A publication of the International Society for Horticultural Science

Chronica Horticulturae

Horticultural highlights

Addressing bottlenecks in the postharvest handling of ornamentals • Breeding of sweet potato in Brazil: progress, challenges and opportunities

Symposia and workshops

European Horticultural Congress • Greener Cities: Improving Ecosystem Services in a Climate-Changing World • Biotechnology and Molecular Breeding in Horticultural Species • Protected Cultivation, Nettings and Screens for Mild Climates • Persimmon • Organic Fruit and Organic Vegetables

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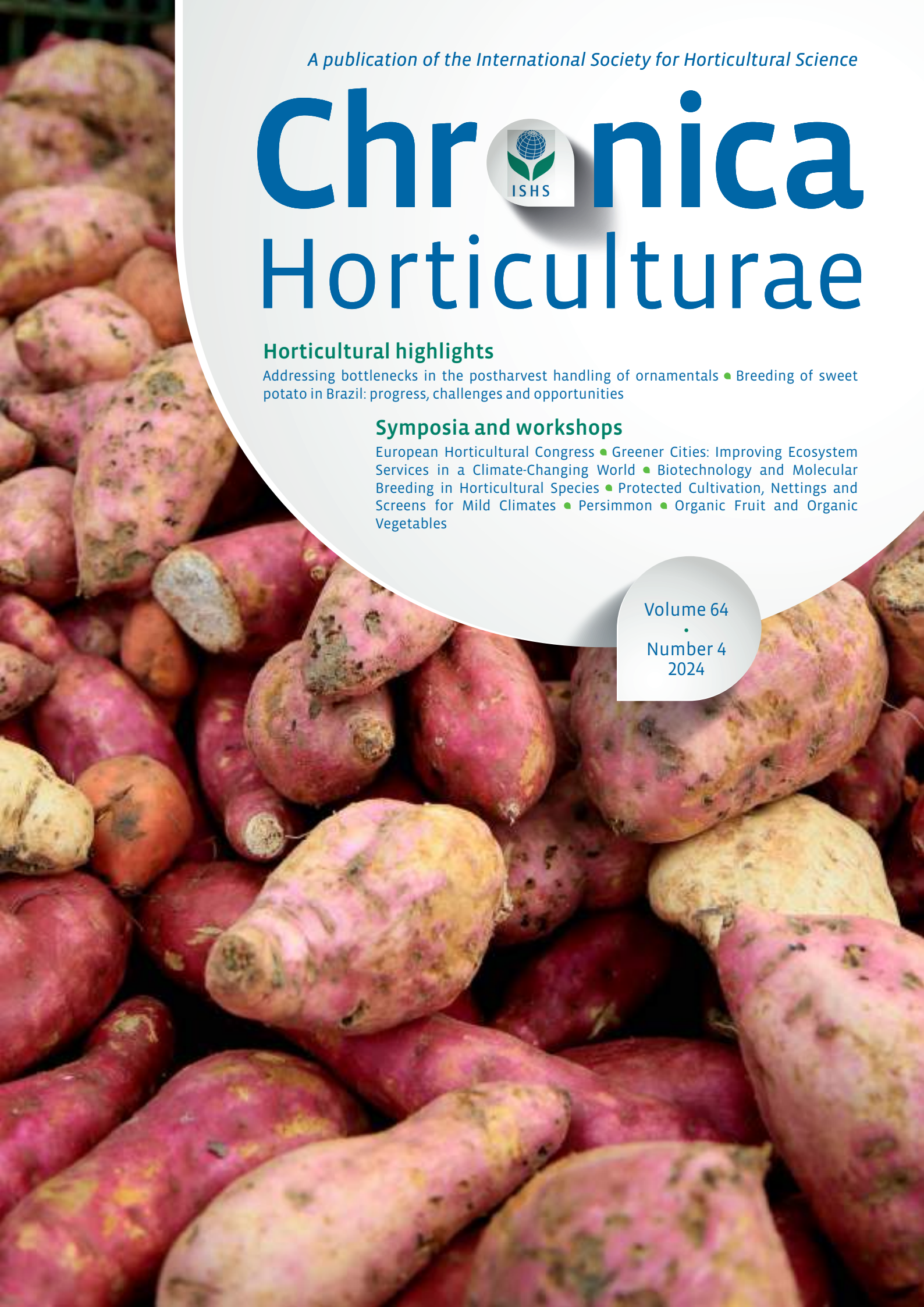

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Cover photograph: Sweet potatoes for sale in Salvador, Bahia, Brazil (copyright: Joa Souza/ Shutterstock). See article p.17.

› Peter J. Batt

› From the cockpit: where has this year gone???

Peter J. Batt, Editor, *Chronica Horticulturae*

In this final edition for 2024, Julian Verdonk and his co-authors seek to address many of the bottlenecks associated with the postharvest handling, transportation and marketing of ornamental flower crops. With more production occurring in the developing countries, due to the lower cost of labour and more favourable growing environments, most of the gains are offset by the increasing costs of air transport and the need for significant investments in the cold chain. With postharvest losses typically exceeding 35%, sustainability is emerging as a key issue. As global conflicts and climate change threaten food security, consumers are beginning to question the value of the cut flower industry and the resources that are committed to it.

To alleviate some of the pressure on the three main food crops (wheat, rice and corn), Valter Carvalho de Andrade Júnior and Orlando Gonçalves Brito describe some of the challenges and opportunities associated with breeding sweet potatoes in Brazil. Sweet potato (*Ipomoea batatas*) is not only the seventh most important food crop in the world, but it's easy to grow, it's low cost, it's highly adaptable and it's rich in carbohydrates, vitamins, minerals and nutraceutical compounds. However, in Brazil, due to the low level of technology applied largely by smallholder subsistence farmers, productivity is well below its potential. To improve the situation, advanced breeding programs at the Universidade Federal de Lavras (UFLA) are focused on the potential uses of the crop for human consumption, processed food production, animal feed, ethanol and ornamental purposes, while simultaneously addressing the adaptability of the crop to water scarcity and severe dry spells in a semi-arid climate.

In this edition, we hear from the conveners of the highly successful European Horticultural Congress in Romania, and three other specialist symposia dealing with biotechnology and molecular breeding, protected cropping and persimmon. On the topic of sustainability, we hear from the conveners of the organic fruit and vegetable symposium, and on a topic very dear to my own heart, the role of plants in supporting improved ecosystem services in our cities. Topics that were discussed included the environmental benefits of green roofs and walls, water management in urban spaces, urban food and environmental policies.

We duly acknowledge and congratulate the many winners of our ISHS Young Minds Awards for their outstanding oral and poster presentations. Staying with the theme of urban horticulture, Caitlin Cook seeks to quantify the impact of artificial lawns on the structure and function of urban ecosystems, while Agata Morelli explores how the introduction of diverse vegetation in an urban environment positively influences local pollinator communities. Luka Batistič tests the efficacy of a tractor-mounted insect vacuum against various hemipteran species on soybean, alfalfa, sorghum, and sunflower crops, while Yaiza Padilla explores the drought tolerance of rootstocks for pepper crops, and Marie Serrie examines disease resilience in stone fruit by exploiting genetically diverse plant material. Attiq ur Rehman employs a multi-model genome-wide association study (GWAS) to investigate eleven crucial traits within a re-constructed strawberry population, while Hikaru Ishikawa seeks to better understand the role of dihydroflavonol 4-reductase (**DFR**) genes in the development of berry skin color of grapes. Kristyna Simkova looks at the sugar, organic acid content and antioxidant capacity of strawberry in relation to the colour stability of puree, while Zinabu Hailu Siyum monitors changes in plum fruit quality during postharvest storage. On a broader scale, Elena Barcanu provides a comprehensive review of vegetable production in Romania. Nicola Cinosi evaluates the suitability of different olive cultivars for their adaptability to high-density cultivation in Italy, while Daniel Ostrowski explores the potential for improved stress tolerance and enhanced fruit set from the addition of iodine to almond, pistachio and avocado trees.

Ferdinando Branca, Chair of ISHS Division Vegetables, Roots and Tubers, provides a comprehensive review of the revised edition of Vegetable Brassicas and Related Crucifers, edited by Geoff Dixon and Rachel Wells. Eight well illustrated chapters cover: i) the origins and diversity of brassica and its relatives; ii) breeding genetics and models; iii) seed and transplant management; iv) developmental physiology; v) crop agronomy; vi) competitive ecology and sustainable production; vii) pests, pathogens and abiotic disorders; and viii) postharvest quality, value and marketing. Karin Hannweg, Chair of ISHS Division Tropical and Subtropical Fruit and Nuts, reviews the text by André Drenth and Gert Kema on Achieving Sustainable Cultivation of Bananas: Volume 3: Diseases and Pests. This book describes the most important pests and diseases affecting banana from pre-planting to postharvest packaging, handling and storage. The book considers methods for disease and pest identification, their management strategies for control, the prevention of outbreaks and epidemics, as well as the development of disease-tolerant cultivars.

Finally, we pay our respects to one of colleagues, Emeritus Professor Miltiadis Vasilakakis, who sadly passed away in August 2024 after a brave battle with major health issues. Prof. Vasilakakis served as President of the Hellenic Society for Horticultural Science for two terms and was an active member of ISHS having participated in many scientific symposia.

As we close off on 2024, in the words of that most famous Hollywood rabbit "That's all folks". I look forward to seeing you all next year. With my very best wishes for the festive season and the New Year, be kind to one another and stay safe.

› Laying the foundations for a revitalized Society

François Laurens, President of ISHS

› François Laurens

As yet another year draws to its close, I want to look back and to reflect on the achievements of our Board over the last 12 months. This year has been one where we have made significant progress across all of our portfolios: science, publications, communication, membership and strategic partnerships. In parallel, we have been committed to addressing some of the most pressing global challenges impacting horticulture.

One of the most effective and impactful achievements of 2024 has been the official launch of the partnership agreement between ISHS and CABI, the result of which will see CABI publish our scientific journal eJHS – *European Journal of Horticultural Science*. eJHS is the official journal of the International Society for Horticultural Science (www.cabidigitallibrary.org/journal/ejhs). It is an international, open access journal that publishes significant plant science discoveries, new and modified methodologies, and applied technologies with a broad, cross-disciplinary focus on global horticulture. Without touching its core values, the aims and scope of eJHS have been expanded, adding a global focus on tropical and subtropical horticulture to better support the community that was previously served by *Fruits*. eJHS covers both applied and fundamental aspects of the entire food value chain, from plant breeding, production, and processing to trading and retailing of horticultural crops and commodities, grown in temperate, Mediterranean, tropical and subtropical climates. Discounted article processing charges (APC) will continue to be offered for ISHS members with special discounts for members from developing countries. The efforts of both Yao-Chien Alex Chang, ISHS Board member in charge of publications, and Renato Paiva, our new Editor-in-Chief, are duly acknowledged in bringing this to fruition. I shall also take this opportunity to thank Sisir Mitra, Editor-in-Chief of *Fruits,* for his service over so many years.

Our focus on engaging Young Minds reached new heights in 2024, with the establishment of an international Young Minds Committee. Under the guidance of Patricia Paiva, ISHS Vice-President in charge of Young Minds, this group has laid the foundations for some important actions, such as mentorship for young horticulturists, a program designed to connect the next generation of scientists with experienced mentors in the field. This initiative will roll out in 2025, offering opportunities for guidance, career development and engagement within the ISHS community. This mentorship program aligns with our strategic goals to not only nurture future talent, but also to ensure that Young Minds are deeply involved in shaping the future of global horticulture.

In terms of membership, we have made significant strides in expanding and diversifying our community. This year, we welcomed a new corporate member: CH Biotech from Taiwan, and the Board has actively sought to build stronger relationships with industry through our participation in Macfrut (Italy) and Hort Connections (Australia). We have revised and reshaped the membership benefits for our professional, corporate and Young Minds, and sought to recognize the invaluable expertise that our senior colleagues bring to ISHS through the creation of a new "retired professional" membership category. Through Lukas Bertschinger, ISHS Board member in charge of strategy to strengthen membership and outreach, we continue to search for ways to create a more dynamic, interactive and collaborative platform for sharing innovations and advancing the impact of horticultural science globally.

Our partnership with the Food and Agriculture Organization of the United Nations (FAO) remains strong, with FAO inviting a number of young scientists to join the V All Africa Horticultural Congress in Morocco in February 2024. We have also engaged with the World Vegetable Centre in Taiwan, and under the leadership of Moctar Fall, ISHS Board member in charge of partnerships, we continue to explore a number of other options to broaden our reach and to engage with other members of the CGIAR consortium, NGOs and other agencies.

As President of ISHS, I am particularly proud of the remarkable achievements we have witnessed this year under our science portfolio, led by our Vice-President in charge of scientific programs, Ted DeJong. I shall also take this opportunity to thank each of our Division and Commission Chairs and especially the many conveners and their supporting organizations. This year, we saw 21 symposia successfully organized worldwide, covering a wide range of topics. In addition, two major regional congresses were held: the V All Africa Horticultural Congress (AAHC) in Marrakech, Morocco, in February, and the V European Horticultural Congress (EHC) in Bucharest, Romania, in May. These events not only brought together a large number of people who shared the results of their scientific endeavors, but also provided a platform for educators, researchers and practitioners to meet, share insights, and discuss the key challenges facing horticulture. Planning, organizing and conducting these events requires a huge amount of effort and determination, for which, on behalf of ISHS, I am immensely grateful.

Under our HortForum series, we successfully hosted three insightful webinars: one focused on fruit postharvest, one on agroecology, and a third thought-provoking webinar entitled 'Perspectives on scientific research to meet academic goals vs. research to directly address industry needs'. I extend my thanks once again to Ted DeJong, but also to George Manganaris, professor at the Cyprus University of Technology, for their excellent work in organizing these webinars. All of these HortForums were recorded and are available on our website (www.ishs.org/hortforum).

I am also indebted to the on-going efforts of Prof. Ryutaro Tao, President of the 32nd International Horticultural Congress, and his team in Japan. They continue to work tirelessly, seeking sponsorship for the event, identifying and selecting keynote speakers, and developing the scientific and social programs. While the event is still some 18 months away, for and on behalf of the Organizing Committee, we look forward to your joining us in Kyoto, Japan, from August 23-28, 2026 (www.ihc2026.org).

As a service organization, our capacity and ability to meet the diverse needs of our membership can only be met by having competent staff. Under the leadership of our Executive Director, Peter Vanderborght, I want to thank Kelly Van Dijck, Dirk Van Holderbeke, Maria Lourdes Minette Testor, Steven Franssens, Jelle Ollivier, and Kantkawee Neraphukieo, for their on-going efforts over the past twelve months.

As we focus our attention on 2025, we will see a number of projects come to fruition. As

mentioned before, the official launch of our mentorship program for Young Minds will be a key milestone in our efforts to inspire and guide the next generation of leaders in horticultural science.

In the spring of 2025, we will embark on an important initiative: the revision of our business model. This on-going work will shape the future of the Society by ensuring that ISHS remains sustainable, innovative and well-positioned to support our diverse membership. By reassessing and refining our business strategy, we aim to better serve the global horticultural community, enhancing our value proposition and increasing our impact on the sector worldwide. This initiative continues to be led by Lukas Bertschinger and our Executive Director, Peter Vanderborght.

To promote and disseminate information about ISHS and our activities, in early 2025 we will launch a new website and a new logo, reinforcing our identity and our forward-thinking vision for the future of horticulture. Here, I acknowledge the extraordinary efforts of ISHS Board member Peter Batt, who is not only in charge of communications and ESG, but as Editor of *Chronica Horticulturae*, has introduced a number of new initiatives that have greatly improved the quality and the appeal of our quarterly publication.

Looking towards the future, new technologies are poised to play an increasingly important role in the evolution of horticulture. The Board and the Executive Committee are particularly excited about the potential of new genomic technologies (NGTs) and artificial intelligence (AI) in transforming plant breeding, crop management, pest and disease control, and climate adaptation strategies. Nevertheless, we will continue to support initiatives such as agroecology and regenerative farming practices that seek more sustainable outcomes and minimize the impact on biodiversity. We expect to see more of these topics embedded within our symposia, the HortForum series and *Chronica Horticulturae*.

As we move into 2025, ISHS stands at the threshold of an exciting new era. We are deeply committed to advancing the science of horticulture through innovation, mentorship and strategic partnerships, while keeping a sharp focus on the challenges and opportunities posed by climate change and technological advancements. Together, we will continue to drive positive change, ensuring that horticulture remains a vital force in addressing global food security, environmental sustainability and the health of our planet.

May I extend to you all my very best wishes for the festive season and the New Year.

On August 13, 2024, the amendments to the ISHS Statutes, approved by the General Assembly of 18 August 2022, were published in the *Belgian Official Gazette* (https://www.ishs.org/statutes-constitution-funding).

Issues

Addressing bottlenecks in the postharvest handling of ornamentals

Julian Verdonk, Aike Post, Dirk Köpcke, John Dole,
Antonio Ferrante, Rob Schouten and Margherita Beruto

The V European Horticultural Congress (EHC2024), which took place in Bucharest, Romania, from May 12-16, 2024, featured the International Symposium on Ornamental Horticulture for the Service of Society. This symposium was organized into three sessions focusing on innovative strategies for breeding ornamental plants, holistic and sustainable practices in the ornamental industry, and the challenges associated with the marketing and distribution of ornamental plants. To bridge the gap between research and industry on key topics, focus group events were held as part of the symposium. In this article, we summarize the discussions in the focus group about bottlenecks in the postharvest handling of ornamentals. The focus group was moderated by Julian Verdonk (Wageningen University and Research, The Netherlands) and included the panelists: Aike Post (Deliflor Chrysanten B.V., The Netherlands), Dirk Köpcke (Esteburg Obstbauzentrum Jork, Germany), John Dole (North Carolina State University, NC, USA), Antonio Ferrante (University of Milan, Italy), and Rob Schouten (Wageningen University and Research, The Netherlands).

Introduction

Scientific research has, on numerous occasions, benefited from collaborations between academia and industry. Several highly cited papers have emerged from these joint efforts, illustrating the impact and importance of exploring emerging problems. These papers highlight how academic research can offer valuable insights and solutions that contribute to the progress of an industry or sector. The synergy between academic curiosity and industry needs to ensure that both realms benefit from the continuous exchange of knowledge and innovation.
Ornamental Horticulture is a diversified and rapidly changing sector. This industry has a great economic impact: 300,000 producer companies with a total surface of about 680,000 ha are ascribed to the worldwide production of ornamentals (Gabellini and Scaramuzzi, 2022). The total estimated production is 53 billion euro, which is equally subdivided between the flower and ornamental segment and the nursery segment (Crespi, 2024). Europe is estimated to contribute a 40% market share. Asia is the continent with the highest number of companies (100,000) and cultivated surface (520,000 ha) and is the world's major producer (the main producer counties are China and India). Other important players include North America with a production value around 19 billion euro (USDA, 2024),

› Discussion during the focus group event held in the framework of the International Symposium on Ornamental Horticulture for the Service of Society at EHC2024.

with Africa contributing around 1 billion euro by production value.

The ornamental sector is encountering several socio-ecological factors that can greatly affect the performance of the production chain: persistent high inflation, causing a strong increase in production costs and consumer prices; international and European-based conflicts; and the persistence of bad growing seasons and extreme weather events. Besides these issues, the ornamental industry is always in need of innovative products (often based on fashion) and the necessity to have high quality products. Finally, there is an increasing demand for more sustainable products. This can be achieved by reducing air transport and moving the chain to refrigerated transport over sea. A reduction in the use of plastics is also going to be a big goal to achieve in the near future.

Total postharvest losses in the floriculture industry are estimated to exceed 35-40%. In general, postharvest losses are the result of the physiology of the living product, and cannot be easily avoided. The most important processes that reduce quality are respiration, senescence, and water loss. The effect of the postharvest chain on these processes determines the final quality. Refrigeration and ventilation are the most important tools to reduce respiration and senescence, thereby prolonging keeping quality. However, ventilation can increase water loss, and cold temperatures can lead to chilling injury in some products. There is also the risk of mechanical damage. As a living plant product, there are challenges, but for ornamentals there is an increasing risk of losing value, because of its fragility and the effect of mechanical damage on the aesthetic value.

To discuss the bottlenecks in the postharvest handling of ornamentals, we address the following topics: transport, sustainability, preharvest and plant breeding.

Question 1. What are the main challenges in the field of long-distance transport, and long-term storage? What kind of research is needed to address these challenges?

Long term storage is crucial as it helps manage demand peaks, such as during Valentine's Day and Mother's Day. It also enables transport from equatorial regions, where year-round production is possible, and labor is more affordable. Current political developments, for example around the Red Sea and the Suez Canal, also increase the need for improved long-term storage. The critical issue is the cost of transportation that can be lowered by using shipping rather than air freight. Several solutions have been adopted to optimize this kind of transportation with, for example, the use of mild-vacuum packaging, but there is, in parallel, a need to develop appropriate pre- and post-shipping treatments to improve vase life.

Prolonging the shelf life of ornamental flowers is crucial for maintaining their quality throughout distribution and sale. Techniques such as maintaining low temperatures, reducing oxygen levels, and using ethylene-blocking agents like 1-MCP are commonly employed to extend their freshness. Keeping the temperature low is particularly important. Flowers generally have high respiration rates, which can cause temperatures to rise during storage. The more widespread use of the cold chain has led to an enormous increase in the range of flowers available. However, the question that remains is how to do this in a more sustainable way.

One major challenge is ensuring that temperatures are consistently maintained at the desired low levels. Inadequate temperature control can drastically reduce flower quality, leading to increased waste and reduced marketability. Cut flowers and foliage should be treated with appropriate cryo-protectants especially if they are stored for long periods. Innovative solutions that increase osmotic potential may help cut flowers better adapt to the low temperatures experienced with long-term storage. Low-oxygen environments and other modified atmosphere solutions can help extend shelf life, but these methods are not widely used due to their high cost and complexity. However, it is expected that the need for long-term transport will only increase, and controlled atmosphere (CA) storage may be the way to achieve this. However, the higher respiration rate of flowers compared with fruits and vegetables might lead to problems, but little is currently known about this. The use of ethylene-blocking agents, though effective in delaying senescence, leads to increased costs and their benefits are not that clear for some species. For example, not all ornamental crops are climacteric: while some roses are climacteric and benefit from ethylene inhibitors, chrysanthemums are not affected by ethylene in the same way.

A new treatment that is being investigated and tried is the gentle freezing of flowers at -0.6°C. This has extended the vase life of a number of species, for example peony, iris and tulip. However, this approach is linked to a relatively underexplored area of research: the impact of chilling injury in ornamental plants. Another difficulty is that for this kind of storage, growers and market intermediaries need modern, high-tech facilities that are costly and seldom available for ornamentals. While some species, such as *Alstroemeria* and *Anthurium*, are known to suffer from chilling injury, the effects on other species are not as well documented. For example, chrysanthemum and rose are both considered sensitive to chilling. Chilling injury can manifest in various ways, including changes in carbohydrate metabolism and a decrease in antioxidant levels due to reactive oxygen species (ROS) quenching. These physiological changes can affect the overall health and quality of the flowers, but they are often not immediately apparent. Improved phenotyping of these physiological phenomena is essential to find solutions, both for current cultivars, and for breeding improved ones.

Question 2. What is the main challenge for the implementation of a more sustainable chain?

The sustainability of the ornamental industry, including flowers, is increasingly questioned due to it being considered a non-essential industry. Unlike food, flowers are cultivated purely for enjoyment and cultural significance, raising doubts about the industry's overall usefulness given its high environmental impact. While flowers enhance happiness and aesthetics, its global operations present significant sustainability challenges. For instance, transitioning from air to sea transport could reduce the carbon footprint. However, global trade introduces difficulties in pest management, raising concerns about the spread of invasive species.

Bouquet makers face additional challenges as they combine products from many different regions, leading to unpredictable outcomes. Ornamentals are typically inspected visually for pests, which are less stringent than the protocols for food crops. While insect pests are problematic, bacteria, fungi, and viruses pose even greater risks. The use of pesticides is becoming more restricted due to regulations and public opinion. Hence the importance of growing and transporting flowers globally being debatable. New methods such as using low temperature control, CA, and UV light, show promise in pest management, but more research is needed to ensure these methods are effective and sustainable.

While the shift from air to sea transport has already been adopted for many ornamental products, there are still questions about the extent of this transition. For instance, how much of the industry has embraced sea transport, and which species are suitable for this method? Sea transport generally offers better quality control due to more stable conditions during transit. Another advantage of sea transport is the possibility of longer storage, which is crucial for handling peak demand periods. Currently, flowers can only be stored for 2-3 weeks, but improvements are needed to extend this duration.

Advanced storage solutions, such as using sensors and digital twin technology, can help monitor and optimize conditions. Lower temperatures, including gentle freezing, may also extend the lifespan of flowers. Importantly, the time between harvest and cold storage needs to be minimized, as even an hour at the wrong temperature can reduce vase life by an entire day.

Question 3. What are the main developments in the field of cultivation?

Preharvest conditions play a critical role in determining the quality of ornamental plants and their postharvest performance (van Doorn, 1996; van Meeteren, 1992; Schouten et al., 2018). The use of bio-stimulants can improve the quality of ornamentals and hence their performance along the distribution chain. Optimal growing conditions lead to higher carbohydrate levels in plants, which are crucial for improving storability and vase life. However, a significant challenge in this area is the ability to measure carbohydrates non-destructively. Hyperspectral imaging and near-infrared (NIR) technology, which have been effective in fruit and field crop analysis, could potentially be even more useful in assessing carbohydrate levels in flower petals.

Sustainable growth practices in ornamental horticulture are also essential, especially given the fluctuating energy prices. Dynamic growth conditions, such as adjusting lighting and heating, based on energy costs, could be a viable strategy. However, this approach is challenging because growth conditions significantly impact the quality of the final product.

Preharvest factors, such as photosynthesis and source-sink manipulations, directly influence the quality of cut flowers. For instance, photosynthesis increases carbohydrate production, while specific growth conditions can manipulate where these carbohydrates are stored. In addition, high humidity during growth can cause increased water loss postharvest due to stomatal malfunction (Verdonk et al., 2023).

The interaction between preharvest conditions and plant genotype is not well understood, complicating the selection of appropriate genotypes for different growing conditions. Flowers are often harvested based on their stage of opening, with expected quality largely determined by the grower's experience. This subjective approach can lead to inconsistent quality, as it heavily depends on the grower-cultivar combination and past experiences.

Preharvest conditions are often overlooked in vase life testing, leading to varied and unreliable results. Factors such as high nitrogen levels, which result in weaker cells, but stimulate growth, and climate conditions, such as high humidity and low vapor pressure deficits, can significantly affect postharvest quality. Additionally, light sources, particularly LEDs, can lower crop temperatures and reduce transpiration, potentially causing postharvest issues. Therefore, understanding and optimizing preharvest conditions are vital for ensuring the quality and sustainability of ornamental horticulture.

Question 4. What role can plant breeding provide?

Breeding ornamental plants for extended storage, transport, and vase life presents several challenges, particularly in the accurate and early selection of traits related to vase life. Early phenotyping for vase life is difficult due to significant seasonal and environmental variations, making it challenging to disentangle genotype from phenotype. Reliable results require large sample sizes, which can be costly. Despite these challenges, it is crucial for companies to conduct extensive vase life testing to gather more data across different cultivars and locations, as current testing methods show significant variability between sites.

One major challenge in vase life testing is that it often occurs late in the breeding process, after 80-90% of the genetic variation has already been discarded. This highlights the need for complexity reduction in breeding programs to make more significant strides in improving vase life quality. For instance, methods have been developed to select against disc floret degreening, a trait less influenced by environmental conditions, which could be key in enhancing vase life.

Breeding programs also face challenges such as chilling injury and the limited use of biotechnological tools like GMO and CRISPR/Cas9 in certain regions, particularly Europe. However, in countries like the United States, these technologies hold promise for improving postharvest quality through traits such as ethylene sensitivity, carbohydrate storage, and water stress tolerance. While gene discovery remains important, there are ongoing debates about the necessity of CRISPR, given the availability of traditional breeding methods. However, CRISPR is more targeted and less cumbersome than methods like EMS.

Another promising approach is RNA interference (RNAi) to silence specific genes in postharvest, offering numerous possibilities for improving postharvest quality. Although still in the early stages of development, RNAi-based methods could provide an alternative to traditional breeding and genetic modification techniques, potentially revolutionizing postharvest quality management in ornamental horticulture.

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Julian Verdonk is an associate professor in postharvest physiology, molecular plant physiology, and specialized metabolites. He obtained his PhD at the University of Amsterdam, The Netherlands, on the production of floral scent in petunia. He did several postdocs in the Unites States (Florida, Wisconsin), and Chile, all on the interplay of plant physiology and specialized metabolite biosynthesis. Since 2014, he has been at the Department of Horticulture and Product Physiology at Wageningen University and Research, The Netherlands. Current research interests are specialized metabolites, postharvest quality, and the interplay between (a)biotic conditions during cultivation on the quality of plant products. He studies genes and gene products involved in enzyme organization and regulatory mechanisms of plant natural products to select plants with improved qualities: better resistance against pests, drought, or salinity, or with better postharvest qualities: better seed set, fruit size or flavor, vase and/or shelf life. E-mail: julian.verdonk@wur.nl

Aike Post is Head of Breeding at Deliflor Chrysanten B.V., working in this role in chrysanthemum breeding since 1997. He is responsible for the worldwide development of new chrysanthemum varieties. He has broad knowledge of cultivation of ornamentals all over the world and the latest developments in cultivation. Deliflor is world market leader in cut chrysanthemums. E-mail: aike.post@deliflor.nl

Dirk Köpcke is Head of the Department of Fruit Quality and Fruit Storage at the Fruit Research Station Jork, which is part of the Chamber of Agriculture of Lower Saxony, Germany. He holds a PhD and a Dipl. Ing. agrar from the University of Hannover, Germany. With over 25 years of practical experience in fruit production, control, and consulting, Dirk Köpcke also brings 19 years of research experience. He has played a significant role in leading and coordinating numerous national and transnational research projects focused on improving fruit quality and storage. Dirk's expertise bridges both practical and theoretical knowledge in the field of fruit growing. E-mail: dirk.koepcke@lwk-niedersachsen.de

John Dole is professor at the Department of Horticulture, North Carolina State University, USA. His research focuses on the production and postharvest physiology of floriculture crops, in particular, cut flowers, poinsettias, and vegetatively-propagated cuttings. John maintains a comprehensive research program on greenhouse and field cut flowers, including new cultivar evaluations, production studies, postharvest experiments, and marketing analysis. In cooperation with the Association of Specialty Cut Flower Growers (ASCFG), he co-coordinates the national ASCFG Seed, Perennial and Woody Plant Trial Programs and serves as Executive Advisor for the ASCFG. E-mail: jmdole@ncsu.edu

Antonio Ferrante is full professor at Sant'Anna School of Advanced Studies of Pisa, Italy. Previously he was professor at the University of Milano, Italy. His research topics include the evaluation of preservative solutions for prolonging storage and vase life of cut flowers and foliage. In particular, the most relevant works are related to leaf yellowing and its control using cytokinins or cytokinin-like activities. E-mail: antonio.ferrante@santannapisa.it

Rob Schouten has been a postharvest physiologist and modeler at the postharvest physiology group of Wageningen Food Based Research (WFBR), The Netherlands, for the last two years. Previously he was involved as assistant professor at the Department of Horticulture and Product Physiology at Wageningen University and Research. His research interests revolve around both ornamental and fruit physiology, often (but not always as he is also involved in PhD projects) in the form of commercial projects. Keywords are modeling of quality relayed processes, long distance transport and storage, volatiles and digital twins. E-mail: rob.schouten@wur.nl

Margherita Beruto is the Chair of ISHS Division Ornamental Plants. She obtained her PhD in Agricultural Sciences and Applied Biology: Cell and Gene Biotechnology in 1997 from the University of Ghent, Belgium. From 2009 to 2021, Margherita Beruto, as Director of the Regional Institute for Floriculture (IRF), Sanremo, Italy, coordinated the research activities of four research units (breeding; in vivo propagation and crop management; pathology and crop protection; and tissue culture) and developed specialized services to support breeders and nurserymen. She is Associate Editor of scientific journals and acted as a Guest Editor for Special issues on Ornamentals. E-mail: margheberuto@gmail.com

Horticultural Science News

› ISHS Young Minds Award winner summaries

Below is a selection of research summaries from winners of ISHS Young Minds Awards for best oral and poster presentations at ISHS symposia. To view other exciting research summaries by other winners, please visit www.ishs.org/young-minds-award

Phylogenetic classification and functional prediction of DFR genes in grape vines

› Hikaru Ishikawa

Hikaru Ishikawa is a Ph.D. student at the United Graduate School of Agriculture Sciences, Iwate University in Japan, where she is currently studying berry color variation in grapes. In Japan, the berry skin color of grapes varies from green to red and black. Grapes with red skins show a red color due to the presence of cyanidin and peonidin glycosides, which are synthesized downstream of dihydroquercetin (DHQ). Hence, the fruit skin color in grapes is determined by the accumulation of anthocyanin and these compounds. In a previous study, MYBA and AOMT loci were identified as the main genetic contributors to grape skin color, but this study was unable to explain differences in the rates of red and blue anthocyanin accumulation in different cultivars. Hikaru is currently exploring the phylogenetic analysis and conservation of amino acid sequences of dihydroflavonol 4-reductase (DFRs) in grapes. DFRs are known to influence polymorphism on anthocyanin composition in ornamental trees. Some red varieties turn purple-black due to the increased accumulation of blue pigments such as delphinidin glycosides, which are synthesized downstream of dihydromyricetin under conditions that are favorable for color development. If the substrate specificity and function of DFR in grapes can be revealed, differences in red and blue anthocyanin accumulation rates in several cultivars can be elucidated, which may prove useful for future orange and pink grape breeding.

Hikaru Ishikawa won the ISHS Young Minds Award for the best poster presentation at the V International Symposium on Woody Ornamentals of the Temperate Zone in Japan in April 2024.

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Adapting stone fruits to pesticide reduction: identification of resilience components and exploitation of genetic diversity via genome-wide association studies

› Marie Serrie

Climate change leads to unpredictable epidemiological disturbances, intensifying the multi-disease and pest challenges in fruit tree orchards, leading to significant damage and economic losses. With an urgent need to reduce the application of phytosanitary products, alternative and durable solutions must be found. As such, disease resilience is an appealing concept that still needs to be explored for fruit trees. The main objective of this PhD project is to gain key insights into disease resilience in stone fruit by exploiting genetically diverse plant material under low phytosanitary protection conditions, and by developing appropriate methodological tools to characterize its components.

Based on the regular monitoring of 10 biotic stress symptoms in a peach (*P. persica*) and an apricot (*P. armeniaca*) core collection under low phytosanitary conditions in five environmentally different locations in southeastern France, we quantified the cumulative susceptibility to the multiple pests and diseases attacking fruit trees, as well as their evolution over the years. The monitoring of several 'resilience biomarkers' (i.e. trunk growth, flower density and fruit load) allowed us to assess the impact of the different pests and diseases on tree health and performance. Several genome-wide association models (GWAS) were tested to dissect the genetic architecture of disease resilience components. In the first approach, an individual study of each biotic stress was undertaken to: i) classify them into different typologies according to the influence of the environment and G×E interactions, and ii) identify candidate QTLs, the majority being environment-specific or interactive. Secondly, based on several multi-trait GWAS approaches, we detected co-localized peaks controlling a diverse range of pests or diseases. Finally, thanks to the development of several indexes based on the combination of disease symptoms and biomarkers, we successfully identified resilient accessions able to cope with the multiple biotic stresses imposed by low phytosanitary protection, thus fuelling the reflection on the design of resilient ideotypes. This work pioneers the exploration of resilience in stone fruit trees

while providing a framework for the identification of disease resilience components. It contributes to a profound and necessary shift in breeding targets to create more resilient agricultural systems.

Marie Serrie won the ISHS Young Minds Award for the best oral presentation at the I International Symposium on Apricot and Plum in France in April 2024.

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Cultivating roots: a historical overview of vegetable growing in Romania

› Elena Barcanu

The story of vegetable cultivation in Romania is one filled with resilience, cultural influences and ongoing transformation. It stretches back thousands of years to the Dacians, the ancient people who grew peas, faba beans and lentils, long before modern farming techniques even existed. With the arrival of the Romans in the 2nd century AD, new crops and more advanced farming methods were introduced, laying the foundation for the future of Romanian agriculture. As time passed, Romania's farming practices progressed with the changing times. During the Middle Ages, the feudal system and numerous invasions brought challenges, but also new opportunities. The Ottoman Empire introduced new vegetables like eggplants and peppers – which are staples of Romanian cuisine today. However, the 19th century was the real turning point. The abolition of serfdom led to a boom in private land ownership and more efficient farming techniques. Scientific methods began to take hold, helping to modernize the country's horticultural landscape. However, the 20th century brought its own set of challenges for Romanian farming. While the two World Wars disrupted everything, the post-war communist era saw massive efforts to increase vegetable production through collectivization. After the fall of communism in 1989, Romania faced a new challenge: transitioning to a market economy. With that came a shift towards organic and sustainable farming practices, reflecting the growing global focus on healthier and more eco-friendly food. Today, Romania produces a diverse range of vegetables – from the classic potatoes and tomatoes to more exotic varieties. However, the country still faces challenges, like a reliance on imports and the need to better organize its horticultural markets. But one thing is for sure: Romania's rich tradition of vegetable cultivation is here to stay, blending the wisdom of the past with the possibilities of the future.

Elena Barcanu won the ISHS Prof. Jens Wünsche Young Minds Award for the best poster presentation at the International Symposium on History of Horticulture in Europe at EHC2024 in Romania in May 2024.

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Why does a pepper rootstock confer tolerance to water stress? The case of NIBER®

› Yaiza G. Padilla

Yaiza G. Padilla is a biotechnologist specializing in the abiotic stress tolerance mechanisms of horticultural plants and plant breeding for climate change adaptation. She is a postdoctoral researcher in the Horticulture Department at IVIA in Spain, where she studies heat and cold stress tolerance mechanisms of pepper plants to obtain tolerant genotypes that could be used as rootstocks for grafted plants to overcome temperature stress conditions in the field. In the awarded paper, Yaiza summarized the main physiological and molecular traits related to water stress mitigation for grafted plants using NIBER®, a hybrid pepper rootstock registered by the IVIA research group as tolerant to water and salt stress. The results demonstrated that the drought tolerance observed in the pepper variety grafted onto NIBER® was a consequence of both constitutive traits and activated mechanisms mediated by the rootstock. As a result of numerous heat stress experiments, the research group has obtained a heat tolerant rootstock whose patent application is in progress. With the use of patented rootstocks, farmers should be able to obtain better yields and superior quality fruit. In-field trials are usually conducted in collaboration with local farmers to test the newly developed hybrids under real stress conditions.

Yaiza G. Padilla won the ISHS Prof. Jens Wünsche Young Minds Award for the best oral presentation at the International Symposium on Sustainable Vegetable Production from Seed to Health Booster Sources at EHC2024 in Romania in May 2024.

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Evaluation of the vegetative-productive behavior of different olive cultivars for their adaptability to high-density cultivation

› Nicola Cinosi

In recent years, a new high-density model requiring low-vigor cultivars has been proposed for renewed olive growing. The aim of the present work was to evaluate the adaptability of Italian cultivars to high-density cultivation. The study began in 2015 in central Italy in an irrigated olive orchard with trees planted at 5×2 m. The cultivars chosen for their low vigor, compact vegetative habit and/or their high production potential were: 'Borgiona', 'Don Carlo', 'FS17', 'Gentile di Anghiari', 'Gentile di Montone', 'Giulia', 'Leccio del Corno', 'Maurino', 'Moraiolo', 'Pendolino', 'Piantone di Falerone' and 'Piantone di Mogliano'. The cultivar 'Arbequina' was used as the reference (control). From 2020 to 2023, measurements were taken to evaluate vegetative growth, yield and oil quality. Most of the Italian cultivars had greater vegetative growth (trunk section and pruned material) than 'Arbequina'. However, with selective pruning, it was possible to maintain the crowns of the trees within the space available. The cultivars 'FS17', 'Gentile di Anghiari', 'Leccio del Corno', 'Maurino' and 'Piantone di Mogliano' had a yield and production efficiency (calculated on per unit of canopy volume) similar to that of 'Arbequina', with 'Leccio del Corno' having the highest production and a production efficiency higher than that of 'Arbequina'. In general, the Italian cultivars had oils with a higher content of phenolic substances than the reference cultivar. Moreover, they had higher oleic acid contents than those of 'Arbequina'. Overall, the results indicate that several Italian cultivars have promise, having shown similar production behavior to 'Arbequina', and high oil quality. Further studies are needed for the long-term evaluation of the cultivars considered.

Nicola Cinosi won the ISHS Prof. Jens Wünsche Young Minds Award for the best poster presentation at the International Symposium on Fruit Production Systems for Sustainable and Resilient Development at EHC2024 in Romania in May 2024.

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Genetic dissection of horticultural traits in a reconstructed octoploid strawberry population: a multi-model GWAS approach

› Attiq ur Rehman

Attiq ur Rehman is a research scientist at the Natural Resources Institute Finland (Luke) and a PhD candidate at the University of Helsinki, under the supervision of Dr. Tuuli Haikonen. With a robust background in plant breeding and genetics, his doctoral research focuses on strawberry pre-breeding, utilizing advanced genomic tools to explore novel allelic and phenotypic diversity within a "Re-Constructed" (ReC) strawberry population derived from elite selections of the progenitor species *Fragaria virginiana* and *Fragaria chiloensis*.

Modern strawberry cultivars and wild-collected accessions exhibit significantly reduced heterozygosity and phenotypic diversity compared to early commercial strawberry varieties. In addressing this issue, Attiq employed a multi-model genome-wide association study (GWAS) to investigate eleven crucial traits within the ReC population. His findings have identified significant quantitative trait loci (QTL) regions associated with eight field-evaluated traits, including winter survival, plant vigor, flowering time, runner vigor, male and female fertility, berry appearance, and productivity. This detailed characterization of adaptiveness within a highly diverse pre-breeding germplasm holds significant potential for future strawberry breeding efforts. The identified QTLs lay a strong foundation for marker-assisted selection, enabling breeders to enhance desirable traits while reducing the influence of unwanted wild alleles.

Attiq's research was recognized with the prestigious ISHS Prof. Jens Wünsche Young Minds Award for the best oral presentation at the International Symposium on Berries between Opportunities and Challenges at EHC2024 in Romania in May 2024. His work not only contributes to the advancement of strawberry breeding but also plays a vital role in addressing the broader challenges of genetic diversity and sustainability within modern agriculture. Part of the work is done under the EU Horizon-funded BreedingValue project.

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Sugar, organic acid content and antioxidant capacity of strawberry in relation to colour stability of puree

› Kristyna Simkova

Consumers appreciate strawberries for their nutritional quality and characteristic flavour. While the distinct flavour can be attributed to the balance between the content of sugars and organic acids as well as the aromatic compounds, the nutritional quality is attributed to the phenolic compounds and ascorbic acid, which also contribute to the antioxidant capacity of the fruit. However, strawberries are not only used for fresh consumption but also for processing. The colour stability of processed strawberry products (nectar or puree) is a concern for the industry. It has been previously shown that ascorbic acid might have a negative effect on colour stability. This study aimed to determine whether there was any relationship between the content of primary metabolites (ascorbic acid, other organic acids and sugars) and antioxidant capacity (DPPH method) of 12 strawberry cultivars and the colour stability of strawberry puree made from this fruit. The sugar content of the strawberry puree ranged from 38-77 mg g^{-1} fresh weight and the organic acid content ranged from 13-26 mg g^{-1} fresh weight. Even though no connection was found between the content of sugars or acids and the colour stability, there was a strong negative correlation (r=0.60) between the ascorbic acid content in the fruit and the colour acceptance factor. However, not all cultivars followed the same trend. Results showed that a high ascorbic acid content in fruit can negatively affect the colour stability of the processed fruit, but it depends on the chosen cultivar.

Kristyna Simkova won the ISHS Prof. Jens Wünsche Young Minds Award for the best poster presentation at the International Symposium on Berries between Opportunities and Challenges at EHC2024 in Romania in May 2024.

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Monitoring changes in plum fruit quality during postharvest storage

› Zinabu Hailu Siyum

Plums, as climacteric fruits, undergo significant physiological changes during postharvest storage, primarily influenced by ethylene production and respiration. This study investigated the effects of storage temperature and duration on the physiological and structural changes of the two most popular cultivars in the Hungarian market. The 'Stanley' and 'Elena' plums were stored at temperatures of 1, 5, 10, and 15°C for 24 days. The ethylene production, respiration and microscopic structure measurements were performed at 4-day intervals. However, some sample groups were terminated early due to overripeness and softening, making it difficult to measure. The results revealed that ethylene production and respiration rate increased with storage temperature, accelerating the ripening process. Additionally, microscopic images showed an increase in epicuticular wax, damaged cells and open stomata after storage, which may be related to the ripening and softening of the plums. Thus, the microscopic technique, combined with ethylene and respiration measurements, is promising for monitoring the structural and physiological changes affecting plum quality during postharvest storage.

Zinabu Hailu Siyum won the ISHS Prof. Jens Wünsche Young Minds Award for the best poster presentation at the International Symposium on Postharvest and Horticultural Products Quality at EHC2024 in Romania in May 2024.

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Exploring the potential for improved stress tolerance and enhanced fruit set with the addition of iodine in almond, pistachio and avocado

› Daniel Ostrowski

The importance of iodine in human diets is well understood, but despite over 100 years of research, little is known about how iodine impacts plants. Prior research has shown that the addition of exogenous iodine has led to a variety of responses based on species (and even varieties), application timing, the form of iodine, and the rate. Documented responses of most interest to this research are: increased stress tolerance and altered bloom timing. This research seeks to determine how the addition of iodine at varying times and through various application methods impacts almond, pistachio and avocado trees during bloom. At this stage of the project, which looks only at almond, we have developed a novel method to analyze and compare treatments in floral progression. This is done at the spur level by using non-linear least square model fitting in R, and at the tree level using raster calculations in ArcGIS on fixed wing, multi-spectral, high temporal resolution imagery. These data show that the application of iodine to almond spurs at the pink-bud stage is leading to more earlier and concentrated flowering with a commensurate 5% increase in fruit set, albeit that these results are statistically insignificant due to the high natural variance. A whole-tree foliar pink-bud application experiment in 2024 has confirmed the timing trend seen in spurs, but it will be necessary to wait until harvest to see if there is any increase in yield. Further work is ongoing to determine if the bloom dynamics noted are evidence of improved pollination due to iodine (mechanism unknown), or because of temporal variability in pollinator availability due to the altered peak bloom date. In the former case, we would expect a benefit each season, whereas in the latter, any benefit would be seasonally dependent.

Daniel Ostrowski won the ISHS Young Minds Award for the best oral presentation at the X International Symposium on Plant Nutrition of Fruit Crops in the USA in June 2024.

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Testing the efficacy of a tractor-mounted insect vacuum against various hemipteran species of shield bugs on crops of soybean, alfalfa, sorghum, and sunflower

› Luka Batistič

Luka Batistič is a researcher and Ph.D student at the Biotechnical Faculty, University of Ljubljana, Slovenia, working under the supervision of Prof. Dr. S. Trdan. Together with his colleagues, Batistič is focused on developing eco-friendly alternatives to chemical pesticides, specifically exploring the use of mechanical pest control methods. Shield bugs (*Pentatomidae*) are a major concern in various crops, and their growing resistance to pesticides has increased the need for more sustainable solutions.

In 2023, Batistič and his team conducted a field experiment to evaluate the effectiveness of a tractor-mounted insect vacuum as a potential solution for managing shield bugs and other bug species. The study was conducted at the Faculty of Biotechnology laboratory field area, targeting four crops: soybeans, alfalfa, sorghum, and sunflowers. These crops were selected as trap crops for stink bugs, and the goal was to determine whether mechanical vacuuming could successfully suppress these bug populations.

The team performed three vacuuming sessions throughout the growing season, assessing stink bug populations before and after each session. Results showed that soybeans and alfalfa attracted the most shield bugs and other bugs (*Miridae*), with the vacuum reducing populations by up to 50% in these crops. Soybeans saw a particularly notable reduction in nymphs, with up to 65% fewer bugs after vacuuming. However, in sorghum and sunflower crops, where bug populations were already low, reductions were minimal.

The study also emphasized the importance of operational parameters. Faster vacuum speeds and specific nozzle positions were more effective at reducing bug populations, especially for nymphs. This suggests that fine-tuning these settings could further enhance the efficiency of mechanical pest control.

Although the tractor-mounted vacuum showed promising results, especially in soybean and alfalfa crops, further refinement is needed to improve its efficiency in controlling adult bugs and optimizing its use across different crop types. With further development, this method could be a practical addition to integrated pest management (IPM) systems, potentially reducing the reliance on harmful chemical treatments and promoting more environmentally friendly agricultural practices.

Luka Batistič won the ISHS Young Minds Award for the best oral presentation at the IV International Organic Fruit Symposium and II International Organic Vegetable Symposium in Poland in September 2024.

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The impact of urban agriculture on pollinator communities: a case study of Bologna (Italy)

› Agata Morelli

Insects are the primary pollinators of most wild flora and food crops around the world. However, global declines in pollinator populations threaten the provision of the ecosystem services that insects provide in both managed and natural ecosystems. Urban agricultural sites are expanding in cities, potentially enhancing sustainability by providing sources of habitat for biodiversity. Yet, the extent to which urban agriculture supports pollinator conservation in cities is poorly understood and requires further exploration. This study sampled wild bees (*Hymenoptera: Apoidea*) and hoverflies (*Diptera: Syrphidae*) at a newly established urban farm in Bologna, Italy. Sampling was performed two years before and two years after the farm's establishment to assess if the introduction of diverse vegetation for agriculture positively influenced local pollinator communities by providing food and nesting resources. Using observational plots and pan traps, the pollinator diversity was monitored and plant-pollinator networks were constructed to illustrate the interactions between trophic levels and the ramifications of species decline. The findings showed an increase in ground-nesting and specialist bee species following the farm's establishment, along with the presence of rare hoverfly species. This suggests that urban agriculture could provide the green infrastructure that over time supports pollinator conservation by providing adequate areas of habitat and refuge. The results also underpin the need for greater attention to non-bee pollinators, such as hoverflies, especially in urban environments where the decline in bee populations is most pronounced. As urban agriculture harnesses environmental, economic and social value, understanding the ecosystem services that fundamentally sustain it is vital for the adoption of effective conservation strategies to provide suitable habitats for pollinators.

Agata Morelli won the ISHS Young Minds Award for the best oral presentation at the III International Symposium on Greener Cities: Improving Ecosystem Services in a Climate-Changing World (GreenCities2024) in the United Kingdom in September 2024.

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Faux-tanical gardens: the impact of artificial lawns on the structure and function of urban ecosystems

› Caitlin Cook

Urban areas are under increasing pressure to contribute to the mitigation of the climate impacts arising from urbanisation. Urban greenspaces, including natural lawns, are recognised as critical resources for ecosystem service provision. Natural lawns contribute a variety of ecosystem services including carbon sequestration, water absorption, and mitigation of the urban heat island effect. However, in recent years, there has been a rise in the installation of artificial lawns that could threaten these contributions to ecosystem services. Artificial lawns have been found to increase run-off and decrease infiltration compared to natural lawns. Additionally, satisfying the cultural need for green space with artificial lawns could shift expectations towards the removal of nature from domestic spaces entirely. Furthermore, there are many unknown impacts from the removal of topsoil, a potential increase in temperature, usage patterns, and method of installation of artificial lawns. Caitlin Cook is a PhD researcher at Northumbria University where she is investigating the impacts of artificial lawns in domestic gardens on the structure and function of urban ecosystems. This involves using remote sensing image classification to quantify the area covered by and the uptake rate of artificial lawns, as well as analysing which garden and land cover types are being removed for artificial lawn installations. Caitlin has developed an online survey to assess the socio-demographic patterns in artificial lawn ownership, people's motivations for installing artificial lawns, and how they use them. The next steps in her research involve setting up ground-level experimental plots to compare the ecosystem functions of natural and artificial lawns. This interdisciplinary research will inform the scale of impacts of artificial lawns and assist in promoting a shift towards more sustainable gardening practises. Caitlin's project is funded by the NERC OnePlanet DTP and the Royal Horticultural Society (RHS). She is under the supervision of Dr. Mark Goddard and Dr. Miranda Prendergast-Miller from Northumbria University, Dr. Rachel Gaulton from Newcastle University, and Dr. Chloe Sutcliffe from the RHS.

Caitlin Cook won the ISHS Young Minds Award for the best poster presentation at the III International Symposium on Greener Cities: Improving Ecosystem Services in a Climate-Changing World (GreenCities2024) in the United Kingdom in September 2024.

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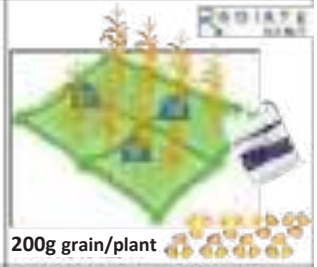
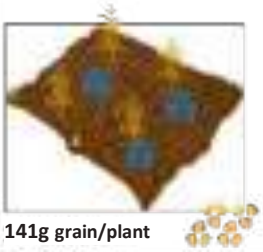
Under reduced fertilizer use

-40% Fertilizer use	Radiate NEXT
	
164g grain/plant	200g grain/plant
-20% Yield loss	Yield recovered

Under reduced fertilizer use + drought

-40% Fertilizer use + drought	Radiate NEXT
	
141g grain/plant	179g grain/plant
-30% Yield loss	+20% Yield recovered

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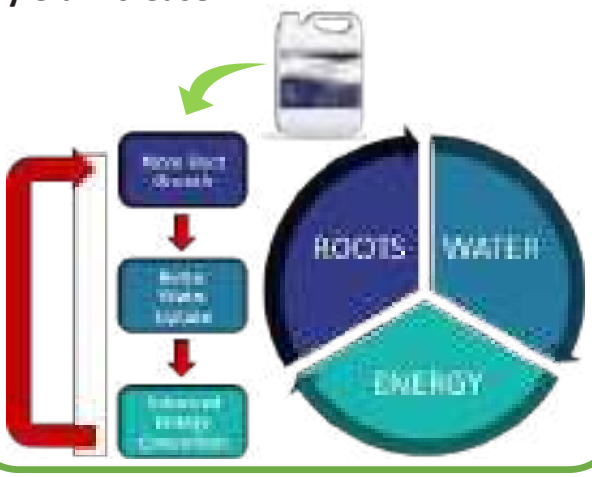

For more information, please contact us: info@chbio.com.tw

Breeding of sweet potato in Brazil: progress, challenges and opportunities

Valter Carvalho de Andrade Júnior, Orlando Gonçalves Brito and Jeferson Carlos de Oliveira Silva

Sweet potato (*Ipomoea batatas* (L.) Lam.) is a highly nutritious species, rich in carbohydrates, vitamins, minerals, and nutraceutical compounds (Mohanraj and Sivasankar, 2014; Bach et al., 2021). Moreover, the plant is recognized as the seventh most important food crop in the world (Tan, 2015; Laryea et al., 2019; Santos et al., 2021). This is mainly due to its ease of cultivation, low implementation cost, and good adaptability to different growing conditions (Vizzotto et al., 2017).

In 2021, 89.5 million tons were produced on 7.4 million hectares worldwide, with an estimated production value of USD 60 million (FAOSTAT, 2023). In 2020, China was the world's largest producer, accounting for 49.2 million tons from a planted area of 2.3 million hectares (FAOSTAT, 2023). The crop also holds significant economic and social importance in Brazil, where it is widely cultivated, especially by smallholder farmers for subsistence purposes (Costa et al., 2022). However, Brazil is only the 15th largest sweet potato producer (FAOSTAT, 2023).

Despite this, according to data from the Brazilian Institute of Geography and Statistics (IBGE), the area cultivated with sweet potatoes in Brazil increased by 20.7% between 2016 and 2020 – from 49,554 to 59,790 ha, respectively (IBGE, 2022). This led to a 26.7% increase in production, from 669,454 t in 2016 to 847,896 t in 2020. Another highlight during this period was the 26.1% increase in the production value, rising from R$ 801.23 million to R$ 1.01 billion (IBGE, 2022). This production increase reflects the growing demand for sweet potatoes, mainly driven by the rising demand for healthier diets (Costa et al., 2022). However, despite the increase in area and production, the growth in productivity during the same period was considered low (1.3%), rising from 14.07 t ha^{-1} in 2016 to 14.25 t ha^{-1} in 2020.

The vast majority of the world's sweet potato production (98.6%) takes place in developing countries. However, due to the low level of technology applied in these crops, the average productivity is well below the crop's potential, which can exceed 40 t ha^{-1}. It is important to note that with the application of minimal technology, yields of 25 to 30 t ha^{-1} can be easily achieved in just 4-5 months after planting (Andrade Júnior et al., 2009).

A similar scenario is observed in Brazil, where low productivity is mainly due to the limited adoption of technologies in cultivation. This factor is directly related to the scarcity of genotypes adapted to various agricultural regions, resulting in yields well below the crop's potential (Andrade Júnior et al., 2018; Brito et al., 2021; Silva et al., 2022). This technological gap is largely due to the traditional species being predominantly used by smallholder farmers and the ease of vegetative propagation. These characteristics reduce the farmers' reliance on seeds and consequently discourage private companies from investing in genetic improvement. Therefore, there is a role for public institutions to support research and technological innovation to enhance sweet potato cultivation, especially with regard to genetic improvement.

In recent years, the genetic improvement of sweet potatoes in Brazil has advanced significantly. The plant breeding program at the Universidade Federal de Lavras (UFLA) is well-established, focusing on the various uses of the crop, such as human food, animal feed, industry, ornamental purposes and ethanol production, as well as drought tolerance. The program currently has a portfolio of approximately 200 elite genotypes, pre-selected for different desirable traits, with around 15 of them under evaluation for registration as new commercial cultivars. Most of these genotypes were developed through recombinations via polycrossing between previously selected parents, followed by the screening of superior individuals (Brito et al., 2021; Silva et al., 2022). The first

Figure 1. Research group conducting fieldwork at the Center for Development and Technology Transfer (CDTT) of the School of Agricultural Sciences (ESAL) of Universidade Federal de Lavras (UFLA), Ijaci, MG, Brazil.

Figure 2. Center for Development and Technology Transfer (CDTT) of the School of Agricultural Sciences (ESAL) of Universidade Federal de Lavras (UFLA), Ijaci, MG, Brazil.

genotypes of the program came from UFLA's sweet potato germplasm bank. These initial parent plants were recombined in the field between February and November 2017 in the municipality of Lavras. Of the 81 progenies initially used, 55 flowered and underwent recombination, resulting in the production of 12,903 botanical seeds (C1 Cycle). Based on seed productivity and root production history, 31 of these progenies were pre-selected, and from them, 2,000 seeds were chosen to continue the development of new clones and agronomic testing (Figures 1 and 2).

The selected seeds were sent to the Vegetable Evaluation Laboratory at UFLA's Horticulture Sector, where seed dormancy was broken using sulfuric acid. The chemical scarification process followed the methodology described by Rossel et al. (2008). After scarification, the seeds were placed in Gerbox boxes, on Germitest paper, and irrigated with distilled water. The boxes were labelled and placed in BOD (biological oxygen demand) chambers for germination under a 12-hour photoperiod at a temperature of 25°C for seven days. At the end of the sulfuric acid treatment, 81.4% of the 2,000 seeds germinated, resulting in 1,627 seedlings.

After germination, the seedlings were transplanted into polyethylene trays with 162 cells, containing artificial substrate, and kept under irrigation in a greenhouse for 30 days. Subsequently, the seedlings were transplanted into soil beds 1.0 m wide and 0.25 m high, spaced 0.25 m between plants and 0.30 m between rows, separated by progeny. The purpose of this stage was to produce stems in a nursery for later cloning of each genotype (individual from a botanical seed). This initial production phase is referred to as 'A – Clones' by the International Potato Center (CIP, 2009). After three months of growth in the beds and stem production, three stems (6 to 8 buds and 0.3 to 0.4 m) were collected from each plant and planted in the 'clonal evaluation' phase in ridges. This process and the results obtained are described by Silva et al. (2022).

The new clones developed in this research form the foundation of the program's genetic diversity and are continuously recombined with new introgressions over the years. It is also noteworthy that, in recent years, the program's researchers have concentrated their efforts on establishing controlled diallel crosses to more rapidly select for traits of interest, thus reducing the time required for developing promising genotypes. These described processes have been fundamental for preserving the program's genetic diversity, which includes numerous studies focused on recurrent selection, with an emphasis on different agronomic traits.

Sweet potato is a crop with a wide variety of uses (Gonçalves Neto et al., 2011; Silva et al., 2022), including human food (Costa et al., 2022), animal feed (Andrade Júnior et al., 2012; Azevedo et al., 2015; Donato et al., 2020), and biofuel production (Vieira et al., 2015; Viana et al., 2017). The UFLA breeding program covers various research areas, including the development of biofortified genotypes for human consumption (Costa et al., 2022; Silva et al., 2022), promising genotypes for leaf consumption in human diets (Gama et al., 2023), genotypes for animal feed (Silva et al., 2022), and genotypes with potential for ethanol production. Recent studies also reveal innovative results highlighting the crop's great potential for ornamental use (Souza et al., 2022). Currently, new university projects have prioritized the development of high-performance genotypes for industrial applications, such as processed food production and bioethanol production, as well as the identification of genotypes with greater drought tolerance. In one of the experiments most recently carried out, sweet potato farmers participated in the evaluations, carefully considering the characteristics that they most value in a new sweet potato cultivar (Figure 3).

Among these various lines, those focused on the search for high-performance industrial sweet potato cultivars stand out the most (Terres et al., 2012). This potential application arises from the high starch concentration in the roots (Ali et al., 2012), the versatility in terms of both flesh color and texture (Truong et al., 2018), and the low production cost of the raw material. Additionally, sweet potato possesses other important characteristics compared to other roots and tubers, such as a shorter production cycle and higher nutritional value (Truong and Avula, 2010; Truong et al., 2018). Therefore, sweet potato emerges as a highly competitive industrial raw material compared to crops like corn, wheat, cassava and potato (Sharavati et al., 2019; Bach et al., 2021). Its most notable uses in the food industry include the production of flours, chips, fries and food colorants.

The use of sweet potatoes for the production of bioethanol, which uses both the roots and

Figure 3. Participatory breeding, involving local farmers who cultivate sweet potatoes. CDTT/ESAL/UFLA.

Figure 4. Project for the selection of drought-tolerant biofortified genotypes at the Vegetable Sector of Department of Agriculture of Universidade Federal de Lavras (UFLA), Lavras, MG, Brazil.

Figure 5. Professor Dr. Valter Carvalho de Andrade Júnior, responsible for the sweet potato breeding program at UFLA, along with students from the UFLA/CNPq research group on "Production and Breeding of Vegetable Species", at Fazenda 3W Agronegócios, in Itutinga, MG, visiting the sweet potato production area.

leaves, also has great potential in Brazil. The search for renewable and sustainable energy sources has intensified in recent decades due to growing concerns about climate change, the depletion of fossil fuels, and the need to reduce reliance on non-renewable energy sources. Among the proposals to mitigate these effects, the use of biofuels derived from clean energy sources stands out, such as ethanol produced from agricultural crops. In Brazil, while ethanol production is currently derived primarily from sugarcane and corn, research has shown very favorable results for ethanol production from sweet potato. Viana et al. (2017) obtained promising genotypes, such as UFVJM 28, with root yields of 43.8 t ha^{-1}, excellent starch content, and high digestibility of both roots and stems. These characteristics resulted in excellent ethanol yields, reaching 5,930 L ha^{-1} in 180 days and 11,860 L ha^{-1} per year, demonstrating the competitive potential of sweet potato compared to sugarcane. Furthermore, utilising the crop as a complementary alternative to sugarcane could significantly contribute to the economic and social development of rural regions while ensuring greater sustainability.

In addition to these advantages, there is an urgent need to diversify biomass sources for biofuel production, which will contribute to ensuring energy security and sustainability. Expanding the range of crops for energy production is crucial for protecting food security, as it reduces competition for widely used food crops such as corn, soybeans and sugarcane, which are often used for energy production. Another relevant point to consider is that Minas Gerais, one of the most industrialized and agricultural states in Brazil, faces significant challenges in balancing its economic development with environmental sustainability. It is important to highlight that, despite numerous research efforts related to this topic, there are still no cultivars developed exclusively for this purpose. Furthermore, the country lacks significant investments in technologies aimed at maximizing bioethanol production from this crop, as well as in creating a logistics network and basic infrastructure to enable the activity.

Studies on tolerance to abiotic stresses are essential for the technological dissemination of sweet potato cultivation. Although the crop is well-adapted to different growing environments and exhibits significant drought tolerance, severe water deficits can compromise productivity by more than 70%. Therefore, the development of cultivars better adapted to drought conditions is a strategic action for increasing productivity. In Brazil, this is a priority for regions with a semi-arid climate, where water scarcity and severe dry spells occur during the rainy season. Since sweet potato is predominantly cultivated by small farmers, even where it is possible, the intensive use of irrigation can make sweet potato production economically unfeasible due to significantly higher production costs. Thus, developing drought-tolerant genotypes that can promote substantial increases in root productivity, even under conditions of intense water deficit, is a major challenge.

In the context of food security, sweet potato genotypes with orange and purple flesh are strategic foods for feeding populations in vulnerable regions with nutritional deficiencies, as they are functional foods with great biofortification potential. Currently, various research projects are being developed for this purpose at UFLA, mainly aiming at the development of genotypes with a colored flesh. There is also research related to biofortification through fertilization with micronutrients such as selenium and iodine. The results of this research to date have been quite promising.

Currently, research on drought tolerance and biofortification is being conducted in a network project (Figure 4), coordinated by Professor Dr. Valter Carvalho de Andrade Júnior from UFLA (Figure 5) in partnership with other educational and research institutions in Brazil, such as the Universidade Federal de Viçosa (UFV), the Universidade Federal de Minas Gerais (UFMG), the Universidade Federal dos Vales do Jequitinhonha e Mucuri (UFVJM), and the Empresa de Pesquisa Agropecuária de Minas Gerais (EPAMIG), as well as West Virginia University in the United States. Together, these institutions form the Sweet Potato Research Network of the State of Minas Gerais, dedicated to studying the crop through assisted selection with molecular markers. This is the only research network focused on sweet potato in Brazil, established with the support of the Fundação de Amparo à Pesquisa do Estado de Minas Gerais (FAPEMIG).

In the last two years, the sweet potato genetic improvement program at UFLA has launched two new high-performance commercial cultivars. The first, launched in 2022, is 'UFLA R1440'. This cultivar stands out for its very intense purple flesh and excellent root shape (Figure 6). This new

Figure 6. Purple-fleshed cultivar 'UFLA R1440', developed and registered by UFLA, registration no. 52779.

cultivar is recommended for cultivation in the southern region of the State of Minas Gerais and has an average root productivity of around 40 t ha^{-1}. This productivity is approximately three times the national average. 'UFLA R1440' is recommended for human consumption, agro-industrial use, and landscaping.

The other cultivar developed by UFLA is 'UFLA B556', registered with the Ministry of Agriculture in 2023 (Figure 7). This cultivar has intense white flesh, which is important for Brazil, as it is the main flesh color demanded by the Brazilian market. The cultivar also has high productive potential, with the capacity to produce an average of 45 t ha^{-1} of high-quality commercial roots. 'UFLA B556' is also recommended for cultivation in the southern region of the State of Minas Gerais and for similar uses.

Figure 7. White-fleshed cultivar 'UFLA B556', developed and registered by UFLA, registration no. 54454.

It is observed that sweet potato breeding in Brazil has shown significant advancements, reflecting the growing importance of this crop for both food security and economic and environmental sustainability. Efforts directed towards research and the development of cultivars adapted to the different edaphoclimatic conditions of the country have increased the productive potential and competitiveness of sweet potato. However, challenges persist. The scarcity of investments in science and technology and inadequate infrastructure for the production chain are obstacles that require attention and coordinated action from policymakers and institutions. Promoting partnerships between research institutions, universities, and the private sector can be an effective strategy to overcome these barriers, enhancing the use of innovations and sustainable technologies.

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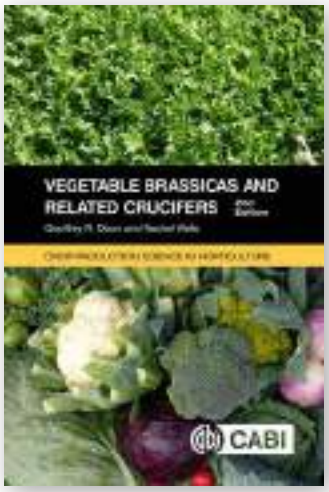
› New books, websites

Book reviews

The books listed below are non-ISHS-publications. For ISHS publications covering these or other subjects, visit the ISHS website www.ishs.org or the *Acta Horticulturae* website www.actahort.org



Dixon, G.R., and Wells, R., eds. (2024). Vegetable Brassicas and Related Crucifers, 2nd edn. Crop Production Science in Horticulture (Wallingford, Oxfordshire, UK; Boston, MA, USA: CAB International), pp.544. ISBN 9781789249156 (paperback) / 9781789249163 (ePDF) / 9781789249170 (ePub). €85 / $95 / £70.

A 25% discount will be received by entering the code "SHS25" when ordering through https://www.cabidigitallibrary.org/doi/book/10.1079/9781789249170.0000

The 2nd edition of the book "Vegetable brassicas and related crucifers", edited by Geoffrey R. Dixon (University of Reading and GreenGene International) and Rachel Wells (John Innes Centre, Norwich), published by CABI, provides a useful and specific update for a wide diversity of economically important *Brassica* species and their related crops. There is considerable evidence to demonstrate that the regular consumption of brassica crops in the human diet improves health and well-being. Hence the consumer demand for brassica leaves, watercress, rocket, broccoli, cauliflower, cabbage and kale is increasing, indicative of the public's acceptance of the advantages conferred. Eight well illustrated chapters cover the following topics: i) origins and diversity of brassica and its relatives; ii) breeding genetics and models; iii) seed and transplant management; iv) developmental physiology; v) crop agronomy; vi) competitive ecology and sustainable production; vii) pests, pathogens and abiotic disorders; and viii) postharvest quality, value and marketing.

Gaining a greater understanding of brassicas as vegetables involves a fascinating journey through time, witnessing wild plant populations interbreeding and the formation of stable hybrids that have evolved into the crops that we know today. Against this background, the book discusses how humankind took both the wild parents and their progeny and refined them by selection and further combination. The resultant crops, alongside the cereals, are mainstays in the global supply of food. Discussions illustrate the origins, evolution and the vast level of diversity in today's wild, feral and cultivated brassicas. The authors move on to discuss breeding methodologies, such as inter-crossing using embryo rescue and fusion, including the recent advances in new technologies, such as genetic modification and genome editing. The authors show how high-throughput sequencing methodologies have produced a step change in progress towards understanding individual genes, genomic interactions, protein products and the resultant phenotypic characteristics.

Crop agronomy, over the last 20 years since the 1st edition was published, has identified the interactions between crop husbandry and technologies, edaphic and aerial factors, environmental sustainability and changing climates. Conservation and improvement of soil health and fertility are critically important aspects of agronomy. Consequently, considerable emphasis is now given to maintaining nutrient status and the measured application of manufactured fertilisers. Minimising the use of synthetic fertilisers and the rising use of biostimulants and bio-fertilisers are discussed in detail, together with smart scheduling, sensing soil moisture stocks, tracking and electronically powered control systems. The science and technology underpinning the use of tillage, non-tillage, inter- and cover-cropping, overseeding, crop covers, biostimulants and biofumigation are described in detail. Precision weeding, sensing and discrimination from crop plants are examined. Factors such as competition for light, space, soil nutrients and harbouring pests and pathogens are seen as essential elements in understanding weed competition.

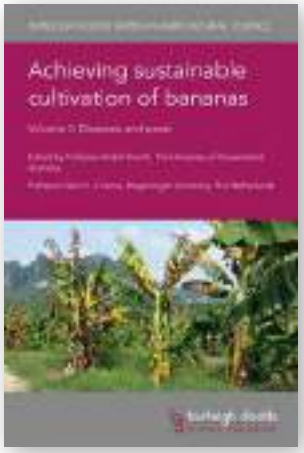
Monitoring and forecasting the incidence of pests and pathogens are becoming more precise with sensing and recording using physical, molecular and artificial intelligence diagnostic systems, each of which is discussed in considerable depth. These developments guard against the shifting spectra of pests and pathogens, which at least partially, are a response to climate change. Control strategies including the use of host resistance, biological controls, tillage methods, altering crop geometries and density are explained and their effects evaluated. The smarter and more precise application of agro-chemicals is discussed enabling producers to reduce the use of synthetic chemicals.

Quality factors are defined, especially appearance and the health benefits for which brassicas are renown. Moving high quality brassica products onto consumers' plates is achieved by efficient cold-chain handling and sophisticated packaging. Freshness can be impeded by several physiological (abiotic) disorders, which are reported in detail. These result from imbalances between genotype and husbandry environments. Harvesting, transporting, storage and packaging are becoming increasingly automated and more autonomous. Marketing systems are examined, as the downstream demand has a considerable influence on research and development.

Each chapter is copiously supported by a substantial number of references defining current and past research findings. Some chapters have bibliographies of several hundred references. The Index is similarly provided in detail and depth covering 64 pages in double columns. Each chapter's text is well supported by tables, line-diagrams and clear coloured pictures.

This book is essential reading and provides an international reference for researchers and students of horticulture, plant science, biology, environmental and marketing studies, growers, processors, consultants, industry advisors and those interested in sustainable food production.

Reviewed by Ferdinando Branca, Chair ISHS Division Vegetables, Roots and Tubers



Drenth, A., and Kema, G.H.J. eds. (2024). Achieving Sustainable Cultivation of Bananas, Volume 3: Diseases and Pests (Cambridge, UK: Burleigh Dodds Science Publishing), pp.652. ISBN 9781786769817 (hardback). €205 / $220 / £170.

A 25% discount will be received by entering the code "ISHS25" when ordering through https://shop.bdspublishing.com/store/bds/detail/workgroup/3-190-109529

Burleigh Dodds has recently published the third volume of a three-volume series on Achieving Sustainable Cultivation of Bananas, one of over 160 titles in the Burleigh Dodds Series in the Agricultural Science stable. With the ever-burgeoning world population, coupled with an increasing number of climate change stressors, agriculture needs to remain relevant, adaptable and ultimately become more sustainable. The three volumes are a testament to the complexities of sustainable banana cultivation globally. Volume 3 in the series follows on from Volume 1, which focused on cultivation techniques aimed at facilitating sustainable production, including an improvement of the environmental impact of banana cultivation; and Volume 2, which focused on germplasm and genetic improvement to ensure not only a more sustainable yield of quality fruit, but also tolerance and adaptability to abiotic and biotic stresses in the face of changing climatic conditions.

Banana is critical to the livelihoods of millions of people primarily in the tropics and subtropics and is a major nutritious food source world-wide. Even though banana is one of the most widely cultivated crops in the tropics and subtropics, there is a myriad of diseases and pests that have a negative impact on both smallholder and large commercial growers. The rapid and wide dispersal of emerging diseases and pests throughout these production regions has necessitated consolidation and review. It is necessary to understand the epidemiology and biology of existing and emerging pests and diseases to ensure their effective control and ultimately, sustainable management. To this end, the distinguished editors, Professors André Drenth and Gert Kema, have assembled several leading and globally-sourced experts who have contributed to the chapters making up the various parts of this volume.

The volume is separated into several parts and within each part, several chapters outline the most important pests and diseases affecting banana cultivation throughout the value chain from pre-plant to postharvest. These include: Fungal diseases (Part 1), which incorporates the major diseases such as Sigatoka, leaf streak disease, freckle disease, an extensive review of Fusarium wilt and an overview of several minor fungal diseases. Bacterial and phytoplasma diseases, including moko bacterial wilt, banana blood disease, Xanthomonas wilt, bacterial soft rot and phytoplasma diseases, are discussed in Part 2. Viral diseases (Part 3) includes banana bunchy top virus, banana streak virus and other viral banana pathogens. Nematode pests are discussed in Part 4, including their sustainable management strategies, while insect pests, including banana weevil borer, banana red rust thrips and the management of bunch pests, are discussed in Part 5. Finally, in Part 6, fruit diseases, including their pre- and postharvest management, are discussed. The book considers methods for disease and pest identification, their management strategies for control and the prevention of outbreaks and epidemics, as well as the development of disease-tolerant cultivars. Critical to sustainable production practices are integrated management programmes and these discussions are also included. Not only are future trends expanded upon, but an extensive list of additional reading and references also accompanies each chapter. The book is an invaluable tool for students, scientists and technical production managers alike.

Reviewed by Karin Hannweg, Chair ISHS Division Tropical and Subtropical Fruit and Nuts

› Courses and meetings

The following are non-ISHS events. Be sure to check out the Calendar of ISHS Events for an extensive listing of all ISHS meetings. For updated information, log on to www.ishs.org/calendar

Seminar on Art and Science Behind Floral Design: the Mississippi State University Extension's Programs for Consumers and Professional Florists, 25 February 2025, Sanremo, Italy. Info: Dr. Margherita Beruto, Chair ISHS Division Ornamental Plants, e-mail: margheberuto@gmail.com

XXI Eucarpia Meeting of the Tomato Working Group, 10-13 June 2025, Plovdiv, Bulgaria. Info: https://cmebg.com/en/sabitia/eucarpia-2025/

V European Horticultural Congress (EHC2024)

Organised by the University of Agronomic Sciences and Veterinary Medicine, under the auspices of the International Society for Horticultural Science (ISHS) and the patronage of the Romanian Academy, the V European Horticultural Congress (EHC2024) took place from 12-16 May 2024, at the Palace of Parliament in Bucharest, Romania. EHC2024 brought together 855 participants from 63 countries (Figure 1). The congress included 10 symposia, 11 technical tours, and 3 post-congress professional tours to Romania's most important horticultural areas (Figure 2).

With the joint efforts of the University of Agronomic Sciences and Veterinary Medicine of Bucharest, the Ministry of Education, the Bucharest City Hall, and the Romanian Society of Horticulturists, EHC2024 was not just a local event, but a global platform for education and research.

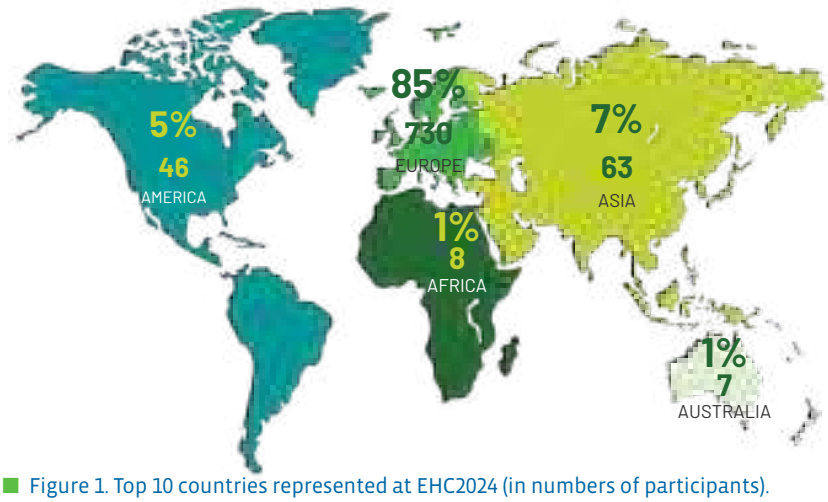
For ISHS, EHC2024 signified a paradigm shift. Beyond the name change from "International Symposium on Horticulture in Europe" to the "European Horticultural Congress", the event was indicative of ISHS's objective to be recognized as a global leader in horticultural research and innovation. From a more niche approach, the congress transitioned to provide a more comprehensive coverage of the realities in the field, under 10 thematically rich symposia. The transformation was also highlighted by the event's slogan: "Horticulture at a Crossroad", for horticulture faces a number of important challenges that must be addressed. The symposia tackled sensitive and current topics such as sustainability, resilience, climate change, biodiversity, artificial intelligence, robotics, and aspects of smart horticulture and new technologies.

› Florin Stănică, President of EHC2024.

A grand opening at the V European Horticultural Congress in Bucharest

EHC2024 commenced with a grand opening ceremony, attended by an impressive line-up of esteemed personalities from various fields. Sorin Mihai Cîmpeanu, a prominent leader in education and academia, opened

855 ATTENDEES



Romania	208	
Italy	124	
Germany	44	
Spain	37	
Netherlands	27	
Greece	26	
Poland	26	
France	25	
USA	25	
Serbia	20	

Figure 1. Top 10 countries represented at EHC2024 (in numbers of participants).

Table 1. EHC2024 symposia.

EHC2024 Symposium	Conveners	# Orals	# Posters	Total
S01 - History of Horticulture in Europe	Ana Cornelia Butcaru, USAMV, Bucharest, Romania Michael Blanke, University of Bonn, Germany Luca Dondini, University of Bologna, Italy	46	23	69
S02 - Sustainable Vegetable Production from Seed to Health Booster Sources	Silvana Nicola, University of Torino, Italy Vasile Stoleru, University of Life Sciences, Iaşi, Romania	51	72	123
S03 - Fruit Production Systems for Sustainable and Resilient Development	Luca Corelli Grappadelli, University of Bologna, Italy Florin Stănică, USAMV, Bucharest, Romania Mekjell Meland, Norwegian Institute of Bioeconomy Research, Norway	55	100	155
S04 - Viticulture and Winemaking between Tradition and Innovation	Arina Oana Antoce, USAMV, Bucharest, Romania Gregorio Muñoz Organero, Madrid Institute of Research, Spain Arif Atak, Bursa Uludağ University, Turkey	34	41	75
S05 - Berries between Opportunities and Challenges	Bruno Mezzetti, Marche Polytechnic University, Italy Adrian Asanică, USAMV, Bucharest, Romania Nesibe Ebru Kafkas, Çukurova University, Turkey	37	35	72
S06 - Ornamental Horticulture for the Service of Society	Margherita Beruto, Chair of ISHS Division Ornamental Plants, Italy Erzsébet Buta, USAMV, Cluj-Napoca, Romania Sandra Gonçalves, University of Algarve, Portugal	29	35	64
S07 - Urban Horticulture: from Vertical Farming to Planting Design	Ioana Tudora, USAMV, Bucharest, Romania Leo Marcelis, Wageningen University, The Netherlands Trine Hvoslef-Eide, Norwegian University of Life Sciences, Norway	31	17	48
S08 - Genetic Resources in Horticulture: Screening, Propagation, Use, and Conservation	Dorin Ioan Sumedrea, National Research & Development Institute for Biotechnologies in Horticulture, Stefăneşti, Argeş, Romania Emmanuel Geoffriau, Institut Agro, Angers, France Geza Bujdoso, HUALS, Research Centre for Fruit Growing, Budapest, Hungary	43	80	123
S09 - Robotics, Mechanization and Smart Horticulture	Luigi Manfrini, University of Bologna, Italy Konni Biegert, Kompetenzzentrum Obstbau Bodensee, Germany Mihai Gabriel Matache, INMA, Bucharest, Romania	39	11	50
S10 - Postharvest and Horticultural Products Quality	Dirk Köpcke, OVA, Jork, Germany Liliana-Aurelia Bădulescu, USAMV, Bucharest, Romania	45	62	107

the ceremony. As the Rector of the University of Agronomic Sciences and Veterinary Medicine of Bucharest, Vice-President of the Romanian Senate, President of the Francophone University Association, and President of the Romanian Council of Rectors, Prof. Dr. Cîmpeanu continues to be a driving force in shaping the future of education and academia in Romania and beyond.

Ligia Deca, the Minister of Education, and Sebastian Burduja, the Minister of Energy, also honored the event. Both emphasized the vital connection between energy and horticulture. Mr. Burduja highlighted the potential of alternative energy sources and the integration of agrivoltaics as future solutions for sustainable agriculture.

Nicuşor Dan, the General Mayor of Bucharest, welcomed the participants to the city. Dr. François Laurens, ISHS President, introduced ISHS and the urgent need to advance horticultural science on a global scale.

Prof. Dr. Florin Stănică, EHC2024 President and Vice-Rector at the University of Agronomic Sciences and Veterinary Medicine in Bucharest, played a pivotal role in organizing the event. With his extensive experience and expertise in horticulture, Prof. Stănică spearheaded initiatives promoting innovation, sustainability, and knowledge exchange.

Keynote speakers at the congress included notable figures such as Paolo Inglese, Francesca Neonato, Cristos Xiloianis, Dan Dinu, Charlie Ottley, and Loekie Schreefel. Their presentations covered a wide range of topics, from the history of the International Symposia on Horticulture in Europe (SHE), regenerative agriculture and sustainable orchard management, to environmental consultancy and the success of the "Wild Romania" documentary.

Major horticultural themes discussed in the 10 symposia

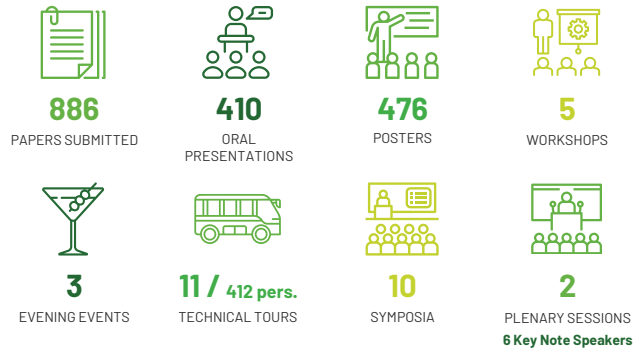
The 10 symposia brought industry representatives together in an open dialogue about when, how, and why bridges can be created for the sustainable development of European and global horticulture (Table 1). Research papers and their results were presented and shared, allowing participants to draw fruit-

› Participants of EHC2024.

■ Table 2. Winners of the ISHS Prof. Jens Wünsche Young Minds Awards.

Symposium	Oral presentation	Poster presentation
S01	Giulio Demetrio Perulli – Italy The origins of fruit growing in Romagna (Italy): symbiosis between research and business	Elena Barcanu – Romania Cultivating roots: a historical overview of vegetable growing in Romania
S02	Yaiza Padilla – Spain Why does a pepper rootstock confer tolerance to water stress? The case of NIBER	Nicolas Al Achkar – Italy Enhancing the water use efficiency of tomato crop in cold greenhouse by using grafted plants
S03	Sophie Richter – Germany Unraveling the mechanism of resistance to apple blotch through genome-wide association studies	Nicola Cinosi – Italy Evaluation of the vegetative-productive behavior of different olive cultivars for their adaptability to high-density cultivation
S04	Luca Capriotti – Italy RNAi-based approaches in grapevine plants for grey mould disease protection	-
S05	Attiq ur Rehman – Finland Genetic dissection of horticultural traits in a reconstructed octoploid strawberry population: a multi-model GWAS approach	Kristyna Simkova – Slovenia Sugar and organic acid content and antioxidant capacity of strawberry fruit in relation to colour stability of puree
S06	Laurine Lambelin – France Towards the identification of quantitative resistance mechanisms of rose to black spot disease Sara Yasemin – Turkey Assessing the impact of salinity on *Viola* x *wittrockiana*: exploring morphological, physiological, and anatomical parameters	-
S07	Brechtje de Haas – Belgium Root exudation rates of three leafy vegetables under different light qualities	Laura Carotti – Italy BEST microgardens – elaboration of an online platform to resolve food insecurity in urban areas
S08	Charlotte Hubert-Schöler – Germany Screening of a *Mentha* sp. collection for physiology and essential oil content	Francesco Desiderio – Hungary Hidden treasures: phenotyping and genotyping of Hungarian and Carpathian cherry landraces
S09	Gianmarco Bortolotti – Italy Exploiting entropy and camera distance normalization for fruit sizing by means of consumer grade depth cameras	Roberta Ascolese – Italy Intelligent pest control: AI-driven solutions for sustainable agroecosystems through remote surveillance and descriptive modeling
S10	Tuany Gabriela Hoffmann – Germany A data-driven approach for fresh produce preservation inside cold room	Zinabu Hailu Siyum – Hungary/Ethiopia Monitoring changes in plum fruit quality during postharvest storage

› Participants from 63 countries attended EHC2024.



■ Figure 2. Some figures from EHC2024

ful conclusions, identify new opportunities for collaboration, and formulate innovative strategies for the future of horticulture.

Research and innovation focused on the young generation of researchers

EHC2024 placed special emphasis on the involvement of young researchers, integrating students and early-career professionals into the scientific community through training and mentorship, thus ensuring the continuity and future of horticultural research. A total of 19 ISHS Prof. Jens Wünsche Young Minds Awards were presented for the best oral and poster presentations (Table 2).

Honoring excellence at the V European Horticultural Congress

For EHC2024, the National Bank of Romania commemorated the event with a special anniversary medal. This prestigious medal was awarded to the Presidents of the National Societies of Horticulture, acknowledging their dedication and outstanding contributions to the field. Among the honored recipients were Gheorghe Glăman (Romania), Antonio Ferrante (Italy), Xiuxin Deng (China), Boris Duralija (Croatia), Ryutaro Tao (Japan), Yüksel Tüzel (Turkey), Amílcar M. Marreiros Duarte representing Portugal, and Miljan Cvetkovic representing Bosnia and Herzegovina, with President Gordana Djuric participating online. This recognition highlighted the collaborative spirit and the global impact of horticulture.

› ISHS presentation at the opening ceremony. From left to right: François Laurens, ISHS President; Sebastian Burduja, Minister of Energy; Ligia Deca, Minister of Education; Nicușor Dan, General Mayor of Bucharest; Sorin Mihai Cîmpeanu, Rector of USAMV Bucharest; Florin Stănică, EHC2024 President.

Discovering Romania through post-congress tours

The technical and post-congress tours offered participants an authentic experience, connecting them with Romania's his-

› Participants in front of the congress venue, the Palace of Parliament.

› EHC2024 keynote speakers and presidents of national societies for horticultural science.

› EHC2024 organisers and volunteers.

› Major horticultural themes were discussed in the 10 symposia.

› EHC2024 placed a special emphasis on the involvement of young researchers.

tory, traditions, and natural beauty. From the medieval castles of Transylvania, the refined wines of Moldova, to the picturesque landscapes of Muntenia, each tour contributed to strengthening Romania's image as a preferred tourist destination in Europe.

A night to remember: the gala dinner of the V European Horticultural Congress

The EHC2024 gala dinner was a spectacular celebration of excellence and innovation. Held in the magnificent surroundings of Mogoșoaia Palace, a jewel of Romanian architecture, the event was steeped in history and elegance. Built by King Constantin Brâncoveanu in 1702, in the distinctive Brâncovenesc style, this majestic palace was the perfect location for the gala event.

Under an open sky and surrounded by the beauty of nature and the historic palace, the gala dinner brought together esteemed guests, including representatives from the Bucharest City Hall, the Ministry of Education, and the Ministry of Foreign Affairs. Their presence underscored the importance of horticulture as a vital component of Romania's cultural heritage and economic development.

The industry exhibition at EHC2024

In addition, EHC2024 provided a highly successful industry exhibition featuring over 40 companies and research organizations involved in technology transfer from Romania and abroad. Located in the grand halls of the Palace of the Parliament, the exhibition was strategically positioned within the support area. This facilitated meaningful collaboration between the academic and economic sectors, an essential aspect for the sustainable development of the horticultural industry and related fields. The presence of commercial companies at the exhibition provided a robust platform for identifying market opportunities.

Florin Stănică

› Some of the ISHS Prof. Jens Wünsche Young Minds Award winners.

› Contact

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III International Symposium on Greener Cities: Improving Ecosystem Services in a Climate-Changing World (GreenCities2024)

Division Landscape and Urban Horticulture	#ishs_durb
Division Ornamental Plants	#ishs_dorn
Division Precision Horticulture and Engineering	#ishs_deng
Division Protected Cultivation and Soilless Culture	#ishs_dpro

With over 55% of the world's population living in urban areas, the imperative to advance the greening, sustainability and liveability of cities is paramount. In addressing this, the III International Symposium on Greener Cities: Improving Ecosystem Services in a Climate Changing World, took place in the United Kingdom between 25-28 September 2024 under the aegis of the International Society for Horticultural Science (ISHS). It was proudly hosted and convened by the Royal Horticultural Society (RHS) at Hilltop: Home of Gardening Science in Wisley, Surrey. The symposium offered an opportunity for researchers and practitioners to share their findings and insights on this important topic. There were over 70 presentations (40+ speakers and 30+ posters), with representation from 16 countries over the three-day event. There were five keynote speakers:

- Prof. Diane Pataki (Arizona State University and National Wildlife Federation, USA);
- Prof. Stephan Pauleit (Technical University Munich, Germany);
- Dr. Fraser Torpy (University of Technology Sydney, Australia);
- Mr. Felix Loh (Gardens by the Bay, Singapore); and
- Mr. Philipp Nedomlel (Heatherwick Studios, United Kingdom).

A wide range of research and practice was presented, with an appropriate sense of progression through the symposium programme. Talks covered plant selection for ecosystem services' delivery, environmental benefits of green roofs and walls, the science of green behaviours and sustainability, environmental policies, water management in green spaces and urban food. Day 1 themes included: ecosystem services delivery and plant choices; indoor planting and green roofs and walls; hedges: from science to application; and green city case studies. Day 2 themes included: water and climate; and urban food. Day 3 themes included: urban trees research; and policy and application. Poster themes included: urban green infrastructure and ecosystem services' delivery; water use and management; climate change, urban areas and policy; urban agriculture and horticulture; and biodiversity and conservation.

We were delighted to have an international perspective on each of the above topics,

› Delegates on the final day of the symposium. Credit: Jay Mullins (RHS).

indicative of the need for a more universal approach to advance the science of greening our cities. Some key messages emerging from the symposium were:

- The potential for complementarity of green and built infrastructure (e.g. improved efficiencies of photo-voltaic panels when surrounded by green roof vegetation, due to cooling and more optimum operating temperatures);
- Considerations around appropriate species/cultivar choice for various green infrastructure installations (green roofs, green walls, sustainable drainage systems, hedges, street and garden trees) to enhance future resilience to a changing climate under more extremes of temperature and water availability;
- Ways to provide water sustainably in urban green spaces, so that plants can continue to deliver ecosystem services that depend on active transpiration, such as cooling (green/blue considerations).

Some future research needs identified during the symposium were:

- The importance of phentotype and genotype screening and modelling of plants for future climates/urban environments;
- Identification of climate-appropriate geographic locations (globally) where plant genetic material could potentially be sourced;
- Increased focus on research in domestic gardens, as this was found to represent only 1% of studies related to thermal and pollution regulation in urban areas.

Some important policy considerations that emerged from the symposium were:

- The need for recognition of the importance of biodiversity support provided by gardens and urban green spaces, e.g. the need for review of the Biodiversity Net Gain 4.0 policy in the UK;
- Recognition, in the context of a changing climate and biodiversity loss, of the potential of a full palette of plant varieties (native and non-native), thereby boosting diversity and resilience.

The ISHS Young Minds Awards (for best oral presentation and best poster by a junior scientist, enrolled or recently enrolled at a university, and under the age of 35 years), were keenly contested at the symposium. The two winners (as decided by a panel of 3 judges) were:

- Agata Morelli (University of Bologna, Italy) – best oral presentation: "Impacts of urban agriculture on pollinator communities: a case study in Bologna (Italy)."
- Caitlin Cook (Northumbria University, UK) – best poster presentation: "Faux-tanical gardens: the impact of artificial lawns on the structure and function of urban ecosystems."

› Dr. Mark Gush and Dr. Tijana Blanusa, co-conveners of the symposium, presented the ISHS Young Minds Award for the best oral presentation to Agata Morelli. Credit: Jay Mullins (RHS).

› Caitlin Cook, winner of the ISHS Young Minds Award for the best poster presentation.

Overall, the atmosphere of the symposium conveyed that delegates were inspired by the research and insights that were presented, encouraged by interactions with colleagues across varied disciplines, and invigorated by the wonderful venue and activities. The symposium was marked by a common and unifying objective: making our cities greener, healthier and more sustainable – and providing the scientific evidence on how to do it.

Mark Gush and Tijana Blanusa

› Contact

Dr. Mark Gush and Dr. Tijana Blanusa, Royal Horticultural Society, Science & Collections Division, Wisley, GU23 6QB, United Kingdom, e-mail: Markgush@rhs.org.uk and tijanablanusa@rhs.org.uk

› Keynote speakers Prof. Stephan Pauleit and Prof. Diane Pataki network with Convener Dr. Tijana Blanusa. Credit Richard Dawson (RHS).

› Caitlin McLaughlin, RHS and University of Reading PhD student, delivering her oral presentation. Photo credit: Richard Dawson (RHS).

› V International Symposium on Biotechnology and Molecular Breeding in Horticultural Species

Division Plant Genetic Resources and Biotechnology	#ishs_dbio
Division Protected Cultivation and Soilless Culture	#ishs_dpro
Division Temperate Tree Fruits	#ishs_dfru
Division Temperate Tree Nuts	#ishs_dnut
Division Vegetables, Roots and Tubers	#ishs_dveg

› Participants of the symposium.

The V International Symposium on Biotechnology and Molecular Breeding in Horticultural Species was held from June 14-17, 2024, in Nanjing, China, under the aegis of the International Society for Horticultural Science (ISHS). The symposium was organized by Nanjing Agricultural University, with co-organization by the Chinese Society for Horticultural Science, Huazhong Agricultural University, South China Agricultural University, Northwest A&F University, Beijing Academy of Agricultural and Forestry Sciences, Chinese Academy of Agricultural Sciences, China Agricultural University, Zhejiang University, and several other institutions. More than 100 experts, scholars and student representatives from China, the USA, the United Kingdom, Japan, New Zealand, Spain, and other countries participated in the symposium to focus on new theories, technologies and methods for horticultural plant biotechnology and molecular breeding.

At the opening ceremony, four plenary speeches were given by: Shaoling Zhang, Symposium Convener and academic at the Chinese Academy of Engineering; Dr. Kanchit Thammasiri, ISHS representative; Dr. Yanning Zhai, representative of the Chinese Society for Horticultural Science (CSHS) and Deputy Director of the Institute of Vegetables and Flowers at the Chinese Academy of Agricultural Sciences; and Fadi Chen, President of Nanjing Agricultural University, the host institution.

Nanjing Agricultural University (NAU) has always adhered to the fundamental mission of fostering virtue and talent and strengthening and revitalizing agriculture. NAU actively promotes technological innovation and social services and is striving to achieve new breakthroughs in the cultivation of new horticultural plant varieties and the development of new technologies. Fadi Chen outlined the university's commitment to work together with all parties to build a "community" of development and to contribute to the advancement of the horticultural industry at a global level.

Dr. Kanchit Thammasiri gave a presentation on ISHS and expressed gratitude to NAU and the co-organizing institutions for hosting the symposium. He looked forward to the participants actively engaging in discussions during the three-day event, collectively driving the innovation and prosperity of global horticulture.

Dr. Yanning Zhai emphasized the importance of biotechnology and molecular breeding in the development of the horticultural industry. She noted that the successful hosting of this symposium would further promote the integration and connectivity of global horticultural science and technology innovation. She encouraged participants to actively engage with others, strengthen cooperation with international peers, and jointly contribute to the development of the horticultural industry.

Prof. Shaoling Zhang noted that the development of biotechnology and molecular breeding has become a crucial force in advancing horticultural science and technology, improving the quality of horticultural products, and promoting the sustainable development of the industry. He expressed hope that the

› Speeches at the opening ceremony by A) Fadi Chen, President of Nanjing Agricultural University, B) Kanchit Thammasiri, ISHS representative, C) Yanning Zhai, CSHS representative, D) Shaoling Zhang, Symposium Convener.

› Participants in front of the National Pear Breeding Center (Nanjing) and the Pear Engineering Research Center of Jiangsu Province.

› Dr. Kanchit Thammasiri presenting the ISHS Young Minds Awards to A) Weiyuan Song for the best oral presentation, and B) Zhihua Guo for the best poster presentation.

symposium would establish an international academic exchange platform to strengthen in-depth exchanges and cooperation in horticultural plant biotechnology and molecular breeding, and jointly promote the cultivation of talent, technological innovation, and high-quality industrial development in these areas.

The symposium focused on horticultural plant biotechnology and molecular breeding, covering areas such as horticultural plant germplasm resources and genetic diversity, genomics and molecular biology, molecular markers and genetic breeding, cell engineering, and abiotic stress.

In addition, participants visited the experimental fields at NAU to observe fruit trees, vegetables and flowers. During the field trip, participants visited the National Pear Breeding Center, National Germplasm Reservation Center for Plum Species, and the Phenotyping Center at NAU.

ISHS Young Minds Awards were presented to Weiyuan Song, a PhD candidate from China Agricultural University, for the best oral presentation entitled "SNP changes in SEP2 contributes to fruit length variations in cucurbits", and Zhihua Guo, a PhD candidate from Nanjing Agricultural University, China, for the best poster presentation entitled "Transcription factors PbTCP10 and PbbHLH164 regulate pear fruit ripening".

BMBH2024 Organizing Committee

› Contact

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I International Symposium on Protected Cultivation, Nettings and Screens for Mild Climates

Division Protected Cultivation and Soilless Culture #ishs_dpro
Division Vegetables, Roots and Tubers #ishs_dveg
Commission Agroecology and Organic Farming Systems #ishs_cmor

During September 23-26, 2024, the I International Symposium on Protected Cultivation, Nettings and Screens for Mild Climates was held at the Agricultural University of Athens (AUA), Greece, under the auspices of the International Society for Horticultural Science (ISHS). The symposium incorporated the following two symposia:

- XII International Symposium on Protected Cultivation in Mild Winter Climates;
- II International Symposium on Nettings and Screens in Horticulture.

The combined symposium offered the opportunity for specialists in protected cultivation of vegetables and ornamentals, as well as the use of netting and screens in horticulture, to meet and present their research innovations, to share ideas and knowledge, and to discuss the current status and future perspectives of protected cultivation and use of netting and screens in regions with mild winter climates. The main topics of the symposium were:

- Greenhouse technologies for mild climatic conditions;
- Climate control in greenhouses and screenhouses;
- Propagation, nurseries and genetic material;
- Nets and screens in agriculture;
- Organic cropping in protected environments;
- Biostimulants and other non-chemical means to increase resilience to biotic and abiotic stress in greenhouses and screenhouses;
- Plant nutrition and irrigation;
- Horticultural substrates and soilless culture;
- Biowaste management and circular greenhouse cropping systems.

The symposium received in total 145 abstracts, from which 126 were accepted and presented at the symposium. More than 140 participants from 26 countries all over the world attended the symposium. The five countries, apart from Greece, with the most symposium participants were: Italy, Spain, China, Japan and the Netherlands.

The symposium was divided into nine oral sessions where 44 presentations were given and six poster sessions to accommodate the 65 poster presentations. The topic with the most oral presentations was “Climate control in greenhouses and screenhouses”. On the other hand, the topic “Organic cropping in protected environment” did not have enough presentations to fill one oral session. The topic with the most poster presentations was “Plant nutrition and irrigation”. Posters were presented as e-posters, electronically on screens, where authors were encouraged to present the highlights of their work in a 5-minute oral presentation during the designated poster session.

The highest level of scientific interest was in climate, nutrition and irrigation control. Apparently, the use of LED lighting, climate sensors and shade nets are important for maintaining optimal growing conditions in regions with a mild winter climate. On the other hand, interest in plant nutrition and irrigation is increasing, due to the development of novel DSS systems for supporting farmers and the increased importance of optimal water and nutrient use to maintain high productivity in greenhouses, while concomitantly reducing water and nutrient losses.

During the 2nd day of the symposium, attendees had the opportunity to visit the experimental greenhouses of the Laboratory of Vegetable Production at AUA, where PhD candidates demonstrated ongoing experiments in open field crops, greenhouse crops

› Symposium participants at the Agricultural University of Athens.

› Prof. Dr. Leo F.M. Marcelis (left), Prof. Youssef Rouphael, Chair ISHS Division Protected Cultivation and Soilless Culture (second from right) and Dr. Francisco M. del Amor, Chair ISHS Working Group Protected Cultivation, Nettings and Screens for Mild Climates (right) presenting the ISHS Young Minds Award for the best oral presentation to Evangelos Giannothanasis.

› Dr. Francisco M. del Amor, Chair ISHS Working Group Protected Cultivation, Nettings and Screens for Mild Climates (left), Prof. Youssef Rouphael, Chair ISHS Division Protected Cultivation and Soilless Culture (second from right) and Prof. Dr. Dimitrios Savvas, Symposium Convener (right) presenting the ISHS Young Minds Award for the best poster presentation to Basak Selin Dincer.

› Visit to the experimental facilities of AUA

and soilless crops. During the technical tour, participants visited i) a high-tech greenhouse producing leafy greens using the moving gutter system (MGS), ii) a plant nursery where self-rooted and grafted vegetables were produced, and iii) a well-advanced greenhouse with eggplants grown in soilless media.

During the symposium, two ISHS Young Minds Awards for junior scientists were given. Two 3-member committees were established during the symposium by senior professors originating from Italy, Turkey, Spain, the Netherlands and Greece to evaluate the presentations. The winners were:

- Evangelos Giannothanasis, Agricultural University of Athens, Greece, for the best oral presentation entitled "Improving the control of sodium accumulation in closed-loop soilless culture systems using ion selective electrodes and the DSS NUTRISENSE";
- Basak Selin Dincer, Technical University of Cartagena, Spain, for the best poster presentation entitled "The impact of growing media on the phytochemical composition of *Eruca sativa* L. and *Diplotaxis tenuifolia* L. microgreens".

At the ISHS business meeting, it was decided that the next symposium be held in Italy in 2028.

Panagiotis Kalozoumis

› Contact

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› Tour to leafy vegetable greenhouse with moving gutter system.

› VIII International Symposium on Persimmon

Division Temperate Tree Fruits #ishs_dfru

› Group photo of guests, keynote speakers and participants of the symposium

The VIII International Symposium on Persimmon (EISP) took place from October 20 to 25, 2024, in Yangling and Fuping, Shaanxi Province, China. Held under the aegis of the International Society for Horticultural Science (ISHS) and the Chinese Society for Horticultural Science (CSHS), the symposium was co-organized by Northwest A&F University (NWAFU), the State Key Laboratory for Crop Stress Resistance and High-Efficiency Production (NWAFU), Huazhong Agricultural University (HZAU), the National Key Laboratory for Germplasm Innovation & Utilization of Horticultural Crops (HZAU), the Department of Agriculture and Rural Affairs of Shaanxi Province, the Management Committee of the Yangling Agricultural High-tech Industry Demonstration Zone, and the Fuping Persimmon Industry Association. Additional support was provided by the College of Horticulture (NWAFU), the Administration for Rural Revitalization of the Yangling Agricultural High-tech Industry Demonstration Zone, and the Yangling Fruit Industry Innovation Center. This symposium welcomed over 150 experts, industry representatives, and government officials from Australia, China, Italy, Japan, Korea and Spain. The symposium aimed to foster international collaboration to advance persimmon research and addressed critical topics related to global expansion, profitability, and diversification within the persimmon industry.

Conveners for this event included Prof. Yong Yang from NWAFU, Prof. Zhengrong Luo and Dr. Qinglin Zhang from HZAU. The secretariat was managed by Changfei Guan (NWAFU) and Wenxing Chen (HZAU), ensuring a seamless execution of the symposium.

The symposium unfolded in two main stages: the academic exchange phase in Yangling from October 20 to 22 and an industry-focused phase in Fuping from October 23 to 25. Opening remarks were delivered by Prof. Ryutaro Tao from Kyoto University, Japan, on behalf of ISHS, with welcoming speeches from Dr. Jun Luo, Vice President of Northwest A&F University, and local government officials. The academic exchange phase, which included 30 oral presentations and 39 posters, addressed key issues in global persimmon research, focusing on four main topics: the current state of the global persimmon industry; genomics, genetics and breeding; orchard management; and postharvest biology and technology.

› Keynote speech by Prof. Yong Yang.

The symposium provided a showcase for several cutting-edge advancements in persimmon genomics, imaging technology, and molecular breeding. Genomic studies played a pivotal role in unraveling the domestication and adaptation history of persimmon. An evolutionary perspective through genome analysis of *Diospyros* offered essential insights into how persimmon varieties adapt to diverse environmental conditions. This genomic foundation supports targeted breeding, especially for developing climate-resilient varieties. Additionally, the integration of marker-assisted selection for non-astringent traits is accelerating the breeding process, meeting market demands for specific fruit qualities more efficiently. These advancements have significant practical implications for persimmon growers, such as developing varieties that are more adaptable to different environmental conditions, improving fruit quality, and increasing overall yield and resilience against climatic challenges.

Technological advancements in imaging have also enhanced understanding of fruit quality formation at a micro-level. Research teams applied advanced two- and three-dimensional ultrastructural imaging to analyze tannin cells in persimmon fruits, offer-

ing a detailed cellular view of quality traits during fruit development. This micro-level understanding is a breakthrough in identifying cellular characteristics that influence taste and texture, thus supporting the development of improved storage and handling methods for persimmon. For growers and producers, this means better control over fruit quality, enabling them to meet market demands more effectively and reduce losses during postharvest handling.

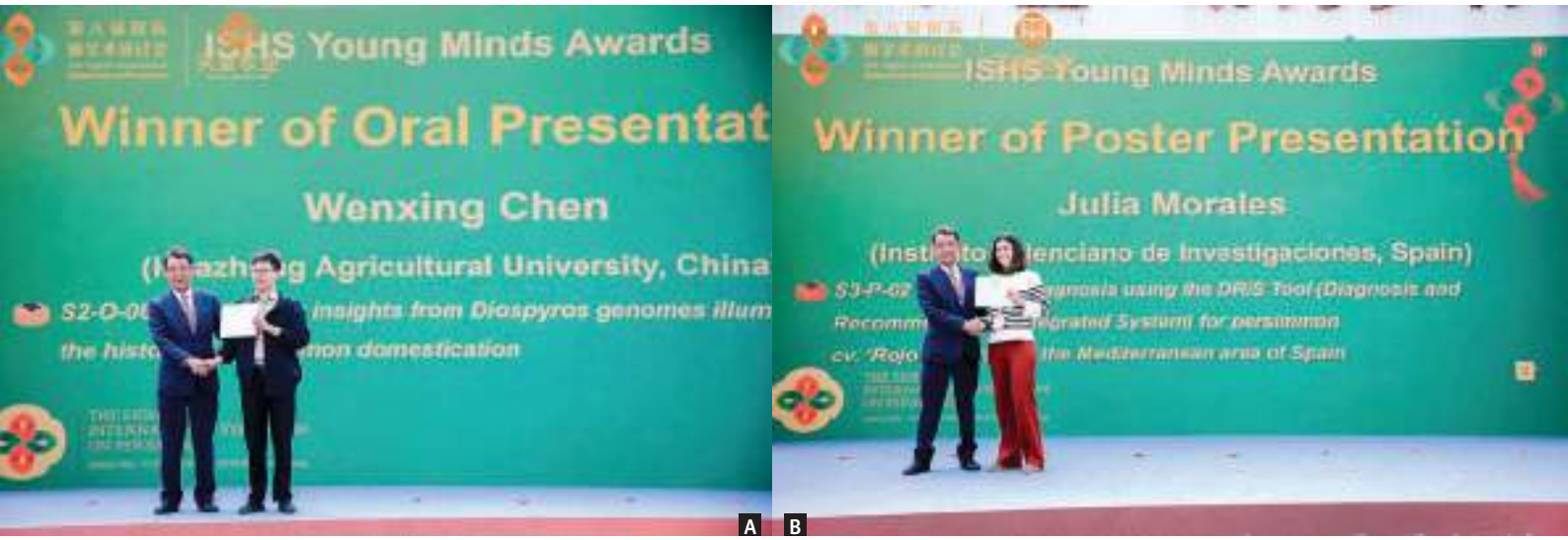
Molecular techniques such as gene editing and RNA interference (RNAi) are now being explored in persimmon research. These approaches allow scientists to silence specific genes, such as the *MeGI* transcription factor gene, impacting gender expression in persimmon, which holds potential for precision breeding. Further studies analyzed developmental patterns influencing fruit shape diversity, decoding genetic controls that allow for the breeding of desirable fruit shapes to meet consumer preferences.

In postharvest biology, the symposium presented research on internal hormonal mechanisms that influence deastringency and softening in persimmons, particularly the role of ethylene and abscisic acid. This research provides a scientific basis for extending shelf life and improving the storage quality of persimmons, directly addressing issues in transportation and market reach. Additionally, persimmon leaf polyphenols have shown potential as functional food ingredients for modulating starch digestibility, which opens new avenues for utilizing byproducts and broadening the scope of persimmon's industrial applications. Other promising research demonstrated novel persimmon-based extracts and derivatives, such as emulsifiers derived through deep eutectic solvents,

› Technical tour to A) National Field Genebank for Persimmon (NFGP) in China, and B) Shaanxi Fuping Dafang Tianxi Green Agriculture Development Co., Ltd.

showing potential in stabilizing probiotic-enriched ice creams and related products. The use of persimmon leaves for tea and natural health supplements further illustrates the multifaceted applications of persimmon extracts within the food industry, creating added value beyond traditional uses.

In the context of sustainable agriculture, the symposium explored the agronomic efficiency of organic versus conventional cultivation. A comparative analysis of 'Rojo Brillante' persimmons showed that organic cultivation enhances soil quality and plant health, supporting the long-term viability of sustainable agricultural practices. Additionally, innovations in rootstock propagation, such as optimizing the growth regulators for dwarfing rootstocks like MKR1, promise to increase production efficiency, addressing industry needs for scalable propagation techniques. Research on the dwarfing cultivar 'Nantong-xiaofangshi' also highlighted its role in promoting controlled growth and enhancing rootstock performance, which is particularly beneficial for intensive cultivation systems, allowing for higher density



› Prof. Ryutaro Tao presenting the ISHS Young Minds Awards to A) Dr. Wenxing Chen for the best oral presentation, and B) Dr. Julia Morales for the best poster presentation.

planting and better management of orchard resources.

An ISHS business meeting, chaired by Prof. Zhengrong Luo, former Chair of ISHS Working Group Persimmon, included a tribute to the contributions of Prof. Maria Badenes Catalá and the election of Dr. Qinglin Zhang from Huazhong Agricultural University as the new chair for 2024-2028.

The industry phase in Fuping featured a series of site visits and events showcasing China's advances in persimmon processing and marketing. Participants visited the NFGP and the Fuping Persimmon Museum to learn about local cultivation and processing practices. A highlight was Shaanxi Fuping Dafang Tianxi Green Agriculture Development Co., Ltd., which showcased its innovative "3+X modern agriculture" model, propelling its "Shishi Hong" persimmon brand to national prominence. Additional visits to local companies provided insights into processing technologies, including traditional dried persimmon production methods.

The symposium concluded with the ISHS Young Minds Awards, with the Best Oral Presentation awarded to Dr. Wenxing Chen for his research entitled "Evolutionary insights from *Diospyros* genomes illuminate the history of persimmon domestication", and the Best Poster awarded to Dr. Julia Morales for her study on "Crop yield and agronomic efficiency of organically and conventionally produced 'Rojo Brillante' persimmon". Organizers Prof. Yong Yang, Prof. Zhengrong Luo, and Dr. Qinglin Zhang were recognized with ISHS Medals for their contributions to the symposium.

Wenxing Chen, Changfei Guan, Qinglin Zhang, Zhengrong Luo and Yong Yang

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Dr. Changfei Guan, College of Horticulture, Northwest A&F University, Taicheng Road No.3, Yangling District, Shaanxi Province, P.R. China, e-mail: persimmon@mail.hzau.edu.cn

Prof. Zhengrong Luo, National Key Laboratory for Germplasm Innovation & Utilization of Horticultural Crops, Huazhong Agricultural University, Shizishan Street No.1, Hongshan District, 430070 Wuhan City, Hubei Province, P.R. China, e-mail: luozhr@mail.hzau.edu.cn

Prof. Yong Yang, College of Horticulture, Northwest A&F University, Taicheng Road No.3, Yangling District, Shaanxi Province, P.R. China, e-mail: yang_yong@nwsuaf.edu.cn

› IV International Organic Fruit Symposium and II International Organic Vegetable Symposium

Commission Agroecology and Organic Farming Systems #ishs_cmor
Division Protected Cultivation and Soilless Culture #ishs_dpro
Division Vegetables, Roots and Tubers #ishs_dveg

Almost three years after the last symposia dealing with organic fruit and vegetable production, the OrgHort series has seen the organization and successful outcome of both symposia in September 2024. The symposia, held on 17-20 September 2024 in Warsaw, Poland, were convened by Prof. Eligio Malusà, Prof. Joanna Puławska and Prof. Lidia Sas of the National Institute of Horticultural Research in Skierniewice (INHORT). The symposia discussed many aspects of organic horticultural production, with an emphasis on the two key practices that drive organic farming: plant protection and soil management.

The three sessions on plant protection were co-organized in collaboration with the conference "Harvesting the Future: Embracing the Synergy of Integrated Pest Management, Crop Technology and Organic Solutions in Soft and Stone Fruit Cultivation" organized under the aegis of the International Organization for Biological Control (IOBC), with the support of Dr. Ewa M. Furmanczyk and Dr. Monika Michalecka, both from INHORT.

Three sessions dealt with soil management, focusing particularly on practices and tools to improve biodiversity, both below and above ground. One of these sessions facilitated the dissemination of the results obtained by an EU-funded project (https://excaliburh2020.eu/en/), which also sponsored the event.

The symposia program included some "unconventional" topics. A keynote lecture explored the opportunities to increase dissemination and communication of scientific knowledge using new approaches: Dr. Camilla Rossi-Linnemann, from the National Museum of Science and Technology Leonardo da Vinci in Milan, Italy, presented "Art and science dissemination: any fruitful con-

› Mr. Stefan Krajewski (left), Deputy Minister of Agriculture and Rural Development, and Prof. Eligio Malusà (right), Convener, welcoming the participants

› Participants of the symposium.

nections?". The presentation was a good prologue to an art-science workshop led by Prof. Joanna Hoffman, an artist, where the participants were asked to transform the emotion derived from the smell of a compost into memories (https://artscience-node.com/memory-nexus/). New approaches for knowledge transfer were also presented by Prof. Maria Claudia Dussì in the keynote entitled "Sustainable agriculture in the face of climate change: research, extension and higher education".

Research into organic farming cannot disregard the search for alternatives to peat for growing substrates. A presentation on this issue was followed by a short survey, carried out in the framework of SPIN-FERT project (https://spinfert.eu/) and asking the participants to provide their opinion on the barriers and drivers that are hampering the use of peat-free substrates in horticultural production.

Breeding of vegetables was another topic where new technologies were matched with the exploitation of local germplasm. In this case, examples from India were presented by two young researchers (Saurabh Singh and Srija Priyadarsini) from the state (Sikkim) where the whole land is organically certified.

› Luka Batistič, winner of the ISHS Young Minds Award for the best oral presentation.

› The study tour included visits to organic farms (A) and a packing house (B).

› Prof. Maria Claudia Dussì, Chair of ISHS Commission Agroecology and Organic Farming Systems (center), and Prof. Eligio Malusà, Convener and Chair of ISHS Working Group Organic Temperate Fruits (right), presenting the ISHS Young Minds Award for the best poster presentation to Sophie Wenzel (left).

› Participants enjoying Polish folk dance.

The oral and poster presentations were accompanied by a technical tour visiting two contrasting organic fruit farms. One of them was characterized by long-time organic production, exploiting crop and variety diversification, and had been developed through four generations of farmers. The second farmer was a new entrant to organic production, with the farm based into the very heart of Polish apple production territory. Technical and market issues were the subjects of very lively discussions between the owners and the symposia participants.

It is part of the Polish culture to give foreign guests the possibility of experiencing local culture. A concert from a young pianist from the Music Academy enabled participants to listen to some of Chopin most famous or less known pieces of music. The social dinner, based on typical dishes, was concluded with a folk dance and singing, engaging the participants in learning polka or mazurka balls.

The symposia, which were opened by the Deputy Minister of Agriculture and Rural Development, Mr. Stefan Krajewski, were attended by about 80 people, and up to about 120 during the sessions shared with the IOBC conference. There were 39 oral and 40 poster presentations. The ISHS Young Minds Awards were granted to Luka Batistić from the University of Ljubljana, Slovenia, for the oral presentation "Testing the efficacy of a tractor-mounted insect vacuum against various hemipteran species of shield bugs on crops of soybean, alfalfa, sorghum, and sunflower" and to Sophie Wenzel from the Hochschule Geisenheim University, Germany, for the poster "Enhancing insect diversity through companion plants for creating a resilient organic strawberry cropping system".

The V International Organic Fruit Symposium and III International Organic Vegetable Symposium will be held in Germany in 2028.

Eligio Malusà, Joanna Puławska and Lidia Sas

› Contact

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From the Secretariat

› New ISHS members

ISHS is pleased to welcome the following new members:

New Individual Members

Argentina: Dardo Hernán Figueroa, Dr. Alberto Gochez; **Australia:** Mr. Travis Brunnbauer, Dr. Alison Fuss, Mr. David McRae, Mr. Adrian Parsons; **Austria:** Georg Schramayr; **Bahrain:** Assoc. Prof. Abdelhadi Mohamed; **Belgium:** Ms. Diethe Peeters; **Bolivia:** Antonio Meregil Marmol Figueroa; **Brazil:** Prof. Jose Geraldo Eugenio de Franca, Prof. Dr. Emerson Fachini, Dr. Marcos Antonio Machado, Dr. Angela Mehta, Mr. Everaldo Santos, Dr. Hiago Antonio Silva, Dr. Nelson Arno Wulff; **Cambodia:** Hour Phann; **Chile:** Dr. Maria Jose Montañola, Dr. Bernardo Pollak, Mr. Mario Toro; **China:** Peng Bai, Prof. Dr. Peng Chen, Assoc. Prof. Wei Chen, Mr. Yuan Chu, Zhehui Hu, Hu Huali, Mr. Ivan Kinsella, Feifei Li, Dr. Xiaoyuan Li, Yingjie Li, Ms. Hongye Ma, Assist. Prof. Penghui Song, Dr. Aihua Wang, Yue Wang, Mr. Zong-Neng Wang, Dr. Ranran Wei, Huan Wen, Dr. Junyu Yang, Zhang Yingtong, Prof. Hong Yu, Dr. Yan Zha, Prof. Dr. Liqing Zhang, Xiaoyun Zhang; **Chinese Taipei:** Mr. Hanyin Chang, Mr. Shih-Han Yen; **Denmark:** Assist. Prof. Antonios Petridis, Assoc. Prof. Marten Srensen; **Egypt:** Dr. Yigezu Atnafe Yigezu; **Fiji:** Mr. Christian-Yves David Amato-Ali; **France:** Dr. Marianne Avignon, Dr. Etienne Danchin, Dr. Yann Froelicher, Mr. Sebastien Hallo, Mr. Arnaud Nouvion, Dr. Ana Zotta Mota; **Germany:** Dr. Faiqa Atique, Dirk Behrens, Isabell Brügger, Melanie Dombrowsky, Dr. Stefan Dultz, Ms. Pooja Suresh Gowda, Dr. Alexander Haug, Eleonora Itri, Ms. Swati Jagani, Alisa Kehr, Catarina Lino, Mr. Hadi Hama Aziz Muhammed, Phillip Olak, Ms. Rhedia Tehrin Proma, Dr. Quentin Schorpp, Madita Schulz, Franz Sperhake, Prof. Dr. Remco Stam, Mr. Philip Testroet, Sabine Wittmann, Dr. Sabine Zikeli; **Ghana:** Mr. Fredrick Asante; **Greece:** Ioannis Tsourekas; **Iceland:** Ms. Saerun Stefansdottir; **India:** Prof. Tridip Kumar Hazarika, Dr. Zakir Hussain, Mr. Balkrishna Nayak, Dr. Rashmita Toppo; **Ireland:** Ms. Patricia Morris, Dr. Akinson Tumbure; **Italy:** Dr. Dalila Bellomo, Assoc. Prof. Matteo Busconi, Mr. Federico Caruso, Assoc. Prof. Donato Castronuovo, Salvatore D'Aquino; **Japan:** Assoc. Prof. Takashi Fudano, Ms. Koshi Hashiguchi, Assist. Prof. Md Mukhtar Hossain, Seiichi Okazaki; **Korea (Republic of):** Mr. SeungYong Jeong, Ms. Kim Jinju, Ms. Hyunjung Kim, Mr. Risu Kim, Se Yeong Lee, Myung Hyup Oh, Mr. San Su Min Oh; **Mexico:** Dr. Marilena Antunes Ricardo, Gabriela Arroyo-Figueroa, Prof. Dr. Daniel Guajardo Flores, Prof. Dr. Mariana Martínez-vila; **Moldova:** Assoc. Prof. Tatiana Novac; **Morocco:** Mr. Khallou Abdelhak, Ms. Rachida El Boullani; **Nepal:** Mr. Rohit Saraff; **Netherlands:** Mr. Robbie Gieslink, Dr. Annelein Meisner, Ms. Citlali Melchor Ramírez, Mr. Folkert Moll, Mr. Joseph Stoenner, Mr. Johannes Vogelsang, Zixin Yao; **New Zealand:** Ms. Liya Mathew, Dr. Dalila Pasquini; **Norway:** Dr. Siv Mari Aurdal, Maha Ezziddine, Bjornar Helliesen, Halldor Sklnes; **Philippines:** Bong Salazar; **Portugal:** Andreia Afonso, Maria Manuel Balseiro Vidal, Luciano Chá Chá, Ms. Mariana Correia, Assoc. Prof. Ana Luisa Fernando, Ana Rita Trindade, Diamantino Trindade; **Singapore:** Mr. Caleb Beh; **South Africa:** Ms. Shahiëda Cloete, Mr. Alwyn de Waal, Ms. Lerato Mamabolo, Ms. Tebogo Marutha, Ms. Khezwo Nematshema, Mr. Pieter Uys, Ms. Bea-Marie Visser; **Spain:** Prof. Dr. Francisco José Arenas Arenas, Ms. Irene Besné-Eseverri, Mr. Isidoro Colmenero, Dr. Jose Cuenca, Ms. Aintzane Esturo Errazti, Iker Gómez García, María Nieves Guzmán Reyes, Jose Maria Martin Berrocoso, Dr. Miriam Romero-Muñoz; **Sri Lanka:** Dr. Ishara Perera; **Switzerland:** Mr. Laurent Nicole, Mr. Nils Reichen; **Tanzania:** Assist. Prof. Emmanuel Sulle; **Uganda:** Dr. Yona Baguma, Mr. Peter Dhamuzungu; **United Kingdom:** Ms. lorna beck, Graham Howell; **United States of America:** Ms. Nazim Akter, Mr. Elias Barriga-Hernandez, Dr. Robert Bevacqua, Assist. Prof. Jessica Chitwood-Brown, Drew Falabella, Dr. Ronald Fritz, Louis Harris, Dr. Carlos Iglesias Fraschetti, Dr. Arun Jani, Assoc. Prof. Zhenyu Jia, Mr. Joey Khandehroo, Prof. Dr. Richard Litz, Curtis Louie, Mr. Jonathan Magby, Yeyen Novitasari, Dennis Perry, Mr. Mariano Resendiz, Dr. Oscar Riera-Lizarazu, Dr. Beth Rowan, Toby Sheppard Bloch, Pooja Tripathi, Mr. Lee van Laer, John Weber, Alex Woodward; **Venezuela:** Mr. Jesus Morillo.

› In memoriam

Miltiadis Vasilakakis (1944-2024)

Emeritus Professor Miltiadis Vasilakakis sadly passed away in August 2024 after a brave battle with severe health issues over the last eight years. Prof. Vasilakakis served as President of the Hellenic Society for Horticultural Science for two terms and was an active member of ISHS, having participated in many scientific symposia.

He was born in Imathia (Central Macedonia, Greece) in 1944. In 1967, he received his degree in Agronomy from the School of Agriculture of the Aristotle University of Thessaloniki (AUTH), Greece. In 1970, he was employed as a Research Associate in the Laboratory of Pomology at AUTH. He was a recipient of a Fulbright (USA) and a NATO scholarship that allowed him to continue his postgraduate studies at the University of Wisconsin – Madison, from which he received his doctorate degree (PhD) in 1978.

For one additional semester he served as a postdoctoral fellow at the University of Wisconsin, where in addition to his research duties, he taught the undergraduate course "Temperate zone pomology". In March 1979, he was appointed Curator at the Laboratory of Pomology at the Department of Agriculture at AUTH. In 1982, he received the rank of Lecturer, and in 1988 he was promoted to the rank of Full Professor.

He taught the following courses: "Arboriculture", "Small fruits" and "Postharvest physiology and technology" in the undergraduate program and "Physiology of growth and development" and "Postharvest physiology of fruit and vegetables" in the postgraduate program. He authored five textbooks as a sole or main author that are still being used in Greek universities as teaching material for deciduous and evergreen tree fruit crops as well as postharvest physiology, orchard management and technology.
He participated in many international and Greek conferences and served as a partner in several European-funded programs and workshops. He had an extensive publication record that is well recognized by the scientific community, primarily on fruit crops. He supervised 34 postgraduate theses (23 Masters and 11 PhDs). Two of his previous PhD students currently serve as academic staff in Cyprus (Prof. George Manganaris) and the United States (Associate Professor Ioannis Minas).

George Manganaris,
Vice-Chair ISHS Division Temperate Tree Fruits

› Calendar of ISHS events

For updates and more information, go to www.ishs.org › calendar of events. For a comprehensive list of meetings in each Division or Working Group use the "science" option from the website navigation menu.
To claim reduced registration for ISHS members, your personal membership number is required when registering - ensure your ISHS membership is current before registering. When in doubt, sign in to your membership account and check/renew your membership status first: www.actahort.org or www.ishs.org

Year 2025

- January 19-24, 2025, Napier (New Zealand): **XIII International Symposium on Integrating Canopy, Rootstock and Environmental Physiology in Orchard Systems.** Info: Dr. Adam Friend, 55 Old Mill Road, RD 3, Motueka 7198, Tasman, New Zealand. Phone: (64)3-9073622, Fax: (64)3-9073596, E-mail: adam.friend@plantandfood.co.nz or Dr. Ben van Hooijdonk, Plant and Food Research, Hawkes Bay, Private Bag 1401, Havelock North, 4130, New Zealand. E-mail: ben.vanhooijdonk@plantandfood.co.nz Web: https://scienceevents.eventsair.com/orchard-systems
- March 16-21, 2025, Yancheng city, Jiangsu Province (China): **X International Strawberry Symposium.** Info: Dr. Jian Sun, Institute of Forestry and Pomology, Beijing Academy of Agriculture and Forestry, NO.12, Ruiwangfen Jia, Xiangshan, Haidian, Beijing, 100093, China. Phone: (86)10-82598882, E-mail: sjroad@126.com or Dr. Yuntao Zhang, BJ Academy Forestry & Pomology Sciences, Rui Wang Fen, Xiang-Shan, Hai Dian District, Beijing 100093, China. Phone: (86)1082598882, Fax: (86)1062598882, E-mail: zhytao1963@126.com or Prof. Mizhen Zhao, 50 Zhongling Street,Nanjing, Nanjing, 210014, China. Phone: (86)25-84390219, Fax: (86)25-84390218, E-mail: njzhaomz@163.com or Prof. Jiajun Lei, Shenyang Agricultural University, Shenyang, China. E-mail: jiajunleisy@163.com Web: https://www.iss2025.org.cn
- March 30 - April 4, 2025, Temecula, CA (United States of America): **XV International Protea Research Symposium.** Info: Kenneth W. Leonhardt, Dept of Horticulture, University of Hawaii, 3190 Maile Way, Rm 102, Honolulu, HI 96822-2232, United States of America. Phone: (1)8089568909, Fax: (1)8089563894, E-mail: leonhard@hawaii.edu E-mail symposium: protea2025@gmail.com Web: https://www.proteaconference2025.org
- May 5-9, 2025, Rimini (Italy): **International Symposium on Biotechnological Tools in Horticulture.** Info: Dr. Silvia Sabbadini, Via Brecce Bianche 10, Ancona, Italy. E-mail: s.sabbadini@staff.univpm.it or Dr. Luca Capriotti, Dept Agric., Food & Environmental Sciences, Università Politecnica delle Marche, Via Brecce Bianche 10, Ancona, Italy. Phone: (39)3662844234, E-mail: l.capriotti@staff.univpm.it or Dr. Angela Ricci, Dept Agric., Food & Environmental Sciences, Università Politecnica delle Marche, Via Brecce Bianche 10, Ancona, Italy. E-mail: angela.ricci@pm.univpm.it E-mail symposium: info@symposiumbiotechinhort.com Web: https://symposiumbiotechinhort.com/
- May 6-9, 2025, Adeje, Tenerife (Spain - Canary Islands): **XI International Congress on Cacti as Food, Fodder and Other Uses.** Info: Prof. Dr. M. Pilar Cano, Nicolás Cabrera, 9, 28049 Madrid Madrid, Spain. Phone: (32)910017937, Fax: (34)910017905, E-mail: mpilar.cano@csic.es or Dr. M. Gloria Lobo, Carretera del Boquerón s/n, 38270 Valle de Guerra, Spain - Canary Islands. Phone: (34) 922923316, E-mail: globo@icia.es Web: https://www.cactuscongress2025.com/
- May 10-15, 2025, Beijing (China): **IX International Symposium on Rose Research and Cultivation.** Info: Prof. Junping Gao, China Agricultural University, Beijing, 100193, China. E-mail: gaojp@cau.edu.cn or Prof. Dr. Nan Ma, Department of Ornamental Horticulture, China Agricultural University, No.2 Yuanmingyuan West Road, Haidian District, Beijing, 100193, China. Phone: (86)-10-62733603, E-mail: ma_nan@cau.edu.cn E-mail symposium: Roses2025@163.com Web: https://www.rose2025.cn/
- May 18-22, 2025, Wenatchee, WA (United States of America): **XIV International Controlled and Modified Atmosphere Research Conference - CAMA2025.** Info: Dr. Carolina A. Torres, Washington State Univ, 1100 N. Western Ave, Wenatchee, WA 98801, United States of America. Phone: (1)206 331 4780, Fax: (1)509 848 2231, E-mail: ctorres@wsu.edu E-mail symposium: info@cama2025.com Web: https://cama2025.com
- May 28-31, 2025, Mazatlán, Sinaloa (Mexico): **XIV International Mango Symposium.** Info: Prof. Dr. Sergio Marquez-Berber, 4ta Cda Huautla 3A, San Luis Huexotla, 4ta Cda Huautla 3A, San Luis Huexotla, Texcoco, Mexico, 56220, Mexico. Phone: 5215951070500, Fax: 5959521642, E-mail: sermarber@gmail.com E-mail symposium: info@mango2025.com Web: https://mango2025.com/
- June 1-5, 2025, Richland, WA (United States of America): **X International Cherry Symposium.** Info: Dr. Matthew Whiting, Washington State University, IAREC, 24106 N. Bunn Road, Prosser, WA 99350, United States of America. E-mail: mdwhiting@wsu.edu Web: https://www.xishscherrysymposium.com/
- June 2-6, 2025, Thessaloniki (Greece): **IX International Symposium on Seed, Transplant and Stand Establishment of Horticultural Crops and III International Symposium on Vegetable**

Grafting. Info: Athanasios Koukounaras, Aristotle University of Thessaloniki, Alamanas 33, 55 132 Kalamaria, Thessaloniki, Greece. E-mail: thankou@agro.auth.gr Web: https://sest-vg2025.com/

- June 22-27, 2025, Almeria (Spain): **GreenSys2025 - International Symposium on Advanced Technologies and Management for Sustainable Greenhouse Systems.** Info: Prof. Dr. Diego L. Valera, Dpto. Ingeniería, Universidad de Almería, Ctra Sacramento sn, 04120 Almería, Spain. Phone: (34)950015546, E-mail: dvalera@ual.es or Prof. Dr. Francisco Domingo Molina Aiz, Universidad de Almería, CITE II-A, Despacho 1.07, Carretera Sacramento s/n, 04120 Almería, Spain. Phone: (34)950015449, Fax: (34)950015491, E-mail: fmolina@ual.es E-mail symposium: greensys2025@ual.es Web: http://www2.ual.es/greensys2025/ NEW
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- July 8-10, 2025, Melaka (Malaysia): **III International Symposium on Tropical and Subtropical Ornamentals.** Info: Prof. Dr. Asmah Binti Awal, Faculty of Plantation and Agrotechnology, UiTM Cawangan Melaka, Kampus Jasin, 77300 Melaka Merlimau, Malaysia. E-mail: asmah138@uitm.edu.my E-mail symposium: tso2025.secretariat@gmail.com Web: https://tso2025.org/ NEW
- August 3-8, 2025, Fort Collins, CO (United States of America): **IV International Symposium on Germplasm of Ornamentals.** Info: Mengmeng Gu, Dept. Horticulture & Landscape Architecture, Colorado State University, 1173 Campus Delivery, Fort Collins CO 80523, United States of America. Phone: (1)9792299683, E-mail: mengmeng.gu@colostate.edu or Dr. Youping Sun, Department of Plants, Soils & Climate, Utah State University, 4820 Old Main Hill, Logan Utah 84335, United States of America. Phone: (1)4357972972, E-mail: youping.sun@usu.edu Web: https://agsci.colostate.edu/hortla/isgo/

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