Maize Products Development & Deployment Strategies
Experiences from CIMMYT’s Global Maize Program
and lessons to Nepal

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Ghorahi, Dang
OUTLINE

• CIMMYT’s global maize program
• Background on a functional Seed System
• New Products Development
• Multi location testing
• Important Traits for products identification
• Products deployment
• New products allocation under NSAF
• Partnership and way forward
CIMMYT Global Maize Program

One of the largest public sector breeding programs worldwide

Focus on low & lower-middle income countries

Strong focus on stress resilience, nutritional enrichment, and improving maize genetic gains in the tropics

Strong collaboration/networks with an array of NARS institutions & Seed companies
Elite stress resilient and nutritious tropical maize germplasm developed and distributed globally by CIMMYT

<table>
<thead>
<tr>
<th>Products</th>
<th>Breeding locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought tolerance</td>
<td>Africa; <strong>Asia</strong>; Latin America</td>
</tr>
<tr>
<td>Nitrogen use efficiency</td>
<td>Africa; LA; <strong>Asia</strong></td>
</tr>
<tr>
<td>Drought + heat tolerance</td>
<td><strong>Asia</strong>; Africa; LA</td>
</tr>
<tr>
<td>Acidity / Al toxicity tolerance</td>
<td>LA</td>
</tr>
<tr>
<td>Waterlogging tolerance</td>
<td><strong>Asia</strong></td>
</tr>
<tr>
<td>Insect-pest resistance</td>
<td>Africa; LA; <strong>Asia</strong></td>
</tr>
<tr>
<td>Disease resistance</td>
<td>LA; Africa; <strong>Asia</strong></td>
</tr>
<tr>
<td>Nutritious maize (Provitamin A, QPM, Kernel Zn)</td>
<td>LA; Africa; <strong>Asia</strong></td>
</tr>
</tbody>
</table>
## ASIA MAIZE INDICATORS (2013-14)

Source: USDA PSD 2014

<table>
<thead>
<tr>
<th></th>
<th>Area (M ha)</th>
<th>Yield (t/ha)</th>
<th>Production (M t)</th>
<th>Net Export (M t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>35</td>
<td>5.9</td>
<td>205.6</td>
<td>-3.7</td>
</tr>
<tr>
<td>India</td>
<td>9.1</td>
<td>2.5</td>
<td>22.7</td>
<td>4.4</td>
</tr>
<tr>
<td>Indonesia</td>
<td>3.1</td>
<td>2.9</td>
<td>8.8</td>
<td>-2.6</td>
</tr>
<tr>
<td>Nepal</td>
<td>0.9</td>
<td>2.4</td>
<td>2.1</td>
<td>-0.1</td>
</tr>
<tr>
<td>Pakistan</td>
<td>1.1</td>
<td>4.3</td>
<td>4.8</td>
<td>-0.2</td>
</tr>
<tr>
<td>Philippines</td>
<td>2.6</td>
<td>2.8</td>
<td>7.3</td>
<td>-0.4</td>
</tr>
<tr>
<td>Thailand</td>
<td>1.1</td>
<td>4.3</td>
<td>4.6</td>
<td>0.0</td>
</tr>
<tr>
<td>Vietnam</td>
<td>1.1</td>
<td>4.3</td>
<td>4.9</td>
<td>-1.8</td>
</tr>
<tr>
<td>Asia-7</td>
<td>19.0</td>
<td>2.9</td>
<td>55.3</td>
<td>-0.2</td>
</tr>
<tr>
<td>World</td>
<td>176.5</td>
<td>5.2</td>
<td>915.5</td>
<td></td>
</tr>
</tbody>
</table>
Vitamin A deficiency, children <5 years

Red Countries: Ethiopia, Kenya, Zambia, Zimbabwe, Botswana, South Africa, Madagascar, Mali, C.A.R., Mexico, India, Nepal, Bangladesh, Indonesia...
Maize consumption in some of the “red” countries in Asia for Vit.A

<table>
<thead>
<tr>
<th>Country</th>
<th>Maize intake, g/capita/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timor-Leste</td>
<td>190</td>
</tr>
<tr>
<td>Nepal</td>
<td>98</td>
</tr>
<tr>
<td>Indonesia</td>
<td>79</td>
</tr>
<tr>
<td>Philippines</td>
<td>43</td>
</tr>
</tbody>
</table>

Source: Ranum et al. (2014)

- Provitamin A-enriched maize hybrids with 12-15 ppm provitamin A content already developed and deployed by CIMMYT in Zambia, Zimbabwe, Mozambique and Malawi.
- Possible to introduce, test, release and deploy improved provitamin A-enriched maize hybrids in Nepal.
Functional seed system

Affordable price

Sufficient quantity

Right time

Adequate quality

Right place

VARIETIES & SEEDS
The Seed Value Chain

Breeding & variety release

Seed company establishment

Seed production & processing

Seed marketing

Seed demand and adoption

Policies & regulations
WHY WE NEED NEW PRODUCTS?

• To get advantages from genetic gains
• Shift in market/consumers trends
• Diseases/pest outbreak
• Climate Change (biotic and abiotic stresses, shift in planting/harvesting times...)
• Demands in cropping systems
• In general to meet an ever increasing customer demands...and it is a continuous process
The Breeding Funnel

Advanced/screening trials

Season/year 1
Large no. of entries, few locations

Season/year 2
Regional/MLT

Season/year 3
NPT/NUYT
NSAF target stages

Season/year 4
OFVT
Few no. of entries, many locations

Market product(s)
PRODUCTS TESTING & VALIDATION

• Number of entries
• Ideal testing environments
• Field design and data analysis
• Multi location testing and GxE interaction
• Implication on costs
WHAT ARE WE LOOKING FOR?

• Yield (grain)

• Maturity (early, intermediate, late...)

• Diseases resistance (TLB, GLS, MLN...)

• Nutritional quality (QPM, PVA, Zn...)

• Climate resilient (heat, drought...)
I am more or less a value added maize!
TYPES HYBRIDS VS OPVS

Double-cross Hybrid

Three-way Hybrid

Single Cross

CML395 / CML444 / CML312 / CML442

Female / Male / Female / Male

Single Cross Female

Single Cross Male

Top cross hybrid: population/inbred line
Double top cross: Single Cross/population
Variety cross hybrid: Population/population
# TYPES OF HYBRIDS IN MAIZE

<table>
<thead>
<tr>
<th>Hybrid type</th>
<th>Female parent</th>
<th>Male parent</th>
<th>Seed yield</th>
<th>Seed price</th>
<th>Hybrid characteristics</th>
<th>Hybrid grain yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single cross</td>
<td>Inbred line</td>
<td>Inbred line</td>
<td>lowest</td>
<td>highest</td>
<td>Uniform</td>
<td>Highest</td>
</tr>
<tr>
<td>Three-way</td>
<td>Single cross hybrid</td>
<td>Inbred line</td>
<td>high</td>
<td>Moderate</td>
<td>Slightly variable</td>
<td>High</td>
</tr>
<tr>
<td>Double cross</td>
<td>Single cross hybrid</td>
<td>Single cross hybrid</td>
<td>Highest</td>
<td>Low</td>
<td>Highly variable</td>
<td>Moderate high</td>
</tr>
<tr>
<td>Top-cross</td>
<td>OPV</td>
<td>Inbred</td>
<td>Moderate</td>
<td>Low</td>
<td>Highly variable</td>
<td>Moderate</td>
</tr>
<tr>
<td>Varietal cross</td>
<td>OPV</td>
<td>OPV</td>
<td>Moderate to high</td>
<td>Low</td>
<td>Highly variable</td>
<td>Moderate low</td>
</tr>
</tbody>
</table>
DEPLOYMENT/FAST TRACKING PROCESS

• Rigorous testing followed by product identification
• Seed producibility research/seed micro increase
• Ideal seed production sites
• Market segmentation
• Seed production and marketing roadmap
• Product positioning/branding
Branding and logos
WHAT IS YOUR BRANDING STRATEGY?
To build competitive and synergistic seed and fertilizer systems for inclusive and sustainable growth in agricultural productivity, business development, and income generation in Nepal.

It is aligned with the GoN Agriculture Development Strategy (ADS) and Seed Vision – 2025.
ENHANCING NEPAL’S SEED SYSTEM VIA NSAF - MANDATE CROPS

- Rice
- Maize
- Lentil
- Onion
- Tomato
- Cauliflower

Community photo: ICIMOD
NSAF- PROJECT AREAS
Mrs. Dashami Chaudhary: a farmer near Surkhet
Mrs. Dhansara Ghartimagar: maize farmer near Banke
## MARKET READY MAIZE PRODUCTS UNDER NSAF FOR WINTER TESTING

<table>
<thead>
<tr>
<th></th>
<th>Code</th>
<th>Description</th>
<th>Quantity</th>
<th>Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BHQPMY</td>
<td>Single cross yellow kernel QPM hybrids</td>
<td>3</td>
<td>CIMMYT-Colombia</td>
</tr>
<tr>
<td>2</td>
<td>ADVQPM</td>
<td>White Kernel three way cross QPM hybrids</td>
<td>5</td>
<td>CIMMYT-Zimbabwe</td>
</tr>
<tr>
<td>3</td>
<td>BEHSZN</td>
<td>Zinc fortified maize</td>
<td>3</td>
<td>CIMMYT-Colombia</td>
</tr>
<tr>
<td>4</td>
<td>ASA18HY</td>
<td>Yellow kernel normal maize single cross hybrids</td>
<td>6</td>
<td>CIMMYT-Colombia</td>
</tr>
<tr>
<td>5</td>
<td>TTWCWL</td>
<td>Tropical three way cross white materials</td>
<td>4</td>
<td>CIMMYT-Mexico</td>
</tr>
<tr>
<td>6</td>
<td>TTWCYL</td>
<td>Tropical three way cross Yellow materials</td>
<td>4</td>
<td>CIMMYT-Mexico</td>
</tr>
<tr>
<td>7</td>
<td>IHYB</td>
<td>Intermediate maturing, white kernel hybrids</td>
<td>3</td>
<td>CIMMYT-Zimbabwe</td>
</tr>
<tr>
<td>8</td>
<td>EPOP</td>
<td>Early/extra early maturing white kernel OPVs</td>
<td>3</td>
<td>CIMMYT-Zimbabwe</td>
</tr>
<tr>
<td>9</td>
<td>EEVT</td>
<td>Early/extra early maturing yellow kernel OPVs</td>
<td>3</td>
<td>IITA-Ibadan</td>
</tr>
<tr>
<td>10</td>
<td>EHYB</td>
<td>Early/extra early maturing white kernel hybrids</td>
<td>3-5</td>
<td>CIMMYT-Zimbabwe</td>
</tr>
</tbody>
</table>
Seed replanting guarantee: an innovation

Source: Kilimo Salama
Redeemed cards
Launch of new maize products and parental lines handing over ceremony under USAID-AIP-Pakistan
NSAF SUPPORT

- Product evaluation and validation
- Variety release and registration
- Early generation seed production and scale up
- Market and business opportunity
- Product promotion and adoption
- Capacity building across value chains
- Financial and technical support
CIMMYT’S SUPPORT TO SEED COMPANIES

Equality ≠ Equity

Large Medium Small

Large Medium Small
धन्यवाद

DHANYABAD!