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Focus on heat stress resilient maize for Asia

Scientists from the Heat Stress Tolerant Maize for Asia (HTMA) project and representatives from collaborating public and private sector institutions from the region, Purdue University, and CIMMYT gathered together during 30-31 July 2013 in Kathmandu, Nepal, for the 1st HTMA Annual Progress Review and Planning Meeting. The meeting was jointly organized by the National Maize Research Program (NMRP) and CIMMYT to discuss progress to-date and future HTMA work plans. HTMA, supported by USAID under the Feed the Future initiative, is a public-private alliance targeting resource-poor people in South Asia who rely on growing maize for subsistence or income in rainfed conditions and whose welfare is directly dependent on maize yields and negatively affected by crop failures.

K.B. Koirala, National Maize Coordinator for Nepal, welcomed all participants and highlighted the importance of the public-private alliance through HTMA, especially for addressing such complex issues as developing and distributing heat stress resilient maize. CIMMYT Global Maize Program director B.M. Prasanna reiterated the need for and importance of maize breeding for heat-stress resilience in his opening remarks, while USAID's Larry Beach stressed the project's significance in addressing the emerging effects of climate change.

The first day was devoted to an annual progress review, which was initiated by senior maize physiologist and CIMMYT and HTMA project leader P.H. Zaidi, who presented updates on the project execution and status of progress during the project's first year. The following session, chaired by Nepal Agricultural Research Council (NARC) executive director D.B. Gurung, covered membrane lipid profiling in relation to heat stress; identifying quantitative trait loci (QTL) for heat-stress tolerance and component traits by joint linkage analysis; association mapping for heat tolerance; latest marker statistics on genotyping-by-sequencing; genomic selection for heat stress tolerance; and development of target populations for rapid-cycle genomic selection.

The afternoon session was chaired by Pakistan Agricultural Research Council (PARC) chairman Iftikhar Ahmad and focused on phenotyping for heat-stress tolerance; crop modeling and the IMPACT model component; a road map for development and distribution of heat resilient maize; seed distribution systems; and seed companies' perspectives on target markets. ▶

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During day two, participants discussed and developed a workplan and activities for the second year of the project for each collaborating institution. This was followed by a special session on "Exploring linkages & synergy among USAID-funded projects in South Asia." Representatives from various ongoing projects in the region, including the Hill Maize Research Project (HMRP), Cereal System Initiative for South Asia (CSISA), and HTMA, as well as NARC and the Nepalese Ministry of Agriculture, joined in the lively discussion, which helped to identify opportunities for potential linkages among the region's initiatives and a synergy between them. The linkages could offer a win-win situation for all stakeholders.

The meeting was concluded with an HTMA project steering committee meeting chaired by B.M. Prasanna. The committee members expressed their satisfaction with the strategy, ongoing activities, and the progress being made.

Strengthening CIMMYT cooperation with Russia

CIMMYT Global Wheat Program director Hans-Joachim Braun and winter wheat breeder Alex Morgounov attended the G-20 Meeting of Agricultural Chief Scientists in Moscow, Russia, on 24-25 July 2013 where they presented on CRP WHEAT and the cooperation between CIMMYT and Russia. The G-20 meeting adopted a declaration stating the importance of cooperation in agricultural research and defining future priority areas and directions for this cooperation. The meeting also emphasized the involvement of the Russian Federation in international agricultural research and development. In 2013, Russia supported CRP WHEAT with US$1.1 million, part of which was allocated to the Kazakhstan-Siberian Network on Wheat Improvement (KASIB) for spring wheat improvement and part to Strategic Initiatives related to biotic and abiotic stresses. The funds utilization and strengthening of cooperation with Russian scientists were discussed with Sergey Kiselev, director of Eurasian Center of Food Security at Lomonosov Moscow State University, and Ivan Savchenko, vice president of the Russian Academy of Agricultural Sciences.

Left to right: Vladimir Shamanin, Alex Morgounov, Sergey Petukhovskiy, Hans Braun, and Nina Kazydub.

Following the meeting, Braun and Morgounov visited Omsk in Western Siberia on 26 July to sign a sub-grant agreement between CIMMYT and Omsk State Agrarian University on technical coordination of KASIB activities; development of shuttle breeding germplasm for Russian cooperating institutions; and expansion of training and visits between the university and CIMMYT, and attendance of regional and international conferences for Russian scientists.

The subsequent field visits to the university and Siberian Agricultural Research Institute demonstrated the value of regional germplasm exchange and improved adaptation of the shuttle germplasm developed for the region in Mexico and Turkey. "The shuttle breeding program, initiated in early 2000s to incorporate rusts resistance into local material, finally bears fruit as several advanced lines competitive with local checks have been identified and will be considered as variety candidates in the near future," said Morgounov. As Northern Kazakhstan and Western Siberia jointly cultivate almost 20 million hectares of high latitude spring-planted wheat, this area plays a significant role in global wheat supply.

The struggle of maize against climate change in Zimbabwe

"Maize production is likely to suffer the most due to climate change compared to other crops in Southern Africa," said CIMMYT physiologist Jill Cairns, who presented on CIMMYT work under the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) at the FAO Agriculture Coordination & Information Forum in Harare, Zimbabwe, on 25 July 2013. During her presentation on future climate scenarios in Zimbabwe, Cairns focused on adaptation strategies to climate change, temperature and rainfall projections for 2050, and climate change implications for maize production.

CIMMYT's ongoing research in Zimbabwe shows an increase in extreme temperature events and the intensity of droughts, which are conditions likely to reduce harvests and affect the suitability of current crops. Discussing the key adaptation strategies for Zimbabwe, including improved varieties, redefined agro-ecological zones, new policies, and better management, Cairns stressed that the initial climate change projections are not downscaled enough to make decisions at the country level. This is important as agricultural responses to climate change cannot be determined and priorities for adaptation strategies cannot be set without the ability to accurately predict future climate scenarios.

The major climate-related threats to maize in Zimbabwe right now are low rainfall and drought stress under high temperatures. "CIMMYT research in Southern Africa has shown that maize production linearly decreases with every accumulated degree above 30 degrees," said Cairns. "While the amount of rainfall during the maize growing season in the drought-prone areas may increase slightly, it is unlikely to translate into higher yields as evapotranspiration will increase under higher temperatures."

The challenges are not easy to tackle, but there are opportunities to offset losses. To mitigate the effect of increased temperature, maize lines with tolerance to combined drought and heat stress need to be developed. Such lines have been already identified and can be used to adapt maize production to climate change in Southern Africa.

The presentation, prepared by Cairns with significant input from CIMMYT specialist in geographic information systems, Kai Sonder, was well received by the FAO representatives.

Learning to breed insect-resistant maize at CIMMYT-Kenya

"The trip was an eye opener for me. We have no mass rearing facility in Ethiopia; neither do we practice artificial infestation of stem borers. We only undertake natural infestation for our trials, which does not give uniform infestation, leading us to wrong conclusions," said Midekssa Ardessa from Bako Agricultural Research Center at the Ethiopian Institute of Agricultural Research (EIAR), who visited CIMMYT-Kenya during 21-27 July 2013 with a team of scientists from Ethiopia, Uganda, Tanzania, and Mozambique, to gain hands-on experience in breeding insect-resistant maize. "We are now very knowledgeable on mass rearing of stem borers and on running an insectary after our visit and practical sessions at the CIMMYT Katumani Insectary," added Abiy Dibaba from EIAR's Melkasa Agricultural Research Center. "At the CIMMYT Kiboko Postharvest Lab, we learned a lot about maize weevils and the larger grain borer, and how to screen maize for resistance against these postharvest pests."

The visit, organized and facilitated by the Insect Resistant Maize for Africa (IRMA III Conventional) and the Water Efficient Maize for Africa (WEMA) projects, aimed to build capacity in maize breeding for insect resistance using conventional approaches, insect resistance screening, and management of field and lab infestations. Participants came from EIAR; Kenya Agricultural Research Institute (KARI); Selian Agricultural Research Institute (SARI), Tanzania; National Biological Control Program, Tanzania; Ministry of Agriculture, Tanzania; National Crops Resources Research Institute (NACRRI) of the National Agricultural Research Organization (NARO), Uganda; and National Institute of Agronomic Research (IIAM), Mozambique.

"The visit provided an opportunity for the scientists to understand IRMA's and WEMA's research work in Kenya and a forum to share experiences in mass rearing, breeding, and pest control among participating countries," said Stephen Mugo, CIMMYT principal scientist/maize breeder and IRMA and WEMA projects coordinator. It is also a learning process for CIMMYT scientists, he added. The team visited CIMMYT insect pests resistant germplasm nurseries and trials at the Embu, Kirinyaga University College, and Kiboko sites where they learned how to set up, infest, manage, and taka data on stem borer trials and nurseries. At the KARI-Katumani IRMA III Conventional collaborative stem borer mass rearing facilities, participants learned to set up, equip, and manage stem borer mass rearing; in Kiboko they focused on the set up, management, and data collection for storage pests screening. The field and lab practical sessions were facilitated by CIMMYT scientist/entomologist Tadele Tefera.

The annual IRMA project's program has trained more than 50 scientists since its inception in 2009. "Most of us talk very easily and confidently about insect rearing. However, it is quite a challenge when we engage in the practical aspects," said Tefera. "What we have exposed you to is just a tip of the iceberg in the business of mass rearing of insects. There is still a lot to learn, much of it by yourself as you engage in the practical aspects of it." The participants appreciated the effort taken by the organizers. One of them, Egas Nhamucho of IIAM, said: "Infestation of maize with stem borers was a real learning point for me, a real delicate task of picking out very tiny 10 insect larvae, ensuring that you do not pierce and kill them with the camel brush, and carefully and strategically placing them on each maize plant. The practical sessions really made me appreciate some of the tasks we have always taken for granted."

Concluding the event, CIMMYT scientist/maize breeder Yoseph Beyene called on the participating scientists to ensure that as many people as possible get access to the knowledge they gained. "Invest in people to effectively and successfully undertake your research," he said.

WEMA project manager Sylvester Oikeh thanked CIMMYT scientists for the support they provided to the Ugandan team in setting up the Namulonge Insectary. "I am looking forward to other countries emulating Uganda and setting up their insectaries," Oikeh added.

NSIMA: Seeding hope for smallholder farmers through partnerships

To achieve food security, smallholder farmers in Southern Africa require access to improved seed and inputs for higher yields. "Seed is one of the key movers in agricultural development," says John MacRobert, New Seed Initiative for Maize in Southern Africa (NSIMA) leader, indicating the importance of going beyond developing improved seed varieties to encompass their dissemination, promotion, and adoption in developing strategies around seed development. These issues, together with NSIMA's to date progress (the project is in its third phase) and strategies for the next phase, were discussed at a meeting in Lusaka, Zambia, during 7-9 August 2013. About 50 participants from institutions collaborating on the project led by CIMMYT and funded by the Swiss Agency for Development and Cooperation (SDC) were present; among them were representatives from national agricultural research institutes, seed companies, and institutions of higher learning from Angola, Botswana, Democratic Republic of the Congo, Lesotho, Malawi, Mozambique, Swaziland, South Africa, Zambia, and Zimbabwe.

"Some of the challenges of the maize crop can be addressed by research," said Moses Mwale, Zambia Agricultural Research Institute (ZARI) director, during the opening ceremony. "The rest can be addressed by other players in the maize sector," he added, emphasizing the importance of collaboration within the maize seed value chain. Challenges such as variable distribution of rainfall, low soil fertility, and heat and drought stress can be addressed by improved varieties from CIMMYT-led projects including the Drought Tolerant Maize for Africa (DTMA) and Improved Maize for African Soils (IMAS). Other climate-change related issues in small-scale farming could be confronted via conservation agriculture. For example, cover crops and crop residue left on the soil help to retain moisture and thus mitigate the impact of droughts.

But do smallholder farmers have access to the new seeds, technologies, and information? The answer is often no. "Integrating stress tolerant maize and legumes, such as pigeon peas, beans, and cowpeas, leads to sustainable production systems. We need effective seed road maps to enhance access and availability of improved maize and legume seeds," CIMMYT regional director for Southern Africa Mulugetta Mekuria said, giving an example of one such gap in the system.

Seed companies and community-based organizations producing seed play a very significant role in fixing these issues. Nelson Munyaka from the SDC Seeds and Markets Project spoke of the success of Zaka Superseeds, a nascent seed company that transformed from a community seed enterprise. MacRobert agreed: "In Benin and Congo, where we do not have seed companies, the community seed producers could learn from Zaka's experience and grow into full-fledged seed businesses with the proper structures." DTMA project leader Tsedeke Abate added that mainstreaming drought tolerant maize varieties in the product portfolio of seed enterprises could have a significant impact.

Policy makers in the seed value chain must be engaged as well. "Many projects do not seem to believe in smallholder ability," said consultant Michael Jenrich. The policies that govern the seed trade tend to vary among the Southern African Development Community (SADC) countries. An SDC-funded initiative to implement harmonized seed laws in all SADC countries to facilitate easier intra-regional seed

movement is currently under way. "So far, 10 countries have signed the memorandum of understanding," said K C Kawonga, SADC Seed Centre interim coordinator. Such laws would enhance seed trade and contribute to food security by ensuring farmers' access to improved seed, especially during times of disaster.

"Private sector players steer away from smallholders viewing them as high risk because of their poor infrastructure, lack of credit, and land tenure, while governments may not view them as a viable investment," Jenrich summarized the lack of interest in smallholders' problems. Zaka Superseeds proves them wrong; cooperating with smallholders can, in fact, be beneficial for seed companies, as they can work more closely with the community consuming their seed. Zaka, for example, is removing a product from its selection after consultations with the community during which they found out the discussed maize variety has a long maturity period and is thus undesirable.

The meeting ended on a high note with the announcement of the 2012 DTMA Breeding and Dissemination Awards winners. Malawi won first prize for both categories; the breeding award runners-up were Zambia and Zimbabwe, and Zimbabwe also took second position in drought tolerant technologies dissemination.

Snapshot

Photo: Florence Sipalla/CIMMYT

A cob showing poor pollination.

Recent publications by CIMMYT staff

Formation of heterotic groups and understanding genetic effects in a provitamin a biofortified maize breeding program. 2013. Suwarno, W.B.; Pixley, K.V.; Palacios-Rojas, N.; Kaeppler, S.M.; Babu, R. *Crop Science* Online first

Optimal design of preliminary yield trials with genome-wide markers. 2013. Endelman, J.B.; Atlin, G.N.; Beyene, Y.; Fentaye Kassa Semagn; Xuecai Zhang; Sorrells, M.E.; Jannink, J-L. *Crop Science* Online first

Out of America: tracing the genetic footprints of the global diffusion of maize. 2013. Mir, C.; Zerjal, T.; Combes, V.; Dumas, F.; Madur, D.; Bedoya, C.; Dreisigacker, S.; Franco, J.; Grudloyma, P.; Hao, P.X.; Hearne, S.; Jampatong, C.; Laloe, D.; Muthamia, Z.;Nguyen, T.; Prasanna, B.M.; Taba, S.; Xie, C.X.; Yunus, M.; Zhang, S.; Warburton, M.L.; Charcosset, A. *Theoretical and Applied Genetics* Online first

Circus world

The circus is in El Batán! The summer course continues and week four brought the kids to circus world. Marco Granados, the summer course coordinator, says: "Week four was a success. The kids uncovered many hidden skills, skills they didn't know they have. It was incredible to see how talented they are! Their spontaneity and improvisation were crucial for the success of the circus: we saw acrobatics, car somersaults, human towers, clowns, jellyfish, jugglers, dwarfs, tamers, equilibrists, mimes, magicians, dancers, painters... We also played sports. We first thought that soccer was going to be everyone's favorite, but after teaching the children to play baseball, we were proven wrong! Everyone – both boys and girls – loved baseball the most, followed by volleyball and soccer."

Weekly photo contest ▶

Informa is published every Friday by CIMMYT Corporate Communications. We welcome your input, preferably in both English and Spanish. The deadline for submissions is 3:00 p.m. on the Wednesday before publication. We reserve the right to edit all contributions. Please send proposed material to Connie Castro c.castro@cgiar.org.
web site: www.cimmyt.org

Photo contest winner: A pile of maize, a pile of pro-vitamin A

A pile of pro-vitamin A maize at the Zamseed seed company in Lusaka, Zambia. The photo was taken during a DTMA traveling workshop. For more information on provitamin A maize, visit our blog.

Runner-up: Wheat nursery evaluation, come rain or shine

International Winter Wheat Improvement Program head Alex Morgounov (left) and Karabalyk station breeder Vladimir Chudinov (right) evaluated spring wheat shuttle breeding nurseries in Karabalyk, Kostanay region, Kazakhstan, on 29 July 2013, despite the 114 mm of precipitation that dropped down that day (the average monthly rate is 50 mm). Photo taken in the rain by Yuriy Zelenskiy.

Don't forget to send us your entries for next week's competition. Please email them to Connie Castro (c.castro@cgiar.org)—or hand them over on a USB stick. Look out for the winners on CIMMYT's flickr, where they are shared under a Creative Commons license.