

Not another typical corny trial: Genetic and agronomic zinc biofortification of sweetcorn

Cheah Z^{1,2}, O'Hare T², Harper S³, Kochanek J¹, Kopittke P¹, Bell M^{1,2}

¹The University Of Queensland, School Of Agriculture And Food Sciences, Gatton, Australia, ²Queensland Alliance for Agriculture and Food Innovation, Gatton, Australia, ³Department of Agriculture and Fisheries, Gatton, Australia

Zinc deficiency is widespread in agricultural soils, resulting in ca. 30% of the world's population being considered zinc-deficient. This deficiency is ranked as the fifth leading cause of disease in the developing world, especially among children, pregnant women and the elderly. It has also been associated with age-related macular degeneration (AMD), the leading source of blindness in the developed world.

Biofortification has been shown to be the most cost-effective approach to addressing malnutrition, but zinc biofortification of maize over the last 15 years has not reached its full potential as the tough outer layer, where zinc is deposited, is often removed during processing into flour. A promising alternative is sweetcorn, since the entire kernel is consumed, including the zinc-rich outer layer. Being one of the widely consumed fresh vegetables worldwide, it is a candidate for zinc biofortification research, promising to deliver potential benefits in both developed and developing countries.

This study focuses on zinc biofortification of sweetcorn, a previously unreported research area. In this research, genetic variation for high zinc uptake and storage is being quantified in breeding populations, with suitable candidates identified as potential future parents for targeted crosses. Concurrently, research is also exploring agronomic and fertilizer application strategies that may deliver elevated zinc concentrations in commercial crops. Early results indicate that sweetcorn zinc concentrations could potentially be doubled or even tripled, enabling sweetcorn to contribute a large proportion of the recommended daily intake of this important micronutrient.

Molecular screening of selected rice blast resistance genes in elite rice germplasm from the Philippines and other Asian countries

Aquino J^{1,2}, Undan J¹, Tabanao D³, Collard B², Zhou B²

¹Central Luzon State University, Science City Of Munoz, Philippines, ²International Rice Research Institute, Los Banos, Philippines, ³Dupont Pioneer, San Miguel, Philippines

Rice blast is one of the economically devastating rice diseases that reduce rice production. Resistance to the pathogen (*Magnaporthe oryzae*) is usually a basis for plant selection during variety development. Many rice blast resistance genes have been well characterized, however the genotype for known blast resistance loci in Asian rice varieties is largely unknown. This study aimed to profile broad spectrum blast resistance genes in improved rice varieties. Five resistance loci, namely Pish, Pi2/Pi9, Pi5, Pik, and Pita, were assayed by 5 locus-specific markers and 42 SSR markers. A differential system was used to infer the presence of blast resistance genes by analyzing the reaction patterns of rice entries to 11 well-characterized blast isolates. The plant materials, susceptible checks and monogenic lines clustered into three main groups based on their disease reactions to the differential isolates. The allele segregation pattern for SSR markers among the entries did not show any correspondence to their disease reaction to the differential isolates. The preponderance of varieties with three or more loci combinations strongly implies that blast resistance is considered by breeders as a very important trait in variety development. BSR (broad spectrum resistance) levels of Philippine-released varieties showed a slight increase over a half-century of breeding in the country. The precision brought about by improvements in screening methods has undoubtedly resulted in better resistance levels, but the presence of new varieties with relatively lower resistance spectrum underscores the need to further strengthen breeding strategies and discovery of resistance genes.

Improving livelihoods of rural smallholders in Myanmar through floriculture

Aung T^{1,2}, Prior J¹, Kristiansen P¹

¹University Of New England, Armidale, Australia, ²Yezin Agricultural University, Zay Yar Thiri, Myanmar

The rural livelihoods in Myanmar and the livelihood protocol in order to promote living standards of rural people have been reviewed. This paper has also analyzed the former research on the development of floriculture as an agricultural diversification to increase the income of households in the developing countries. Then, how floriculture is important as a livelihood strategy to promote the socioeconomic status of rural families has been illustrated. Finally, this review has pointed out the areas of the floriculture sector that should be improved for better rural communities in Myanmar.

Preharvest and postharvest handling practices of some cut flowers in selected areas of Myanmar

Aung T^{1,2}, Oo K², Soe T², Nyo N², Thwe A², Prior J¹

¹University Of New England, Armidale, Australia, ²Yezin Agricultural University, Zay Yar Thiri, Myanmar

This study was conducted to examine the existing preharvest and postharvest operation and care practices of some cut flowers in selected areas of Myanmar in 2007. The data were collected by individual interviews using two sets of questionnaires from 102 respondents in Pyinoolwin, Mandalay, Nay Pyi Taw (Pyinmana) and Yangon. The first questionnaire concerning preharvest cultural practices affecting postharvest quality and postharvest handling systems of cut flowers was used in interviewing 31 growers and 5 grower-wholesalers. The second questionnaire was prepared to collect the postharvest handling practices on cut flowers of 6 collectors, 5 town-wholesalers, 30 market-wholesalers and 25 retailers. The stakeholders of cut flower production have strong knowledge on the effects of preharvest cultural practices on postharvest quality of cut flowers and good management of preharvest practices was commonly employed rather than the postharvest handling practices. In transportation and sale processes, the flowers were kept dry by means of dewatering, covering with plastic sheet, and switching on the fan, and kept wet by spraying water, covering with wet clothes, and placing in the water bucket. Postharvest chemical treatment for bud-opening was found only in chrysanthemum. Any other advanced technique was not found in postharvest handling of cut flowers. Transporting of cut flowers before deterioration is a very important postharvest handling practice in cut flower production in Myanmar.

Strengthening agriculture for marginal and Tenant Farmers in Eastern Gangetic Plains: Agrarian relations with Gender perspective in agricultural value chain

Das D¹, Sugden F², Bastakoti R³, Leder S⁴

¹University Of Southern Queensland, Toowoomba, Australia, ²International Water Management Institute, Kathmandu, Nepal, ³International Water Management Institute, Kathmandu, Nepal, ⁴International Water Management Institute, Kathmandu, Nepal

The Eastern Gangetic Plain (EGP) region, which includes Nepal Tarai, is deeply entrenched in poverty and social stratification of class and caste system, consisting high prevalence of unequitable landlord-tenant relations. Agriculture being major source of livelihood, poverty is reinforced by poor access to irrigation water in the dry season, limited irrigation capacity and low agricultural innovation. A project funded by Australian Centre for International Agricultural Research, "Improving dry season irrigation for marginal and tenant farmers in the Eastern Gangetic Plains" is accessing both technical and institutional innovations in water access that addresses both biophysical and socio-economic barriers for sustainable agricultural intensification. In Saptari, the trend of outmigration for better employment influences both local gender relations and global food security, directing women to manage farming process that has remained dominant men's sphere since ages. Here, particularly female-headed households, face new patterns of vulnerability, increase in work burden and limited access to and control over water resources, are strongly linked with class and caste divisions. Concurrently, gender norms are changing, as women's increased mobility and their need to speak up to provide for their families. Results shows collective farming approach can strengthen bargaining power of marginalized farmers for access to water and improved farming production. The contribution of woman especially acting as a collective in the value chain has been important for sustainable production system. Though the need to further explore the resource factors for bargaining power in agricultural value chain could highly support to generate better income to combat poverty.

Molecular Detection of Tetracycline Resistance Genes in Salmonella Isolated From Pork and Poultry Egg

Gaban P¹, Fandialan M², Domingo C²

¹Philippine Carabao Center, Science City of Munoz, Philippines, ²Central Luzon State University, Science City of Munoz, Philippines

Tetracycline resistance in bacteria is a serious issue worldwide due to the frequent use of tetracycline for prophylaxis and growth promotion, aside from disease treatment and prevention among livestock animals. Thus, the present study is focused on the detection of tetracycline resistance determinants (tetA, tetB, tetG) on identified Salmonella isolates from four municipalities of Nueva Ecija, Philippines using a PCR-based protocol.

240 eggs and 180 fresh pork cuts were bought from different wet markets in 10 municipalities of the province of Nueva Ecija, Philippines. All the samples were cultured in non-selective enrichment medium and selective medium for Salmonella bacterial culture and isolation. Isolated colonies were subjected to colony PCR targeting the conserved invA gene of Salmonella spp. Only 13 isolates from the albumin samples and 18 isolates from the pork samples showed the expected 219 bp amplicon size. DNA sequence identified two Salmonella species with 99% identity, these were Salmonella enterica serovar enteritidis and Salmonella enterica serovar typhimurium.

41.67% of albumin isolates from Guimba were positive to tetB and 8.33% are positive to tetA. On the other hand, among the pork samples from Cabanatuan City, Talavera and San Jose City 5% were positive to tetA and 0.91% was positive to tetB. However, tetG was not detected among all the isolates. Thus, the protocol used was able to detect the presence of tetracycline resistance genes. However, a larger study area including all the municipalities in Nueva Ecija is recommended for a more intensive surveillance of tetracycline resistance in the province.

Micropropagation: The future of clonal propagation of avocado

Hiti Bandaralage J¹, Hayward A¹, O'Brien C¹, Beveridge C², Mitter N¹

¹Queensland Alliance For Agriculture And Food Innovations, University of Queensland, St Lucia, Australia, ² University of Queensland, St Lucia, Australia

Avocado is a high demand, high value tropical fruit recognised for its nutritional value. Being planted as a grafted tree, propagation of avocado refers to propagation of rootstock cultivar, then graft it with budwood from a mature scion cultivar. Elite rootstock propagation is critical to maintain the quality of fruit and farm management practices. Rootstock propagation through seeds exhibit high genetic variation, hence less appealing for orchard plantings. Rooting of cuttings is only possible through a complex, lengthy and expensive process called 'Frolich and Platt method'. This creates limitations on rapid industry expansion due to scarcity and high price of plants in many countries including Australia. Alternative propagation methods are sought over 5 decades.

Potential of micropropagation has been well demonstrated for wide variety of economically important plants. However, avocado is highly recalcitrant to in vitro conditions. Over three years of research carried out in Mitter laboratory, University of Queensland has successfully established the world's first high throughput micropropagation pipeline for avocado cv. 'Reed' using shoot tip culture. Various parameters have been optimised to identify optimum conditions for all stages; initiation, shoot induction, multiplication, in vitro hardening, root regeneration and acclimatisation. Large number of plants have been acclimatised with 97% survival under nursery conditions. Micropropagated rootstocks, conventionally propagated rootstock and seedling rootstocks grafted with scion cultivar have been planted in field for evaluation. The technology developed has a great impingement on both Australian and global avocado industry by meeting timely supply of high demand for clonal avocado plants.

MOLECULAR DETECTION OF TOXOPLASMA GONDII INFECTION IN SMALL RUMINANTS IN NORTHWEST TUNISIA

AMDOUNI Y¹, Rjeibi M¹, Rouatbi M¹, Amairia S¹, Awadi S², Gharbi M¹

¹National School Of Veterinary Medicine Of Sidi Thabet, Sidi Thabet, Ariana, Tunisia, ²Regional Slaughterhouse of Béja, 9000, Tunisia, Béja, Tunisia

Between March and October 2015, a total number of 270 meat samples (neck muscles) were collected from 150 ewes and 120 goats slaughtered in the regional slaughterhouse of Béja (North Tunisia). The samples were screened for *Toxoplasma gondii* infection. DNA was extracted using Wizard® Genomic DNA purification kit (Promega, Madison, USA) according to the manufacturer's instructions. Each sample was amplified by a PCR reaction detecting specific *T. gondii* DNA.

The overall molecular prevalence of *T. gondii* in sheep and goats were 33.3 (50/150) and 32.5 (39/120), respectively. The molecular prevalence of *T. gondii* in small ruminants was significantly higher in adults compared to young animals ($p < 0.001$). The infection distribution differed within localities and breed in both sheep ($p < 0.001$) and goats ($p < 0.001$). These results provide important information about human exposure to *T. gondii* through the consumption of raw or undercooked meat.

An extension programme should be implemented to decrease the risk of infection related to sheep and goats' meat manipulation and raw or undercooked meat consumption.

IN-VITRO OOCYTE MATURATION BY RADIAL NERVE EXTRACT AND FERTILIZATION OF THE BLACK SEA CUCUMBER HOLOTHURIA LEUCOSPILOTA

Hoang Dinh C^{1,2}, Cummins S¹, Elizur A¹, Suwansa-ard S¹, Abramov T¹, Shahida Akter M¹

¹*University Of the Sunshine Coast, Sippy Down, Australia,* ²*Research Institute for Marine Fisheries, Ngo Quyen, Vietnam*

The overexploitation of wild sea cucumbers has led to an increasing need to develop its aquaculture. Artificial induction of oocyte maturation followed by in-vitro fertilization represents an innovative approach that could help increase supply. The inducers of oocyte maturation are naturally synthesised within neural tissue, which in sea cucumbers includes a circumoral nerve ring and radial nerves. In this study, we prepared radial nerve extract (RNE) that was incubated with ovary tissue to induce in-vitro oocyte maturation of the black sea cucumber *Holothuria leucospilota* (Brandt, 1835). Maturation was determined by germinal vesicle breakdown (GVBD) at 3 h post-treatment. GVBD was most efficient with 0.7 mg RNE (98.9%), compared to 1.4 mg RNE (77.6%) and filtered artificial seawater (1%). RNE-matured oocytes were fertilized (99%) and larvae developed to late Auricularia stage (25 days post-hatch). These results provide a scientific foundation for the identification of the bioactive RNE factor that may be used for large-scale artificial breeding in black sea cucumber hatcheries.

Prospects of utilizing wild germplasm for future improvement of macadamia

Mai T¹, Alam M¹, Henry R², Hardner C², Topp B¹

¹*Queensland Alliance for Agriculture and Food Innovation, Maroochy Research Facility, Nambour, Australia*, ²*Queensland Alliance for Agriculture and Food Innovation, St Lucia, Brisbane, Australia*

Recent trend of world population growth creates increasing demand for food supply through developing new varieties with improved yield and adaptability. The path of developing new varieties leads to strategies to use the resource of wild genepool. The existing genetic diversity of wild macadamia could help the industry to adapt the changes in weather patterns, emerging pests and possible diseases, and improving economically important traits. Though macadamia is Australian native, but the detail information about the genetic diversity of wild germplasm is still inadequate and the use of wild genepool in the current national macadamia breeding program is limited. We, therefore, aimed to characterise wild macadamia species using an integrated approach encompassing morphological, molecular and biochemical explorations. Investigations will be made on total 301 wild macadamia accessions including 115 *M. integrifolia*, 102 *M. tetraphylla*, 4 *M. janseni*, 9 *M. ternifolia*, and 71 wild trees from mixed/hybrid/uncertain origin populations planted as randomized replicated trials in 2000 and 2001 at Asltonville (NSW) and Tiaro (QLD) respectively. Morphological characterisation will be made on growth parameters, leaf, flower, and nut traits. High-throughput genotype by sequencing (GBS) will be used for genetic diversity study and to identify markers associated with key traits. Biochemical investigation is aimed to explore oil profiling and cyanogenesis in wild macadamia nuts. Comparative molecular investigation of wild and cultivated genepool will provide evidence of domestication signature of macadamia cultivars. This study can be the founding stone of next generation macadamia breeding program by providing key tools for improved productivity and sustainability.

Coconut cloning: towards the sustainability of the ‘tree of life’

Nguyen Q^{1,2}, Biddle J³, Mu Z³, Foale M¹, Adkins S³

¹*School of Agriculture And Food Sciences, The University Of Queensland, St Lucia, Australia*, ²*International University, Vietnam National University, Ho Chi Minh City, Vietnam*, ³*School of Agriculture and Food Sciences, The University of Queensland, Gatton, Australia*

Coconut (*Cocos nucifera* L.) has been widely acknowledged as the ‘tree of life’ in many tropical and subtropical countries as it provides an essential source of nutrition and revenue for millions of people. In recent years, the global demand for coconut products, ranging from food to cosmetics and medicinal use, has been growing precipitously. However, its supply is slowing down due to the falling productivity of senile palms, rapid invasion of lethal diseases and frequent occurrence of natural catastrophes. Clonal propagation of coconut plantlets via somatic embryogenesis has been identified as a promising solution in this context, especially when it is to be used for elite varieties. Nonetheless, how these varieties respond to this treatment is yet to be understood. It is crucial to optimise the embryogenic-to-plantlet conversion as it has been known to be difficult for this recalcitrant species. In this study, five coconut varieties including those with special fruit traits (i.e. makapuno and aromatics) were investigated. Friable embryogenic structures derived from callus clumps were then used for establishment of cell suspension culture. Histological analysis was undertaken to differentiate compact embryogenic callus (CEC) and friable embryogenic callus (FEC). Temporary immersion cultures on a RITA® system were also tested to improve regenerability of plantlets. This work bolsters capacity of the cloning technique on all varieties, offering a sustainable approach for production of coconut seedlings. The paper also discusses a possibility of building a coconut research and training facility in Northern Australia for domestic and international benefits.