

Drought-tolerant maize for Africa: Better food security and livelihoods

Highlights of 2007

"Imagine there is drought and your maize crop suffers less. There is still enough to harvest to feed your family and maybe sell some grain or green cobs on the market..."

"Imagine seeds of these varieties are available in your country and can be purchased near your farm ..."

"Imagine due to farmers growing such varieties there is less need for grain imports..."

These are the dreams that a broad alliance involving CIMMYT and IITA, national research and extension programs, local seed companies, and non-governmental organizations — more than 50 partners in 20 nations of sub-Saharan Africa — wants to make a reality over the next 10 years. Part of this alliance is the Drought Tolerant Maize for Africa (DTMA) Project.

The DTMA Project's work builds upon the early successes of these partners in developing and disseminating drought tolerant, high-yielding, locally-adapted maize varieties to farmers in sub-Saharan Africa. The aim is for farmers to be able to harvest a ton more of grain per hectare than with their current varieties, when drought hits their crop. With the added food and income, farmers are more food secure and they can also sow less maize and allocate land to cash crops or legumes, which provide protein for diets and improve soil fertility. The project hopes to benefit 30-40 million farmers within 10 years.

The work of the broad alliance is made possible with combined support from the Swiss Agency for Development and Cooperation, the Federal Ministry for Economic Cooperation and Development in Germany, the International Fund for Agricultural Development, the Bill & Melinda Gates Foundation, the Howard G. Buffet Foundation, USAID, Pioneer HiBred and the Eiselen Foundation.

Key activities

Finding and drawing on new sources of drought tolerance from global maize genetic resources

Maize contains a large amount of natural variation for drought tolerance. DTMA uses the best sources from among the world's maize genetic resources, tries to identify genes and alleles responsible for drought tolerance, and combines them together into new highly drought tolerant varieties that can be used by breeders world-wide to harden their own varieties. We are examining landraces, maize grown in temperate environments such as China and the USA and the best of CIMMYT's and IITA's germplasm.

Developing drought tolerant open-pollinated varieties (OPVs) and hybrids adapted to sub-Saharan Africa (SSA)

To be useful to farmers in SSA, drought tolerance needs to be built into locally adapted, high-yielding varieties, that do well under farmers' conditions and are popular with seed producers and consumers. The conditions and preferences are diverse across SSA. The collaboration among CIMMYT, IITA and national breeders will generate varieties suited to various countries and needs, while using and interchanging information about the best germplasm and methods.



The DTMA Project Leader Wilfred Mwangi in discussions with IITA's Deputy Director General - Research, Paula Bramel (center) and CIMMYT Global Maize Program Director, Marianne Bänziger during the project's inception.

Developing the varieties faster - new technologies

The DTMA Project makes advanced technologies available to maize breeders working for Africa – precise drought sites for screening experimental varieties, molecular analysis platforms for identifying the right genetics, doubled haploids to develop inbred lines faster, software and information to make more appropriate selection.

It is all about doing the job faster, more cost effectively, and more precisely. In addition to CIMMYT and IITA, Cornell University and the University of Hohenheim are important partners.

Getting the seed to farmers faster – capacity building and partnerships

"Researchers tell me that a new variety is available but I cannot get the seed" – This is a frequent concern of farmers in SSA. The DTMA Project strengthens the capacity of national agencies for rapid farmer-participatory varietal testing and release by promoting new skills and team work. Breeder seed is provided to seed companies and new seed companies supported with technical advice. Farmers, extension officers and NGO groups are made aware of the new varieties. In-country workgroups ensure a coherent set of activities planned and executed by the countries' own people and institutions.

Generating impact – working with partners

The DTMA Project is looking for holistic solutions for farmers in drought-affected areas. Guided by powerful GIS-based climatic analysis and community surveys, we are looking for partners among seed companies, government and NGOs that provide complementary technologies and services to make real differences in farmers' livelihoods.

Highlights

Going for the quick and long wins: Based on feedback from farmers and seed companies, breeders chose 16 open-pollinated varieties and 20 hybrids for rapid improvement in Kenya, Nigeria, and Zimbabwe. "Sometimes it is only one characteristic that keeps a drought tolerant variety from being more widely used. We fix that with a focused improvement effort and at once have the overall breeding investment for drought tolerance paying much bigger dividends to farmers," says CIMMYT breeder Dan Makumbi. "We have also made thousands of new crosses whose progenies will create the drought tolerant varieties that farmers grow in ten years' time."

Getting national breeders involved: "How can I develop drought tolerant varieties?" – "What germplasm should I use?" – "How can I access and get training for new software and molecular tools?" – "How should I strategize to succeed with my seed business?" These are the questions asked by many national and private company breeders and seed companies in Africa. In 2007, DTMA Project scientists supervised 9 PhDs, 14 MSc and 4 BSc projects. Fifty-three national scientists increased their technical know-how through visits to various DTMA Project sites. Seventy technicians were trained while national agricultural research systems (NARS) and seed companies in 20 countries benefited from diverse types of support. To increase the availability and usefulness of DTMA training material, training sessions are being captured in DVD-and in web-based records—a joint initiative with Cornell University, USA.

Large-scale drought screening made operational: In collaboration with the Ministry of Agriculture in Kenya and the Kenya Agricultural Research Institute (KARI), a precise drought screening site was developed at Kiboko, Kenya, allowing the evaluation of 5,000 new varieties every year. Similar investments are planned for southern and West Africa. "Precise drought screening sites are crucial for the identification of drought tolerant maize varieties. In eastern Africa, we feel like we are taking our fate in our own hands and can start to tackle the devastating impacts of drought," says Dr. Ephraim Mukisira, Director of KARI.

1.6 Gigabytes of historical power: CIMMYT and IITA have been building up their drought tolerant germplasm base for over two decades. "Knowing how to make the best use of this germplasm to the benefit of African farmers is crucial for IARC and NARS breeders to succeed," says Bindi Vivek, a breeder and software developer with CIMMYT. "During 2007 we improved our capacity to enter and locally process our breeding data but also combined over 6,500 historical trials into a single global database. The programs Fieldbook and MaizeFinder have been made available via the internet and several NARS are already using them."

Scrutinizing the world's elite genetic resources: Drought tolerance is a complex trait and looking for drought tolerance genes in landraces may be likened to searching for a needle in a haystack. Fortunately, breeders around the world have been working for generations on building valuable traits into their most treasured breeding materials: inbred lines. The project acquired and now examines over 1,000 elite inbred lines from CIMMYT, IITA,



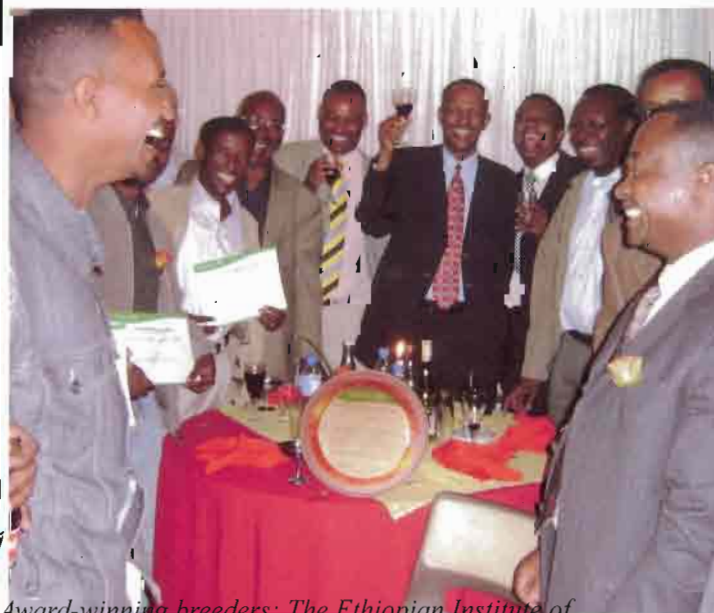
Investments in large-scale, high precision drought screening sites such as the one at Kiboko, Kenya, empower national agricultural programs to evaluate thousands of drought tolerant varieties annually.

CAAS and US public and private breeding programs for their value in drought tolerance breeding. "Our goal is to make the best drought tolerant sources and associated molecular markers available to collaborating breeders. Feeding their breeding engines with drought tolerant sources will make DTMA Project's investment pay off in the future", says Marilyn Warburton, a molecular geneticist at CIMMYT.

Without? - The insights
: Why is seed not getting to farmers? This question was examined through a seed sector survey that obtained feed-back from 80 seed companies and 46 NARS and NGOs in 11 countries. Of those surveyed, 100% responded- evidence of the trust and interest by the project's network of partners in solving bottlenecks in the seed value chain. "High investment capital and lack of qualified manpower hinder the growth of small local seed companies that have emerged in SSA over the past decade" says Augustine Langyintuo, CIMMYT economist. "In West Africa we are linking community-based seed production schemes to emerging seed businesses - it's a win-win situation for everybody" says Baffour Badu-Apraku from IITA.

DTMA invest collaborative to impacts
During 2007 DTMA invested heavily to strengthen multi-stakeholder national coordination units or maize working groups that develop, evaluate, and scale up new maize varieties in partner countries. With the view of a value chain, they involve NARS, NGOs, private seed companies, and farmer representatives. "Resources in Africa are too constrained for every stakeholder to go it alone. What is needed is a win-win partnership with existing initiatives," says Dr. Jeffrey Luhanga, DTMA Project Advisory Board Member and Controller of Agricultural Extension and Technical Services in Malawi. "DTMA appeals to the country's own stakeholders from the public, private and NGO sectors to come together and develop real action plans that make improved livelihoods for farmers a reality in the face of climate change."

Partnership and values
An output-orientation and teamwork are two values that are being recognized with the introduction of the annual "Best Maize Breeding" and "Technology Dissemination Team" awards in 2007 in eastern Africa. The awards will be implemented across the continent in 2008. The eastern Africa maize breeding award went to the Ethiopian Institute of Agricultural Research-Melkassa, and the technology dissemination award went to a multi-institutional team led by the Selian Agricultural Research Institute (SARI), Tanzania. Isaka Mashauri from TanSeed commented: "Thank you very much for the award - it excited and motivated us all."



Award-winning breeders: The Ethiopian Institute of Agricultural Research-Melkassa won the DTMA Best Breeding Team Award 2007.

From farmers, breeders, seed producers
: In addition to feed-back from farmers, breeders, seed producers, NGOs, CBOs and donors, the DTMA Project established an Advisory Board in mid-2007 to provide guidance on scientific, organizational, and institutional issues. The Board includes the following internationally recognized experts:

- Andy Greenland (Director of Research, the National Institute of Agricultural Botany, Cambridge, UK; Biotechnology).
- Aline Funk (CEO and co-founder, Channel Bio Corp, USA; Commercial seed production and sales).
- Jeffrey Luhanga (Controller of Agricultural Extension and Technical Services, Ministry of Agriculture, Malawi; Seed systems).
- Derek Byerlee (Co-Director of the World Development Report 2008; Socio-economics).
- Peter Freymark (Research Coordinator, Maize Product Development for Latin America, Africa, and Asia Pacific, Pioneer Hi-Bred International, Inc.; Genetics and plant breeding).
- Joe DeVries (Rockefeller Foundation and Director, Program for Africa's Seed Systems, Alliance for a Green Revolution for Africa).
- David Bergvinson (Program Officer, Agricultural Development, Bill & Melinda Gates Foundation).

For more information

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