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’ 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)

III. Demonstration & popularization of ‘Merera’
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/A Ug0fLPSFSY
https://youtu.be/muOdEpSdH2M

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

<table>
<thead>
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<th>No</th>
<th>Field days</th>
<th>Participants</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Farmers</td>
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<tr>
<td></td>
<td>Demonstration</td>
<td>M</td>
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<tr>
<td></td>
<td>Seed multiplication</td>
<td>20</td>
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<tr>
<td></td>
<td>Grand total</td>
<td>273</td>
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</tbody>
</table>
Field days
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 Chemeda’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

Disease scale rating (1-5)

- Anthracnose
- TLB
- GLS
- Rust
- PGMR
The combined data on anthracnose showed that:

- 243 Resistant (hypersensitive reaction with local lesions)
- 115 genotypes are susceptible

**Variation for responses to anthracnose**

![Bar chart showing variation in anthracnose over locations.](chart.png)
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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