Food and Agriculture Organization of the United Nations

MEETING REPORT

FAO Regional Meeting on
Agricultural Biotechnologies in Sustainable Food Systems and Nutrition in Asia-Pacific

11–13 September 2017

Kuala Lumpur, Malaysia

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EXECUTIVE SUMMARY

The FAO Regional Meeting on Agricultural Biotechnologies in Sustainable Food Systems and Nutrition in Asia-Pacific was successfully organized on 11–13 September in Kuala Lumpur, Malaysia. The meeting was hosted and co-organized by the Government of Malaysia.

It was the first of a series of regional meetings that FAO is planning to organize in 2017–2018 as a follow-up to the FAO International Symposium on "The Role of Agricultural Biotechnologies in Sustainable Food Systems and Nutrition", which took place on 15–17 February 2016 at FAO headquarters, Rome.

The purpose of the meeting was to engage a broad range of stakeholders in the dialogue on the role and the application of agricultural biotechnologies to improve food security and nutrition and make food systems more sustainable in the Asia-Pacific region. The meeting encompassed a wide spectrum of available biotechnologies used in forestry, crops, livestock and aquaculture/fisheries, from low- to high-tech. The Asia-Pacific regional meeting brought together about 200 representatives of governments; intergovernmental organizations; private sector entities; academia and research institutions; and civil society organizations and producer organizations from 41 countries.

As for the 2016 global symposium, the success of the regional meeting confirmed the importance of FAO's role as a neutral broker – bringing together a wide range of different stakeholders in the region, with their different perceptions, aspirations and goals, to learn and share experiences and knowledge together.

The two and half-day meeting consisted of presentations by 42 speakers and moderated discussions during nine plenary and six parallel sessions dedicated to a wide range of issues concerning agricultural biotechnologies in the region, including investments; dissemination, adoption and use of biotechnologies (and their social and economic impacts); regional innovation opportunities; regulation, policies and intellectual property rights; genetic resources for food and agriculture; nutrition; climate change and South-South Cooperation.

The meeting underlined that a wide range of agricultural biotechnologies are currently being used in the region – from those that are low-tech and have been used for hundreds of years to those that are high-tech and newly developed. These agricultural biotechnologies presently contribute, and will continue to contribute, to ensuring food and nutrition security and to enhancing adaptation and resilience of the agriculture sector to climate change in the countries of the Asia-Pacific region. However, it was revealed that, while low and medium technologies are widely used in the region, only few countries have adopted high technology applications such as genome editing and genome mapping. It could be partly because of capacity and communication gaps in this subject.

Despite the extensive use of a wide range of agricultural biotechnologies in the region, the application of which can vary widely across subsistence farms to enterprises, most of the potential users do not have substantial knowledge about those technologies. This reflects in some cases a very narrow perception about agricultural biotechnologies, limited to only genetically modified organisms (GMOs), which may lead to a negative reaction against biotechnologies.

The regional meeting offered a neutral forum for a dialogue on issues related to agricultural biotechnologies and analyzed their role for improved food security and nutrition and for making food systems more sustainable in the region. Many examples where presented where biotechnologies have been applied successfully to meet the needs of smallholders in the Asia-Pacific region. The FAO videos presented at this meeting showed four of these examples, and feedback from participants was very

positive about them. They showed the use of artificial insemination and semen sexing in dairy cows for milk production in Nepal; DNA-based diagnostics and probiotics for disease management in shrimp populations in Thailand; DNA marker-assisted selection to develop Swarna-Sub1, a rice variety tolerant to floods in India; and tissue culture for propagating tree planting stock for agroforestry in Thailand.

Agricultural biotechnology development initiatives and application in the developing countries are often hampered by lack of investment and funding sources. However, it is not necessary for all countries to develop their own or new biotechnologies. Since the region has enough technologies already available it is important to take an initiative to facilitate partnership between countries so that they can assist each other adopt agricultural biotechnologies to meet the needs of their smallholders.

I. Background

FAO convened the international symposium on *The Role of Agricultural Biotechnologies in Sustainable Food Systems and Nutrition* on 15–17 February 2016 at FAO headquarters, Rome[1]. The symposium brought together over 400 people, including 230 delegates from 75 member countries and the European Union, as well as representatives of intergovernmental organizations, private sector entities, civil society organizations, academia/research organizations and producer organizations/cooperatives. The Symposium highlighted the important contribution that agricultural biotechnologies[2] can make in achieving the Sustainable Development Goals and it also provided numerous examples where both low- and high-tech biotechnologies are being applied to meet the needs of small-scale producers and family farmers. The symposium successfully broadened the discussions beyond the narrow and polarized debate on genetically modified organisms. It reinforced FAO's role as a neutral forum that can bring together stakeholders from different backgrounds for a frank, open and constructive dialogue and exchange of knowledge on a controversial topic. During the Symposium, the importance of bringing the dialogue from the global to the regional level was highlighted by participants. In closing the Symposium, the FAO Director-General therefore concluded: "*Now FAO has to move forward. We intend to bring the debate to a regional perspective. We want to hear from governments, farmers and researchers of all regions about their needs and concerns regarding biotechnology*".

Therefore, FAO has planned to organize four regional meetings in the Asia-Pacific, Sub-Saharan Africa, Latin America and the Caribbean and North Africa/Near East in 2017–2018, with the first meeting to be held in the Asia-Pacific region. At this Asia-Pacific meeting, FAO offered an open and neutral forum for the exchange of ideas and practices between representatives of member countries, intergovernmental organizations, research institutions, farmer organizations, cooperatives, academia, civil society and the private sector.

II. Objective and organization

The FAO Regional Meeting on Agricultural Biotechnologies in Sustainable Food Systems and Nutrition in Asia-Pacific took place on 11–13 September 2017 in Kuala Lumpur, Malaysia[3]. The meeting was hosted and co-organized by the Government of Malaysia, involving both the Ministry of Agriculture and Agro-Based Industry (MOA) and the Ministry of Science, Technology and Innovation (MOSTI).

The main objective of the regional meeting[4] was to engage a broad range of stakeholders in the dialogue on the role and the application of agricultural biotechnologies to improve food security and nutrition and make food systems more sustainable in the Asia-Pacific region. The meeting encompassed a wide

[1] The Global Symposium website is at http://www.fao.org/about/meetings/agribiotechs-symposium/en/. The proceedings are at http://www.fao.org/documents/card/en/c/66e9a36c-19b2-407a-83c9-5b767e233417/. A 4-page summary report of the symposium is available at http://www.fao.org/3/a-bl623e.pdf

[2] Based on the definition of 'biotechnology' in Article 2 of the Convention on Biological Diversity (i.e. "any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use") the term 'agricultural biotechnologies' encompasses a broad range of technologies used in food and agriculture for a number of different purposes, such as the genetic improvement of plant varieties and animal populations to increase their yields or efficiency; the characterization and conservation of genetic resources for food and agriculture; plant or animal disease diagnosis; and vaccine development. For an overview of the wide range of biotechnologies involved, see http://www.fao.org/biotech/biotech-forum/conference-16/en/

[3] The meeting website is http://www.fao.org/asiapacific/events/detail-events/en/c/1440/

[4] Further details on the background, scope, focus, expected outputs etc. for the meeting are available in the FAQs document produced for the meeting, at http://www.fao.org/3/a-bt520e.pdf

spectrum of available biotechnologies used in forestry, crops, livestock and aquaculture/fisheries, from low- to high-tech.

The regional meeting took place over two and a half days. The first half day, on the afternoon of 11 September, consisted of the opening ceremony and a plenary session with keynote addresses. The next day and a half consisted of six parallel and four plenary sessions. The last half day consisted of reporting from the plenary and parallel sessions meeting, a plenary session on 'the way ahead' and the closing session[5] *(Annex 1: Final programme)*.

The process for developing the programmes for the plenary and parallel sessions involved the FAO Task Force, responsible for the development and delivery of the regional meeting, and a 15-member external Advisory Panel (AP) of internationally recognized experts and stakeholders, providing advice and guidance to the Task Force[6]. The programmes for the different sessions were developed through a participatory process where the AP played a central role. A key point in this process was a meeting of the AP which took place on 8–9 June 2017 at the FAO Regional Office for Asia and the Pacific in Bangkok, Thailand. Twelve of the 15 AP members attended the meeting, where there was active brainstorming and many suggestions were made by the AP members regarding the programme, including the titles for each session; the topics to be covered in each one and their format. The AP members also proposed names of possible speakers, panellists and chairs for the different sessions. After the meeting, the AP members had an additional few days to provide additional suggested names and/or other comments and nine of them did.

After that, the draft programme was discussed and revised by the FAO Task Force and then submitted to FAO senior management for final approval. Formal invitations were then sent by FAO to the proposed speakers/chairs. A small proportion of these were unable to come and replacements were identified by the Task Force.

Over 200 people attended the regional meeting from 41 countries. Apart from the Government of Malaysia, 29 other countries in the region nominated a total of 43 people to represent their governments. There were also six representatives of intergovernmental organizations. Forty-seven representatives of non-state actors also attended, coming from academia/research institutions (12), civil society organizations (CSOs)/producer organizations (22), and the private sector (13). Four of these representatives were also invited to be speakers in a parallel session *(Annex 2: List of participants)*.

The list of participants also included 47 resource persons, invited by FAO to give presentations in the nine plenaries and six parallel sessions or to chair/moderate some of these sessions. As this was a technical meeting, the majority were from academia/research institutions (28). The others were from FAO (3), CSOs/producer organizations (3), the private sector (5), intergovernmental organizations (3) and governments (5).

Funding for organization of the meeting came from a small amount of seed money provided by FAO for the regional meetings which was supplemented by extra budgetary funding from the US Department of Agriculture (USDA), the Australian Centre for International Agricultural Research (ACIAR) and Agriculture and Agri-Food Canada (AAFC). About 60% of the budget was used to fund people to participate in the meeting, including nominees from 26 governments, representatives of 12 civil society organizations and eight research/academic institutions as well as travel for many of the invited speakers and chairs.

[5] The final agenda for the meeting is at http://www.fao.org/3/a-bt683e.pdf
[6] Members of the AP as well as the role of the AP are described in http://www.fao.org/3/a-bt519e.pdf

III. Sessions

The two and half-day meeting consisted of presentations and moderated discussions in nine plenary and six parallel sessions dedicated to wide range of issues concerning agricultural biotechnologies in the region, including investments; dissemination, adoption and use of biotechnologies (and their social and economic impacts); regional innovation opportunities; regulation, policies and intellectual property rights; genetic resources for food and agriculture; nutrition; climate change and South-South Cooperation[7].

Opening session

Kundhavi Kadiresan, Assistant Director-General and Regional Representative for Asia and the Pacific, FAO of the United Nations

The meeting was opened by Dr Kundhavi Kadiresan, Assistant Director-General and Regional Representative of the FAO Regional Office for Asia and the Pacific and Mr Azhar Haji Yahaya, Secretary General of the Ministry of Science, Technology and Innovation (MOSTI), Malaysia.

In her opening remarks, Dr Kundhavi Kadiresan highlighted that the application of science and technology, including but not limited to agricultural biotechnologies, is one essential option that can play a substantial role in providing solutions to the unprecedented challenges we must meet of feeding an expanding world population in the face of climate change.

Dr Azhar Haji Yahaya, on behalf of the Honourable Datuk Seri Panglima Wilfred Madius Tangau, Minister of Science, Technology and Innovation, welcomed participants and noted that Malaysia was honoured to host the regional consultation meeting for the analysis, discussion and prioritization of the application of biotechnologies for the benefit of family farmers in developing sustainable food systems and improving nutrition.

Mohd Azhar Haji Yahaya, Secretary General, Ministry of Science, Technology and Innovation, Malaysia

Ahead of the meeting, the FAO Regional Office for Asia and the Pacific produced four short videos, one each for the livestock, fishery, crop and forestry sectors, to showcase typical examples where biotechnologies are being applied in real life to meet the needs of smallholders in Asia-Pacific.

The videos covered the use of artificial insemination and semen sexing in dairy cows for milk production in Nepal; DNA-based diagnostics and probiotics for disease management in shrimp populations in Thailand; DNA marker-assisted selection to develop Swarna-Sub1, a rice variety tolerant to floods in India; and tissue culture for

[7] The final meeting agenda, as well as the abstracts and PowerPoints of all presentations made, are available on the meeting website – at http://www.fao.org/asiapacific/events/detail-events/en/c/1440/. In addition, video recordings of presentations should soon be available on the FAO website

propagating tree planting stock for agroforestry in Thailand. These videos were shown in the opening sessions[8].

Keynote addresses

Keynote addresses were delivered by Professor Zakri Abdul Hamid, Science Advisor to the Prime Minister of Malaysia; Dr Margaret Gill, Chair, Consultative Group on International Agricultural Research (CGIAR) Independent Science and Partnership Council; Mr Om Kimsir, Secretary of State, Ministry of Agriculture, Forestry and Fisheries of Cambodia; and Mr Teariki Matairangi Purea, State Secretary of the Ministry of Agriculture of Cook Islands.

In his keynote address, Professor Zakri Abdul Hamid accentuated biotechnology as an integral part of a knowledge-based economy as it provides a new model of wealth creation to a country's economy, and through which bioeconomy can make changes in ways of not only transforming smallholder's production systems into knowledge and technology based, business oriented farming for improvement of their lives, but also helping agriculture and food systems to tackle some of their inherent challenges.

He believes this model of economic activity termed as 'bioeconomy' will offer many countries, not only Malaysia but also others in the Asia-Pacific region, significant opportunities for economic growth stimulation and diversification of economy. Though it was not an easy task, Malaysia has made some significant achievements in bioeconomy development, some of which he shared with participants.

The keynote address by Dr Margaret Gill focused on the opportunities for research to help smallholders engage with biotechnology. She highlighted that biotechnology is nothing new. Since humans became farmers rather than hunter gatherers, people have benefited from biotechnology.

She talked about the demand for new technologies in Asia-Pacific, and issues related to the use of new techniques by researchers and to the adoption of biotechnology by smallholders. She suggested that researchers must understand the context, what the barriers are at farm level to minimize risk to poor farmers, think of beneficiaries not just as smallholder farmers but also the poor consumers, and identify policy and instrumental barriers particularly with respect to environmental benefits.

Margaret Gill, Chair, CGIAR Independent Science and Partnership Council, Italy

The session included statements from two countries, one from Asia (Cambodia) and the other from the Pacific (Cook Islands). The statements focused on the policies and programmes on agricultural biotechnologies of these countries. Common issues that emerged during this plenary session discussion included: biotechnology is a toolbox filled with many different technologies, but people's perception of biotechnology is very narrow, often referring only to genetic modification and genetically modified organisms (GMOs).

[8] They are available at http://www.fao.org/asiapacific/events/detail-events/en/c/1440/

Teariki Matairangi Purea, Secretary of the Ministry of Agriculture, Cook Islands

Om Kimsir, Secretary of State, Ministry of Agriculture, Forestry and Fisheries, Cambodia

The wide range of technologies in the toolbox needs to be understood; the need for increased awareness of the pros and cons of agricultural biotechnologies; agricultural biotechnology is not a key to all the problems; importance of integrating traditional knowledge into biotechnology development; there is significant divergence among the countries and within the sub-regions of Asia-Pacific in the levels of application of agricultural biotechnologies as well as in their capacities to develop them and in their existing enabling environments.

The status and challenges regarding agricultural biotechnologies in Asia-Pacific

At the beginning of the second day of the meeting, the preliminary findings of a study that is being carried out on "The State of Application, Capacities and the Enabling Environment for Agricultural Biotechnologies in the Asia-Pacific Region" were introduced by the Research and Information System for Developing Countries (RIS). Four experts from the region, each representing the crop, livestock, forestry and fishery sectors, gave their personal views on the status and challenges in agricultural biotechnologies development within their respective sectors in Asia-Pacific.

The status evaluation was carried out with specific concerns to applications, capacity and enabling environment for agricultural biotechnologies in the Asia-Pacific Region, covering low, medium and high technologies altogether. Situating the status of agricultural biotechnologies in the context of global development and challenges such as climate change, the study highlighted the importance of many roles that agricultural biotechnologies have to play. It revealed that, while low and medium technologies are widely used in the region, few countries have adopted high technology applications such as genome editing and genome mapping. Agricultural biotechnologies are firmly established in the region with many countries having specific policies to promote these technologies, including many more which have integrated them in agricultural development plans. The enabling environment is mostly positive and there is new dynamism in some countries in supporting agricultural biotechnologies. However, the gap among countries regarding application, capacity and the enabling environment remains huge and this has to be addressed. Personal reflections on the status and challenges regarding agricultural biotechnologies in the livestock, fishery, crop and forestry sector confirmed the preliminary findings.

Investments in agricultural biotechnologies

In the subsequent parallel session on "Investments in agricultural biotechnologies", China's ongoing commitment to research involving biotechnologies and product development since 1986, and the

Malaysian example of full government support to biotechnology initiatives for the benefit of small-scale farmers in the form of a public private partnership were presented. In the Chinese case, drivers include the government's desire to promote various agricultural biotechnologies, and to support the development of small and medium enterprises and in the case of Malaysia, drivers include the clear need for vaccines – made obvious with the avian influenza epidemic; a sustained government support and the availability of visionary entrepreneurs. The session noted that many products of biotechnologies benefit producers in the region and it is crucial to ensure adequate support to help producers continue benefitting from those products. The widening investment/funding gap in developed and developing countries needs serious attention. It is particularly important in the face of scientific advancements where technological innovations are taking place at a fast pace. In this situation, it is desirable that producers in the region have access to and benefit from these new tools. Agricultural investments, in general, are under pressure in the region. Private sector investment is limited to only few crops and this must be complimented by funds from other sources, for example from other relevant crops, livestock and fisheries and forestry.

Dissemination, adoption and use of biotechnologies

In the parallel session on "Dissemination, adoption and use of biotechnologies", the presentations demonstrated application of biotechnologies such as marker-assisted selection as well as tissue culture which are more widely accepted by consumers and farmers in the region than genetic modification. However, there are also examples of both farmers and consumers accepting the use of genetic modification for non-food crops, such as rose and silkworm in Japan. The adoption and use of biotechnologies can make a more significant impact on the livelihoods of smallholders when they solve practical problems, either by making new information available or overcoming obstacles created by biological characteristics of animal and plant species cultivated in the systems. It was noted that two-way communication between smallholders and scientists in the region is crucial for identifying these practical problems and for the dissemination and adoption of research results. Furthermore, capacity building and regional cooperation play a critical role in promoting the dissemination, adoption and use of biotechnologies.

Social and economic impact of agricultural biotechnologies for communities

In the afternoon, speakers in the parallel session on "Social and economic impact of agricultural biotechnologies for communities" looked at some examples of on-the-ground applications of biotechnologies in crop production and fisheries/aquaculture and their socio-economic impact. The presentation by Dr CK John emphasized the need to promote varietal diversity; highlighted the merits of low-tech biotechnologies (e.g. plant tissue culture) which are currently adopted in farming communities to develop improved varieties of banana, spices, etc. Also, the potential impact of applying biotechnologies, mostly in shrimp production (as this industry has been plagued with problems in aquatic animal health management) was presented.

Regional innovation opportunities in agricultural biotechnologies

Khatijah Yusoff, Universiti Putra Malaysia, Malaysia

In the parallel session on "Regional innovation opportunities in agricultural biotechnologies", presentations showed that there is a wide range of biotechnologies available today in the region in the different sectors, e.g. poultry, shrimp, crop and forestry, that includes, for example, development of a poultry vaccine, particularly the role of the Newcastle disease virus in controlling disease outbreak for sustainable poultry meat production, and the genome sequencing of several major aquaculture species including Atlantic salmon, rainbow trout, tilapia, seabass as well as oyster and shrimp. Participants highlighted the needs for more research on non-staple crops and study of long-term costs and benefits of using genomic biotechnologies.

Regulation, policies and intellectual property rights

During the parallel session on "Regulation, policies and intellectual property rights", the challenges facing countries in the region to effectively manage regulations, policies and intellectual property rights pertaining to agricultural biotechnologies, to derive the most benefits for smallholder farmers, were examined. In discussions, some people highlighted that smallholder farmers should be empowered so that they are co-innovators rather than being the passive users of tools that have been pre-packaged for them in a top-down mind-set into an inflexible toolbox.

Local innovations and indigenous technologies developed by farmers need to be promoted and their capacities to develop such technologies must be supported. It was also noted that the accessibility of agricultural biotechnologies to resource poor countries can be improved further if governments can minimize the regulatory burden on the agricultural sector and at the same time ensure enabling policies and sound regulatory approaches are used. The session underlined that policies and regulations that fit the right context and technologies and enhance food security and nutrition are critically important. Also, national and regional discussions are critically important in order to both manage the challenges and reap the benefits of agricultural biotechnologies.

Conservation, characterization and sustainable use of genetic resources for food and agriculture

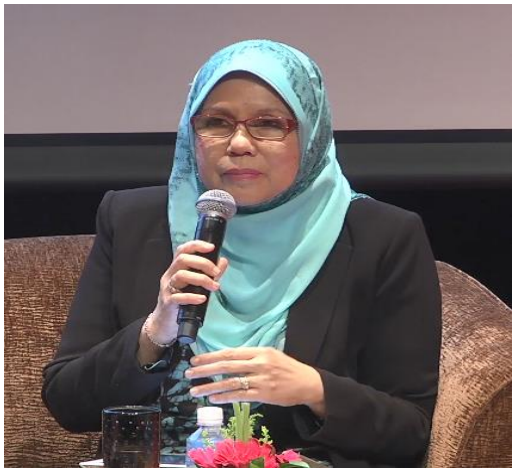
The parallel session on 'Conservation, characterization and sustainable use of genetic resources for food and agriculture', was opened with an introduction of the work of the FAO Commission on Genetic Resources for Food and Agriculture (CGRFA), which covers animal, aquatic, forest, plant and microbial genetic resources and also actively follows a number of cross-sectoral issues, including biotechnologies. The session contained presentations on the application of biotechnologies for the management of farmed aquatic genetic resources in the Philippines; differentiating meat samples of wild boar and domesticated village pig in Sri Lanka; identification of tree species and verifying the origin of wood samples in Thailand; improvement and utilization of crop genetic resources in China; and conservation of crop and tree genetic resources in the Pacific.

As shown by the presentations, the different sectors use similar biotechnologies, such as DNA markers, for characterization but the conditions in which they are applied differ among the sectors. The common

aim of these multifaceted initiatives is to promote not only the conservation and sustainable use of genetic resources for food and agriculture but also responsible production and consumption. The germplasm collection in the region is of global significance, in particular the genebank collections of taro, sweet potato and yam in the Pacific. Potentially higher costs of using biotechnologies especially for smaller countries, was also mentioned, stressing that a single country may often not need to deploy the full spectrum of tools in the biotechnology toolbox but just a few of them, depending on their needs. It was also suggested that increased engagement with farmers, other keepers and users of genetic resources can produce multiple benefits.

Improving nutrition using the biotechnology toolbox

'Improving nutrition using the biotechnology toolbox' was discussed in a plenary session at the beginning of the third day. There was agreement that agricultural biotechnologies provide promising tools for contributing to improved nutrition and food quality. Presentations highlighted the importance of ongoing and potential future contributions of plant genetics and genomics to improvement of food security and nutrition. Participants were informed about draft genomes of several pulses that have been assembled, and large-scale re-sequencing efforts, initiated in chickpea and pigeon pea for identification of new sources of genetic variation and allelic variants of candidate genes associated with beneficial traits which can be targeted for molecular breeding and genome editing.



Umi Kalsom Abu Bakar, Malaysian Agricultural Research and Development Institute, Putrajaya, Malaysia

It was highlighted that crop genomics is currently a "best bet" for embracing and sustaining nutritional security. The session underlined that biotechnology itself is also not always the optimal solution and is often used best when complemented with other technologies.

The role of biotechnologies in climate-smart agriculture and bioeconomy

The following plenary session on 'The role of biotechnologies in climate-smart agriculture and bioeconomy' had a keynote presentation on the role of biotechnologies in climate-smart agriculture and bioeconomy and six case studies. Presentations drew the audience's attention to fact that climate change can have multiple impacts, and that the intensity and severity of future climate events are highly unpredictable. Responding to climate change requires not only a proactive and integrated approach but also the rapid development of technological responses. How biotechnologies are being used to cope with climate change's current effects and future impact was discussed. Case studies showed that a range of biotechnologies are being used to enhance adaptation and resilience to climate change in the crop and aquaculture sectors. The use of several biotechnologies as well as agroecology for these

Leocadio Sebastian, CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Viet Nam

purposes were discussed. Agricultural biotechnologies may offer potential for increasing adaptation and resilience to climate change, but they need to be assessed for their feasibility, affordability, safety and sustainability.

South-South Cooperation

In the plenary session on 'South-South Cooperation' (SSC), participants were informed that China, from the highest levels of government, is committed to SSC as a means of international cooperation, with a dedicated budget of US$500m. The South Korea based, Asian Food and Agriculture Cooperation Initiative (AFACI), with 14 member states and four international organizations, which currently implements nine Pan-Asian projects, was also presented as a model for SSC. The Japan International Research Center for Agricultural Sciences (JIRCAS) has been facilitating a blast research network for stable rice production since 2006 with contribution by International Rice Research Institute (IRRI) and AfricaRice Center. The network assists partners to fight against this important fungal disease in the participating countries, however its scope could be widened through SSC, which, apart from being financial cooperation, is also knowledge cooperation.

Reporting and 'the way ahead'

The key outcomes of the different plenary and parallel sessions were presented in a plenary session on the last half-day of the meeting. Following this, in a plenary session on 'The way ahead', Dr Margaret Gill, Chair, CGIAR Independent Science and Partnership Council; Dr Teariki Matairangi Purea, Secretary of the Ministry of Agriculture, Cook Islands; and Dr Kazuo Nakashima, Scientist, Japan International Research Center for Agricultural Sciences shared their personal highlights and take-home messages from the regional meeting.

The diversity in terms of population number, topography and heterogeneity in agricultural biotechnologies application and benefit from biotechnologies were the highlights of Dr Gill's inputs. She underlined the depth and breadth of bioscience expertise in the region – people and infrastructure – and the ease with which those scientists move between sectors e.g. agriculture to health. She mentioned that addressing the immense challenges of the 21st century would require collaborative working in which we learn from each other and share experiences, and people in the region can take pride from the wealth of science skills. But there is a need to make sure that those skills are used in an equitable way, she added. She concluded by saying "scientists need to be challenged by non-scientists and not get carried away by what science can deliver and we all need to observe trends in demand and external drivers and be responsive to them".

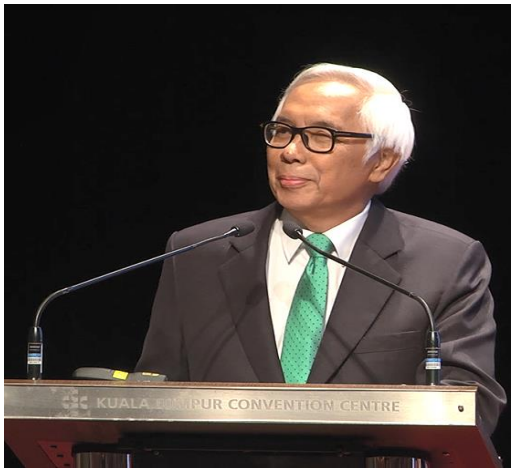
Understanding and holding onto biotechnologies that work best with our farms and protecting these technologies were Dr Teariki Matairangi Purea's main point. Ensuring collaboration among national institutions, international and regional partners is a crucial step towards helping growers to take good use of ranges of biotechnologies, and make progress in other areas of the agricultural sector such as product effectiveness, seed banking and preservation and data collection and monitoring.

Dr Kazuo Nakashima's inputs focused on the importance of collaboration in the utilization of biotechnology to solve the problems. We should select the suitable technologies and materials developed by biotechnologies and combine with other technologies, he highlighted. For that, it is important to collaborate. Researchers of biotechnology should cooperate with researchers in other research sectors, such as field researchers, eco-physiological researchers, post-harvest and value-chain researchers, and socio-economical researchers in the Asia-Pacific. It is also necessary to communicate

and cooperate with farmers, extension services, NGOs, and government in Asia-Pacific to solve the problems for food security and nutrition security, he added.

Closing session

In the closing session, Professor Zakri Abdul Hamid, Science Advisor to the Prime Minister of Malaysia, summarised his main highlights of the meeting. He concluded that the meeting showed there was a need for continuous regional dialogue on biotechnologies, a term which encompassed much more than GMOs.



Zakri Abdul Hamid, Science Advisor to the Prime Minister of Malaysia

He noted that the meeting had shown that many biotechnologies are benefiting producers in the region and that SSC, networking and other mechanisms should be used to spread these benefits at the international and regional level. He also underlined the key role of communication, ensuring that research results are communicated properly, and that biotechnologies alone cannot achieve food security and nutrition but a more holistic approach, including agroecology, is required.

In her closing remarks, Ms Xiangjun Yao, Regional Programme Leader, FAO Regional Office for Asia and the Pacific, concluded that participants in the meeting had heard: about the opportunities that agricultural biotechnologies could offer, from low to high tech, to address food security and nutrition challenges in the region; that science-based and unbiased risk/benefit assessments are required before taking decisions; about concerns regarding intellectual property rights, preserving traditional knowledge, access and affordability of these technologies; and about the concerns from smallholder farmers about their needs and priorities. She also noted that there was a growing divide between countries in the region in the application of agricultural biotechnologies, its enabling environment and capacity challenges. She underlined that all stakeholders from governments to farmers need to gain access to appropriate knowledge on these biotechnologies before taking decisions. This implies greater knowledge about existing technologies, risk assessments, regulatory process etc. and that, as a knowledge organization, FAO stands ready to meet this challenge.

Xiangjun Yao, Regional Programme Leader for Asia and the Pacific, FAO of the United Nations

After thanking the Government of Malaysia, particularly the Ministry of Agriculture and Agro-Based Industry (MOA), the Ministry of Science, Technology and Innovation (MOSTI) and the Malaysian Bioeconomy Development Corporation, for hosting and co-organizing the meeting, she then closed the regional meeting, on behalf of FAO.

IV. Outcomes and key messages

As for the 2016 Global Symposium on Agricultural Biotechnologies in Rome, the success of the regional meeting confirmed the importance of FAO's role as a neutral broker – bringing together a wide range of different stakeholders in the region, with their different perceptions, aspirations and goals, to learn and share experiences and knowledge together.

During two and half day discussions and exchanges of information and experiences, participants accentuated the following:

- Agricultural biotechnologies can help not only to meet the rapidly growing demand for food and the challenges of climate change, but also benefit small scale farmers and ensure food and nutrition security, should issues like regulation, public perception and investment be tackled successfully.
- Agricultural biotechnologies are much more than GMOs and they encompass the full range of both low- and high-tech biotechnologies. There is no one "best" biotechnology, the optimal choice depends on the context. Biotechnology itself is also not always the optimal solution and is often used best when complemented with other technologies.
- GMOs are not synonymous with biotechnologies. Many concerns about GMOs are due to uncertainties, lack of information, science-based evidence and experimental data on GMOs. Risk assessment and considerations of socio-economic impact of GMOs should be defined.
- Many applications of biotechnologies benefit producers including small-scale farmers in the region and it is critical that adequate support and investment are continuously mobilized. South-South Cooperation, public-private-partnerships, networking and other mechanisms to increase funding/investment and strengthen science and innovation cooperation between various stakeholders from developed and developing countries should be explored.
- Research results need to be properly communicated to support policies and be converted into useful products that can attract investment, including up-scaling and ensuring equal access for all. Two-way communication between smallholders and scientists is crucial for identifying practical problems and for the dissemination and adoption of research results. Capacity building and regional cooperation play a critical role in promoting the dissemination, adoption and use of biotechnologies.
- There should be a platform/mechanism that would enable knowledge sharing among the various stakeholders, especially farmers, to enable them to also seek guidance and advice regarding the different biotechnologies.
- Some socio-economic aspects should be considered in policy and regulatory frameworks: social inclusiveness, point of checks and balances, etc.
- National and regional dialogues are critically important to both manage the challenges and reap the benefits of agricultural biotechnologies.
- The germplasm collection in the region is of global significance, in particular, the genebank collections of taro, sweet potato and yam in the Pacific.
- Cost of applying biotechnologies can be a potential burden for smaller countries, but a single country may not need to deploy the full spectrum of tools in the biotechnology toolbox. Instead, it may apply a few of them, depending of its needs. Ranges of benefits can be derived from increased engagement with farmers, and other keepers and users of genetic resources.
- Agricultural biotechnologies on their own are not a guarantee for food security and nutrition. Thus, a more holistic approach, including agroecological practices, is needed to make agriculture sustainable and climate smart, alongside biotechnologies. Increasing resilience of

crops in the light of climate change, through enhancement of existing traits, or introduction of new ones with application of non-GM biotechnologies is important.

V. Recommendations and possible follow-up actions

Creation of a knowledge platform on agricultural biotechnologies

Despite the extensive use of a wide range of agricultural biotechnologies, the application of which can vary widely across differing farming systems – from subsistence farms to large enterprises – most of the potential users do not have some cursory knowledge on those technologies. Building on the call from meeting participants for improved communication and networking, increased knowledge exchange and strengthened partnerships regarding agricultural biotechnologies, it is suggested to create a platform, involving stakeholders, especially those who are in the forefront of technology application, where they can gain access to knowledge on the diversity of agricultural biotechnologies, their applications, returns, limiting factors/constraints, opportunities, etc., that may provide answers to their many questions related to food security and safety, productivity increase, etc.

Promote public-private partnership and South-South Cooperation for agricultural biotechnologies

One of the key constraints in development and application of agricultural biotechnologies is inadequate investment. It has dual effects: limited public investments in agriculture, and private sector's money tied up in few staple biotechnology products only, do not provide much incentive to, and may even constrain, the use of agricultural biotechnologies on farms; biotechnology development initiatives in developing countries are often hampered by lack of investment and funding sources. This is an underlying cause to many other constraints in agricultural biotechnology development such as poor regulatory frameworks, lack of scientific materials and sufficient human capacities, and unsupportive environment for intellectual property right protection. The hypothesis is that fostering and strengthening public-private partnerships and South-South Cooperation to be more synergistic, and to fill investment gaps where necessary, is an innovative approach that would help developing countries to move a step closer to exploiting the benefits of agricultural biotechnologies for their needs.

Improve technology transfer in the Pacific countries

Pacific countries are highly vulnerable to the effects of climate change and natural disasters, which can be potentially reduced by adoption of relevant agricultural biotechnologies. Although, they can benefit farmers and environment as well, in various ways, and play and will continue to play important role in agriculture development in the Pacific small island countries, such benefits are not appreciably enough in practice, due to geographical isolation and limited market size of those countries. Agricultural biotechnology development initiatives are often hampered by lack of investment and funding sources. However, it is not necessary for the Pacific countries to develop their own or new limited market size of those countries. Since many Asian countries have enough technologies already available, it is important for island countries to take a good advantage of those technologies through technology transfer and improvement of their absorptive capacities.

Annexes

Annex 1 Final programme of the FAO Regional Meeting on Agricultural Biotechnologies in Sustainable Food Systems and Nutrition in Asia-Pacific

Time	Sessions
11 SEPT 13.30-14.30 Plenary Theatre (level 3 of KLCC)	Plenary Session 1: Opening session • **Kundhavi Kadiresan**, Assistant Director-General and Regional Representative for Asia and the Pacific, FAO Regional Office for Asia and the Pacific, Bangkok, Thailand • **Mohd Azhar Haji Yahaya**, Secretary General, Ministry of Science, Technology and Innovation, Malaysia • **Two videos**, on livestock breeding in Nepal and eucalyptus intercropping in Thailand, from a video series called 'Biotechnology – Changing lives in Asia-Pacific' produced by FAO for this regional meeting
14.30-15.00	*Coffee break*
15.00-17.30 Plenary Theatre (level 3 of KLCC)	Plenary Session 2: Keynote addresses **Chair: Kundhavi Kadiresan**, FAO Regional Office for Asia and the Pacific, Bangkok, Thailand Keynote addresses: • **Zakri Abdul Hamid**, Science Advisor to the Prime Minister, Prime Minister's Office, Kuala Lumpur, Malaysia *The role of biotechnologies in Malaysia's bioeconomy (20')* • **Margaret Gill**, Chair, CGIAR Independent Science and Partnership Council, Rome, Italy *Opportunities for research to help smallholders engage with biotechnology (20')* • **Two videos**, on shrimp production in Thailand and flood-tolerant rice in India, from a video series called 'Biotechnology – Changing lives in Asia-Pacific' produced by FAO for this regional meeting • **Om Kimsir**, Secretary of State, Ministry of Agriculture, Forestry and Fisheries, Cambodia *Policies and programmes regarding agricultural biotechnologies in Cambodia (10')* • **Teariki Matairangi Purea**, Secretary of the Ministry of Agriculture, Cook Islands *Policies and programmes regarding agricultural biotechnologies in Cook Islands (10')* Panel/audience discussion facilitated by the Chair

12 SEPT 08.30-10.30 Plenary Theatre (level 3 of KLCC)	Plenary Session 3: The status and challenges regarding agricultural biotechnologies in Asia-Pacific **Chair: Shadrack Moephuli**, Agricultural Research Council, Pretoria, South Africa • **Ravi Srinivas Krishna**, Research and Information System for Developing Countries (RIS), New Delhi, India *The status of application, capacities and the enabling environment for agricultural biotechnologies in the Asia-Pacific region: Presentation of some preliminary findings (20')* • **Neena Amatya Gorkhali**, National Animal Science Research Institute, Khumaltar, Nepal *Personal reflections on the status and challenges regarding use of agricultural biotechnologies in the livestock sector (8')* • **Anchalee Tassanakajon**, Chulalongkorn University, Bangkok, Thailand *Personal reflections on the status and challenges regarding use of agricultural biotechnologies in the fishery sector (8')* • **Rajeev Varshney**, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India *Personal reflections on the status and challenges regarding use of agricultural biotechnologies in the crop sector (8')* • **Zheng Yongqi**, Chinese Academy of Forestry, Beijing, China *Personal reflections on the status and challenges regarding use of agricultural biotechnologies in the forestry sector (8')* Panel/audience discussion facilitated by the Chair
10.30-12.30 Plenary Theatre (level 3 of KLCC)	Parallel Session 1: Investments in agricultural biotechnologies **Chair: Usha Barwale Zehr**, Maharashtra Hybrid Seeds Company, Dawalwadi, India • **Xinhai Li**, Chinese Academy of Agricultural Sciences, Beijing, China *Investment and R&D of agro-biotechnology in China (12')* • **Rashidah Ibrahim**, Malaysian Vaccines and Pharmaceuticals (MVP), Selangor, Malaysia *A case study in public-private funding partnership (12')* Panel/audience discussion facilitated by the Chair
10.30-12.30 Room 408-409 (level 4 of KLCC)	Parallel Session 2: Dissemination, adoption and use of biotechnologies **Chair: Kazuo Nakashima**, Japan International Research Center for Agricultural Sciences, Tsukuba, Japan

	Case studies of applications of biotechnologies in different sectors: • **Kazuo Nakashima**, Japan International Research Center for Agricultural Sciences (JIRCAS), Tsukuba, Japan *Challenges to develop new functional crops and silkworms that consumers can accept in Japan (15')* • **Carmen Ablan-Lagman**, De La Salle University, Manila, The Philippines *Knowledge platforms; Ongoing initiatives on mudcrab biotech for adoption by farmers (15')* • **Doreen Goh**, YSG Biotech Sdn Bhd, Kota Kinabalu, Malaysia *Use of biotechnologies for producing clonal teak as planting materials for smallholders (15')* • **Neena Amatya Gorkhali**, National Animal Science Research Institute, Khumaltar, Nepal *Use of artificial insemination to improve goat meat production in Nepal (15')* Panel/audience discussion facilitated by the Chair
12.30-13.30	*Lunch break*
13.30-15.30 Plenary Theatre (level 3 of KLCC)	<u>Parallel Session 3:</u> Social and economic impact of agricultural biotechnologies for communities **Chair: Rowena R. Eguia**, Southeast Asian Fisheries Development Center, Rizal, The Philippines Speakers: • **Sayed Azam-Ali**, Crops for the Future, Semenyih, Malaysia *Social and economic potential of agricultural biotechnologies for crop diversification in South East Asia (20')* • **Seuseu Tauati**, Scientific Research Organization of Samoa (SROS), Apia, Samoa *The role of SROS in Samoa (10')* • **Cherdsak Virapat**, Network of Aquaculture Centres in Asia-Pacific (NACA), Bangkok, Thailand *Case studies of the impacts of biotechnologies and the missing biotechnologies in aquaculture (10')* • **C. K. John**, CSIR-National Chemical Laboratory, Pune, India *Impact of crop biotechnologies for smallholder farmers in India: A case study of plant tissue culture (10')* Panel/audience discussion facilitated by the Chair
13.30-15.30 Room 408-409 (level 4 of KLCC)	<u>Parallel Session 4:</u> Regional innovation opportunities in agricultural biotechnologies **Chair: Margaret Gill**, CGIAR Independent Science and Partnership Council, Rome, Italy

	Keynote: • **Khatijah Yusoff**, Universiti Putra Malaysia, Selangor, Malaysia *Newcastle Disease Virus: From poultry vaccine to malignacy hero (20')* Speakers: • **Anchalee Tassanakajon**, Chulalongkorn University, Bangkok, Thailand *The role of genomics in shrimp improvement (10')* • **Sneh Lata Singla-Pareek**, International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi, India *Novel biotechnologies for raising stress tolerant and high yielding crop plants (10')* • **Pannaga N. Prasad**, Karnataka Rajya Raitha Sangha (KRRS), Bangalore, India *Radically simple innovations for Indian agriculture (10')* • **Zheng Yongqi**, Chinese Academy of Forestry, Beijing, China *Applications of biotechnologies in the forestry sector (10')* Panel/audience discussion facilitated by the Chair
15.30-17.30 Plenary Theatre (level 3 of KLCC)	Parallel Session 5: Regulation, policies and intellectual property rights **Chair: Shadrack Moephuli**, Agricultural Research Council, Pretoria, South Africa Panellists: • **Elenita Daño**, Action Group on Erosion, Technology and Concentration (ETC Group), Davao City, The Philippines *How to ensure access of small farmers to technologies they need (15')* • **Vilasini Pillai**, Quest International University Perak, Ipoh, Malaysia *Enabling policies for agricultural biotechnologies (15')* • **Bhagirath Choudhary**, South Asia Biotechnology Centre (SABC), New Delhi, India *Global adoption and regulation impacting technology adoption (15')* • **Teh Guat Hong**, Lo Chambers, Kuala Lumpur, Malaysia *Intellectual property rights and agricultural biotechnologies (15')* Panel/audience discussion facilitated by the Chair
15.30-17.30 Room 408-409 (level 4 of KLCC)	Parallel Session 6: Conservation, characterization and sustainable use of genetic resources for food and agriculture **Chair: Chang-Yeon Cho**, Rural Development Administration, Jeonju-si, Republic of Korea

	Case studies: • **Rowena R. Eguia**, Southeast Asian Fisheries Development Center, Rizal, The Philippines *DNA marker applications in the management of farmed aquatic genetic resources in the Philippines (12')* • **Suchitra Changtragoon**, Department of National Parks, Wildlife and Plant Conservation, Bangkok, Thailand *DNA markers and DNA profiling to verify species and individuals from confiscated wood in Thailand (12')* • **Pradeepa Silva**, University of Peradeniya, Peradeniya, Sri Lanka *Molecular applications in characterization and differentiation of Sri Lankan wild boar (Sus scrofa affinis) meat from exotic and village pig (Sus scrofa domestica) meat (12')* • **Xinhai Li**, Chinese Academy of Agricultural Sciences, Beijing, China *Crop genetic improvement and utilization in China (12')* • **Logotonu Waqainabete**, Pacific Community (SPC), Suva, Fiji *A case study from crop or tree genetic resources in the Pacific (12')* Panel/audience discussion facilitated by the Chair
17.30-19.00	*Social mixing event, sponsored by the Ministry of Science, Technology and Innovation (in Exhibition Hall 2, ground floor of KLCC)*
13 SEPT 09.00-10.00 Plenary Theatre (level 3 of KLCC)	Plenary Session 4: Improving nutrition using the biotechnology toolbox **Chair: Ghizan Saleh**, National Council of Professors, Kuala Lumpur, Malaysia Panellists: • **Rajeev Varshney**, International Crops Research Institute for the Semi-Arid Tropics, Patancheru, India *Pulses for improved nutrition and the role of biotechnologies (10')* • **Umi Kalsom Abu Bakar**, Malaysian Agricultural Research and Development Institute, Putrajaya, Malaysia *Crop genomics: Towards nutritional security (10')* Panel/audience discussion facilitated by the Chair
10.00-12.00 Plenary Theatre (level 3 of KLCC)	Plenary Session 5: The role of biotechnologies in climate-smart agriculture & bioeconomy **Chair: Logotonu Waqainabete**, Pacific Community (SPC), Suva, Fiji Keynote: • **Leocadio Sebastian**, CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Viet Nam *The role of biotechnologies in climate-smart agriculture (15')*

	Case studies: • **Mohd Ali Hassan**, Universiti Putra Malaysia, Selangor, Malaysia *Case study on recycling of oil palm biomass waste and turning it into renewable energy (7')* • **Kshirod Jena**, International Rice Research Institute, Manila, The Philippines *The use of wild relatives of rice through wide hybridization against drought, salinity and low temperatures (7')* • **Nhuong Tran**, WorldFish, Penang, Malaysia *Integrated aquaculture systems as climate smart aquaculture and ecosystem based bio-technology: Potentials for scaling out in the North Central Coast of Vietnam (7')* • **Pervez Haider Zaidi**, CIMMYT-Asia Regional Maize Program, Hyderabad, India *Climate change impacts and potential benefits of heat stress resilient maize for Asian tropics (7')* • **Li Lin Lim**, Third World Network, Kuala Lumpur, Malaysia *Can agricultural biotechnologies address the challenges of climate change? (7')* • **Kazuo Nakashima**, Japan International Research Center for Agricultural Sciences, Tsukuba, Japan *Development of crops tolerant to adverse environments using agricultural biotechnologies (7')* Panel/audience discussion facilitated by the Chair
12.00-13.00 Plenary Theatre (level 3 of KLCC)	<u>Plenary Session 6:</u> South-South Cooperation **Chair: Xiangjun Yao**, FAO Regional Office for Asia and the Pacific, Bangkok, Thailand • **Chun-Ming Liu**, Chinese Academy of Agricultural Sciences, Beijing, China *Perspectives from China on south-south cooperation in agricultural biotechnologies (15')* • **Changyeon Cho**, Rural Development of Administration, Jeonju-si, Republic of Korea *An overview of the Asian Food and Agriculture Cooperation Initiative (5')* • **Yoshimichi Fukuta**, Japan International Research Center for Agricultural Sciences, Tsukuba, Japan *The rice blast research network for sustainable rice production (5')* Panel/audience discussion facilitated by the Chair
13.00-14.30	*Lunch break*

14.30-15.30 Plenary Theatre (level 3 of KLCC)	Plenary Session 7: Reporting from parallel and plenary sessions **Chair: Kodi Isparan Kandasamy**, Malaysian Bioeconomy Development Corporation, Kuala Lumpur, Malaysia Reporting of outcomes by the chairs of the different sessions (5'each): • Plenary session 3: **Shadrack Moephuli** • Parallel session 1: **Rashidah Ibrahim** • Parallel session 2: **Kazuo Nakashima** • Parallel session 3: **Rowena R. Eguia** • Parallel session 4: **Margaret Gill** • Parallel session 5: **Shadrack Moephuli** • Parallel session 6: **Chang-Yeon Cho** • Plenary session 4: **Ghizan Saleh** • Plenary session 5: **Logotonu Waqainabete** • Plenary session 6: **Xiangjun Yao**
15.30-16.00	*Coffee break*
16.00-17.30 Plenary Theatre (level 3 of KLCC)	Plenary Session 8: 'The way ahead' **Chair: Shadrack Moephuli**, Agricultural Research Council, Pretoria, South Africa Some personal highlights and take-home messages from the regional meeting (5'each): • **Teariki Matairangi Purea**, Ministry of Agriculture, Cook Islands • **Margaret Gill**, CGIAR Independent Science and Partnership Council, Rome, Italy • **Kazuo Nakashima**, Japan International Research Center for Agricultural Sciences, Tsukuba, Japan Discussion with the audience facilitated by the Chair
17.30-17.45 Plenary Theatre (level 3 of KLCC)	Plenary Session 9: Closing session **Chair: Samy Gaiji**, FAO headquarters, Rome, Italy Closing remarks: • **Zakri Abdul Hamid**, Prime Minister's Office, Kuala Lumpur, Malaysia • **Xiangjun Yao**, FAO Regional Office for Asia and the Pacific, Bangkok, Thailand

Annex 2 List of participants

I. Participants nominated by FAO Member States in the Asia-Pacific region

AUSTRALIA

1. Enrico **Perotti**
Agriculture Counsellor
Department of Agriculture and Water Resources
enrico.perotti@agriculture.gov.au

BANGLADESH

2. Jannatul **Ferdous**
Senior Scientific Officer
Bangladesh Rice Research Institute
kbdjannatul@yahoo.com

3. Md. Motiar **Rohman**
Senior Scientific Officer
Bangladesh Agricultural Research Institute
motiar_1@yahoo.com

4. Mohammad Imtiaz **Uddin**
Chief Scientist
Bangladesh Institute of Nuclear Agriculture
imtiazukm@gmail.com

BHUTAN

5. Sangay **Dorji**
Dy. Chief Agriculture Officer
Department of Agriculture, Ministry of Agriculture & Forests
sangaykheng06@hotmail.com

CAMBODIA

6. H.E. Kimsir **Om***
Secretary of State
Ministry of Agriculture, Forestry and Fisheries
bun.radet99@gmail.com

7. Kynet **Kong**
Deputy Head
Cambodian Agricultural Research and Development Institute (CARDI)
kongkynet@yahoo.com

8. Chantha **Roeun**
Chief of International Organization Affairs Office
Ministry of Agriculture, Forestry and Fisheries
chantha.roeun168@gmail.com

CHINA

9. Ting **Tang**
Deputy Director
Ministry of Agriculture
tangting@agri.gov.cn

COOK ISLANDS

10. Teariki Matairangi **Purea***
Secretary of the Ministry of Agriculture
Ministry of Agriculture
mat.purea@agriculture.gov.ck

FIJI

11. Savenaca **Cuquma**
Principal Research Officer - Agronomy
Ministry of Agriculture, Research Division
scuquma@gmail.com

INDIA

12. Suresh Kumar **Malhotra**
Agriculture Commissioner
Ministry of Agriculture & Farmers Welfare
ag.comm@nic.in

*acted as a resource person (i.e. as speaker, chair and/or panellist)

INDONESIA

13. Toto **Hadiarto**
Scientist
Indonesian Center for Agricultural Biotechnology and Genetic Resource Research and Development (ICAB)
thadiarto@gmail.com

14. Bahagiawati **Husin**
Senior Scientist, Regulator for GMO Approval in Indonesia
ICABIOGRAD, IAARD, Ministry of Agriculture
bahagiawati@indo.net.id

15. Dannu **Idris**
Government Employee
Coordinating Ministry for Economic Affairs of the Republic of Indonesia
dannu.idris01@gmail.com

16. Arief **Sulistya**
Policy Analysis for Food and Agriculture Facility
Coordinating Ministry for Economic Affairs of the Republic of Indonesia
ariefsulistya@ekon.go.id

17. Dwinita **Utami**
Researcher
ICABIOGRAD, IAARD, Ministry of Agriculture
dnitawu@windowslive.com

IRAN (ISLAMIC REPUBLIC OF)

18. Seyed Ghasem Hosseini **Salekdeh**
Deputy Director General for Research
Agricultural Biotechnology Research Institute of Iran
hsalekdeh@yahoo.com

JAPAN

19. Michiko **Nishikawa**
Second Secretary, Agriculture, Forestry, Fisheries & Environment
Embassy of Japan in Malaysia
michiko.nishikawa@mofa.go.jp

MALAYSIA

20. Umi Kalsom **Abu Bakar**[*]
Executive Director
MARDI Ventures & Farming Sdn Bhd (MVSB)
umiab57@gmail.com

21. Norwati Binti **Adnan**
Director
Department of Biosafety
norwati@nre.gov.my

22. Zakri Abdul **Hamid**[*]
Science Advisor to the Prime Minister
Prime Minister's Office
zakri@pmo.gov.my

23. Azlindah Binti **Hassan**
Ketua Cawangan Sayur Dan Buah Buahan
Lembaga Pertubuhan Peladang
azlindahhasan@gmail.com

24. Maliza **Hazin**
Agriculture Officer
Department of Agriculture, MOA
mahadoamy@gmail.com

25. Nordina Binti **Idris**
Deputy Secretary
Ministry of Science, Technology and Innovation
nordina@mosti.gov.my

26. Tan Ying **Ju**
Research Officer
Animal Science Research Centre, MARDI
yjtan@mardi.gov.my

27. Kodi Isparan **Kandasamy**[*]
Senior Vice President
Malaysian Bioeconomy Development Corporation Sdn Bhd
kodi.kandasamy@bioeconomycorporation.my

28. ABD Rahman **Milan**
Professor
University Malaysia Sabah, NPC
armilan@ums.edu.my

29. Mohamad **Osman**
Professor
Universiti Putra Malaysia
mbopar2004@yahoo.com

30. Mohamad Ridzuan Abdul **Rahman**
Assistant Director
UMP, NPC
ridzuan@mycc.gov.my

31. Khairul Zarina **Mohd Yusop**
Principal Assistant Director
Nutrition, Ministry of Health (MOH)
khairul_zarina@moh.gov.my

32. Mohd Shuhaizam **Mohd Zain**
Chief Executive Officer
Malaysian Bioeconomy Development Corporation Sdn Bhd
drzam.zain@bioeconomycorporation.my

33. Shuerni Mohamad **Razi**
Agriculture Officer
Department of Agriculture, MOA
shuerni@gmail.com

34. Aldrich **Richard**
Director, International Affairs Division
Forestry Department of Peninsular Malaysia
aldrich@forestry.gov.my

35. Sanimah Binti **Simoh**
Deputy Director
Malaysian Agricultural Research and Development Institute
sanimah@mardi.gov.my

36. Mohd Saupee **Sudin**
Timbalan Pengarah
Lembaga Pertubuhan Peladang
saupee33@yahoo.com

37. Mee-Hua **Wong**
Researcher
Department of Agriculture, Sarawak
wongmh1@sarawak.gov.my

38. Mohd Azhar Haji **Yahaya***
Secretary General
Ministry of Science, Technology and Innovation
drazhary@mosti.gov.my

39. Kamarul Anwar Mohamed **Zabri**
Fisheries Officer
Department of Fisheries
kamzabri@gmail.com

MALDIVES

40. Mariyam **Ahmed**
Senior Project Officer
Ministry of Fisheries and Agriculture
mariyamvishama@gmail.com

MICRONESIA (FEDERATED STATES OF)

41. Emihner **Johnson**
Executive Director
Island Food Community of Pohnpei
info@islandfood.org

MONGOLIA

42. Tungalag **Davaa**
Senior Officer, Department of Coordination for Food Production Policy Implementation
Ministry of Food Agriculture and Light Industry of Mongolia
tungafood@yahoo.com

MYANMAR

43. Yu Yu **Min**
Associate Professor
Yezin Agricultural University (YAU)
yumindin@gmail.com

NEPAL

44. Basudev **Regmi**
Senior Agriculture Development Officer
District Agriculture Development Office
regmibasu@gmail.com

PAKISTAN

45. Zaheer **Abbas**
Senior Scientific Officer
National Institute for Genomics and Advanced Biotechnology (NIGAB)
zaheerpbg@yahoo.com

46. Ghulam **Ali**
Chief Scientist/Senior Director
National Institute for Genomics and Advance Biotechnology, National Agriculture Research Center
drgmali5@gmail.com

PALAU

47. Fernando **Sengebau**
Director
Bureau of Agriculture
fsengebau@gmail.com

SOLOMON ISLANDS

48. MacDonnell Hiva **Bule**
Project Coordinator, Agriculture Livelihood Improvements and Export Base
Ministry of Agriculture and Livestock
MacDonnell.Hiva@sig.gov.sb

SRI LANKA

49. Samanthi **Wasala**
Senior Scientist
Department of Agriculture
samanthiwasala@gmail.com

THAILAND

50. Anong **Nimlamai**
Fishery Biologist
Department of Fisheries, Ministry of Agriculture and Cooperatives
anongni@gmail.com

51. Chumnun **Piananurak**
Forest Research Officer
Royal Forest Department
chumnunpian@gmail.com

52. Muksuda **Ruangkree**
Veterinary Officer
Department of Livestock Development
muksudaruang@gmail.com

THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

53. Kroungsivilay **Malaythong**
Deputy National Project Coordinator
Department of Planning and Cooperation, Ministry of Agriculture and Forestry
kroungsivilay@yahoo.com

54. Alounsak **Xayasouk**
Officer
Department of Agriculture, Ministry of Agriculture and Forestry
alounsakx@gmail.com

THE PHILIPPINES

55. Casiano Jr. **Choresca**
Project Development Officer
Fisheries Biotechnology Center
cchorescajr@gmail.com

56. Vivencio **Mamaril**
Director
Department of Agriculture Biotechnology Program Office
choymamaril@yahoo.com

57. Mary Rose De Leon **Uy**
Researcher
Livestock Biotechnology Center, Philippine Carabao Center
uymaryrosedeleon@yahoo.com

TIMOR-LESTE

58. Claudino Ninas **Nabais**
National Director of Research, Statistic & Geographic Information
Ministry of Agriculture and Fisheries
claudino_nabais@yahoo.com

TONGA

59. Sione **Foliaki**
Deputy CEO
Ministry of Agriculture, Food, Forestry & Fisheries
sionekelo@gmail.com

TUVALU

60. Uatea **Vave**
Senior Agriculture Officer
Department of Agriculture
uateavave@gmail.com

UZBEKISTAN

61. Zafarjon **Ziyaev**
Scientific Secretary
Research Institute of Plant Industry
zafaruzripi@gmail.com

VANUATU

62. Lawrence **Nimoho**
Food Security and Nutrition Officer
Ministry of Agriculture Livestock, Forestry, Fisheries and Biosecurity
lnimoho@vanuatu.gov.vu

VIET NAM

63. Nguyen Quoc **Nghi**
Fishery Biologist
Department of Science Technology and Environment, Ministry of Agriculture and Rural Development
nghinq.khcn@mard.gov.vn

II. Other participants

AUSTRALIA

64. Tammi **Jonas**
President and Farmer
Australian Food Sovereignty Alliance
tammois@gmail.com

BANGLADESH

65. Kuasha **Mahmud**
Principal Scientific Officer
Bangladesh Sugarcrop Research Institute
kmahmud31@yahoo.com

CANADA

66. Darcie **Doan**
Director
Agriculture and Agri-Food Canada (AAFC)
darcie.doan@agr.gc.ca

67. Richard **White**
Chief Executive Officer
Canadian Canola Growers Association
rickw@ccga.ca

CHINA

68. Yong **Gao**
Director Corporate Engagement Asia Africa
Monsanto (China)
yong.gao@monsanto.com

69. Xinhai **Li**[*]
Professor
Institute of Crop Sciences, Chinese Academy of Agricultural Sciences
lixinhai@caas.cn

70. Chunming **Liu**[*]
Professor
Institute of Crop Sciences, Chinese Academy of Agricultural Sciences
liuchunming@caas.cn

71. Yongjun **Qin**
Professor
Shanxi Academy of Agricultural Sciences
eurowall@hotmail.nl

72. Yanqing **Wang**
Senior Manager
BASF (China) Co. Ltd
yanqing.wang@basf.com

73. David **Yeh**
Head of Market Acceptance APAC and Seeds Greater China
Bayer
david.yeh@bayer.com

74. Yongqi **Zheng***
Director, Research Professor
Chinese Academy of Forestry
zyq8565@126.com

FIJI

75. Logotonu **Waqainabete***
Curator
Centre for Pacific Crops and Trees (CePaCT), The Pacific Community (SPC)
logow@spc.int

FRANCE

76. Sébastien **Bouvatier**
Agricultural Counsellor for ASEAN countries
French Embassy in Singapore
sebastien.bouvatier@dgtresor.gouv.fr

INDIA

77. Mandeep Singh **Azad**
Scientist/Subject Matter Specialist
Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu
mandeepsinghazad@gmail.com

78. Bhagirath **Choudhary***
Founder Director
South Asia Biotechnology Centre (SABC)
bhagirath@sabc.asia

79. Somenath **Ghose**
Area Manager - Asia
Vestergaard SA
som@vestergaard.com

80. C.K. **John***
Scientist
CSIR-National Chemical Laboratory
ck.john@ncl.res.in

81. Rony **Joseph**
Traditional Farmer
International Federation of Rural Adult Catholic Movements (FIMARC)
rjoseph133@gmail.com

82. Krishnakar **Kummari**
President
International Movement of Catholic Agricultural and Rural Youth (MIJARC)
k.kummari@mijarc.net

83. Pavitar Pal **Pangli**
President
Borlaug Farmers Association for South Asia
ppspangli@gmail.com

84. Ashwani **Pareek**
Professor
Jawaharlal Nehru University
ashwanipareek@gmail.com

85. Pannaga N. **Prasad***
Communications Officer
Karnataka Rajya Raitha Sangha
pannagaprasad@gmail.com

86. Kapilkumar **Shah**
Co-Convener
Alliance for Sustainable and Holistic Agriculture
jatantrust@gmail.com

87. Sneh Lata **Singla-Pareek***
Group Leader
International Centre for Genetic Engineering and Biotechnology (ICGEB)
snehpareek@gmail.com

88. Krishna Ravi **Srinivas***
Consultant & Managing Editor: Asian Biotechnology & Development Review
Research and Information System for Developing Countries (RIS)
ravisrinivas@ris.org.in

89. Kannaiyan **Subramaniam**
Secretary
South Indian Coordination Committee of Farmers Movements
sukannaiyan69@gmail.com

90. Rajeev Kumar **Varshney***
Research Program Director
ICRISAT
r.k.varshney@cgiar.org

91. Pervez Haider **Zaidi***
Principal Scientist
CIMMYT
phzaidi@cgiar.org

92. Usha **Zehr***
Chief Technology Officer
Mahyco
usha.zehr@mahyco.com

INDONESIA

93. Zainal Arifin **Fuat**
Head of Foreign Department
Serikat Petani Indonesia
zainal@spi.or.id

94. Hoang **Lien**
Executive Director
International Pepper Community
ed@ipcnet.org

IRAN (ISLAMIC REPUBLIC OF)

95. Ali Motevally Zadeh **Ardekani**
Director
Iranian Health Biotechnology Convention of Iran
IranHealth@hotmail.com

ITALY

96. Paul **Boettcher**
Animal Production Officer
FAO headquarters
Paul.Boettcher@fao.org

97. Mauro **Conti**
IPC Secretariat
International Planning Committee for Food Sovereignty
ipc-cip@foodsovereignty.org

98. Samy **Gaiji***
Head Research and Extension
FAO headquarters
Samy.Gaiji@fao.org

99. Margaret **Gill***
Chair
CGIAR Independent Science & Partnership Council (ISPC)
m.gill@abdn.ac.uk

100. Jarkko **Koskela**
Forestry Officer
FAO headquarters
Jarkko.Koskela@fao.org

101. Chikelu **Mba**
Senior Plant Production Officer/Team Leader
FAO headquarters
Chikelu.Mba@fao.org

102. Stefano **Mori**
Project Assistant
Centro Internazionale Crocevia
s.mori@croceviaterra.it

103. Melba **Reantaso**
Aquaculture Officer
FAO headquarters
Melba.Reantaso@fao.org

104. John **Ruane**
Senior Consultant (Agricultural Biotechnologies)
FAO headquarters
John.Ruane@fao.org

JAPAN

105. Yoshimichi **Fukuta***
Senior Researcher
Japan International Research Center Agricultural Sciences (JIRCAS)
zen@affrc.go.jp

106. Kazuo **Nakashima***
Program Director
Japan International Research Center Agricultural Sciences (JIRCAS)
kazuo.nakashima@affrc.go.jp

107. Kazuo **Watanabe**
Professor and Associate Director
Tsukuba Plant Innovation Research Center, University of Tsukuba
nabechan@gene.tsukuba.ac.jp

MALAYSIA

108. Abdul Ghani **Abdul Aziz**
Principal Assistant Secretary, Strategic Technology and S&T Application
Ministry of Science, Technology and Innovation
ghani@mosti.gov.my

109. Musaalbakri **Abdul Manan**
Research Officer
Biotechnology Research Centre, MARDI
bakri@mardi.gov.my

110. Ridzwan **Abdul Rahman**
Professor
Universiti Malaysia Perlis, NPC
ridzwan.ar11@gmail.com

111. Mohd Rosli Bin Haji **Abdullah**
Division Secretary
Ministry of Science, Technology and Innovation
mohdrosli@mosti.gov.my

112. Sayed **Azam-Ali***
Chief Executive Officer
Crops For the Future
sayed.azam-ali@cffresearch.org

113. Hizahwati **Badri**
Assistant Secretary
Ministry of Science, Technology and Innovation
hizahwati@mosti.gov.my

114. Razali **Bolhi**
Chairman
Panggau LVC Malaysia
agrotechs_acad@yahoo.com

115. Sara Jane **Chiu Soo Hon**
Vice President, Agbiotech
Malaysian Bioeconomy Development Corporation Sdn Bhd
sara.chiu@bioeconomycorporation.my

116. Low Chen **Fei**
Research Fellow
Universiti Kebangsaan Malaysia (UKM), MOSTI
low@ukm.edu.my

117. Doreen **Goh***
Managing Director
YSG Bioscape Sdn Bhd/Sabah Foundation Group
dorngoh@hotmail.com

118. Haslina **Hamidan**
Senior Manager, Events & Business Support
Malaysian Bioeconomy Development Corporation Sdn Bhd
haslina.hamidan@bioeconomycorporation.my

119. Khairuddin **Hamsan**
Head of Production Division
Malaysian Vaccines & Pharmaceuticals Sdn Bhd
khairuddin@mvp.com.my

120. Mohd Ali **Hassan***
Professor
Universiti Putra Malaysia
alihas@upm.edu.my

121. Mudalipah **Hoslin**
Head of Regulatory Division
Malaysian Vaccines & Pharmaceuticals Sdn Bhd
mudalipah@mvp.com.my

122. Abdul Latif **Ibrahim**
Director, Institute of Bio-IT Selangor
UNISEL, Ministry of Science, Technology and Innovation (MOSTI)
alatif@yahoo.com

123. Rashidah **Ibrahim***
Chief Executive Officer
Malaysian Vaccines & Pharmaceuticals Sdn Bhd
irashidah@gmail.com

124. Hasan Basri **Idris**
Executive, Business Analyst
Malaysian Bioeconomy Development Corporation Sdn Bhd
hasan.idris@bioeconomycorporation.my

125. Ridzuan Al **Idrus**
Chief Executive Officer
Putra Al-Mawashi Genetic SDN BHD
ridzuan@palmgen.com.my

126. Nor Aisyah **Ismail**
Executive
SGS (Malaysia) Sdn Bhd
noraisyah.ismail@sgs.com

127. Riina **Jalonen**
Associate Scientist
Bioversity International
r.jalonen@cgiar.org

128. Wan Mohd Aizat Wan **Kammaruddin**
Senior Lecturer
Universiti Kenabgsaan Malaysia (UKM)
wma@ukm.edu.my

129. Tan Wei **Kiat**
Senior Executive, ICT Infrastructure
Malaysian Bioeconomy Development Corporation Sdn Bhd
weikiat.tan@bioeconomycorporation.my

130. Li Lin **Lim***
Legal and Environment Advisor
Third World Network
lin@twnetwork.org

131. Jiun Yan **Loh**
Assistant professor, Faculty of Applied Science
UCSI University
lohjy@ucsiuniversity.edu.my

132. Zuraidah **Long Ibrahim**
Sales Executive
CTI Resources Sdn Bhd
zuraidah@ctiresources.com.my

133. Ankitta **Mishra**
Researcher, Department of Plant Sciences
Universiti Kebangsaan Malaysia (UKM)
ankitta99@gmail.com

134. Anni **Mitin**
Executive Director
Southeast Asian Council for Food Security & Fair Trade (SEACON)
annie@seacouncil.org

135. Siti Norita **Mohamad**
Research Officer
Fisheries Research Institute, Department of Fisheries
ctnorita@dof.gov.my

136. Mohamed Najib A. **Mohamed Ali**
Executive, ICT Service Desk
Malaysian Bioeconomy Development Corporation Sdn Bhd
najib.ali@bioeconomycorporation.my

137. Reno Zenel **Mohd Nazri**
Manager, AgBiotech
Malaysian Bioeconomy Development Corporation Sdn Bhd
renozenel.nazri@bioeconomycorporation.my

138. Mohd Nordin **Mohd Nor**
Chairman
MVP, Ministry of Science, Technology and Innovation (MOSTI)
nnordin46@gmail.com

139. Norihan **Mohd Saleh**
Research director
Agro-Biotechnology Institute, MOSTI
norihan@abi-nibm.my

140. Salwa Hani **Mustajab**
Assistant Secretary
Ministry of Science, Technology and Innovation
salwahani@mosti.gov.my

141. Mohamed Faizal **Noor Batcha**
Senior Manager, AgBiotech
Malaysian Bioeconomy Development Corporation Sdn Bhd
faizal.noorbatcha@bioeconomycorporation.my

142. Patrick **Pee**
Assistant Resident Representative
UNDP Malaysia
patrick.pee@undp.org

143. Vilasini **Pillai***
Associate Professor
Quest International University Perak
vilasini.pillai@qiup.edu.my

144. Daneswar **Poonyth**
Policy Officer, ESD
FAO Malaysia
Daneswar.Poonyth@fao.org

145. Rajini Kanth V. **Ramachandran**
Vice President, Events & Business Support
Malaysian Bioeconomy Development Corporation Sdn Bhd
rajini.kanth@bioeconomycorporation.my

146. Faridah **Salam**
Deputy Director
Malaysian Agricultural Research and Development Institute
faridahs@mardi.gov.my

147. Ghizan Bin **Saleh***
University Professor/Head, Agriculture and Food Cluster
National Council of Professors
ghizan@upm.edu.my

148. Nor Farhain Binti **Sarmin**
Research Officer
Economics & Social Science Research Centre, Malaysian Agricultural Research and Development Institute
farhain@mardi.gov.my

149. Milagros **Serrana**
Pesticide Programme Science Officer
Pesticide Action Network Asia Pacific
mila.serrana@panap.net

150. Sharidzuan **Shariff**
Head of Corporate Services Division
Malaysian Vaccines and Pharmaceuticals Sdn Bhd
sharidzuan@mvp.com.my

151. Dominic **Siau**
Director
D&D Glocal
nic.yusof@gmail.com

152. Ainu Husna M S **Suhaimi**
Deputy Director
Malaysian Agricultural Research and Development Institute
shusna@mardi.gov.my

153. Zainal Arifin Md **Tahir**
Senior Executive, Business Analyst
Malaysian Bioeconomy Development Corporation Sdn Bhd
zainal.tahir@bioeconomycorporation.my

154. Guat Hong **Teh***
Partner
Lo Chambers
guathong.teh@lochambers.com

155. Nhuong **Tran***
Scientist
WorldFish
n.tran@cgiar.org

156. Dzulkifli Abdul **Wahab**
National Consultant
FAO Malaysia
Dzulkifli.ABDWahab@fao.org

157. Foo Fang **Yeow**
Senior Executive, Business Analyst
Malaysian Bioeconomy Development Corporation Sdn Bhd
foofang.yeow@bioeconomycorporation.my

158. Khatijah **Yusoff***
Professor
Department of Microbiology, Universiti Putra Malaysia (UPM)
kyusoff@upm.edu.my

159. Rabiatul Adawiah **Zainal Abidin**
Research Officer
Biotechnology Research Centre, Malaysian Agricultural Research and Development Institute
rabiatul@mardi.gov.my

MYANMAR

160. Nwe Nwe **Yin**
Director
Department of Agricultural Research
nnyin86@gmail.com

NEPAL

161. Neena Amatya **Gorkhali***
Senior Scientist
Nepal Agricultural Research Council
neenagorkhali@hotmail.com

NEW ZEALAND

162. Anaru **Fraser**
International Representative
Te Whanau o Te Rau Aroha
anarungarimu@gmail.com

163. Moe-moana **Fraser**
Youth Facilitator
Ngamuka Puna
frasermoemoana@gmail.com

PAKISTAN

164. Amir **Jahangir**
Chief Executive Officer
Mishal Pvt. Limited
aj@mishal.com.pk

165. Saeed-ul-Hassan **Khan**
Assistant Professor
Quaid-i-Azam University
saeedkhan@qau.edu.pk

SAMOA

166. Viliami **Fakava**
Plant Production and Protection Officer
FAO Sub-regional Office for the Pacific
Viliami.Fakava@fao.org

167. Seuseu **Tauati***
Chief Executive Officer
Scientific Organisation of Samoa
seuseu@srosmanagement.org.ws

SINGAPORE

168. Wei Ning **Chen**
Director of Food Science and Technology Programme
Nanyang Technological University Singapore
wnchen@ntu.edu.sg

169. Jade **Dyson**
Director of Gafta Singapore
The Grain and Feed Trade Association (Gafta)
jadedyson@gafta.com

170. Sonny **Tababa**
Biotechnology Affairs Director
CropLife Asia
sonny@croplifeasia.org

171. Siang Hee **Tan**
Executive Director
Croplife Asia
sianghee.tan@croplifeasia.org

SOUTH AFRICA

172. Shadrack **Moephuli***
President and Chief Executive Officer
Agricultural Research Council
ceosec@arc.agric.za

SRI LANKA

173. Pradeepa **Silva***
Professor
University of Peradeniya
pradeepas@pdn.ac.lk

SWITZERLAND

174. Allan **Mortensen**
Managing Director
Vestergaard SA
amo@vestergaard.com

THAILAND

175. Anil Kumar **Anal**
Head of the Department
Asian Institute of Technology, Department of Food, Agriculture & Bioresources
anilkumar@ait.asia

176. Amgalan **Ariunbold**
Plant Production Consultant
FAO Regional Office for Asia and the Pacific
Amgalan.Ariunbold@fao.org

177. Jacques **Berger**
Representative of IRD for Thailand, Director of Research
Institute of Research for Sustainable Development (IRD)
Jacques.Berger@ird.fr

178. Baramee **Chaiyarat**
General Secretary
Assembly of the Poor
aop_t@yahoo.com

179. Suchitra **Changtragoon***
Forest Technical Expert
Department of National Parks, Wildlife and Plant Conservation
suchitra.changtragoon@gmail.com

180. Heidi **Gallant**
Executive Director
Asia and Pacific Seed Association
heidi@apsaseed.org

181. Kundhavi **Kadiresan***
Assistant Director-General and Regional Representative
FAO Regional Office for Asia and the Pacific
RAP-ADG@fao.org

182. Liudmila **Lyapina**
Administrative Assistant
FAO Regional Office for Asia and the Pacific
Liudmila.Lyapina@fao.org

183. Lapapan **Supamanta**
Director
Thai Poor Act
anne_lapapan@yahoo.com

184. Anchalee **Tassanakajon***
Professor
Chulalongkorn University
anchalee.k@chula.ac.th

185. Rishi **Tyagi**
Coordinator
Asia-Pacific Consortium on Agricultural Biotechnology, APAARI
rishi.tyagi@apaari.org

186. Cherdsak **Virapat***
Director General
Network of Aquaculture Centres in Asia-Pacific
cherdsak.virapat@enaca.org

187. Xiangjun **Yao***
Regional Programme Leader
FAO Regional Office for Asia and the Pacific
Xiangjun.Yao@fao.org

THE PHILIPPINES

188. Ma. Carmen **Ablan-Lagman***
Professor
De La Salle University
ma.carmen.lagman@dlsu.edu.ph

189. Elenita **Daño***
Asia Director
Action Group on Erosion, Technology and Concentration (ETC Group)
neth@etcgroup.org

190. Edilberto **De Luna**
Executive Director
CropLife Philippines, Inc.
delunaedilberto@gmail.com

191. Maria Rowena R. **Eguia***
Scientist
Southeast Asian Fisheries Development Center, Aquaculture Department (SEAFDEC/AQD)
mreguia@seafdec.org.ph

192. Rosalie **Ellasus**
Director
Asian Farmers Regional Network (ASFARNET)
rmellasus@yahoo.com

193. Kshirod **Jena***
Principal Scientist
International Rice Research Institute,
Plant Breeding, Genetics, and Biotechnology Division
k.jena@irri.org

194. Teodoro C **Mendoza**
Professor
University of the Philippines Los Baños
ecofarm.mndz2011@gmail.com

195. Inez **Slamet-Loedin**
Senior Scientist
International Rice Research Institute
i.slamet-loedin@irri.org

THE REPUBLIC OF KOREA

196. Chang Yeon **Cho***
Scientist
National Institute of Animal Science
binuk6979@gmail.com

THE UNITED STATES OF AMERICA

197. Melinda **Belisle**
Science Advisor
US Department of Agriculture (USDA)
melinda.belisle@fas.usda.gov

198. Bruce William **Blakeman**
VP Corporate Affairs APAC
Cargill
bruce_blakeman@cargill.com

199. Deborah **Carstoiu**
Managing Director, Communications
CropLife International
deb.carstoiu@croplife.org

VIET NAM

200. Leocadio **Sebastian***
Regional Program Leader for Southeast Asia
CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)
l.sebastian@irri.org

201. Nhu **Thu**
Deputy Director General
BioSpring SJC
Thu.nhu@biospring.com.vn

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