**Seminar on**

**Sustainable Food Security in ASEAN – Role of Genetics and New Technologies**

**September 5&7, 2016, Singapore & Kuala Lumpur, Malaysia**

In view of the recent establishment of the ASEAN Community on December 31, 2015, ASEAN Member States have laid out its common vision for sustainable agriculture and food security in the region through the ASEAN Integrated Food Security Framework and Strategic Plan of Action for Food Security for 2015-2020. One of the key elements highlighted in the Framework and Plan of Action is the promotion of sustainable food production, such as by adopting new agricultural technologies to improve productivity and efficiency, reduce post-harvest losses, address climate change, as well as enhance nutrition.

To facilitate the adoption of these new agricultural technologies, it is important that key stakeholders along the value chain, including technology providers, food transporters, food processors, as well as the regulatory authorities, are aware of new technological developments and their potential implication on their respective responsibilities.

As such, this seminar was organized by ILSI SEA Region, AACC International and co-organized by Genetic Modification Advisory Committee (GMAC) Singapore and United States Department of Agriculture (USDA) with the objectives to provide an understanding on scientific and policy challenges for ASEAN agriculture production and food security, share the latest information on advancements in current and future food and agricultural technologies and to provide insight on the developments and potential impacts of new genetic-based technologies on various stakeholders along the food production chain. About 90 participants attended the meeting, including academic researchers, seed/technology developers, grain processors and food industry personnel, NGO representatives and government regulators.

The organizers, Ms. Joani Dong from USDA, Mr. Geoffry Smith from ILSI SEA Region and Dr. Anne Bridges from AACC International gave a welcome speech and opened the seminar.

The first presentation, **Challenges for ASEAN Agriculture and Food Security**, was given by Prof. Paul Teng from Nanyang Technological University in Singapore. He first highlighted the challenges to agriculture, which included environmental degradation and climate change. He then explained several challenges to food security, including supply and demand factors, where there is a decline and ageing of farmer population while increase in population and urbanization, leading to diet changes such as increasing demand for more diverse and high protein food. Prof. Teng recommended that actions taken towards food security should be multi-dimensional. The dimensions of food security include food availability, physical food access, economical food access, and food utilization. His recommendations include increasing agricultural productivity through sustainable technologies to reduce losses, improve transport and infrastructure to link farmers to markets, increase entrepreneurial skills of farmers and keep food prices low and stable, and reduce wastage of food through biofortification as well as improving infrastructure and hygiene to ensure food safety and nutrition security. Prof. Teng concluded that food security is not a single-issue problem and it is important to realize that producing enough food is not the entire solution to achieve food security.

Prof. Timothy Murray from Washington State University, USA, then gave the second presentation on **Challenges for Agriculture and Food Production – Understanding Plant Pathology**. He highlighted the impact of plant diseases, which led to worldwide losses. He explained the drivers of future epidemics, including globalization, evolution and genetic changes, and climate changes. Prof. Murray explained that plant disease management principles included exclusion and eradication of pathogens from other areas using physical methods such as barriers, heat or chemicals and biological methods such as introducing organism or gene products to benefit the crop production. Apart from these two principles, other principles include protection of crops by utilizing pesticides and developing genetically disease resistant plants, giving the example of inserting part of the papaya ringspot virus genome into papaya to resist the effects of the virus. Prof. Murray concluded that a multi-pronged approach is required to limit the impact of plant diseases.

Following the presentations about the challenges, Mr. Sean Roberts from Syngenta, Singapore gave the next presentation on **Crop Protection Solutions – Current and Future Technologies**. He shared Syngenta’s objective which was to help both small and large farmers to meet the challenges of global food security in an environmentally sustainable way. Syngenta’s strategy is focused on coming up with solutions from growers’ and farmers’ perspectives, with global crop offers such as corn, soybean, rice, and other plantation crops. He explained the drivers for developing crop protection products were similar to the challenges that were mentioned in the earlier presentations, including labor shortage, regulations, chemical resistance, climate change as well as new technologies. Syngenta also ensured product safety, where the products do not result in harm to human or the environment through data generation and risk assessment. Mr. Roberts then gave examples of fungicides that Syngenta developed such as Adepidyn™**,** which is a fungicide designed for multiple crops and is highly active against major difficult-to-control diseases, and seedcare solutions such as Isabion, which improved root growth of onions under cold conditions, hence producing higher yield.

Dr. Anne Bridges from AACC International then gave the next presentation on **Modern Plant Breeders Toolbox – Current Technologies**. In her presentation, she listed mutation creation, wild crosses of two species, gene stacking, transgenic plants and back-crossing of genes into varieties. She then highlighted GMO event traits including herbicide resistance, insect resistance, and other agronomic traits such as droughts and nitrogen use. Gene stacking, which is a stacked event, was also mentioned, using plant breeding to combine two or more genetically engineered traits into a single plant variety. It could be a seed stack which the events were combined during breeding or a field stack where the events were combined from pollination in the field. There were many releases that were approved by APHIS and that biotech crops have spread globally. Dr. Bridges shared that farmers are keen to take advantage of these new technologies to increase yield. However, there are gaps in regulation of seed quality and technical advice. Hence, farmers from smaller farms tend to depend on information from other farmers or seed suppliers, leading to gaps in information on global crops and technologies.

Following Dr. Bridges’s presentation on current technologies, Prof. Les Copeland from University of Sydney presented on **A Modern Plant Breeder’s Toolbox:
Upcoming Technologies.** He explained that technological change is the main driver for productivity growth. He then highlighted on the next generation of genome sequencing which involves combining of information from short-read lengths which leads to improved efficiency of plant breeding. Another approach is through bioinformatics, which can be used to find out genetic potential and quantitative traits, through looking at the environmental and plant-soil interactions and exploring microbiomes and epigenome. Prof. Copeland then further explained about microbiomes as microbes co-evolved with plants and crops are essential in the plant’s root, leaf and soil environment. Hence, microbiome is one of the largest gene pool and should be considered in plant improvement strategies. Epigenetics, which are phenotypic variations due to chemical modifications on DNA or proteins, was also highlighted in the presentation. These variations, stimulated reversibly by enzymes which are prone to environmental signals, can alter gene expression and are heritable. Epigenetics play a role in adaptation to the environment and transmitting information to future generations. Apart from the new and upcoming technologies, Prof. Copeland also listed several research frontiers for plant breeders, including reducing exposure to abiotic and biotic stresses, improving root architecture and agricultural systems and compositional changes of grains to improve end use quality. He concluded that the hope is that gene editing technology will be more acceptable to consumers than transgenic technology, with the principle of equivalence of the final product and not just the method of production.

The next presentation is by Mr. Jonathan Fischer from Cargill, USA, on **Meeting the Challenges: Managing Food Ingredients from Multiple Sources – Grain Handler’s Perspective**. His presentation focused on identity preservation (IdP) and purity in the supply chain. IdP actively maintains the identity of a differentiated product through the supply chain, preventing leakage or dilution. Mr. Fischer then explained that prior to completing IdP, the team have to gauge the global demand, secure supplies, manage the supply chain expertise and logistics and test for contractual specifications. He shared that the coexistence of agricultural products with specific attributes are well established in markets, where specialty crops are isolated from generic commodity, and consumers are willing to pay premium price for specialty food products. Mr. Fischer then explained the commercialization principles which involve risk assessment, where the threshold level is determined, risk management, where it is sufficient to prevent going above the threshold level and risk responsibility, where there is a single point of contact for downstream stakeholders to address supply chains. Mr. Fischer concluded that as supply chain participants are moving from independence to inter-dependence, there are new opportunities for for value-added supply chains to emerge and prosper.

Dr. Allan Lim from Nestle, Singapore then gave the next presentation on **Practical Approaches to Address Sustainable Nutrition in Asia**. He explained that sustainable nutrition encompasses the entire value chain from agricultural supply to consumer use. One of the case studies he elaborated on was sweet potatoes as sustainable source of beta-carotene. VitAto, a source of beta-carotene, is a new variety of potato developed by Malaysian Agricultural Research and Development Institute which became the primary crop in Malaysia. VitAto could then be processed into flour and puree which would potentially increase the nutritional value of food products that contained VitAto flour. However, the processed products were not developed, due to consumers’ perceptions where consumers prefer to consume sweet potato as a fresh product. Dr. Lim then explained about the plant protein program. Plant proteins have the potential to fulfil future protein needs with emerging markets that mainly consume protein sources of non-animal origin. Plant proteins can potentially produce higher productivity per acre of farmland as compared to milk, egg and meat, and are more efficiency in production where less water is used in production as compared to animal proteins. Dr. Lim also touched on food waste reduction initiatives across the entire value chain. He concluded that a shared value among the different stakeholders is essential for sustainability in nutrition.

The final presentation was given by Dr. Janet Gorst from FSANZ, Australia, on **Perspectives on regulation of technologies for food crop improvement.** She introduced the Australia New Zealand Food Standards Code, and shared that Standard 1.5.2 addresses regulation for food produced by gene technology. She explained that genetically modified (GM) food has to be regulated because there is no history of safe use or unintended effects and that it is important to provide assurance to developers and public confidence. Dr. Gorst then went on to explain the regulation of breeding stacks, and highlighted that FSANZ does not separately assess food from breeding stacks where food from the GM parents have already been approved, as crossing approved GM plant lines are not likely to pose any additional hazards above what had been considered when the parental lines were assessed. Dr. Gorst also highlighted new breeding techniques, which has been speculated if it should be covered by regulations. FSANZ had hosted technical workshops to discuss various new breeding techniques aiming to improve FSANZ’s knowledge of the techniques and provide advice on whether there are safety concerns. She concluded that even though FSANZ is a regulatory body, they are not a policy-setting agency and hence would not be able to change the scope of the standards and are unable to provide interpretive or enforcement advice.

During the Q&A, concerns were raised by the audience regarding the welfare of the traditional farmers, especially from smaller farms where access to new technologies are limited. There were concerns that there would be secondary standards for farmers to market their products. Dr. Lim from Nestle assured that the welfare of farmers were well taken into consideration by the industry and they valued fair trading with them and values the farming community. Mr. Roberts from Syngenta also shared that they support both large farms and small farms, and have different strategies and approaches for them respectively.

Following the seminar, a closed door workshop was held with the invited speakers and experts, representatives from GMAC, government agencies and research institutions. During the workshop, there was discussion on regulations on gene technologies. There was speculation on whether regulations should be based on the gene modification process or the final product, and that there should be different categories of regulation based on the level of modification, impact on environment and safety of the product. The workshop also discussed on how genetically modified products should be labelled and how it would impact on consumers’ acceptance. The discussion also touched on the cost of testing of new genetically modified products and whether the cost would impact on the manufacturers or the consumers.