A publication of the International Society for Horticultural Science

Chronica Horticulturae

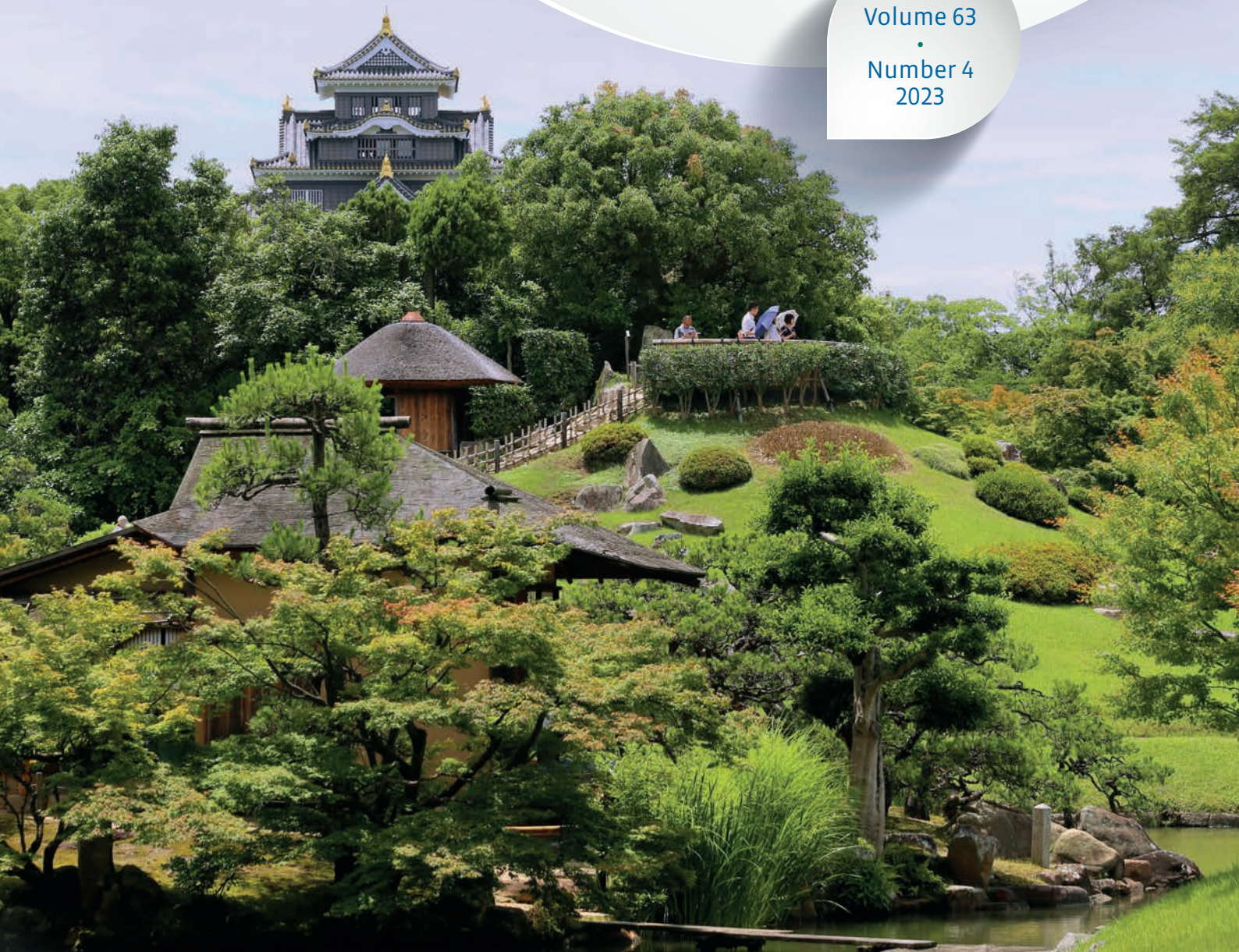
Horticultural highlights

Impact and why it matters • Agroecology and its role within ISHS • Trends and issues in the fresh produce industry

Symposia and workshops

EUCARPIA Section Ornamentals • Models for Plant Growth, Environments, Farm Management in Orchards and Protected Cultivation • Soil and Substrate Disinfestation • Balkan Fruit Growing • Fig • Walnut and Pecan • Lychee, Longan and Other *Sapindaceae* Fruits • Fruit Culture along Silk Road Countries • Artichoke, Cardoon, and Their Wild Relatives • Cucurbits • South-Eastern Europe Vegetables and Potatoes • *Rubus* and *Ribes* • Grapevine Breeding, Genetics and Management

Volume 63
•
Number 4
2023



Chronica Horticulturae© Volume 63 – Number 4; December 2023; ISSN: 0578-039X (print), 2506-9772 (electronic).
Published quarterly by the International Society for Horticultural Science, Leuven, Belgium. Lay-out and printing by Drukkerij Graphius, Gent, Belgium. All previous issues are also available online at www.ishs.org. Contact the ISHS Secretariat for details on full colour advertisements (1/1, 1/2, 1/4 page) and/or mailing list options.

Editorial office and contact address:
ISHS Secretariat, PO Box 500, B-3001 Leuven 1, Belgium. Phone: (+32)16229427, E-mail: **info@ishs.org**, Web: **www.ishs.org** or **www.actahort.org**.

Editorial staff
Peter J. Batt, Editor, **peterjbatt@gmail.com**
Kelly Van Dijck, Associate Editor, **kelly.vandijck@ishs.org**
Peter Vanderborght, Executive Director

Membership and orders of *Chronica Horticulturae*
Chronica Horticulturae is provided to members free of charge: Individual Membership is 95 EUR (including VAT) per year (or two years for members in developing countries). Student Membership: 50 EUR per year (including VAT). For details on ISHS membership categories and membership advantages, or to apply for ISHS membership go to **www.ishs.org/members**.

Payments
All major Credit Cards accepted. Always quote your name and invoice or membership number. Make checks payable to ISHS Secretariat. Money transfers: ISHS main bank account number is 230-0019444-64. Bank details: BNP Paribas Fortis Bank, Branch "Heverlee Arenberg", Naamsesteenweg 173/175, B-3001 Leuven 1, Belgium. BIC (SWIFT code): GEBABEBB08A, IBAN: BE29230001944464. Please arrange for all bank costs to be taken from your account assuring that ISHS receives the net amount. Prices listed are in euro (EUR) but ISHS accepts payments in USD as well.

Acta Horticulturae
Acta Horticulturae is the series of proceedings of ISHS Scientific Meetings, Symposia or Congresses (ISSN: 0567-7572). ISHS Members are entitled to a substantial discount on the price of *Acta Horticulturae*. A complete and accurate record of the entire *Acta Horticulturae* collection, including all abstracts and full text articles, is available online at **www.actahort.org**. ISHS Individual Membership includes credits to download 15 full text *Acta Horticulturae* articles. All *Acta Horticulturae* titles - including those no longer available in print format - are available on USB-drive or in the e-*Acta* format.

eJHS
The *European Journal of Horticultural Science* (eJHS) accepts original research articles and reviews on significant plant science discoveries and new or modified methodologies and technologies with a broad international and cross-disciplinary interest in the scope of global horticulture. The Journal focuses on applied and fundamental aspects of the entire food value chain, ranging from breeding, production, processing, trading to retailing of horticultural crops and commodities in temperate and Mediterranean regions. ISHS members benefit from a discounted publishing charge. eJHS is available in print + online Open Access. Additional information can be viewed on **www.ishs.org/ejhs**.

Fruits – International Journal of Tropical and Subtropical Horticulture
Fruits – International Journal of Tropical and Subtropical Horticulture accepts original research articles and reviews on tropical and subtropical horticultural crops. The Journal is available in print + online Open Access. Additional information can be viewed on **www.ishs.org/fruits**.

Scripta Horticulturae
Scripta Horticulturae is a series from ISHS devoted to specific horticultural issues such as position papers, crop or technology monographs and special workshops or conferences.

PubHort – crossroads of horticultural publications
Pubhort is a service of ISHS as part of its mission to promote and to encourage research in all branches of horticulture, and to efficiently transfer knowledge on a global scale. The PubHort platform aims to provide opportunities not only to ISHS publications but also to other important series of related societies and organizations. The ISHS and its partners welcome their members to use this valuable tool and invite others to share their commitment to our profession. The PubHort eLibrary portal contains over 78,000 downloadable full text scientific articles in pdf format, and includes The Horticulture Journal, Journal of the American Pomological Society, Journal of the International Society for Mushroom Science, Proceedings of the International Plant Propagators' Society, Journal of the Interamerican Society for Tropical Horticulture, etc.
Additional information can be viewed on the PubHort website **www.pubhort.org**.

A publication of the International Society for Horticultural Science, a society of individuals, organizations, and government agencies devoted to horticultural research, education, industry, and human well-being.

› Contents

Cover photograph: Okayama castle and Korakuen garden, Japan.

› From the cockpit

Peter J. Batt, Editor, *Chronica Horticulturae*

› Peter J. Batt

By the time this edition hits either your inbox or your mailbox, almost twelve months will have elapsed since I accepted the role as Editor for *Chronica Horticulturae*. Despite the workload, the past year has been really enjoyable and it's been an absolute pleasure to work with so many of you in both promoting and reporting our symposia activities, celebrating the accomplishments of our Young Minds, and reporting on the world of horticulture. This is a tough industry and regrettably, one within which we seldom get recognition from the general public – and yet we collectively provide them with good health and wellbeing through the nutrition they derive from fresh fruit and vegetables and the physical and mental wellbeing they derive from amenity horticulture. Furthermore, let's not forget that as an industry, through the technologies and farming practices that we adopt, we are doing our utmost to deliver these benefits with minimal impact on the environment.

Each of these themes is captured in the three lead articles that comprise this edition. In a personal interview with Max Teplitski, Chief Science Officer at the International Fresh Produce Association, we discuss the key trends and issues in the fresh produce industry. In talking firstly about the consumer demand, it's apparent, universally, that perceptions of quality, price, nutrition and freshness drive the consumers' decision to purchase fresh fruit and vegetables in-store. However, it's also apparent, despite what they say, that most consumers are unwilling to pay a premium for product that has been grown sustainably. If consumers won't pay, then who will, for natural capital is a public good that is currently in rapid decline. Sunny Verghese, co-founder and CEO of Olam International Ltd, one of the world's major agribusiness commodity traders, has suggested that if current trends continue, we will need 2.5 earths to adequately feed our growing population.

In becoming more sustainable, advances in biotechnology are not only enabling producers to adapt to and to mitigate the impact of climate change, but also to deliver new experiences and superior taste to consumers. However, for these new technologies to be acceptable to the market, the key is transparency – and once again – it's new technologies that provide the means through which industry can educate consumers. By scanning product QR codes – within the limits of commercial confidentiality – consumers can learn about how these new bio-engineered products have been developed. Regrettably though, in many countries, government policy is yet to embrace these new technologies, opting for an outdated hazard reduction strategy rather than a risk-based strategy. Similarly, while we are all conscious of the need to reduce the amount of plastic packaging making its way into our environment, in the fresh produce industry, plastics not only protect the product but may also increase shelf life. But perhaps most importantly, plastic packaging enhances food safety. With few cost-effective alternatives currently available, government policies to ban the use of single use plastic packaging is having a significant negative impact on our industry. There is also a clear role for government to provide a level playing field, for in many countries around the world, the power of the supermarkets is threatening the viability of many small producers. We must appreciate that an industry cannot be sustainable if it's not profitable. Profit is not a dirty word – rather it's about ensuring that all parties – including producers – get a fair and equitable return on their investment – for profit enables producers, as environmental stewards, to make the necessary investments in new technology to adapt to climate change, conserve natural resources and to enhance their natural capital.

The second of our lead papers continues with the theme of sustainability and discusses the role of agroecology. Written by Maria Claudia Dussi and Pierre-Eric Lauri, Chair and Vice-Chair respectively of ISHS Commission Agroecology and Organic Farming Systems, agroecology aims to increase the autonomy and resilience of our food production systems through recycling biomass, enhancing soil biotic activity through the better management of organic matter, minimizing nutrient losses, increasing energy efficiency, increasing species and within-species diversity, and enhancing beneficial interactions and synergisms within agro-ecosystems. Agroecology is not only a science, but also a socio-political movement that pursues new ways of looking at agriculture, food processing, distribution and consumption, and its relationships with society and nature. And as you, our members, have spoken, as climate change and diminishing natural resources continue to dominate our thinking, it's entirely appropriate that we consider elevating the Commission Agroecology and Organic Farming Systems to full Divisional status within our Society. Indeed, at the most recent meeting of the ISHS Executive Committee in Kyoto, Japan, the motion to do so was unanimously passed and will be considered at the next meeting of the ISHS Council.

The third of our lead papers, written by Melinda Knuth, the Chair of ISHS Division Horticulture for Development, grapples with a related issue: how do we measure and evaluate the impact of our interventions? Drawing on the experiences of the Center of Disease Control and Prevention (CDC), Melinda discusses the impact indicator framework developed and used by the CDC during the pandemic to assess which policies and which communication strategies were effective, and which were not. In addressing the key issues that our industry currently faces, as research becomes more interdisciplinary and more complicated, the need to communicate the impact of our activities to society, funding agencies, and institutional leadership will also become more complex. It is, however, a task that we must all embrace for if we are to be credible, we must be able to demonstrate the benefit cost of our research, not only for the industry, but more broadly for society and for the environment.

The Spotlight for this month falls upon Dr. Evelyne Costes, an outstanding horticultural scientist, a Fellow of the ISHS, and currently Chair of ISHS Division Physiology and Plant-Environment Interactions of Horticultural Crops in Field Systems. Evelyne describes how her engagement with ISHS, through different symposia and Working Groups, enabled her to expand her network, to meet other research groups and to develop collaborative research projects. By becoming more involved, first as a Working

Group Chair and then by organizing several symposia and workshops, as she gained international recognition, her personal network rapidly expanded. Not unexpectedly therefore, she strongly encourages students and early career researchers to join the ISHS Working Group that most closely aligns with their domain of research to enhance their network, expand their horizons and engage in stimulating discussions with like-minded researchers in a supportive and friendly network.

In this edition, we also recognize nine outstanding and emerging researchers: our Young Minds awardees. In keeping with our theme of sustainability, Ms. Mariana Calara (Vegetable Research and Development Station Bacau, Romania) discusses options for the allelopathic control of weeds in bean crops, while Raphaël Deragon (Université Laval, Canada) describes his work in detecting and mapping peaty, limnic and mineral layers within the first metre of soil in drained and cultivated peatlands. Christine Schmitz (University of Bonn and the Dienstleistungszentrum Ländlicher Raum Rheinpfalz, Germany) developed and implemented a decision analysis model to compare the benefits, costs and risks of different frost protection measures in Germany. Cognisant of the impacts a warming climate is having on grape vines, Valeria De Rosa (University of Udine, Italy) explores the role of DNA demethylation in dormancy regulation. Clément Larue (INRAE, France) explores the determinants of chestnut pollination, identifying the key role of calyptrate flies and to a lesser extent beetles, rather than bees. Francesco Maldera (University of Bari Aldo Moro, Italy) evaluates how in vitro propagation techniques affect the morphology and architectural parameters of different olive cultivars and thus their suitability for planting in intensive orchards. At the other end of the value chain, Zobabalo Mina (University of Johannesburg, South Africa) describes her research efforts to develop a shelf-stable carrot product for multiple applications in the South African food and beverage industry. Within the ornamental industry, Ms. Bixuan Cheng (Beijing Forestry University, China) explores the molecular mechanisms of the inheritance of important traits in tetraploid roses, while Matteo Martina (University of Turin, Italy), explores the application of K-seq in *Ranunculaceae* species.

As this is the final edition for 2023, for and on behalf of the President, the Board and our Executive team in Leuven, please accept our very best wishes for the festive season and the New Year.

This space is for you

We, the Board, are cognisant that *Chronica Horticulturae* is the primary communication vehicle for our Society. However, it is largely one way – and that's something that we would like to change.

We would like to hear from you – what issues concern you – do you have things you would like to say – or contributions you might wish to make on articles we have presented.

By email, please submit your comments and contributions to **peterjbatt@gmail.com**, Editor of *Chronica Horticulturae,* or **kelly.vandijck@ishs.org**, Associate Editor of *Chronica Horticulturae*.

Upon receipt, we will direct your correspondence to the appropriate member of the Board, but we reserve the right to exercise appropriate editorial control over all submissions received.

In publishing your contributions – and our response – we will identify you only by using your first name and country, unless you request otherwise.

› One year on

François Laurens, Peter J. Batt, Lukas Bertschinger, Yao-Chien Alex Chang, Ted DeJong, Moctar Fall, Patricia Paiva, Ryutaro Tao and Peter Vanderborght

› François Laurens

Upon our election in Angers 15 months ago, one of the first outcomes to emerge from our early discussions was the desire for greater transparency. As the incoming Board, we recognised the need to communicate with you, our members, more often, to let you know what we were doing to address some of the key issues facing our Society. In our first full meeting as the new Board in Leuven in November 2022, we agreed that we would prepare an annual report for our members. However, rather than it being based on a calendar year, given the timing of the XXXI International Horticultural Congress – IHC2022 (in August) and the subsequent election of Board members by Council, our report will cover the twelve months from September 2022 to August 2023.

Over the past twelve months, the Board has met online on almost a monthly basis, with one face-to-face meeting in Tokyo in parallel with the IV Asian Horticultural Congress (AHC2023) and with the Executive Committee in Kyoto to view the planning for the XXXII International Horticultural Congress – IHC2026. In addition, a number of sub-committees have been established to address our major priorities: publications, corporate membership and Young Minds. The challenges of working across multiple time zones have seen some members working very late into the night or others awakening well before dawn.

Post COVID, we are delighted to report that the Society has returned to some degree of normality. In the past twelve months, a total of 29 symposia and one regional congress (AHC2023) were conducted and 31 volumes of *Acta Horticulturae* published. As the finances of the Society are very much dependent upon the number of symposia conducted and the subsequent publication of the proceedings (*Acta Horticulturae*), the financial position of the Society has improved, and while we still anticipate a budget deficit – as forecasted – the deficit for the current year is expected to be less than anticipated.

As the world within which we live is constantly changing, the business model under which we have operated for so long must be reviewed. There is a need for ISHS to diversify its income base to become more resilient. A tender has been prepared and distributed to identify and recruit a suitably qualified management consultant to assist in the development of a new business plan.

To enhance our income stream, there is a need to not only attract new members, but we must also retain and indeed expand our membership base. Earlier in the year, we conducted a survey of both our members and non-members. Not unexpectedly, the main reasons why people join ISHS is to participate in our various symposia, the IHC, and to collaborate and network with other horticultural scientists working on similar problems and issues. However, other than being able to freely access and download papers from *Acta Horticulturae*, there are few other benefits recognized by our members. We also acknowledge that as a Society we have failed to reward our most loyal members. We also acknowledge that we are falling short in attracting and retaining young people, and that our contacts with industry and our relationships with allied organisations need to be stronger.

Expanding our membership base has been our main priority. Over the last twelve months, the Board has explored a number of new membership categories for individual members – including both a retired members category and life membership – and new institutional, corporate, industry, partnership and donor categories. We are currently finalising the benefit packages for each of these new categories – including a range of new benefits – and are establishing standards for both corporate and industry membership. To enhance our corporate membership, an expert committee has been established to develop a candidate list of potential corporate members and a structured approach developed to contact selected candidates and to bring them in.

Country membership was expanded in 2023, but we need to do better. Many other countries in all regions of the world have been identified as potential new members. To the maximum extent possible, country membership should be reflected in our individual membership base, but for a number of reasons, this is seldom the case.

To expand our reach and to better connect with industry, we participated in Hort Connections, the largest trade fair for horticulturists in Oceania. Similar events in Asia, Africa, Europe, North America and South America are being identified and prioritised. We have also renewed our relationship with FAO and are currently exploring opportunities to engage with other international organisations, development agencies, NGOs and foundations.

Recognising that the future of horticulture is centered around our youth, we are seeking to engage a greater number of students and early career professionals. Our activities have been focused on the development of a Young Minds Committee (#ISHSYMC). This is an ambitious program with a global scope, where the center piece of the proposal is the creation of a committee composed of young representatives from different regions around the world. To communicate this initiative, ISHS published a call on its website and social media platforms. Additionally, an email was sent to all members to inform them about the initiative. Following the dissemination of the program, global meetings will be scheduled to bring young people together and to better explain the idea. Some of the suggestions from the Board to the ISHSYMC to consider are to increase the number of membership benefits available to our Young Minds including training, mentorship, workshops and internships.

In parallel, as we extend the membership benefits, there is a need to provide a members only portal for the website. We are also cognisant of the need for our website and social media platforms to raise greater awareness of the Society and to elevate the profile of ISHS. In conjunction with Media Pilote, a communication company in France, we have embarked upon the development of a communication plan for the Society. Aligning our communication strategy with our vision for ISHS is expected to result in a more consistent image and messaging across all our communication platforms, including our print media and journals, and to enhance the linkage between the IHC and ISHS. We also recognise the need to commit more resources to maintaining our website and social media platforms.

Over the past twelve months, as both of our journals eJHS (*European Journal of Horticultural Science*) and Fruits - *The International Journal of Tropical & Subtropical Horticulture* have continued to operate at a loss, the Board, with input from the Publications sub-committee, has explored several options, including to merge the two journals. The Board is continuing to debate whether the new journal will be managed in-house, or

› Board, Executive Committee and members of the Organising Committee for IHC2026 at the Kyoto International Conference Center.

whether part or all of the process will be sub-contracted to an external publishing house. These discussions are on-going.

With the theme of "Exploring the Diversity of Horticulture" IHC2026 will be a six-day event at the Kyoto International Conference Center from Sunday August 23 to August 28, 2026. In September this year the ISHS Board and Executive Committee members visited the totally renovated venue, where in 1997 the famous United Nations Climate Change COP3 Conference took place, which resulted in the 'Kyoto Protocol'. A total of 27 symposia have been planned in consultation with the ISHS Division Chairs. Across the four days of the congress, August 24-27, two plenary presentations will be made in the mornings, with oral and poster presentations, workshops and business meetings conducted for the remainder of the day. A one-day technical tour is planned for August 28. The IHC2026 website (https://www.ihc2026.org/) is now open. Interested members will find a promotional movie and leaflet, accommodation and travel options, and a sponsor prospectus for platinum, gold, silver and bronze sponsorships. The Organising Committe have distributed promotional materials at the annual meetings of the Horticultural Science Society of Thailand (HSST), the Korean Society for Horticultural Science (KSHS), and the American Society for Horticultural Science (ASHS), the international plant dormancy symposium in Australia, and several ISHS symposia such as the IX International Cherry Symposium in China, the XIII International Rubus and Ribes Symposium in USA, and the XIII International Mango Symposium in Spain. An article promoting the event was published in *Chronica Horticulturae 63* (*2*), 10–12, with additional articles promoting horticulture in Japan to be submitted closer to the event.

› Impact and why it matters

Melinda J. Knuth

At some point in every researcher's career, the inevitable question will be asked: "Why does this matter?". While this question is loaded with multiple interpretations and answers, the most direct interpretation is "What impact does this have?"

Being able to accurately measure the impact of research efforts is a difficult but rewarding activity. Communicating impact can be the difference between receiving a research grant, a promotion, or nothing. As someone currently going through the tenure process, measuring my research impact is imperative. In fact, I am asked about the impact of my research program at every annual review with university leadership.

What is impact?

It is important to appreciate from the outset that impact does not mean physics, inertia, or the dissipation of energy. Impact assessment is "a component of the policy or programming cycle in public management" (OECD, 2020). In science-related fields, impact reflects the influence that a finding or a publication has on science or on society. This can be either short-term or long-term, and both are important. Examples of short-term impact include a change in perception or attitude, something that is often described as project outcomes in logic models. Short term impacts may look at providing educational materials about a topic that changes what people believe about that topic. On the other hand, long-term impacts include a change in behavior. This may include a new field born out of a series of publications, or a new direction in an existing field. Both short-term and long-term impacts are necessary for scientific development.

There are two types of impact measurement: *ex ante* impact analysis and *ex post* impact assessment. *Ex ante* analysis is assessing what the need or the problem is before the experiment or intervention takes place. Researchers usually identify this as a research gap or a social issue. It considers where the intervention impact may be and how it could potentially be assessed. *Ex post* impact assessment is part of the evaluation after the experiment or intervention takes place. This activity seeks to evaluate how the intervention corrected the problem and the extent to which the problem was corrected. Impact assessment focuses on the effects including the ratio of funding to impact efficiency, unintended effects, and the future design of interventions.

At its core, impact measurement helps researchers understand whether their research objective (or project) is driving positive change. For example, knowing that promoting an educational message causes 40% of farmers in drought prone areas to adopt more water conserving practices means that this project not only found a technique to draw farmers attention, but that the message was positively effective. This educational message can be communicated to fellow academics, NGOs and governmental entities with evidence that it works.

Key indicators

A particularly effective impact indicator framework is developed and shared by the Center of Disease Control and Prevention (CDC) (Figure 1).

Thinking about the CDC, it is critically important for them to identify and measure the impact of their policies. For example, during the COVID-19 outbreak, their policies were at the forefront for directions on how to deal with the virus and its spread among the general population in the United States. Being able to assess which policies and which communications were effective, and which were not, was critical. They could then focus on what worked instead of spreading their efforts across all communication types. They were also at the forefront of the vaccine rollouts. Being able to measure the number of Americans who had lesser symptoms from getting the vaccine or the number of lives saved was an incredible impact.

By following the arrows in Figure 1, it can be seen immediately that there is no clear path to measuring impact and that each activity intersects with all other indicators. All of these components collectively lead to impact (CDC, 2017).

Disseminating science

This looks at getting the information that science generates out there and communicating it in a way that is usable. This includes sharing findings via scientific publications, trade and extension publications, presentations and conferences, training, and communications through social media and digital and print publications.

Creating awareness

Society is largely unaware of what they do not know. In this respect, people are ignorant of the information that is generated by science and research. Hence, awareness must first be created. This includes continued education and certification, information sharing through journalism, social media, and through listservs (tied closely with disseminating science), stakeholder resources, feedback (surveys, focus groups), and communication among professional societies, ISHS included.

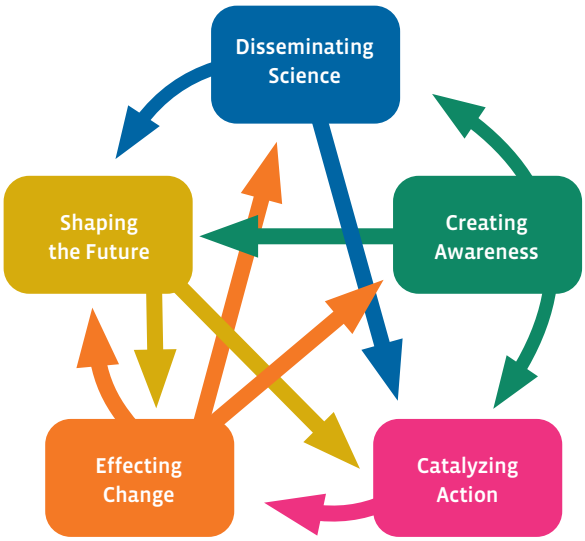


Figure 1. Impact indicator framework.
Source: Modified from https://www.cdc.gov/os/impact/framework.html

Catalyzing action

Catalyzing action is, in essence, facilitating a long-term change associated with behavioral shifts due to the intervention or research findings. For example, technology innovation, new funding opportunities, generation of advocacy groups and NGOs, government hearings, partnerships, collaboration, and methodological or medical practice changes.

Effecting change

This takes the behavioral shifts a step further and generates action. Creation of registrations and surveillance of at-risk populations, changes to government policy, accreditation and certification, economic change, case studies, and sustainable and scalable science translation to the general public are examples.

Shaping the future

The final step includes new hypotheses/continuous quality improvement, the implementation of public health programs/initiatives, health outcomes, prevalence and incidence, morbidity and mortality (e.g., frequency of outbreaks, trends), life expectancy, quality of life improvements and reductions in economic burden.

Impact Science

There is an emerging field of study called Impact Science. It is a social science field that focuses on impact assessment. As stated in the Stanford Social Institution Review, "Social science is by nature a retrospective, post-doc analysis. But, at some point, social science needs to be able to look forward, to predict, to generalize, to think in probabilities about the effects of a novel intervention. This is the promise of Impact Science" (Saul et al., 2022).
This is done through predictive and structural modeling to data and probabilistic models to forecast impact. Perhaps in the future, this field will continue to grow and become more established.

Impact factor is not the same as impact assessment

In horticulture, the impact factor from journals is used as a means of measuring impact. However, the impact factor of a journal manuscript is not equal to the impact assessment of a journal manuscript (Aragón, 2013).
Regrettably, the bulk of academic literature is never cited. Many times, scientists judge the quality of a paper based on where it is published and the ranking of that journal rather than the value of its content.
Critiquing journal impact factors is not the focus here. There is a place for journal impact factors. As Casadevall and Fang (2015) write in their editorial review for the American Society for Microbiology, "While it is true that many published articles are never cited, this does not mean that scientific articles are not the right way to communicate research findings. Articles may not be cited for many different reasons. First, some scientific publications are not truly research publications but relatively short articles that offer perspectives on one or more research findings and these may not be cited, even if they are well read. Second, many research publications cover topics that partially or largely overlap with other publications and modern citation practices generally limit the number of articles that are cited. Finally, some academic articles cover topics of limited interest or are of relatively low quality. With all of that said, research articles should (and will) remain as an important mechanism for communicating scientific research results." The key here is that journal articles are only one way to disseminate information.
What is being critiqued is using impact factor as a metric for impact assessment of researchers as individuals. In fact, as the creator of the impact factor, Eugene Garfield, stated that, "The use of journal impacts in evaluating individuals has its inherent dangers. In an ideal world, evaluators would read each article and make personal judgments." Focusing only on impact factor generates "impactitis" (Casadevall and Fang, 2015). Hence, researchers need to diversify the ways in which they evaluate themselves and constructively look at the importance placed on the impact factor in impact assessments (Aragón, 2013).

Impact of measuring impact

Being able to clearly communicate the impact of research can make a big difference. Common examples of impacts in everyday life from science and technology have simplified human lives. They have made sleeping, cooking, and commuting processes easier and faster, with the help of objects such as air conditioning, microwaves, and vehicles. However, scientists are not particularly good at communicating this (Burke, 1985; D'Este et al., 2018).
Communicating efforts is part of the process and it can pay off handsomely. Scientific research will continue to become more interdisciplinary across all activities. This will result in more research papers with complicated, different components and this, in turn, will require more open communication and conversations among the research community to assess and communicate impact.
A great example of this is the Impact Genome Fund, often known as Impact Genome (https://www.impactgenome.org/). This group has pioneered standardized, objective impact metrics for nonprofit organizations. In the future, perhaps this is an area where the members of ISHS can come together and create a standardized list of metrics to clearly communicate the impact of horticulture research to society, funding agencies, and institutional leadership. The CDC has a nice checklist for choosing high-effect impact that could guide ISHS (see https://www.wmich.edu/sites/default/files/attachments/u350/2014/Indicator_checklist.pdf).

Conclusions

Unfortunately, there is no "one size fits all" to measuring impact, which makes assessment challenging and frustrating. Sometimes there is no impact and worse, a negative impact. Seeing the effects of our strategies can reinforce what is working and change (or eliminate) what is not. Creating a plan to continuously measure the impact of research is a tool that will allow better understanding of impact, and to know when to pivot a strategy and resources when it is not impactful.

› References

Aragón, A.M. (2013). A measure for the impact of research. Scientific reports *3* (1), 1649. https://doi.org/10.1038/srep01649

Burke, J. (1985). The Impact of Science on Society, Vol. 482 (Scientific and Technical Information Branch, National Aeronautics and Space Administration).

Casadevall, A., and Fang, F.C. (2015). Impacted science: impact is not importance. MBio *6* (*5*), 10–1128. https://doi.org/10.1128/mbio.01593-15

Centers for Disease Control and Prevention. (2017). CDC - Science Impact Project - Description of the Science Impact Framework - SPA - OADS (Centers for Disease Control and Prevention). https://www.cdc.gov/os/impact/framework.html

D'Este, P., Ramos-Vielba, I., Woolley, R., and Amara, N. (2018). How do researchers generate scientific and societal impacts? Toward an analytical and operational framework. Science and Public Policy *45* (*6*), 752–763.

Organisation for Economic Co-operation and Development (OECD). (2020). What is Impact Assessment? (Paris, France: OECD). https://www.oecd.org/sti/inno/What-is-impact-assessment-OECDImpact.pdf

Saul, J., King, H., and Noble, L. (2022). The Promise of Impact Science. Stanford Social Innovation Review. https://ssir.org/articles/entry/the_promise_of_impact_science#

› About the author

› Melinda J. Knuth

Melinda J. Knuth is Chair of ISHS Division Horticulture for Development. Dr. Knuth's research priorities are on consumer and market research experience by focusing on the interface between people and plants, helping the horticulture industry understand consumer preferences, perceptions, and motivations. Historically, Dr. Knuth has evaluated trade flows of horticulture products in the United States, assessed the supply chain in the cut flower industry, investigated profit margins in substituting species in floral arrangements, and estimated consumer acceptance of retail messaging. She currently is an Assistant Professor in Horticultural Science at North Carolina State University. Dr. Knuth teaches Greenhouse Management, Floriculture Production, Floral Design, and Horticulture Marketing. Dr. Knuth received her PhD from Texas A&M University in Horticultural Science with a certificate in Applied Statistics. From there, she was a postdoctoral research associate at the University of Florida in the Food & Resource Economics Department. She currently serves as the Young Professional Council Advisor for American Floral Endowment's Executive Board. Her article "What the research says about millennials and houseplants" was the #10 most read article in Greenhouse Product News in 2022. Dr. Knuth received GPN Magazine's 40 under 40 award in 2021 and a 2017 AmericanHort Scholar. E-mail: mjknuth@ncsu.edu

› 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

2024 Principles of Fruit and Nut Tree Growth, Cropping, & Management, 11-15 March 2024, Davis, CA, USA. Info: fruitsandnuts@ucdavis.edu, https://fruitsandnuts.ucdavis.edu/events/2024-principles-fruit-nut-tree-growth-cropping-and-management

Spotlight on Honoured ISHS Members

› Evelyne Costes

Position

INRAE Director of Research (Exceptional Class) and Deputy Director of AGAP Institute in Montpellier, France

ISHS honour

ISHS Fellow

› Research group, including colleagues from the University of Bologna, during a PRIMA project (APMEd) in our experimental orchard in Diascope INRAE Experimental Unit, Montpellier, France, in 2012.

Your involvement with ISHS (roles/positions)

I first joined ISHS in the 90s. As my main research activity was modelling fruit tree structures, I participated in the symposia on "Computer Modelling in Fruit Research and Orchard Management". I then went on to co-organize workshops on functional-structural plant models (FSPM) at IHC2010 in Lisbon (with Professor Ted DeJong) and IHC2014 in Brisbane (with Dr. Jim Hanan). In parallel, I regularly participated in several other Working Groups and symposia related to "Environmental Physiology and Developmental Biology" and Eucarpia. To date, I have published more than 60 papers in *Acta Horticulturae*. In 2015, after organizing the X International Symposium on Modelling in Fruit Research and Orchard Management in Montpellier, France, I became the Chair of Working Group Modelling in Fruit Research and Orchard Management. At IHC2018 in Istanbul, I co-convened the symposium "Understanding Fruit Tree Behaviour in Dynamic Environments" (with Dr. Ayzin B. Küden and Dr. Pasquale Losciale). In 2020, after a short break due to the COVID-19 pandemic, I organized the virtual I International Symposium on Reproductive Biology of Fruit Tree Species. For each of these symposia, I have co-edited the corresponding volume of *Acta Horticulturae*.

I have also been a member of numerous scientific committees for many symposia. In 2019 I became Chair of Division Physiology and Plant-Environment Interactions of Horticultural Crops in Field Systems and I was re-elected to this position in 2022.

What encouraged you to select horticulture as a career?

During my studies at Montpellier University, I became fascinated by plant development and the diversity of plant architectural patterns. Having Professor Francis Hallé as a teacher, strongly motivated me to study botany in tropical plants and led me to discover the incredible diversity of horticultural crops growing in the inter-tropical regions. My Master thesis was at the crossroad between human practices and horticulture, addressing the effects of practices such as pruning, skirting, ring barking, grafting and soil drying that were used in different tropical countries to promote flowering. Since then I have studied multiple fruit tree species, their flowering process and regularity in relation with tree architectural development and subsequently developed quantitative models in collaboration with statisticians and colleagues from the ISHS network.

› Tramping weekend with a group of colleagues after the *Rosaceae* Genomics Conference in New Zealand in 2006. From left to right: Fabrice Foucher and his wife, Charles-Eric Durel (both from INRAE, IRHS Unit, Angers, France), Evelyne Costes, Alla Seleznyova (from PFR, New Zealand) and Elisabeth Dirlewanger (from INRAE BFF unit, Bordeaux, France).

› Wine tasting with Ted DeJong and other colleagues at the X International Symposium on Modelling in Fruit Research and Orchard Management in Montpellier, France, in 2015.

Highlights of your career

Throughout my career I have studied the relationship between architectural development, branching and alternate bearing in fruit trees. After a PhD on lychee, I explored rubber and cacao tree architectures at CIRAD before being recruited by INRAE to study and model temperate fruit tree development (mainly apricots and apples). I have been able to demonstrate the existence of branching patterns and their regularity of fruit bearing. Moreover, these regularities have been modelled in successive zones in which the lateral buds may have different fates, while the between-tree variability is captured by the stochasticity of the proposed models. I have confirmed this concept in different varieties of apricot and apple. Innovative methodological developments have been proposed in collaboration with statisticians (Dr. Yann Guédon and Dr. Jean-Baptiste Durand), which led to collaboration on peach and almond (with Professor Ted Dejong, UC Davis, USA) and the effect of rootstock on branching patterns (with Dr. Alla Seleznyova, PFR, New Zealand). Collectively, we have developed several functional-structural plant models for fruit tree species, in particular MAppleT (for Markov Apple Tree) and L-Almond (developed by UC Davis).

Early in the new millennia, I became interested in the genetic variability of architectural and flowering traits of apple trees. This has led me to orientate my research toward quantitative genetics to explore the genetic determinants of growth and branching, and also flowering time and regularity in bi- and multi-parental populations. The detection of associations between allelic variations along the genome and the genotypic variations of those traits has opened two new research directions: first, deciphering the physiological and molecular mechanisms responsible for the flowering process (induction and timing), and second, the development of high-throughput phenotyping methods to capture relevant traits on a high number of adult trees and enlarge the developmental stages at which genetic association studies can be performed.

How has your participation in ISHS facilitated/encouraged your career?

Through ISHS, the different symposia and Working Groups, I have met many of the colleagues with whom I have collaborated. ISHS is a unique network for disseminating ideas and results, meeting other groups and developing collaborations. The recurrence of symposia and congresses every three to four years is crucial to maintaining relationships, renewing ideas and finally creating a friendly community. ISHS also offered me the opportunity to be more deeply involved as a Working Group chair and by organizing several symposia and workshops to gain international visibility. This enlarged my personal network but also provided a vehicle for the dissemination of our research results.

What words of advice do you have for students/graduates/early career researchers?

By gathering horticulturists working on different species, but also technicians and stakeholders, ISHS is complementary to other scientific international meetings. Attending ISHS symposia and congresses led us to confront extremely diverse views and needs and therefore enlarge our comprehension of research fronts and relevant applications. I strongly encourage students, PhDs and early career researchers to join the ISHS Working Group that aligns with their domain of research to enrich their network and to meet a large community of like-minded horticulturists. This will expand their horizons and provide them with stimulating discussions and a supportive and friendly network. With time, they will have the opportunity to be more deeply involved through becoming convener of a symposium and increasing their international visibility.

› In a greenhouse with colleagues from my team in Montpellier (Fernando Andres and Baptiste Guitton), in 2016.

Horticultural Science Focus

Agroecology and its role within ISHS

Maria Claudia Dussi and Pierre-Eric Lauri

As a concept, agroecology was proposed over a century ago as a framework for more sustainable farming systems. Agroecology seeks to reduce our dependency on fossil fuel (petrol, gas), to reduce pollution of the environment and to mitigate the effects of climate change. It is based on principles that collectively aim to increase the autonomy and the resilience of the agroecosystem: recycling biomass, enhancing soil biotic activity through better management of organic matter, minimizing nutrient losses from the agroecosystem, increasing energy efficiency, increasing species and within-species diversity, and enhancing beneficial interactions and synergisms within agroecosystems (Altieri, 2015).

Although initially inspired by the science of ecology, agroecology is comprised of at least three dimensions: a science; a set of practices; and according to agroecological principles, a social movement that is more or less significant depending on the region in the world where it is developed (Wezel et al., 2020). It thus encompasses not only biotechnical issues that are classically investigated in horticulture (plant breeding, land management, product transformation, and the food supply chain, among others) but also the place human beings have in horticultural research from field to fork, and at a more general level, human health, and environmental safety.

Agroecology is a scientific discipline that involves the holistic study of agroecosystems and food systems: a set of principles and practices that improves the resilience and sustainability of food and agricultural systems, while preserving social integrity, and a socio-political movement that promotes the practical application of agroecology, pursues new ways of considering agriculture, food processing, distribution and consumption, and its relationships with society and nature (Wezel et al., 2009; CIDSE, 2018). It is a profound and continuous transformation that leads us to completely rethink our relationship to each other and to the earth that sustains us.

Agriculture is a significant contributor to climate change due to the amount of greenhouse gas (GHG) emissions generated on farm and in the processing, distribution, and consumption of food products. Global emissions from agriculture and related land use currently account for about one-fifth to one-quarter of total emissions from all economic activities (IPCC, 2019). However, the climate change impact of the entire food system is much greater when pre- and post-production activities along the supply chain, retail, consumption, and waste disposal are included. When all food system activities are considered, food system emissions can account for between 20 and 40% of total anthropogenic emissions (EAT-Lancet Commission, 2019; Tubiello et al., 2021).

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019) global assessment warned that biodiversity is declining faster than at any time in human history. Food systems are responsible for around 60% of global terrestrial biodiversity loss. At the same time, around one-third of all food goes to waste between the points of production and consumption, while around 11% of the world's population are undernourished and 39% are either overweight or obese (FAO, IFAD, UNICEF, WFP and WHO, 2019). There is a close link between human health, plant, soil, animal, and ecological health.

The ETC Group (2017) calculates that smallholder farmers make up 80% of the total number of farmers and, using agroecological methods, produce 70% of the food available for human consumption (measured in calories and weight). Smallholder farmers use less than 25% of the world's agricultural land, only 10% of the fossil fuel and no more than 20% of the world's freshwater. In contrast, global agribusiness uses more than 75% of the world's agricultural land, provides food for only 30% of the world's population, and is responsible for the consumption of almost 90% of the fossil fuels used in agriculture (and consequently the corresponding emissions of GHG), and at least 80% of the fresh water.

Agriculture for the future must consider oil-independent agricultural models; agroecosystems with a low environmental impact that are resilient to climate change; multifunctional agriculture that provides economic, social, and environmental services; and local food systems, among other aspects. The new paradigm to feed the world requires an agroecological approach based on the right to food for all people and an acknowledgement of the social function of land. The conversion of specialized agricultural systems to an agroecological system follows three principles: diversification (by including different species of crops, trees and animals); integration (by the dynamic exchange and recycling

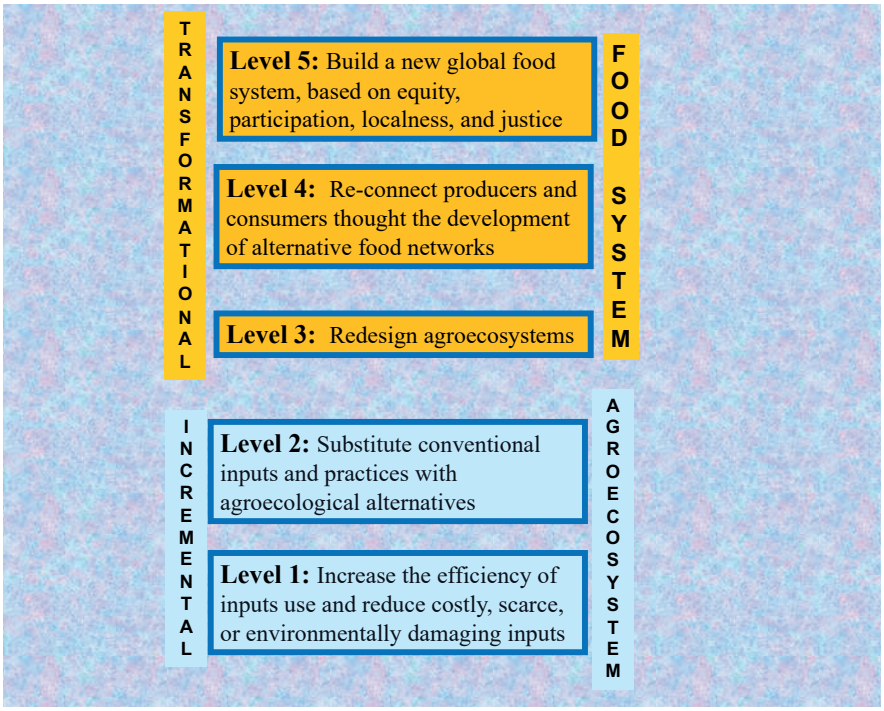


Figure 1. Transformational process from conventional form of agriculture towards agroecological food systems (adapted from Gliessman (2016) and Wezel et al. (2020)).

of energy and nutrients between the components of the system); and the achievement of food self-sufficiency.

In its second international symposium on agroecology "Scaling up Agroecology to Achieve the Sustainable Development Goals" (SDGs), the Food and Agriculture Organization of the United Nations (FAO, 2018) reinforced the opportunities for agroecology: to enhance smallholder and family farmers' adaptation and resilience to the impact of climate change; to improve food security and nutrition through healthy food and diversified diets; to protect and enhance agro-biodiversity to support ecosystem services such as pollination, soil health and the recovery of degraded lands and forests; to improve livelihoods in rural areas; and to achieve a transformative change in agricultural practices towards sustainable development. These statements were reinforced by the High-Level Panel of Experts (HLPE) on food security and nutrition that produced a report on "Agroecological approaches and other innovations for sustainable agriculture and food systems that enhance food security and nutrition" (HPLE, 2019).

Many of the recommendations made by FAO (2018) and the HLPE (2019) already align with the attitudes and values of most ISHS members. The "one-size-fits-all" paradigm that was the main element of standardized mono cropping in the mid 20th century has been replaced by the need to adapt our horticultural systems to specific contexts. Another aspect is the need to reconfigure the relationship between formal scientific research and the local knowledge and experience of farmers, rural and urban communities, and other actors along food value chains. Not only is ISHS interdisciplinary, but also transdisciplinary, for the Society aims to involve all the actors in food value chains (farmers, technicians, scientists, industry, government). This accentuates the importance of thinking both holistically and systemically about our agri-food system. Problems cannot be addressed in isolation, as they are interconnected and interdependent, and when problems become more acute, the effects spread throughout the entire system, potentiating other problems.

Thousands of agroecological initiatives around the world are revitalizing traditional farming systems that have stood the test of time to enhance food sovereignty, while contributing to the conservation of biodiversity. Increased plant species diversity and genetic diversity increase the overall resilience of food systems to new environmental threats and climate fluctuations. Agroecological farmers opt for intercropping and/or silvo-pastoral systems, agroforestry practices, as well as other diversified agricultural approaches that incorporate genetic diversity within their cropping regimes. This choice not only improves the biodiversity of their land, but also revitalizes the health of the soils and strengthens the resilience of their farming systems to extreme weather events.

Agroecology is a holistic model of global change. Its principles are a set of general guidelines that constitute the fundamental pillars of agroecology, its practice and implementation. Within the model, there are four dimensions: an environmental dimension, a social and cultural dimension, an economic dimension, and a political dimension (CIDSE, 2018). According to Gliessman (2016), the transformational process from conventional production systems towards agroecological-based systems involves five levels. Level 1 seeks to increase the efficiency of industrial and conventional farming practices to reduce the use and consumption of costly, scarce, and environmentally damaging inputs. Level 2 requires farmers to substitute conventional inputs and practices with agroecological alternatives. Level 3 requires a redesign of the farming system so that it functions based on a new set of ecological processes. Level 4 seeks to reconnect producers with consumers through the development of alternative food networks. Level 5 ultimately seeks to construct a new global food system, based on equity, participation, democracy, and justice. Whereas Levels 1 and 2 are incremental, Levels 3 to 5 are transformational (Figure 1).

Horticulture faces complex challenges that require problems to be addressed and resolved through an interdisciplinary and transdisciplinary approach to systematically develop, deliver, and apply sustainable farming techniques and methods to reconstruct our agrifood model (Dussi, 2019; Tüzel and Bertschinger, 2020). This integrated approach considers consumer related values like health, nutrition and well-being. In this way, horticulture can play a leading role since fruit and vegetables are food crops of utmost importance in the diet and are a valuable source of income for farmers (Dussi and Simon, 2022).

With its inherent ability to share knowledge and a broad range of Divisions and Commissions encompassing the diversity of tropical and temperate tree fruits, nuts, vegetables and ornamentals, protected cropping, urban food systems and responsible governance and interconnected functions of its members, ISHS is undoubtedly a relevant organization to facilitate the development of agroecology on a world scale.

ISHS promotes and encourages research and education worldwide for horticultural science. Our Society contributes to the achievement of the UN Sustainable Development Goals and in this sense, agroecology plays a strategic role in facilitating a more biodiverse, productive and resilient food system, capable of locally and regionally producing a sufficient quantity of healthy and accessible food for all humanity.

Agroecology is now an integral part of ISHS, with its own events and chairpersons to promote it, and has a bright future in collectively building a transformative process to develop new global food systems based on democracy, equity, knowledge sharing, and participation.

› References

Altieri, M.A. (2015). Agroecology, Key Concepts, Principles and Practices (Third World Network and Sociedad Cientifica Latinoamericana de Agroecologia (SOCLA)), pp.55. https://www.fao.org/agroecology/database/detail/en/c/443630/

CIDSE. (2018). The Principles of Agroecology. Towards Just, Resilient and Sustainable Food Systems (CIDSE), pp.12.

Dussi, M.C. (2019). Agroecology and education: socio-ecological resilience to climate change. Chronica Hortic. *59* (*1*), 20–22.

Dussi, M.C., and Simon, S. (2022). Agroecology and system approach for sustainable and resilient horticultural production. Acta Hortic. *1355*, 1-4. https://doi.org/10.17660/ActaHortic.2022.1355.1

EAT-Lancet Commission. (2019). Summary Report. https://eatforum.org/content/uploads/2019/07/EAT-Lancet_Commission_Summary_Report.pdf

ETC Group. (2017). ¿Quién nos alimentará? ¿La red campesina alimentaria o la cadena agroindustrial? 3rd edn (ETC Group).

FAO. (2018). Scaling up agroecology to achieve the sustainable development goals. Paper presented at: Second FAO international symposium (Rome, Italy). Licence: CC BY-NC-SA 3.0 IGO.

FAO, IFAD, UNICEF, WFP and WHO. (2019). Review of the State of Food Security and Nutrition in the World, 2018: Building Climate Resilience for Food Security and Nutrition (FAO, IFAD, UNICEF, WFP and WHO).

Gliessman, S. (2016). Transforming food systems with agroecology.

Agroecology and Sustainable Food Systems *40* (*3*), 187–189. https://doi.org/10.1080/21683565.2015.1130765

HLPE. (2019). Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition. A report by the High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security (Rome: HLPE). Full report forthcoming at www.fao.org/cfs/cfs-hlpe

IPBES. (2019). Global Assessment Report on Biodiversity and Ecosystem Services (Science Policy Platform on Biodiversity and Ecosystem Services (IPBES)).

IPCC. (2019). Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems. Summary for Policy Makers (Cambridge: IPCC).

Tubiello, F.N., Rosenzweig, C., Conchedda, G., Karl, K., Gütschow, J., Xueyao, P., Obli-Laryea, G., Wanner, N., Qiu, S.Y., De Barros, J., et al. (2021). Greenhouse gas emissions from food systems: building the evidence base. Environmental Research Letters *16*, 065007. https://doi.org/10.1088/1748-9326/ac018e

Tüzel, Y., and Bertschinger, L. (2020). Future direction and opportunities for horticultural research. Chronica Hortic. *60* (*1*), 9-19.

Wezel, A., Bellon, S., Doré, T., Francis, C., Vallod, D., and David, C. (2009). Agroecology as a science, a movement, and a practice. A review. Agron. Sustain. Dev. *29* (*4*), 503–515. https://doi.org/10.1051/agro/2009004

Wezel, A., Herren, B.G., Kerr, R.B., Barrios, E., Goncalves, A.L.R., and Sinclair, F. (2020). Agroecological principles and elements and their implications for transitioning to sustainable food systems. A review. Agron. Sustain. Dev. *40*, 1–13. https://doi.org/10.1007/s13593-020-00646-z

› About the authors

› Maria Claudia Dussi

Prof. Maria Claudia Dussi is Chair of ISHS Commission Agroecology and Organic Farming Systems, and is a full professor of agroecology and temperate fruit physiology and culture at the Department of Agricultural Sciences, National University of Comahue, Rio Negro, Patagonia, Argentina. She is Board member of the Latin America Scientific Society of Agroecology (SOCLA). Prof. Dussi was convener of the IHC2022 Symposium 15: Agroecology and System Approach for Sustainable and Resilient Horticultural Production, Convener of the IHC2018 Workshop on Agroecology and Education, and was involved in organizing the XI International Pear Symposium in Argentina in 2010. E-mail: mcdussi@yahoo.com

› Pierre-Eric Lauri

Dr. Pierre-Eric Lauri is Vice-Chair of ISHS Commission Agroecology and Organic Farming Systems and Senior Researcher at INRAE Montpellier, Joint Research Unit 'ABSys – Biodiversified agrosystems', France. E-mail: pierre-eric.lauri@inrae.fr

Trends and issues in the fresh produce industry

An interview with Max Teplitski, Chief Science Officer at the International Fresh Produce Association (IFPA)

Peter J. Batt (PB): Max. Many thanks for accepting my invitation. I wanted to talk today about trends in both supply and demand. Starting with the demand side: what are the key issues impacting the consumer demand for fresh fruit and vegetables?

Max Teplitski (MAX): Here at the International Fresh Produce Association (IFPA) we conduct a lot of research to try to better understand our consumers, where their interests are and what attributes consumers are looking for in food in general. Let's start with the premise: let food be thy medicine. However, consumers are actually turned off by the medicinal narrative, for in their minds, medicine is associated with something that doesn't taste good. Consumers are looking for an experience and they're looking for something that is fun and exciting and will help them to live a more healthy and productive life.

When consumers go to a grocery store, we've asked them if they would pay more for sustainably grown produce. Invariably they say yes. When we ask them if they will pay more for ethically grown produce, more than half say yes. But when we analyse data from the point-of-sale registers, the reality is that most consumers across the globe make the decision to buy fresh food on just three attributes: perceptions of quality, price, and nutrition and freshness. We've done these tests in multiple markets including the US, Mexico and Brazil, Australia, New Zealand and the Far East. While the ranking of these three attributes may change across different markets, these three are the key drivers of consumer demand. While consumers might consider whether the produce has been ethically grown or sustainably grown, locally grown and even the impact of modern technologies, when they're in front of the checkout registers, it's perception of quality, perceptions of freshness and nutrition, and price that ultimately influence choice.

PB: Our experience here in Western Australia (WA) is not dissimilar. While everybody wants local food and food that has been produced sustainably, nobody wants to pay for it. However, sustainability and natural capital, they're important, so if consumers won't pay, who will? Do we look to government?

MAX: That's a great conversation. I happen to be a big believer in market forces rather than imposing government regulation. In a past life, I spent more than a decade in the food safety area. When we started, our key premise was that food safety did not provide a competitive advantage. Rather, food safety was where you start, for food safety is a public good. Framing the conversation in a similar way is a good place to start. However, sustainability means different things to different people. We need to start with the 3Ps: planet, profit and people. Picture it as a Venn diagram: it won't work if any of the circles are removed. First and foremost, sustainability is about profitability, for the growers, for their communities and frankly for the consumers.

PB: I agree completely. However, starting with those 3Ps, is there not room for a fourth – policy? We actually need government intervention to ensure the market works. In WA, the key constraint is the increasing power of the supermarkets, driving prices down for the growers. While low prices might be good for the consumers, in the long run, if producers are not making a profit, they don't have the cash to invest in new product innovation or technologies.

MAX: Across the globe, we have seen many different approaches to how government imposes rules, regulations and policies. I think the best thing that government can do is to level the playing field and to then step back. Unfortunately, in some parts of the globe, government attempts to take a more active role. At one extreme, we have heavy handed totalitarian control and the negative consequences of that. Retailers have an immediate relationship with consumers because they are the frontline: they hear directly from the consumers. Using retailers as a proxy for regulation is unfair. For example, in Canada, with the new plastic packaging regulations, the Canadian government has absolved itself from the responsibility and is now making retailers do all the dirty work. Now the retailers must impose very draconian regulations on packaging on their suppliers. Policy and relationships in the triangle between the consumers, business and the government must be balanced and equidistant. I hope that governments around the world don't abuse their relationships and the trust that they have from the people who elected them. That said, there is a need for government to set a level playing field to ensure fairness, then let everybody play. Government needs to step in only when there is unfair play.

PB: Coming back to the consumer. We know that their decisions to purchase are made in relation to perceptions of quality, price and nutrition. However, what are you currently doing to help consumers pick better produce? Just because an apple looks nice, that doesn't mean it will taste good.

MAX: It's perception of quality. All consumers have their own different ways of deciding what's going to taste good. Some of them use smell, some of them use some physical interaction with the fruit to determine how good it is.

Consistency in the taste and organoleptic properties is something that is stopping fresh produce from conquering new markets. Today, consumers might purchase a bag of product that tasted great, but when they go back tomorrow to pick up what they think is the same brand, it doesn't have the same crispy attributes, the same flavour profile, or the same sugar content. There are a variety of reasons for this. Our product is very sensitive to ethylene levels. For example, deviations in temperature along the supply chain for mangoes can lead to internal brown streaking that's not appealing to consumers. It's this consistency in flavour and experience that will expand the consumer base.

This inconsistency is leading to the decommodification of products. In the US, we're seeing more fresh produce being sold under their varietal names or trade names. Apples were the pioneers in this space. Today, tomatoes are being sold under their commercial names: Kumato tomatoes are not only sweet, but have a very unusual pigmentation. Kumato is a traditionally bred variety. Then we have 'Pink Glow' pineapple. It's a bioengineered (BE) pineapple that is labelled as a BE product. This presents another opportunity to go from a generic product – where the consumer is taking a risk – to buying a product

with a specific flavour profile that they know and expect.
The fresh cut industry has very specific requirements on the quality of the product that they will buy so that when the consumer buys a cup of fresh cut pineapple or fresh cut melon, they know that it's going to be sweet and delightful.
Advances in plant breeding are leading to the decommodification of the fresh produce industry. A second trend that we're very excited about is new technologies for the postharvest preservation of fresh produce. We are currently seeing the development of some exciting new ways to control the gases that impact spoilage, so we can help the product to stay fresher and to maintain its visual appeal for longer.
There is a lot happening in the industry on the tech innovation side. However, consumers don't see that, and frankly, we would prefer them to pay attention to the products rather than to the science behind it. We recently had a think tank where we asked consumers what they knew about modern technology and how that impacted fresh produce and consumers' perception of the product. When we offered a test product to consumers that had an exciting taste and had been developed using the Crispr technology, without fail, consumers in the US said we want to know what it tastes like. We want an exciting experience and flavour. How it was developed – the technology is fine – but don't sell it as a high tech product.
We see innovations like this being put into practise by several companies. Pairwise have developed a gene edited mustard green that doesn't have that spicy wasabi flavour that knocks you out. It still has some bitterness to it, but they gene edited these vibrant beautiful purple mustard greens that still have that crispness and great nutritional profile, but they're not pungent. They are test driving these new leafy greens in multiple markets in the US. They open by saying this is an experience in flavour profile and by the way it's gene edited. You can scan the QR code and you can learn about the genetic modifications that were done and all the protocols that were followed. It's transparent, but they open the conversation with consumers with the flavour profile and experience.
We see a similar thing with purple tomatoes, another BE product. In this case, there is a regulator gene from snapdragon that allows tomatoes to make purple pigment. While tomatoes are able to make their own purple pigment, at some stage in their evolution, they just stopped doing it, so this flower regulator gene turns that purple pigment back on. In the marketing campaign for these purple tomatoes, producers focus on the visual experience. These purple tomatoes are vibrant: they look fantastic and they taste fantastic. While Norfolk Produce are very transparent about how they developed the product, the technology is not the opening conversation with consumers.
The takeaway message here is that consumers want freshness, quality, taste and a great price, and while they want to know how it was grown, as long as they're comfortable with the technology, their decision to purchase will be made on these three key attributes.

PB: Do you think the US market is different for example to the European market where there is this absolute paranoia about anything that is genetically modified (GM).

MAX: It saddens me to see that in some markets there is still a luddite attitude towards technology. It hasn't served the luddites well and it's not going to serve humanity well. We cannot address the challenges of tomorrow with the tools of yesterday. The challenges of climate change, nutritional insecurity and an exploding population, the technologies from 100 years ago are not going to get us there.
Here's an example that I give everybody: a few years ago, Sri Lanka decided to embark on an organic experiment. Fast forward and the President was ousted in a coup as the result of massive famine and unrest. We can't use technologies from a century ago to deal with the realities of today. However, having said that, growers should have access to all the tools of production, but government policies need to make these tools available to the growers.

PB: I concur completely. GM gives us the tools to be able to bring better tasting products to the market, with a whole range of better nutritional properties, with a whole range of natural resistance to pests and disease, and a whole range of climatic adaptations. In 2015, Dave MacLennan, President of Cargill, declared that GM was an integral part of sustainability. So how do we overcome this bipolarism across the globe?

MAX: Let's spend a minute on the GM conversation and organics. If you look at the evolution of the organic market, it all started a decade and a half ago. To buy organics you had to go to an organic store, but today, it's mainstream. Yesterday I was shopping at Walmart where the organic section is about half of the fresh produce section. Here's an example of the consumer pull. When consumers get excited about a product category then market forces take care of it. As long as there is a clear definition of what organic is and the organic label is truly enforced – so that we don't undermine the trust in the system – we won't damage the market for both organic and conventionally grown products. Organic has a place and a very special place. I would speculate that at least one quarter of the leafy greens that are on the market in the US have either been grown organically or pesticide free. Growers need to make production decisions based on their local environment and local conditions.
We're having in-depth conversations now with several retailers about their efforts to ban some of the pesticides and specifically insecticides. Our industry depends on pollinators, so it's in the industry's interest to make sure that we are responsible stewards of the land and animals, including pollinators. However, on the other hand, sometimes growers have no choice but to use synthetic pesticides. They need to have access to those tools, whether organic or conventional, as long as the rules are clearly spelled out.
On modern technology, whether it's BE or gene editing, it's not a schism between the US and Europe. We see the greatest adoption of modern biotechnology in Central and South America. Latin America is a great example of what modern technology can do for the economy. If we then look at Europe, BE crops are not allowed to be grown but are widely consumed. The European Union and the United Kingdom are some of the largest importers of BE products. It's a riddle that policy makers and consumers need to sort out themselves, but we're excited to see the conversation on gene editing moving in the right direction.
We (IFPA) will never support a wild wild West that sees the unregulated introduction of new products irresponsibly. However, many of these gene edited products would have occurred naturally. Single point mutations, even in polyploids, gene editing is a tool, just like any other tool, that advances innovation. However, safety measures need to be risk appropriate. We could go down this route of risk appropriate regulation versus hazard focused regulation, but I think it's in everybody's interest to focus on risk based regulation. Hazards surround us everywhere. So instead of getting paranoid about the perception of hazard associated with BE and gene editing, focus on risk based regulation.

PB: I think we would all agree that the actions of Monsanto didn't do a lot to help the cause. Their heavy handed approach to prosecute smallholder farmers turned most people off. But for this new wave of GM products, we're offering things to consumers like superior taste, superior shelf life or superior nutritional quality in terms of purple tomatoes with anthocyanins and antioxidants. The more we position these innovations at the consumer, and how we can use these technologies to deal with issues like climate change and resource

scarcity, the greater the acceptance. That brings me to another issue that is embedded within this: social licence.

MAX: Yes. It's very real. We recently held a think tank on gene editing where the main question was to avoid making the same mistakes that we saw with the first generation of BE crops. Social licence comes with transparency. Consumers probably don't need to know the sequence of primers that were used to knock out a gene, as most of them will not understand what it means. But they need to be able to look at the technology and to see that there is nothing hidden from them. Companies like Pairwise and Norfolk Produce are taking giant steps toward ensuring this transparency. Click on the QR code, come to our website and we will show you everything that there is to see – without revealing our trade secrets – and they say we'll overcome that by linking the information to a patent.

We are very interested in how consumers interact with the QR codes on boxes. What we have learned is that consumers use them, but only once. When consumers pick a brand that is unfamiliar to them and they see the QR code, they will click on it. Having read the information, consumers will either trust the company, or they won't, but they're unlikely to scan it again. Giving consumers all the information that they can possibly want allows them to tease out what makes sense to them and what information they include in their cognitive framework.

Many of the first generation BE crops were focused on agronomic traits that made it easier for the growers. For example, it was easier to control weeds because we could selectively use just one herbicide. Remember, consumers look for perceptions of quality, taste, nutrition and price. While it might be easier for a grower to control weeds, the industry miscalculated how much consumers cared about production practises. For the majority of consumers, there is a disconnect, but we must be transparent and we certainly can't lie to the consumers, nor can we hide information from them because they will find it. We live in a world where everything is only three clicks away. The biggest mistake we can make with our technology is not to be transparent about it.

PB: That is a seriously good message that might help us address some of the key issues associated with the adoption of innovation. On the one hand, while there can be a lot of consumer resistance to innovation, we've observed that consumers perceive hydroponics very favourably. Because it's perceived to be like a laboratory, that means it's free from pests and diseases and so it's free from chemicals. Perhaps for the same reason, consumers' perceptions of urban plant factories are quite positive: it doesn't seem to matter if their salad greens have been grown under artificial light.

MAX: Its regional. The moment you say artificial light and artificial medium in some markets, the consumers ears perk up. In general, I think it's a mistake to focus on the technology. It's more important to go with the attributes of the product: the freshness, nutrition and price.

PB: We have talked a lot about taste. Some years ago, there was a huge push into nanotechnology. Where do you feel this fits – if at all – for many people were talking about potential safety issues.

MAX: The big question is risk appropriate decision making. When you think about applying sun screens to your skin and face in the amounts that are recommended three times a day, these all contain very healthy amounts of nano particles. Given how widely nanomaterials are used in everyday lives, the conversation about potential uptake of nanoparticles into plants has fizzled. And by the way, plants – for most parts – cannot take up nanoparticles all that easily.

However, we do need to have a conversation about micro plastics and nano plastics. Plastics have changed our lives in so many ways, but some plastics are made of petrochemicals and petrochemicals can have negative health effects in the long run. We need to think about how we can mitigate hazards in a risk appropriate manner. Plastic waste littering the environment is an issue, but the trade-offs in our industry are considerable. As an industry, we have invested so much to ensure that our products are safe. We're now watching the government in the UK say that all fresh cut needs to be sold in bulk. How can we scale it and how can we make it available to every consumer and what impact will that have on our industry? Fresh cut is not a luxury. For many shoppers, but particularly single parent households or where both parents are working, fresh cuts allow families to have time to have a salad. When the UK government says it will have to be sold in bulk, they are robbing consumers of choice and raising a lot of questions about food safety and food waste. In the US, up to 70% of fresh produce is wasted post farm gate, because fresh produce is so perishable and fragile. Selling it completely unpackaged will increase costs and increase food loss and waste. But we also need to reduce packaging waste.

We need to have a conversation with our governments about food safety. We need a category exemption for fresh cut product, because food safety cannot be compromised. For some products that can be sold in bulk we have PLU stickers, but these PLU stickers are not available to fresh cut or produce with a thin skin. In most retail stores, fresh produce makes up less than 7% of the packaging. Why then is government so focused on fresh produce rather than the products in the store's centre aisle?

Another option is reusable, recycled and compostable containers. While many consumers are interested in this option, let's think about the supply chain implications and the costs associated with lugging all those empty containers back to the washing facility. What is the carbon footprint? All decisions are not without trade-offs and we need to be thoughtful. If we have compostable plastic or plant polymer bags as an option, that option should be on the table. But let's do a lifecycle assessment to understand the carbon footprint of multi-use packaging before completely disrupting our supply chains.

PB: Currently there is a lot of chatter about regenerative farming. How is this moving in the market in terms of acceptance?

MAX: Right now there is no definition of regenerative and we would love to see a definition that is consistent. Currently we have at least three dozen audit schemes that certify regenerative product based on somebody's definition and that's not helping the industry, the consumers, or the retailers. One of the hopes that we have as an association is that whoever is in charge: the government, retailers or some consortia, they will define regenerative agriculture and create a single system audit, because we can't expect growers to comply with 15 audits for any given commodity for any given buyer. It's important to remember that in our industry, most growers are family-based operations. To comply with 15 different audits on any given day is not only unfair, but it also puts a huge drain on resources.

That aside, regenerative agriculture is a production tool. When we talk about soil health and farming on a planet that is warming and where natural resources are rapidly depleting, regenerative agriculture is an option that should be available to growers. However, many of the definitions of regenerative agriculture include integrating animal operations. We must also be thoughtful about that, for we can't have livestock running around in vegetable fields. We need to know that when composted animal manure is incorporated into the soil, it's been tested and found not to contain any foodborne pathogens.

PB: In Australia the popularity of regenerative farming lies in the fact that it's not defined. Growers are able to adopt practices that are appropriate to their particular situation and to the way they individually manage their farms, whereas organic is

so prescriptive and rule based. However, the downside is growers can't market their product as regenerative for as you say, it leads to huge confusion at the consumer level.

MAX: In the US, we have multiple definitions of regenerative farming: it's climate smart, it's carbon smart. One of the projects that IFPA are currently working on, with funding from the USDA, is to trial climate smart production practises. Our industry hasn't had herbicide resistant crops, for better or for worse, but it also means that no-till or conservation tillage is not widely adopted in the US. The USDA has a list of practises that they consider to be conservation practises and we're trialling six of these practises to see how they fit into this climate smart framework. We're incentivizing growers with a small amount of money, but more importantly, we're connecting them to technical support services that can help them think through the operations and trial these practises. We're there with the growers to collect data. If a grower is using biochar, what does it mean to the carbon sequestered on farm and how does that translate into profitability through increased yields. While we can sequester as much carbon as we want, if farmers are not making money, then why are we doing it.

An integral part of this project is to measure the inputs and to measure the outputs both in terms of yield and ecosystem services. In the US, we have a food traceability system that has already penetrated the industry. We can track every batch of fresh produce from the field to the retail store, so we're exploring how we can use the same food traceability system to track sustainability benefits. We can then explore mechanisms to use the free market to incentivize the adoption of these practises, perhaps through the carbon market, or alternatively, whether growers can use these sustainable attributes to promote their products to retailers.

PB: What else is emerging in the climate smart agriculture space?

MAX: We need to think about how we can grow crops in a way that is appropriate for a changing climate. It's not just the warming trend, but it's also the diminishing availability of resources and the unpredictability of the growing season. Chilling hours are important for some crops, rising humidity levels will impact our ability to fight pests and pathogens and then, with warming climates, we will have the intrusion of exotic pests. Climate impacts also disrupt the availability of the labour force, consumption and migration patterns.

Agriculture plays a part in climate change, but it is also an important component of the solution. Both mitigation and adaptation go hand in hand and all governments need to incentivize both. While we can collectively strive to reduce energy emissions, we must also adapt to the realities that we're living in. We need to track and define sustainability and incentivize a marketplace that will truly support climate smart practises, as governments around the world cannot continue to inject billions of dollars into sustaining this marketplace.

Finally, we need to educate consumers about the opportunities for agriculture to be a partner in resolving the climate crisis. Unfortunately, there are some narratives in the West where agriculture is portrayed as the boogeyman that needs to be controlled and reined in. I invite those who propagate these storylines to visit any farm in their neighbourhood and to appreciate the work and the thought that goes into food production practises.

We need to change consumers' perception of agriculture. Grant Wood's "American Gothic" painting comes to mind where a man and a woman in their 60s are holding a pitchfork. Modern agriculture is nothing like that. It's about drones, machine learning and AI, precision inputs and molecular breeding. How do we get young people into the industry and get them excited about the innovations, the thinking and the opportunities?

We also need to deal with consumption and food waste, and circling back to the start of our conversation, consumers' perceptions of quality, taste and price. Price and value are sometimes entangled in consumers' minds. Once we start thinking about the value of what I'm buying – yes – I can buy a lot of junk food – but then in the long run, I'll pay for those poor decisions in terms of increased medical bills, poor quality of life and even the longevity of life. We need to have these conversations and find ways to incentivize fresh produce consumption and to make fresh produce available to all segments of the population. While I live in Washington DC, the nearest grocery store in my neighbourhood is 2 miles away. As most of my neighbours don't have cars, they rely on the corner store for their daily necessities. However, the corner store has more varieties of cigarettes than they have fruits and vegetables, and those cigarettes are very expensive. How then do we continue the narrative of promoting the benefits and the experience of consuming fresh fruit and vegetables and to get our consumers hooked and addicted – not to junk food and cigarettes – but to apples and berries, fresh crispy salads and peaches?

› About the author

› Max Teplitski

Dr. Max Teplitski is a Chief Science Officer at the International Fresh Produce Association (IFPA), where he is responsible for the science, ag. technology, supply chain and sustainability programs. Prior to joining IFPA, Dr. Teplitski was Division Director (Acting) and National Program Leader at the USDA National Institute of Food and Agriculture, where he oversaw federal research investment portfolios in produce safety, microbiology and nutrition. An author of over 100 peer-reviewed publications, Dr. Teplitski was a Professor at the University of Florida, where his research and education program focused on comparative and functional genomics of human pathogens to understand their adaptations to survival in non-host environments. Dr. Teplitski served as a Fulbright Specialist in Agriculture (Escuela Politecnica del Litoral), U.S. Embassy Science Fellow, Biotech Outreach Speaker (U.S. Department of State), and G.E. Burch Fellow in Theoretical Medicine (Smithsonian Institution). He is a recipient of J.E. Feeley Award in Recognition of Significant Contributions in Environmental Microbiology, UF-HHMI Science for Life Distinguished Mentor Award, Animal Conservation Award (Lindberg Foundation), and W.E. Krauss Director's Award for Excellence in Research (Ohio Agricultural Research and Development Center). He is also a Courtesy Faculty at the UF Plant Pathology Department. E-mail: MTeplitski@freshproduce.com

› 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

Effect of freeze drying, oven drying and their combination for energy conservation and quality of carrot slices

› Zobabalo Mina

Zobabalo Mina is a Masters candidate at the Postharvest and Agroprocessing Research Centre at the University of Johannesburg, South Africa. Her research is focused on the development of a shelf-stable carrot product for multiple applications in the South African food and beverage industries. An efficient and effective drying method is crucial for preserving fresh carrots. Simultaneously, the dried product needs to maintain its color, shape and nutritional quality for better consumer acceptability. The objective of this study was to investigate the effect of oven drying (OD) at 50°C, freeze drying (FD) at -60°C and 0.03 mbar, and a combination of oven and freeze drying (OD+FD) on the drying behavior, color, phytochemical content, antioxidant activity, energy requirements, and cost implications for dried carrots. The drying conditions included 36 h of FD, 1 h of OD + 21 h of FD, 2 h of OD + 18 h of FD, 3 h of OD + 15 h of FD, and 9 h of OD. Although the OD treatment had the shortest (9 h) drying time, the finished product was of poor quality. Results showed that a combination of OD and FD reduced the time by 39-50%. The β-carotene content, lycopene content and antioxidant capacity were highest for freeze drying › combined drying › oven drying. However, OD+FD provided a significant advantage in total phenolic content retention, decreasing the total color difference (8.05-20.76) and the energy cost by 40-56% compared to only FD. In summary, combined drying of 2 h OD + 18 h FD was the least time consuming and most energy-efficient drying method to produce nutrient-rich dried carrot slices.

Zobabalo Mina won the ISHS Young Minds Award for the best oral presentation at the III International Symposium on Beverage Crops in Spain in April 2023.

› Contact

Zobabalo Mina, University of Johannesburg, Auckland Park, 2092 Gauteng Johannesburg, South Africa, e-mail: zobabalop@gmail.com

Discriminating stratigraphic layers of cultivated organic soils using proximal sensors

› Raphaël Deragon

Raphaël Deragon is a Ph.D. candidate at Université Laval (Canada), working under the supervision of Drs. Jean Caron and Budiman Minasny. His work focuses on detecting and mapping peaty, limnic and mineral layers found within the first metre of soil in drained and cultivated peatlands. To survey thousands of hectares more efficiently, the use of automated and proximal sensors has the potential to reduce manual sampling efforts and eliminate the need for laboratory measurements. Few studies have attempted to specifically detect limnic layers in an agricultural context, and even fewer have discussed appropriate sensors for detecting them. To gain a better understanding of the physical and chemical properties of the three soil materials, Raphaël characterized around 900 10 cm soil profiles from nine fields. He hypothesized that there were at least two discriminant properties that could be easily evaluated in situ with proximal sensors to classify each soil material. In his first field experiment, he found that soil volumetric water content, electrical conductivity, and penetration resistance exhibited statistically significant differences between the soil materials and with depth. With this new information, he selected a time-domain reflectometry probe and a soil penetrometer to replace manual sampling and intersected these measurements with those of commonly used proximal sensors, such as the EM38-MK2, Veris Q2800, and the MS-700 gamma-ray spectrometer. Data from this new experiment is currently being processed and results are expected soon. A detailed chemical characterization of limnic layers will be performed to assess the long-term use of degraded soils. This work will allow farmers to delineate priority management zones for applying soil conservation practices at the field-scale.

Raphaël Deragon won the ISHS Young Minds Award for the best poster presentation at the I International Symposium on Growing Media, Compost Utilization and Substrate Analysis for Soilless Cultivation in Canada in June 2023.

› Contact

Raphaël Deragon, Soil Science and Agrifood Engineering Department, Université Laval, G1V 0A6 Québec, Canada, e-mail: raphael.deragon.1@ulaval.ca

Decision support for selecting suitable frost protection methods for apricot orchards in Germany

› Christine Schmitz

Christine Schmitz is a PhD candidate working on management models for fruit growers with the Horticultural Sciences team at the University of Bonn and the Dienstleistungszentrum Ländlicher Raum Rheinpfalz (Germany).

Spring frost damage is a major problem for temperate fruit production in Germany. Techniques to protect apricot orchards against such damage include wind machines, paraffin candles and below-canopy irrigation. Christine implemented a decision analysis model to compare the costs, benefits and risks of different frost protection measures and production without frost protection in a probabilistic way to estimate their financial performance (as net present value (NPV)) over ten years. Assuming an established apricot orchard planted in southwestern Germany, the chance of obtaining a positive NPV without frost protection was greater than 90%. Similarly good results were projected for an investment in mobile or stationary wind machines, with an estimated chance of 88% for a positive outcome. The use of paraffin candles, which requires a high workload and high uncertainty regarding their efficiency, was found to be the least profitable option, with a chance of only 57% for positive outcomes. These results clearly demonstrate which frost protection measures are the best when considering the NPV. However, growers are also interested in stable and reliable yields over the years, leading towards a preference for stationary wind machines that combine good NPV with reduced yield losses. Further research will concentrate on the full orchard lifetime and on other species.

Christine Schmitz won the ISHS Young Minds Award for the best oral presentation at the International Symposium on Models for Plant Growth, Environments, Farm Management in Orchards and Protected Cultivation (HorchiModel2023) in Spain in June 2023.

› Contact

Christine Schmitz, Dienstleistungszentrum Ländlicher Raum Rheinpfalz, Rheinbach, Germany, and INRES – Horticultural Sciences, University of Bonn, Germany, e-mail: christine.schmitz@dlr.rlp.de

Diversity of pollinators and pollenizers is key to successful chestnut pollination

› Clément Larue

Chestnuts are an ecologically and economically important fruit and forest tree species that have been cultivated for several centuries. Annual chestnut production now reaches over two million tons, yet little is known about the ecology of chestnut pollination. How is chestnut pollen dispersed? Is the quantity and quality of pollen limiting? What are the determinants of chestnut pollination success? Without an in-depth study of these mechanisms, it is difficult to design highly productive orchards. During his PhD studies and post-doctoral contract with INRAE in Bordeaux, France, Clément Larue has attempted to tackle these questions.

Are chestnuts pollinated by wind, insects, or both? A few years ago, there was no available study to give a definitive answer to this question. Over several years, Clément performed pollinator exclusion experiments and monitored insects visiting chestnut flowers. In pollinator exclusion experiments, fruit set (i.e. the percentage of flowers that bear fruit) of branches accessible to insects were compared with fruit set of branches that could only be pollinated by wind as they were enclosed by insect-proof nets. Within these nets, scarcely any fruit was formed. Chestnut is therefore strictly entomophilous. During insect monitoring experiments, insects visiting chestnut flowers were photographed and identified. Only those insects that regularly visited both male and female flowers were considered as pollinators. Clément and his team found that calyptrate flies and to a lesser extent beetles were the main pollinators of chestnut trees. Bees – whether domestic or wild – only visited male flowers of chestnuts and therefore did not participate in pollination. The installation of beehives, therefore, will not improve orchard pollination. Instead, the preservation of non-bee pollinators is crucial to guarantee fruit production.

In another study, Clément identified another important issue for chestnut pollination: pollenizer limitation. If the number and diversity of pollen donor trees planted in orchards are insufficient, fertilization will fall, resulting in very low fruit set in monovarietal or bivarietal orchards. Pollinators and pollenizer diversity are therefore key to the design of highly productive chestnut orchards.

Clément Larue won the ISHS Young Minds Award for the best poster presentation at the VII International Chestnut Symposium in Spain in June 2023.

› Contact

Clément Larue, INRAE, UMR Biogeco, 69 route d'Arcachon, 33610 Cestas, France, e-mail: clement.larue@inrae.fr, web: https://clementlarue1.github.io/

High-density genetic map construction and QTL analysis of flower color traits based on a tetraploid rose genome

› Bixuan Cheng

Bixuan Cheng is in the first year of her Ph.D. studies at the School of Landscape Architecture, Beijing Forestry University, China, under the supervision of Prof. Chao Yu. Based on genomics and linkage analysis, she is seeking to discover the molecular mechanism of important traits for tetraploid roses.

China has been cultivating *Rosa* species for many centuries. More than a hundred Chinese rose cultivars are recorded in "The Rose Anthology" compiled by Chuanchuo Liu in the Qing Dynasty (1636-1912). Some of them have excellent ornamental traits and strong adaptability. *R.* 'Yunzheng Xiawei' is a tetraploid, with pink to light pink petals and a moderate fragrance. In previous breeding work, this ancient germplasm was used as maternal material to generate an F_1 tetraploid rose YS population. However, due to the complex genetic background and inefficiency in polyploid mapping, the construction of tetraploid genetic maps based on existing diploid rose genomes was leading to inaccurate marker information and genotyping results.

Combining PacBio, Illumina and Hi-C scaffolding technologies, Bixuan and her colleagues presented the first highly heterozygous tetraploid rose genome for *R.* 'Yunzheng Xiawei.' Based on this reference genome and tools for polyploids, they performed inheritance analyses, which showed that tetraploid roses had both tetrasomic and preferential pairing events. By aligning the previous whole genome re-sequencing data to the reference *R.* 'Yunzheng Xiawei' genome, an average of 13,113,819 SNPs were developed for each offspring. Then they used MSTmap to cluster and assign markers into linkage groups and finally obtained three near-saturated genetic linkage maps. Based on 67 pigment content data, 11 QTL clusters were identified for each pigment, including three QTL clusters for anthocyanins, four clusters for flavonols and four clusters for carotenoids. Combing genome annotation and RT-qPCR results, four differentially expressed genes were identified within the confidence intervals, including CHYB, CCD4, PDS and NXS. The study provides the basis for further genetic analyses of highly heterozygous tetraploid roses and could facilitate the progress of marker-assisted selection in modern roses.

Bixuan Cheng won the ISHS Young Minds Award for the best oral presentation at the XVII International Eucarpia Symposium Section Ornamentals: From Nature to Culture – Breeding Ornamentals for Sustainability in Italy in July 2023.

› Contact

Bixuan Cheng, School of Landscape Architecture, Beijing Forestry University, 100083 Beijing, China, e-mail: chengbixuan@126.com

Application of K-seq genotyping protocol in *Ranunculus asiaticus* L. and *Anemone coronaria* L.

› Matteo Martina

The *Ranunculaceae* family, comprising 2500 species across 53 genera, has long intrigued researchers due to its unique position among flowering plants. Two species, *Anemone coronaria* L. (poppy anemone) and *Ranunculus asiaticus* L. (Persian buttercup), are renowned for their ornamental value as cut flowers and potted plants, with breeding efforts focused on enhancing various traits from flower uniformity to resistance to environmental stressors. High-throughput next-generation sequencing (NGS) has revolutionized genetic research, but its effectiveness often relies on reference genomes – a challenge when dealing with species like poppy anemone and persian buttercup, which harbour large, heterozygous and repetitive genomes. To overcome this, a reduced-representation sequencing (RRS) approach was applied through the K-seq protocol, which is known to be cost-effective and adaptable. In this work, the K-seq was applied using primer sets derived from a closely-related reference genome (*Aquilegia oxysepala* var. *kansuensis*). Despite the absence of reference genomes, we were able to demonstrate that K-seq holds promises in cultivar fingerprinting, aiding in legal disputes and supporting molecular-assisted breeding programs. This breakthrough facilitates the development of new cultivars and unravels genetic factors underpinning complex traits. In summary, the application of K-seq in *Ranunculaceae* species marks a significant breakthrough. This cost-effective, versatile technique unlocks new possibilities for research and breeding, promising a brighter future for the cultivation of both poppy anemone and persian buttercup.

Matteo Martina won the ISHS Young Minds Award for the best poster presentation at the XXVII International EUCARPIA Symposium Section Ornamentals: From Nature to Culture – Breeding Ornamentals for Sustainability in Italy in July 2023.

› Contact

Matteo Martina, University of Turin, Department of Agricultural, Forest and Food Sciences, Plant Genetics, Largo Paolo Braccini 2, 10095 Grugliasco (TO), Italy, e-mail: matteo.martina@unito.it

Micropropagation affects tree architecture of two olive cultivars: a field evaluation

› Francesco Maldera

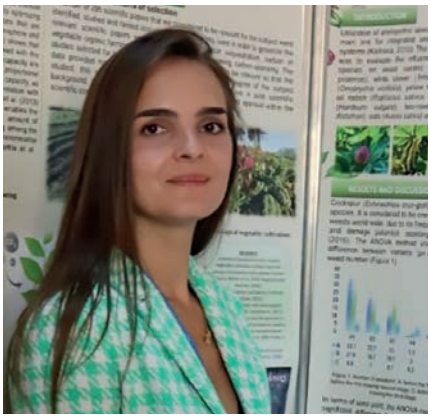
As part of his PhD at the Department of Soil, Plant and Food Sciences, University of Bari Aldo Moro, Italy, Francesco Maldera is evaluating the behavior of new hedgerow systems in olive and almond orchards. This research is exploring the relevance of propagation methods for olive trees and how the in vitro propagation techniques affect the morphology and architectural parameters of different olive cultivars and thus their suitability in orchard intensification. The aim of this study was to observe the impact of different propagation methods on the shooting dynamics of two olive cultivars, 'Arbequina' and 'Coratina', in a super high-density orchard. The research was conducted in an experimental olive orchard in Apulia, southern Italy. Micropropagation (micro) and mist propagation (auto) techniques were compared. Measurements were taken to analyze growth, internodal length and the number of nodes, to understand how they affect the growth and architecture of olive trees. Micropropagation had a significant effect on the apical sprout growth of 'Coratina' compared to auto, resulting in longer internodes with the same amount of nodes. In 'Arbequina', no significant differences were observed in apical sprout growth between the two propagation methods. However, shorter internodes were observed in micropropagated trees. An analysis of the branching model revealed differences in the shoot architecture between the cultivars and propagation methods. 'Arbequina' showed an acrotonic gradient with sprouts developing from the upper part of the shoot, whereas 'Coratina' exhibited a proleptic shoot branching pattern, where sprouts appeared linearly relative to the apical sprout. Micropropagation led to more lateral sprouts with strong branching in 'Coratina'. Overall, the study finds that micropropagation does not significantly impact the vegetative dynamics of 'Arbequina' but negatively affects the shoot dynamics of 'Coratina'. These findings suggest that new low-vigor cultivars may benefit from micropropagation techniques. However, further studies are needed to better understand the behavior of newly introduced low-vigor cultivars and to optimize propagation methods for different olive varieties in super high-density orchards.

Francesco Maldera won the ISHS Young Minds Award for the best oral presentation at the I International Symposium on Plant Propagation, Nursery Organization and Management for the Production of Certified Fruit Trees in Italy in July 2023.

› Contact

Francesco Maldera, Department of Soil, Plant and Food Sciences, Università degli studi di Bari Aldo Moro, Bari 70126 (Puglia), Italy, e-mail: francesco.maldera@uniba.it

Exploitation of some allelopathic species for weed control in ecological agriculture in a climbing bean crop



› Mariana Calara

As part of her PhD at the University of Life Sciences "Ion Ionescu de la Brad" Iasi, Romania, Mariana Calara's research has focused on "Optimization of some organic vegetable crop systems using allelopathic interactions". There are many products available for disease and pest control in organic agriculture. However, when it comes to weed control, the measures are limited. Allelopathy can be helpful in this regard.

Allelopathy is a biological phenomenon involving chemical interactions, where a plant releases specific chemicals that exert various effects on neighboring or associated plants. Allelopathic substances are phytochemicals produced by plants as secondary metabolites, seemingly devoid of direct involvement in their own growth and development. Instead, these substances serve as a form of defensive adaptation. Consequently, allelopathic species hold significant promise for applications in organic farming and organic weed control strategies.

While allelopathy can offer several benefits for agriculture, it also presents challenges. The allelopathic effects vary depending on factors such as plant species, environmental conditions, and the concentration of allelopathic compounds. In field crops, allelopathy can be used following rotation, using cover crops, mulching and plant extracts.

The goal of the present work was to evaluate the influence of nine allelopathic species on weed control: red clover (*Trifolium pratense*), white clover (*Trifolium repens*), sainfoin (*Onobrychis viciifolia*), oil radish (*Raphanus sativus* var. *oleiformis*), yellow mustard (*Sinapis alba*), barley (*Hordeum vulgare*), two-rowed barley (*Hordeum distichon*), oats (*Avena sativa*) and Japanese grass (*Lolium perene, Festuca rubra* and *Poa pratensis*).

The research results revealed that the degree of weed infestation in climbing beans was significantly reduced by intercropping with red clover, oil radish, yellow mustard and red clover, sainfoin, oats, barley, and two-rowed barley. The study also revealed that plant species possessing allelopathic properties did not adversely affect the yield of the climbing bean crop.

These results suggest that intercropping with plant species that have allelopathic properties can be a beneficial and sustainable approach for weed control. However, further research is needed to determine the long-term effects of intercropping on soil health, crop productivity, and weed management.

Mariana Calara won the ISHS Young Minds Award for the best poster presentation at the IX South-Eastern Europe Symposium on Vegetables and Potatoes in Romania in September 2023.

› Contact

Mariana Calara, Vegetable Research and Development Station Bacau, Calea Bârladului 220, 600388, Romania, e-mail: calaramariana@gmail.com, sclbac@legumebac.ro

Early epigenetic changes are involved in bud dormancy release in grapevine

› Valeria De Rosa

Plant phenological development is deeply influenced by changes in temperature, with budbreak dates occurring earlier as the mean global temperature increases. As a result, spring frost damage risk is increasing in many areas of the world. In grapevine, early dormancy release may also result in the advancement of all subsequent developmental stages, including ripening and harvest, thus challenging traditional wine production schedules in important wine-making regions. Understanding the molecular regulation of dormancy release in buds is essential to direct breeding efforts to produce late-budbreak varieties better suited to the new climatic scenarios. Recent evidence collected in field-grown grapevines implies that DNA demethylation is involved in dormancy regulation. To further describe these aspects, potted plants of 'Cabernet Sauvignon' were kept in controlled conditions to induce dormancy, chilling requirement fulfilment and dormancy release. Buds were regularly sampled for transcriptomic analyses to assess the major biological processes taking place from cold acclimation to deacclimation. RNA-seq revealed a wide range of significant changes concerning epigenetic regulation taking place exclusively during deacclimation. Genes affected by these changes, up to 18 days before budbreak, included homologs of DNA demethylases ROS1 (Repressor of Silencing 1) and DME (DEMETER). Evidence of demethylated regions within gene promoters was detected with BS-seq, including several developmental and growth-related targets characterized by an increased expression during forcing conditions. While dedicated studies are required to validate these preliminary observations, these results reinforce the possibility of a role for active DNA demethylation in dormancy progression and release in grapevine.

Valeria De Rosa won the ISHS Young Minds Award for the best oral presentation at the XVI EUCARPIA Symposium on Fruit Breeding and Genetics in Germany in September 2023.

› Contact

Valeria De Rosa, Dipartimento di Scienze Agroalimentari, Ambientali e Animali (Di4A), University of Udine, Via delle Scienze 206, 33100 Udine, Italy, e-mail: valeria.derosa@uniud.it

Symposia and Workshops

XXVII International EUCARPIA Symposium Section Ornamentals: From Nature to Culture – Breeding Ornamentals for Sustainability

Division Ornamental Plants	#ishs_dorn
Division Horticulture for Development	#ishs_ddev
Division Landscape and Urban Horticulture	#ishs_durb
Division Plant Genetic Resources and Biotechnology	#ishs_dbio
Division Protected Cultivation and Soilless Culture	#ishs_dpro

To promote greater innovation in the field of breeding ornamental plants and sustainability, the XXVII International Eucarpia Symposium, Section Ornamentals: From Nature to Culture – Breeding Ornamentals for Sustainability, was held in Genoa (Italy), from July 2-5, 2023. The symposium was organized by the University of Genoa and the Hanbury Botanical Gardens and supported by the European Association for Research on Plant Breeding (EUCARPIA) and the International Society for Horticultural Science (ISHS). The audience for this symposium attracted representatives from 19 countries with 40% of the audience coming from non-European countries. This resulted in a very rich and informative meeting with 33 oral and 31 poster presentations. The scientific structure of the meeting considered a research-industry approach to facilitate the exchange of information among the participants about the latest challenges and opportunities in the improvement of ornamental crops. Four different scientific sessions were oriented to highlight: 1) the importance of the use of native and wild species for introducing new features/new products but also for fostering local economies; 2) the need for breeding strategies to respond to the challenges of simultaneously addressing new flowering/new flower colours and an improved adaptation to climate change, coupled with more sustainable production; 3) the impact of new genomic tools and the challenges to be taken into account to protect the breeder's work; and 4) the use of ornamentals in different contexts with attention to roles played by ornamental plants in improving the environment, sustainability and human welfare.

› Participants of the symposium.

Nine keynote speakers, each renowned at an international level, introduced the four sections by highlighting their scientific approaches and providing case-studies.

In the first invited lecture "From wild species to ornamental crops – a never-ending story", Dr. Rodrigo Barba Gonzalez (CIATEJ A.C., Guadalajara, Mexico) reported that programs in Mexico had begun to promote the creation of gardens with wild species to protect pollinators from extinction. This was leading to the discovery of a huge number of new ornamental crops that could be used in several areas in the world. He provided several case studies that highlighted the different phases that

› Scientific sessions held at the Main Hall of the University of Genoa. The room is decorated with paintings dated between 1683 and 1684 and inspired by the Jesuit sermons.

must be addressed to include wild species in genetic improvement programs. Pre- and post-fertilization barriers can occur in interspecific and intergeneric crossings, but biotechnology tools can often overcome these problems. Dr. Barba Gonzalez demonstrated how his research had led to the development of new varieties of tuberose with new colors or varieties of *Eustoma* varieties that could be cultivated at high temperatures.

The second invited lecture "Short notes on breeding using botanical species to produce innovative ornamental products" by Flavio Sapia (Hybrida srl, Sanremo, Italy) showed how it was possible to get new varieties or to improve already cultivated crops using wild species in the breeding program. In this way, his company had managed to develop new varieties of *Iberis*, *Dianthus* and *Helichrysum* that required less water, nutrition, and energy during the production cycle.

The second scientific session was introduced by Prof. Michelle Jones (Ohio State University, USA) with her lecture on "Sustainable production of greenhouse ornamentals using plant growth-promoting bacteria (PGPB)". Prof. Jones highlighted the importance of using PGPB to increase nutrient efficiency and to improve the sustainability of ornamental crop production. To overcome many of the bottlenecks that arise during PGPB treatments, digital phenotyping using systems like TraitFinder with PlantEye sensors were shown to allow high-throughput screening. This section went on with the fourth invited speaker, Dr. Lisa W. Alexander (USDA-ARS FNPRU, McMinnville, USA). In her speech entitled "Genomic analysis of inflorescence development and double flowering in bigleaf hydrangea", Dr. Alexander presented the genome resources and candidate genes useful in determining the genetic mechanisms that drive flowering characteristics and floral development.

In the third session "New genomic techniques and ornamental plant breeding", Dr. Jan G. Scaart (Wageningen UR Plant Breeding, The Netherlands) and Prof. Prem Bhalla (University of Melbourne, Parkville, Australia) pointed out how traditional breeding approaches, based on crossing and selection, could be made more efficient thanks to the recent advances in genomics. Dr. Scaart, with his talk "Gene editing to support breeding in ornamental species", gave a nice overview of the challenges and potentialities arising from the use of new gene editing techniques and provided applications in ornamental crops for getting new varieties with improved resistance to pests and diseases. He stressed the importance of an interdisciplinary approach and of enhancing studies on in vitro regeneration protocols. In her speech entitled "Non-coding genome controlling plant morphology and flowering" Prof. Bhalla spoke about the vital role of the non-coding part of the genome on the regulation of multiple plant morpho-physiological traits. These aspects are very important in understanding the transition from the vegetative to the flowering state. In a third paper, Dr. Edgar Krieger (International Community of Breeders of Asexually Reproduced Horticultural Plants - CIOPORA) focused on the challenges that breeders must face in the light of new breeding techniques, climate change, globalization, and the consumer demand for new and sustainable products. His presentation, "Sustainability in ornamentals needs effective protection of intellectual property", showed how the UPOV Plant Breeders' Rights system and its members were responding to these challenges.

The last session "Ornamentals for a suitable world" referred to the use of ornamentals not only for decorative purposes, but also for lifestyle, taking into consideration sustainability and welfare. The session was introduced by Rossana Porta (plant designer, London, UK) with her speech "Ornamental plants in different contexts that favor sustainability and quality of life", highlighting the use of ornamental plants in gardens through the ages and in several countries of the world. She pointed out the importance of an integrated approach to valorize the use of ornamentals in gardens and landscapes where scientific knowledge should support the practical application and vice versa. The last invited speaker was Dr. Maurizio Abbati (science writer and lecturer, Italy) with his speech "Flora & Green are the new must in communicating your sustainable reputation". Dr. Abbati pointed out the importance of an appropriate business communication strategy to make a difference in the market and foster eco-responsibility in the target audience. He provided an overview of the evolution of eco-communication from its birth to the present, with a look to the future through a targeted case study.

Two field excursions were organized. The first one visited the Park of Villa Durazzo Pallavicini (Genova Pegli) with its Botanical

› Winners of the ISHS Young Minds Awards: A) Bixuan Cheng (best oral presentation), B) Matteo Martina (best poster presentation).

› Closing ceremony at the Hanbury Botanical Gardens. Prof. Kexuan Tang (center) is delivering the ISHS medal award to the conveners, Prof. Mauro Mariotti (left) and Dr. Margherita Beruto (right).

› Technical tour to Diemme Fiori s.r.l., Taggia (IM). Processing for the packaging of dried lavender flowers.

Garden established in 1794. This park is one of Europe's most important historical gardens and is also home to one of Italy's oldest collections of camellias, as well as important specimens of cork oaks, camphor laurels, araucaria, Lebanon cedars and many types of palm trees.

The second field excursion visited two floriculture companies in the western part of the Liguria region. The first visit was to Azienda Agricola Biologica RaveraBio, located in Albenga, an area renowned for the production of aromatic plants throughout Italy and abroad. The farm has a long tradition in the cultivation of several aromatic plants (basil, coriander, tarragon, chives, lavender, marjoram, mint, oregano, parsley, rosemary, rocket, sage, savory, thyme). No pesticides or herbicides are used, and the farm is Bioagri certified. A recent innovation was achieved by the production of edible flowers and during the visit, participants could taste juices, ice creams and sauces made from begonias and other edible flowers that were grown in the open field and in greenhouses of the company. During the visit, Dr. Luca De Michelis, President of the Floriculture District, introduced the participants to the Ligurian floriculture industry. The second visit was to Diemme fiori s.r.l., one of the major wholesalers shipping cut foliage and flowers daily to several worldwide destinations. At its beginning, Diemme Fiori's core business was fresh Italian ruscus (sorted for different market segments), pittosporum, ivy, grevillea, aralia, aspidistria and eucalyptus such as *E. cinerea*, *E. stuartiana*, *E. parvifolia*, *E. pulverulenta* 'Baby Blue', *E. populus*, and *E. nicholii*, along with fresh cut seasonal flowers such as ranunculus, anemones, sweet peas, brooms, mimosa, poppies and French tulips and peonies. Diemme Fiori s.r.l. has recently developed a new production line for preserved and dried products. During the visit, participants saw the facilities for drying flowers and sterilizing dried flowers before storing or shipping. This technical tour ended at Hanbury Botanical Gardens, Ventimiglia, which are operated by the University of Genoa and included in the list of the ten most beautiful gardens in Italy. Today only 9 hectares of the gardens' 18 hectares are under cultivation and contain about 2500 taxa. Many of the species are plants of Mediterranean climates from the six Mediterranean climate zones of the world. Major collections include agaves, aloes and salvia, as well as specimens of *Araucaria cunninghamii*

› Technical tour to Azienda Agricola Biologica Ravera, Albenga (SV). The owners are showing the products resulting from the processing of the edible flowers that are grown in their company.

(planted 1832), *Casimiroa edulis* (1867), olive trees, *Olmediella betschleriana*, and *Pinus canariensis* (1870).

At the closing ceremony, Prof. Kexuan Tang, Vice-Chair of ISHS Division Ornamental Plants, presented a certificate of honour to Prof. Mauro Mariotti and Dr. Margherita Beruto, conveners of the symposium. Prof. Patricia Paiva (ISHS Vice-President in charge of Young Minds) presented the ISHS Young Minds Awards. Bixuan Cheng, School of Landscape Architecture, Beijing Forestry University (China), received the Young Minds Award for the best oral presentation entitled "High-density genetic map construction and QTL analysis of flower color traits based on a tetraploid rose genome". Dr. Matteo Martina, Dipartimento di Scienze Agrarie, Forestali e Alimentari-DISAFA, Plant Genetics, University of Turin, Grugliasco (Italy), won for the best poster presentation entitled "Application of K-seq genotyping protocol in *Ranunculus asiaticus* L. and *Anemone coronaria* L.".

Margherita Beruto and Mauro Mariotti

› Poster session.

› Contact

Dr. Margherita Beruto, Vicolo Barbarossa 13, 18038 Sanremo – IM, Italy, e-mail: margheberuto@gmail.com

Prof. Mauro Mariotti, University of Genoa, Department of Earth, Environment and Life Sciences - DISTAV, Corso Europa 26, 16132 Genoa, Italy, e-mail: m.mariotti@unige.it

› International Symposium on Models for Plant Growth, Environments, Farm Management in Orchards and Protected Cultivation (HorchiModel2023)

Division Physiology and Plant-Environment Interactions of Horticultural Crops in Field Systems #ishs_dphy
Division Precision Horticulture and Engineering #ishs_deng
Division Protected Cultivation and Soilless Culture #ishs_dpro

The International Symposium on Models for Plant Growth, Environments, Farm Management in Orchards and Protected Cultivation (HorchiModel2023) was held in Almería (Spain) from June 26-28, 2023, under the aegis of the International Society for Horticultural Science. The symposium was hosted by the University of Almeria in collaboration with the Andalusian Institute for Agriculture Research (IFAPA) and attracted 107 delegates from 17 countries.

This symposium incorporated the XI International Symposium on Modelling in Fruit Research and Orchard Management and the VI International Symposium on Models for Plant Growth, Environment Control and Farming Management in Protected Cultivation (HortiModel), under two ISHS Divisions, "Physiology and Plant-Environment Interactions of Horticultural Crops in Field Systems" and "Precision Horticulture and Engineering", and two ISHS Working Groups, "Modelling in Fruit Research and Orchard Management" and "Modelling Plant Growth, Environmental Control, Greenhouse Environment".

Over three days, the symposium brought together specialists in modelling horticul-

› Participants of the symposium.

tural production systems in both orchards and greenhouses. Plant modellers presented their research innovations, shared ideas and knowledge and discussed state-of-the-art and future perspectives for modelling.

Some 90 participants from all over the world (mainly Spain, the Netherlands, Germany, USA, South Korea, Japan and France) contributed 59 oral and 38 poster presentations. A keynote speaker followed by oral and poster presentations introduced each topic. In the first invited lecture, "Considering plant activities in greenhouse climate models using computational fluid dynamics (CFD): current achievements and future perspectives", Dr. Hicham Fatnassi spoke about integration of plant modelling in CFD simulations. In the second invited lecture, "Crop modelling in and for horticulture: paradigms, methods, workflows and scales", Dr. Gerhard Buck-Sorlin discussed different types of crop models and presented the case for these models in horticulture. In the third invited lecture, "Modelling organ and plant growth", Dr. Leo Marcelis established the relationship between light interception, photosynthesis and plant development. Dr. Katrin Kahlen presented the fourth invited lecture on "Modelling plant architecture in vineyards and greenhouses", which demonstrated that plant form and function can be simulated by dynamic models of plant architecture. Finally, the invited lecture "Exploring climate change impacts and adaptation strategies in crop production by using dynamic crop simulation models: possibilities and limitations" was given by Dr. Ixchel Hernandez Ochoa, which discussed the negative effects of climate change on crop production.

Almería has a long tradition in horticulture. Today, Almeria has more than 32,000 ha of plastic greenhouses that provide almost 4 million tons of fruit and vegetables for domestic and export markets. To a lesser extent, field crops such as almond and olive are also important in the province.

During the field day, participants saw papaya, pitahaya, pepper and zucchini crops

› Weihong Luo, Chair of ISHS Working Group Modelling Plant Growth, Environmental Control, Greenhouse Environment (left), Ted DeJong, ISHS Vice-President in charge of Scientific Programs (second from right), and Prof. Dr. Francisco Domingo Molina Aiz, co-convener of the symposium (right), presenting the ISHS Young Minds Awards: A) best oral presentation to Ms. Christine Maria Schmitz and B) best poster to Mr. Ioannis Moutsinas.

› Francisco Domingo Molina Aiz (left) and Lorenzo León Moreno (right), symposium conveners.

› Visit to "Oro del Desierto" Company, olive oil producers, where attendants enjoyed Extra Virgin olive oil tasting.

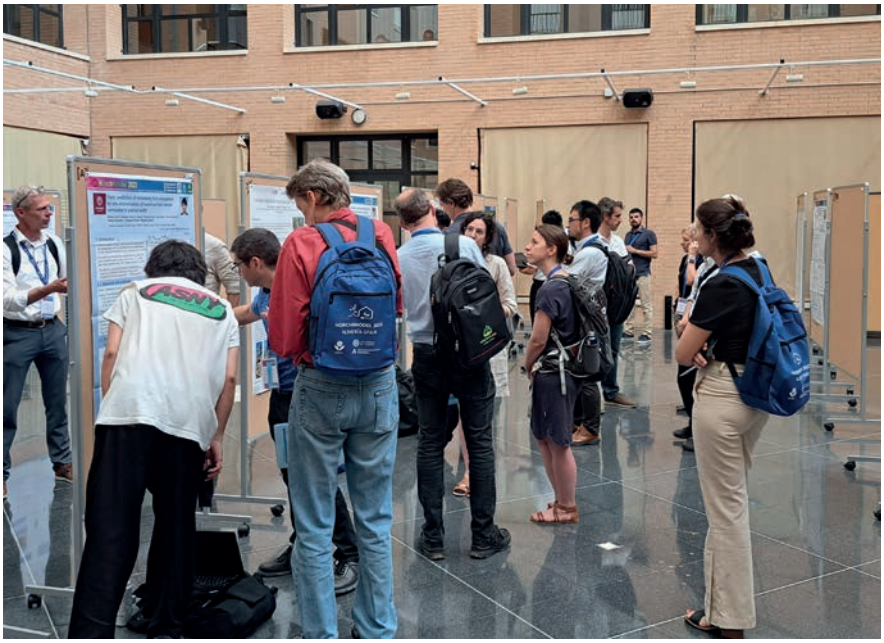
inside greenhouses at the Experimental Farm of the Foundation UAL-ANECOOP (one of the sponsors), as well as olive trees at the "Oro del Desierto" Company. The French company HIPHEN, which specializes in agricultural imaging solutions, also sponsored the symposium.

A guided visit to the Almería Alcazaba (fortified complex) and a flamenco show from the cultural association "La Guajira" were included as social activities. The gala dinner was celebrated at "Catamaran" restaurant, next to the Almería Marina, accompanied by live flamenco music.

The ISHS Young Minds Award for the best oral presentation, as determined by an international independent panel, was awarded to Ms. Christine Maria Schmitz for her research entitled "Decision support for selecting suitable frost protection methods for apricot orchards in Germany". Christine is a student of Agricultural Sciences in Universität Bonn (Germany). The ISHS Young Minds Award for the best poster presentation was awarded to Mr. Ioannis Moutsinas for his research entitled "Use of the AgroNIT smart farming IoT platform to assess the impact of climate variability and change on peach phenology and evapotranspiration in northern Greece". Ioannis is a Ph.D. candidate at the University of Thessaly, Volos (Greece).

During the business meeting of the two Divisions, it was agreed that the next symposium on modelling will continue to be a joint meeting of the two Working Groups. A proposal for the next International Symposium on Models for Plant Growth, Environments, Farm Management in Orchards and Protected Cultivation in 2027 was presented by Dr. Ningyi Zhang from Nanjing Agricultural University, Nanjing (China).

Francisco Domingo Molina Aiz and Lorenzo León Moreno



› Lively poster session discussion.

› Contact

Prof. Dr. Francisco Domingo Molina Aiz, Universidad de Almería, CIAIMBITAL (Research Center on Agricultural and Food Biotechnology), CITE II-A, Despacho 1.07, Carretera Sacramento s/n, 04120 Almería, Spain, e-mail: fmolina@ual.es

Dr. Lorenzo León Moreno, Andalusian Institute for Agriculture Research (IFAPA), Centro "Alameda del Obispo", Avda. Menendez Pidal s/n, 14004 Córdoba, Spain, e-mail: lorenzo.leon@juntadeandalucia.es

› X International Symposium on Soil and Substrate Disinfestation

Division Protected Cultivation and Soilless Culture **#ishs_dpro**
Division Vegetables, Roots and Tubers **#ishs_dveg**

Almería, in southern Spain, provided an appropriate venue for the International Society for Horticultural Science (ISHS) X International Symposium on Soil and Substrate Disinfestation. In this province, the protected horticultural area covers more than 33,000 ha, with plastic greenhouses producing mainly *Solanaceae* and cucurbits for the European market. More than 85% of these greenhouses have soils that have been intensively cropped, and in the EU, where there are restrictions on the use of soil fumigants, most of the soils in the region are infected with soilborne pests and diseases.

The symposium was conducted at the University of Almería from June 6 to 8, 2023, and attracted some 76 researchers and industry stakeholders from Europe, Asia, Africa and the Americas. The symposium was organized under the leadership of Dr. Miguel de Cara and his dedicated team from the Instituto Andaluz de Investigación y Formación Agraria, Pesquera, Alimentaria y de la Producción Ecológica (IFAPA).

The symposium programme consisted of plenary lectures, scientific sessions (oral and poster presentations), a social event, and a technical excursion in the Poniente area, where attendees visited experimental fields at IFAPA, SOTRAFA's agricultural film factory and KIMITECH's biotechnology R&D headquarters.

› Participants of the symposium.

Scientific contributions covered two main topics: new chemical disinfection materials and their application methods, and physical and biological concepts for restoring soil health by solarization and fumigation. The symposium highlighted the link between crop health and soil health and commenced with four keynote speeches on: "The role of organic matter to reduce pathogens and nourish plants", "The impact of disinfestation on functional microorganisms and soil nitrogen", "The value of biowaste as suppressive biofertilizers", and "The implementation of biosolarization in Mediterranean greenhouses". Issues directly related to improving the effectiveness and optimization of soil fumigants and substrates within the paradigm of sustainable agriculture were presented in four scientific sessions.

Two young and inspiring researchers were each presented with the ISHS Young Minds Awards. The best oral paper was awarded to Yi Zhang from the Chinese Academy of Agricultural Sciences, China, for his presentation entitled "Environmental fate of soil fumigant – allyl isothiocyanate". The best poster went to Joana Serrão, University of Porto, Portugal, for her presentation entitled "Is soil amendment a safe practice to recycle end-of-life organic substrates from soilless cultures?".

› View of Almería's "sea of plastics" taken from the top of SOTRAFA's film factory.

› Visit to experimental sites on soil management at IFAPA-La Mojonera.

The symposium provided an opportunity for participants to refresh common interests, allow for the exchange of knowledge and to plan and develop future collaborations. The Organizing Committee would like to thank all the people who contributed to the success of the symposium, particularly the sponsors (Grupo Armando Álvarez, EASTMAN, ARKEMA, LAINCO) for their support and collaboration.

Miguel de Cara

› Contact

Dr. Miguel de Cara, IFAPA-Centro La Mojonera, Camino San Nicolás 1, 04745 La Mojonera, Almería, Spain, e-mail: franciscom.cara@juntadeandalucia.es

› Keynote speaker Prof. Francesco Di Gioia (third from right) presenting the ISHS Young Minds Awards to A) Yi Zhang (right) for the best oral presentation and B) Joana Serrão (second from right) for the best poster.

› V Balkan Symposium on Fruit Growing

Division Temperate Tree Fruits #ishs_dfru
Division Temperate Tree Nuts #ishs_dnut
Division Vine and Berry Fruits #ishs_dvin

The V Balkan Symposium on Fruit Growing was held in Zagreb, Croatia, from June 18-21, 2023, under the aegis of the International Society for Horticultural Science. The symposium was organised by the University of Zagreb, Faculty of Agriculture, and convened by Prof. Boris Duralija and Prof. Martina Skendrović Babojelić. They were ably supported by members of the Organizing, Scientific, Technological and Honorary Committees drawn from many Croatian and foreign scientific institutions, government bodies and producer organisations.

The symposium had a hybrid format (in-person and virtual participation) and was attended by 116 participants from 22 countries: Australia, Bosnia and Herzegovina, Bulgaria, Canada, Chile, Croatia, Cyprus, Czech Republic, Germany, Greece, Hungary, Italy, Latvia, Northern Macedonia, Norway, Poland, Portugal, Romania, Serbia, Slovenia, Turkey and the United States.

The lecture program lasted for two days and was divided into five sessions: 1) Biodiversity, plant genetic resources and breeding; 2) Biotechnology and physiology; 3) Cultivation systems and pest control; 4) Postharvest, fruit quality and food science; and 5) Sustainability, economics and management.

Two plenary lectures were given during the symposium by Gabrijel Ondrašek (Croatia) on "Salt stress in fruit growing" and Sezai Ercişli

› Discussion during the plenary lecture of Prof. Sezai Ercişli.

› Participants of the symposium.

(Turkey) on “Exploitation of wild edible fruit in the Balkan peninsula: a historical journey.” In addition, 28 oral presentations were given, among which there were five keynote lectures, one for each session: Samir Debnath (Canada) on “Micropropagation strategies and epigenetic variation of small fruit crops”; Tom Kon (USA) on “Minimization of stem-end splitting in ‘Gala’ apples with aminoethoxyvinylglycine and GA4+7”; Sandra Münzel (Germany) on “Healthy apples by increasing soil vitality – monitoring results of extensive soil analyses on Central European farms”; George Manganaris (Cyprus) on “The efficacy of priming agents on qualitative attributes and phytochemical properties of strawberry fruits”; and Hamid Ashrafi (USA) on “Genotype, environment, year and harvest effects on fruit quality traits of blueberries (*Vaccinium corymbosum* L.) cultivars”.

› Prof. George Manganaris (left), Vice-Chair of ISHS Division Temperate Tree Fruits, presenting the ISHS medals to the Conveners Boris Duralija (right) and Martina Skendrović Babojelić (second from right) and the ISHS Young Minds Awards to Aleksandra Korićanac (centre) for the best oral presentation and Ana Marija Antolković (second from left) for the best poster.

The virtual format of the meeting included all of the aforementioned sessions, while the keynote lecture was given by Katarina Mikac (Australia) on “Improved understanding of *Cydia pomonella* biology in Croatian apple production systems”.

During the symposium, a further 72 posters were presented.

The ISHS Young Minds Award for the best oral presentation was given to Aleksandra Korićanac (Fruit Research Institute, Čačak, Serbia) for her paper on “Changes in fruit quality during ripening of two European plum cultivars”. The ISHS Young Minds Award for the best poster was awarded to Ana Marija Antolković (University of Zagreb, Croatia) for her poster entitled “Digital image analysis for assessing quality parameters of mandarin (*Citrus reticulata* B.) fruit.”

On the last day of the symposium, a professional orchard tour took place, where the latest achievements in Croatian cultivation technology were presented at four different locations.

At the close of the symposium, it was concluded that it is important to intensify collaboration between scientists in the field of fruit growing through systematic and practical research. In addition, it is important to introduce and apply the latest knowledge, technology, and experience from other coun-

tries that are committed to sustainable fruit production. In the future, the impact of climate change on fruit production must be taken into account. Resilient fruit species, rootstocks and cultivars that can mitigate the negative impact of climate change must be developed and selected. The enormous genetic wealth of fruit crops in the Balkans could be utilized for this purpose.
In the final session, it was decided that the VI Balkan Symposium on Fruit Production Systems would be held in Bosnia and Herzegovina in 2027.

Boris Duralija and
Martina Skendrović Babojelić

› Contact

Prof. Boris Duralija (Convener) and Martina Skendrović Babojelić (Convener), University of Zagreb, Faculty of Agriculture, Department of Pomology, Svetosimunska 25, 10 000 Zagreb, Croatia, e-mail: bduralija@agr.hr and mskendrovic@agr.hr

› Participants visiting a blueberry plantation near Zagreb.

› VII International Symposium on Fig

Division Temperate Tree Fruits #ishs_dfru

Three hundred and eighty-four attendees, including researchers, scholars, growers and representatives from various organizations across 18 countries and regions participated in the VII International Symposium on Fig in Weiyuan, Sichuan, China, from August 15 to 18, 2023. This was the largest gathering in the history of ISHS Fig symposia and the first time that an ISHS Fig symposium had been conducted outside the traditional Mediterranean production region. The symposium was jointly hosted by China Agricultural University, China Cash Forest Association and Neijing Municipal government.
The symposium theme, "Unite Culture and Innovation," emphasized the collaborative role of culture and technology in propelling the development of the fig industry. The symposium highlighted the remarkable growth of the fig industry in China in recent years, demonstrating the benefits of scientific and technological exchange and collaboration with international colleagues.

The symposium spanned four days and featured an extensive program comprising 42 oral presentations and 31 posters. The presentations covered a wide spectrum of topics, including international industry trends, horticultural practices and applications, germplasm, breeding, genetics, genomics, proteomics, metabolomics, fruit quality, postharvest techniques, processing technology, pest and disease management, as well as economic aspects, sales and marketing. This diverse range of topics provided an expansive platform for the meaningful exchange of information within the fig community.
The outcomes of these exchanges spanned various research domains, encompassing the exploration of novel and exceptional fig cultivars, the study of the co-evolution between figs and fig wasps, multi-omics analyses, investigations into mechanisms governing the formation of crucial traits, and advancements in molecular breeding. Notably, several new and outstanding fig cultivars, such as

› Moshe A. Flaishman (center), former Chair of ISHS Working Group Figs, presented commemorative medals to the conveners of this symposium, Professor Ma Huiqin (left) and Professor Sun Lei (right).

› Attendees visited local businesses and factories and participated in the themed brain storm.

'Tianchenghong', 'Jinqing' and 'Zibao', were demonstrated in the field, with special recognition given to the first fig aerospace breeding project conducted by Weiyuan County.

The symposium also highlighted the latest progress in key technology areas, including cultivation technology and production models, integrated water and fertilizer management, the formulation of industry standards, new processed products, postharvest commercialization, and developments in cold chain logistics and e-commerce.

The two ISHS Young Minds Award winners were selected by the scientific committee of the symposium. Hantang Huang, a doctoral student from China Agricultural University, won the award for the best oral presentation on a new high-quality fig genome constructed using ONT sequencing technology, shedding light on the regulation of fig biology and providing new insights into the molecular mechanisms governing the formation

› Members of the team of Professor Ma Huiqin from the College of Horticulture, China Agricultural University, who assisted in organizing the symposium.

› Prof. Moshe A. Flaishman (left) and Prof. Ma Huiqin (right) presenting the ISHS Young Minds Award for the best oral presentation to Huang Hantang (A) and for the best poster to Iva Prgomet (B).

of chemical characteristics. Dr. Iva Prgomet from the Skink plant nursery, Croatia, won the award for the best poster, which demonstrated how, after a decade of cultivation experience involving 55 local and introduced fig cultivars in the Rovinj region of Croatia, those with strong market competitiveness and consumer acceptance were identified, ultimately leading to the selection of nine commercial cultivars.

Beyond scientific and technological exchanges, the symposium was marked by a pioneering initiative to strengthen business cooperation. Weiyuan County forged a significant partnership, signing the "Fig Friendship County and City Agreement" and establishing the "Alliance of Leading Fig Regions" with Svenita City in Romania and the Chamber of Commerce of Aydin City in Turkey. Furthermore, Weiyuan County entered into eight scientific and technological support and business cooperation agreements with esteemed institutions, including China Agricultural University, resulting in an investment worth RMB 300 million.

Participants had the opportunity to explore key venues during their visit, including the Weiyuan World Fig Expo Park, Fig Expo Center, Fig Agricultural Service Center, and the Zhenxi Food Concentrated Development Zone. These visits provided participants with a comprehensive and in-depth understanding of the integrated development and promotion of the "Sweetness+" industry, symbolized by Weiyuan Figs, and allowed them to witness the tangible results of rural revitalization. Within the region, research activities are focused on sustainable industry development, fig breeding and cultivar innovation, and fig genomics and molecular biology. The enduring friendships forged among participants, the willingness to share scientific research outcomes, and the benefits derived from mutual exchange and collaboration will collectively contribute to the global development of the fig industry.

Huiqin Ma and Miaoyu Song

› Contact

Prof. Dr. Huiqin Ma and Dr. Miaoyu Song, China Agricultural University, Yuan Ming Yuan Xi Lu No. 2, Beijing, China, e-mail: hqma@cau.edu.cn and songmiaoyu@cau.edu.cn

› IX International Symposium on Walnut and Pecan

Division Temperate Tree Nuts #ishs_dnut

The IX International Symposium on Walnut and Pecan was held at the ALPEXPO exhibition site in Grenoble (France) from June 12-16, 2023, under the aegis of the International Society for Horticultural Science. The event attracted some 147 researchers, engineers, technicians, growers, and students, with 70 scientists from 20 different countries presenting their research work in five main areas: genetics and biotechnology; plant physiology; production and marketing; plant production and orchard management; and pests and diseases. Each session was introduced by a renowned scientist whose specialty was related to the session's theme.

Under the theme of genetics and biotechnology, Patrick J. Brown (University of Davis, USA) outlined the latest biotechnological advances in walnut. During this session, most of the papers presented focused on walnut and pecan rootstocks. For some, it was a question of characterizing new rootstocks, and for others it was a question of improving knowledge of rootstock/variety interactions under prescribed cultural practices and pedoclimatic conditions. The pecan tree is a species of growing interest in Europe, particularly in Spain, Italy and France.

Thierry Ameglio (INRAE, France) opened the session on plant physiology with a presentation on the eco-physiological functioning of walnut and the main risks in a changing climate. The session covered a wide range of issues, from variation in phenolic compounds in different walnut tissues, to the influence of light on pecan fruit quality, walnut yield in relation to the method of pruning, and the study of photosynthesis in pecan under different cultural conditions. Two major issues were the subject of several presentations: water management in pecan trees, through the analysis of evapotranspiration, the development of decision-making tools and the determination of the pecan tree's cultural coefficient. The second issue concerned the winter chilling requirements of walnut and pecan trees. Results have shown that winter chilling requirements during the endo-dormancy phase and heat requirements during the eco-dormancy phase affect bud break and growth, with marked differences between walnut cultivars. Similar work carried out on three pecan varieties showed variability in the number of hours of chilling needed to satisfy the needs of each variety.

Introducing and moderating the session on production and marketing, Catherine Baros (CTIFL, France) talked about new trends in food consumption and the purchase of fruit and vegetables in connection with crises and climate change. The issues addressed in this session largely concerned the study of fruit quality and the quality of processed products. Papers were presented on the results of studies conducted to monitor phenolic compounds and fatty acids and the impact of processing on these variables from harvesting, drying times for kernels and the optimum temperature for extracting walnut oil. Preliminary work was also presented on the use of controlled atmosphere packaging for the marketing of in-shell walnuts to improve shelf life.

Daniel Wipf (INRAE, France) opened the session on plant production and orchard management, reminding participants of the importance of soil biodiversity. The interaction between plants and micro-organisms was widely discussed during this session. This included work on improving the adaptability of walnut to semi-arid and saline soils by adding *Ascolphyllum nodosum* extract, which improves physical properties and increases microbial activity; the use of mycorrhizal fungi to improve the production of walnut vitro plants; and a study on the characterization of soil fungi in pecan orchards, to identify fungi that can provide a wide range of ecological services to the tree. Finally, for the first time, work was presented on traditional agroforestry cultivation systems for both species.

Florent Trouillas (University of California, USA) gave the introductory presentation on pests and diseases by looking at climate

› Dr. Giulia Marino (center), Chair of ISHS Division Temperate Tree Nuts, presenting the ISHS Convener medals to Delphine Sneedse (left), Fabrice Lheureux (right) and Eloïse Tranchand (absent).

› Gaurab Bhattarai, winner of the ISHS Young Minds Award for the best oral presentation.

change and plant diseases. His remarks were illustrated by work on walnut dieback in France. In addition to a few presentations on the identification and characterization of pests and diseases in both species, a broader line of research emerged in this session, with work on alternative and innovative control methods for walnut pests and diseases; the use of bacteriophages to combat bacterial blight in walnut; development of the sterile insect technique (SIT) to combat codling moth in walnut; the use of aggregation pheromones against the walnut fruit fly; and the development of breeding by studying the nutritional content of the walnut on which fly larvae feed.

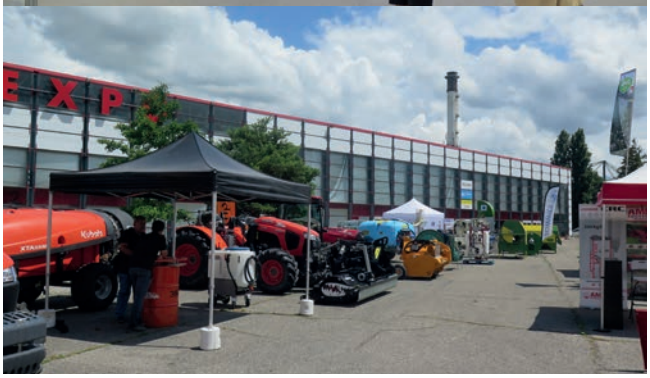
The last day was devoted to a technical visit to three sites: postharvest processing of walnuts at the Coopenoix cooperative; walnut tree production at Payre nurseries; and experimental research trials at SENuRA.

The ISHS representative, together with the Conveners, established a Special Committee to select the best oral presentation by a junior scientist. The ISHS Young Minds Award was given to Gaurab Bhattarai, (University of Georgia, USA), for the best oral presentation entitled "Transcriptome analysis under pecan scab infection reveals the molecular mechanisms of the defense response in pecan".

The main conclusion of the IX International Symposium on Walnut and Pecan was that, even though considerable research on walnut and pecan has been undertaken, more efforts are needed to secure the future of this species with climate change.

In the business meeting, Turkey was selected to hold the X International Symposium on Walnut and Pecan in 2027.

Fabrice Lheureux, Delphine Sneedse and Eloïse Tranchand



› Indoor and outdoor trade show.

› Oral presentations in the ALPEXPO amphitheatre.

› Contact

Dr. Fabrice Lheureux (Convener), Centre Techniques Interprofessionnel des Fruits et des Légumes (CTIFL), Route des Nebouts 28, 24130 Prigonrieux, France, e-mail: fabrice.lheureux@ctifl.fr

Delphine Sneedse (Convener), Station Nucicole Rhône-Alpes (SENuRA), Route de St Marcellin 385A, 38160 Chatte, France, e-mail: dsneedse@senura.com

Eloïse Tranchand (Convener), Station Expérimental de la Noix de Creysse, Perrical, 46600 Creysse, France, e-mail: e.tranchand@stationcreysse.fr

VII International Symposium on Lychee, Longan and Other *Sapindaceae* Fruits

Division Tropical and Subtropical Fruit and Nuts #ishs_dtro

The VII International Symposium on Lychee, Longan and Other *Sapindaceae* Fruits was successfully held from 27 June to 1 July 2023 at the South China Agricultural University (SCAU), Guangzhou, China. The symposium was co-organized by SCAU and the China Litchi and Longan Research System under the aegis of the International Society for Horticultural Science (ISHS) and supported by the Department of Science and Technology of Guangdong Province, Maoming Branch, the Guangdong Laboratory for Lingnan Modern Agriculture, and the Guangdong Society for Horticultural Science. It attracted 130 participants from China, South Africa, Thailand, Vietnam, India, Israel, Mauritius and Madagascar. This symposium was convened by Prof. Xuming Huang from SCAU and was the second symposium in this series hosted by SCAU. The first symposium held in 2000 was co-convened by Prof. Huibai Huang from SCAU and Prof. Shmuel Gazit from Hebrew University of Jerusalem, Israel. At the opening ceremony, a video entitled "Symposium Recollection" was shown which captured some of the previous symposia on *Sapindaceae* fruits which had been held in Guangzhou, China (2000), Chiang Mai, Thailand (2003), Fuzhou, China (2008), White River, South Africa (2012), Sabour, India (2016) and Hanoi, Vietnam (2019). The video highlighted the efforts of Prof. Huang and Prof. Gazit, who initiated the symposium series. At the opening ceremony, Prof. Xiaobo Wen, vice president of SCAU, Mr. Li Xudong, vice director of the Department of Science and Technology of Guangdong Province, and Dr. Karin Hannweg, Chair of ISHS Division Tropical and Subtropical Fruit and Nuts, gave speeches on behalf of the university, provincial science and technology authority, and ISHS, respectively.

› Participants of the symposium.

A total of 85 abstracts were received, with 46 oral presentations, 13 keynotes, and 39 posters being presented at the symposium. The presentations covered multiple topics including: 1) industry status of *Sapindaceae* fruits in the world; 2) germplasm, genomics, biotechnology and crop improvement; 3) physiology and cultivation; 4) pest and disease management; 5) postharvest handling and uses; 6) orchard mechanization and smart management.

After voting by all participants, the best oral presentation for a young scientist was awarded to Dr. Guanghui Kong from SCAU for his presentation entitled "Identification of plant resistance genes based on *Litchi-Peronophythora litchii* interaction". The best poster was awarded to Dr. Wenpei Song from Zhongkai Agricultural and Engineering College for her presentation entitled "A study on

› Prof. Xiaobo Wen, vice president of SCAU (A), and Mr. Xudong Li, vice director of the Department of Science and Technology of Guangdong Province (B), addressing the participants at the opening ceremony.

› Lychee and longan fruits of different cultivars displayed at the symposium.

the calcium uptake pattern and absorption pathway of 'Shixia' longan".

Throughout the symposium, 16 varieties of lychee and 2 longan cultivars from different regions and some processed products (lychee wine and vinegar, lychee and longan nuts, and dried longan pulp) were displayed, enabling participants to taste many cultivars and other products derived from the fruits of *Sapindaceae*.

A full-day mid-symposium tour was organized from SCAU to Conghua and Zengcheng, the two major lychee producing regions in the municipality of Guangzhou. The first site was a packing house under Hualong Fruit & Vegetable Freshness in Conghua District, where a sorting and packing line equipped with a hydraulic cooling system was operational. Off-grade fruit from the packing house was collected for drying either in an oven or a gas-burning hot air drying chamber. The second site was Conghua Liboyuan (Litchi Expo Park), where smart elements in lychee production, key cultivars, top grafting and processed products, were demonstrated. The third site visited was Xiancun Litchi Culture Museum and Xianji Orchard, in the Zengcheng District of Guangzhou. The museum and orchard are owned by Mr. Haochao Chen. The orchard is primarily planted with 'Xianjinfeng', a new cultivar certified in 2011. The cultivar is characterized by high internal and external quality, high yield, high cracking resistance and good storability, and is rapidly emerging as one of the major late lychee cultivars in China.

After the professional visits, participants were invited to a Pearl River night cruise.

During the business meeting at the end of the symposium, Dr. Pawin Manochai from Maejo University, Thailand, expressed his willingness to host the VIII International Symposium on Lychee, Longan and Other *Sapindaceae* Fruits in Chiangmai, Thailand. Dr. Theeranuch Jaroenkit was elected as the new Chair of ISHS Working Group Lychee, Longan and Other *Sapindaceae* Fruits replacing Prof. Xuming Huang. In her closing address, Dr. Karin Hannweg concluded that this symposium had been a great success!

Xuming Huang

› Contact

Prof. Dr. Xuming Huang, College of Horticulture, South China Agricultural University, Guangzhou 510642, China, e-mail: huangxm@scau.edu.cn

› Convener Prof. Xuming Huang (center) with Dr. Pawin Manochai, Convener of the VIII International Symposium on Lychee, Longan and Other Sapindaceae Fruits (right) and Dr. Theeranuch Jaroenkit, Chair of ISHS Working Group Lychee, Longan and Other *Sapindaceae* Fruits (left) from Thailand.

› Mid-symposium professional tour to orchards in Conghua (A) and Zengcheng (B).

› Dr. Guanghui Kong (A) and Dr. Wenpei Song (B) receiving the ISHS Young Minds Awards (best oral presentation and best poster, respectively) from Dr. Karin Hannweg, Chair of ISHS Division Tropical and Subtropical Fruit and Nuts.

III International Symposium on Fruit Culture along Silk Road Countries

Division Tropical and Subtropical Fruit and Nuts	#ishs_dtro
Division Plant Genetic Resources and Biotechnology	#ishs_dbio
Division Temperate Tree Fruits	#ishs_dfru
Division Vine and Berry Fruits	#ishs_dvin

› Participants of the symposium.

The III International Symposium on Fruit Culture along Silk Road Countries was successfully held in Hangzhou, China, from July 10-14, 2023, under the theme of "Ancient Road, Modern Way" under the aegis of the International Society for Horticultural Science (ISHS) and the Chinese Society for Horticultural Science (CSHS). The symposium was co-hosted by Zhejiang University, China Agricultural University, Xianghu Laboratory of Zhejiang Province and Nanxun District People's Government of Huzhou City. The conveners of the symposium, Prof. Yuanwen Teng of Zhejiang University, Prof. Zhenhai Han of China Agricultural University and Prof. Xingjiang Qi of Xianghu Laboratory of Zhejiang Province, co-chaired the opening ceremony. Dr. François Laurens, President of ISHS, Prof. Ganjun Yi, Vice-President of CSHS, and Prof. Gongyin Ye, Council Member of Zhejiang University, all delivered speeches at the opening ceremony.

The symposium was attended by nearly 160 delegates from nine countries. During the symposium, six main topics were discussed: germplasm resources, breeding and genomics; rootstocks and orchard management systems; fruit development and quality; abiotic stress; plant protection; and pests and diseases. A total of 39 oral papers and 53 posters were presented.

The countries along the Silk Road are not only the most important fruit producing areas in the world today, but also the birthplaces of many important fruit trees. The keynote address "The journey of the cultivated apple along the Silk Routes: insights from population genomics" was presented by Dr. Amandine Cornille from France, who demonstrated the origin of the cultivated apple from the perspective of genomics. In the era of genomics, the design of fruit tree genomes to combine beneficial variants with desired agronomic traits, while simultaneously eliminating harmful variants is the goal of future fruit tree breeding programs. Due to rising labor costs, the fruit tree industry in China and many countries along the Silk Road are experiencing a shift from traditional to modern fruit production models, which cannot be achieved without the selection and breeding of dwarfing rootstocks and precision management under high-density cultivation. This topic was also discussed during the symposium. Improving fruit quality is the eternal pursuit of the fruit industry. A total of 13 oral presentations explored the basis and regulatory pathways impacting fruit appearance and internal fruit quality from the molecular biology level. With global warming, deciduous fruit trees in the southern fringes of the Silk Road are receiving insufficient chilling hours to break dormancy. The symposium discussed the mechanisms and regulation of dormancy, as well as the impact of other abiotic stresses on fruit tree production. Protection and control of traditional diseases and emerging viral pathogens and phytoplasmas were also discussed.

After two days of intense and active academic exchange, participants visited the protected citrus production region in Nanxun District, Huzhou City, and the globally important agricultural heritage site – Zhejiang Huzhou Mulberry-dyke & Fish-pond System, to learn

› Assoc. Prof. Arif Atak, Vice-Chair of ISHS Division Vine and Berry Fruits, presenting the ISHS Young Minds Awards to A) Jia Wei for the best oral presentation, and B) Zhen Xu for the best poster.

about modern orchard cultivation technology and relive the ancient ecological cycle of agriculture.

The ISHS Young Minds Award for the best oral presentation was awarded to Jia Wei for her research entitled "Application of plant growth regulators in inhibition of autumn flowering in pear". Dr. Jia Wei received her Ph.D. degree a few months ago and is now a postdoctoral fellow at Zhejiang University. The ISHS Young Minds Award for the best poster presentation was awarded to Zhen Xu, Ph.D. candidate from China Agricultural University, for her research entitled "Long-distance movement of LncRNA NCRS6 between apple scion and rootstock involved in iron deficiency stress".

During the ISHS business meeting, it was confirmed that the IV International Symposium on Fruit Culture along Silk Road Countries will be held in Turkey in 2026.

Yuanwen Teng, Zhenhai Han and Xingjiang Qi

› Participants attending the field day at Citrus Sustainable Development Demonstration Park in Nanxun District, Huzhou City, Zhejiang Province.

› Contact

Prof. Dr. Yuanwen Teng, College of Agriculture and Biotechnology, Zhejiang University, 866 Yuhangtang Road, Hangzhou City, Zhejiang Province, 310058, China, e-mail: ywteng@zju.edu.cn

Prof. Dr. Zhenhai Han, College of Horticulture, China Agricultural University, 2 Yuanmingyuan West Road, Beijing, 100083, China, e-mail: rschan@cau.edu.cn

Prof. Xingjiang Qi, Xianghu Laboratory of Zhejiang Province, 168 Gengwen Road, Xiaoshan District, Hangzhou City, Zhejiang Province, 311231, China, e-mail: cnqixj@zaas.ac.cn

XI International Symposium on Artichoke, Cardoon, and Their Wild Relatives

Division Vegetables, Roots and Tubers #ishs_dveg

The 11th edition of the International Symposium on Artichoke, Cardoon, and Their Wild Relatives (Artichoke 2023) was successfully held in Molfetta (Italy) from April 18-21, 2023, with Prof. Giancarlo Colelli and Prof. Antonio Elia of the University of Foggia acting as Conveners.

Molfetta is situated in the Puglia region, a major area for horticultural production in Italy where more than 1.4 million hectares are cultivated: about 10% of the cultivated land in Italy. Producing over 370,000 tons in 2021, Italy is the primary artichoke producing country in the world, with the Puglia and Sicily regions together accounting for three quarters of national production.

The event, which covered the most recent innovations in cultivation techniques, breeding, postharvest technology and minimal processing, and the non-food use of the genus *Cynara*, was structured into six oral sessions and one poster session. Around 60 oral presentations, introduced by five keynote talks, were presented. The program was completed with a stakeholder round table discussion, and two technical visits to artichoke-producing areas in the provinces of Foggia and Brindisi.

Dr. Aurelio Scavo from the University of Catania, Italy, opened Session 1 with a talk on "Allelopathy in *Cynara cardunculus* L." describing the properties of extracts derived from various genotypes and highlighting the role of induced stress as a valuable strategy for enhancing the synthesis of allelochemicals. He also emphasized the pressing need for more focused research efforts aimed at elucidating the genetic traits associated with allelopathy.

› Dr. Matteo Martina (center), winner of the ISHS Young Minds Award for the best oral presentation with the Symposium Conveners Giancarlo Colelli (left) and Antonio Elia (right).

Prof. Daniel Valero (University Miguel Hernandez, Spain) opened Session 2, presenting the latest advancements in preharvest treatments and their impact on fruit quality both at harvest and during postharvest handling. Special emphasis was placed on bioactive compounds and on the results achieved through the application of oxalic acid and methyl jasmonate.

Session 3 was dedicated to the outcomes of R&D Project ICARUS, which focused on process and marketing innovations for the valorization of the Apulian artichoke from a sustainable perspective. This project, funded by the Puglia Regional Government and coordinated by the University of Foggia, involved collaboration with nine partners including public institutions and private companies.

Prof. Ezio Portis from the University of Turin, Italy, introduced Session 4 with a talk on "Genetic diversity and population structure studies towards an association mapping approach in globe artichoke". He covered the current understanding of the genome structure and the utilization of next-generation sequencing markers. Additionally, he highlighted how a meticulously characterized germplasm core collection can expedite the identification of quantitative trait loci asso-

› Participants of the symposium.

› Keynote speakers (from left to right): Maria Luisa Amodio, Daniel Valero, Ezio Portis, Aurelio Scavo, and Andrzej Salata.

› Stakeholder round table (from left to right): Claudia Iannarella, Angelo Giordano, Donato Pentassuglia, Giuseppe Semeraro, and Pasquale Lillo.

ciated with agronomically and economically significant traits.

Session 5 started with a keynote lecture by Prof. Maria Luisa Amodio from the University of Foggia, Italy, entitled "Fresh-cut artichokes: what we know and what we should know". She addressed the influence of genotypes, the impact of critical pre-cutting handling procedures, anti-browning treatments, optimal modified-atmosphere packaging conditions, and their effects on product quality.

The stakeholder round table was dedicated to the future perspectives of the artichoke market and was introduced by Dr. Claudio Scalise of SG MARKETING, Italy, who presented a talk on "The artichoke market scenario and strategies for increasing value". The table included the Councilor for Agriculture of the Puglia Regional Government, Dr. Domenico Pentassuglia, and four industry representatives covering breeding, production, processing, and retail.

Finally, Prof. Andrzej Salata from the University of Lublin, Poland, introduced Session 6, which focused on the non-food use of *Cynara* and other wild relatives. His presentation entitled "The cultivation of *Cynara cardunculus* as a medicinal plant in Central Europe" explored culinary and medicinal aspects, as well as the utilization of *Cynara cardunculus* as an herb for extracting valuable bioactive compounds.

During Technical tour no. 1 in the Foggia area, participants had the opportunity to visit a packing facility specializing in fresh ready-to-use artichokes and a catalog field for testing new genotypes. Technical tour no. 2, in the Brindisi area, featured visits to two artichoke processing facilities, and to a nursery dedicated to the multiplication of virus-free plantlets through meristem culture.

Artichoke 2023 fostered and encouraged networking between the participants through various cultural initiatives, including guided visits to the *Museo del Mare* and to the City Library Painting Collection. In addition, attendees enjoyed a pleasurable Opera concert by the Alter Chorus, directed by Antonio Allegretta, featuring guest soprano Marilena Gaudio and baritone Antonio Stragapede. These experiences, along with ample time for coffee and lunch breaks, and a symposium dinner, took place in the splendid setting of the 17th century St. Domenico monastery, now a hub for city culture.

The ISHS business meeting, chaired by Prof. Ferdinando Branca, Chair of ISHS Division Vegetables, Roots and Tubers, covered several topics. Most notably, discussion led to the selection of Prof. Andres V. Casas Diaz from the Universidad Nacional Agraria la Molina as the host for the next International Symposium on Artichoke, Cardoon, and Their Wild Relatives, in Peru in 2027.

The symposium attracted more than 90 people in person (and about 10 people online), from 7 different countries. The conveners, Giancarlo

› Technical visit to a commercial artichoke field (Az. Agric. Lillo, Brindisi, Italy).

› Technical visit to a nursery producing virus-free plantlets (Vivai F.lli Corrado, Brindisi, Italy).

Colelli and Antonio Elia expressed their satisfaction with the high quality of scientific reports and the breadth of topics covered. Among participants, six scientists applied for the ISHS Young Minds Award, which was given to Dr. Matteo Martina from the University of Turin, Italy, for his oral presentation entitled "Application of bulked-segregant analysis coupled with whole genome sequencing (bsa-seq) for the identification of male sterility-related genes in globe artichoke".

Giancarlo Colelli and Antonio Elia

› Contact

Giancarlo Colelli and Antonio Elia, Department of Science of Agriculture, Food, Natural Resources and Engineering, University of Foggia, Via Napoli 25, 71122 Foggia (FG), Italy, e-mail: giancarlo.colelli@unifg.it and antonio.elia@unifg.it

› VII International Symposium on Cucurbits

Division Vegetables, Roots and Tubers **#ishs_dveg**

With the theme of "Cucurbit crop nutrition and human health", the VII International Symposium on Cucurbits was successfully held in Zhengzhou, China, from June 11-15, 2023. The symposium was organized by Zhengzhou Fruit Research Institute, Chinese Academy of Agricultural Sciences (CAAS), under the aegis of the International Society for Horticultural Science (ISHS). The symposium was co-organized by Henan Agricultural University, the Chinese Society for Horticultural Science, the Watermelon and Melon Research & Development Center, China Agriculture Research System (CARS), the Major Vegetables Research & Development Center, CARS, and the National Key Laboratory for Germplasm Innovation & Utilization of Horticultural Crops, in collaboration with the Henan Institute of Science and Technology, Northeast Agricultural University, Jiangsu Academy of Agricultural Sciences, the Vegetable Research Institute of Guangdong Academy of Agricultural Sciences, Henan Ouland Seed Industry Co, the Key Laboratory of Biology and Genetic Improvement of Horticulture Crops (Northeast Region), the Ministry of Agriculture and Rural Affairs, and the Henan Joint International Research Laboratory of South Asian Fruits and Cucurbits. The symposium was sponsored by the Ministry of Science and Technology of China to facilitate high-level cooperation and exchange activities.

› Participants of the symposium.

More than 400 representatives from 17 countries and regions, including China, France, Italy, India, the United States, Spain and South Korea, participated in the symposium, either in person or virtually.

Throughout the symposium, 866 new varieties of cucurbit crops from 107 units in China were exhibited, including 342 watermelon varieties, 274 melon varieties, 79 cucumber varieties, 58 pumpkin varieties, 37 wax melon varieties, 29 bitter gourds, 17 loofah, 12 hairy gourds, 5 wild species, 3 lagenaria gourds, 2 snake melons, 2 common melons, 2 gourd melons, 2 summer squash, 1 West Indian melon, and 1 Zambian melon. The Organizing Committee invited 25 well-known experts from all over the world to evaluate these new varieties and 38 outstanding varieties were selected. These outstanding varieties were awarded the Excellent New Variety Award.

Professor Ferdinando Branca, Chair of ISHS Division Vegetables, Roots and Tubers, delivered a speech at the opening ceremony of the symposium. Professor Fang Jinbao, director of Zhengzhou Fruit Research Institute, CAAS, presided over the opening ceremony.

A total of 49 scientific papers, including 12 invited papers, 29 general papers and 8 youth papers were presented during the symposium, with 68 posters displayed. The oral presentations were divided into four sessions: germplasm resources and genetic breeding, postharvest and fruit quality, biological and abiotic stress, and biotechnology and genomics.

At the closing ceremony, Professor Gu Xingfang, Chair of ISHS Working Group Cucurbitaceae, presented the ISHS Convener award to Liu Wenge. Siqi Zhang, a postdoc student from the University of Paris Saceray, France, won the ISHS Young Minds Award for the best oral presentation entitled "The gynoecy sex determination gene WIP1 targets the carpel determinacy pathway to promote male flower development in cucurbits". Yong Zhao, a PhD candidate from Zhengzhou Fruit Research Institute, CAAS, China, won the ISHS Young Minds Award for the best poster entitled "A convenient and high-efficiency *Agrobacterium rhizogenes*-mediated hairy root transformation for CRISPR/Cas9-based gene editing efficiency evaluation in different *Citrullus* species".

During the field tour, participants were able to view the 866 new cucurbit varieties and to visit the Wanbang international wholesale market, the largest wholesale agricultural market in central China.

Hongju Zhu

› Contact

Hongju Zhu, Zhengzhou Fruit Research Institute, Chinese Academy of Agricultural Sciences, Guancheng District, Zhengzhou, 450009, China, e-mail: zhuhongju@caas.cn

› Professor Wenge Liu presenting the ISHS Young Minds Awards to A) Siqi Zhang for the best oral presentation, B) Yong Zhao for the best poster.

› The experts judging on the ISHS Young Minds Award for the best poster. From left to right: Professor Junguo Zhou, Professor Wenge Liu (Convener), Professor Zhilong Bie, Professor Chao Zhang, Professor Abdelhafid Bendahmane, Professor Mingfang Zhang.

› Display of new varieties of cucurbit crops.

IX South-Eastern Europe Symposium on Vegetables and Potatoes

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

The IX South-Eastern Europe Symposium on Vegetables and Potatoes took place from September 5-9, 2023, in Bucharest, Romania, co-organized by the Academy of Agricultural and Forestry Sciences (Gheorghe Ionescu - Șișești), the University of Agricultural Sciences and Veterinary Medicine of Bucharest, and the Romanian Society of Horticulture, under the auspices of the International Society for Horticultural Science (ISHS). This event was hosted in the Hall of the Academy of Agricultural and Forestry Sciences and the Campus of the University of Agronomic Sciences and Veterinary Medicine of Bucharest, in one of the most picturesque areas of the Romanian capital.

The symposium featured three keynote addresses covering research in vegetables and potatoes, regional and global perspectives on research and development, opportunities and challenges in value-added products, practical aspects of fertilizer and nutrient solutions, current trends in mitigating the impact of climate change on horticultural crops, knowledge dissemination, and horticultural applications.

The symposium was attended by 116 participants from 21 countries who engaged in the many scientific sessions. These sessions encompassed ten thematic tracks, addressing diverse subjects such as cultivation practices and quality, greenhouse technologies, plant biodiversity and breeding, plant protection, plant propagation, growing media, climate change and sustainable production, smart agriculture, and postharvest physiology, technology, and processing. Attendees shared insights on the current status, technological advancements, and future directions in the global vegetable and potato industry.

The symposium served as a valuable platform for researchers, students, growers, and stakeholders to present their work, exchange knowledge, and engage in meaningful discussions regarding recent advances in vegetable and potato management, particularly in South-Eastern Europe.

The symposium was opened by Assoc. Prof. Marian Bogoescu from the Academy of Agricultural and Forestry Sciences and the welcoming addresses were delivered by Dr. Florin Badiu, Vice-President of the Academy of Agricultural and Forestry Sciences, and Prof. Dr. Florin Stănică, Vice-Rector of the University of Agronomic Sciences and Veterinary Medicine of Bucharest. Dr. Badiu and Prof. Stănică emphasized the significance of vegetables and potatoes in Romanian agriculture and the country's strong tradition in horticultural research. They expressed the hope that the symposium would enhance international collaboration and contribute to the growth of the vegetable and potato industries in the region.

During the closing ceremony and business meeting, Prof. Dr. Nazim Gruda, Vice-Chair of ISHS Division Vegetables, Roots and Tubers and Chair of ISHS Working Group South-Eastern Europe Vegetable and Potato Production, underscored the nutritional and economic importance of vegetables and potatoes. He awarded the ISHS Young Minds Awards to PhD student Aida Shomali from the Universi-

› Assoc. Prof. Marian Bogoescu (left), Assoc. Prof. Viorica Lagunovschi (center) and Prof. Dr. Nazim Gruda (right) received medals from ISHS for convening the symposium. Photo by Xun Li.

› Participants of the symposium. Photo by Nicole Petculescu.

› Prof. Dr. Nazim Gruda presenting the ISHS Young Minds Award to A) Aida Shomali (best oral presentation), B) Mariana Calara (best poster). Photos by Xun Li.

ty of Tehran, Iran, for the best oral presentation entitled "Light intensity influences the impact of far-red photon energy and signaling on photosynthesis", and Master student Mariana Calara from R.D.S.V.C. Bacau, Romania, for the best poster entitled "Exploitation of some allelopathic species for weed control in ecological agriculture on a climbing bean crop". The conveners of the symposium, Assoc. Prof. Marian Bogoescu, Prof. Dr. Nazim Gruda, and Assoc. Prof. Viorica Lagunovschi, received the ISHS Medal award from Prof. Daniel Leskovar, former Chair of ISHS Division Vegetables, Roots and Tubers.

The symposium included a professional field trip and a cultural tour, offering insights into Romanian horticultural practices and cultural diversity. Participants visited several companies and institutions involved in vegetable production near the Black Sea coast and potato cultivation in the Southern Carpathian Mountains. On September 6, the participants had the opportunity to explore the University of Agronomical Sciences and Veterinary Medicine Bucharest's Research Center. During the field trips, participants had the chance to visit a vertical farm specializing in basil and herbs, and a greenhouse dedicated to vegetable production. Additionally, they explored the research institute for viticulture and winemaking. A winetasting event was the highlight of the social program, allowing both formal and informal discussions. The itinerary included a visit to the Targu Secuiesc Potato Research and Development Station the following day. Finally, the journey culminated with a visit to the historic Bran Castle, infamously associated with the legendary Dracula and King Vlad the Impaler.

In conclusion, the IX South-Eastern Europe Symposium on Vegetables and Potatoes featured presentations by several experts, scholars, and postgraduates, resulting in 109 contributions. The associated manuscripts will be published in *Acta Horticulturae*. The symposium's success is expected to drive regional development in the vegetable and potato industry and contribute positively to Romanian horticulture.

Marian Bogoescu and Nazim Gruda

› Contact

Assoc. Prof. Marian Bogoescu, Academy of Agricultural and Forestry Sciences "Gheorghe Ionescu - Şişeşti", 042159 Bucharest, Romania, e-mail: bogoescumarian@gmail.com

Prof. Dr. Nazim Gruda, University of Bonn, INRES Horticultural Sciences, Auf dem Hügel 6, 53121 Bonn, Germany, e-mail: ngruda@uni-bonn.de

› Participants during the field trip to A) IVDVV Valea Calugareasca and B) S.C.D.C.C. Targu Secuiesc. Photos by Nicole Petculescu.

› XIII International *Rubus* and *Ribes* Symposium

Division Vine and Berry Fruits #ishs_dvin
Division Plant Genetic Resources and Biotechnology #ishs_dbio
Division Protected Cultivation and Soilless Culture #ishs_dpro
Commission Agroecology and Organic Farming Systems #ishs_cmor

› Participants of the symposium.

The XIII International Rubus and Ribes Symposium was held from 19 to 21 July 2023 in Portland, Oregon, USA. The theme of the symposium was "Resiliency in Rubus and Ribes Cultivation". Resiliency was on display throughout the symposium, as well as during a three-day pre-symposium tour in Washington and Oregon. Both Washington and Oregon are leaders in processed blackberry and raspberry production, offering international guests the opportunity to learn about this historically important and evolving industry.
Like many places around the world, *Rubus* and *Ribes* production is being challenged by a changing climate that encompasses extremes in heat threatening crop productivity and quality. Alongside climate change, emerging pests and diseases, pollination constraints, labour shortages, and the rising costs of production are requiring the industry to explore new genetics and horticultural practices to maintain productivity.
Keynote speaker, decorated plant breeder, and professor emeritus at the University of Arkansas, USA, Dr. John Clark, emphasized that plant breeding is itself an act of resiliency and highlighted how breeding within his lifetime had led to thornlessness and increasingly higher quality of primocane fruiting blackberries that could be grown in a broad range of climates. Dr. Clark left the audience with a motivating message that blending the past and present will be key in building a more resilient future within the *Rubus* and *Ribes* community.
Changing climate and production practices also mean that we need to safeguard important ecosystem services, such as pollination. Keynote speaker and Associate Professor at the University of New England in Australia, Dr. Romina Rader, addressed this topic and inspired the audience by highlighting the diversity of animals that contribute to berry crop pollination, management practices to support pollinators and their services, and emphasized the importance of sharing knowledge between industry and research partners to ensure pollination success.
At the heart of climate change in the Pacific Northwest (and elsewhere in the world) is the need to deal with extremes in weather. Priming agents are one potential tool that can increase the resiliency of plants to both biotic and abiotic stressors. This was elaborated further upon by Dr. George Manganaris, Associate Professor at Cyprus University, and the symposium's third and final keynote speaker. Priming essentially is exposure to a stimulus that activates plants defence systems and establishes a "molecular memory" that can help plants better respond to future stress. Research on the topic is promising and provides another alternative to complement plant breeding and other horticultural techniques that seek to maintain *Rubus* and *Ribes* production across variable and changing climatic conditions.

› Conveners David R. Bryla (left) and Lisa Wasko DeVetter (right) handing over the ISHS Young Minds Awards to A) Lisa Rayburn, North Carolina State University graduate student, for the best oral presentation, B) Lena Wilson, Cornell University graduate student, for the best poster.

While learning and the transfer of information were core to this symposium, the group was delighted by the musical talents of Dr. John Clark. Attendees also had the opportunity to visit the scenic Columbia Gorge and to network over a delightful dinner cruise on the Willamette River. Many attendees also reminisced and celebrated the extraordinary lives and legacies of three recently departed *Rubus* and *Ribes* scientists, Drs. Bernadine Strik, Chad Finn and Elizabeth Keep.

The final day of the symposium was also a day of celebration by concluding the event and recognizing the ISHS Young Minds Award winners. All entries in the competition were exemplary, but Lisa Rayburn and Lena Wilson took home awards for best oral and poster presentations. Lisa, from North Carolina State University, USA, presented her paper on "Pine bark as an alternative to coco coir for substrate production of long-cane raspberry in the southeastern US" while Lena Wilson, from Cornell University, USA, presented her poster on "Chromosome doubling of black raspberry in tissue culture."

The event was a great success, with 170 people attending from 27 countries representing six continents. Industry participation was also high with approximately one third of attendees coming from the private sector to listen, learn, and share information. While resiliency was core to this symposium, the issue remains an important topic for the next International *Rubus* and *Ribes* Symposium, which will be held in Trento, Italy in July 2027.

Lisa Wasko DeVetter and David R. Bryla

› Pre-symposium tour participants posing by a berry machine harvester in Lynden, Washington, USA.

› Contact

Dr. Lisa Wasko DeVetter, WSU NWREC, 16650 WA-536, Mount Vernon, WA 98273, USA, e-mail: lisa.devetter@wsu.edu

Dr. David R. Bryla, USDA-ARS HCPGIR, 3420 NW Orchard Avenue, Corvallis, OR 97330 USA, e-mail: david.bryla@usda.gov

› XIII International Conference on Grapevine Breeding, Genetics and Management

Division Vine and Berry Fruits **#ishs_dvin**

Division Plant Genetic Resources and Biotechnology **#ishs_dbio**

The XIII International Conference on Grapevine Breeding, Genetics and Management (GBG2023) was held in Cappadocia, Turkey, from 21-24 August 2023. The conference was organized in cooperation with the General Directory of Agriculture Research and Policy (TAGEM) and Atatürk Horticultural Central Research Institute, under the auspices of ISHS Division Vine and Berry Fruits.

The conference brought together almost 100 participants from 20 countries, who also came from many different sectors of the grape industry. In total, 54 scientific papers and 11 sponsored presentations were delivered.

The opening ceremony was led by Assoc. Prof. Arif Atak (Bursa Uludağ University, Turkey), Conference Convener and Vice-Chair of ISHS Division Vine and Berry Fruits. During the welcome speeches, Dr. François Laurens (President of ISHS) introduced ISHS, while Assoc. Prof. Davut Keleş (Head of the Horticulture Department of TAGEM) introduced TAGEM and provided some background information about grape production in Turkey. After the opening speeches, Gabriella De Lorenzis (Italy) gave a plenary lecture on "The history of grapevine germplasm from ancient to modern varieties" and Murat Yanki (Turkey) gave a keynote presentation on "History of Cappadocia viticulture and winemaking".

The symposium included ten oral and poster presentation sessions. In this symposium, unlike previous ones, in addition to R&D studies on wine grapes, studies on table and dried grapes, and the effects of climate change on viticulture were presented. In parallel with developments in biotechnology, it was reported that breeding studies had begun to achieve the desired targets in a much shorter time.

In session 1-4 (Breeding and genetics), keynote presentations were given by Assoc. Prof. Arif Atak (Turkey) on "Table grape breeding programs and new varieties", Elena Ilnitskaya (Russia) on "Evaluation of seedless grape varieties by DNA markers linked to disease resistance loci", Yongfeng Zhou (China) on "Population genetics and genomic breeding for grapevine", and Summaira Riaz (USA) on "Resistance breeding for table and raisin grapes at the San Joaquin Valley Ag Center in Parlier, CA". Following these keynote presen-

tations, other oral presentations were given on grapevine genetics and breeding.
In session 5 (Grapevine plant protection), a keynote lecture entitled “An overview of grapevine trunk diseases: problematic, what we know and how to control” was presented by Florence Fontaine (France). After this keynote presentation, three oral presentations related to the session title were given.
During sessions 6 and 7, two sponsored webinars were held, during which a total of 11 sponsored presentations were given where participants were informed about the work of leading organizations in the Turkish grapevine industry. The latest developments in the sector were explained and company representatives answered questions. These webinars were organized with the participation of private companies and the General Directory of Agriculture Research and Policy of Türkiye (TAGEM).
In session 8 (Grapevine management), Gabriele Valentini (Italy) gave a keynote presentation entitled “Vineyard canopy management techniques to cope with climate change”. Afterwards, two more presentations related to grapevine management were given.
In session 9 (Smart viticulture), a keynote presentation entitled “Climate smart viticulture with groundcover vegetation management” was given by Mehdi Sharifi (Canada). Afterwards, two more presentations related to smart viticulture were given.
In session 10 (Biotic/abiotic stress), Andreia Figueiredo (Portugal) gave a keynote presentation on “New strategies to cope with biotic and abiotic stress in grapevine using PGPB and pathogen-driven elicitor molecules” and Harlene Hatterman-Valenti (USA) gave a keynote lecture entitled “This is how we chill from ’23 ’til: breeding cold hardy grapevines for unprecedented and unpredictable climate challenges”. Afterwards, two more presentations related to the session title were given.

› Assoc. Prof. Arif Atak, Conference Convener, presenting the ISHS Young Minds Awards to A) Valentina Ricciardi (best oral presentation), B) Patrick Mdemba (best poster).

Apart from these oral presentations, a total of 19 posters covering several topics were presented during the symposium.
ISHS Young Minds Awards were given to Valentina Ricciardi from the University of Milan, Italy, for the best oral presentation entitled “The genome of Mgaloblishvili, a *Vitis vinifera* variety resistant to grapevine downy mildew” and to Dr. Patrick Mdemba from Ben-Gurion University of the Negev, Sede Boker, Israel, for the best poster entitled “Management of table grapes through precision nitrogen fertilization”.
On the third day of the conference, technical tours were made to vineyards, wineries and some touristic areas in the Cappadocia region. Participants had the chance to see local grape varieties (grown on their own roots) and to sample the wines made from them.
During the closing session, participants expressed their satisfaction with the symposium and its excellent organization and hoped for continuity in full collaboration between ISHS and the vine research community.

Arif Atak

› Contact

Arif Atak, Bursa Uludag University, Agriculture Faculty, Department of Horticulture, 16059 Bursa, Turkey, e-mail: arifatak@uludag.edu.tr

› Technical tour to Urgup in the Cappadocia region.

› Some of the symposium participants.

From the Secretariat

› New ISHS members

ISHS is pleased to welcome the following new members:

New Individual Members

Armenia: Dr. Anna Tadevosyan; **Australia:** Ms. Carolina Echave Chiappe, Dr. Andrew Richard Granger, Ms. Camilla Humphries, Dr. Muhammad Islam, Ms. Bhupinder Kaur, Mr. Malcolm McKinlay, Mr. Chiranjivi Neupane, Dr. Hugh Zhou, Dr. Shuangxi Zhou; **Belgium:** Ms. Kaat De Boeck, Mr. Sander Fleerakkers; **Brazil:** Dr. Remark Brandao do Vale, Prof. Dr. Ítalo Cavalcante, Prof. Valter Carvalho de Andrade Júnior, Dr. Rondon Vale; **Bulgaria:** Prof. Dr. Tsvetelina Stoilova; **Canada:** Ms. Sara Benchaa, Mr. Oumar Berthe, Karine Jarzecki, Tony Kalf, Mr. Ernesto Lagarda, Prof. Danielle Monfet, Dr. Joël Passicousset, Dristy Zaman; **Chile:** Mr. Raimundo Cuevas, Dr. Viviana Tudela; **China:** Muhammad Anees, Assoc. Prof. Jiaowen Cheng, Mr. Shuanzhu Du, Wei Guan, Xiu Hu, Prof. Chunhui Huang, Dr. Ming Jia, Prof. Dr. Jidong Li, Shanshan Li, Dr. Yukuo Li, Dr. Guanglian Liao, Assoc. Prof. Miaomiao Lin, Jingtong Lu, Prof. Dr. Wei Lu, Eftekhar Mahmud, Dr. Wenpei Song, Prof. Xiao Tao, Prof. Dr. Rencai Wang, Yan Wang, Assoc. Prof. Jun Xu, ming Xu, Assoc. Prof. Jinqiang Yan, Prof. Luming Yang, Assoc. Prof. Yunliu Zeng, Baige Zhang, Prof. Jianguo Zhang; **Cote d'Ivoire:** Mr. Thomas Wibaux; **Egypt:** Prof. Dr. Sahar Youssef; **Estonia:** Rachel Puusta; **France:** Mr. Corentin Chateau, Elsa Desnoues, Hana Lamouchi, Patricia Sanvicente; **Germany:** Ms. Anika Muder; **Ghana:** Dr. Paul Kweku Tandoh; **Greece:** Dr. Stefanos Kostas, Dr. Afroditi Tsampalla, Christos Vatistas; **Hungary:** Prof. László Baranyai; **India:** Mr. Krishna Kaushik, Prof. Dr. Dil Mohammad Makhdoomi, Prof. Dr. Tariq Hussain Masoodi, Prof. Dr. Arshad H Mughal; **Ireland:** Ms. Michelle McKeon-Bennett; **Israel:** Mr. Ori Eisenbach, Mr. Martin Gitonga, Dr. Ilana Shtein; **Italy:** Matteo Giaccone, Mr. Leone Magliocchetti Lombi, Ella Dominique Maxwell, Ms. Anna Maria Milani, Dr. Eugenia Monaco, Dr. Enzo Perri, Marco Resecco; **Japan:** Assist. Prof. Tzu-Fan Hsiang, Mr. Wataru Takada, Mr. Shimon Tanaka; **Jordan:** Ms. Saja Majali; **Korea (Republic of):** Yunwoo Cho, Mr. Hoon Choi, Youngbae Choi, Prof. Hak-Jin Kim, Sung Joon Kim; **Latvia:** Dzintra Dekena, Liga Lepse; **Malaysia:** Mr. Wui Chai Chew; **Mexico:** Dr. Ma. de Lourdes Arevalo-Galarza; **Morocco:** Mr. Omar Abou-Saaid; **Netherlands:** Assist. Prof. Elias Kaiser, Mr. Gertjan Meeuws, Dr. Natalia Moreno, Mr. Paul Ruigrok, Mr. Jordan Van Brenk, Sjoerd van Vilsteren; **New Zealand:** Ms. Kelvina Barrett-Manako, Dr. Saman Berenji, Mr. Nicolas Castro, Dr. Yi Chen, Hayden Green, Dr. Dinum Herath, Dr. Mauren Jaudal, Erin Lane, Dr. Sam Langdon-Arms, Ms. Minoo Mohajer, Dr. Chandan Pal, Dr. Emma Sherman, Dr. Susan Thomson, Dr. Magdalena Urbanska, Ms. Charlotte Voogd, Dr. Bo Yang, Dr. junqi Zhu; **Norway:** Emily Follett, Mr. Tore Gravermoen, Assoc. Prof. Mehdi Sharifyazdi, Ms. Theresa Weigl; **Poland:** Assist. Prof. Przemyslaw Babelewski, Mr. Miron Lewandowski, Natalia Miler, Dr. Jacek Nowak; **Portugal:** Nuno de Abreu Freire Neto, Ms. Daniela Figueira, Ms. Marisa Lourenço, Sara Rodrigues; **Romania:** Ms. Iuliana Golache, Assist. Prof. Ana-Maria-Roxan Istrate, Assoc. Prof. Endre Kentelky, Mr. Alexandru Mexi, Dr. Mihaela Ileana Oprea, Dr. Leinar Septar, Ms. Andreea Serac, Dr. Ana-Maria Stoenescu; **Saudi Arabia:** Dr. Yveline Pailles; **Slovak Republic:** Alena Andrejiová, Dr. Marcel Golian, Ján Mezey, Assoc. Prof. Ivana Mezeyova; **Slovenia:** Ms. Kristyna Simkova; **South Africa:** Mr. Rodrigo Oliva, Ms. Dineo Raphasha, Dr. Sabelo Shezi, Mr. Frik Van Rooyen, Mr. John Wolfaardt; **Spain:** Ms. Cristina Aguirado Montero, Assist. Prof. Abelardo García Martín, Fulgencio Honorio Guisado, Dr. Juan M Losada, Dr. Antonio Jose Monforte, Dr. Consuelo Penella, Lourdes Rebollo Moyano, Ms. Alicia Sánchez, Dr. Alicia Sánchez-Gorostiaga, María Santisteban; **Sweden:** Assoc. Prof. Jorge Solis; **Switzerland:** Mr. Fabien Dutoit; **Thailand:** Ms. Siriporn Earsakul, Dr. Taweesak Viyachai; **Turkey:** Dr. Birgul Ertan, Nurhan Keeler, Ayse Kirkpinar, Evrim OKUTAN, Mr. Hasimcan Yazicioglu; **Uganda:** Ms. Irene Deborah Nnattabi; **United Kingdom:** Dr. Nicholas Cryer, Dr. Tatiana Kondratyeva; **United States of America:** Dr. Ellie Andrews, Ms. Cathy Avera, Ms. Janet Brown, Richard Buchner, Mr. George Buss, Mr. Spencer Butterfield, Dr. Ye Chu, Cristian Collado, Walker Ditrich, Mr. Adam Gannon, Renee Holland, Nicola Hughes, Mr. Jordan McCornack, Christopher McNett, Dr. Aubrey Mendonca, Dr. Ayman Mostafa, Dr. Jessica Orozco, Ms. Yue Pan, Peter G. Petrelis, Assist. Prof. Matthew Recsetar, Keiya Satoh, Kim Shearer, Assist. Prof. Suzanne Slack, Mr. Jeremy Tuler, Marcena Ver Ploeg, Kathleen Wellington, Becky Wheeler-Dykes

› 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 2024

- January 16-19, 2024, Bologna (Italy): **VertiFarm2024: III International Workshop on Vertical Farming.** Info: Dr. Francesco Orsini, University of Bologna, Viale fanin, 44, Bologna 40127, Italy. Phone: (39)0512096677, Fax: (39)0512096241, E-mail: f.orsini@unibo.it or Dr. Giuseppina Pennisi, University of Bologna, Viale Giuseppe Fanin 44, 40127 Bologna, Italy. E-mail: giuseppina.pennisi@unibo.it E-mail symposium: vertifarm2024@unibo.it Web: https://site.unibo.it/vertifarm2024/
- February 20-24, 2024, Mount Maunganui (New Zealand): **XI International Symposium on Kiwifruit.** Info: Dr. Sarah Pilkington, 120 Mt Albert Road, Mt Albert, 1025 Auckland, New Zealand. Phone: (64)21-809645, E-mail: sarah.pilkington@plantandfood.co.nz or Dr. Juliet Ansell, 400 Maunganui Road, Mt Maunganui, 3116 Tauranga, New Zealand. E-mail: juliet.ansell@zespri.com Web: https://events.zespri.com/ishs-kiwifruit2024
- February 26 - March 1, 2024, Marrakech (Morocco): **V All Africa Horticultural Congress - AAHC2024.** Info: Prof. Dr. Abdelhaq Hanafi, 14 Residence Naama, Agadir 80100, Morocco. Phone: (1)7866781552, E-mail: hanafi.abdelhaq1@gmail.com E-mail symposium: secretariat@aahc2024.com Web: https://www.aahc2024.com/

Symposium at AAHC2024:

- February 26 - March 1, 2024, Marrakech (Morocco): **III International Symposium on Jackfruit and Other Moraceae.** Info: Prof. Dr. Sisir Kumar Mitra, B-12/48, Kalyani, Nadia, West Bengal 741235, India. Phone: (91)9432174249, Fax: (91)3325828460, E-mail: sisirm55@gmail.com or Prof. Dr. Abdelhaq Hanafi, 14 Residence Naama, Agadir 80100, Morocco. Phone: (1)7866781552, E-mail: hanafi.abdelhaq1@gmail.com or Prof. Dr. Mohamed El-Otmani, Institut Agronomique et Vét. Hassan II, Complexe Horticole d»Agadir, B.P. 728, 80 000 Agadir, Morocco. Phone: (212)661386216, Fax: (212)528240558, E-mail: elotmani.mohamed@gmail.com E-mail symposium: a.hanafi@aahc2024.com Web: https://www.aahc2024.com/
- April 14-17, 2024, Warsaw (Poland): **XIV International Symposium on Flower Bulbs and Herbaceous Perennials.** Info: Dr. Dariusz Sochacki, Warsaw University of Life Sciences, Dept of Ornamental Plants, Nowoursynowska 166, 02-787 Warsaw, Poland. E-mail: dariusz_sochacki@sggw.edu.pl E-mail symposium: info@flowerbulb2024.pl Web: http://www.flowerbulbs2024.pl
- April 21-25, 2024, Matsue, Shimane (Japan): **V International Symposium on Woody Ornamentals of the Temperate Zone.** Info: Prof. Dr. Nobuo Kobayashi, Faculty of Life and Environmental Science, Shimane University, Nishikawatsu, Matsue 690-8504, Japan. Phone: (81)852-32-6506, Fax: (81)852-32-6506, E-mail: nkobayashi@life.shimane-u.ac.jp or Dr. Takashi Handa, Meiji University, School of Agriculture, Higashimita 1-1-1, Tama-ku, Kawasaki, 214-8571 Kanagawa, Japan. Phone: (81)449347814, Fax: (81)449347814, E-mail: thanda@meiji.ac.jp Web: http://wotz2024.jshs.jp/
- April 22-25, 2024, Avignon (France): **I International Symposium on Apricot and Plum.** Info: Jean-Marc Audergon, INRA Centre PACA, UR1052 GAFL, Domaine St Maurice - 67 Allée des Chênes, CS60094, F84143 Montfavet, France. Phone: (33)4.32722668, Fax: (33)4.32722702, E-mail: jean-marc.audergon@inrae.fr or Dr. Bénédicte Quilot-Turion, INRAE, GAFL, Allée des Chênes, 84143 Montfavet, France. E-mail: benedicte.quilot-turion@inrae.fr Web: https://ishs-plum-apricot-2024.colloque.inrae.fr/
- May 12-16, 2024, Bucharest (Romania): **V European Horticultural Congress - EHC2024 (SHE2024)**. Info: Prof. Dr. Florin Stanica, University of Agronomic Sciences, Faculty of Horticulture, B-dul Marasti, 59, Sector 1, 011464, Bucuresti, Romania. Phone: (40)722641795, Fax: (40)213182888, E-mail: flstanica@yahoo.co.uk E-mail symposium: secretariat@ehc.usamv.ro Web: https://ehc.usamv.ro/

Symposia at EHC2024:

- May 12-16, 2024, Bucharest (Romania): **International Symposium on History of Horticulture in Europe.** Info: Ms. Ana Cornelia Butcaru, Sector 3, str.Branduselor nr.9, bl.G4, Bucharest, Romania. E-mail: anabutcaru@gmail.com or Dr. Michael Blanke, Institut Obstbau Bonn, Auf dem Hugel 6, 53121 Bonn, Germany. Phone: (49)228735142, Fax: (49)228735764, E-mail: mmblanke@uni-bonn.de or Dr. Luca Dondini, Università di Bologna, Dip. Scienze e Tecnologie Agro-Alimentari, Via Fanin 46, 40127 Bologna, Italy. Phone: (39)0512096400, Fax: (39)0512096401, E-mail: luca.dondini@unibo.it E-mail symposium: secretariat@ehc.usamv.ro Web: https://ehc.usamv.ro/
- May 12-16, 2024, Bucharest (Romania): **International Symposium on Sustainable Vegetable Production from Seed to Health Booster Sources.** Info: Prof. Dr. Silvana Nicola, University of Turin, Dept. of Agric., Forest and Food Sciences, Leonardo Da Vinci 44 (L.Paolo Braccini, 2), 10095 Grugliasco (TO), Italy. Phone: (39)0116708773, Fax: (39)0112368773, E-mail: silvana.nicola@unito.it or Prof. Dr. Yüksel Tüzel, Ege University, Agriculture Faculty, Department of Horticulture, 35100 Bornova Izmir, Turkey. Phone: (90)2323111398, Fax: (90)2323881865, E-mail: yuksel.tuzel@ege.edu.tr or Prof. Dr. Vasile Stoleru, Iasi, M. Sadoveanu 6, Romania. E-mail: vstoleru@uaiasi.ro E-mail symposium: secretariat@ehc.usamv.ro Web: https://ehc.usamv.ro/
- May 12-16, 2024, Bucharest (Romania): **International Symposium on Fruit Production Systems for a Sustainable and Resilient Development.** Info: Prof. Dr. Florin Stanica, University of Agronomic Sciences, Faculty of Horticulture, B-dul Marasti, 59, Sector 1, 011464, Bucuresti, Romania. Phone: (40)722641795, Fax: (40)213182888, E-mail: flstanica@yahoo.co.uk or Prof. Luca Corelli Grappadelli, Department of Agricultural Sciences, Università di Bologna, Via Fanin 46, 40127 Bologna, Italy. Phone: (39)0512096434, Fax: (39)0512096401, E-mail: luca.corelli@unibo.it or Prof. Dr. Mekjell Meland, Nibio Ullensvang, Norwegian Institute of Bioeconomy Research, N-5781 Lofthus, Norway. E-mail: mekjell.meland@nibio.no E-mail symposium: secretariat@ehc.usamv.ro Web: https://ehc.usamv.ro/
- May 12-16, 2024, Bucharest (Romania): **International Symposium on Viticulture and Winemaking between Tradition and Innovation.** Info: Prof. Dr. Oana Arina Antoce, Univ. of Agronomical Sci. & Veterinary Medicine of Bucharest, 59, Marasti Ave., Sector 1, 011464 Bucharest, Sector 1, Romania. E-mail: aantoce@yahoo.com or Prof. Gregorio Muñoz Organero,

Autovía de Aragón Km, 38.2, Finca El Encí, 28800 Madrid, Spain. E-mail: gregorio.munoz@madrid.org or Assoc. Prof. Arif Atak, Bursa Uludağ University, Faculty of Agriculture, Department of Horticulture, 16059 Bursa, Turkey. Phone: (90) 224 2941578, E-mail: arifatak@uludag.edu.tr E-mail symposium: secretariat@ehc.usamv.ro Web: https://ehc.usamv.ro/

- May 12-16, 2024, Bucharest (Romania): **International Symposium on Berries in Europe between Opportunities and Challenges.** Info: Prof. Dr. Adrian Asanica, Facutly of Horticulture Bucharest, Bd Marasti 59 sector 1, 011464 Bucharest, Romania. E-mail: asanica@gmail.com or Prof. Dr. Bruno Mezzetti, Dip.Sci. Agrarie, Alimentari ed Ambientali, Università Politecnica delle Marche, Via Brecce Bianche, Ancona 60100, Italy. Phone: (39)0712204933, Fax: (39)0712204856, E-mail: b.mezzetti@univpm.it or Prof. Dr. Nesibe Ebru Kafkas, Department of Horticulture, Faculty of Agriculture, TR-01330 Adana Balcali, Turkey. Phone: (90)5365227774, E-mail: ebruyasakafkas@gmail.com E-mail symposium: secretariat@ehc.usamv.ro Web: https://ehc.usamv.ro/
- May 12-16, 2024, Bucharest (Romania): **International Symposium on Ornamental Horticulture at the Service of the European Society.** Info: Dr. Margherita Beruto, Vicolo Barbarossa, 13, 18038 San Remo (Imperia), Italy. Phone: (39) 0184670781, E-mail: margheberuto@gmail.com or Dr. Erzsebet Buta, 3-5 Manastur Street, 400372 Cluj - Napoca, Romania. E-mail: ebuta2008@yahoo.com or Sandra Gonçalves, University of Algarve, Fac. of Sciences &Tech., Campus de Gambelas, 8005-139 Faro, Portugal. E-mail: smgoncalves@ualg.pt E-mail symposium: secretariat@ehc.usamv.ro Web: https://ehc.usamv.ro/
- May 12-16, 2024, Bucharest (Romania): **International Symposium on Urban Horticulture: from Vertical Farming to Planting Design.** Info: Prof. Dr. Leo F. M. Marcelis, Wageningen University, Horticulture & Product Physiology, Droevendaalsesteeg 1, 6708 PB Wageningen, Netherlands. Phone: (31)317485675, E-mail: leo.marcelis@wur.nl or Dr. Ioana Tudora, Bdul Marasti, nr. 59, 011464 Bucuresti, Romania. E-mail: ioana.tudora@horticultura-bucuresti.ro or Dr. Trine Hvoslef-Eide, Norwegian University of Life Sciences, NMBU, Dept. of Plant Sciences, Boks 5003, 1432 Aas, Norway. E-mail: trine.hvoslef-eide@nmbu.no E-mail symposium: secretariat@ehc.usamv.ro Web: https://ehc.usamv.ro/
- May 12-16, 2024, Bucharest (Romania): **International Symposium on Genetic Resources in Horticulture: Screening, Propagation, Use and Conservation.** Info: Dr. Dorin-Ioan Sumedrea, NRDIBH Stefanesti, General Director, Bucureşti-Pitesti Str, 37, Stefanesti, Stefanesti 117715, Romania. Phone: (40)248266838, Fax: (40)248266808, E-mail: dsumedrea@yahoo.com or Dr. Emmanuel Geoffriau, Agrocampus Ouest - IRHS, Institute Research Horticulture Seeds, 2, rue le Notre, 49045 Angers, France. Phone: (33)241225431, E-mail: emmanuel.geoffriau@agrocampus-ouest.fr or Dr. Geza Bujdosó, MATE - Hungarian University for Agriculture, Life Sciences, 2100 Godollo, Pater K. u. 1, Hungary. Phone: (36)13621596, E-mail: resinfru@yahoo.com E-mail symposium: secretariat@ehc.usamv.ro Web: https://ehc.usamv.ro/
- May 12-16, 2024, Bucharest (Romania): **International Symposium on Robotics, Mechanization and Smart Horticulture.** Info: Dr. Luigi Manfrini, Università di Bologna, 40127 Bologna, Italy. E-mail: luigi.manfrini@unibo.it or Dr. Konni Biegert, Kompetenzzentrum Obstbau Bodensee, KOB, Schuhmacherhof 6, D-88213 Ravensburg, Germany. Phone: (49)751 7903-343, E-mail: konni.biegert@kob-bavendorf.de or Mihai Gidea, 59 M259r259351ti Boulevard, District 1, 011464 Bucharest, Romania. E-mail: gideam@yahoo.com E-mail symposium: secretariat@ehc.usamv.ro Web: https://ehc.usamv.ro/

NEW

- May 12-16, 2024, Bucharest (Romania): **International Symposium on Postharvest and Horticultural Products Quality.** Info: Prof. Dr. Liliana Aurelia Badulescu, Bd Marasti nr 59, 011464 Bucharest Bucharest, Romania. Phone: (40)745368989, E-mail: liliana.badulescu@usamv.ro or Dr. Dirk Köpcke, Chamber of Agriculture in Lower Saxony, Fruit Research Station Jork (OVA), Moorende 53, 21635 Jork, Germany. Phone: (49) 4162 6016 120, E-mail: dirk.koepcke@lwk-niedersachsen.de or Dr. Krzysztof Rutkowski, Research Institute of Horticulture, Konstytucji 3 Maja 1/3, 96-100 Skierniewice, Poland. Phone: (48) 468345363, E-mail: krzysztof.rutkowski@inhort.pl E-mail symposium: secretariat@ehc.usamv.ro Web: https://ehc.usamv.ro/
- May 19-22, 2024, Seoul (Korea (Republic of)): **X International Symposium on Light in Horticulture.** Info: Prof. Dr. Myung-Min Oh, Dept. of Horticultural Science, Chungbuk National University, Cheong-Ju, 28644, Korea (Republic of). Phone: (82)43-261-250, Fax: (82)43-271-0414, E-mail: moh@cbnu.ac.kr or Prof. Dr. Seung Jae Hwang, Division of Horticultural Science, College of Agriculture & Life Science, Gyeongsang National University, Jinju, 52828, Korea (Republic of). Phone: (82)55-772-1916, Fax: (82)55-772-1919, E-mail: hsj@gnu.ac.kr or Prof. Dr. Wook Oh, Department of Horticultural Science, Jeju National University, 102 Jejudaehak-ro, Jeju 63243, Korea (Republic of). Phone: (82)7543327, Fax: (82)7254905, E-mail: wookoh@jejunu.ac.kr or Prof. Dr. Jung-Eek Son, Dept of Agriculture, Forestry & Bioresurces, Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul 08826, Korea (Republic of). Phone: (82)28804564, Fax: (82)28732056, E-mail: sjeenv@snu.ac.kr E-mail symposium: info@lightsym2024.org Web: http://lightsym2024.org
- June 3-6, 2024, Foggia (Italy): **V International Conference on Fresh-Cut Produce: Maintaining Quality and Safety.** Info: Prof. Dr. Maria Luisa Amodio, Via Napoli 25, 71100 Foggia, Italy. Phone: (39)0881-589105, Fax: (39)0881-589244, E-mail: marialuisa.amodio@unifg.it E-mail symposium: freshcut.2024@unifg.it Web: http://www.unifg.it/freshcut.2024
- June 9-12, 2024, Budapest (Hungary): **XVII International Symposium on Processing Tomato - XV World Processing Tomato Congress.** Info: Dr. Luca Sandei, SSICA, Tomato Department, Viale f.Tanara 31/a, 43121 Parma (PR), Italy. Phone: (39) 0521795257, Fax: (39) 0521771829, E-mail: luca.sandei@ssica.it or Prof. Dr. Lajos Helyes, Hungarian University of Agriculture, and Life Science, Páter K. str. 1, 2100 Gödöllö, Hungary. Phone: (36)28522071, E-mail: helyes.lajos@uni-mate.hu or Prof. Zoltán Pék, Hungarian University of Agriculture, and Life Sciences, 2103 Gödöllö, Páter Károly u. 1., Hungary. Phone: (36)28522071, Fax: (36)28410804, E-mail: pek.zoltan@uni-mate.hu E-mail symposium: symposium@worldtomatocongress.com Web: https://15thworldtomatocongress.com
- June 14-17, 2024, Nanjing (China): **V International Symposium on Biotechnology and Molecular Breeding in Horticultural Species.** Info: Jun Wu, Nanjing Agricultural University, College of Horticulture, Nanjing, Jiangsu, 210095, China. E-mail: wujun@njau.edu.cn or Prof. Dr. Shaoling Zhang, Nanjing Agricultural University, 1 Weigang, 210095 Nanjing, China. E-mail: nnzsl@njau.edu.cn or Prof. Dr. Xiuxin Deng, Huazhong Agricultural University, College of Horticulture & Forestry, Shizishan Street No. 1, Wuhan, Hubei Province 430070, China. Phone: (86)2787281712, Fax: (86)2787280016, E-mail: xxdeng@mail.hzau.edu.cn Web: http://www.bmbh2023.com
- June 24-27, 2024, Wenatchee, WA (United States of America): **X International Symposium on Plant Nutrition of Fruit Crops.** Info: Assoc. Prof. Lee Kalcsits, Washington State University, WSU-TFREC, Wenatchee, WA 98801, United States of America. Phone: (1)5096638181, E-mail: lee.kalcsits@wsu.edu Web: https://ishsplantnutrition.com/

NEW

- July 10-12, 2024, Reading (United Kingdom): **XVI International People Plant Symposium**. Info: Prof. Dr. Sin-Ae Park, 225 Life and Environment Science building, 05029 Seoul, Korea (Republic of). E-mail: sapark42@konkuk.ac.kr or Ms. Rebecca Haller, 1432 Grape Street, Denver, CO 80220, United States of America. E-mail: rhaller@htinstitute.org or Mr. Damien Newman, Thrive, The Geoffrey Udall Centre, Beech Hill, RG7 2AT Berks Reading, United Kingdom. Phone: 01189 885688, E-mail: damien.newman@thrive.org.uk
- August 24-29, 2024, Halifax, Nova Scotia and Charlottetown, Prince Edward Island (Canada): **XIII International Vaccinium Symposium.** Info: Prof. Dr. David Percival, Dalhousie University, Department of Plant, Food, and Environmental Sciences, PO Box 550, Truro, NS B2N 5E3, Canada. Phone: (1)9028937852, Fax: (1)9028931404, E-mail: david.percival@dal.ca Web: http://www.Dal.ca/ivs
- September 17-20, 2024, Warsaw (Poland): **IV International Organic Fruit Symposium and II International Organic Vegetable Symposium.** Info: Assoc. Prof. Eligio Malusa, Instytut Ogrodnictwa-PIB, ul. Konsty, 96-100 Skierniewice, Poland. E-mail: eligio.malusa@inhort.pl or Joanna Pulawska, Instytut Ogrodnictwa - PIB, ul. Konstytucji 3 Maja 13, 96-100 Skierniewice, Poland. Phone: (48)468345366, E-mail: joanna.pulawska@inhort.pl or Prof. Dr. Lidia Sas Paszt, National Inst. of Horticultural Research, Dept. Microbiology & Rhizosphere, Pomologiczna 18, 96-100 Skierniewice, Poland. Phone: (48)468345235, Fax: (48)468333228, E-mail: lidia.sas@inhort.pl E-mail symposium: info@orghort2024.pl Web: https://orghort2024.pl/
- September 23-26, 2024, Athens (Greece): **I International Symposium on Protected Cultivation, Nettings and Screens for Mild Climates.** Info: Dr. Dimitrios Savvas, Agricultural University of Athens, Laboratory of Vegetable Production, Iera Odos 75, 11855 Athens, Greece. Phone: (30)2105294510, Fax: (30)2105294504, E-mail: dsavvas@aua.gr or Assoc. Prof. Thomas Bartzanas, Agricultural University of Athens, Laboratory of Farm Structures, Iera Odos 75, 11855, Athens, Greece. Phone: (30)2105294045, Fax: (30)2105294045, E-mail: t.bartzanas@aua.gr E-mail symposium: info.ishsathens2024@afea.gr Web: https://promicli.athens2024.org

NEW

- September 25-28, 2024, Wisley, Woking (United Kingdom): **III International Symposium on Greener Cities: Improving Ecosystem Services in a Climate-Changing World (GreenCities2024).** Info: Dr. Tijana Blanusa, Science Department, RHS Garden Wisley, GU23 6QB Woking, United Kingdom. E-mail: tijanablanusa@rhs.org.uk or Dr. Mark Gush, Royal Horticultural Society, Wisley, GU23 6QB Surrey Woking, United Kingdom. E-mail: markgush@rhs.org.ukE-mailsymposium:greencities2024@rhs.org.uk Web: https://www.rhs.org.uk/science/green-cities-2024

NEW

- October 1-4, 2024, Brasília, DF (Brazil): **VII International Symposium on Tomato Diseases.** Info: Prof. Eduardo Mizubuti, Departamento de Fitopatologia, Universidade Federal de Viçosa, 36570-900 Viçosa-MG, Brazil. Phone: (55) 31 3899 1090, E-mail: mizubuti@ufv.br or Dr. Alice Kazuko Inoue-Nagata, Embrapa Vegetables Km 09,BR060, 70275970 Brasilia-DF, Brazil. Phone: (55)6133859053, E-mail: alice.nagata@embrapa.br or Prof. Dr. Nadson Pontes, BR 153, km 633. CP 92, Zona Rural, 75650-000 Morrinhos-GO, Brazil. Phone: (55)64-34137900, E-mail: nadson.pontes@ifgoiano.edu.br E-mail symposium: 7istd@7istd.com Web: https://7istd.com/

NEW

- October 20-25, 2024, Yangling (China): **VIII International Symposium on Persimmon.** Info: Yang Yong, Yangling, Shannxi, China. Phone: (86)29-87082613, E-mail: yang_yong@nwsuaf.edu.cn or Prof. Dr. Zhengrong Luo, Persimmon Group, National Key Lab of Horticultural Germplasm, Huazhong Agricultural University, Shizishan, Wuhan, Hubei 430070, China. Phone: (86) 27 8728 2677, Fax: (86) 27 8728 2010, E-mail: luozhr@mail.hzau.edu.cn or Dr. Qinglin Zhang, Huazhong Agricultural University, College of Horticulture and Forest Sciences, Wuhan, Hubei, 430070, China. Phone: (86)27-8728-2677, E-mail: qlzhang2000@webmail.hzau.edu.cn
- October 28-30, 2024, Coimbra (Portugal): **International Symposium on Arbutus unedo (Strawberry Tree) and Related Species: from Biology to Biotechnology.** Info: Prof. Dr. Jorge Canhoto, Department of Life Sciences, University of Coimbra, Calçada Martim de Freitas, 3000-456 Coimbra, Portugal. Phone: (351)917859860, E-mail: jorgecan@ci.uc.pt or Dr. João Martins, Department of Life Sciences, University of Coimbra, Calçada Martim de Freitas, 3000-456 Coimbra, Portugal. Phone: (351)239240700, E-mail: joao.martins@uc.pt Web: https://www.uc.pt/en/uid/biotec/events/arbutus2024
- November 11-15, 2024, Rotorua (New Zealand): **VII International Symposium on Postharvest Pathology: Next Frontiers for Improved Knowledge and Management of Postharvest Disease.** Info: Dr. Kerry Everett, PB 92169, Mt Albert, 1142 Auckland, New Zealand. Phone: (64)9-9257133, E-mail: kerry.everett@plantandfood.co.nz Web: https://www.scienceevents.co.nz/postharvest2024
- November 11-15, 2024, Rotorua (New Zealand): **IX International Postharvest Symposium.** Info: Dr. Allan Woolf, Plant and Food Research, Mt Albert Research Centre, 120 Mt Albert Road, Sandringham, 1025, Auck, Private Bag 92169, Auckland, New Zealand. Phone: (64)99257267, Fax: (64)99258628, E-mail: allan.woolf@plantandfood.co.nz or Prof. Andrew East, Massey University, Private Bag 11222, Palmerston North, New Zealand. E-mail: a.r.east@massey.ac.nz Web: https://www.scienceevents.co.nz/postharvest2024
- November 11-15, 2024, Rotorua (New Zealand): **X International Symposium on Human Health Effects of Fruits and Vegetables - FAVHEALTH2024.** Info: Dr. Carolyn Lister, New Zealand Institute for Plant and Food Research Limited, Lincoln, New Zealand. Phone: (64)3-3259453, E-mail: carolyn.lister@plantandfood.co.nz Web: https://www.scienceevents.co.nz/postharvest2024

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://www.scienceevents.co.nz/orchard-systems
- February 10-13, 2025, Sde Boker (Israel): **II International Symposium on Reproductive Biology of Fruit Tree Species**. Info: Prof. Avi Sadka, ARO, The Volcani Center, Department of Fruit Trees Sciences, 68 HaMaccabim Rd., P.O. Box 15159, Rishon LeZion 7528809, Israel. Phone: (972)3-9683343, Fax: (972)3-9669583, E-mail: vhasadka@volcani.agri.gov.il or Prof. Noemi Tel-Zur, Ben-Gurion University of the Negev, Beersheba, Israel. E-mail: telzur@bgu.ac.il Web: https://www.reproductive-biologyfruittree.org.il/
- March 26-31, 2025, Yancheng city, Jiangsu Province (China): **X International Strawberry Symposium.** Info: 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
- 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

NEW ■ 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

NEW ■ May 19-21, 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

■ 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

■ July 10-11, 2025, Kuala Lumpur (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

NEW ■ August 4-8, 2025, Beijing (China): **XI International Congress on Hazelnut.** Info: Prof. Jianguo Zhang, Research Institute of Forestry, Chinese Academy of Forestry, Dongxiaofu 1, Haidian District, Beijing, China. E-mail: chinahazelnut2025@163.com E-mail symposium: chinahazelnut2025@163.com

■ September 16-19, 2025, Bogor (Indonesia): **IX International Symposium on Edible Alliums.** Info: Dr. Awang Maharijaya, Pakuan Regency, cluster Lingga Buana, Blok E6 no 24, 16680 West Java Bogor, Indonesia. E-mail: awangmaharijaya@apps.ipb.ac.id

■ September 22-24, 2025, Bari (Italy): **VI International Symposium on Pomegranate and Minor Mediterranean Fruits.** Info: Assoc. Prof. Giuseppe Ferrara, Università di Bari, Dpt. Scienze Suolo, Pianta e Alimenti, Via Amendola 165/a, 70126 Bari, Italy. Phone: (39)805442979, Fax: (39)805442979, E-mail: giuseppe.ferrara@uniba.it or Prof. Dr. Stefano La Malfa, Di3A, Catania University, Via Valdisavoia 5, 95123 Catania, Italy. Phone: (39)095-354641, Fax: (39)095-234406, E-mail: stefano.lamalfa@unict.it

For updates logon to www.ishs.org/symposia

› Index to Volume 63 of *Chronica Horticulturae*

Subject index

Book reviews

Horticultural Science Focus

Horticultural Science News

Issues

News & Views from the Board

Spotlight on Honoured ISHS Members

Symposia and Workshops

The World of Horticulture

Author index

› Available issues of *Acta Horticulturae*

Available numbers of Acta Horticulturae (print). In addition, any *Acta Horticulturae* title is also available in the electronic e-Acta Horticulturae online format. To order *Acta Horticulturae* or for more information on price and availability, including tables of content, please check www.actahort.org

Acta Number **Acta Title** **Price (EUR)**

1380 XXXI International Horticultural Congress (IHC2022): International Symposium on Value Adding and Innovation Management in the Horticultural Sector 62
1379 X International Congress on Hazelnut 123
1378 XXXI International Horticultural Congress (IHC2022): International Symposium on Sustainable Control of Pests and Diseases 101
1377 XXXI International Horticultural Congress (IHC2022): International Symposium on Innovative Technologies and Production Strategies for Sustainable Controlled Environment Horticulture 195
1376 XV International Asparagus Symposium 72
1375 XXXI International Horticultural Congress (IHC2022): International Symposium on Plant Nutrition, Fertilization, Soil Management 101
1374 XXXI International Horticultural Congress (IHC2022): II International Symposium on Greener Cities: Improving Ecosystem Services in a Climate-Changing World (GreenCities2022) 67
1373 XXXI International Horticultural Congress (IHC2022): International Symposium on Water: a Worldwide Challenge for Horticulture! 69
1372 XXXI International Horticultural Congress (IHC2022): International Symposium on Adaptation of Horticultural Plants to Abiotic Stresses 87
1371 VII International Date Palm Conference 116
1370 XXXI International Horticultural Congress (IHC2022): International Symposium on the Vitivinicultural Sector: Which Tools to Face Current Challenges? 62
1369 XXXI International Horticultural Congress (IHC2022): International Symposium on Advances in Vertical Farming 76
1368 XXXI International Horticultural Congress (IHC2022): International Symposium on Innovations in Ornamentals: from Breeding to Market102
1367 XXXI International Horticultural Congress (IHC2022): XII International Symposium on Banana: Celebrating Banana Organic Production 85
1366 XXXI International Horticultural Congress (IHC2022): International Symposium on Innovative Perennial Crops Management 108
1365 XXXI International Horticultural Congress (IHC2022): International Symposium on Quality Seeds and Transplants for Horticultural Crops and Restorative Species 52
1364 XXXI International Horticultural Congress (IHC2022): International Symposium on Postharvest Technologies to Reduce Food Losses 107
1363 VI International Symposium on Postharvest Pathology: Innovation and Advanced Technologies for Managing Postharvest Pathogens 79
1362 XXXI International Horticultural Congress (IHC2022): International Symposium on Breeding and Effective Use of Biotechnology and Molecular Tools in Horticultural Crops 141
1361 XXXI International Horticultural Congress (IHC2022): International Symposium on Natural Colorants from Plants 64
1360 XXXI International Horticultural Congress (IHC2022): III International Symposium on Mechanization, Precision Horticulture, and Robotics: Precision and Digital Horticulture in Field Environments 88
1359 XXXI International Horticultural Congress (IHC2022): International Symposium on In Vitro Technology and Micropropagated Plants 78
1358 XXXI International Horticultural Congress (IHC2022): International Symposium on Medicinal and Aromatic Plants: Domestication, Breeding, Cultivation and New Perspectives 87
1357 XII International Vaccinium Symposium 94
1356 XXXI International Horticultural Congress (IHC2022): International Symposium on Urban Horticulture for Sustainable Food Security (UrbanFood2022) 105
1355 XXXI International Horticultural Congress (IHC2022): International Symposium on Agroecology and System Approach for Sustainable and Resilient Horticultural Production 108
1354 III International Organic Fruit Symposium and I International Organic Vegetable Symposium 95
1353 XXXI International Horticultural Congress (IHC2022): International Symposium on Integrative Approaches to Product Quality in Fruits and Vegetables 88
1352 X International Peach Symposium 142
1351 XVI International Symposium on Processing Tomato 77
1350 V International Jujube Symposium 86
1349 V International Symposium on Pomegranate and Minor Mediterranean Fruits 150
1348 IV All Africa Horticultural Congress - AAHC2021: Transformative Innovations in Horticulture 83
1347 XIV International Protea Research Symposium 54
1345 VIII International Conference on Landscape and Urban Horticulture 110
1344 XIV International Symposium on Plant Bioregulators in Fruit Production 71
1343 X International Congress on Cactus Pear and Cochineal: Cactus - the New Green Revolution in Drylands 135
1342 I International Symposium on Reproductive Biology of Fruit Tree Species 91
1341 EUFRIN Fruit Thinning Working Group Symposium 39
1340 V International Conference on Postharvest and Quality Management of Horticultural Products of Interest for Tropical Regions 71
1339 IX International Scientific and Practical Conference on Biotechnology as an Instrument for Plant Biodiversity Conservation (physiological, biochemical, embryological, genetic and legal aspects) 113
1337 IX International Symposium on Light in Horticulture 103
1336 V Asia Symposium on Quality Management in Postharvest Systems 96
1335 IX International Symposium on Irrigation of Horticultural Crops 159
1334 II International Symposium on Tropical and Subtropical Ornamentals 97
1332 X International Symposium on Kiwifruit 109
1331 IV International Symposium on Woody Ornamentals of the Temperate Zone 85
1329 VIII International Symposium on Human Health Effects of Fruits and Vegetables - FAVHEALTH 2021 62
1328 V International Humulus Symposium 61
1327 IV International Symposium on Horticulture in Europe - SHE2021 186
1326 VII South-Eastern Europe Symposium on Vegetables and Potatoes 86
1325 V International Symposium on Postharvest Pathology: From Consumer to Laboratory-Sustainable Approaches to Managing Postharvest Pathogens 92

For an updated list of all titles (in print or e-Acta Horticulturae format) logon to www.actahort.org