IX ISHS International Postharvest Symposium 2024 at Rotorua Events Centre, New Zealand 11-15 November 2024

Postharvest 2024

Grant recipient

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Headlines

Trends in non-destructive assessment of fruit and vegetables:

- In-orchard sensing and predicting
- The use of machine / deep learning
- Insect and insect-damage detection
- Understanding aroma development
- Modelling / analysing ethylene signalling

Background

The ISHS Postharvest Symposium, the most important conference of the field was delayed four years and finally took place face to face November 2024 in Rotorua New Zealand. The organisers Plant & Food Research and Massey University did a stellar job. The event was well attended with 365 participants from over 25 countries. The conference “Postharvest 2024” was a combination of three events brought together with sessions of the IX ISHS International Postharvest Symposium, VII International Symposium on Postharvest Pathology and the X International Symposium on Human Health Effects of Fruits and Vegetables. This conference hosted scientists, industry leaders, and policy-makers for an exploration of fresh produce preservation, sustainability, and health. The ISHS Postharvest Symposium had 271 talks in twelve slots with four parallel sessions, 95 posters and an afternoon slot with eight parallel workshops and another afternoon with five parallel field trips.

Exhibitions were held by sponsoring companies offering commercial sensors and storage solutions e.g. Tomra, Compac, Unitec, ICL, Janssen PMP, Isocell, and the main sponsor was Zespri kiwifruit.

Findings

The opening address was delivered by Giancarlo Colelli, Chair of the ISHS Postharvest Group, who highlighted the ISHS’s pivotal role in fostering the global dissemination of scientific knowledge.

Areas of focus for food waste reduction included extending the postharvest life of fruits and vegetables, preserving nutritional value, valorising food waste into new products, enhancing food safety, advancing processing techniques for organic resources, and improving methods such as anaerobic digestion for waste conversion. A discussion emphasised the difference of the labels ”best before” and “use by” to inform customers of potential for spoilage and not the need for disposal. A call was made for system change by innovation, but also to remind customers of the intangible good around food.

Pre- and postharvest practices play a significant role in influencing the levels of health-promoting phytochemicals in fruits and vegetables. These practices, which can be viewed as part of a "harvest-to-health" approach, include the selection of high-quality cultivars, optimization of growing conditions, harvest timing, and postharvest handling strategies aimed at boosting phytochemicals that benefit health. A number of presenters talked about LED light treatments to enhance fruit quality.

Several studies on sensing within the orchard were presented as well as methods to use biomarkers to predict maturity in-orchard. In-orchard non-destructive sensing of internal quality of fruit is becoming more and more commonplace with the help of data cloud calculation techniques. In addition, the information collected during cultivation is being used to predict storage behaviour and potential for disorder development. An insightful study was presented by Lauri Favre, Plant and Food Research, NZ, which revealed advances in predicting optimal harvest date of ‘Royal Gala’ apples. The work comprised of metabolomic, hormone, enzyme activity, proteomic and transcriptomic analysis. Their next step is to develop a comprehensive understanding of the pre-harvest conditions on the biological pathways in the fruit.

Efforts to extend the shelf life and maintain the postharvest quality of fruits and vegetables typically involve early harvesting, controlled atmosphere storage, and genetic modifications that delay ripening and/or impact texture. While these methods are effective in preserving shelf life and meeting the demands of the fresh produce market, they can sometimes compromise quality. I chaired a session on non-destructive assessment of fruit and vegetables with focus on my special expertise in mechanical properties. Here I had conversations with Andrew McGlone and Sam Langdon-Arms, Plant and Food Research, NZ, on the subject of laser Doppler vibrometry (LDV) to estimate fruit firmness. They have greatly advanced the possibility of measuring kiwifruit on a grading line at high-speed. A new impact technique and a reliable LDV measurement were developed and we were able to discuss what fruit are most likely to give repeatable results.

I had the chance to meet with Mo Li, Massey University, NZ. Our research interests overlap in applying non-destructive optical techniques to solve industrial problems in the horticulture sector. She focused on predicting kiwifruit storage potential by developing mathematical predictive models in the past. She is currently investigating the performance of consumer scale sensors for fruit quality prediction. These sensors take advantage of topographical and morphological details on the skin of crops. This epidermis is the linking tissue between the external environment and the intrinsic make-up of the plant and reveals their effects.

In addition, she is an expert in advanced machine learning methods. It was evident that deep learning tools are now a staple of data analysis in postharvest science, e.g. Pieter Verboven, K.U.Leuven, B, adopted X-ray images and deep learning techniques, in order to find internal infestation of a fruit moth. Due to the global trade of fruit and vegetables, phytosanitary treatments received a special focus section. Physical and chemical treatments to decrease or remove insect and pathogen pressure were presented.

Luke Barnes and Luke Bell, the University of Reading, UK, presented a work on the reduction of peat in Brassica production. In field trials the impact of peat free

cultivation was analysed. Luke Bell is hosting a GCxGC-TOF-MS machine for sophisticated volatile analysis and the flavour profile of the investigated Brassicas was investigated. Several speakers made aroma detection their topic and Randy Beaudry, Michigan State University, USA, in particular examined the ester synthesis as an anabolic process and not a by-product of senescence.

Bart Nicolai, K.U.Leuven, B, gave a talk on modelling the heterogenous distribution of the plant hormone ethylene in tomato fruit at various O_2 concentrations in controlled atmosphere and the diffusion and production of ethylene in the fruit's tissue. In this study, the interaction of ethylene signalling with climacteric respiration was further explored showing the bidirectional interaction of O_2 and ethylene.

Acknowledgements

The event offered a great opportunity to meet with leading professionals in the fields of postharvest, postharvest pathology and horticultural health-related research. I would like to say a big thank you to the Worshipful Company of Fruiterers and the Glasshouse Crops Research Institute (GCRI) trust who made my participation possible by generous travel grants.

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Title of presented work: "Feasibility study to utilize near-infrared spectroscopy as a decision support tool to reduce asparagus tip breakdown"

Personal statement

The conference covered a broad range of fascinating topics in postharvest science, horticulture, and food waste management with emphasis on innovation and new perspectives. The focus on food waste reduction and sustainable practices is crucial in today's context of global food insecurity and environmental concerns. The research on the manipulation of microbial communities is a fresh approach that could offer new insights into disease control, moving beyond traditional methods. The role of phytochemicals in fruits and vegetables for fruit ripening and desired quality was also a key point. The combination of scientific talks, workshops, and a field trip as well as the conference dinner at Hobbiton (the "Lord of the rings" film set), offered a blend of professional development and informal networking.

The symposium started with a traditional Māori welcoming call (Karanga).

Kiwifruit orchard field trip.

Dinner with emerging researchers.