Improving Farmers Access to Improved Maize and Legume Varieties

Objective 3 Team: NARS, CIMMYT and ICRISAT
Pathways for maize variety release

Breeding new maize varieties

Regional Trials, WWT, ROFT

Variety release, registration (DUS, VCU)

Basic & Certified Seed Production

Varietal Promotion and dissemination

CIMMYT, NARS, large Seed companies

CIMMYT, NARS, Seed companies

NARS Seed companies

NARS (for basic seed only), Seed companies, CIMMYT (initial seeds)

Seed companies NARS, CIMMYT
Trait prioritization/Trait combinations

**Foliar Diseases**
- MSV, GLS, ET, PLS, PS

**Ear Rots/Aflatoxins**
- *Fusarium, Diplodia*

**High yield potential**
- Local and Introductions
- Density response

**Compatibility**
- Cropping systems compatibility

**Foliar Diseases**
- Striga
  - Specific in some areas

**Ear Rots/Aflatoxins**
- MLN
  - New serious challenge

**High yield potential**
- Pests/FAW
  - Field Pests
  - Storage Pests

**Compatibility**
- Producing females
Selection for drought and heat tolerance

Drought susceptible

Drought tolerant
Models used to identify farmer-preferred variety

• Farmer participatory variety selection (PVS)

• Mother-baby trials

• Regional on-farm trials of elite varieties

<table>
<thead>
<tr>
<th>Pedigree</th>
<th>Rank in Yield</th>
<th>Grain yield t/ha</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC501</td>
<td>5 3 5</td>
<td>3.63</td>
<td>4</td>
</tr>
<tr>
<td>SC5201</td>
<td>4 4 4</td>
<td>3.92</td>
<td>3</td>
</tr>
<tr>
<td>SC403</td>
<td>3 5 2</td>
<td>3.42</td>
<td>5</td>
</tr>
<tr>
<td>PAN413</td>
<td>7 6 7</td>
<td>3.20</td>
<td>7</td>
</tr>
<tr>
<td>CG4141</td>
<td>6 7 6</td>
<td>3.29</td>
<td>6</td>
</tr>
<tr>
<td>CIMMYT2</td>
<td>2 2 1</td>
<td>5.12</td>
<td>1</td>
</tr>
<tr>
<td>CIMMYT5</td>
<td>1 1 4</td>
<td>4.09</td>
<td>2</td>
</tr>
<tr>
<td>ZM301</td>
<td>4 4 3</td>
<td>2.80</td>
<td>5</td>
</tr>
<tr>
<td>ZM421</td>
<td>1 1 1</td>
<td>4.14</td>
<td>2</td>
</tr>
<tr>
<td>ZM521</td>
<td>2 2 4</td>
<td>4.39</td>
<td>1</td>
</tr>
<tr>
<td>QPM</td>
<td>3 5 5</td>
<td>3.48</td>
<td>4</td>
</tr>
<tr>
<td>MATUBA</td>
<td>5 3 2</td>
<td>3.61</td>
<td>3</td>
</tr>
</tbody>
</table>
## Farmers’ Varietal Selection Criterial Assessment of PVS trials

### Traits (top 5) of preferred varieties – female farmers

<table>
<thead>
<tr>
<th>Trait</th>
<th>Proportion (%, n=161)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size and number of cobs/plant</td>
<td>30.19</td>
</tr>
<tr>
<td>Good standing</td>
<td>30.19</td>
</tr>
<tr>
<td>Drought tolerance</td>
<td>18.87</td>
</tr>
<tr>
<td>Lodging resistance</td>
<td>9.43</td>
</tr>
<tr>
<td>Grain quality</td>
<td>5.66</td>
</tr>
</tbody>
</table>
Agro-ecology base variety selection criteria's:

- **Maturity** (Early, medium, late)
- **Farmer’s preferences** (Flint, dent, colour)
Mega-environment classification
Performance of new DT varieties across different drought environments

Tesfaye et al., 2016
Stress tolerant maize during 2015/2016 El Niño

SC513

CZH132018

Setimela et al., 2017
Variety performance under CA/CP

Maize grain yield variety demos, all Malawi sites (N=318), 2015/2016

Conventional ridge tillage

Conservation agriculture

Thierfelder et al., 2017
Seed of high yielding singles cross testers for seed production

**Single Cross female yields**

- SC727
- CML539/CML444
- CML536/CML312
- CML312/CML442
- CML312/CML444
- CML312/CML443
- CML538/CML539
- CML444/CML489
- CML539/CML197
- CML540/CML442
- CML395/CML444
- CML547/CML444
- CML442/CML539
- CML509/CML540
- CML539/CML540
- CML537/CML312
- CML536/CML538

Average Yield (t/ha)
Identification of legumes

- Round nuts
- Soybean
- Cowpeas
- Beans
Intercropping compatible varieties in Ethiopia
Selected forage in Ethiopia and Tanzania

**Varieties selected for upscaling Ethiopia**

- **Lupine**: Bora, Vitabor, Sanabor
- **Cowpea**: Acc.17216, Acc.12688, black eyepea, Kenkety
- **Lablab**: Acc.1169

**Forage varieties being evaluated in Tanzania**

ILRI 16837, KK2, Guatemala ILRI 16803, ILRI 14984, P. Maximum, Kakamega, ILRI 16835, Leucaena pallida 14203, K780K,
Number identified maize and legumes

![Graph showing the number of identified maize and legumes in different countries: Ethiopia, Kenya, Tanzania, Malawi, and Mozambique. The graph compares the number of maize and legumes.](image)
Drought-tolerant maize rescues Malawian farmers

WEIJE KALUNELA,
JOHNSON SIAMACHIRA,
KENNEDY LWEYA and
PETER SETIMELA

A recent World Food Programme survey has said the current El Niño-induced drought has put scores of millions of people in southern Africa, including Malawi, at risk of being affected by drought which has devasted agricultural production in the region.

But there is hope for Malawian farmers following introduction of drought-tolerant maize varieties, courtesy of International Maize and Wheat Improvement Centre (CIMMY). According to the World Food Programme (WFP), the agency is currently assisting nearly three million people in Malawi.

"The current drought situation in Malawi came on the back of a bad crop last year, due to flooding which affected parts of the country," WFP’s southern
Challenges and possible solutions in legumes seed systems

- Field day
- Demonstrations

Poor infrastructure
- Machinery
- Labour
- Irrigation

Slow uptake

Early generation seed
- Seed quality
- Few seed companies
Seed models for pre basic/basic seed supply

Model 1: Provision of breeders/foundation seed by CGIAR/NARS

Model 2: Foundation Seed companies

Model 3: Seed companies producing their own EGS
ICRISAT Model for Legume Seed Revolving Fund in Malawi

The bold black arrows indicate the flow of seed. The red arrows indicate the flow of cash in the system.
SIMLESA Seed Roadmap

2017
Breeders seed
Production of breeders seed to support the production of foundation seed in 2018

2018
Foundation seed
Production of foundation seed to support the production of certified seed in 2019

2019
Certified seed
Production of certified seed in 2019

Each season each class of seed is produced to meet target for given year

- The Seed Roadmap implemented by 45 seed companies
- Each seed company implementing 3 -4 seed roadmaps
Foundation seed companies

QualiBasic Seed Company Ltd. (QBS)

Trusted Quality
Quality Assurance/Quality Control

• QA/QC protocols need to be rigorously implemented throughout the seed value chain

• Genetic purity and genetic identity of the materials under production
Maize and legume seed production partners

- 45 seed companies are involved in scaling up identified products
- Partnering with AGRA and other projects
Estimated maize and legume certified seed production

[Graph showing the estimated maize and legume certified seed production from 2013 to 2017. The graph indicates an increase in production over the years, with maize showing a steady increase and legume production fluctuating.]
EGS production and supply

Kg

2013 2014 2015 2016 2017
Adoption of climate-resilient maize

Fisher et al., 2015

Estimated area (ha)

- <50,000
- 50,000-99,000
- 100,000-149,000
- 150,000-199,000
- 200,000-249,000
- 250,000-299,000
SME Seed companies are growing through improved varieties and Seed Systems Support

Example: Meru-Agro in Tanzania

<table>
<thead>
<tr>
<th>Variety</th>
<th>Production Year (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2015</td>
</tr>
<tr>
<td>Meru HB623</td>
<td>100</td>
</tr>
<tr>
<td>Meru HB515</td>
<td>100</td>
</tr>
<tr>
<td>Meru HB513</td>
<td>200</td>
</tr>
<tr>
<td>Meru HB405</td>
<td>300</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>600</strong></td>
</tr>
</tbody>
</table>

Source: WG Chacha
Market Segmentation and Territory Planning: the Case of Ethiopia
Accelerating variety replacement

Tsedeke et al. 2017
## Varieties identified by partners for replacement in ESA

<table>
<thead>
<tr>
<th>Country</th>
<th>Varieties that need to be replaced</th>
<th>Varieties for replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uganda</td>
<td>Longe 4, Longe 5, Longe 1, H614, PAN15, PAN67, DK8031, DH04, H513, etc.</td>
<td>Longe 10H, Longe 9H, Longe 11H, Bazooka, UH5051, UH5052, UH5053, UH5355, UH5556, VH2, WE2115, WE2114, WE3016, etc.</td>
</tr>
<tr>
<td>Kenya</td>
<td>H622, H511, H614, H611, H612D, Kat CB, H513, etc.</td>
<td>KDV4, KSD01, H520, H12ML, DSLH103, WE1101, SC301, WH509, MH401, MH501 etc</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Situka, Kilima</td>
<td>Meru HB513, Meru HB515, NATA105, NATA104</td>
</tr>
<tr>
<td>Mozambique</td>
<td>Matuba, PAN 67</td>
<td>Pris 601, CZH113</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>BH660, BH540, BH543, Melkassa-2, Gibe-1</td>
<td>BH661, BH546, MH140, BH547</td>
</tr>
<tr>
<td>Malawi</td>
<td>SC513, PAN 67,</td>
<td>Peacock 10, CAP 9004, PAN53</td>
</tr>
</tbody>
</table>
Targeted varietal replacement based on farmer preference
Where we want to be in the future

Early generation seed

Time in years

- Seed Companies
- NGOs

- CIMMYT
- ICRISAT
- ILRI
New challenges and opportunities
Emerging challenges

MLN tolerant hybrids are also good for grain yield under optimum condition and early maturing

- Kenya
- Tanzania
- Ethiopia
Fall Armyworm (*Spodoptera frugiperda*)
A new and major threat in Africa
Marketing of maize and legumes

- Large companies vs. small seed companies
- CBOs
- Informal markets
Promoting nutrition

Pro vitamin A maize

Quality protein maize

Various legumes
Thank you!