

Maize Opportunities and Challenges for Asia

■ GENEVIEVE RENARD

Compared with other cereals, maize has recorded the fastest annual growth in Asia at around 4 percent, but consumption is rising faster than yields.

When BM Prasanna, CIMMYT's global maize program director, opened the 12th Asian Maize Conference and Expert Consultation on "Maize for Food, Feed, Nutrition and Environmental

Security" in Bangkok last week he said that boosting maize crops would be a key to food security.

In China, maize is the number one crop in acreage, covering 35.26 million hectares (87 million acres) in 2013, an area comparable to that of the United States, Prasanna said.

The big questions are whether or not China can increase yields before 2020 to avoid being the largest importer of maize and whether Asia can meet the demand for maize "by shortening, widening and improving the breeding funnel," Prasanna said.

He added that efforts are underway to significantly enhance genetic gain per unit over time: CIMMYT and the University of Hohenheim (Stuttgart, Germany) are utilizing doubled haploid technology; other partnerships are focused on genetic diversity

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— BM Prasanna
CIMMYT Global Maize Program Director



▲ BM Prasanna, CIMMYT's global maize program director, presents maize challenges and opportunities in Asia. Photo courtesy of APAARI.

and introgressing transgenic traits under humanitarian license through public-private partnerships.

"Strengthening seed systems is also important for breeding programs to make an impact," Prasanna said. "The sooner farmers, especially ►



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◀ smallholders in unreached areas, have access to improved varieties and a complementary agronomic package of practices, the greater the opportunity to increase productivity.”

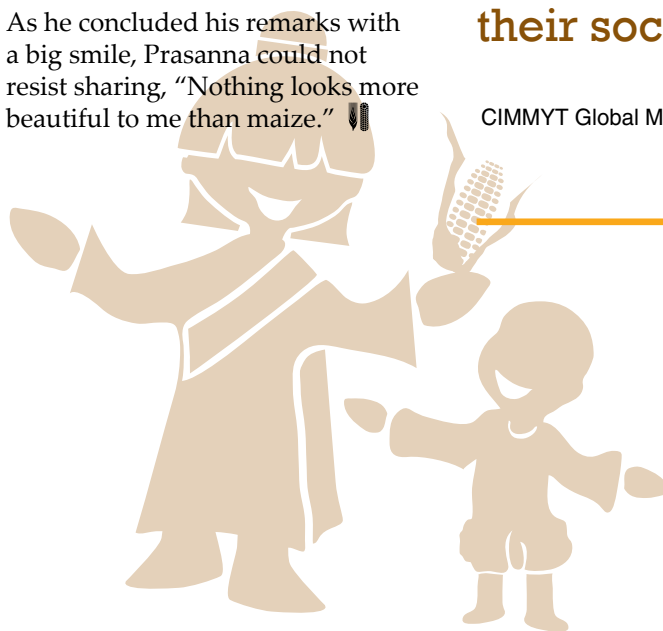
Challenges are many. Heat stress and drought stress, among others, are an increasing reality in many maize-growing regions in the tropics. Two promising CIMMYT-Asia heat-tolerant commercial hybrids (31Y45 and DKC9108) are currently being marketed in Asia. Scientists also confirm that a strong pipeline of water stress-resilient, Asia-adapted maize hybrids is ready for deployment in rainfed areas of Asia.

Prasanna concluded by reminding the 350 conference participants that “putting women and children at the center of development will help transform their societies.” Quoting Melinda Gates, he said that by ignoring gender inequities, many development projects fail to achieve their objectives.

As he concluded his remarks with a big smile, Prasanna could not resist sharing, “Nothing looks more beautiful to me than maize.”

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– BM Prasanna
CIMMYT Global Maize Program Director



▼ The 12th Asian Maize Conference, held in Bangkok, Thailand, drew 350 participants. Photo courtesy of APAARI.



Strengthening Maize Policies and Public-Private Partnerships in Asia

■ ANURADHA DHAR

Policies designed to promote maize industry growth require data and information, which is often difficult to obtain in Asian countries. This was discussed during the technical session on improving maize seed systems in Asia at the 12th Asian Maize Conference. David Spielman, senior research fellow at the International Food Policy Research Institute (IFPRI), highlighted that policy-makers often face difficult challenges in promoting seed industry growth – especially in Asian countries that have more smallholder and resource-poor farmers.



▲ David Spielman, senior research fellow at the International Food Policy Research Institute highlights the importance of innovative policies. Photo courtesy of APAARI.

Spielman said, “Innovation policies require data on firm-level research and development spending; product pipeline and competition policies require data on market structure and firm behavior.”

Firms often do not share proprietary revenue data and governments may not monitor firm-level activity on a regular basis. One of the factors could be that policy-makers are not sufficiently informed about the opportunities and trade-offs associated with designing laws and regulations that enable the effective governance of seed industry development. Spielman emphasized that a better designed dataset with a finite set of indicators to measure competition and innovation in a country’s seed industry can better inform policy-makers.

The conference highlighted the need for the public and private sectors to work together to provide affordable new seed varieties and deliver new technologies to smallholder farmers. An eminent group of panelists – Arvind Kumar, Rasi Seeds; Shilpa Divekar Nirula, Monsanto; Fan Xingming, Yunnan Academy of Agricultural Sciences, China; John McMurdy, U.S. Agency for International Development; and Bijendra Pal, Bioseed, discussed the opportunities and challenges to ensure a vibrant Asian maize seed sector through public-private partnerships (PPPs).

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The panel noted that decision-makers should not look at public vs. private; rather they should learn from models and best practices where the two sectors have worked together successfully.

As a best practice on PPPs, Ian Barker, head of agricultural partnerships at the Syngenta Foundation for Sustainable Agriculture (SFSA), talked about its Seeds2B program in Africa that builds linkages between breeders and seed companies to make more improved seed varieties available to farmers at the right time and price.

He also highlighted that SFSA is now aiming to kick-start the Seed2B concept in Asia – bringing together breeders, seed companies, farmer associations and other relevant players in the Asian maize value chain – to improve access to seed in marginal maize areas. Barker said, “Public-private breeding partnerships can efficiently deliver new affordable and accessible hybrids – correctly positioned and targeted at proven smallholder demand.”

Enhancing the Nutritional Quality of Maize

■ MIRIAM SHINDLER

Malnutrition and micronutrient deficiency, which can cause blindness and stunting, increased infant and maternal mortality and lower IQs, are at epidemic levels in some parts of Asia. People across Asia depend on maize, rice and wheat but these staple crops do not meet daily dietary requirements and are deficient in essential vitamins (such as Vitamin A) and micronutrients such as iron and zinc.

Photo: Xochiquetzal Fonseca/CIMMYT.



At the 12th Asian Maize Conference, held last week in Thailand, scientists highlighted several collaborative interventions to utilize the genetic variability in maize for the development of bio-fortified maize. Bio-fortified maize varieties have been bred to include considerably higher concentrations of essential vitamins and micronutrients. Breeding efforts in Asia are currently focused on quality protein maize (QPM) and Provitamin A (ProVA)-enriched varieties.

There are a number of nutritionally enhanced QPM varieties that contain much higher levels of essential amino acids. QPM was developed by former CIMMYT scientists and 2000 World Food Prize Laureates Dr. Evangelina Villegas and Dr. Surinder Vasal. CIMMYT QPM inbred lines have been used in several breeding programs in China. CIMMYT scientists are currently working with the Yunnan Academy of Agricultural Sciences to develop and deploy QPM hybrids in southern China.

QPM was developed by former CIMMYT scientists and 2000 World Food Prize Laureates Dr. Evangelina Villegas and Dr. Surinder Vasal.

Joint efforts between CIMMYT scientists and the Bogor Agricultural University of Indonesia, under the HarvestPlus component of the Agriculture for Nutrition and Health CGIAR Research Program, have shown that breeding for increased concentrations of ProVA is especially promising because of the genetic variation available in maize germplasm. New hybrids released in 2012 showed 80 percent higher ProVA levels than common yellow maize, bringing widespread health benefits. ▼



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Wheat to Study Gender Norms and Wheat-based Livelihoods in Afghanistan, Ethiopia and Pakistan

■ KATIE LUTZ, MIKE LISTMAN AND LONE BADSTUE

In a newly funded project, the CGIAR Research Program on Wheat will explore how the differing roles and rights of women, men and youth influence wheat research and development impacts in three nations whose inhabitants depend heavily on the crop for protein, carbohydrates and livelihoods.

“Understanding gender in wheat-based livelihoods for enhanced wheat research for development (R4D) impact in Afghanistan, Pakistan and Ethiopia” is funded by Germany’s Federal Ministry for Economic Cooperation and Development (BMZ). The project will seek evidence to promote an appreciation of gender integration and social inclusion as an opportunity to enhance impact. There is ample literature on gender and agriculture, but less on studies that explore gender and social equity issues relating to wheat-based livelihoods, according to Lone Badstue, CIMMYT strategic leader for gender research and mainstreaming.

“Wheat accounts for more than one-third of the food supply in Pakistan and over half of the supply in Afghanistan; Ethiopia is the second-largest wheat producer in Sub-Saharan Africa,” said Badstue. “Gender norms are very conservative in these countries and male farmers are better positioned to benefit from new technologies, furthering the gap between men and women. Gender-sensitive approaches in research can help to diminish this gap and ultimately benefit everyone,” Badstue added.

The [FAO 2011 State of Food and Agriculture report](#) indicates women are less likely than men to own land or livestock, access credit or adopt new technologies. If women had equal access to these resources, farm yields would increase by as much as 30 percent, agricultural output in developing countries would rise as much as 4 percent and there would be 12 to 17 percent fewer hungry people in the world (up to 150 million), according to the study.



▲ The new BMZ-funded project seeks to ensure that women and men of different ages and social groups participate in and benefit from wheat research. Photo: Mike Listman/CIMMYT.

“Ignoring gender dynamics in agriculture has serious consequences. Today’s donors are aware of this and prioritize investments that address gender inequality,” concluded, Badstue.

Results from this new work will feed into other CIMMYT projects, including the [Wheat Production Enhancement Program \(Pakistan\)](#), [Sustainable Wheat and Maize Production in Afghanistan](#) and [Farm Mechanization and Conservation Agriculture for Sustainable Intensification \(Ethiopia\)](#).

“Afghanistan, Pakistan and Ethiopia are conservative with regard to gender relations,” said Hans Braun, CIMMYT Global Wheat Program director. “We know that research on technical issues, such as optimizing wheat quality, nutrition and processing traits, can impact the lives of women and youth. This project will uncover new issues and shed light on how best to improve socioeconomic factors with wheat-related impacts.” ▼

BMZ



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and Development

Productivity and Resilience: Can We Have Both?

■ FRÉDÉRIC BAUDRON

Crop breeders know there is a trade-off between productivity and resilience in plants. Similar trade-offs are generally observed at the farm level – the intensification of farming systems is generally accompanied by a loss of resilience. Managing these trade-offs is a major challenge of sustainable intensification.

Ecological Network Analysis is an approach that assesses the functions of food webs (resilience, dependence on resources imported from the outside environment, etc.) based on the architecture of these food webs. Farming systems can be conceptualized as networks of energy flowing between crops, trees, livestock, the soil, the household and the outside environment (common land, other farms and the market, for example).

To better appreciate how to increase the productivity of smallholder farming with minimum negative impact on its resilience, CIMMYT-Ethiopia, in partnership with the Farming Systems Ecology Group of Wageningen University, adapted the Ecological Network Analysis approach to analyze energy flows in the farming systems of southern Ethiopia. For the purpose of the study, a diversity of farms was selected in three landscapes: a landscape dominated by annuals (mainly maize and beans); a landscape dominated by perennials (ensete, coffee, khat and native and planted trees); and an intermediary landscape. Flows of biomass (food, feed, fuel, manure, etc.), labor and draught power in each farm were estimated through interviews and direct measurements.

Data analysis is ongoing, but early findings show that the dependence on external energy (imported biomass for feed and fuel, hired labor, etc.) decreases and resilience increases as the diversity of internal flows of energy increases. Therefore, maintaining

a large diversity of energy flows in farming systems should be an aim of sustainable intensification.

How can this be achieved? Not surprisingly, the study found that diversification is a key strategy, as the number of flows between internal components of the farming systems increases as the number of components increases. Crop-livestock integration was also found to be another strategy to recycle energy; livestock feed on non-food products (crop residues and trees, for example) and generate products

such as milk, meat, manure and draught power. This brings a new dimension to the current debate on the competition between soil and livestock for biomass in conservation agriculture-based systems in Africa.

Another finding, which was unexpected, is that maize may promote resilience and energy self-sufficiency because of the diversity of flows its multiple uses generate: grain as food and a source of cash, and stover as feed, fuel and soil amendment. ▮▮



▲ Jean-Yves Duriaux, from the Farming Systems Ecology Group of Wageningen University, estimates the amount of maize stover used for feed and fuel by a household in southern Ethiopia. Photo: Frédéric Baudron.

Recent Publications by CIMMYT Staff

■ KNOWLEDGE CENTER

[Assessing rice and wheat germplasm collections using similarity groups.](#) 2014. Hazekamp, T.; Payne, T.S.; Sackville Hamilton, N.R. *Genetic Resources and Crop Evolution* 61 (4) : 841-851.

[Genetic Analysis of Leaf Rust Resistance in Six Durum Wheat Genotypes.](#) 2014. Loladze, A.; Dhouha Kthiri; Pozniak, C.; Ammar, K. *Phytopathology*. Online First.

[Genetic loci associated with high grain zinc concentration and pleiotropic effect on kernel weight in wheat \(*Triticum aestivum* L.\).](#) 2014. Yuanfeng Hao; Velu, G.; Peña-Bautista, R.J.; Sukhwinder-Singh; Singh, R.P. *Molecular Breeding*. Online First.

[Potential Economic Impact of Biofortified Maize in the Indian Poultry Sector.](#) 2014. Krishna, V.V.; Erenstein, O.; Sadashivappa, P.; Vivek, B. *International Food and Agribusiness Management Review* 17(4):109-138.

[Stripe rust and leaf rust resistance QTL mapping, epistatic interactions, and colocalization with stem rust resistance loci; in spring wheat evaluated over three continents.](#) 2014. Singh, A.; Knox, R.E.; DePauw, R.M.; Singh, A.K.; Cuthbert, R.D.; Campbell, H.L.; Shorter, S.; Bhavani, S. *Theoretical and Applied Genetics* 127(11):2465-2477.



In February of this year, photographer Xochiquetzal Fonseca captured this image at the Norman E. Borlaug Research Center (CENEB) in Obregón. The photo shows the extruded anthers and pollen shed from experimental hybrid wheat parents. The research effort is part of CIMMYT's hybrid wheat program.