12th Asian Maize Conference and Expert Consultation on

# "Maize for Food, Feed, Nutrition and Environmental Security"

## RECOMMENDATIONS

***Organizers***

Asia-Pacific Association of Agricultural Research Institutions (APAARI)
International Maize and Wheat Improvement Center (CIMMYT)
Food and Agriculture Organization of the United Nations (FAO RAP)
Department of Agriculture (DOA), Thailand

## Asia-Pacific Association of Agricultural Research Institutions

The Asia-Pacific Association of Agricultural Research Institutions (APAARI), with its headquarters in Bangkok, aims to strengthen the research capabilities of national agricultural research systems in the Asia-Pacific region, and to promote experience sharing among them in order to alleviate poverty, increase agricultural productivity and resource use efficiency, conserve/ protect the environment and improve the overall sustainability. The primary focus of APAARI is to enhance exchange of scientific and technical knowhow and information in agricultural research for development; assist in strengthening research capability of member institutions and promote cross linkages among national, regional and international research organizations. For details, please visit: www.apaari.org

## The International Maize and Wheat Improvement Center

Headquartered in Mexico, the International Maize and Wheat Improvement Center (known by its Spanish acronym, CIMMYT) is a not-for-profit agriculture research and training organization. The Center works to improve food security and livelihoods by sustainably increasing the productivity of maize and wheat in the developing world. CIMMYT maintains the world's largest maize and wheat seed bank and is best known for initiating the Green Revolution, which saved millions of lives across Asia and for which CIMMYT's Dr. Norman Borlaug was awarded the Nobel Peace Prize. CIMMYT is a member of the CGIAR Consortium and receives support from national governments, foundations, development banks and other public and private agencies. For more information, please visit: www.cimmyt.org

## The Food and Agriculture Organization

The Food and Agriculture Organization (FAO) of the United Nations is an intergovernmental organization located in Rome, has 191 member nations, and is present in over 130 countries. FAO comprises four main areas, namely, i) putting information within reach, ii) sharing policy expertise, iii) providing a meeting place for nations, and iv) bringing knowledge to the field. The FAO serves as a knowledge network and utilizes the expertise of agronomists, foresters, fisheries and livestock specialists, nutritionists, social scientists, economists, statisticians and other professionals to collect, analyse and disseminate data/ information that aid development. FAO lends its years of experience to member countries in devising agricultural policy, supporting planning, drafting effective legislation and developing national strategies to achieve rural development and hunger alleviation goals. For details, please visit: www.fao.org

## The Department of Agriculture

The Department of Agriculture (DOA), Government of Thailand, has the vision to be the Center of Excellence in the field of crops research and development and farm mechanization, in harmony with international standards and in adherence to the principles of natural resource conservation and environmental protection. DOA has the mandate to: i) conduct research and development studies concerning crops and farm mechanization; ii) provide services on the analysis, inspection, quality certification and advices on soil, water, fertilizer, crops, agricultural inputs, production and products quality, export promotion and other areas of concerns; iii) enforce the six Regulatory Acts on plant quarantine, plant variety protection, fertilizer, plant variety, rubber regulation, and toxic substances; iv ) transfer agricultural technologies to extension agents, farmer leaders and the private sector; and v) implement urgent programs related to crop productivity. For details, please visit: www. doa.go.th

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# "Maize for Food, Feed, Nutrition and Environmental Security"

## Preamble

The 12th Asian Maize Conference and Expert Consultation on "Maize for Food, Feed, Nutrition and Environmental Security" was organized jointly by the Asia-Pacific Association of Agricultural Research Institutions (APAARI), International Maize and Wheat Improvement Center (CIMMYT), Food and Agriculture Organization of the United Nations - Regional Office for Asia and the Pacific (FAO RAP), and Department of Agriculture (DOA), Government of Thailand in Bangkok from 30 October to 1 November, 2014. The Conference was cosponsored by the CGIAR Research Program on Maize, United States Agency for International Development (USAID), Monsanto, Syngenta Foundation for Sustainable Agriculture, Maharashtra Hybrid Seeds Company (Mahyco), Bioseed, International Plant Nutrition Institute (IPNI), DuPont Pioneer, Rasi Seeds, Borlaug Institute for South Asia (BISA), and Global Forum on Agricultural Research (GFAR).

The goal of the conference was to review the progress and identify opportunities for strengthening maize production, value chains and sustainable intensification of maize-based systems in Asia for enhancing food, feed, nutrition and environmental security. The objectives were to: i) assess the regional priorities and identify the niches for enhancing maize production and productivity; ii) share experiences and the latest information on cutting-edge maize technologies among the maize research and development community; iii) create general awareness and provide a platform for synergies among institutions and stakeholders for better use of maize as food, feed and industrial crop in Asia; and iv) develop an innovative impact-oriented regional strategy and road map around accelerated adoption of resilient technologies, new market opportunities, building networks, enhanced investment options and required policy interventions.

The Conference was attended by 292 participants from 30 countries (Bangladesh, Bhutan, China, Fiji, India, Indonesia, Iran, Japan, Malaysia, Nepal, Pakistan, Papua New Guinea, the Philippines, Sri Lanka, Taiwan, Thailand, Turkey, Vietnam, Australia, Egypt, Germany, Italy, Kenya, Mexico, the Netherlands, Spain, Switzerland, UK, USA and Zimbabwe). The participants represented a wide cross-section of stakeholders including researchers, policy makers, service providers, innovative farmers and representatives of various organizations including NARS institutions, the private sector, international agricultural research centers and advanced research institutions, non-government organizations, foundations and funding agencies.

Mr. Hiroyuki Konuma, Assistant Director General, FAO RAP, the Chief Guest, inaugurated the Conference and Dr. Simon Hearn, Chairman, APAARI presided.

Dr. Thomas Lumpkin, DG, CIMMYT, Dr. Anan Suwannarat, DG, Department of Agriculture, Thailand, Dr. Raj Paroda, Executive Secretary, APAARI and Dr. B.M. Prasanna, Director, Global Maize Program, CIMMYT also addressed the gathering emphasizing the importance of maize in Asia and future potential for its growth and development as well as in addressing the future food, feed, nutrition and environmental security in the future.

The Conference Program was structured in three Plenary Sessions on specific themes, namely, i) Doubling Asia's maize production; ii) Ensuring a vibrant maize seed sector in Asia; and iii) Interface with farmers and entrepreneurs. In addition, there were 12 Technical Sessions on various aspects, viz., i) Enhancing genetic gains in maize breeding; ii) Maize for fodder/feed, specialty corn, value-addition and processing; iii) Stress resilient maize for Asia; iv) Socioeconomics and innovative policies for enhanced maize production and impacts; v) Biotechnology for maize improvement in Asia; vi) Strengthening maize seed systems in Asia; vii) Regional assessment of maize in South Asia and the Oceania; viii) Regional assessment of maize in East Asia, Southeast Asia and West Asia; ix) Precision-conservation agriculture for enhanced input-use efficiency; x) Enhancing nutritional quality of maize; xi) Adapting maize production practices to the changing climate; and xii) Enhancing gender equity and social inclusiveness.

The Conference provided a neutral platform and an excellent opportunity for participants in reviewing the ongoing efforts on maize research and development, identifying constraints and bottlenecks in production and productivity, and developing suitable recommendations and a strategic road map for enhancing (rather doubling) maize production and its utilization in Asia.

## Perspective

Maize is a major food, feed and industrial crop around the world. It contributes towards food security in several developing countries of Asia. Among cereals, maize offers immense opportunities to address food, feed, fodder and nutritional security. Exciting scientific achievements in the recent past and their faster adoption on large scale have led to higher annual growth in maize production than those in other major cereals in the region. In fact, annual production growth rate in maize had been much higher in Asia over that of global average, reflecting tremendous potential for future up-scaling and out-scaling of innovations in maize to have greater impact on livelihoods of smallholder farmers in Asia.

The area, production and productivity of maize have increased significantly in Asia over the last 50 years; much of these have occurred in the developing countries. At the same time, the demand for maize is increasing significantly. It is expected to double by 2050. On the contrary, the maize production and productivity are severely constrained by an array of factors; including the lack of training and knowledge transfer to the resource-poor farmers, inadequate access to improved seeds, lack of critical inputs and adapted management practices, and above all the increasing abiotic and biotic stresses, the magnitude and dynamics of which are rapidly changing because of the changing climate. For sustainable increase in yields and stabilizing prices, concerted efforts are required at the policy level to create enabling environment for long-term AR4D investments. This would ensure greater preparedness by the Asian farmers to respond to the present and emerging challenges.

As Asia's agribusiness and food processing industries and economies continue to grow, the opportunities for use of maize as food, feed and fodder and for industrial purposes have increased significantly. The growing needs of the poultry and piggery sectors (especially in Southeast Asia and China), the expansion of maize seed industry, and the increasing interest of the consumers in nutritionally enriched and specialty maize products, require greater attention from both the research and development viewpoints. There are specific issues concerning Asian maize industry that require urgent attention in order to harness the emerging opportunities. Also, the CGIAR Research Program (CRP) on Maize "Global Alliance for Improving Food Security and the Livelihoods of the Resource-Poor in the Developing World" offers opportunities to catalyze stakeholder initiatives in the region to scale-out innovations in maize-based systems by building new public-private partnerships (PPPs).

Accordingly, the 12th Asian Maize Conference and Expert Consultation offered an opportunity to the maize stakeholders to deliberate on various options for doubling the maize production and strengthening maize value chains to ensure food, feed, nutrition and environmental security in Asia.

# Recommendations

The following recommendations emerged from the Conference:

1. There is considerable scope for doubling maize production in the next decade. Asia will be the niche for maize production considering the emerging demands and potential for future expansion, as reflected by the recent growth trends in both area and production. Also, there exist tremendous opportunities for productivity increases by harnessing innovations in genetic improvement and agronomic management. Concerted efforts are, therefore, needed to integrate the novel breeding techniques for improved genetic gains (especially under stress-prone environments), accelerate the development and deployment of high-yielding climate-resilient maize genotypes, strengthen the maize seed sector and to provide access to quality seed through public-private partnerships (PPPs). Opportunities also exist to out-scale innovations such as conservation agriculture and climate-smart agriculture practices (CSAPs) in maize-based cropping systems, and adoption of progressive policies for value chains in order to link farmers to markets so as to benefit producers, consumers and the value chain facilitators.

2. There is an urgency to widen the genetic base of the existing elite maize germplasm through multi-institutional efforts and enhanced exchange of germplasm. The standard material transfer agreement (SMTA), adopted by the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) under FAO, needs to be modified for effective multilateral exchange of germplasm /breeding materials among the partner institutions. Collecting and characterization of maize landraces from genetic diversity-rich and hitertoo unexplored areas, and pre-breeding efforts need to be intensified as a matter of priority. In order to achieve this, innovative measures with increased long-term funding has to be ensured by the National Agricultural Research Systems (NARS) and the International Research Centers (IRCs).

3. Importance of maize in the Asian cropping systems has grown rapidly in the recent past, with several countries registering impressive growth in both production and productivity. There is a scope for further expansion of maize area in the region. Tremendous opportunities exist for out-scaling innovations in crop improvement, management and crop diversification. International and national institutions engaged in maize research and development are also laying emphasis on foresight, technology targeting, partnerships involving all stakeholders and capacity development to effectively up-scale and out-scale innovations for greater impact. Such innovations include climate-resilient and nutritionally enriched single-cross maize hybrids, quality protein maize (QPM), genetically modified (GM) maize, conservation agriculture (CA), small farm mechanization, transplanted maize, winter and spring maize, specialty maize (baby corn, sweet corn, pop corn, etc.), and above all maize processing and value-addition, including biofuel production.

4. Concerted and accelerated breeding efforts using novel techniques, such as double haploids, molecular marker-assisted selection and precision phenotyping, are needed for developing improved maize varieties (especially single-cross hybrids) with high yield, stress resilience and better nutritional quality (especially QPM, provitamin A enrichment, and improved fodder quality), and adaptability to diverse agro-ecologies. Elite lines need to be recycled keeping in view the heterotic relationship so as to develop superior hybrids.

5. The Philippines has significantly moved forward with regard to deployment of insect-resistant and herbicide-tolerant genetically modified (GM) maize, while Vietnam has recently declared its intention to deploy GM maize for the benefit of maize farmers in the country. Other countries in Asia (especially the large maize producing countries like China, India and Indonesia) will need to assess the opportunities that GM maize offers to the smallholder farmers, through technologies that can reduce cost on inputs and ensure resilience.

6. In order to enhance maize production and productivity, sustainable cropping/farming systems need to be developed and adopted. Efficient input-use systems and conservation agriculture practices need to be scaled-up and scaled-out. Improved management practices (such as sustainable intensification, site-specific nutrient management and soil health, pest and weed control, and small-scale low-cost farm implements/machinery) need to be promoted through participatory research, involving smallholder farmers.

7. Malnutrition is pervasive with high intensity in South Asia. Hotspots of such micronutrient deficiency need to be identified and regional priorities determined for biofortification. QPM has been demonstrated to be nutritionally superior to conventional maize in maize-based human diets, particularly for young children and lactating mothers. It is an important potential tool for combating protein malnutrition in countries where maize is a staple food. The value of nutritional stacks in maize was also appreciated by the participants and recommended it as a high priority. High oil, quality protein

and enhanced provitamin A are some of the most preferred traits for immediate germplasm development. High methionine, high zeaxanthin (deep orange), high vitamin E, low lignin (forage maize) are some of the desired traits for which preliminary genetic leads are available but are yet to be channelized into varietal development. Molecular breeding for developing nutritionally enriched maize varieties has to be given high priority, whereas high QPM varieties/hybrids need to be promoted through appropriate intervention through pricing based on value added products.

8. Post-harvest processing, value addition, product packaging, storage and marketing need to be given high priority to strengthen maize value chains and to enhancing income as well as livelihoods of smallholder farmers. Increasing interest of consumers in nutritionally enriched and specialty maize products warrants greater attention from research, development and policy point of view. In this context, needed efforts on public awareness will have to be made to ensure much greater use of maize as food in Asia.

9. Availability of quality seed of improved maize varieties/hybrids is one of the key factors determining production and productivity. Therefore, urgent attention is required to producing better quality seed through strong public-private-producer partnerships. For this, there is a need to assess the regional, inter-country and intra-country demand of hybrid seeds vis-a-vis availability and to develop a strategy to produce enough seed by empowering private seed sector. Empowering the farming communities to produce good quality seeds of improved varieties (especially hybrids) and linking them to the markets assumes special significance in the existing scenario. Fortunately, the maize seed industry in Asia has grown over the years. However, the industry requires better statistics, more insightful analysis and better seed quality monitoring/ regulatory system. Delivery of improved maize seeds at the door step of farmers at affordable price is a major challenge that has to be addressed by building strong public-private partnership. Hence, a Mission Mode approach on maize seed production in the Asian region is the need of the hour.

10. Agricultural research for development (AR4D) on maize in Asia should adopt a more holistic approach, requiring greater inter-institutional linkages/partnerships among various stakeholders, public-private partnerships and above all strong commitment of scientists (including social scientists), extension specialists and the farmers. The role of youth as service/knowledge providers to farmers has to be appreciated and strengthened henceforth to bridge the existing yield gaps. This in turn warrants greater thrust on human resource development and capacity building, through vocational training and use of modern information and communication technologies (ICT).

11. As a long-term strategy for sustainable intensification, balancing demand-supply vis-à-vis natural resources, "A Maize Atlas for Asia" should be developed so as to define the current and potential maize production systems' domains and targeting portfolios of technologies and innovations with the present and projected resource scenarios.

12. Smallholder farmers, especially women, should be at the centre-stage of agricultural research and development agenda, especially to address the existing constraints to household nutrition security and enhanced production and income. In this regard, women empowerment through improved access to agricultural inputs at affordable cost, availability of micro-finance/credit at low interest rates, crop insurance, and access to low-cost, small-scale farm machinery would ensure improved agricultural production and household nutrition security. Hence, gender programs at the national, regional and global level will have to be promoted through higher commitment and policy support to gather both qualitative and quantitative data on gender dynamics, drudgery and technological options. There is also a need to understand the social constraints that exist around women participation in agriculture, especially in the changing context of migration, economic liberalization and the positive shift towards gender and social inclusion.

13. Conducive policy environment as well as enhanced investment (at least double) on maize research for development are the key factors for the growth of maize and related value chains in Asia. Besides addressing specific issues concerning Asian maize industry, there is a need to catalyze the stakeholders in the region to scale-up and scale-out innovations in maize-based cropping systems. This will require innovative institutional reforms such as public-private-producer partnerships.

14. To strengthen maize research for development in Asia, there is also a need to establish maize innovation platforms and initiate regional and sub-regional networks focused on prioritized areas, identified during the Conference, It was recommended that such networks should target improving maize genetic base through pre-breeding; doubled haploid technology for enhancing genetic gains and breeding efficiency; accelerated development of improved single-cross maize hybrids using genomics-assisted breeding and precision phenotyping; adopting GM maize technology, strengthening maize seed sector and deploying climate resilient maize germplasm through public-private partnerships; sustainable intensification of maize-based cropping systems, conservation agriculture, precision nutrient management, small farm mechanization and climate-smart production practices; and strengthening maize value chains through innovative policies and socio-economic interventions.

15. Participants strongly emphasized on the need to work together in a network mode to derive synergies among the international and national agricultural research institutions and to facilitate improved germplasm development in the Asia-Pacific region. To this effect, a "Value Added Maize Network for Asia" (VAMNET) was proposed keeping in view the benefits of earlier networks such as TAMNET (Tropical Asian Maize Network) and AMBIONET (Asian Maize Biotechnology Network). Facilitation role of CIMMYT to establish such a network was recognized. NARS participants assured their full support to such an initiative.

# Acronyms & Abbreviations

AMBIONET : Asian Maize Biotechnology Network

APAARI : Asia-Pacific Association of Agricultural Research Institutions

AR4D : Agricultural Research for Development

BISA : Borlaug Institute for South Asia

CA : Conservation Agriculture

CIMMYT : International Maize and Wheat Improvement Center

CRP : CGIAR Research Program

CSAPs : Climate Smart Agriculture Practices

DOA : Department of Agriculture

FAO RAP : Food and Agriculture Organization of the United Nations - Regional Office for Asia and the Pacific

GFAR : Global Forum on Agricultural Research

GM : Genetically Modified

ICT : Information and Communication Technologies

IPNI : International Plant Nutrition Institute

IRCs : International Research Centers

ITPGRFA : International Treaty on Plant Genetic Resources for Food and Agriculture

Mahyco : Maharashtra Hybrid Seeds Company

NARS : National Agricultural Research Systems

PPPs : Public-Private Partnerships

QPM : Quality Protein Maize

SMTA : Standard Material Transfer Agreement

TAMNET : Tropical Asian Maize Network

USAID : United States Agency for International Development

VAMNET : Value Added Maize Network for Asia

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It is our expectation that this Policy Brief will catalyze all the stakeholders to accelerate the activities relating to implementation of important recommendations for strengthening maize research for development in Asia.

***APAARI & CIMMYT***

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