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Abstracts of the presentations from the plenary and parallel sessions on 12-13 September 2017. ***(This file will be updated as more abstracts are available. The file was last updated on 30 August and 17 of the 45 abstracts were available at that time).***

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12 September 2017

Plenary Session 3, 08.30-10.30

Personal reflections on the status and challenges regarding use of agricultural biotechnologies in the fishery sector

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Agricultural biotechnologies have been widely and successfully applied in food crops and farmed animals but relatively little has been implemented and should be encouraged in the fields of fisheries and aquaculture in order to enhance the production efficiency and quality, prevent outbreaks of infectious diseases and improve sustainable development of economic aquaculture species.

Because disease outbreaks are the major constraint for development of sustainable aquaculture, biotechnological tools such as molecular diagnostic methods, pathogen identification, and development of recombinant vaccines have gained attention and are being applied in fish and shellfish health management in the Asia-Pacific region including Thailand.

However, biotechnology and genomics approaches applied in the genetic improvement of aquaculture species are still limited and require long term commitment of government and/or private sectors. The opportunities and challenges on applications of fish and shellfish breeding based on transgenic technology and recently developed genome editing technologies will also be discussed.

Parallel Session 2, 10.30-12.30

Knowledge platforms; ongoing initiatives on mudcrab biotech for adoption by farmers
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In this paper, some of the solutions developed at the Practical Genomics Laboratory at DLSU are presented as examples of how biotechnology can be used to develop solutions to crab rearing issues identified by farmers, fishers and field researchers.

The specific needs are as follows: (1) identification to species of wild caught juvenile and instar mud crabs prior to stocking into farms; (2) identification of populations naturally adapted to heat stress for use as broodstock in hatcheries; (3) more rapid conduct of factorial experiments to test for the ideal temperature and salinity combination that hastens molting and (4) possibility of breeding for the market preferred intermediate sex phenotype in cultured populations. The solutions we developed for adoption are based on integration of work on molecular markers with image analysis, GIS and mobile computing. They include (1) CrabAPP – a phone app for species identification to species based on diagnostic DNA regions; (2) CrabADAPT – a RNA-Seq based analysis that evaluates responses of crab populations to heat stress (3) CrabMAP – a simple GIS analysis of temperature range and anomalies in of crab rearing and fishing areas (4) CrabMOLT – using qPCR to determine the best temperature and salinity combinations to hasten molting and (5) CrabSNPs – a genome wide association study on the high value intermediate sex phenotype in crabs for possible use in breeding.

Use of biotechnologies for producing clonal teak as planting materials for smallholders
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The fast decline of natural teak (*Tectona grandis*) forests has accounted for a greater interest in teak plantation establishment. The planting of clonal teak has now become a reality and is a priority for a lot of land owners and investors in many humid tropical countries. Contribution from smallholder farmer plantings can be quite significant given the availability of selected quality planting materials produced from the use of biotechnologies. YSG Bioscape, a commercial subsidiary of the Sabah Foundation Group, has been involved in the mass propagation of superior teak clones that can be planted either as monocultures or in combination with other crops using efficient nursery and *in vitro* propagation techniques since the early 1990s. Jointly developed with the forestry division of Cirad, the technologies allow mass production of clones from any outstanding teak tree selected based on traits such as fast growth, straight bole, minimal branching and high heartwood to sapwood ratio.

The promising yield from planting clonal materials is greatly encouraging to smallholders who are eager to maximize in the shortest delays. Further, the possibility to intercrop teak clones with rubbers, coffee, cocoa or even annuals such as legumes with nitrogen-fixing ability allows farmers to have more practical and profitable land use.

Use of artificial insemination to improve goat meat production in Nepal
Neena Amatya Gorkhali and Saroj Sapkota
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Goat is an important livestock species that has been identified as having potential for reducing poverty in the rural areas of the country. Goats have multifaceted use and serve as handy source of cash at the time of need.

The contribution of goats in terms of food and nutrition security at household level is significant. Goats are being reared by more than half of the farm families in Nepal for their various utilities but primarily for meat (chevon) production and as a living bank during the time of need. This sector contributes to about 4 percent of Agriculture Gross Domestic Product (AGDP) and about 20 percent of the total meat production in the country. There are more than 10 million goats in Nepal, of which 90 per cent are indigenous breeds and owned by the smallholder farmers. To some extent productivity of these goats is low mainly due to low genetic potential of the goat in terms of meat production and lack of good animal husbandry practices. Human populations are growing, and creating a significant and increasing demand for additional animal protein foods. The goat can play an important role in meeting these demands. This calls for farmers to put value in their goat enterprises by shifting from subsistence production to commercial production. It is easier to increase the population of small ruminants (goats and sheep) than large ruminants. In economic terms, the opportunity costs are low for goat production. Nepalese Government has tried many different exotic goat breeds to increase the productivity of goat in terms of meat viz. Jamunapari, Kiko, Barberi, Sirohi, Damascus and many more. High genetic merit exotic goats were brought for this purpose, but could not be successful and ended up in failure. Recently, Boer goat which has average daily weight gain of 200-250 grams per day in their home tract has been introduced. Nepal Agricultural Research Council (NARC) has developed an appropriate goat breeding strategy (Goat Open Nucleus Breeding Scheme) for goat improvement program and Government organization (Livestock Development Services Offices) is an implementing agent to create genetic change in the goat population in order to benefit goat keepers and wider group of stakeholders. Learning from earlier experience, not only live animals are brought in but also semen is collected for them for sustainability. With the popular simple biotechnological tool especially by using Fixed Time Artificial Insemination (FTAI), farmers are getting good genetic material and having more production than earlier. Interestingly, the research revealed around 50% and 25% increment in annual growth rate respectively in 50% and 25% Boer crossbred in farmers' condition in comparison to the common indigenous goat breed, Khari goat. The farmers are enthusiastic to achieve better conception rate from FTAI (using CIDR followed by PMSG) which is about 65%. Hence, implementation of FTAI in wider scale together with systematic pedigree and performance recording scheme will ensure the sustainability of the commercial meat goat production.

Parallel Session 3, 13.30-15.30

Case studies on the impacts of biotechnologies and the missing biotechnologies in aquaculture

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Since 1987, shrimp farming in Thailand initially and gradually evolved into intensive farming of *P. monodon.* During this period, flow-through systems were used to maintain good pond water quality and to accelerate shrimp growth. With two crops a year, the national yield from these systems increased from 23,566 metric tonnes a year in 1987 to about 263,500 tonness in 1994. Pacific white shrimp (*P. vannamei*) farming was introduced in Thailand in 2003-2004. From 2005 to 2008, a new breeding program to promote fast growth of white shrimp and a new super-intensive farming technology were developed. Thailand produced nearly 600,000 tonnes of shrimp in 2009-2010. The Thai Frozen Foods Association (TFFA) reported that during the past twenty years, frozen and processed shrimp have been the most important fishery export of Thailand. Production from closed, intensive shrimp farms created export income of over $3 billion US annually during 2010–2011. [1]

[1]The Food and Agriculture Organization of the United Nations. Regional Office for Asia and the Pacific (Bangkok, Thailand). Sustainable Intensification of Aquaculture in the Asia-Pacific Region/Documentation of Successful Practices. Editors W. Miao and K.K. Lal. 2016. Country Paper 12: Development and Dissemination of Closed (semi-closed) Intensive Shrimp Farming Systems in Thailand. Putth Songsangjinda (Email putths@yahoo.com, Marine Shrimp Culture, Department of Fisheries Kaset-Klang, Chatuchak, Bangkok 10900, Thailand).

Two case studies of the impacts of biotechnologies in aquaculture in Thailand will be presented. The first case is on using HPLC to inspect shrimp products for antibiotic residues in 1997-1998. Investment of about US$10 million in the project by Thailand's Department of Fisheries (DOF) was able to maintain the quantity and quality of export products to U.S.A. and Japan, with a value of more than US$1 billion. The shrimp quality inspection system at farm level in Thailand has developed to include traceability of exported shrimp at the present time.

The second case is on a NACA shrimp project for Thailand in 2016 entitled "Adaptive learning in sustainable aquaculture best practices for small-scale shrimp farmers in Thailand (SSSF-Thailand)". A biotechnological approach was adopted in dealing with PCR screening of brood stock, shrimp larvae and monitoring for acute hepatopancreatic necrosis disease (initially termed early mortality syndrome or "EMS") during the grow out period in six demonstration farms under the project. These practices were in line with DOF's biosecurity measures and certification for shrimp hatcheries (FMD) and grow out farms (GAP)[2]. The project contributes to disease risk reduction and on-farm water management for sustainable shrimp farming for more than 2,000 small-scale shrimp farmers in Thailand.

From genetic perspective, we do not presently have biotechnology that allows aquaculture to adapt to the requirements of new and diverse farming systems, environments and consumer groups. Conspicuously missing biotechnologies in aquaculture are techniques for exchanging germplasm without transferring disease agents such as sterile egg/sperm transfer, nuclear transplantation and genome segment transplantation. Let's get on with it so we can improve the practices and productivity of the aquaculture industry.

Parallel Session 4, 13.30-15.30

Newcastle Disease Virus: from poultry vaccine to malignacy hero

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Food security remains an issue perennially plaguing many developing economies worldwide, including Malaysia. With the unrelenting increase in the world population, agriculture is vitally important in providing both food security as well as food safety, significantly contributing to the development and wealth of nations. To overcome inadequate food supply, four pillars of food security - availability, access, utilization and stability, need be addressed, thus ensuring a continuous food supply for the future. Malaysia, in particular, has formulated the National Agro-Food Policy 2011-2020, giving utmost priority on increasing food production to ensure food supplies are sufficient, of better quality, safe and nutritious at affordable prices. Over the years, Malaysia has achieved significant increase in the production of several basic food items such as rice, fruits, vegetables, fisheries, and poultry. For this talk, we will focus on the development of a poultry vaccine, particularly the role of the Newcastle disease virus (NDV), in controlling disease outbreak for sustainable poultry meat production. We would also highlight an exciting new development - the potential role of NDV in making treatment of cancer more effective and affordable, thus contributing to the good of public health, both locally and globally.

[2] SSSF-Thailand. 2017. Quick Guide for Shrimp Farmers on Disease Prevention and Sustainable Best Practices

The role of genomics in shrimp improvement

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The application of genomics has offered a powerful solution to revolutionize food security and sustainable aquaculture. The genomes of several major aquaculture species have been completely sequenced or are being sequenced including Atlantic salmon, rainbow trout, tilapia, seabass as well as oyster and shrimp. The genome of Pacific white shrimp *Litopenaeus vannamei* has been sequenced and assembled but it is not yet being published. Nevertheless, large numbers of expressed sequence tag (EST) resources and large RNA-Seq datasets have been generated for major shrimp species. The genomic information of shrimp is important for identification of genes associated with metabolism, growth and diseases, biomarker discovery and breeding selection. Recently, we conducted RNA-Seq analysis to identify differentially expressed genes in response to infectious diseases and to identify candidate markers associated with disease resistance in *L. vannamei* in order to assist selective breeding of disease resistance shrimp lines and to develop a platform to evaluate health status of shrimp based on gene expression profiling.

Applications of biotechnologies in the forestry sector

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Traditional breeding methods are often constrained by the long reproductive cycles of most tree species and the difficulty in achieving significant improvements to the complex traits such as wood properties, disease and pest control, and tolerance to abiotic stresses. Biotechnology can be broadly defined as anything that combines technology and biology. It focuses on such things as DNA-level analyses, transfer of genes from a different species, and cloning by somatic embryogenesis. Biotechnology provides important tools for the sustainable development of agriculture, fisheries and forestry. It is one of the fields of scientific research in which the most rapid advances have been made in recent years. Forest trees have entered the genomic era. Biotechnological tools such as tissue culture, genetic transformation, RNA interference, functional genomics, marker assisted selection and QTL etc. have paved road for successful exploitation and integration of scientific fields, both in academia and industry. Advances in micro-propagation, cryopreservation, molecular breeding, transgenesis, *in vitro* culture, abiotic and biotic stress resistances, modification of lignin of trees and integration of such fields will have a great impact in many aspects, and will continue to provide new information, thereby offering exciting prospects for future tree improvement programs worldwide.

Parallel Session 5, 15.30-17.30

Global adoption and regulation impacting technology adoption

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Biotechnology tools have been transforming agricultural research and production landscapes in the last two decades. Cutting-edge biotech crop innovations provide round the clock in-built protection against pests and efficient weed management systems that helped farmers to leapfrog production and productivity of food, feed and fibre crops. In 2016, the global adoption of biotech crops peaked at 185.1 million hectares planted by 26 countries registering an incredible 110 fold increase from 1996. Spreading its root from industrial countries, biotech crops were adopted rapidly by around 16 million small holder farmers in 19 developing countries surpassing the adoption by those in industrial countries. Global experience confirms that biotech crops increases farmers' income not only by decreasing cost of production but also by enhancing productivity through saving of losses caused by pests and weeds. Estimates indicate that biotech crops generated US$167.8 billion additional gain in farmers' income, contributed to large amount of additional food grain

production and increasingly dominate the global trade in food grains, edible oil and meal from 1996 to 2015. Expectedly, biotech crops will continue to be important to meet the 50% increase in food demand by 2050. However, the timely delivery of biotech crops to farmers and consumers will depend largely on a predictable but non-onerous science-based regulatory process, and a pre-emptive role by governments to drive the transfer of biotech innovations from the lab to the land.

Parallel Session 6, 15.30-17.30

DNA Marker Applications in the Management of Farmed Aquatic Genetic Resources in the Philippines
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Molecular marker techniques have evolved quite fast from the simple allozyme protein analysis in the early 1980s to the advanced next generation sequencing methods applied in genetic stock characterization and genomic research. In spite the lack of funds, local laboratory facilities and difficulties in the procurement of reagents for DNA analyses, genetic marker studies to assess populations of major aquaculture species in the Philippines have been pursued through (a) externally funded research internship training, graduate degree thesis researches and/or collaborative projects with foreign academic and research institutions, and (b) for locally funded work, through sequencing services offered by commercial laboratories outside the Philippines. As such, DNA marker research on wild and hatchery stocks of tilapia (to include genetically improved strains), milkfish, shrimp, mangrove crab, abalone, mussel, oyster, seahorse, etc. have either been completed and written about in scientific publications or are in different phases of development. This paper shall briefly cover the status of the use of DNA marker technologies in managing stocks that are important in Philippine aquaculture and the prospects of utilizing such information for the sustainable development of the industry.

DNA markers and DNA profiling to verify species and individuals from confiscated wood in Thailand
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Illegal logging of tropical trees of high economic value in natural forests and protected areas is common due to high demands in international trade. DNA markers and DNA profiling have been acknowledged as an efficient tool to verify species and individuals from confiscated wood in Thailand. There are 3 cases in Thailand. The first case is to verify whether the confiscated mango wood is from the protected wild mango. The results showed that variable nucleotide sites at non-coding trnH-psbA spacer region in chloroplast DNA of the confiscated wood were the same as domesticated mango varieties. The phylogenetic analysis showed that this confiscated wood is genetically more closely related to domesticated mango varieties than to wild mango. This implies that confiscated wood is from domesticated mango rather than protected wild mango species. The second case is to identify whether the confiscated sawdust and confiscated wood at the crime scene are the same species and protected species. Based on the Chloroplast DNA sequence and phylogenetic analysis at non-coding trnH-psbA spacer region and Maturase K gene, the results showed that the confiscated sawdust is from Malvaceae, which is not from protected species and the confiscated wood is from Agarwood (*Aquilaria crassna*). The third case is to identify whether 142 confiscated pieces of wood are from any of 3 illegally logged trees of endangered rosewood (*Dalbergia cochinchinensis*) in the NationalPark. According to the analysis of 9 loci of SSR makers of 64 confiscated wood pieces, it turned out that there were 2 pieces of wood had genotypes and genetic identity to one of stumps of illegally log trees. This means that at least one tree in the National Park was possibly illegally logged. Therefore, DNA forensics is one tool to efficiently facilitate and enhance law enforcement in Thailand as well as help the innocent local people.

Molecular applications in characterization and differentiation of Sri Lankan wild boar (Sus scrofa affinis) meat from exotic and village pig (Sus scrofa domestica) meat

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Correct and precise identification of food and food combinations is vital in ensuring food safety as well as sustainable use of genetic resources in food systems. Cheap food resources are commonly used to adulterate highly demanded food items. Nevertheless, over extraction of natural food resources is continued, despite the regulatory actions for their protection and sustainable utilization. In Sri Lanka use of pork to substitute wild boar meat which is highly demanded but commercially banded item provides a classic example in this context. Attempts were made to differentiate Sri Lankan Wild pig (SLWB) meat from exotic and native domesticated pig (Village pigs or VP) meat using molecular tools. Mitochondrial DNA D-loop marker was successfully employed with PCR-RFLP analysis with a simple restriction digestion using cost effective Dra 1 enzyme. Enzyme targeted two unique polymorphic sites in reverse complement in SLWB differentiating SLWB from VP. As a tool for SLWB meat authentication a synonymous mutation at codon 207 of the Melanocortin Receptor 1 (MC1R) gene of SLWB was identified as a candidate allele which is unique to SLWB. Both the techniques can be routinely applied to authenticate and/or differentiate SLWB meat. Thus, can be a model for other meat authentication process.

13 September 2017

Plenary Session 4, 09.00-10.00

Crop genomics: Towards nutritional security
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Crop Genomics is the study of genes, their function and how the genetic information is organized within the genome of a plant. This field of science provides the essential tools to speed the work of the traditional geneticist where instead of single genes, the whole genome is sequenced and decoded. Through advancements in sequencing technology and bioinformatics, valuable information stored within the crop genome is decoded and used to decipher important cellular and biosynthetic pathways that are important in the production of valuable health benefiting nutrients. Crop genomics has ushered us into a modern breeding era and it is currently our "best bet" for embracing and sustaining nutritional security. This powerful technology has been applied successfully to unlock the potential of genetic biodiversity to develop highly nutritious crop varieties more efficiently than conventional breeding practices. Through its application in breeding program, a saving of up to 40% of operational costs has been reported in crop plants where its application increases efficiency of selecting desirable traits and reduces generation cycles.
This technology can only be fully realised if serious efforts are made towards its awareness and adoption by next generation of breeders.

Plenary Session 5, 10.00-12.00

The use of wild relatives of rice through wide hybridization against drought, salinity, and low temperatures
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Rice (*Oryza sativa* L.) is the most important cereal crop for global food security. It is grown, harvested, and consumed worldwide under a range of agro-climatic conditions, including marginal lands and high-altitude regions, with a multitude of abiotic stresses that are the primary causes of unstable rice production. Rice production is further threatened by climate change-induced conditions, mainly drought due to changes in rain fall patterns, increasing salinity levels in agricultural lands due to rising sea levels, and temperature extremes. The genus *Oryza* has 22 wild species that can survive in diverse habitats. These wild rice species are an important reservoir of novel genes that control agriculturally important traits. Rare traits or genes in the wild species for tolerance to major abiotic stresses such as drought, salinity, and low temperatures have been identified at IRRI. We have transferred some of these genes into modern elite rice cultivars using conventional crossing, backcrossing, and DNA analysis procedures. The new genetic materials we have developed serve as valuable resources for protecting rice farmers against the adverse effects of climate change and in making rice production sustainable.

Development of crops tolerant to adverse environments using agricultural biotechnologies
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There are concerns that global strains on food supply could occur in the medium to long term due to global population rise, chronic malnutrition in developing countries, projected economic growth in emerging

countries, and increased frequency of abnormal weather events. Thus, it is necessary that sustainable agricultural production activities are carried out especially in developing countries where the production potential of the agricultural sector has not been fully harnessed. In order to establish stable and sustainable production of agricultural crops in developing countries that are vulnerable to climate change impacts such as droughts, high temperature, and high salinity, we work on developing breeding materials and breeding technologies including agricultural biotechnologies to produce crops that are highly productive yet adaptable to such adverse environments.

We developed rice near-isogenic lines (NILs) with early-morning flowering trait that mitigates high temperature-induced sterility and soybean NILs with high salinity tolerance using marker assisted selection. Recently, we have shown that overexpression of an Arabidopsis galactinol synthase gene improved drought tolerance in transgenic rice and increased grain yield in the field. By promoting the research to develop environmental stress-tolerant crops using agricultural biotechnologies, we hope to contribute to enhancing and stabilizing agricultural productivity in developing regions.

Climate change impacts and potential benefits of heat stress resilient maize for Asian tropics
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In Asian tropics, millions of smallholders grow maize as rain-fed crop, highly vulnerable to extreme weather events including high temperatures and drought stress. Climate model studies show South Asia is heating up – both day and night. Sharp increases in temperatures adversely affect maize production in many parts Asian tropics. Maize varieties that thrive despite soaring temperatures and water deficits play an important role in adapting to the changing climate. The project Heat Tolerant Maize for Asia (HTMA), supported by USAID under Feed the Future (FTF) initiative of the US Government, is a public-private alliance targets resource-poor farmers of South Asia prone to weather extremes and climate-change effects. Accelerated development and deployment of heat resilient maize gives these farmers a chance to thrive in the face of increasingly volatile weather conditions. The stress-resilient hybrids were developed by using elite maize germplasm from CIMMYT and partners, novel maize breeding tools, such as genome-wide association studies (GWAS), rapid-cycle genomic selection (RC-GS), and double haploidy, supported with precision phenotyping network in the region. Within a period of past four years a total 35 heat-resilient hybrids were licensed to partners in South Asia from public sector, SMEs and MNCs for evaluation, seed scale-up and deployment in vulnerable target agro-ecologies/markets.

Plenary Session 6, 12.00-13.00

The rice blast research network for sustainable rice production
Yoshimichi Fukuta
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Blast **(***Pyricularia oryzae* Cavara**)** is one of the most serious diseases for rice **(***Oryza sativa* L.**)** in world wide. JIRCAS collaborative research project, "Blast Research Network for Stable Rice Production", have been conducted for aiming the developments and distributions of differential systems for resistance in rice and virulence genes in blast fungus, with Asian countries, and CG centers, such as International Rice Research Institute and Africa Rice Center. Under the network research, the differentiations of blast races and rice cultivars, and interaction of them, have been clarified in global level, by the sharing of information among participated countries.

Based on these achievements, genetic improvement of promising rice cultivar in each county are ongoing using the differential system and novel gene sources, and then exchanges of the materials are also planning

for evaluations of resistance in rice developed under different environmental conditions among the collaborative counties.

Sharing of the materials, genes' sources, methods for identification of virulence and resistance genes, and selection methods for resistance plants, will be important for enhance to develop the durable protection system against the disease, among Asian and African countries.