Progress on development of Africa Dryland Crops Improvement Network

Presented by:
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Maryam Dawud, Pearl Millet Breeder, LCRI, Nigeria

THE SECOND LEADERSHIP CONSULTATION MEETING
NARES - CGIAR - AIDE MEMOIRE
THURSDAY, OCTOBER 26TH, 2023, Marrakech, Morocco
Dryland legumes and cereals – Update

Pearl millet  
(*Pennisetum glaucum*)

Sorghum  
(*Sorghum bicolor*)

Finger millet  
(*Eleusine coracana*)

Groundnut  
(*Arachis hypogaea*)

Pigeon pea  
(*Cajanus cajan*)

Chickpea  
(*Cicer arietinum*)
Consultation with NARES

August 2021
Transfer of AVISA project to CIMMYT

Oct 2021
Visit & consultation with AVISA partners in WCA

Nov 2021
Visit & consultation with AVISA partners in ESA

Feb 2022
NARES workshop of AVISA partners in Senegal on future directions

Consultation and advice from other networks – PABRA/IAVAO
Key insights & outputs from consultation

• More distributed model of crop improvement is required
  – More equitable sharing of the project’s investments among partners
  – Partners did not like the idea of developing “one” center of excellence in the region; shared facilities among network members
  – Greater investment in crop breeding, through shared regional programs
• Renewed commitment to benefit ‘hard to reach,’ resource-poor farmers and consumers
  – Seed systems, choosing appropriate pathways to impact
• Senegal workshop: Proposed development of regional crop improvement network with governance structure
  – Multiple options were proposed; most favored was by the region
  – Multiple models of partnership between CG-NARES were discussed – “Bish” model, “Geoff” Morris Model, “Harish” Model→ Each were good, had some lacunas
Complimentary role of network partners at various stages of cultivar development pathway: Leverage strengths

This changes by crop & region; understanding of this is critical for developing effective partnerships.
Greater regional alignment & understanding of dryland crops partner status and their needs (market segmentation, capacity building, etc.)

Several Opportunities identified to leverage country member capacities, expertise and germplasm for whole network (e.g., GRD, Uganda; Pathology- Burkina Faso)
Countries program & facilities assessment

Peer-to-peer assessment (CG & NARES Breeder)

- Current level of breeding, pre-breeding & testing efforts at each country level by crops
- Staffing & their expertise to run breeding activities
- Infrastructure and facilities available to support in-country and network breeding activities
- Documented – Improvement plans
- Establishment of current base level and aspiration of NARES
GN ESA: Network Infrastructure for Phenotyping of critical TPP traits

- CtEH Proposal: $830k proposal was accepted to upgrade network infrastructure based on:
  - Reviews of Current Station Infrastructure & Equipment
  - Identification of Phenotyping hubs for regional priority traits

<table>
<thead>
<tr>
<th>SN</th>
<th>Trait</th>
<th>Phenotyping Hub</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Groundnut Rosette</td>
<td>Serere, Uganda; Nampula, Mozambique</td>
</tr>
<tr>
<td>2</td>
<td>Early Leaf Spot</td>
<td>Msekera, Zambia; Chitedze, Malawi</td>
</tr>
<tr>
<td>3</td>
<td>Late Leaf Spot</td>
<td>Msekera, Zambia; Chitedze, Malawi</td>
</tr>
<tr>
<td>4</td>
<td>Rust</td>
<td>Naliendele, Tanzania</td>
</tr>
<tr>
<td>5</td>
<td>Drought Tolerance</td>
<td>El Obeid, Sudan; Kiboko, Kenya</td>
</tr>
<tr>
<td>6</td>
<td>Aspergillus</td>
<td>Kiboko, Kenya</td>
</tr>
</tbody>
</table>

32 sites identified for Regional Testing
Shared breeding pipeline of network partners: Example schematic for one breeding pipeline
Update from WCA Pearl Millet NARES-CG Workgroup

Maryam Dawud, Pearl Millet Breeder
LCRI, Nigeria
SUMMARY – Progress on developing NARES-CG Regional Pearl Millet Crop Improvement Program for WCA

Regional Pearl Millet Workgroup consist of 8 WCA countries
Key theme: Co-designing, Co-developing, and Co-implementing

- Sep 2022: Multidisciplinary workshop-PDT
- Development of regional MS, TPP & Breeding Program Assessment
- Oct 2023: Breeding pipeline Optimization
- Network sharing of responsibilities base on capacities
  - Nov 2023
## Defined Regional MS and TPP – Proposed Sharing of Breeding Pipeline

<table>
<thead>
<tr>
<th>MS #</th>
<th>Market Segment Description</th>
<th>MS code</th>
<th>Total (ha)</th>
<th>CIMMYT</th>
<th>Nigeria</th>
<th>Burkina Faso</th>
<th>Mali</th>
<th>Ghana</th>
<th>Togo</th>
<th>Senegal</th>
<th>Niger</th>
<th>Chad</th>
<th>Regional MS Priority</th>
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<tbody>
<tr>
<td></td>
<td>Short duration dual purpose pearl millet OPVs adapted to Sahelian zone for food and food processing</td>
<td>SD-O</td>
<td>8,728,590</td>
<td></td>
<td>0.5 BP1</td>
<td>0.25 BP1</td>
<td></td>
<td></td>
<td></td>
<td>0.25 BP1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Medium duration pearl millet OPVs adapted to Sudanian zone for food and food processing</td>
<td>MD-O</td>
<td>4,303,147</td>
<td></td>
<td>0.5 BP2</td>
<td>0.5 BP2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Late maturing pearl millet OPVs adapted to lowland Sudanian zone for food and food processing</td>
<td>LM-O-LL</td>
<td>442585</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Medium duration Pearl millet hybrids for better endowed Sudan environments for food and food processing</td>
<td>MD-H</td>
<td>350,134</td>
<td></td>
<td>0.75 BP3</td>
<td>0.25 BP3</td>
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<td></td>
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<td>3</td>
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<tr>
<td></td>
<td>Short duration Pearl millet hybrids for better endowed sahel environments for food and food processing</td>
<td>SD-H</td>
<td>126,489</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Late maturing pearl millet OPVs adapted to High land northern guinea zone for food and food processing</td>
<td>LM-O-HL</td>
<td>40000</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

6 Market identified in total across 8 WCA countries
3 Market segments identified across countries as regional Priority MS.
Population development for the 3 TPP shared between 3 Network countries and CIMMYT
Breeding scheme optimization pearl millet development

- NARES-CG Teams, together co-designed this breeding schema for Pearl Millet OPV Breeding Pipeline with feedback from QG & other breeding expertise
- Plan is to implement this schema by all network breeders (previous slide)
**Network level** shared infrastructure and facilities (e.g. biotic and abiotic trait screening)

<table>
<thead>
<tr>
<th>Cap Dev Approach</th>
<th>Trait</th>
<th>List potential location/s for screening</th>
<th>Current capacity/status at the proposed locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regional</td>
<td>Drought</td>
<td>Senegal, Niger</td>
<td>Senegal (yes, some capacities exist upgrades are planned)</td>
</tr>
<tr>
<td>Regional</td>
<td>Downy mildew</td>
<td>Mali, Nigeria, Burkina Faso</td>
<td>Burkina Faso (greenhouse – upgrades are planned), Mali and Nigeria sick plot nursery</td>
</tr>
<tr>
<td>Regional</td>
<td>Striga</td>
<td>To be discussed</td>
<td></td>
</tr>
<tr>
<td>Regional</td>
<td>Low P</td>
<td>Senegal, Togo</td>
<td></td>
</tr>
<tr>
<td>Distributed</td>
<td>Hotspot downy mildew</td>
<td>per country</td>
<td>All</td>
</tr>
<tr>
<td>Distributed</td>
<td>Striga field</td>
<td>Ghana</td>
<td></td>
</tr>
<tr>
<td>Distributed</td>
<td>Low P</td>
<td>One location per country for yield trial (part of trial location)</td>
<td>All</td>
</tr>
</tbody>
</table>
WCA Pearl Millet Workgroup is already working together: Rainy Season 2023

<table>
<thead>
<tr>
<th>Breeding program</th>
<th>Providing country</th>
<th>Origine of parents</th>
<th># of lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>INERA</td>
<td>Burkina Faso</td>
<td>Burkina Faso</td>
<td>226</td>
</tr>
<tr>
<td>IER</td>
<td>Mali</td>
<td>Mali</td>
<td>30</td>
</tr>
<tr>
<td>INRAN</td>
<td>Niger</td>
<td>Niger</td>
<td>167</td>
</tr>
<tr>
<td>LCRI</td>
<td>Nigeria</td>
<td>Nigeria</td>
<td>131</td>
</tr>
<tr>
<td>ISRA</td>
<td>Senegal</td>
<td>Senegal</td>
<td>198</td>
</tr>
<tr>
<td>INERA</td>
<td>Burkina Faso</td>
<td>ICRISAT</td>
<td>21</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>752</strong></td>
</tr>
</tbody>
</table>

- 752 inbred lines were genotyped with DArT Seq. the data will be used to initiate crosses for Heterotic grouping

- 68 frequently used parents in the different workgroup countries program were genotyped with QA/QC markers for line purity check

- 39 pearl trailing locations mapped and described across the 8 workgroup country

- 50 elite OPV lines contributed by the different countries and tested in all the 8 workgroup countries in 12 location in 2023 raining season = 10 to 15 founder lines will be selected

**Purpose:**

Founder lines identification for regional and national breeding programs – OPV & Hybrids

Defining heterotic pool strategy for hybrid pearl millet
Pearl millet WCA: Key messages

- We are experiencing improved capacity development matching needs of breeding – Human and infrastructure
- Access to cutting-edge technologies
- Breeding modernization of NARES programs due to shared responsibilities
- Access to global network – connecting with experts in various fields
- Improved research funding to NARES programs (based on their role in network)
Leveraging synergies across Dryland Crops partners

• Implementing this strategy across all dryland crops in Africa requires coordination, governance and monitoring
• Consultation meeting in Senegal (Feb 2022) and network members meeting in Ghana (Jan 2023)
  – Recommended to form two regional dryland crop improvement network with governance structure (steering committee)
  – Steering Committee will provide overall oversight to functioning of these networks and monitor performance of network members

- Africa Dryland Crop Improvement Network (ADCIN) -

*This name is chosen through the recent poll of 200+ members of NARES and CGIAR
Development of logo and website work is in progress
Africa Dryland Crop Improvement Network Structure

WCA Dryland Crop Improvement Network
- Sorghum-WCA
- Pearl-Millet-WCA
- Groundnut-WCA
- Cow pea - WCA
- Pathologist & entomology
- Seed system
- Socio-economics
- Breeding informatics
- Steering Committee-WCA

ESA Dryland Crop Improvement Network
- Sorghum & Millets-ESA
- Chickpea & Pigeonpea-ESA
- Groundnut-ESA
- Common bean-ESA*
- Pathologist & entomology
- Seed system
- Socio-economics
- Breeding informatics
- Steering Committee-ESA

* Linkages with PABRA

Africa Dryland Crop Improvement Network of 17 Countries of 200+ Scientists
Regional Steering Committees

Purpose of SC

1. Support crop workgroups and technical teams on priority work areas, capacity building and infrastructure development.

2. Build sustainability of the networks and workgroups by engaging and advocating with stakeholders, fundraising, and building institutional capacity of the networks.

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WCA – Dryland Crops Improvement Network – Steering Committee members

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name</th>
<th>Orgnization</th>
<th>Crop</th>
<th>Gender</th>
<th>Country</th>
<th>Discipline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Richard Oteng-Frimpong</td>
<td>CSIR-SARI</td>
<td>Groundnut</td>
<td>Male</td>
<td>Ghana</td>
<td>Breeding</td>
</tr>
<tr>
<td>2</td>
<td>Sanusi Gaya</td>
<td>BUK</td>
<td>Multicrop</td>
<td>Male</td>
<td>Nigeria</td>
<td>Seed Systems</td>
</tr>
<tr>
<td>3</td>
<td>Maryam Abba Dawud</td>
<td>LCRI</td>
<td>Pearl millet</td>
<td>Female</td>
<td>Nigeria</td>
<td>Breeding</td>
</tr>
<tr>
<td>4</td>
<td>Edward Martey</td>
<td>CSIR-SARI</td>
<td>Multicrop</td>
<td>Male</td>
<td>Ghana</td>
<td>Pathology</td>
</tr>
<tr>
<td>5</td>
<td>Elizabeth Zida</td>
<td>INERA</td>
<td>Multicrop</td>
<td>Female</td>
<td>Burkina Faso</td>
<td>Gender/Socio-economics</td>
</tr>
<tr>
<td>6</td>
<td>Eveline Compaore</td>
<td>INERA</td>
<td>Multicrop</td>
<td>Female</td>
<td>Burkina Faso</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Ibrahima Sarr</td>
<td>ISRA-CNRA</td>
<td>Multicrop</td>
<td>Male</td>
<td>Senegal</td>
<td>Entomology</td>
</tr>
<tr>
<td>8</td>
<td>Abdoulaye Diallo</td>
<td>IER</td>
<td>Sorghum</td>
<td>Male</td>
<td>Mali</td>
<td>Breeding</td>
</tr>
<tr>
<td>9</td>
<td>Sory Diallo</td>
<td>IER</td>
<td>Cowpea</td>
<td>Male</td>
<td>Mali</td>
<td>Breeding</td>
</tr>
<tr>
<td>10</td>
<td>Aissata Yahaya Mamadou</td>
<td>INRAN</td>
<td>Sorghum</td>
<td>Female</td>
<td>Niger</td>
<td>Breeding</td>
</tr>
<tr>
<td>11</td>
<td>Daniel Fonseca</td>
<td>CIRAD-CERAAS</td>
<td>Groundnut</td>
<td>Male</td>
<td>Senegal</td>
<td>Genomics</td>
</tr>
<tr>
<td>12</td>
<td>Harish Gandhi</td>
<td>CIMMYT</td>
<td>Multicrop</td>
<td>Male</td>
<td>Regional</td>
<td>Breeding</td>
</tr>
<tr>
<td>13</td>
<td>Baloua Nebie</td>
<td>CIMMYT</td>
<td>Multicrop</td>
<td>Male</td>
<td>Regional</td>
<td>Breeding</td>
</tr>
<tr>
<td>14</td>
<td>Ousmane Boukar</td>
<td>IITA</td>
<td>Cowpea</td>
<td>Male</td>
<td>Regional</td>
<td>Breeding</td>
</tr>
</tbody>
</table>

*Similar committee is formed for ESA

Represents institutions, crops, disciplines, countries; balanced for gender
Regional Steering Committees

Officials for each SC
• Chair
• Vice-chair
• General Secretary
• Finance Secretary (only WCA)

Subcommittees
• Cap-dev (human & infrastructure)
• Finance
• Monitoring, Evaluation and Learning
• Network sustainability and fundraising

Key Responsibilities of Steering Committees
• Develop and implement a Human capacity development plan for the network
• Develop and implement an infrastructure development plan for the network (country assessment to serve as guide)
• Management of budget for above activities (for 2023 ~400K USD budget provided to each SC)
• MEL, Review of performance of network partners, Networking, Policy advocacy, Fundraising – Network sustainability
• Dispute resolution among network members
2023 Key Activities of SC

Budget managed for SC
- ~400,000 USD per region for 2023
- expected to increase up to 600,000 USD per region for 2024

Each SC agreed
- 60% of budget for infrastructure development and
- 40% for human capacity development
- Only for those project that benefits region and it’s agenda

Key Planned Activities of SC for 2023
• Finalize ToR for SC
• Develop bylaws for “Africa Dryland Crop Improvement Network”
• Develop Request for Proposal to distribute budget to crop workgroups or technical teams & evaluate proposals and distribute funds
• Raise awareness about Network and its mandate
Key Summary

• Development of strong partnership and network will require greater understanding of partners strengths and weaknesses;
• Decentralization of decision making through Steering Committees is new and novel approach
• **Africa Dryland Crops Improvement Networks** will develop fit-for-purpose capacities of NARES - matching to their priorities and role in network
  – Shared regional pipeline, shared facilities for managed stress screening → targeted human and infrastructure capacity
• Over longer run success of this approach will allow us to develop “system-level” (NARES and CG) capacity for crop improvement research & development
• Improved System-level capacities will ensure each country has food & nutritional security, and means to manage climate change effects & other shocks in agile and localized manner
Thank you for your interest!