International Horticultural Congress 2022

Event	31st International Horticultural Congress 2022
Date	14-20 August 2022
Organiser	Prof François Laurens, INRAE, France
Delegates & RSA participants	• ~2500 delegates from >100 countries (50% Europe, 23% Asia, 15% Americas, 7% Africa, and 5% Oceania) • Hugh Campbell, Wiehann Steyn, Marno van der Westhuizen, Karen Theron, Esmé Louw, Xolani Siboza, Willie Kotze, Elmi Lötze, Stephanie Midgley, Nicky Taylor, Shelley Johnson, Renate Smit, Elke Crouch, Frederik Voigt, Andrew van Lingen, Adriaan Theron, Rudolph Cronjé, etc.
Programme	• **4 Plenary sessions** (relevant sessions listed) o *Monday 15 August*: Adaptation to climate changes and effect mitigation, o *Tuesday 16 August:* Agroecology/sustainability of production systems, • **18 Workshops** (relevant workshops listed) o Why is regulated water stress not widely used in commercial horticulture? o How can plant modelling be a leverage for cropping system improvement by integrating plant physiology and smart horticulture? o How to transition automated fixed spray systems from research to commercial market for horticultural crop protection? o How to harness innovative technologies for crop pollination? o How can we reach enhanced climate resilience considering sunburn and heat damage in fruit and vegetables production? o What innovative technical and technological approaches developed by researchers for the apple orchards of the future? • **25 symposia** (relevant symposia listed) o S11 Adaptation of horticultural plants to abiotic stress o S12 Water: a worldwide challenge for horticulture o S13 Plant nutrition, fertilization, soil management o S14 Sustainable control of pests and diseases o S16 Innovative perennial crops management (W Steyn served on the scientific committee of this symposium). o S18 Mechanization, precision horticulture, and robotics: precision and digital horticulture in field environments o S23 Postharvest technologies to reduce food losses
Noteworthy symposia and interesting presentations	**S11: International symposium on adaptation of horticultural plants to abiotic stresses** Climate change is posing a serious threat to the sutainable production of horticultural crops by increasing the prevalence of drought and heat stress, as well as increasing autumn and winter temperatures. In this symposium, current research in adaptation of horticultural crops to abiotic stresses; physiological mechanisms of plant adaptation to constrained environments and their molecular, genetic, and epigenetic bases including plant adaptability and plasticity, and plant-environment interaction were discussed:

Interesting presentations

- Genotype-by-environment interactions in major agronomic traits in sweet cherry: flowering date and fruit quality.
- Soil temperature and water stress affect the physiological response, nutrient uptake and distribution of young pear tree.
- Forecasting tree phenology in a climate change context.
- Dominant functions of Japanese apricot PmDAM6 in vegetative bud dormancy by the controls of multiple hormone metabolism, lipid accumulation and cell division.
- Elucidating the molecular mechanism of dormancy control and bud break in apple to prepare for climate change.
- Epigenome analysis identifies dominate role of H3K4me3 over H3K27me3 in dynamic gene expression regulation underlying apple bud dormancy and bud break.
- Effectiveness and mechanisms of dormancy breaking treatments for walnuts.
- Epigenetic and physiological adaptative responses of apple seedlings to drought stress.
- Physiological and molecular mechanisms of cold deacclimation – a crucial part of plant winter survival in a warming world.
- Dissecting peach cold hardiness eco-physiology and metabolism.
- Apple fruit responses to sunburn in Italy.

S12 Water: a worldwide challenge for horticulture

Water resources are becoming scarce in quantity and quality in many parts of the world, while irrigation requirements are rising due to increased water use. This represents serious challenges for the whole horticultural sector, that need to be addressed for the future of the horticultural crop production. This symposium took stock of the high number of existing initiatives from a wide range of actors along the horticultural chain, to favor a holistic approach for improving water use in horticulture while sharing experience between temperate and tropical environments.

Interesting presentations

- Tree water transport dynamics in a changing climate.
- Relathionship between daily intercepted radiation and tree transpiration in pear.
- Spatial decision support systems for precision horticultural water management.
- Using micro-tensiometers to manage water stress to maximize fruit size of apple orchards.
- Water-related climate adaptation strategies for the horticultural sector in the Western Cape, South Africa.
- Final discussion – synthesis of the main points.

S13- Session 03 – Plant nutrition, fertilization, soil management

This symposium presented different strategies to improve plant nutrition, fertilization, and soil management in horticultural cropping systems. Specifically, physiological and genetic mechanisms of plant nutrition, root absorption and nutrient use efficiency were addressed. The characterization

	of agronomic soil quality and the description of innovative cropping strategies with lower environmental impacts were also discussed. **Interesting presentation** • Effect of rootstock on apple tree nutrition. Results indicate that rootstocks differ in efficiency of accumulation of micro and micro nutrients, which may require individual adaptation of fertilizer programmes for specific rootstocks. • Lee Kalcsits presented a similar talk on accounting for crop load to identify rootstock differences in the incidence of nutrient-related physiological disorders in apple. The study showed that some rootstocks behave very differently across a range of crop loads. Prof Kalcsits found a correlation between vigour and incidence of bitter pit while rootstock also differ in their ability to take up minerals. G.41 takes up more K than rootstocks of similar vigour and is therefore more prone to induce bitter pit. **S14 Sustainable control of pests and diseases** Climate change and globalization tend to modify the biotic and abiotic environment of pests and pathogens as well as their geographic distribution. This is conducive to pest and disease invasions and to the emergence of populations with new phenotypes, which in turn may jeopardize established control methods. These global changes stress the importance of monitoring in Integrated Pest Management (IPM) and the crucial need of adapting prevention and control strategies. Management strategies should also aim at being more environmentally-friendly and less detrimental to human health according to the one health concept. Thus, this symposium aimed to address the challenges of working out innovative prevention and monitoring tools as well as sustainable pest and disease control methods in temperate and tropical cropping systems. **Interesting presentations** • Shelley Johnson found presentations on the spotted wing drosophila (*Drosophila suzukii*) and the brown marmorated stink bug (*Halyomorpha halys*) of particular interest as pests of concern. • Renate Smit found the thermonebulization process of disinfection of interest. The process produces very fine particles by means of a special ULV (ultra low volume) type device that generates a light fog that penetrates all cracks or places where other disinfectants or other methods cannot reach. **S16 Innovative perennial crops management** The aim of this symposium was to gather researchers working on innovative findings to increase sustainability of perennial crop agrosystems (including pome and/or stone fruit, and other fruit-bearing trees, shrubs and vines). The symposium focused on studies on evaluation of cultivars and rootstocks and combinations of both in various environments, tree and orchard design and management, plant manipulation including with plant growth regulators (PGR), monitoring technologies for plant development and production, modeling for understanding genetic and environmental regulation of spatial and temporal development and, innovative approaches on perennial crops in their environments, biodiversity and ecosystem services, production in

protected environments, and microbial soil ecology in perennial crop agrosystems.

Interesting presentations

- The effect of a mild winter climate (low chill accumulation) on apple production and how this can be mitigated – keynote by Karen Theron
- Plant growth regulators to increase fruit set on two different ´Williams´ pear orchards in Uruguay: with and without pollinizer.
- Pomological performance of a 2-dimentional planar cordon apple orchard.
- Unifying concepts for understanding fruit trees.
- Effect of harvest time on maturity, fruit quality, and consumer acceptance of WA 38 apples.
- Field testing *Prunus* rootstocks in South Carolina for peach tree short life and armillaria tolerance.
- Studying spatial variability of fruit size within the tree canopy with a functional-structural plant model.
- Advances in precision crop load management of apple.
- Apple russeting: the contribution of vascular and transpiration flows in the early fruit growth development stages.
- The effect of environment and canopy manipulation on the development of red flesh colour in apple.
- Adaptability of apple, plum and cherry genotypes to diverse South African growing conditions.
- Apple replant disease - new insights into an old problem. A biotest was used to identify the presence of ARD within 1 week by identifying the expression of genes that code for phytoalexin biosynthesis. Wiehann Steyn informed Prof Adele McLeod at SU Plant Pathology of these findings.
- Irrigation during ripening may reduce sunburn damages on berries of cv. Sangiovese.
- Effect of different reflective ground covers on light reflection and on the coloring of apples at harvest.

S18 Mechanization, precision horticulture, and robotics: precision and digital horticulture in field environments

This symposium highlighted the recent advancements in robotics, high-throughput phenotyping, and precision and digital horticulture tools and technologies in the field conditions. The overall symposium aimed to support the development and the use of connected sensing and automation technologies (Internet of things/IOT, edge- and cloud-computing, app-based applications), robotics and automation, and artificial intelligence/AI tools for crop modelling, monitoring and management.

Interesting presentation

- The smart orchard of the future

S23 Postharvest technologies to reduce food losses

This symposium focussed on traditional and innovative postharvest techniques including more sustainable and resilient technologies to reduce pesticides, carbon emissions and promote energy efficiency. It particularly

	focussed on quality change, food safety, new knowledge in biotechnology and postharvest physiology, new tools to evaluate maturity and food quality. New horticultural practices related to mechanization, robotization, integrative approach and modelling were also covered. **Interesting presentations** • Innovative advances of postharvest technologies for sustainability. • Key presentations for Renate Smit were on postharvest technologies included low oxygen treatments on peaches, HD cold refrigeration technology and irradiation. She will consider the treatment regimens applied and results from the low oxygen trials on peaches while planning stone fruit trials.
Noteworthy workshops	**Workshop 12: How can we reach enhanced climate resilience considering sunburn and heat damage in fruit and vegetables production?** *Date:* Monday 15 August *Moderator:* Brunella Morandi *Objectives of the workshop:* Discuss the present situation related to sunburn stressors and the actual impact of heat days on pre- and post-harvest diseases observed in different crops. *Main topics that were presented and discussed:* 1. Heat stress and sunburn-related problems on fruit and vegetables crops in different growing regions 2. Sunburn damage in vineyards 3. Estimating fruit surface by means of 3D point clouds as a result from ICT-AGRI-FOOD SHEET project 4. Application of RGB images to estimate fruit position and 3D tree structure 5. Modelling of fruit temperature distribution **Workshop 18: What innovative technical and technological approaches developed by researchers for the apple orchards of the future?** Date: Tuesday 16 August *Moderators:* Claude COUREAU, Pomme et Poire *Objectives of the workshop:* Identify innovative technical and technological approaches developed by researchers for the apple orchards of the future. *Main topic that was discussed:* The Pink Lady® Europe Association – has launched a project to create an experimental network of plots on which the Rosy Glow variety will be grown in 10 European research centres located in the three producer countries: France, Italy, and Spain, to develop innovative and practical technical and technological solutions for technicians and producers. This project is only available to the European growers.
Some additional observations	• Temperature is considered the main driver of tree physiology. It is important to have access to accurate weather stations as well as cleaned-up and complete weather records. However, many weather records in most databases are incomplete. The Phenoflex model can be used for modelling the spring phenology of deciduous trees. It uses the structure

	of the Dynamic Model for chill accumulation and the Growing Degree Hours model for heat accumulation. • The increase of temperature in autumn and winter leads to inadequate winter chilling and heat requirements for flowering. Increase of temperature in spring advances flowering dates and frost risk. • Very few studies on the plasticity of important traits including flowering, maturity dates, fruit weight, fruit firmness or fruit cracking susceptibility, and on the genotype by environment interaction (G×E) in fruit trees – this is a focus area of the ProHort ecophysiology platform. • PmDAM6 causes deeper bud dormancy, early entry into dormancy, and may play a role in regulating ABA metabolism. • Understanding the metabolic mechanisms governing the transition from endo-dormancy to eco-dormancy and growth is critical. • The Washington Tree Fruit Research Commission created the Smart Orchard concept, with an emphasis on fruit harvest automation. The Smart Orchard investment has increased fruit production and quality while also assisting growers in remaining economically viable in a globally competitive economy. However, supporting these developments presents obstacles, including lack of research funds. Building and maintaining public and private partnerships with fruit tree experts throughout the world is the greatest strategy for addressing research funding on robotics or automation. • Nutrient uptake and transport depend on the rootstock genotypes. There is a need to reconsider apple orchard fertilisation programs and adaptation according to rootstock genotypes. To study this, 27 apple rootstock genotypes, and 4 pear rootstock genotypes were planted in 13 countries in Europe. The largest variation of mineral contents caused by rootstock genotypes was recorded for leaf Mn and B, and fruit Ca. G.41 was the most efficient genotype in leaf mineral uptake. This study confirmed that different rootstocks have a different efficiency of the accumulation of micro and macro nutrients in apple tree leaf and fruit tissues.
Key contacts/meetings	• Karen Theron and Wiehann Steyn met with Dr Ines Hanrahan, Executive direction of the Washington Tree Fruit Research Commission. We discussed various issues of mutual interest, including potential collaboration. • Prof Lee Kalcsits of Washington State University and keynote at the recent Hortgro technical symposium spent much time with the RSA attendees. He is very keen on collaboration and keen to visit South Africa on a sabbatical. He intends to collaborate with Esmé Louw on sunburn using the ProHort ecophysiology platform. • Prof Eike Luedeling who leads the horticultural science group at the University of Bonn is a collaborator of Esmé Louw. Esmé in particular spent much time with Eike to further solidify their relationship.

	• Dr Ken Breen leads the Pipfruit and Summerfruit Physiology Science Team at the New Zealand Institute for Plant & Food Research. He recently presented at the Hortgro technical symposium. • Prof Luca Corelli-Grappadelli from the University of Bolgna and Vice-Chair, ISHS Section "Pome and Stone Fruits" will visit South Africa for a sabbatical early in 2023. He intends to collaborate on projects with Elke Crouch, Sebinazi Dzikiti and Elke Crouch. • Prof Bart Nicolai heads the Agrotech division at KU Leuven. He will visit South Africa in early 2023 to collaborate on a project with Elke Crouch. • Prof Dugald Close is the Associate Head Global at the Tasmanian Institute of Agriculture (TIA). Wiehann Steyn had some good discussion with him. • Renate Smit established contact with Prof Achour Amiri of the WSU Tree Fruit Research and Extension Centre re the thermonebulization technology and the potential use of it for disinfestation or fumigation. • Prof Elizabeth Mitcham is the director of the postharvest technology centre at UC Davis. Renate Smit spoke to her about current projects aimed at replacing methyl bromide with fumigants such as Vapormate and nitric oxide on mainly citrus and grapes to control pests such as Fuller rose beetle eggs. • Dr Katherine Jarvis-Shean of the University of California established contact with Drs Siboza and Louw after the symposium for collaboration and sharing findings on rest breaking of apple and walnut.