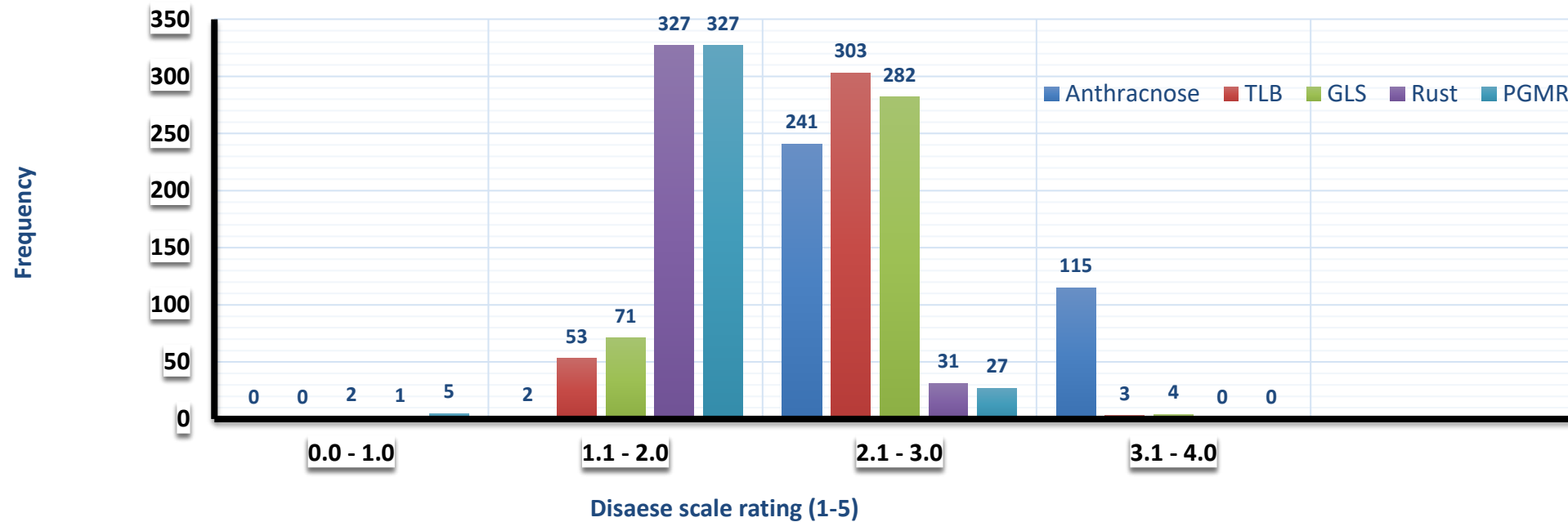
Comprehensive data collection on sorghum core

- 358 landraces evaluated at Bako, Jimma, Asosa, and at Haramaya
- The sites are hot spots for disease, good for screening germplasm, and evaluate yield potential
- Scored anthracnose, rust, turcicum leaf blight, grey leaf spot, and grain mold
- Other quantitative and qualitative traits



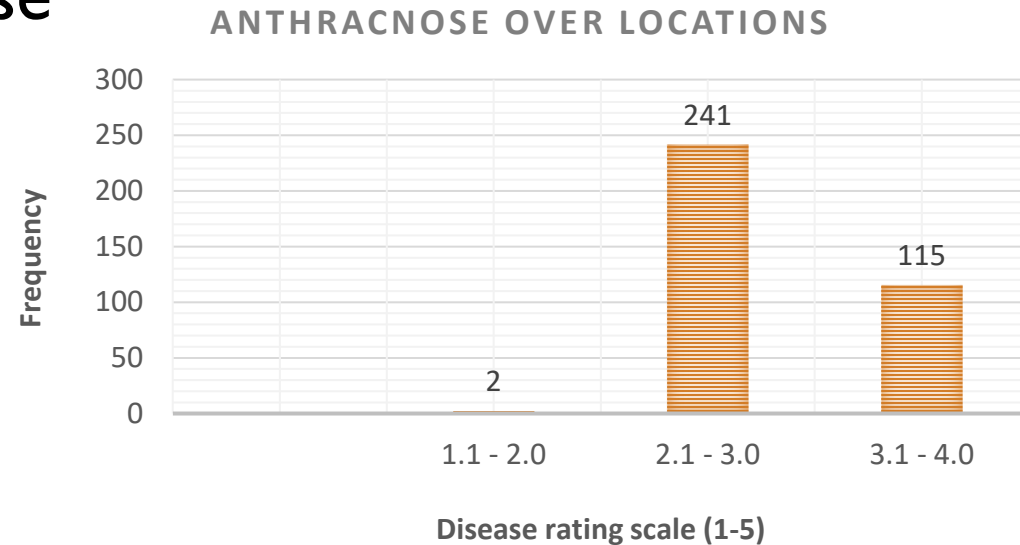
Variation for responses to different fungal diseases

Multiple disease reaction across location and year



Variation for responses to anthracnose

- The combined data on anthracnose showed that:
 - 243 Resistant (hypersensitive reaction with local lesions)
 - 115 genotypes are susceptible



Examples of anthracnose resistant and susceptible genotypes at Bako



Examples of anthracnose resistant and susceptible genotypes at Bako



Key achievements

- SMIL sorghum cores materials are intensively explored for breeding program
- New variety “Merera” was released
- New sorghum candidate varieties in the pipeline for possible release
- Materials from crosses advancing through the breeding scheme
- Source of disease resistance genes identified for future breeding

Future Plan

- Finalize data analyses and prepare thesis and manuscript
- Complete GWAS for anthracnose and other traits
- Select lines from core collection for nursery and further breeding
- Breeding activities from crosses initiated at Melkassa and Bako centers will continue at all stages
- New and continued trials from the national and regional programs

Challenges

- Lack of vehicle
- Conflict
- Covid-19 pandemic
- Labor intensive data collection
- Budget

Thank you !

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