A publication of the International Society for Horticultural Science

Chronica Horticulturae

ISHS International Society for Horticultural Science

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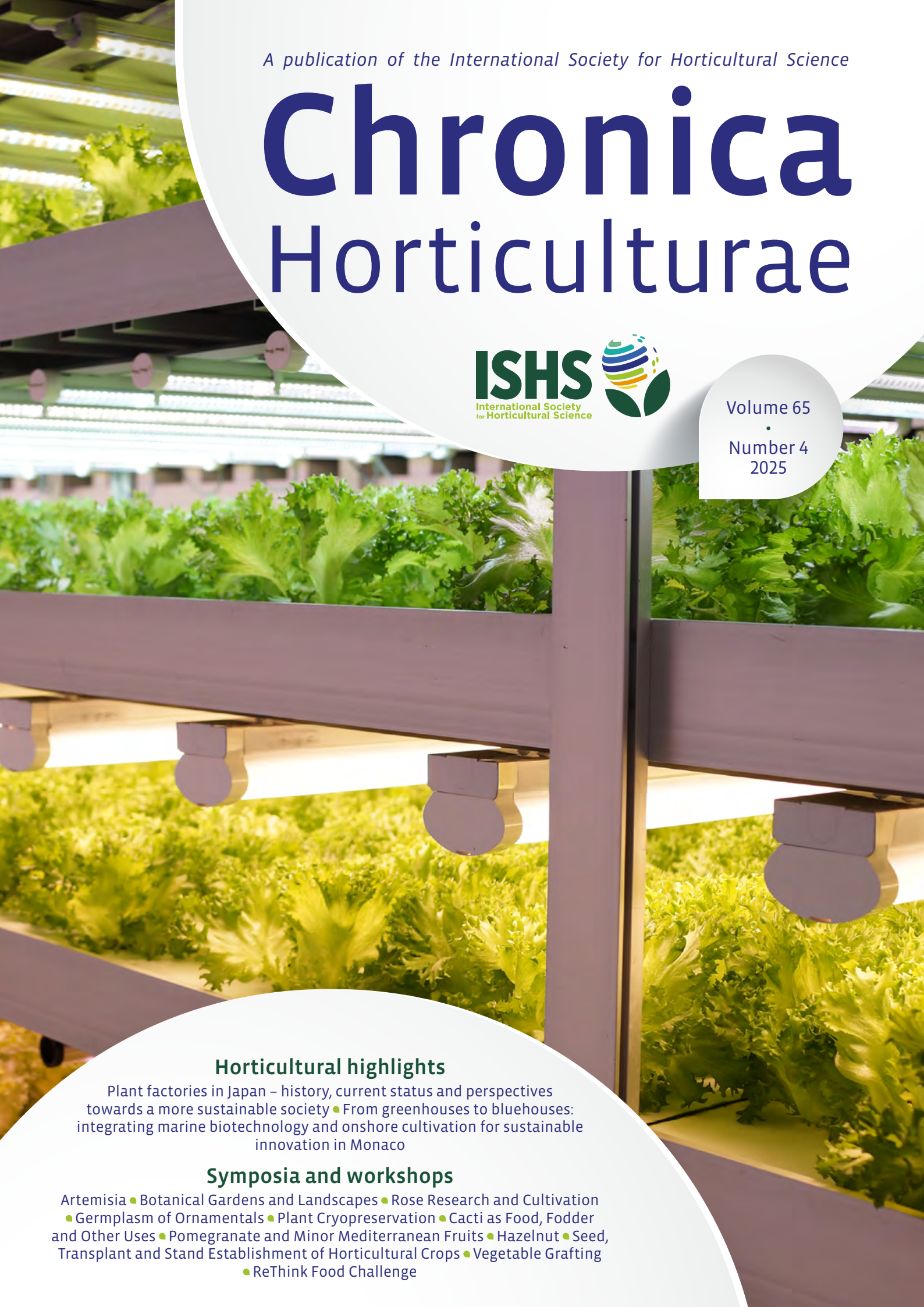

Horticultural highlights

Plant factories in Japan – history, current status and perspectives towards a more sustainable society • From greenhouses to bluehouses: integrating marine biotechnology and onshore cultivation for sustainable innovation in Monaco

Symposia and workshops

Artemisia • Botanical Gardens and Landscapes • Rose Research and Cultivation • Germplasm of Ornamentals • Plant Cryopreservation • Cacti as Food, Fodder and Other Uses • Pomegranate and Minor Mediterranean Fruits • Hazelnut • Seed, Transplant and Stand Establishment of Horticultural Crops • Vegetable Grafting • ReThink Food Challenge

Chronica Horticulturae

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eJHS (*European Journal of Horticultural Science*) is the official journal of the International Society for Horticultural Science. eJHS is an open access journal publishing 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 scope covers both applied and fundamental aspects of the entire food value chain, including breeding, production, processing, trading and retailing of horticultural crops and commodities grown in temperate, Mediterranean, tropical and subtropical climates. Additional information can be found at **www.ishs.org/ejhs**

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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.

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ISHS International Society for Horticultural Science

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.

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Cover photograph: Interior view of cultivation room of plant factory. Source: Japan Plant Factory Association. See article p.16.

› From the cockpit

Peter J. Batt, Editor, *Chronica Horticulturae*

› Peter J. Batt

I've just recently submitted five papers on the hidden costs of food to one of my clients. It shouldn't come as any surprise that food production is the world's largest employer and that collectively, from paddock to plate, the food and agribusiness sector is worth a staggering USD 10 trillion per annum: that's about 10% of global GDP.

What is surprising however, is the true cost of food, which the FAO (2023) currently believes exceeds USD 12.5 trillion per annum: in other words, to cover the hidden costs associated with food production and consumption, the price of food will need to double. Most of these hidden costs (73%) relate to health and to the poor dietary choices that consumers make, leading to obesity and the increasing health costs associated with cardiovascular disease, stroke, Type II diabetes and cancer. Today, unhealthy diets pose a greater risk to morbidity and mortality than unsafe sex, and the consumption of alcohol, illicit drugs and tobacco combined (Willett et al., 2019).

The hidden environmental costs arising from greenhouse gas emissions, the exploitation of fresh water resources, nutrient runoff and land-use changes, including the loss of biodiversity, amount to USD 2.9 trillion per annum (23%) (FAO, 2023). Food production is the largest single cause of global environmental change (Willett et al., 2019). From paddock to plate, agriculture is responsible for more than 30% of global greenhouse gas emissions. Agriculture occupies about 40% of the global land mass, with the conversion of natural ecosystems to croplands and pastures contributing to environmental degradation and the loss of biodiversity. Not only does agriculture consume more than 70% of the world's freshwater reserves, but the overuse and misuse of nitrogen and phosphorus fertilisers lead to the eutrophication of underground water resources, rivers, lakes and coastal zones. Furthermore, soil degradation, soil erosion and the rate at which terrestrial nutrients are being depleted are accelerating.

In seeking to make agriculture more sustainable, more producers are adopting techniques such as regenerative agriculture. However, with increasing urbanisation and the increasing pressure on land, there is another alternative: intensive production in plant factories with artificial lighting (PFALs). In this edition, Dr. Eri Hayashi, President of the Japan Plant Factory Association (JPFA), provides us with an overview of plant factories in Japan and how, as the technology improves, these systems minimise the use of external inputs. These fully enclosed facilities for plant cultivation, with full environmental control, allow high quality plants to be grown consistently and efficiently all year round. Within these controlled environments, artificial lighting replaces natural sunlight, where the spectral quality, photosynthetic photon flux density (PPFD) and photoperiod can be adjusted to optimize photosynthesis, morphogenesis and the accumulation of functional metabolites. Temperature, relative humidity, airflow and the level of carbon dioxide in the atmosphere are all controlled, with hydroponic systems providing a constant supply of water and nutrients. A closed cultivation system with precise environmental control results in shorter cultivation cycles and significantly higher productivity per unit area. Water consumption is reduced by as much as 90%, with a closed-loop hydroponic system significantly reducing the cost of fertilisers. Furthermore, as these systems are not exposed to the external environment, pests and diseases can be controlled, eliminating the need for pesticides. Postharvest losses are also minimised as a greater proportion of the harvest meets buyers' expectations. However, these systems are not cheap.

In a second paper by Mitchell J. NewDelman, Chuck Toombs and Rachid Benchaouir, the authors discuss how horticultural principles such as controlled environments, cultivar selection and postharvest quality can be extended beyond terrestrial plants to the onshore cultivation of algae, seagrasses and coral-associated microorganisms in so-called blue houses. Using filtered seawater in controlled environments, the Monaco Biome Initiative combines AI-driven gene discovery and recombinant protein production technologies to transform marine biodiversity into tangible biomolecules for health, nutrition, cosmetics and environmental restoration.

Among the winners of our Young Minds Awards, Ryohei Koyabayashi discusses the impact of long-day conditions on the production of potato micro-tubers in a PFAL. Continuing with the theme of sustainability, Alessando Pesole describes his work with pecan, exploring the link between leaf area and stomatal density among cultivars. The results of his work support the existence of cultivar-specific morphological patterns that influence photosynthetic efficiency and tolerance to water limitations under Mediterranean conditions. In a related study, Valeria Imperiale explores the impact of three irrigation regimes on the photosynthetic rate, stomatal conductance, intrinsic water use efficiency and midday stem water potential for pistachio. In reducing food waste, Sadat Amankona explores the use of dynamic controlled atmosphere storage as a means for prolonging the shelf life and improving the quality of organic apples.

In looking towards improved phenotypes, Suilin Zhang investigates the molecular mechanism for enhancing the number of female flowers in hazelnut, while Aliif Ihsaan Akmal Shukri utilizes gamma mutation breeding of aromatic rice in Malaysia to develop new varieties with higher yield, better agronomic performance, enhanced aromatic properties and greater ornamental potential.

This is the last edition for 2025. May I take this opportunity to thank all the authors of the many papers we have published, conveners for their symposium reports and the contributions from our Young Minds. I look forward to working with more of you in 2026. Take care. Stay safe and best wishes for the New Year.

› References

FAO. (2023). The State of Food and Agriculture 2023 – Revealing the True Cost of Food to Transform Agrifood Systems (Rome, Italy: FAO). https://doi.org/10.4060/cc7724en

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› Nominations and voting for Board and Division Chairs and Vice-Chairs

Ted DeJong, ISHS Vice-President in charge of scientific programs and Statutory Chair of the ISHS Executive Committee

› Ted DeJong

As we begin the New Year, it's appropriate to remind members that IHC2026 in Kyoto, Japan, marks the end of a term and the beginning of the next term for ISHS Board Members and Division Chairs (Executive Committee members).

Before we commence the nomination process and voting gets underway for these important positions within ISHS, I believe it is important to review and provide recent updates to the organizational structure of the Society. I suspect that many members are a little confused about how our Society is organized and how it functions. I am reminded of the time when, as Vice-Chair of a Division, I was asked to attend a meeting of the ISHS Executive Committee, Council and Board, on behalf of a Division Chair. I was clueless about what these three entities were, even though I had been a member of the Society for about 15 years. I knew what Working Groups and Divisions were, but I didn't know how the Society functioned above that level. Hence, on the off-chance that this might be helpful, I have created an organizational chart of the Society and will explain that now (Figure 1).

There are five key levels to the organization of ISHS. The Members' Forum, the ISHS Council, the ISHS Board, the ISHS Executive Committee (consisting of the ISHS Division Chairs) and the Working Groups within Divisions led by Working Group Chairs.

The Members' Forum is comprised of all the ISHS Individual Members and is chaired by the ISHS President. The Members' Forum reviews the activities of the Society and can make recommendations to the Society management.

The ISHS Council is the legal 'General Assembly' of the Society and consists of up to three representatives from each ISHS Country/Region member. Organizations such as national societies or government officials within member countries appoint their country representatives to the Council. The ISHS Council elects the President of the Society and the other Board members (after a nomination process), receives and approves the forward plans of the Society, including the financial budget, and approves the general policy and program of the Society. The Council appoints the ISHS Executive Director as recommended by the ISHS Board.

The ISHS Board is the governing body of the Society and is empowered with the management of the Society. The President is the legal representative and Chief Officer of the Society and ex-officio non-voting member of all Standing Committees. The Board is made up of six members elected with a fair geographical balance and represents the six regions of the world where the ISHS is most active (Africa, Asia, Europe, North America, Oceania, South America). In addition, the ISHS Executive Director and the President of the next International Horticultural Congress (IHC) are ex-officio members of the Board. Each member of the Board has duties assigned to them by the President with the consensus of the Board members. The Board is responsible for strategic planning and the overall operation of the Society, overseeing the scientific programs, finances, membership, publications, communications and partnerships, with an increasing emphasis on attracting and sustaining Young Minds within the Society.

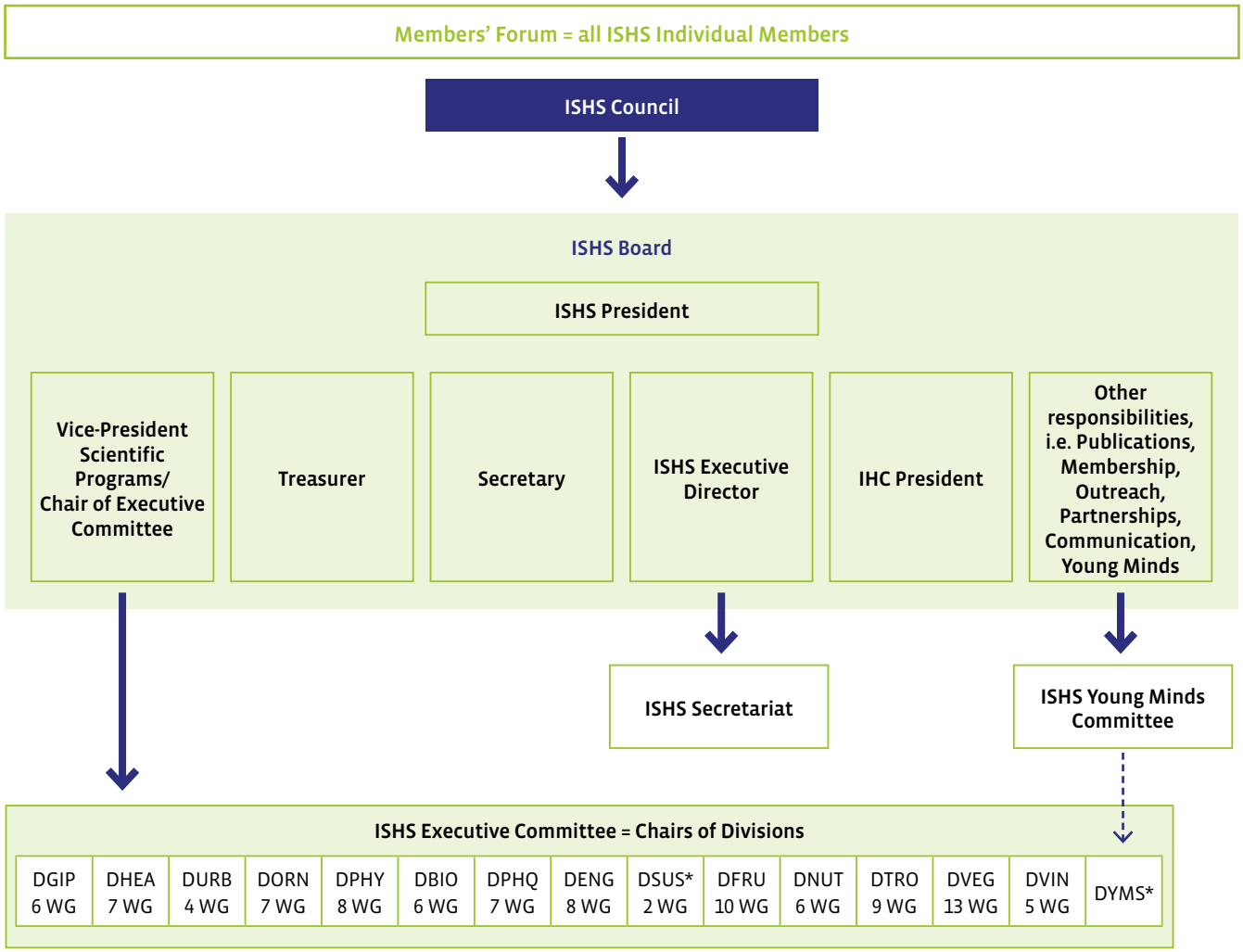
The ISHS Vice-President in charge of scientific programs serves as the Chair of the **ISHS Executive Committee**. The ISHS Executive Committee consists of the Chairs of the fifteen Divisions in the Society (Table 1). The Divisions are organized by either crop commodity types or clusters of disciplines within horticulture. Each Division Chair oversees the functioning of the Working Groups within their Division. The role of Division Chairs is important for ensuring the smooth functioning of Working Groups and providing support and assistance to Working Group Chairs and conveners of symposia that are organized by Working Groups. As the organization and delivery of symposia, regional congresses and the IHC are the core activities of the Society, the roles of conveners, Working Group Chairs and Division Chairs are key to the success of the ISHS. Working Group Chairs and the conveners of symposia are elected by members of Working Groups. Too often the elections of these individuals are conducted in a *pro forma* manner at business meetings held during symposia. It is very important that thoughtful consideration be put into these decisions.

Younger ISHS members represent the Society within the **ISHS Young Minds Committee**. The Young Minds Committee has two representatives from each of the six regions, one representing students and the other representing early career professionals (no more than 10 years of professional experience in horticulture and up to 40 years old). The Young Minds Committee has been very active in the two

■ Table 1. ISHS Divisions after IHC2026.

ISHS Divisions*
Division Greenhouse and Indoor Production Horticulture (DGIP)
Division Horticulture for Human Health (DHEA)
Division Landscape and Urban Horticulture (DURB)
Division Ornamental Plants (DORN)
Division Plant-Environment Interactions in Field Systems (DPHY)
Division Plant Genetic Resources, Breeding and Biotechnology (DBIO)
Division Postharvest and Quality Assurance (DPHQ)
Division Precision Horticulture and Engineering (DENG)
Division Sustaining Horticulture in a Changing World (DSUS) *
Division Temperate Tree Fruits (DFRU)
Division Temperate Tree Nuts (DNUT)
Division Tropical and Subtropical Fruit and Nuts (DTRO)
Division Vegetables, Roots and Tubers (DVEG)
Division Vine and Berry Fruits (DVIN)
Special Division Young Minds (DYMS) *

*These are the new ISHS Divisions that will be in place after IHC2026



■ Figure 1. Organizational chart of the Society. *These are the new ISHS Divisions that will be in place after IHC2026.

years since its establishment. In September 2025, the ISHS Board approved the creation of a Young Minds Special Division and after IHC2026, the President and Vice-President of the Young Minds Committee will become Chair and Vice-Chair of the Young Minds Special Division. This Division will be considered a "Special Division" because its Chair and Vice-Chair will be elected by the members of the Young Minds Committee and its activities will be overseen jointly by the Chair of the Executive Committee and the Board member responsible for Young Minds activities. In addition, the Young Minds Special Division Chair will become a member of the ISHS Executive Committee.

In September 2025, the ISHS Board and Executive Committee approved the establishment of a new Division named "Sustaining Horticulture in a Changing World" (DSUS). At the same time, the Board and Executive Committee voted to dissolve the Division Horticulture for Development (DDEV) and the Commission Agroecology and Organic Farming Systems (CMOR) as well as the Commission Cultivar Registration (CMNR). The activities of DDEV and CMOR will be addressed by new Working Groups established within the new DSUS Division. CMNR will continue as a Working Group within Division Plant Genetic Resources, Breeding and Biotechnology. The creation of the new Division provides an opportunity for the Society to develop new interdisciplinary initiatives or Working Groups to address emerging issues within horticulture (see the article "A new ISHS Division: Sustaining Horticulture in a Changing

› ISHS Board, Executive Committee and Council meeting, September 2025, Senegal.

World" by Melinda Knuth and Maria Claudia Dussi in this issue of *Chronica Horticulturae*). The new alignment of Divisions will take effect at the conclusion of IHC2026.

The ISHS Executive Director and members of the **ISHS Secretariat** are the only salaried employees of ISHS. The Executive Director, appointed by the ISHS Council, is responsible for the day-to-day administration of the Society and the supervision of staff within the Secretariat. The Executive Director carries out her/his functions under the direction of the Board. The Secretariat provides administrative support to all the members of the ISHS Board, Division Chairs, Working Groups Chairs and conveners of symposia to ensure the quality and success of ISHS programs and other activities.

Upcoming elections

Between now and IHC2026, there will be nominations and elections for the ISHS President, members of the ISHS Board and Division Chairs and Vice-Chairs. For all positions, there is a nomination process as described on the ISHS website https://www.ishs.org/elections.

The ISHS Secretariat will call for nominees and administer on-line elections for all Division Chairs and Vice-Chairs in the months prior to IHC2026. Voting for Division Chairs and Vice-Chairs will be open to all members of each Division. Please note that ISHS members may join any number of Divisions but can only vote for the Division Chair and Vice-Chair if they are a member of that Division.

The Secretariat will also call for nominations for the ISHS President and Board members prior to IHC2026. The ISHS Council will vote on the nominees for those positions, and their terms of office will begin at the conclusion of IHC2026.

Should you be considering a leadership role within the Society, please think about it now, as you do need letters of support from at least five other members of the Society.

A new ISHS Division: Sustaining Horticulture in a Changing World

Melinda Knuth, Chair of ISHS Division Horticulture for Development
Maria Claudia Dussi, Chair of ISHS Commission Agroecology and Organic Farming Systems

The ISHS Board and Executive Committee recently met in Dakar, Senegal, for their annual meeting. After much discussion, it was resolved that from August 2026 onwards, the Commission Agroecology and Organic Farming Systems (CMOR) and the Division Horticulture for Development (DDEV) be merged to create a new Division with an expanded focus: the Division Sustaining Horticulture in a Changing World (DSUS). This is an important step for ISHS, which, in part, is designed to strengthen the organization's response to the complex challenges facing horticulture in the 21st century. This merger represents a proactive alignment of scientific, educational and ecological priorities, reaffirming ISHS's commitment to promoting horticultural systems that are resilient, innovative and sustainable for future generations.

Bringing together complementary strengths

DDEV has historically emphasized the human dimension of horticulture, including education and training, economics and marketing, impact studies, communication and technology transfer. Its mission has been to support the global exchange of knowledge that empowers growers, educators and researchers to enhance horticultural practice and understanding.

CMOR has been dedicated to integrating research, teaching, outreach and scaling efforts to advance agroecology as a pathway towards sustainability, food sovereignty and socio-ecological resilience to climate change. The horticultural sector has benefited from adopting agroecological strategies, methodologies and tools, enabling a transition toward farming systems that rely less on external inputs and more on knowledge-intensive practices. Key principles guiding this transformation include diversification, soil health, input and emission reduction, efficient natural resource management through recycling, as well as participatory and co-creation approaches that foster fairness, connectivity and synergy.

By merging these two groups, there is a recognition of the growing intersection of education, innovation and sustainability. The newly formed DSUS Division will integrate these strengths to advance both the science and the application of new technologies in horticulture.

Horticulture for a sustainable future

Horticulture faces an increasingly complex global landscape shaped by climate change, resource limitations, urbanization, supply chain globalization, and evolving consumer expectations. Addressing these challenges requires collaboration that crosses disciplinary boundaries – linking ecological science with value chains across all the other Divisions of ISHS, whether they be focused on vegetables, breeding, fruits, human health, or ornamental plants.

DSUS will provide a central platform within ISHS to promote climate-smart horticulture, circular resource systems, and resilient production models that safeguard biodiversity and livelihoods. Equally, it will highlight the vital role of education, extension and communication in disseminating responsible practices, and engaging new generations of horticultural scientists and practitioners. The merger is not intended to diminish the capacities or importance of these relevant sciences, but rather to integrate these essential communities within ISHS, thereby strengthening their representation and fostering their continued active participation.

Fostering global collaboration and inclusion

As with all ISHS Divisions, DSUS will serve as a dynamic and inclusive network for collaboration. It will sponsor symposia, Working Groups and publications that showcase leading research and applied knowledge in sustainable horticulture. Emphasis will also be placed on capacity building, with mentoring opportunities for early-career scientists, engagement with local and regional networks, and cross-cultural exchange of ideas and experiences.

This new structure will encourage cooperation among researchers, educators and stakeholders from diverse backgrounds, strengthening horticulture's contribution to global sustainability goals.

Looking ahead

The establishment of DSUS embodies both continuity and transformation within ISHS. It reaffirms the Society's long-standing commitment to education and outreach, while broadening its scope to address the ecological, social and economic imperatives of a rapidly changing world. Through DSUS, ISHS invites its members to shape a vibrant, transdisciplinary future for horticultural science – one where innovation, inclusion and sustainability evolve together to nurture both horticulture and humanity, in the years ahead.

Call for nominations: ISHS Honorary Membership and Fellowship

Nominations for new Honorary Members and Fellows of the ISHS will be considered by the ISHS Council at its meeting in Japan (IHC2026). All nominations for these awards should be received by the Secretariat **no later than 31 March 2026** for them to be considered by the ISHS Awards Committee prior to the Council meeting.

ISHS Honorary Membership

Honorary Membership of the ISHS will be presented by the Council to a person who is a member of ISHS in recognition of his/her exceptional service to the Society. A certificate will be given to the recipients of this ISHS award. Honorary Members are appointed for life by the Members' Forum.

ISHS Fellow Award

The ISHS Fellow Award will be presented to a person who is a member of ISHS in recognition of their outstanding contribution to horticultural science worldwide. A precious pin and a certificate will be given to the recipients of this ISHS award. Awarded by the Council, the total number of ISHS Fellows should not exceed 1% of the total membership, averaged over a 5-year period.

Horticulture Innovation Award

The Horticulture Innovation Award is the highest recognition granted by the Council to a person or institution for an exceptional contribution to horticulture innovation. This award is targeted at those with innovative ideas to create new products and services that are seen as important landmarks in the progress of horticulture at an international level. A plaque and a certificate will be given to the recipients of this award.

Procedure

The ISHS Awards Committee (hereafter AC) invites members of the Society to bring possible candidates for an ISHS Honorary Membership and Fellow Award to the attention of the Society.

Nominations must be received by the Executive Director (info@ishs.org) no later than 31 March 2026. A nomination letter, to meet the requirements, should be accompanied by five duly signed letters of support, giving reasons why a nominee is considered worthy of the honour. These letters must come from members in no less than three different countries/regions.

The Executive Director must receive nominations at least three months prior to the next Council meeting. The Executive Director will receive and collect the complete nomination files and send them (together with the letters of support) to the AC for their consideration. The AC Chair will submit the AC recommendations for awards to the Council. AC recommendations must be balloted by the Council members, either by electronic voting (one vote per country/region as for other Council matters) prior to a Council meeting, or by a secret ballot at a Council meeting. Two-thirds of Council votes present at the meeting, or where the poll is electronic, must be in favour of a nominee for the award to be granted.

More information on the ISHS awards can be found at https://www.ishs.org/ishs-awards

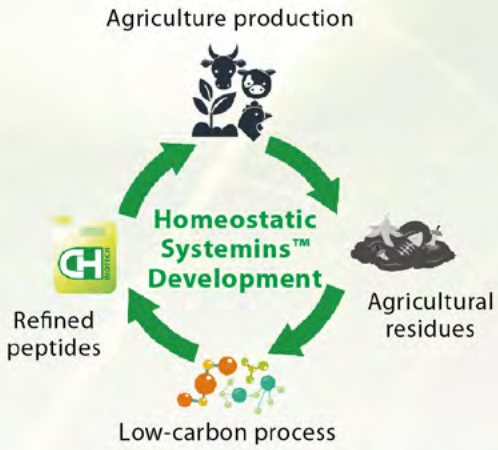
Important

When taking the lead in nominating someone or when supporting a nomination, please do not confuse the two types of awards. The criteria for both awards are very clear and the ISHS Board wishes to stress that nominations should be based on the specific criteria for each distinct award category, namely:

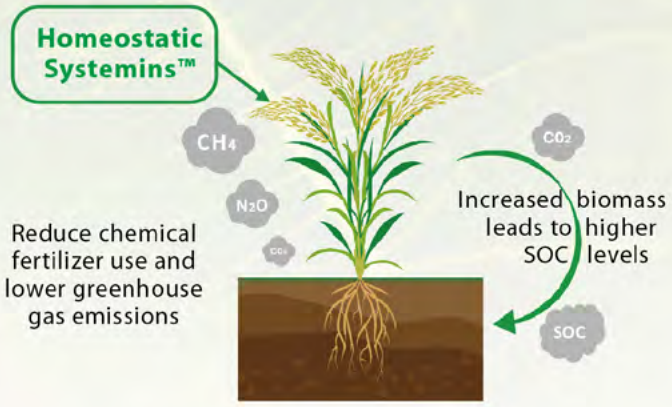
- **ISHS Honorary Member: in recognition of his/her exceptional service to the Society (not related to their contribution to horticultural science).**
- **ISHS Fellow: in recognition of his/her outstanding contribution to horticultural science worldwide (not related to their contribution to ISHS).**

Homeostatic Systemins™

Recycling-Oriented, Low-Carbon and High-Efficiency: Innovative Technologies for Net-Zero Agriculture



Recycle circular materials to refine high-quality peptides

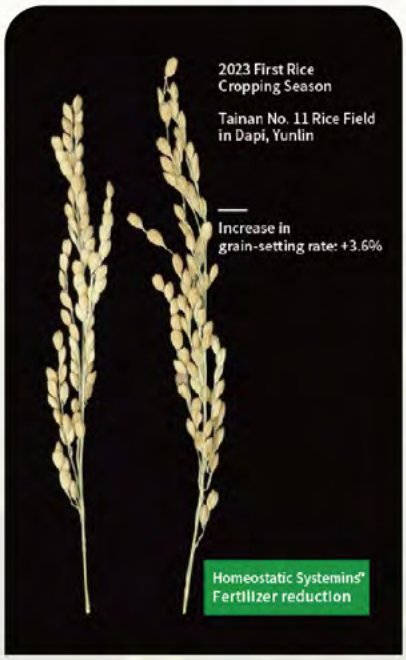


Homeostatic Systemins™ cuts fertilizer use and reduces carbon footprint in rice cultivation

Rice

Achieve High Yield, Superior Quality & Reduced Carbon Emissions through strategic fertilizer reduction without compromising crop productivity

Enhanced-Grain Setting Rate



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Homeostatic Systemins™: a novel approach to enhancing crop resilience and sustainable crop production

Global climate change is intensifying both abiotic and biotic stresses resulting in inefficient nutrient utilization and reduced crop yields. Conventional agricultural inputs often fall short in fully mitigating these impacts as plant homeostasis is disrupted. In response, CH Biotech has been actively developing innovative solutions tailored for climate-smart crop production.

One of the latest breakthroughs is Homeostatic Systemins™, a world-leading product specifically designed to help modern agriculture cope with the complex demands of increasingly variable weather and environmental stress. Homeostatic Systemins™ is not just another input – it's a paradigm shift. This peptide-based biostimulant is derived from recycled agricultural byproducts such as feathers and fish scales, transforming waste into a powerful tool for resilience. But what truly sets it apart is its precision.

Using advanced transcriptomic analysis and AI mining technology, Homeostatic Systemins™ precisely regulates three core gene groups: priming, balance, and recovery. This targeted action restores and maintains cellular homeostasis in plants, enhancing their natural ability to adapt. As a result, crops gain improved stress resistance, better nutrient use efficiency, and ultimately, higher and more sustainable yields with a reduced environmental footprint.

Beyond conventional inputs: searching for a new strategy to restore plant homeostasis

Climate change is making farming more unpredictable. Crops are now exposed to a complex mix of environmental stresses – such as heat, drought, and pest pressure – that disrupt their internal balance, known as homeostasis. When this equilibrium is lost, plants struggle to absorb nutrients efficiently, and yields decline by as much as 30% of their full potential (Figure 1).

Although the use of fertilizers and other conventional inputs are embedded within modern agricultural practice, their effectiveness is significantly reduced when plant homeostasis is compromised. This growing challenge highlights the need for innovative approaches that extend beyond typical inputs and empower crops to actively regulate stress, restore physiological balance, and maintain productivity under unstable conditions.

CH Biotech unveils Homeostatic Systemins™: a next-generation sustainable solution redefining biostimulants

As climate volatility continues to undermine the effectiveness of conventional agricultural inputs, CH Biotech's Homeostatic Systemins™ offers a transformative alternative – one that works from within the plant to restore and sustain physiological balance. Building on the urgent need for solutions that surpass conventional nutrient supplementation, Homeostatic Systemins™ introduces a new generation of biostimulants designed to actively regulate stress responses and reinforce crop resilience at the molecular level.

This innovation begins with sustainable sourcing: protein-rich agricultural byproducts such as chicken feathers (keratin) and fish scales (collagen) are converted into functional peptides through green hydrolysis technologies. These peptides are then screened and selected using CH Biotech's proprietary "Precision Oriented Peptides" platform, which integrates advanced transcriptomics analysis and AI mining technology to identify those with the highest potential to restore plant homeostasis (Figure 2). Specifically, Homeostatic Systemins™ regulates three core gene groups:

- Priming: priming the plant's defense system for enhanced readiness before severe stress;
- Balance: stabilizing metabolic regulation, balancing and optimizing resource allocation for growth, and fortifying resilience against environmental changes;
- Recovery: efficiently scavenging reactive oxygen species (ROS) to promote rapid cell recovery and accelerated post-stress resilience.

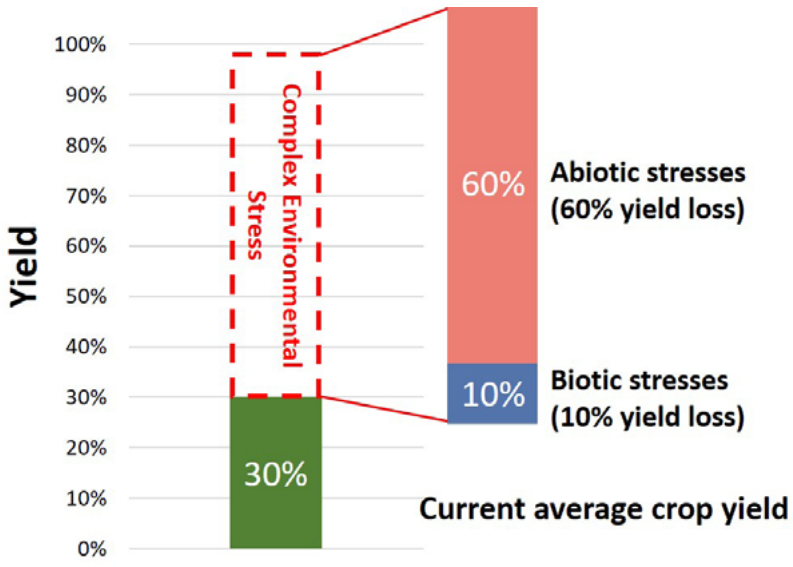

Figure 1. Up to 60% of yield losses are caused by abiotic stress, while approximately 10% are associated with biotic stress. Modified from Ashraf et al. (2012).

Unlike conventional biostimulants, Homeostatic Systemins™ delivers precision-guided internal regulation – maintaining critical homeostasis and providing comprehensive protection against external environmental changes.

By bridging climate-smart agriculture with molecular precision, Homeostatic Systemins™ sets a new benchmark for biostimulant innovation – one that truly transcends conventional inputs.

Field-proven efficacy: Homeostatic Systemins™ boosts yields and grower profits

Backed by extensive multi-season trials and crop types (including row and horticultural crops), Homeostatic Systemins™ delivers measurable gains in yield, quality, and grower profitability. This breakthrough technology helps plants maintain physiological balance under stress – restoring lost yield and unlocking new potential.

In experimental trials, the following crops have demonstrated the field efficacy of Homeostatic Systemins™ (Figure 3):

- Onion: Homeostatic Systemins™ helped mitigate damage from waterlogging during the typhoon season and alleviate physiological stagnation under heat stress, enabling plants to maintain photosynthesis and energy accumulation. It promoted bulb enlargement, increasing the proportion of large bulbs and fresh bulb weight by 22%, while improving seed germination rates by 34%, ultimately reducing production costs for farmers.
- Table grapes: Homeostatic Systemins™ helped overcome slow leaf growth and insufficient photosynthetic efficiency caused by low temperatures. It promoted fruit enlargement and developmental uniformity during the young fruit stage and alleviated the decline in photosynthesis caused by overcast conditions during the rainy season. This ultimately enhanced uniform fruit ripening and enabled a harvest 7-14 days earlier.
- Wine grapes: Homeostatic Systemins™ improved pollination and fruit-setting rates under challenging conditions during the flowering stage, reducing parthenocarpy. It promoted fruit development, doubled skin anthocyanin content, accelerated ripening, and ultimately increased yield by 33.6%. These benefits enhanced the flavor traits necessary for winemaking by increasing sugar content and the Brix-acidity ratio by 13.35%.
- Coffee: Homeostatic Systemins™ reduced flower and fruit drop caused by drastic temperature and humidity fluctuations, increasing yield by an average of 18.8%. It improved fruit ripening and the uniformity of colour, reducing labor costs from multiple harvests, while enhancing flavor profiles to elevate green bean quality and market value.
- Strawberry: Homeostatic Systemins™ strengthened young seedling health, which reduced replanting rates and costs for growers. It improved fruit development, even when impaired by high temperatures, boosting yields by 17.9%, and prolonging the late-season harvest by up to two weeks, despite heat stress.

Beyond crop yield and quality, Homeostatic Systemins™ supports sustainable farming practices, enabling reduced fertilizer use in crops like rice, while maintaining yield and significantly lowering the carbon footprint (e.g. reducing field emissions by approximately 342 kg of CO_2 equivalent per hectare). Homeostatic Systemins™ provides a scientifically validated and sustainable solution for modern horticulture. Engineered to empower plants to maintain their homeostasis, it helps them effectively respond to environmental challenges. This ensures robust growth, superior yields and enhanced quality, ultimately transforming

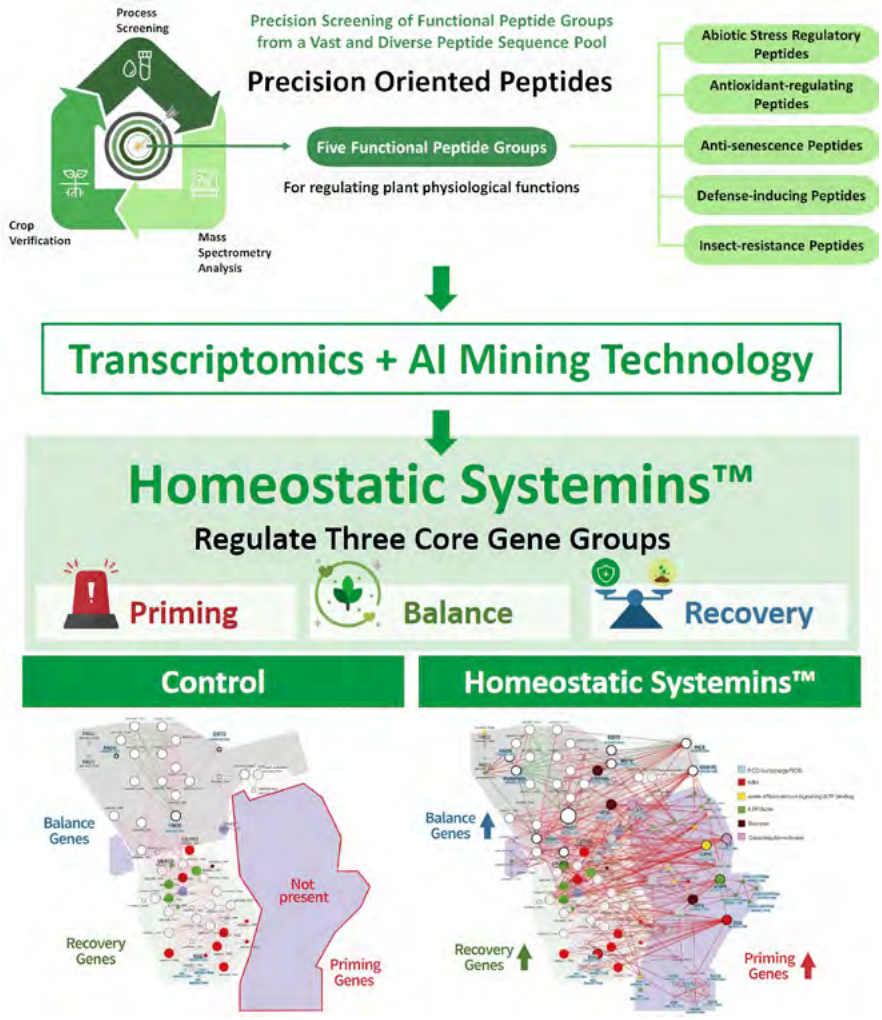

Figure 2. This diagram illustrates how CH Biotech leverages its proprietary platform, "Precision Oriented Peptides," combined with advanced transcriptomic analysis and AI mining technology to precisely identify five functional peptide groups (abiotic stress regulatory, antioxidant-regulating, anti-senescence, defense-inducing and insect-resistance), which are then engineered into a next-generation biostimulant product – Homeostatic Systemins™. The Homeostatic Systemins™ restores plant homeostasis by regulating three core gene groups (priming, balance, and recovery), making crops more resilient to changing environments.

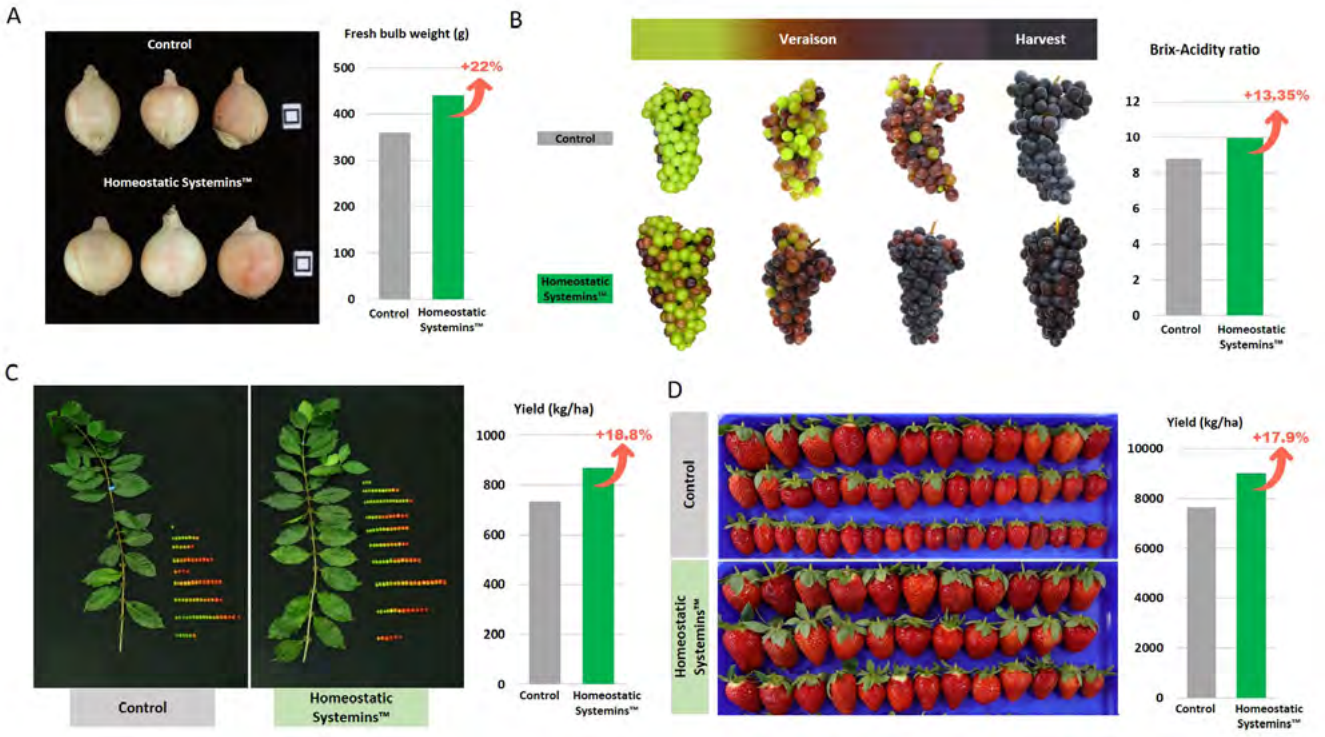

Figure 3. Field trial results demonstrating the efficacy of Homeostatic Systemins™ on A) onion, B) wine grape, C) coffee, and D) strawberry.

cultivation practices for a more resilient and profitable future for agriculture.

Unfolding a new chapter in agricultural resilience with CH Biotech Homeostatic Systemins™

As agriculture stands at the crossroads of climate disruption and technological advancement, CH Biotech's Homeostatic Systemins™ emerges not merely as a product – but as a paradigm-shifting solution. It redefines what biostimulants can achieve by aligning molecular precision with ecological responsibility. From its sustainable origins in recycled agricultural byproducts to its targeted regulation of priming, balance, and recovery gene groups, Homeostatic Systemins™ exemplifies the future of climate-smart agriculture: intelligent, adaptive and regenerative.

Its field-proven efficacy across diverse crops – from onions and grapes to coffee and strawberries – demonstrates that restoring plant homeostasis is not a theoretical ideal, but a practical pathway to higher yields, improved quality, and reduced input costs. More than that, it empowers growers to meet the demands of a changing climate while lowering their environmental footprint – cutting CO_2 emissions and reducing fertilizer dependency without compromising productivity.

In a world where conventional inputs are no longer enough, Homeostatic Systemins™ offers a new standard: one that equips plants to thrive under stress, recover with speed, and perform with consistency. It is a solution engineered not just for today's challenges, but for tomorrow's possibilities – where resilience is built into every cell, and sustainability is embedded in every harvest.

With Homeostatic Systemins™, CH Biotech invites growers, researchers and agricultural innovators to embrace a new era – where science meets stewardship, and where every crop has the power to turn stress into strength.

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About the author

CH Biotech R&D is a dynamic team of agricultural scientists, harmoniously working together to create high-quality, effective and environmentally friendly products. Since 2013, their unwavering commitment to excellence ensures that their solutions contribute to a sustainable and prosperous agribusiness sector worldwide. E-mail: info@chbio.com.tw; website: https://www.chbio.com

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› 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

The impact of DCA storage on fruit quality: a comparison between organic 'Gala' and 'Honeycrisp' apples

› Sadat Amankona

Sadat Amankona is a Ph.D. candidate in the postharvest systems lab at Washington State University – Tree Fruit Research and Extension Center. His research focuses on using non-chemical strategies to optimize the storage of organic apples in the Pacific Northwest.

There has been a surge in the demand for organic apples in the USA with Washington State supplying over 90% of them. 'Gala' and 'Honeycrisp' apples are currently the top two cultivars. Despite the year-round demand for organic apples, storage challenges continue to impact fruit quality due to prohibitions on the use of synthetic chemicals. Dynamic controlled atmosphere (DCA) storage is emerging as a promising chemical-free alternative to optimize fruit quality and minimize physiological disorders.

In this study, the main objective was to evaluate the effectiveness of DCA based on the respiratory quotient (RQ) compared to controlled atmosphere (CA) and regular atmosphere (RA) storage for organic 'Gala' and 'Honeycrisp' apples for two consecutive years (2022-2024). Fruit samples were stored for up to 9 months and an additional 2 or 4 weeks in regular air to mimic transit and presentation on the retail shelf. Fruit quality parameters [firmness and titratable acidity (TA)], and physiological disorders were evaluated after 7 days at 20°C.

Overall, the results showed cultivar-specific responses. For 'Gala', DCA fruit was both firmer (≥3 lb) and the TA was higher (≥0.2% malic acid), outperforming CA and RA. For 'Honeycrisp', firmness was not significantly different across treatments, but DCA showed better TA retention, particularly in year 2 (2023/24). DCA also reduced internal browning and shriveling disorders in 'Gala'. However, Honeycrisp' showed a greater incidence of bitter pit while soft scald remained below 5% in all treatments.

These findings suggest that DCA is a viable postharvest treatment for optimizing the storage and quality of organic apples, although its effectiveness appears to be cultivar-dependent and benefits 'Gala' more than 'Honeycrisp'. Further research is necessary to assess the consistency of the impact of DCA for fruit produced under varying seasons and environmental conditions.

Sadat Amankona won the ISHS Young Minds Award for the best poster presentation at the XIV International Controlled and Modified Atmosphere Research Conference in USA in May 2025.

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Study on high yields of potato microtubers formed by long-day conditions using temporary light interruption treatment

› Ryohei Kobayashi

In Japan, tubers of approximately 10 g are generally used as seed potatoes. Replacing these with disease-free 1-3 g microtubers (MTs) has been shown to have a significant and positive impact on yield. However, for this alternative to be more cost effective, it is necessary to increase the number of MTs produced. At the molecular level, under short day (SD) conditions, *SELF-PRUNING 6A* (*stSP6A*) is expressed in the leaves and transported to the stolons where it induces tuber formation. This process requires the expression and destabilization of *CONSTANS-like 1* (*stCOL1*) during the dark period, which suppresses the expression of the tuberization repressor *SELF-PRUNING 5G* (*stSP5G*). By contrast, under LD conditions, stabilization of *stCOL1* enhances *stSP5G* expression, thereby inhibiting tuberization. To promote tuberization under LD conditions, we investigated the regulation of *stCOL1* through light-quality treatments. For this study, we found that day-break lighting (DB) using far red irradiation for 10 min followed by 3 h of darkness, beginning 1 h after the onset of the light period, effectively suppressed *stCOL1* expression. However, the expression level of *stSP6A* under DB was lower than that under SD, suggesting the need for further improvements to enhance yield. This study examined the effects of combining DB and SD treatments on MT formation in a plant factory with artificial lighting (PFAL). Alternating SD treatment at one-week intervals under LD conditions reduced the yield of MTs compared with that under DB treatment alone. In contrast, combining DB and SD treatments at one-week intervals produced the highest yield of MT, with up to 80 MTs per plant, surpassing the yields obtained with either DB or SD treatment alone. These findings provide valuable insights that may contribute to establishing novel strategies for seed potato production in PFAL systems.

Ryohei Koyabayashi won the ISHS Young Minds Award for the best poster presentation at the IX International Symposium on Seed, Transplant and Stand Establishment of Horticultural Crops and III International Symposium on Vegetable Grafting in Greece in June 2025.

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The effects of acute gamma irradiation on Malaysian aromatic rice cultivar 'MRQ104': implications for agronomic performance and ornamental potential

› Aliif Ihsaan Akmal Shukri

Aliif Ihsaan Akmal Shukri is an agronomist/geneticist specializing in the induced mutation breeding of rice. He is a PhD candidate from the Faculty of Plantation and Agrotechnology, Universiti Teknologi MARA, Malaysia. His current project focuses on the gamma mutation breeding of Malaysian aromatic rice 'MRQ104', aiming to develop a new mutant variety with higher yield, better agronomic performance, enhanced aromatic properties and greater ornamental potential. In a greenhouse, ~6000 seeds (M_1 generation) of 'MRQ104' were treated with 5 different acute gamma doses: 0 Gy (control), 100, 150, 200, 250 and 300 Gy. M_1 progenies with stable or improved quality were then cultivated in designated rice fields as M_2 generation and subsequently into M_3. Final results demonstrated a marked increase in yield of 15-33% per hectare for the irradiated groups. The flowering and maturity period for all irradiated groups was 3-7 days earlier than the control group. A wide spectrum in plant height could also be observed between groups, with the 300 Gy treatment growing 20 cm taller than the unirradiated seeds. While the main purpose was to develop a staple food crop, the findings also opened the potential for ornamental rice species. The distinct differences in height could potentially be manipulated to produce rice art (*Tanbo*), which is widely practiced in Japan. The application of rice lines from at least two groups (i.e. control and 300 Gy) offered the greatest potential for eco-tourism (rice art).

Aliif Ihsaan Akmal Shukri won the ISHS Young Minds Award for the best oral presentation at the III International Symposium on Tropical and Subtropical Ornamentals in Malaysia in July 2025.

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The molecular mechanism of gibberellin regulates sex differentiation in *Corylus heterophylla* × *Corylus avellana*

› Suilin Zhang

Hazelnut, one of the four major nut crops in the world, has significant economic value. Hazelnuts have unisexual flowers, with both male and female flowers on the same plant. However, the ratio of female to male is very low, which seriously affects their yield. This study found that exogenous GA_3 increased the male-to-female ratio of hybrid hazelnuts (*Corylus heterophylla* × *Corylus avellana*) by increasing the number of male flower buds. Conversely, the exogenous application of paclobutrazol increased the ratio of female to male flowers. Exogenous GA_3 promotes the expression of *ChaLFY* and *ChaAP1*, which inhibits the expression of *ChaFT*, but has no significant effect on the expression of *ChaSOC1*. Exogenous paclobutrazol inhibits the expression of *ChaLFY*, promotes the expression of *ChaFT* and *ChaSOC1*, but had no significant effect on the expression of *ChaAP1*. In this study, three *ChaDELLA* genes were identified from the genome of *C. heterophylla* × *C. avellana*, namely *Cor0144260.1*, *Cor0053250.1*, and *Cor0117260.1*. Analysis of the protein interaction network revealed that the ChaDELLA protein could interact with the ChaLFY and ChaSOC1 proteins. An analysis of the upstream and downstream regulatory networks revealed that the *ChaDELLA* transcription factor can bind to the promoter regions of the flowering genes *ChaLFY*, *ChaFT*, *ChaAP1*, and *ChaSOC1*, and may regulate the sex differentiation of *C. heterophylla* × *C. avellana* by regulating the expression of the flowering genes. This study aimed to lay a theoretical foundation for revealing the mechanism by which gibberellin is involved in regulating the flowering regulation of hybrid hazelnuts of the common European variety, and to offer suggestions for artificially regulating the ratio of male to female flowers and increasing yield.

Suilin Zhang won the ISHS Young Minds Award for the best poster presentation at the XI International Congress on Hazelnut in August 2025.

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Water stress effect on eco-physiological parameters of pistachio trees

› Valeria Imperiale

The pistachio (*Pistacia vera* L.) is a highly resilient crop, capable of tolerating several abiotic stresses, including water shortage. Due to this, it is traditionally cultivated in dry conditions in the Mediterranean region, including Sicily. However, the lack of irrigation often causes physiological limitations and agronomic issues, such as reduced CO_2 assimilation, alternate bearing, poor nut quality, and reduced yields. Even though pistachios are drought-tolerant, maintaining a sufficient water supply is crucial to sustain high productivity. This study aimed to investigate the response of mature pistachio trees to different water supply levels to improve irrigation management in Sicilian orchards. The experiment was carried out in the Caltanissetta area on trees of the 'Bianca' cultivar grafted onto *Pistacia terebinthus* L. Three water regimes were compared: rainfed (T0), 50 mm ha^{-1} (T1), and 100 mm ha^{-1} (T2), applied during fruit development, from June to August 2024. The physiological measurements included maximum net photosynthesis rate (A_{max}), stomatal conductance (g_s), intrinsic water use efficiency (WUE_i), and midday stem water potential (SWP). Although the water supplied was very limited in T1 and T2, it enabled the trees to sustain a higher water status than the rainfed ones throughout the entire growing season. Stomatal conductance and assimilation rates were also higher in the irrigated treatments, confirming that supplemental irrigation reduces stress during the production season. However, the opposite situation was observed in terms of water use efficiency. A sharp decline in photosynthesis and stomatal conductance occurred when the SWP dropped below -1.5 MPa, indicating the onset of severe water stress conditions. Despite these physiological benefits, no significant differences were observed among treatments in yield parameters, such as nut number and kernel weight per tree in the first year. This study demonstrates that small amounts of water were beneficial in enhancing the physiological performance of the plants. However, to assess the effects on production, it will be necessary to observe the physiological responses over a longer term, considering also the species' alternate bearing behavior.

Valeria Imperiale won the ISHS Young Minds Award for the best poster presentation at the I International Symposium on Temperate Tree Nuts: from Agroecologically Sustainable to Organic Production in Italy in August 2025.

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Stomatal traits in pecan [*Carya illinoinensis* (Wangenh.) K. Koch]: varietal differences and seasonal adaptations under Mediterranean conditions

› Alessandro Pesole

Pecan [*Carya illinoinensis* (Wangenh.) K. Koch] is gaining increasing attention in Mediterranean regions as a promising alternative crop for diversifying nut production and coping with climate variability. Despite its recognized nutritional and agronomic value, limited information exists on its morphological and physiological behavior under Mediterranean conditions. To address this gap, a two-year trial (2019-2020) was conducted to characterize selected leaf traits in different cultivars.

The study was carried out at the repository of the Department of Soil, Plant and Food Sciences, University of Bari 'Aldo Moro', located at the "Martucci" experimental and educational center in Valenzano (Bari province, Puglia region, Italy). Ten pecan cultivars were evaluated for two parameters: leaf area (LA) and stomatal density (SD). Leaf samples collected during the growing season were analyzed microscopically for SD, while LA was determined using image-based techniques. Data were statistically analyzed through analysis of variance (ANOVA) followed by Ryan-Einot-Gabriel-Welsch and Quiot (REGWQ) post hoc tests to identify significant differences among cultivars.

Results revealed marked variability among cultivars under the pedo-climatic conditions of the Puglia region. 'Cherokee' and 'Choctaw' displayed the largest leaves, with mean areas of 454.13 mm^2, whereas 'Cape Fear' had the smallest (215.56 mm^2). In contrast, stomatal density was highest in 'Stuart' and 'Cape Fear' (589.58 and 566.66 stomata mm^{-2}, respectively) and lowest in 'Peruque' and 'Cherokee' (427.08 and 444.79 stomata mm^{-2}). The contrasting combinations of LA and SD suggest that pecan genotypes may adopt different adaptive strategies to a Mediterranean climate. For instance, larger leaves with fewer stomata, as in 'Cherokee', may indicate a strategy to maximize photosynthetic surface while reducing water loss, whereas smaller leaves with higher stomatal density, as in 'Cape Fear', could encourage faster gas exchange but imply greater drought sensitivity.

Overall, the data supports the existence of cultivar-specific morphological patterns that may influence photosynthetic efficiency and tolerance to water limitations under Mediterranean conditions. These results provide a first basis for identifying pecan cultivars best adapted to Mediterranean environments. Future research will aim to link stomatal and foliar traits with physiological performance, yield stability, and nut quality, thereby enhancing the role of pecan as a resilient crop in climate-challenged regions.

Alessandro Pesole won the ISHS Young Minds Award for the best poster presentation at the VI International Symposium on Pomegranate and Minor Mediterranean Fruits in Italy in September 2025.

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The world of Horticulture

IHC 2026 Kyoto
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Plant factories in Japan – history, current status and perspectives towards a more sustainable society

Eri Hayashi

Plant factories – also known as plant factory with artificial lighting (PFAL) – enable the consistent and efficient year-round production of high-quality plants in any location. In this article, the concept and social significance, technical components and advantages, history, current status, and challenges associated with plant factories will be discussed. Future perspectives towards evolutionary, resource-autonomous and socially integrated plant factories will be introduced.

Concept and social significance

A plant factory is essentially a fully enclosed facility for plant cultivation with environmental control. Its high insulation and almost airtight structure, with environmental control, minimizes the effect of external environmental fluctuations allowing high-quality plants to be grown consistently and efficiently all year round, regardless of location, weather conditions, or season. Plant factories hold the potential to simultaneously address multiple global challenges in fields such as food safety and food security, the environment and ecosystems, energy and resource utilization, and human health and quality of life. In the face of worsening global and local issues, including climate change, the depletion of natural resources such as water, and the decline and aging of the agricultural workforce, plant factories have been gaining attention worldwide as a sustainable form of agriculture.

Key components of plant factories

Plant factories are designed to enable precise control of the cultivation environment, thereby supporting stable and efficient plant production. The core of such systems lies in highly insulated and almost airtight facilities, which minimize external environmental fluctuations and allow environmental parameters to be precisely managed according to specific cultivation objectives. Within these controlled environments, artificial lighting – where light-emitting diodes (LEDs) are the most widely used – replace natural sunlight, with spectral quality, photosynthetic photon flux density (PPFD), and photoperiod being adjustable to optimize photosynthesis, morphogenesis and the accumulation of functional metabolites (Figure 1).

In addition to lighting, plant factories integrate multiple environmental control systems, including air conditioning (temperature, relative humidity, airflow, CO_2) and hydroponic nutrient supply systems. Advanced environmental control technologies coordinate these components, ideally allowing dynamic adjustment of cultivation conditions in response to plant traits or phenotypes, plant developmental stages, or production goals. Such precise and integrated control not only ensures uniform and predictable yields, but also provides opportunities for enhancing plant quality, improving resource-use efficiency and supporting sustainable production. Minimum ventilation is necessary in the unlikely event that volatile organic compounds (VOC) accumulate in the cultivation room.

Advantages of plant factories

Despite the initial capital investment required for construction, plant factories offer several economic and agronomic advantages. A closed cultivation system with precise environmental control enables shortened cultivation cycles, year-round production and significantly higher productivity per unit area, particularly when multi-layer cultivation systems are employed. The productivity of plant factories can exceed that of conventional open-field farming by more than one hundred times (Kozai, 2013). Furthermore, plant factories provide opportunities for the production of plants with enhanced quality or functional components, achieved through controlling environmental factors such as light (e.g., PPFD, spectrum, etc.) and other elements of the aerial environment and nutrient solutions.

In addition to their agronomic and economic benefits, plant factories also exhibit important environmental and resource-use advantages (Kozai and Hayashi, 2023). The closed cultivation environment and recycling of drainage water from air-conditioning systems have been shown to reduce water consumption by more than 90%. Likewise, closed-loop management can substantially decrease fertilizer use, thereby reducing both input costs and potentially adverse environmental impacts as well. The exclusion of external pests in plant factories eliminates the need for pesticides, producing plants that are safe for consumption and can be eaten without washing due to cultivation in strictly controlled sanitary conditions. At the same time, plant factories can minimize postharvest losses, increasing the edible portion of biomass (percent marketable part of plants or merchantability ratio: the weight of marketable product divided by the weight of harvested plant, which is generally 80-90% in Japan) (Kozai et al., 2018; Kai and Okabe, 2023), and contribute to a reduction in transportation costs and environmental burdens through localized production in urban and peri-urban areas.

Integrating technology and research

Plant factories operate within highly insulated and almost airtight facilities, theoretically enabling precise control of environmental parameters. A distinguishing feature of these systems is their capacity for simple and accurate acquisition of time-series data, allowing real-time monitoring of plant growth, or visualizing and analyzing interactions between

Figure 1. Interior view of cultivation room of plant factory. Source: Japan Plant Factory Association.

plant phenotypes and the environment and cultivation management, thereby improving resource-use efficiency (Hayashi et al., 2022; Kozai and Hayashi, 2023). These data-driven capabilities facilitate predictive production planning, enable detailed analysis of productivity dynamics, and provide unique opportunities to conduct fundamental plant science research in parallel with commercial plant cultivation. Furthermore, its application in selection of seedlings for grading and breeding is also anticipated (Hayashi et al., 2022).

Collectively, these characteristics underscore the dual role of plant factories: they function not only as innovative agricultural production systems that enhance food security and sustainability, but also as experimental platforms for advancing knowledge in plant physiology, environmental control and systems science.

History and current status

Research on plant responses to environmental conditions in environmentally controlled facilities began in the 1950s and in Japan in the 1960s, utilizing environment-controlled chambers known as phytotrons (Mitchell, 2022). Since then, various research institutions, universities and private companies in Japan have continuously advanced plant factory research and development with commercial applications in mind (Hayashi, 2024).

In the 1980s, Japanese commercial plant factories primarily employed high-pressure sodium lamps with single layer cultivation systems, followed in the 1990s by fluorescent lighting with multi-layer cultivation systems. Since the 2010s, LEDs have become the standard for the cultivation of leafy greens in commercial plant factories in Japan. Broadband white LEDs, incorporating red, green and blue wavelengths, have become increasingly common since 2015, enhancing the flexibility and efficiency of plant growth management (Hayashi, 2024). Today, over 80% of the plant factories employing LED lighting for commercial production use white LEDs exclusively (JGHA, 2025).

Currently, there are approximately 200 commercial-scale plant factories of varying sizes operating in Japan. In commercial production, approximately 90% of factories cultivate lettuce varieties (JGHA, 2025). The other crops commercially cultivated on a large scale in Japanese plant factories include herbs like basil, and, in some cases, strawberries. Experimental cultivation of root vegetables, tubers, grains and wasabi is also underway, alongside ongoing research and limited commercialization of genetically modified plants for pharmaceutical applications (Goto, 2011; Hayashi, 2024).

In Japan, large-scale facilities producing up to 10 tonnes of lettuce per day have become quite common. Automation and mechanization are progressively being implemented with the expansion of these facilities. In highly automated plant factories producing lettuce, approximately 70% of the production processes have been automated, including the primary transplanting of seedlings (Figure 2). In Japanese plant factories engaged in the commercial production of lettuce, more than 50% of the total labor hours are devoted to harvesting and postharvest operations, including trimming and packaging (JGHA, 2025). Unlike baby leaf lettuce, which is relatively amenable to automation, each head of lettuce – typically weighing 100 to 250 g – requires postharvest adjustment and trimming after harvesting. At present, these operations are predominantly performed manually in Japanese commercial plant factories.

Hygiene management is also prioritized in the operational management of plant factories in Japan (Figure 3). Consequently, the demand for vegetables produced in plant factories – which require no washing – is expanding, especially in the food processing and food service industry for use in salads, sandwiches, rolls and in restaurants. Lettuce grown in plant factories and sold in supermarkets is typically packaged, and in some cases, it is explicitly stated that they do not require washing and are pesticide-free.

In the United States, plant factories, also known as indoor vertical farms, produce cherry tomatoes and Japanese strawberries using solar power on a large scale. Those products are available for purchase from mass retailers in multiple cities. Moreover, cultivation and research on cannabis (*Cannabis sativa* L.) for medical or regulated recreational use is expanding across North

Figure 2. Automation of transplanting in plant factory. Source: Shinnippou.

America, Europe and other regions in the world. In Japan, recent legal amendments now permit regulated cultivation of cannabis for research and approved purposes (Nakaoka and Hayashi, 2025).

Key challenges

Current plant factories still have substantial room for improvement. The productivity of plant factories can be characterized in terms of resource inputs, including materials, electric energy, labor hours and cultivation area, as well as financial viability. Table 1 presents the estimated productivity of major commercial plant factories operating in Japan (Kozai et al., 2022). These estimates represent the volume of marketable products (lettuce), as most large-scale commercial plant factories in Japan produce and package whole heads of leafy lettuce rather than precut products. Further improvements in resource productivity and financial viability are required.

In large-scale commercial production, achieving uniform plant growth is critical, maintaining desirable plant morphology and preventing physiological disorders such as tip burn, while ensuring consistent quality by cultivating plants that meet customers' requirements under hygienic conditions.

Although plant factories – with thermal insulation and almost high airtightness – offer advantages such as reproducibility, predictability, observability, traceability and controllability, a major challenge remains in that these benefits have not yet been fully realized for research and commercial production (Kozai and Hayashi, 2023). In addition, issues related to system scalability persist, particularly from the perspective of the social implementation of research outcomes.

A critical area for future research is the elucidation of interactions between plant phenotypes and the cultivation environment, including the microenvironment, and cultivation management (Hayashi et al., 2022; Kozai and Hayashi, 2023). Beyond the construction of scalable cultivation systems, there is a need for more precise environmental measurements, considering two- or three-dimensional variations, and standardization of measurement methodologies, as well as the development of non-destructive, non-invasive time-series phenotyping techniques that can be applied under plant factory cultivation conditions (Kozai and Hayashi, 2023).

Figure 3. Hygienically managed cultivation room of plant factory. Source: Shinnippou.

Future perspectives

It is expected that plant factories will make optimal use of artificial intelligence (AI) technologies to enable non-destructive, non-invasive and continuous phenotyping throughout plant growth processes for environmental control (Hayashi, 2024). This will facilitate the elucidation of complex interactions among plant phenotypes, microenvironments – including the surrounding condition of individual plants – and cultivation management practices. Such knowledge will, in turn, contribute to environmental control systems that incorporate business factors and ultimately enable precise phenotype control.

As illustrated in Figure 4, the utilization of digital-twin-based simulators within cyber-physical systems (CPS) can accelerate the research and development of cultivation environment simulations, automated systems and robotics. These approaches also hold promise for enhanced training and education, mental health and even for fostering plant-based entertainment, such as digital games and other media connected with the physical cultivation system. The implementation of decentralized, resource-autonomous and evolutionary plant factory systems interconnected through the internet would enable simultaneous, high-speed, and reproducible plant production and research, while promoting data sharing across facilities. Furthermore, such systems could facilitate on-site selection and breeding during production. In 2012, a trial project using a well-designed small plant factory system was launched in the Kashiwa-no-ha residential district of Kashiwa city, Chiba prefecture, Japan. Vegetables grown in household spaces are connected through a network linking people's homes, sharing information and communicating, receiving advice, and developing the community (Kozai, 2013). This can be extended to networks that link schools, local communities, hobby growers' groups,

Table 1. Estimated resource productivity of commercial plant factories in Japan (Kozai et al., 2022).

Resources applied	Range of resource productivity	Range of monetary productivity (kg USD^{-1})	Range of production cost (USD kg^{-1})
Electric energy	0.11-0.14 kg kWh^{-1}	0.645-0.755	1.09-1.28
Labor hours	7.7-10.0 kg h^{-1}	0.591-0.770	1.18-1.63
Cultivation area (per day)	0.25-0.33 kg m^{-2} d^{-1}	0.482-0.645	1.28-1.72
Other resources	-	0.609-0.827	1.00-1.36
Total	**-**	**0.166-0.219**	**4.55-5.99**

In 2019, 1 USD and 1 Euro were 110 and 130 JPY, respectively. Note that wages ($ h^{-1}) are around two times higher in the USA and some European countries than in Japan as of 2021.

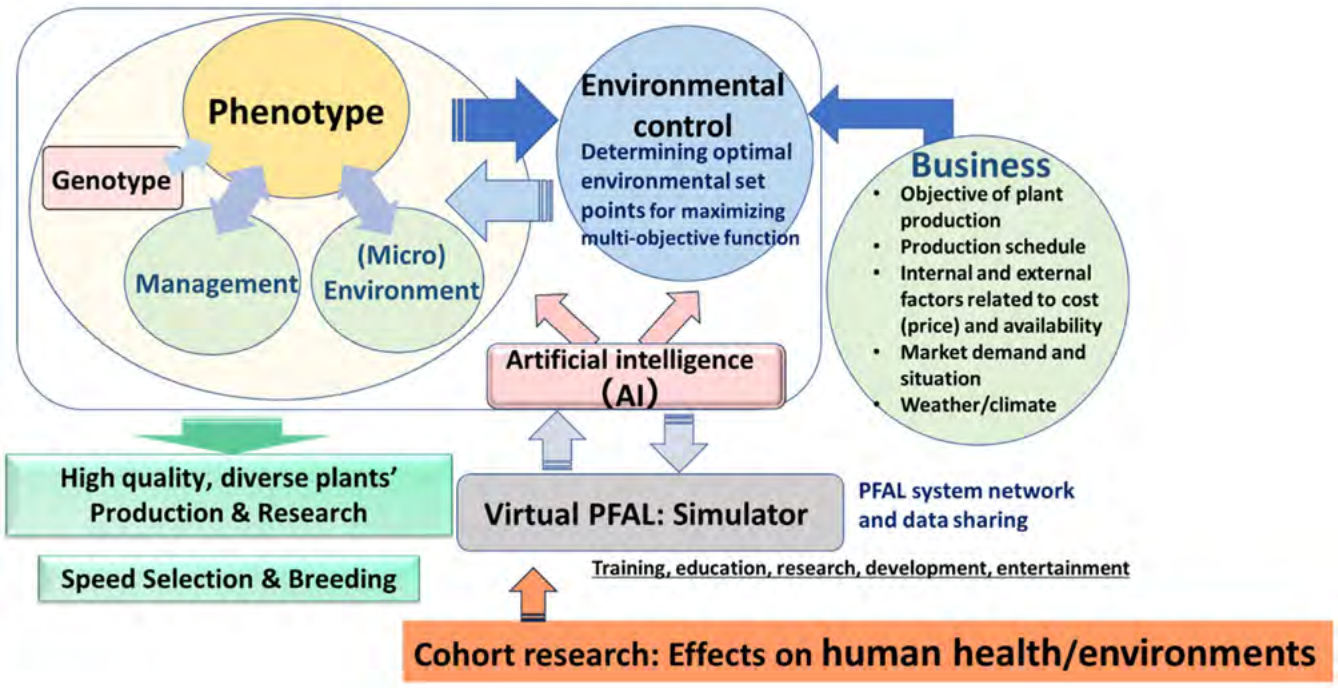


Figure 4. Integrated framework for environmental control based on plant phenotyping, incorporating business factors, phenotype control, and cohort studies on human health and environmental impact. Source: Revised from Hayashi (2024).

restaurants, hotels and hospitals, accumulating and utilizing data.

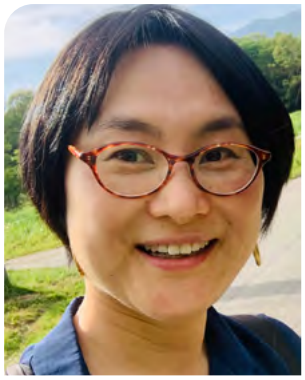
Plant factories can also serve as comprehensive educational tools that integrate biological, chemical, physical and engineering perspectives, while encompassing energy, environmental and resource considerations. As part of plant cohort research, studies and analyses examining the impacts of both plant factories and factory-grown plants on human physical and mental health, as well as on the environment, are becoming increasingly important. The traceability inherent in environmentally controlled plant production offers opportunities for integration with medical, life sciences and agricultural research, as plant production processes including time-series phenotypes, environment and management, along with genotypes, can be visualized and shared to subsequently assess plants' medical impact on humans.

In the coming years, the realization of resource-autonomous, circular and evolutionary plant factories is anticipated to promote diversification in both the application of factory-grown plants and the use of plant factory technologies. Consequently, plant factories are expected to play a key role as part of the social infrastructure in sustainable and smart societies. The use of such technologies will extend beyond commercial producers and researchers to include citizens, who may engage in plant factories as part of citizen science, thereby fostering community development across cyber and physical spaces – from local to global scales – and eventually space farming as well (Kozai et al., 2025).

With the multidimensional expansion of AI-driven plant factories, the focus will shift from simply "how to cultivate plants" towards "how to design plants." Given their multidisciplinary nature, plant factories not only function as comprehensive learning tools, but also exhibit strong affinities with fields such as sports, design and arts. For plant factories to become more deeply embedded in society, it will be essential to adopt an artistic or rather, aesthetic and creative approach in order to create beautiful plant factories that inspire hope in people.

In the future, plant factories may serve as essential instruments for integrating academic, industrial and civic activities, giving rise to new business models such as social enterprises capable of addressing multiple social challenges simultaneously. Ultimately, integration with human cyber-physical systems is envisioned, considering the development and dissemination of humanoids or digital humans, as well as the advancement of the digital society. Beyond solving global issues such as poverty, food insecurity and health disparities, resource-autonomous and aesthetically designed plant factories are expected to contribute meaningfully to human well-being, community development and sustainable regional planning.

About the author



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From greenhouses to bluehouses: integrating marine biotechnology and onshore cultivation for sustainable innovation in Monaco

Mitchell J. NewDelman, Chuck Toombs and Rachid Benchaouir

Horticultural principles such as controlled environments, cultivar selection and post-harvest quality can be extended beyond terrestrial plants to the onshore cultivation of marine organisms, giving rise to so-called bluehouses. The Monaco Biome Initiative combines land-based aquaculture infrastructures with molecular biotechnology to transform Mediterranean biodiversity into a source of high-value biomolecules for health, nutrition, cosmetics and ecosystem resilience. Leveraging Coraliotech's recombinant protein technology and its new marine biotechnology laboratory equipped for rapid proof-of-concept studies, the Monaco Biome Initiative project integrates genomic sequencing, AI-guided gene selection and synthetic biology pipelines. Controlled cultivation systems, supplied with filtered seawater from Monaco's SeaWergie or a similar deep surface pumping network, could ensure stable experimental conditions for growing algae, seagrasses and coral-associated microorganisms while minimizing ecological impact. Partnerships with Oregon Seaweed link ecological expertise with operational scaling capacity. The Monaco Biome provides a replicable model of how onshore marine horticulture can bridge scientific innovation and industrial applications, expanding horticulture into a new blue dimension.

Introduction

Horticulture has long focused on the controlled cultivation of terrestrial plants, optimizing yield, quality and economic value (Pérès and Picard, 1958; Ballesteros, 2006). Recently, these principles have inspired a new frontier: the onshore cultivation of marine organisms in so-called bluehouses. Using filtered seawater in controlled environments, this approach merges the precision of horticulture with the biological potential of marine ecosystems, opening opportunities for conservation, biotechnology and sustainable innovation (Sclodnick et al., 2024; Zhang et al., 2022). The Mediterranean Sea provides an ideal setting for such initiatives. Its coralligenous habitats rank among the most biodiverse ecosystems in temperate waters, hosting hundreds of species with ecological, economic and molecular potential (Ballesteros, 2006; Bracchi et al., 2022; Donato et al., 2024). Yet, climate change, pollution and habitat loss increasingly threaten these environments, highlighting the urgency of developing ex-situ platforms for research, conservation and valorization (Hughes et al., 2017; Tignat-Perrier et al., 2022). Monaco offers unique advantages for this endeavor. The SeaWergie network will bring cold, nutrient-rich seawater onshore before its use in urban cooling, enabling stable, low-impact cultivation systems (Figure 1).

Building on this infrastructure, Coraliotech's marine biotechnology laboratory combines AI-driven gene discovery and recombinant protein production technologies (Sandro and Benchaouir, 2019; Planas-Bielsa et al., 2020). This integration transforms marine biodiversity into tangible biomolecules for health, nutrition, cosmetics and environmental restoration (Leal et al., 2013; Duarte et al., 2017). Importantly, all activities comply with Monaco's environmental regulations and the Nagoya Protocol on Access and Benefit-Sharing, ensuring that sampling, ex-situ cultivation and molecular research follow the highest ethical and legal standards. The Monaco Biome provides a replicable blue-

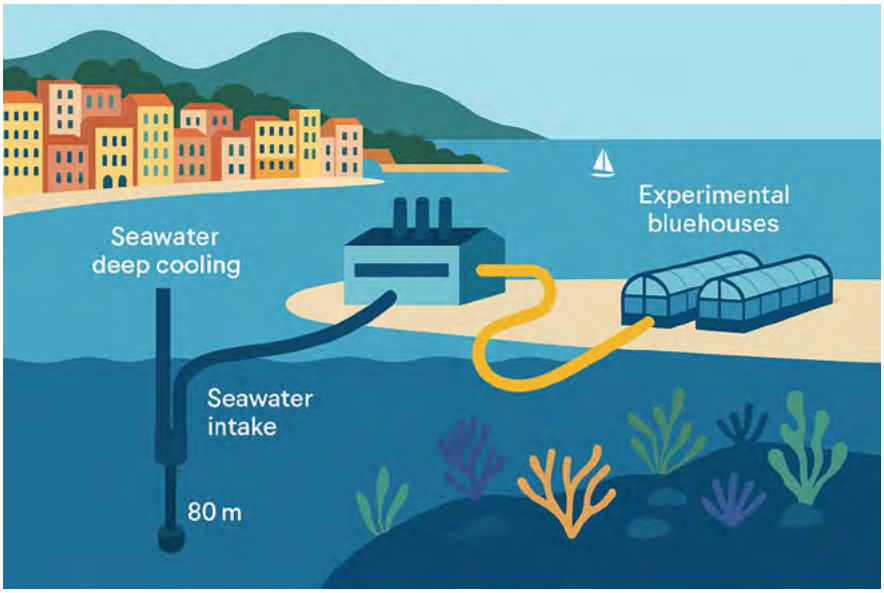

Figure 1. SeaWergie, the Monaco's seawater energy network. The SeaWergie system is a unique infrastructure in Monaco that will pump deep, cold seawater from the Mediterranean and distribute it onshore for urban cooling and renewable energy applications. By harnessing the stable temperature of deep water layers, the system will reduce electricity consumption and CO_2 emissions associated with conventional air conditioning. For the Monaco Biome initiative, SeaWergie offers a dual advantage: while continuing to supply cooling networks for the city, a fraction of this water could be directed to onshore cultivation facilities or bluehouses. This would provide stable environmental conditions for marine organisms cultivated for research, conservation, and biotechnological applications, while maintaining a minimal ecological footprint.

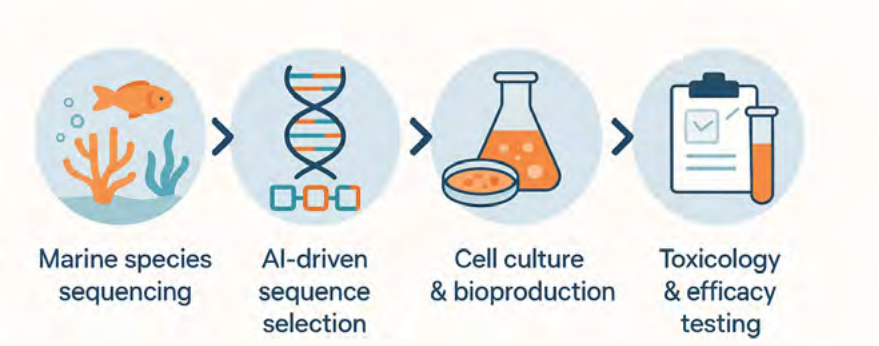

Figure 2. From gene to product, a modular biotechnology pipeline. The Monaco Biome initiative transforms marine biodiversity into high-value biomolecules through a modular pipeline integrating controlled cultivation, genomic discovery, and recombinant production. Functional and safety testing ensures efficacy and compliance before industrial partners enable scaling and real-world applications. This approach bridges marine science, biotechnology, and sustainable innovation in a single framework.

print for integrating marine cultivation into modern horticultural sciences, linking fundamental research with industrial applications and ecosystem resilience (Zhang et al., 2022).

Mediterranean biodiversity, coral-algae symbiosis and the Monaco Biome

The Mediterranean coralligenous habitats represent one of the most diverse ecosystems in temperate waters, hosting hundreds of species of macroalgae, invertebrates and microbes with significant ecological and biotechnological potential (Ballesteros, 2006; Bracchi et al., 2022). Yet these fragile ecosystems face increasing threats from climate change, pollution and coastal pressures, resulting in biodiversity loss and recurrent bleaching events (Hughes et al., 2017; Tignat-Perrier et al., 2022). At the heart of their functioning lies the coral-algae symbiosis, where photosynthetic dinoflagellates provide corals with energy in exchange for nutrients and protection (Baker, 2003; LaJeunesse et al., 2018). When disrupted by environmental stress, this balance collapses, leading to bleaching and reef decline (Huffmyer et al., 2024). A deeper understanding of the molecular mechanisms behind this relationship is crucial, not only for ecosystem resilience, but also for the discovery of novel bioactive molecules with a diversity of applications (Leal et al., 2013; Duarte et al., 2017).

From gene to product: a simple and scalable pipeline

The Monaco Biome Initiative follows a streamlined pipeline designed to transform Mediterranean marine biodiversity into tangible applications for health, nutrition, cosmetics and environmental sustainability. Each stage links controlled cultivation, molecular discovery and biotechnological production, creating a clear path from species selection to industrial innovation (Leal et al., 2013; Duarte et al., 2017). The pipeline encompasses five main stages:

Biodiversity selection

Native Mediterranean species – algae, seagrasses and coral-associated micro-organisms – are cultivated under onshore controlled conditions. This approach safeguards genetic resources while providing material for molecular exploration (Ballesteros, 2006; Bracchi et al., 2022) and for commercial specialty foods.

Molecular characterization

High-throughput sequencing and AI-assisted bioinformatics identify and prioritize genes encoding bioactive compounds with potential industrial or ecological applications (Tignat-Perrier et al., 2022).

Figure 3. Advanced onshore coral cultivation facilities in Monaco. The Principality hosts one of Europe's most advanced infrastructures for ex-situ coral and marine organism culture, located at the Centre Scientifique de Monaco (CSM). This facility supports fundamental and applied research in coral biology, conservation, and marine biotechnology. As an official associate, Coraliotech benefits from Monaco's scientific ecosystem and develops complementary biotechnological applications aligned with the broader objectives of the Monaco Biome initiative. (Source: Centre Scientifique de Monaco, www.centrescientifique.mc).

Figure 4. Land-based seaweed cultivation facilities at Oregon Seaweed. Onshore cultivation tanks enable controlled growth of marine macroalgae under stable conditions, providing a sustainable alternative to open-water farming. The operational experience gained at Oregon Seaweed offers valuable insights for developing scalable bluehouse systems in projects such as the Monaco Biome. (Source: www.oregonseaweed.com).

Synthetic biology and recombinant production

Selected sequences are expressed in cell-based or cell-free systems, enabling the sustainable production of proteins, enzymes and metabolites without harvesting natural populations (Sandro and Benchaouir, 2019).

Functional and safety evaluation

Candidate molecules undergo functional assays and toxicological testing using in-vitro and ex-vivo models (Huffmyer et al., 2024).

Innovation and technology transfer

Validated findings lead to intellectual property protection and partnership agreements with industrial actors, ensuring real-world applications and added economic viability (Planas-Bielsa et al., 2020).

By integrating these steps into a single, modular framework, the Monaco Biome accelerates proof-of-concept studies while laying the foundation for scalable, internationally replicable solutions in marine biotechnology within an innovative onshore horticultural context (Figure 2).

Complementary roles: Coraliotech and Oregon Seaweed

The Monaco Biome Initiative brings together complementary expertise in marine biotechnology, onshore cultivation and scientific outreach. Each partner contributes unique capabilities to ensure scientific credibility, commercial operational efficiency and global visibility.

Coraliotech: marine biotechnology and molecular innovation

Coraliotech provides the technological backbone through its marine biotechnology laboratory in Monaco. Equipped for genomic sequencing, AI-driven gene discovery and recombinant protein production, it enables rapid proof-of-concept studies and bridges biodiversity exploration with industrial innovation (Sandro and Benchaouir, 2019; Planas-Bielsa et al., 2020). The company develops a 100% eco-responsible, biomimetic technology that relies entirely on genetic information as raw material, avoiding any extraction of the biological products it commercializes. The DNA sequences are derived from small fragments or samples collected for research purposes, ensuring that natural ecosystems remain untouched (Figure 3). With a genetic database already exceeding 11,000 entries, Coraliotech aims – through the Monaco Biome Initiative – to significantly expand this resource by sequencing a wide range of marine organisms, including animal, plant, fungal and microbial species. Using a proprietary AI-driven algorithm, the most promising genetic sequences are selected, synthesized and transfected into controlled eukaryotic or prokaryotic cell cultures, leveraging their cellular machinery to produce innovative biomolecules – peptides, proteins and enzymes – with diverse industrial, environmental and health applications. As an official associate of the company, the Scientific Center of Monaco provides additional expertise in coral biology and regulatory compliance, reinforcing certain aspects of the Initiative as required.

Oregon Seaweed: scaling bluehouse innovation from lab to market

Oregon Seaweed, a pioneer in land-based algae cultivation, provides operational experience in scaling production systems from laboratory to commercial demonstration (Sclodnick et al., 2024). The company is one of the world's leading pioneers in land-based seaweed aquaculture, operating commercial-scale bluehouses that grow nutritious red and green algae using filtered seawater. By combining horticultural precision with aquaculture/algaculture know-how, Oregon Seaweed has developed reliable systems that translate laboratory breakthroughs into scalable, real-world production. The company's farms already supply fresh seaweed to retailers and foodservice outlets across the United States, proving that marine crops can reach consumers through established agricultural channels. In the context of the Monaco Biome, Oregon Seaweed provides critical operational expertise in bridging scientific discovery with industrial deployment. Its experience in building and managing land-based algae cultivation facilities ensures that innovations in marine biotechnology can move beyond proof-of-concept to sustainable commercial impact.

By aligning with Coraliotech's molecular pipeline, Oregon Seaweed strengthens the Initiative's capacity to deliver replicable models of marine horticulture – expanding the scope of horticultural science from food security to biotechnology, carbon sequestration and ecosystem resilience (Figure 4).

Expected outcomes

The Monaco Biome Initiative aims to generate tangible outcomes across science, industry and environmental management. By integrating controlled marine cultivation, molecular discovery and biotechnology innovation, the project provides solutions with clear ecological, economic and social benefits. High value sea flora as gastronomic specialty foods is an additional revenue model with "Made in Monaco" branding to identify the territorial source of the products.

Environmental and ecological impact

Onshore cultivation of algae, seagrasses and coral-associated micro-organisms support ex-situ conservation and may help restore degraded reef ecosystems. Insights into the coral-algae symbiosis could inform new strategies to enhance coral resilience under climate stress (Hughes et al., 2017; Tignat-Perrier et al., 2022; Huffmyer et al., 2024).

Health, nutrition and cosmetics

Marine-derived biomolecules offer potential for nutraceuticals and pharmacognosy, functional foods, and cosmeceuticals with antioxidant, anti-inflammatory or skin-protective properties (Leal et al., 2013; Duarte et al., 2017; Planas-Bielsa et al., 2020).

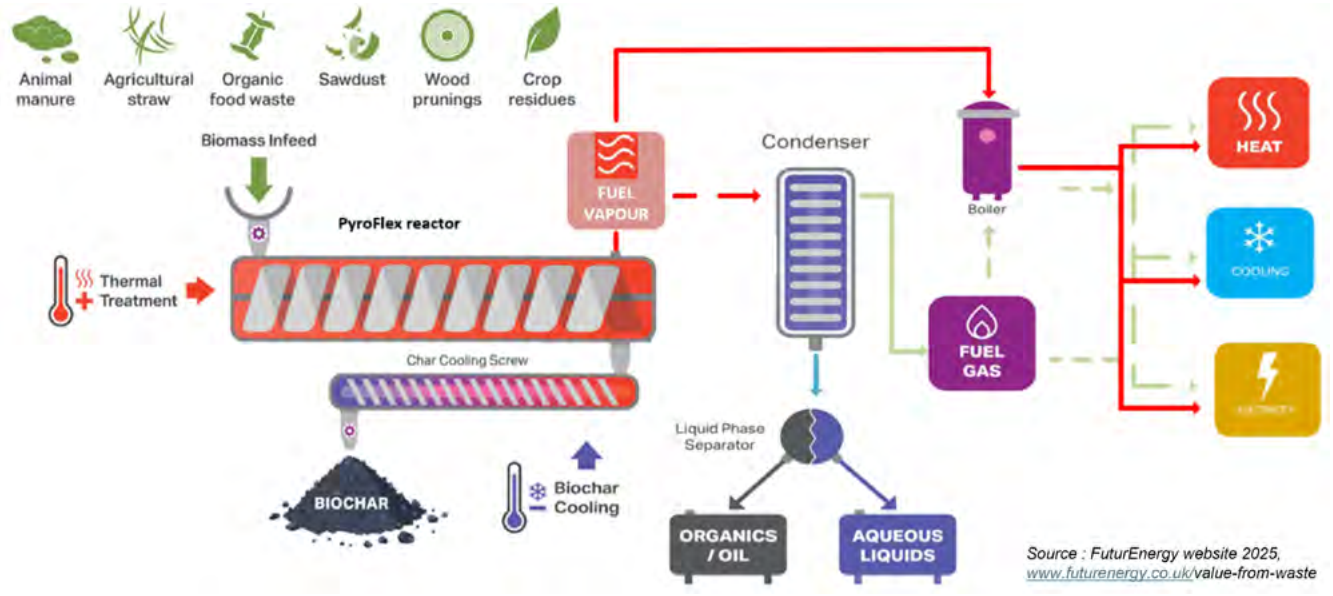

Figure 5. An example of industrial applications by the advanced pyrolysis approach. Technical introduction to a laboratory-scale Pyrolysis Research Facility 'reactor' unit proposed to M.J. NewDelman on 28 August 2025 by FuturEnergy Ltd. (UK) for advanced thermal processing of organic samples from any Biome with biochar & pyro-liquids capture. (Source: www.futurenergy.co.uk).

Industrial circular economy applications

Marine enzymes and metabolites could drive innovations in green chemistry, bioremediation and biomaterials (Figure 5) (Sandro and Benchaouir, 2019). Residual biomass might be converted into unique bio-products, such as biochar for carbon sequestration and soil health improvement.

Scientific outreach and education

By linking research excellence with practical applications, the project creates a replicable model for sustainable marine innovation, extending the scope of horticultural sciences into the blue economy. We intend to cultivate only native Mediterranean species, knowing full well that invasive species exist. What we accomplish in Monaco might provide economic proof of concept for other shore-based operations where such invasive species are native.

Conclusion

The Monaco Biome Initiative represents a new frontier for horticultural sciences, extending the principles of controlled environments, cultivar selection and productivity optimization beyond traditional agriculture into the 'controlled' marine realm (Sandro and Benchaouir, 2019; Planas-Bielsa et al., 2020). By combining onshore cultivation infrastructures, advanced molecular discovery pipelines and biotechnological innovation, the project creates a replicable model linking ecosystem conservation, commercial industrial applications and economic development.

This initiative opens a new chapter for horticulture. Just as greenhouses revolutionized plant cultivation on land, bluehouses bring these techniques to the shores of oceans (later, possibly lakes), using precise environmental control, genetic selection and scalable production methods to cultivate marine (later, possibly lacustrine) species for food, health, cosmetics and ecological restoration. By merging traditional horticultural approaches with emerging marine biotechnology, the project demonstrates how methods developed in terrestrial agriculture can be adapted to meet the challenges of the blue economy.

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› Courses and meetings

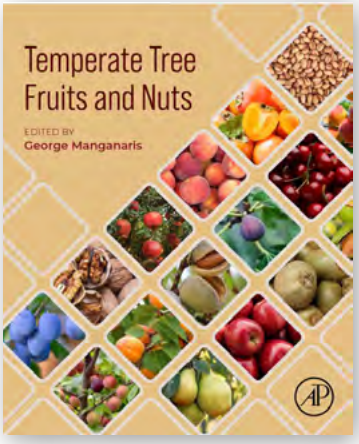
The following are non-ISHS events. Be sure to check out the Calendar of ISHS Events for an extensive listing of all ISHS meetings. For updated information, log on to www.ishs.org/calendar

California Spring Trials, 24-27 March 2026, California, USA. Info: https://caspringtrials.us/

› New books, websites

Book reviews

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



Manganaris, G., ed. (2025). Temperate Tree Fruits and Nuts (Elsevier), pp.350. ISBN 9780443291371 (paperback) / 9780443291388 (eBook). €112.99 / $120 (paperback) / €89.99 / $96 (eBook).

A 20% or 50% discount will be received when ordering through https://shop.elsevier.com/books/temperate-tree-fruits-and-nuts/manganaris/978-0-443-29137-1

This new text provides up-to-date information on a large number of temperate fruit tree (apple, pear, peach, sweet cherry, sour cherry, apricot, plum and prune, fig, persimmon and pomegranate), vine (kiwifruit) and nut (almond, walnut and pistachio) crops. The text is well organised into sections that are largely common across each of the crops (chapters) covered. These are: origin and spread, economic importance, botany and relevant species, breeding and propagation, orchard management, fruit maturation and harvest criteria, postharvest physiology and technology, and main diseases and pests. Each chapter also has a thought-provoking section on current and future challenges facing each specific tree crop.

The 78 contributing authors for the book come from a wide range of countries representing temperate crop production around the world, but most are from Europe (62%) and the United States (23%).

This book is very suitable as a general text for students and professionals involved with horticulture and the related plant sciences. The text is well organised and, in the main, easy to read. Most of the sections are very comprehensive and detailed, and well supported by appropriate, recent references. Photographs, figures and tables support the text.

The first section in each chapter, on the origin and spread of species, is informative and helpful in terms of understanding how the various tree fruit and nut species came to be cultivated in various regions around the world. Similarly, the section on economic importance allows the scale of each crop within specific countries or regions to be evaluated.

The sections on plant breeding and related genetics understandably place considerable emphasis on the important role of molecular biology. The identification of molecular markers for various traits is well covered and the role of CRISPR/Cas 9 is discussed. However, in spite of the promise of these technologies, very few examples of their successful application are presented – limited to the use of CRISPR in the breeding of non-browning Arctic apple, the use of markers for sweet almond selection, and the application of gene silencing in the development of HoneySweet plum. Further examples of, for instance, the successful use of marker assisted breeding to produce new cultivars that are naturally resistant to specific diseases or better adapted to particular growing conditions would be informative.

The overall treatment of orchard management factors is generally well delivered with factors such as propagation, rootstock selection, tree training and soil management being addressed. Nonetheless, the treatment of each crop is highly variable within the various sections, with considerable detail being provided for some crops but only sparce information for others. For example, the information provided for irrigation scheduling and nutrient management varies widely across the different tree crops. Irrigation scheduling, including the use of regulated deficit irrigation, is covered in considerable detail for almond and sweet cherry in comparison to the very general statements provided for apple.

Climate change is frequently presented as a challenge to the production of temperate fruit crops within this text. Changes to flowering dates, shortening of the length of the production season, the frequency and timing of damaging frosts and droughts, and water scarcity are all mentioned but no data are provided in the various chapters to highlight these concerns.

The sections on maturity indices and postharvest handling and storage practices are well presented and illustrated with some good sections on the roles of ethylene and 1-MCP, the uses of CA storage, and the factors involved with fruit softening. Aside from the use of mechanical harvesting for nut crops, no mention is made in the other tree fruit chapters of the recent developments in mechanical harvesting technologies and their likelihood of success, given the current labour constraints in many fruit industries.

The sections on the major diseases and pests are well presented and illustrated. However, given the pressure on registered phytosanitary products, especially in Europe, it was surprising that there is very little mention of organic production or of the emergence of bioactive compounds for a range of applications (for example, for enhancing soil health or for disease control).

The book has two shortcomings that could have been addressed in the production phase. Firstly, the multiplicity of authors used to prepare the overall text has led to some variation in writing style both within and between chapters. While this does not detract from the scientific content, a comprehensive edit would have enhanced readability. Secondly, the reference lists provided follow no particular style with journal titles sometimes appearing in full and sometimes abbreviated, book chapters being presented in different formats, italics being inconsistently used, and URLs being used in only a few cases.

Overall, this text is a valuable addition to the range of books that provide information on temperate fruit and nut crops.

Reviewed by Ian Warrington, Emeritus Professor, Massey University, New Zealand

New website

Horticultural Therapy & Therapeutic Horticulture Research & Readings Database – a comprehensive, organized collection of research studies focused on the benefits, methodologies, and applications of horticultural therapy (HT) and therapeutic horticulture (TH). It serves as a resource for researchers, practitioners, educators, policymakers, and funding organizations interested in evidence-based applications of HT/TH. Info: https://rootinnature.ca/research-database/

International Symposium on *Artemisia*

Division Horticulture for Human Health #ishs_dhea

The inaugural International Symposium on *Artemisia* took place from October 8-10, 2025, at the Aga Khan University, Arusha, Tanzania. Organized through a partnership between the International Society for Horticultural Science (ISHS), Aga Khan University, Aga Khan Foundation and La Maison de l'Artemisia, the event brought together over 130 experts, including scientists, agronomists, veterinarians and policymakers from 29 countries, to explore *Artemisia*'s immense potential for human, animal and ecosystem health.

Scientific and practical highlights

With a focus on the intersection of field practice and high-level research, as highlighted by ISHS President François Laurens, this symposium showcased a rare blend of practical experience and rigorous science. Over three days, participants engaged in inspiring keynote and scientific sessions, with topics spanning the role of *Artemisia* in malaria control and integrated One Health approaches, emphasizing its applications not only in human health but also for animal health. *Artemisia*'s potential reaches well beyond malaria to not only benefit a wide range of health systems, but also applications in biopesticide innovation and sustainable agriculture. These three days provided an opportunity to discover the practical experiences of actors in the social economy, who presented the plant's impact on sustainable farming and on strengthening communities.

A major highlight was the field excursion at Aga Khan University where participants visited *Artemisia* plantations beneath the spectacular Mount Meru, witnessing firsthand both traditional cultivation and innovative practices, including a live demonstration of drone-based spraying of a locally sourced biopesticide made in part with *Artemisia* plants. This showcased *Artemisia*'s relevance to modern precision agriculture and sustainable farming.

The event featured impactful testimonials, notably from Dr. Patient Kaloma (Congo), relating to the use of *Artemisia* in war zones. This and other contributions from Dr. Lucy Kangethe and Dr. Judith Owuor (Kenya), agronomist Mansour Ndiaye (Senegal), and representatives from Nigeria and Burundi, highlighted the strong research leadership from African nations.

Dr. Luis Matias Hernandez (Spain) presented cutting-edge advances in veterinary applications for companion animals, while Romain Duval, Pamela Weathers, Dominique Mazier, Didier van Bignoot and Xavier Simonnet, Chair of ISHS Working Group Medicinal and Aromatic Plant Genetic Resources, Breeding and Cultivation and Chair of the Scientific Committee, provided further scientific depth and breadth.

ISHS Young Minds Award

The ISHS Young Minds Award for the best oral paper was presented to Dr. Methodius Shinyuy Lahngong (Pharmacognosy, University of Liège, Belgium) for his innovative research on the cultural and therapeutic potential of *Artemisia annua* and *A. afra* in combating malaria.

A platform for the future: launch of Artemisia Connect

Building on the symposium's success, the organizers announced the launch of "Artemisia Connect," an independent global platform dedicated to *Artemisia* research. With a mission to foster exchange among researchers worldwide, the platform will organize future symposia and bi-monthly webinars to support interaction among *Artemisia* researchers and practitioners.

Strong links to practice and enterprise

Industrial sponsors – including Atelier Temenos and Tricopharming (noted for science-driven innovation in animal health) – demonstrated the value of public-private collaboration. Botanical Extracts, in particular, reflected on past *Artemisia* production in Tanzania and Kenya, further rooting the symposium in local realities and global ambitions.

› Presentation by Mansour Ndiaye, one of the high-level African researchers and practitioners attending the symposium.

› ISHS President François Laurens (left) presenting the ISHS Young Minds Award to Dr. Methodius Shinyuy Lahngong (right) for the best oral presentation.

› Demonstration of a drone spraying biopesticide with *Artemisia*.

The International Symposium on *Artemisia* stands as a pivotal event in the development of the *Artemisia* scientific community, advancing interdisciplinary research and creating a robust platform for future collaboration. ISHS President François Laurens praised the exceptional scientific quality and unique fusion of on-the-ground experience with state-of-the-art research.

Future editions and continued activity through Artemisia Connect will nurture this dynamic field, bridging continents and disciplines for the benefit of science and society alike.

Arnaud Nouvion

› Contact

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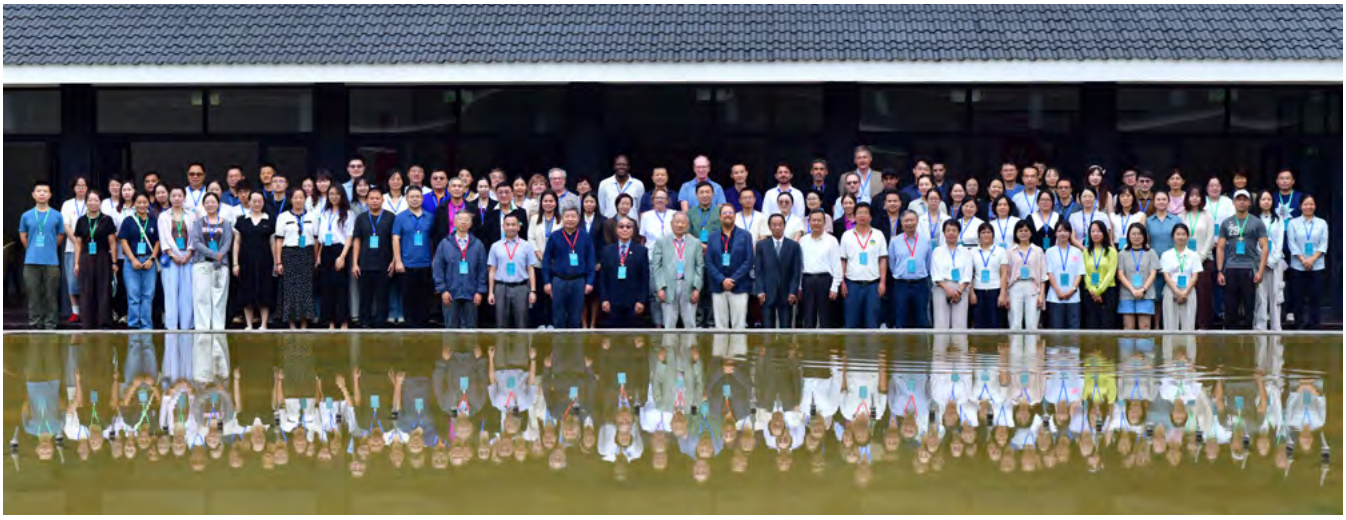
› Researchers from 29 countries visiting *Artemisia* plantations at Aga Khan University.

II International Symposium on Botanical Gardens and Landscapes

Division Landscape and Urban Horticulture **#ishs_durb**
Division Ornamental Plants **#ishs_dorn**
Division Plant Genetic Resources, Breeding and Biotechnology **#ishs_dbio**



› Participants of the symposium.

The II International Symposium on Botanical Gardens and Landscapes (BGL 2025) was successfully held from September 22-26, 2025, in Xishuangbanna, China. The symposium was organized by the Center for Gardening and Horticulture, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences (XTBG, CAS) under the aegis of the International Society for Horticultural Science (ISHS). The symposium attracted 123 participants, including presenters, accompanying persons, staff and researchers from 13 countries around the world (Australia, Benin, Brazil, China, Italy, Japan, Pakistan, Philippines, Russia, Saudi Arabia, Taiwan, Thailand, and USA).

The symposium was opened by Professor Dr. Yongping Yang, Symposium Convener, followed by a welcome address and presentation of ISHS by Professor Dr. Francesco Orsini, ISHS representative and Chair of ISHS Division Landscape and Urban Horticulture. Professor Dr. Orsini then presented the ISHS Convener award to the three Conveners: Professor Dr. Yongping Yang, Professor Fuchuan Wu and Professor Dr. Kanchit Thammasiri.

The scientific program was scheduled for two days. It began with six keynote speakers: Professor Shengji Pei, Kunming Institute of Botany, Chinese Academy of Sciences, China; Professor Dr. Jin Chen, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences, China; Professor Dr. Yonghong Hu, Shanghai Chenshan Botanical Garden, China; Professor Dr. Chunlin Long, Minzu University of China, China; Professor Dr. Irina Mitrofanova, Tsitsin Main Botanical Garden of the Russian Academy of Sciences, Moscow, Russia;

› Professor Dr. Francesco Orsini, Chair of ISHS Division Landscape and Urban Horticulture, presenting the ISHS Convener award to the three Symposium Conveners. From left to right: Professor Fuchuan Wu, Professor Dr. Francesco Orsini, Professor Dr. Yongping Yang, and Professor Dr. Kanchit Thammasiri.

› Professor Dr. Francesco Orsini, Chair of ISHS Division Landscape and Urban Horticulture, presenting the ISHS Young Minds Awards to A) Ms. Pengcheng Yu for the best oral presentation, B) Ms. Xiaohui Song for the best poster presentation. From left to right: Dr. Vichai Puripunyavanich, Professor Dr. Irina Mitrofanova, Professor Dr. Phil Allen, Ms. Pengcheng Yu (A) / Ms. Xiaohui Song (B), Professor Dr. Francesco Orsini, Professor Dr. Yongping Yang, and Professor Dr. Kanchit Thammasiri.

and Professor Dr. Francesco Orsini, Bologna University, Italy.

The 38 oral presentations were divided into three sessions: Botanical gardens and landscapes; Plant diversity and conservation; and Trends in plant technologies. In addition, 24 posters were presented. All oral and poster presentations were of interest to participants, who responded and shared knowledge and experiences with questions, suggestions and discussion. Further discussions occurred during the breaks, lunches, dinner and the technical tour, encouraging participants to exchange research ideas, projects and common interests.

At the end of the second day, a business meeting was arranged by Professor Dr. Francesco Orsini and Professor Dr. Kanchit Thammasiri. The ISHS Young Minds Awards were presented to Ms. Pengcheng Yu, Ph.D. candidate from Beijing Forestry University, China, for the best oral presentation entitled "Hybrid breeding ability and progeny analysis of polyploidy OT hybrid lilies" and to Ms. Xiaohui Song, Ph.D. candidate from Beijing Forestry University, China, for the best poster presentation entitled "Functional study of AmC4H gene in FVBPs biosynthesis in *Anthurium majus* L."

Professor Dr. Francesco Orsini proposed Professor Dr. Kanchit Thammasiri to continue serving as Chair of ISHS Working Group Botanical Gardens. The motion was approved unanimously. It was decided to hold the III International Symposium on Botanical Gardens and Landscapes in Caserta, Italy, on September 9-12, 2027 (Convener: Assistant Professor Dr. Alberto Minelli from the University of Bologna).

At the end of the symposium, Professor Dr. Yongping Yang gave the concluding remarks and expressed his appreciation to all participants and to all members of the Organizing Committee for their efforts and contributions.

The final day was entirely dedicated to a technical tour in the morning to Xishuangbanna Tropical Botanical Garden (XTBG), Chinese Academy of Sciences (CAS). XTBG was founded under the leadership of the late eminent botanist Cai Xitao in 1959. XTBG occupies an area of 1,125 ha, including a 250-ha patch of well-preserved primary tropical rainforest. More than 14,000 species of tropical and subtropical plants from China and abroad flourish in 39 living collections. In the afternoon, participants visited the Traditional Dai People Village.

Kanchit Thammasiri

› Contact

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› Visit to the Xishuangbanna Tropical Botanical Garden.

IX International Symposium on Rose Research and Cultivation

Division Ornamental Plants #ishs_dorn
Division Greenhouse and Indoor Production Horticulture #ishs_dgip

The IX International Symposium on Rose Research and Cultivation was successfully held in Beijing, China, from May 10 to 15, 2025. Organized under the auspices of the International Society for Horticultural Science (ISHS), the event brought together leading researchers, breeders and industry professionals from all around the world to advance knowledge and collaboration in rose science. The symposium program covered six major thematic areas: Genetics and genomics; Breeding, social sciences and humanities; Physiology; Secondary metabolites; Biotic and abiotic stress; Postharvest technology and processing. These topics underscored the interdisciplinary nature of contemporary rose research and its significant impact on global horticulture and regional economic development. The scientific program featured over 60 abstract submissions, including 38 oral presentations (26 by international scholars) and 22 poster displays, spanning the full spectrum of rose research from basic science to applied technology.

› Participants of the symposium.

Significant breakthroughs were presented across multiple disciplines. In genetics and genomics, researchers collaboratively developed a comprehensive phylogenetic tree of *Rosa* species, clarifying the genetic origins and evolutionary pathways of modern roses. Breeding sessions highlighted advanced multi-trait integrated breeding techniques that successfully overcome traditional limitations in combining desirable traits. Notable progress was also reported in understanding physiological responses to environmental stresses, with new insights into molecular mechanisms of drought and disease resistance. Research on secondary metabolites revealed potential pharmaceutical and nutritional applications of rose compounds, while postharvest studies provided innovative theoretical foundations for extending vase life through a better understanding of senescence mechanisms.

› Questions and discussion during the scientific sessions.

These scientific advances are driving substantial progress in rose improvement and commercialization. Breakthroughs in phylogenetic studies offer crucial insights for more effective germplasm utilization and genetic enhancement programs. Multi-trait breeding technologies enable more efficient development of new cultivars with enhanced ornamental qualities, improved fragrance and greater environmental resilience. The novel understanding of postharvest physiology promises to significantly extend vase life and reduce preservation costs, benefiting the global cut flower industry. Additionally, research on bioactive compounds opens new commercial opportunities for rose-based products in the pharmaceutical and cosmetic sectors.

In parallel, the 12th China Rose Exhibition displayed over 300 rose varieties, including stress-resistant Chinese cultivars such as 'Feiyun', 'Bingcha' and 'Beijing Red', alongside international classics. The Beijing Rose Culture Festival featured floral artistry

› Post symposium technical visit to a local garden in Mentougou, Beijing.

demonstrations and public lectures, effectively highlighting the cultural significance of roses. Mentougou District showcased its ecological advantages as a "National Forest City", with demonstration sites like the Miaofeng Mountain Highland Rose Garden serving as an excellent example of "technology-culture" integration, vividly illustrating roses' multifaceted roles in ecological conservation and urban beautification.

The symposium placed a strong emphasis on nurturing young talent through the ISHS Young Minds Awards. Meichun Zhou from Beijing Forestry University, China, received an award for her oral presentation on the functional development of rose hips, while Honami Nakasuji from Kindai University, Japan, won the poster award for her comprehensive work on powdery mildew control. These young researchers represent the promising future of rose science, bringing fresh perspectives and innovative approaches to the field.

In his closing comments, ISHS President François Laurens praised the symposium as a vital international platform, describing it as "a significant gathering for the global rose research and industry community that fosters essential collaboration between scientists and practitioners."

The event attracted approximately 150 participants from 14 countries, facilitating the exchange of knowledge and providing new opportunities for collaboration. The organizers extend their sincere gratitude to all attendees, sponsors and supporting institutions for their contributions to making this event a remarkable success.

During the ISHS Business meeting, Prof. Dr. Nan Ma was elected as the new Chair of ISHS Working Group Roses. The X International Symposium on Rose Research and Cultivation will be held in Belgium in July 2029.

Changxi Chen, Yunhe Jiang, Junping Gao and Nan Ma

› Contact

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› From left to right: Nan Ma and Junping Gao (symposium conveners), François Laurens (ISHS President), Margherita Beruto (Chair of ISHS Division Ornamental Plants) and Fabrice Foucher (former Chair of ISHS Working Group Roses) presenting the ISHS Young Minds Award to A) Meichun Zhou (best oral presentation), B) Honami Nakasuji (best poster presentation).

IV International Symposium on Germplasm of Ornamentals

Division Plant Genetic Resources, Breeding and Biotechnology
Division Ornamental Plants

#ishs_dbio
#ishs_dorn

The IV International Symposium on Germplasm of Ornamentals (ISGO) was held August 3-8, 2025, in Fort Collins, Colorado, USA, under the theme "Climate-Adapted Ornamental Plants." Organized by Colorado State University (CSU) under the aegis of the International Society for Horticultural Science (ISHS), the symposium brought together researchers, educators, and industry professionals from across the world to address the critical challenges and opportunities in developing ornamental plant germplasm resilient to a changing climate.

Scientific focus and highlights

The symposium focused on germplasm exploration, conservation, breeding, and utilization of ornamental plants with climate adaptability, water efficiency and ecological value. Presentations highlighted new advances in molecular breeding, mutagenesis and genome editing, along with applied research in landscape performance and physiological adaptation to drought and temperature stress. Discussions emphasized integrating modern technologies such as CRISPR/dCas9 systems, molecular markers and high-throughput phenotyping into ornamental plant improvement programs.

In comparison with earlier ISGO meetings, this symposium showcased a stronger emphasis on climate resilience and sustainable landscape design. The integration of genomic, ecological, and horticultural approaches reflected the field's evolution toward data-driven and environmentally responsible breeding practices.

Keynote and invited speakers addressed emerging trends in germplasm preservation, global collaboration in plant exploration, and the connection between ornamental breeding and ecosystem services. Mr. Panayoti Kelaidis of Denver Botanic Gardens, USA, presented "Plant exploration: flower lust on four continents," highlighting international efforts to identify and introduce climate-adapted ornamentals.

Research impact and future directions

Several papers presented at the symposium are expected to shape future research and practice in ornamental horticulture. For instance, investigations into leaf micromorphology among *Lagerstroemia* species provided insights for selecting drought-tolerant cultivars, while gamma irradiation mutagenesis in hardy hibiscus demonstrated poten-

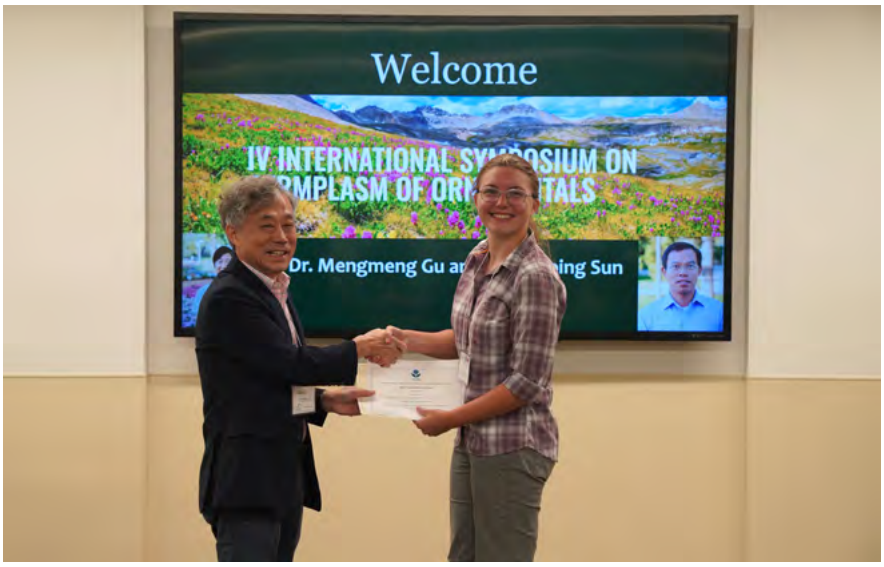
› Xinran Zheng, winner of the ISHS Young Minds Award for the best poster presentation.

› Participants of the symposium.

tial for expanding cold-hardy color variants. Research on DNA marker development for non-invasive *Euonymus alatus* will contribute to responsible breeding practices and improved invasive species management.
The discussions throughout the symposium underscored the importance of international cooperation in germplasm exchange, data sharing and coordinated field trials to accelerate breeding progress. Participants widely agreed that advancing ornamental germplasm science requires integrating genomic tools with classical breeding approaches, supported by global networks such as ISHS Working Groups and regional plant trial programs.

Awards

Outstanding student contributions were recognized through the ISHS Young Minds Awards. The best oral presentation was awarded to Lauren Eberth, University of Georgia, USA, for her paper on "Assessing microscopic leaf morphology in twelve *Lagerstroemia* species". The best poster was awarded to Xinran Zheng, University of Connecticut, USA, for her presentation on "Development of DNA markers for UConn's non-invasive ZeroSeed *Euonymus alatus* 'Compactus' ".
The symposium organizers also presented an award for the second and third placed best oral presentation by students. In second place was Greta Gallina, University of Georgia, USA, for her paper on "Mutagenesis of hardy hibiscus seed using gamma irradiation". In third place, the symposium organizers recognized the work of both Tanner Hamerling, University of Georgia, USA, for his paper on "Evaluating *Pycnanthemum* germplasm for breeding, identification, and landscape performance," and Hengsong Li, University of Connecticut, USA, for his paper on "dCas9-mediated epigenetic editing influences tomato development and physiology".



› Dr. Byoung Ryong Jeong, Chair of ISHS Working Group Plant Genetic Resources, presenting the ISHS Young Minds Award to Lauren Eberth for the best oral presentation.

Organization and participation

The symposium drew around 70 participants representing 32 institutions from 4 countries. Conveners were Drs. Mengmeng Gu (Colorado State University) and Youping Sun (Utah State University), with Dr. Byoung Ryong Jeong (Gyeongsang National University, Republic of Korea), Chair of ISHS Working Group Plant Genetic Resources, serving as the ISHS representative. The event was generously sponsored by Proven Winners-Spring Meadow Nursery, Ball Horticultural Company, and PDSI.

› As part of the post-symposium tour, participants hiked from the Alpine Visitor Center in Rocky Mountain National Park up the Alpine Ridge Trail to a viewpoint at 12,005 feet/3,659 m above sea level to observe a variety of hardy alpine plants adapted to high-elevation conditions.

Daily activities included scientific presentations, poster sessions, networking receptions and field tours. Highlights featured guided visits to the CSU Trial Gardens and Arboretum, a virtual tour of the USDA Plant Germplasm Center, and an alpine flora excursion at Rocky Mountain National Park. The program effectively balanced academic exchange with experiential learning.

Outlook

Participants expressed strong enthusiasm for sustaining the momentum of ISGO through collaborative networks and interdisciplinary research initiatives. As ornamental germplasm science continues to advance toward greater sustainability and climate resilience, the findings shared at ISGO-2025 will shape breeding priorities, conservation strategies and landscape practices worldwide.
Dr. Qixiang Zhang (Beijing Forestry University, China) announced preliminary plans to host the V International Symposium on Germplasm of Ornamentals on Hainan Island, China, in August 2028.

Mengmeng Gu and Youping Sun

› Contact

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V International Symposium on Plant Cryopreservation

Division Plant Genetic Resources, Breeding and Biotechnology

#ishs_dbio

Participants of the symposium.

From October 14-18, 2025, the V International Symposium on Plant Cryopreservation was convened at the National Agricultural Library in Beijing, China. Hosted by the International Society for Horticultural Science (ISHS) and the Chinese Society for Horticultural Sciences (CSHS), the event was organized by the Institute of Vegetables and Flowers, Chinese Academy of Agricultural Sciences (IVF-CAAS), Beijing University of Agriculture (BUA), and Beijing Shuhui Technology Co., Ltd. Over 130 experts and representatives from 14 countries participated in the event, including Prof. Kanchit Thammasiri (representing ISHS), Prof. Manuela Nagel (Chair of ISHS Working Group Conservation of Plant Genetic Resources and Genebank Management), Prof. Yanning Zhai (Deputy Director of IVF-CAAS and representative of CSHS), Prof. Lei Li (Director of the Scientific Research Department of IVF-CAAS), and Prof. Haiping Wang (Chief Scientist of the Vegetable Germplasm Resource Innovation Team and Convener of the symposium).

The opening ceremony was chaired by Prof. Lei Li. On behalf of the hosts and organizers, Prof. Yanning Zhai delivered a welcome address, extending a warm welcome to all participants gathering in Beijing, China. She emphasized the significant role of cryopreservation technology in biodiversity conservation and the preservation of germplasm resources, noting that germplasm resources constitute a core strategic asset for every country. The IVF-CAAS has attached great importance to the development of germplasm resource disciplines, establishing the National Mid-term Genebank for Vegetable Germplasm Resources and the National Germplasm Repository for Perennial and Asexually Propagated Vegetables, which provide crucial foundational material for the development of the vegetable seed sector in China and the world. Prof. Kanchit Thammasiri introduced ISHS's organizational framework and the basic procedures for hosting academic symposia under the aegis of the ISHS. He also presented the ISHS Convener award to Prof. Haiping Wang, the Convener of the symposium, in recognition of his outstanding contributions to the organization of the event and his services to ISHS. Prof. Manuela Nagel elaborated on the responsibilities of the ISHS Working Group Conservation of Plant Genetic Resources and Genebank Management, as well as the history of previous International Symposia on Plant Cryopreservation. Prof. Haiping Wang provid-

Opening ceremony: A) Prof. Lei Li, Director of the Scientific Research Department of IVF-CAAS, chaired the opening ceremony; B) Welcome address by Prof. Yanning Zhai, Deputy Director of IVF-CAAS; C) Prof. Manuela Nagel, Chair of ISHS Working Group Conservation of Plant Genetic Resources and Genebank Management and convener of the VI International Symposium on Plant Cryopreservation in 2029.

› A) Prof. Kanchit Thammasiri (right), ISHS representative, presenting the ISHS Young Minds Award for the best oral presentation to Jingyin Bao (left). B) Prof. Haiping Wang (left), Convener of the symposium, presenting the ISHS Young Minds Award for the best poster presentation to Shuyu Zhong (right).

ed a detailed overview of the symposium's preparation process and agenda.

During the symposium, key invited talks were delivered by Prof. Qiaochun Wang from Northwest A&F University, China; Prof. Hugh Pritchard, Former Head of Germplasm Conservation at the Royal Botanic Gardens, United Kingdom; and Prof. Surendra Kumar Malik from the National Bureau of Plant Genetic Resources, India. The symposium focused on six thematic areas: Plant biodiversity and plant genetic resources; Cryo genebanks of germplasm; Cryopreservation techniques and protocols; Advances in fundamental cryobiology in plant preservation; Cryopreservation of rare and endangered species; and Molecular mechanisms of cryopreservation. A total of 27 national and international experts gave oral presentations, while another 13 participants showcased their research during poster sessions.

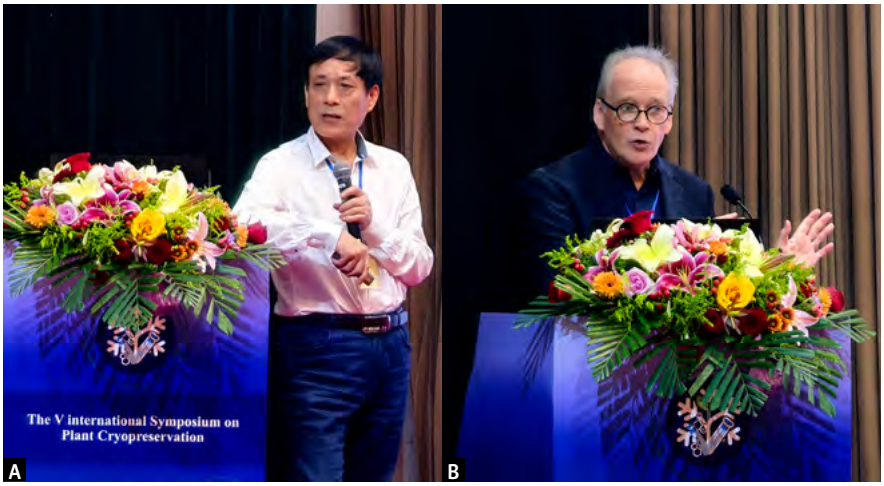
Acknowledging the participation from younger members of the Society, the ISHS Young Minds Awards were presented to Jingyin Bao from the University of Queensland, Australia, for the best oral presentation entitled "Improving cryopreservation success through optimized pre-cryo culture conditions: a case study on *Gossia fragrantissima*" and Shuyu Zhong from the Institute of Crop Sciences, Chinese Academy of Agricultural Sciences, China, for the best poster entitled "Survival after cryopreservation in sweet potato is mediated by different light qualities".

› Visit to the Exhibition Greenhouse for New Vegetable Varieties.

During the symposium, participants visited the Experimental Farm of IVF-CAAS, the Exhibition Greenhouse of the Vegetable and Flower Germplasm Resource, the National Mid-term Genebank for Vegetable Germplasm Resources, and the National Crop Genebank. These visits provided them with an in-depth understanding of China's progress in the preservation and utilization of crop germplasm resources.

During the ISHS Business meeting, Prof. Manuela Nagel was elected to continue as Chair of ISHS Working Group Conservation of Plant Genetic Resources and Genebank Management. The VI International Symposium on Plant Cryopreservation will be convened by Prof. Nagel in May 2029 in Germany.

Haiping Wang



› Keynote presentation of A) Prof. Qiaochun Wang, Northwest A&F University, China; B) Prof. Hugh Pritchard, UK.

› Contact

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XI International Congress on Cacti as Food, Fodder and Other Uses

Division Temperate Tree Fruits #ishs_dfru

› Participants of the congress

The XI International Congress on Cacti as Food, Fodder and Other Uses, held from May 6-9, 2025, in Tenerife, Canary Islands (Spain), brought together 114 participants from 17 countries. Organized by the Instituto de Investigación en Ciencias de la Alimentación (CIAL, CSIC-UAM), the Instituto Canario de Investigaciones Agrarias (ICIA), and the Cabildo de Tenerife, in collaboration with FAO-ICARDA CactusNet and the International Society for Horticultural Science (ISHS), the congress provided an international platform for scientific exchange and collaboration in cactus research and innovation.

The scientific program featured one opening lecture, seven plenary lectures, 36 oral presentations, and two round tables addressing key themes such as cultivation and postharvest management, pest and disease control, processing and commercialization, nutritional and functional properties, and the use of cacti as fodder and bioresources. For the first time, the congress hosted a Young Researchers' session, with nine oral presen-

› Luca Corelli Grappadelli (left), Chair of ISHS Division Temperate Tree Fruits, presenting the ISHS Convener award to M. Pilar Cano (center) and M. Gloria Lobo (right).

› Winners of the ISHS Young Minds Awards: Giuseppe Greco, best oral presentation (right) and Sara Parralejo Sanz, best poster presentation (left).

tations that stimulated dynamic discussion and highlighted emerging talent in the field. Additionally, 58 posters were presented, 13 of which focused on other cacti species such as dragon fruit, garambullo and others.

Overall, 80% of the communications concentrated on the genus *Opuntia* – particularly *Opuntia ficus-indica* – while the remaining contributions explored other members of the *Cactaceae* family. Discussions underscored the importance of cacti for sustainable agriculture, climate-resilient food systems and the circular bioeconomy, reaffirming their status as strategic crops for food security and socio-economic development in arid and semi-arid regions.

The ISHS Young Minds Awards were presented to Dr. Giuseppe Greco from the University of Palermo, Italy, for the best oral presentation entitled "Impact of *Opuntia ficus-indica* chronosequence on soil carbon mineralization and fertility" and to Ms. Sara Parralejo Sanz from the Institute of Food Science Research, Spain, for the best poster presentation entitled "Immunomodulatory potential of *Opuntia* fruits green extracts".

The organizing committee gratefully acknowledges the generous support of all sponsors, whose invaluable contributions made this event possible: dryGrow, Cabildo de Gran Canaria, ACCISI, Volcanic Xperience, ASAGA Canarias ASAJA, COPLACA, Fundación Cajasiete, ICCA, Analysis, Biotein, FAST, Garañaña, ASOCAN, BIOSIGMA, COAG, Horticulture, Scharlab, Tropican, Bernardos, Casa de los Balcones, Pérez Cairós, Tuno Canarias, Ayuntamiento de Adeje, and Tenerife Convention Bureau.

The XII International Congress on Cacti as Food, Fodder and Other Uses will be held in January 2028 in South Africa.

M. Pilar Cano and M. Gloria Lobo

› Congress technical visit to the dragon fruit cultivation of José Rendón, supported by Cabildo de Tenerife specialists in Tenerife.

› Congress technical visit to Tuno Canarias in Tenerife.

› Contact

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Dr. M. Gloria Lobo, Instituto Canario de Investigaciones Agrarias (ICIA), Carretera del Boquerón s/n, 38270 Valle de Guerra, Canary Islands, Spain, e-mail: globo@icia.es

VI International Symposium on Pomegranate and Minor Mediterranean Fruits

Division Temperate Tree Fruits #ishs_dfru

The VI International Symposium on Pomegranate and Minor Mediterranean Fruits (POMSYM2025) was held from September 22-25, 2025, in Bari, Puglia region, Italy, under the aegis of the ISHS. It was convened by Prof. Giuseppe Ferrara (University of Bari 'Aldo Moro', Italy) and Prof. Stefano La Malfa (University of Catania, Italy) with the support of Agridatalog, a spin-off of the University of Bari.

The symposium provided an opportunity for the scientific community working on pomegranate and other minor fruit species to discuss and exchange updated knowledge. The symposium addressed a wide range of subjects, including archaeology and history, physiology, germplasm and breeding, orchard management, harvest and postharvest, diseases and disorders, processing, nutraceuticals, and other aspects related to the food industry.

The symposium was attended by 86 participants from different parts of the world, including Croatia, Cyprus, France, Hungary, Israel, Italy, Mexico, Peru, Poland, Portugal, South Africa, Spain, Turkey, the United Kingdom, and the United States. There were five oral sessions with 43 speakers and 35 posters. During the symposium four keynote presentations were delivered by leading experts in the field, each addressing important aspects of either pomegranate or other fruit species. The keynote address by Prof. Ali Sarkhosh (University of Florida, USA) entitled "Global status of pomegranate production: challenges and opportunities" focused on the present situation of pomegranate cultivation and production in the world and on the current challenges and future trends for this species. Prof. Luis Cisneros-Zevallos (Texas A&M University, College Station, Texas, USA) delivered a keynote address entitled "Husk scald in pomegranate is a stress-induced senescence event: triggered by water loss, exacerbated by low RH, and attenuated by low oxygen", which accurately described the situation and advancements in addressing this physiological problem of pomegranate fruit. The keynote address by Prof. Olaniyi A. Fawole (University of Johannesburg, APK Campus, South Africa) entitled "Pomegranate research for capacity building: insights from a value chain-based approach in South Africa" described the production chain of this species in South Africa. The last keynote lecture entitled "Optimizing postharvest han-

› Prof. Olaniyi Fawole, Chair of ISHS Working Group Pomegranate and Minor Mediterranean Fruits, presenting the ISHS convener award to the symposium conveners, Prof. Giuseppe Ferrara (left) and Prof. Stefano La Malfa (right).

› Participants of the symposium.

› Prof. Ali Sarkhosh giving the keynote lecture.

dling for enhanced quality and utilization of goji berries (*Lycium barbarum* L.)" was delivered by Prof. Maria Luisa Amodio (University of Foggia, Italy), who showed the audience the possibilities of cultivation and utilization of goji.

All the sessions and presentations were followed by debates, animated not only by scientists, but also by contributions from technicians and growers.

Highlights included: the release of a new early season pomegranate variety, along with the description of several varieties; the characterization of 20 prickly pear genotypes selected from the eastern Mediterranean region of Turkey; the description of omics and sensing approaches applied to tackle fruit cracking; fermentation of pomegranates with *Hanseniaspora valbyensis*; the genetic variation in fig trees to identify molecular markers linked to abiotic stress responses; chilling requirements for some pomegranate cultivars; and the application of gellan gum-based hydrogel loaded with pomegranate peel extract for cartilage tissue regeneration. Overall, the presentations offered practical advice for commercial application (cultivation, storage, byproducts), provided important hints for future research (non-destructive analysis, coatings, genetics) and exchanged information on the cultivation and postharvest of ancient and new varieties of pomegranate and other minor fruit species.

Attendees also had the opportunity to participate in a technical visit to the most important company for the cultivation and processing of pomegranate in Italy, Lome Super Fruit, in Castellaneta Marina (Puglia region), where pomegranate orchards and fruit packing and sorting facilities were visited. During the symposium a pomological exhibition of minor fruit tree species was held along with the display of some products produced by local companies and nurseries.

In recognizing the outstanding contributions from students and early career researchers, ISHS presented two Young Minds Awards. The award for best oral presentation was presented to Raesibe Kgaphola from the University of the Free State, South Africa, for her talk entitled "Comparison of *Punica granatum* L. leaf area index determined using in situ and remote sensing techniques". The award for best poster presentation was given to Alessandro Pesole from the University of Bari 'Aldo Moro', Italy, for his work entitled "Stomatal traits in pecan [*Carya illinoinensis* (Wangenh.) K. Koch]: varietal differences and seasonal adaptations under Mediterranean conditions".

During the ISHS Business meeting, Prof. Olaniyi Fawole was confirmed as Chair of ISHS Working Group Pomegranate and Minor Mediterranean Fruits. An election was held to determine the host of the next symposium, with Prof. İbrahim Kahramanoğlu from Northern Cyprus receiving the majority of votes. Accordingly, Northern Cyprus was recommended as the preferred destination for the next International Symposium on Pomegranate and Minor Mediterranean Fruits in 2028.

› Prof. Giuseppe Ferrara, Prof. Stefano La Malfa, Dr. Phumudzo Tharaga and Prof. Olaniyi Fawole presenting the ISHS Young Minds Awards to Ms. Raesibe Kgaphola (third from left) for the best oral presentation and Mr. Alessandro Pesole (second from left) for the best poster.

Giuseppe Ferrara and Stefano La Malfa

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› Participants during the technical tour at the Italian company Lome Super Fruit, the most important one in Italy for pomegranate production and processing.

› Some minor fruit species at the pomological exhibition.

XI International Congress on Hazelnut

Division Temperate Tree Nuts #ishs_dnut

The XI International Congress on Hazelnut was held in Beijing, China, from August 4 to 8, 2025. The congress was organized by the Research Institute of Forestry, Chinese Academy of Forestry, under the aegis of the International Society for Horticultural Science (ISHS).

Hazelnut (*Corylus* L.) is one of the most important nut crops and woody oil plants, having high economic and nutritional value. The genus *Corylus* is widely distributed across temperate regions of the northern hemisphere. Thirteen species are commonly recognized by taxonomists around the world. It is considered that 8 species and 2 varieties of hazelnut originated in China, among which, Ping is the most widespread wild species with about 75,000 ha being cultivated for nut production. Ping'ou hybrid hazelnuts are now widely cultivated for commercial production, with around 130,000 ha planted in China.

The theme of the congress was "Hazelnut: forest food and oil plant", which highlighted hazelnut as one of the most important multiple-usage crop trees. The session topics were: Hazelnut status, marketing, and policies; Genetics, germplasm and genetic improvement; Regionalized cultivation and cultivar evaluation; Biology, physiology and propagation; Orchard management; Pests and diseases; Postharvest, processing and utilization; Hazelnut industry and rural economy.

› Prof. Dr. Roberto Botta (left), former Chair of ISHS Working Group Hazelnuts, and Prof. Dr. Jianguo Zhang (right), Convener of the XI International Congress on Hazelnut, presenting the ISHS Young Minds Awards to Andrea Ferrucci (second from left) for the best oral presentation and Suilin Zhang (second from right) for the best poster presentation.

This congress brought together researchers, educators, students, industry professionals and others interested in hazelnut to share their experiences. A total of 170 representa-

› Participants of the congress.

tives participated in this congress, among which 70 were international representatives from the USA, Italy, Turkey, France, Chile, Georgia and other hazelnut growing countries. More than 200 people participated in the opening ceremony. The event attracted many important guests who were managing industry related associations. As an important international congress, this activity was reported by many media in China, including CCTV, People's Daily, and Science and Technology Daily.

A total of 103 abstracts were accepted, including 62 oral and 41 poster presentations. At the end of the congress, two young researchers were awarded for their inputs: Andrea Ferrucci, from University of Tuscia, Italy, won the ISHS Young Minds Award for the best oral presentation entitled "Preliminary results of a nearly complete genome assembly of European hazelnut Italian cultivar 'Tonda Gentile Romana' ". Suilin Zhang, from Beijing Forestry University, China, won the ISHS Young Minds Award for the best poster presentation entitled "The molecular mechanism of gibberellin regulates sex differentiation in *Corylus heterophylla* × *Corylus avellana*".

The special feature of this congress was the close association with the hazelnut industry. Besides the session topics "Hazelnut status, marketing, and policies" and "Hazelnut industry and rural economy", a hazelnut products exhibition was set up outside the congress venue to display hazelnut related products. The exhibition attracted a large number of domestic and international visitors. The congress really appreciated Ferrero Trading Lux S.A. Luxembourg for offering financial support to invite more hazelnut experts to share their knowledge. Forestry and Grassland Bureau of Jilin Province, Liaoning Institute of Economic Forestry and Hebei Agricultural University engaged with academic and industry experts in China to encourage their participation. Some nut and dried fruit companies offered their products for consumption during the coffee breaks.

› Participants of the congress in front of the gate of the Great Wall.

› The hazelnut products exhibition attracted a large number of domestic and international visitors.

We hope that the five-day academic exchange program, the enthusiasm of the volunteers, the visit to the Great Wall and the audience participation during the dinner party will provide wonderful memories for all those present.

During the ISHS Business meeting, Prof. Dr. Veli Erdogan was elected as the new Chair of ISHS Working Group Hazelnuts. The XII International Congress on Hazelnut will be held in June 2029 in Italy.

Jianguo Zhang, Qinghua Ma and Lisong Liang

› Prof. Dr. Roberto Botta (left), former Chair of ISHS Working Group Hazelnuts, congratulating A) Prof. Dr. Veli Erdogan, new Chair of ISHS Working Group Hazelnuts, B) Assoc. Prof. Daniela Farinelli (left) and Assoc. Prof. Valerio Cristofori (right), Conveners of the XII International Congress on Hazelnut, June 2029, Italy.

› Contact

Prof. Jianguo Zhang, Congress Convener, and Dr. Qinghua Ma and Dr. Lisong Liang, Scientific Secretariat, Research Institute of Forestry, Chinese Academy of Forestry (RIF, CAF), Dongxiaofu No.1, Xiangshan Road, Haidian District, Beijing, 100091, China, e-mail: chinahazelnut2025@163.com, mqhmary@sina.com and lianglscaf@126.com

IX International Symposium on Seed, Transplant and Stand Establishment of Horticultural Crops and III International Symposium on Vegetable Grafting

Division Vegetables, Roots and Tubers #ishs_dveg
Division Greenhouse and Indoor Production Horticulture #ishs_dgip

The "IX International Symposium on Seed, Transplant and Stand Establishment of Horticultural Crops" and the "III International Symposium on Vegetable Grafting", held from June 2 to 6, 2025, in Thessaloniki, Greece, was organized by Aristotle University of Thessaloniki under the aegis of the International Society for Horticultural Science (ISHS). This symposium brought together members from two ISHS Divisions (Division Vegetables, Roots and Tubers, and Division Greenhouse and Indoor Production Horticulture) and two ISHS Working Groups (Working Group Crop Establishment, Seed and Transplant Technology, and Working Group Vegetable Grafting).
The symposium attracted 100 delegates from 18 countries. The joint symposium provided a meeting point for scientists, researchers, academics and professionals in the field of seed, and seedling production and marketing, providing an ideal platform for the exchange of knowledge, experiences and research findings. In addition, the choice of Thessaloniki gave participants the chance to experience the cultural wealth and hospitality of northern Greece.
The scientific program included 35 oral and 41 poster presentations with flash-talks, distributed in thematic sessions related to seedling production technology, vegetable grafting, seed management, and artificial light utilization for seedlings. Moreover, subjects such as the mitigation of abiotic factors and biodiversity were also covered and discussed. The program included an interesting workshop on the "Challenges and opportunities for vegetable propagation material" with emphasis on the vital role of nurseries and the seed sector. Moreover, a round table was held with participants from the seed and nursery sectors (research and industry) around the world, where international developments, recent market trends and potential synergies were discussed.
The participation of young scientists was remarkable. During the symposium, ISHS Young Minds Awards were presented for the best oral and poster presentations. A panel

› Daniel Leskovar, former Chair of ISHS Division Vegetables, Roots and Tubers, Ferdinando Branca, Chair of ISHS Division Vegetables, Roots and Tubers, and Silvana Nicola, former Chair of ISHS Section Vegetables, presenting the ISHS Young Minds Awards to Anna Gkotzamani for the best oral presentation (left) and Ryohei Kobayashi for the best poster presentation (right).

› Participants of the symposia.

of six distinguished international experts evaluated the candidates and selected the winners. Prof. Dr. Daniel Leskovar, Prof. Dr. Silvana Nicola, and Prof. Dr. Ferdinando Branca presented the awards as follows: Anna Gkotzamani from Aristotle University of Thessaloniki, Greece, was awarded the best oral presentation for her paper entitled "Dynamic lighting for growing watermelon scion seedlings in a PFAL", while Ryohei Kobayashi from Tamagawa University, Tokyo, Japan, was awarded the best poster presentation entitled "Study on high yields of potato microtubers formed by long-day conditions using temporary light interruption treatment".

The ISHS business meeting was presided over by Prof. Dr. Ferdinando Branca, Chair of ISHS Division Vegetables, Roots and Tubers, who congratulated the Symposium Convener, Assoc. Prof. Dr. Athanasios Koukounaras, and the organizing committee for their efforts. Assoc. Prof. Dr. Athanasios Koukounaras was elected as the new Chair of ISHS Working Group Crop Establishment, Seed and Transplant Technology, and Dr. Xin Zhao was elected to continue as Chair of ISHS Working Group Vegetable Grafting.

› Field trip at AGRIS S.A. facilities with focus on grafting watermelon seedlings production.

The symposium concluded with a technical and cultural visit at the state-of-the-art nursery facilities of AGRIS S.A., in Kleidi Imathias, where innovative techniques for seed disinfection and handling, vegetable seedling production, grafting and healing were demonstrated and discussed. A visit to the Olympus National Park Information Centre in Litochoro offered the participants a complete experience combining technical knowledge, with natural and cultural highlights.

Athanasios Koukounaras and Filippos Bantis

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› ReThink Food Challenge: young innovators globally rethink the future of food based on space research

After six months of hard work, the ReThink Food Challenge culminated in a final showcase at Wageningen University & Research at the end of May 2025. This global competition began with 360 students representing 148 universities from 50 countries. All were challenged to develop a business idea that offered an innovative, circular, and sustainable approach to growing food on Earth by learning from research on space farming.

For this challenge, proposed ideas were expected to enhance existing technologies, introduce new ones, or entirely reimagine the concept of 'food'. Two key topics within (space) farming were considered: indoor farming or alternative proteins. Participating teams were tasked to identify a real-life problem and a concrete market, then design and develop a viable innovation to fill that gap.

From a diverse and talented pool of 46 teams, 11 finalists were selected. All presented their innovative ideas, ranging from circular farming and alternative proteins to precision agriculture tools.

The International Society for Horticultural Science (ISHS) proudly supported the initiative, with Vice-President Patricia Paiva serving on the selection committee.

Winner: from space research to kitchen gardens

The winning team, The HAB (Morgan Timme, Fuyuki Wakayama, Marcus Mortensen, Leah Jin and Feoddor Gabsatarov (not present on the picture)), took home the € 7,000 grand prize for their indoor farming innovation inspired by space technology. Comprised of Bachelor's and Master's students from Wageningen University & Research (The Netherlands), the team developed Astro Gel, a plant-based, food-grade hydrogel designed to support low-cost, small-scale food production at home.

Astro Gel uses significantly less water and energy than conventional hydroponic systems. Their clean, safe and edible composition makes them particularly well-suited for households with children. Compared to traditional substrates like peat, coir or rockwool, Astro Gel is not only more affordable, but also offers key operational advantages: it can

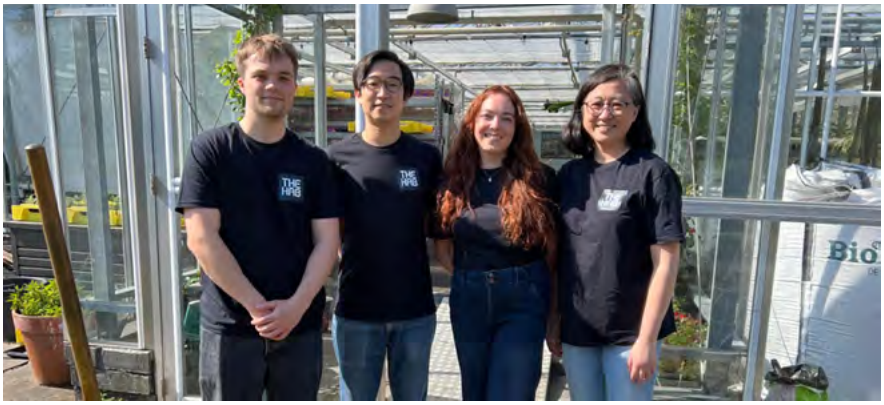
› Winners of the ReThink Food Challenge 2025: Synergrown, The HAB, MAI Farm, and AstraAlgae (left to right).

be compactly shipped, remelted and reused. With working prototypes already in use, the team is now exploring local seaweed sourcing and certification pathways for peat-free labelling and carbon credit eligibility. Astro Gel allows anyone to "farm like an astronaut" and create circular, sustainable food systems at home (https://www.rethinkfoodchallenge.nl/candidate/details/37705).

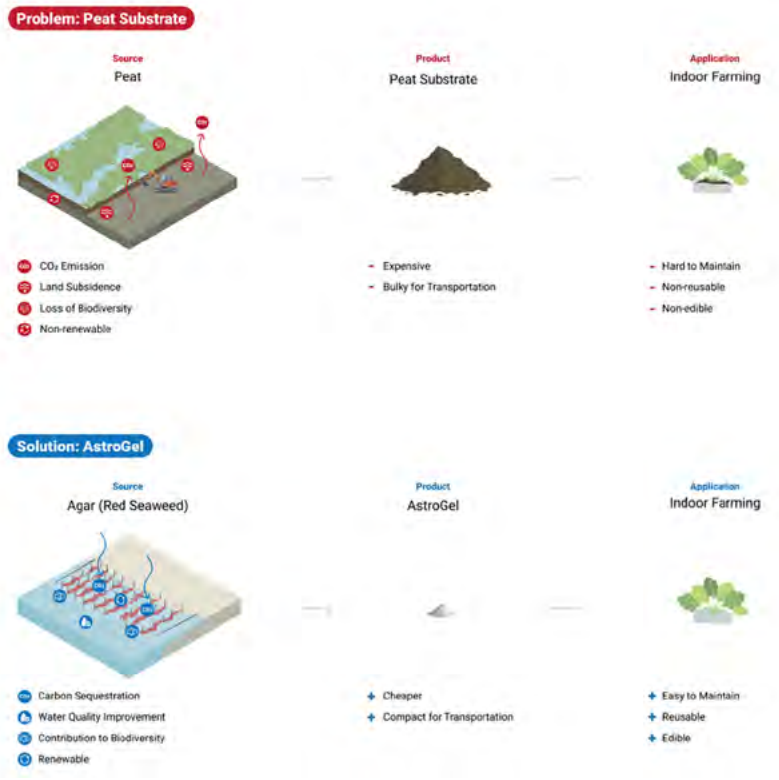
2nd place: runners-up target pet nutrition

Second place went to Synergrown (Jinsoo Kim, Melania Zanforlin, Joaquin Fogel, Andres Montaña, George Truijens and Sahana Yaragatti), a multidisciplinary team that combined biosystems engineering and food technology expertise. This team, also from Wageningen University & Research (The Netherlands), was comprised of Master's students whose hybrid approach combined vertical farming with cellular agriculture to produce cultivated fish proteins. These are incorporated into sustainable pet food tailored for vegan pet owners, an emerging niche with complex formulation challenges.

Inspired by space farming research, where zero-waste is mandatory, circular systems are critical for growing food in extreme environments. The system combined plant and cellular agriculture into a closed-loop and sustainable ecosystem. Integrating cultivated meat production with circularity principles, the system combined a multi-stage bioreactor for growing fish cells with a vertical farm that grew the production inputs. This reduced the dependency on synthetic inputs, minimized waste and ensured efficient resource utilization. As a result, the products avoided many of the issues associated with traditional animal-based feeds, such as unwanted residues from vaccines, microplastics and other contaminants that can be harmful to pets. This approach is not



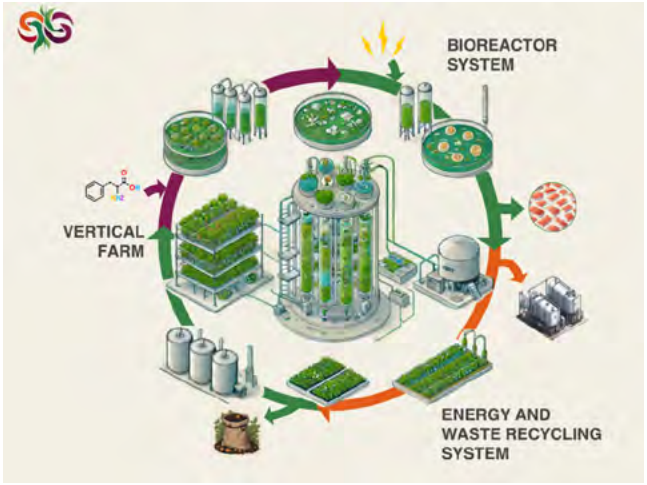
› The HAB team develops edible hydrogel to enable sustainable, small-scale food production in urban homes.



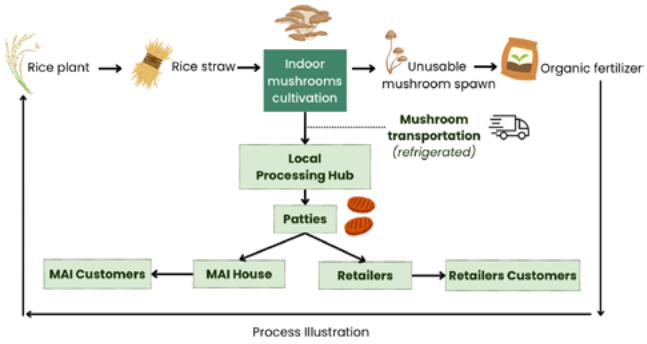
› Astro Gel, developed by The Hab team.

› Synergrown team.

› MAI Farm team.



› Diagram of the system proposed by Synergrown team.



› Diagram of the process proposed by MAI Farm team.

only more sustainable and animal-friendly, but it also dramatically reduced production costs. The fish-cell-based formula is designed to be hypoallergenic and nutritionally suitable for both dogs and cats, the latter of which are often overlooked by current vegan pet food alternatives (https://www.rethinkfoodchallenge.nl/candidate/details/41368).

3rd place: waste valorization

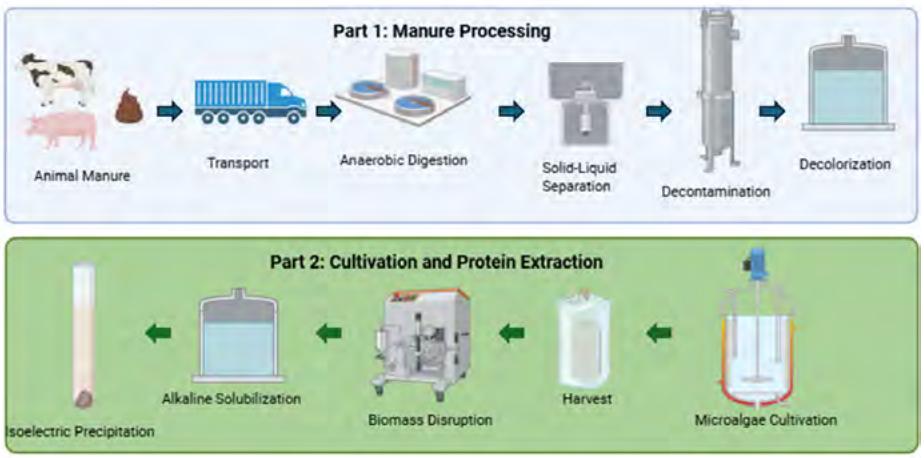
In third place, MAI Farm (Chi Nguyen and An Nguyen), a team of Bachelor degree students from Vin University (Vietnam), addressed a persistent environmental concern: rice straw burning in Southeast Asia. Their solution converted agricultural waste into substrates for mushroom farming, producing both high-protein ingredients and consumer-ready meat alternatives, distributed through a restaurant model.

MAI Farm tackled this challenge with a fully circular model that transformed agricultural waste into nutrition. The idea was to upcycle rice straw, typically burned, into high-protein mushrooms through indoor regenerative farming that mimics closed-loop principles. The spent substrate then became organic fertilizer, completing the cycle. These mushrooms were crafted into clean-label, affordable patties, providing a nutritious and sustainable protein alternative while minimizing waste across every step of the value chain (https://www.rethinkfoodchallenge.nl/candidate/details/41432).

Audience Award

The Audience Award went to AstraAlgae (Windy Yeh, Nadia Putri Az Zahra Julianto, Maria Gayà Rosselló, Rafailia Groudou and Nurwahdah Nurwahdah) from Wageningen University & Research (The Netherlands), which presented a closed-loop system that transformed livestock manure into hypoallergenic microalgae protein for use in functional foods and dietary supplements. By

› AstraAlgae team.



› Process diagram proposed by AstraAlgae team.

cultivating *Chlorella vulgaris* in photobioreactors, the process yielded a nutrient-dense, low-allergen protein tailored to the needs of the health and wellness industry.

Life cycle assessment comparisons revealed significant environmental benefits: up to 90% less land use and over 65% lower greenhouse gas emissions compared to conventional whey protein. The product also avoided common allergens like soy, meeting the growing demand for hypoallergenic nutrition.

Final remarks

This challenge was about more than just great ideas: it was about testing them in the real world. The ReThink Food Challenge encouraged students to confront the complexity of modern food systems and develop solutions with real-world potential.

With a strong emphasis on market readiness, the program pushed participants to progress early-stage concepts into viable ventures. A diverse portfolio of ideas is now entering prototyping and pilot phases, highlighting the importance of interdisciplinary collaboration in tackling global food challenges.

Over the next six months, teams will receive expert guidance from coaches in agronomy, engineering, business and food systems. Feasibility testing, stakeholder engagement and market validation are essential components of the journey.

Patrícia Duarte de Oliveira Paiva and Rebeka Bílik

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From the Secretariat

New ISHS members

ISHS is pleased to welcome the following new members:

New Individual Members

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› In memoriam

Dr. Lusike Wasilwa (21 June 1963-20 September 2025)

A pioneer in horticultural research dedicated to sustainable development.

ISHS would like to pay tribute to Dr. Lusike Wasilwa, an exceptional Kenyan researcher and Director of Research at the Kenya Agricultural and Livestock Research Organization (KALRO), whose passion and scientific rigor have had a profound impact on horticulture in Kenya and across the African continent.

A renowned specialist in tropical horticulture, Dr. Lusike was first of all a warm human being. She dedicated her life to linking people, especially scientists, to the real needs of primary producers, promoting the emergence of more productive, sustainable and inclusive agriculture. Through her commitment, she strengthened food and nutrition security, improved the competitiveness of the horticultural sector, and enhanced the resilience of agricultural systems in the face of climate change.

Beyond Kenya, Dr. Lusike had forged strong international partnerships, actively collaborating with institutions such as the International Society for Horticultural Science (ISHS), the Center for International Cooperation in Agricultural Research for Development (CIRAD), the Food and Agriculture Organization of the United Nations (FAO), the United States Agency for International Development (USAID), and many other research and development organizations. She was the driver of the first All Africa Horticultural Congress in Nairobi (2009). These collaborations helped to disseminate knowledge, support innovation and strengthen the scientific capacity, both globally and within Africa.

She will be remembered as a generous visionary, a committed scientist and a tireless ambassador for horticultural development in Africa.

Rémi Kahane, Vice-Chair of ISHS Division Horticulture for Development

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Year 2026

- January 18-23, 2026, Tatura, Victoria (Australia): **XI International Symposium on Irrigation of Horticultural Crops.** Info: Dr. Alessio Scalisi, Tatura SmartFarm, Agriculture Victoria Research, Dept Energy, Environment and Climate Action, 255 Ferguson Rd, Tatura, Victoria 3616, Australia. E-mail: alessio.scalisi@agriculture.vic.gov.au or Dr. Ian Goodwin, Tatura SmartFarm, Agriculture Victoria Research, Dept Energy, Environment and Climate Action, 255 Ferguson Rd, Tatura, Victoria 3616, Australia. Phone: (61)354831101, Fax: (61)358335299, E-mail: ian.goodwin@agriculture.vic.gov.au or Prof. Pablo J. Zarco-Tejada, SAFES, Faculty of Science, and, Department of Infrastructure Engineering, Faculty Engineering & Information Technol., Univ. Melbourne, Parkville, Victoria 3052, Australia. E-mail: pablo.zarco@unimelb.edu.au Web: https://www.irrigation2026.com.au/
- January 26-31, 2026, Kaohsiung City (Chinese Taipei): **VII International Jujube Symposium.** Info: Dr. Wen-Li Lee, Taiwan Agricultural Research Institute, No.530, Wenlong E.Rd., Fengshan Dist., 83052 Kaohsiung City, Chinese Taipei. Phone: (886)7310191, E-mail: wenlly@tari.gov.tw Web: https://jujube2026.com/ NEW
- March 15-20, 2026, Skukuza (South Africa): **IV International Symposium on Beverage Crops.** Info: Prof. Dr. Olaniyi Fawole, Postharvest & Agroprocesing Research Centre, Department of Botany & Plant Biotechnology, University of Johannesburg, APK Campus, South Africa. E-mail: olaniyif@uj.ac.za Web: https://bevcrops2026sa.carlamani.com/
- April 28-30, 2026, Abu Dhabi (United Arab Emirates): **VIII International Date Palm Conference.** Info: Prof. Dr. Abdelouahhab Zaid, Date Palm Research & Dev. Programme, UAE University, PO Box 81908, Al Ain, United Arab Emirates. Phone: (971)3 7832334, Fax: (971)3 7832472, E-mail: abdelouahhabz@diwan.gov.ae
- May 3-7, 2026, Lleida (Spain): **IX International Symposium on Almonds and Pistachios.** Info: Dr. Xavier Miarnau, IRTA-Fruitcentre, Parc Agrobiotech, Parc de Gardeny, 25003 Lleida, Spain. Phone: (34)675788825, E-mail: xavier.miarnau@irta.cat or Dr. Joaquim Bellvert Rios, Parc de Gardeny, IRTA Fruitcentre, 25003 Lleida Lleida, Spain. Phone: +34669012747, E-mail: joaquim.bellvert@irta.es Web: https://www.almondpistachio2026.com/
- May 17-21, 2026, Chania, Crete (Greece): **X Southeastern and Eastern Europe Symposium on Vegetables and Potatoes.** 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 Assist. Prof. Georgia Ntatsi, Agricultural University of Athens, Laboratory of Vegetable Crops, Iera Odos 75, 11855 Athens, Greece. Phone: (30)2015294532, E-mail: ntatsi@aua.gr or Prof. Dr. Nazim Gruda, University of Bonn, INRES Horticultural Sciences, Auf dem Hügel 6, 53121 Bonn, Germany. E-mail: ngruda@uni-bonn.de Web: http://10seevp2026.maich.gr/
- May 18-22, 2026, Lofthus, Ullensvang (Norway): **VIII International Symposium on Postharvest Pathology.** Info: Dr. Jorunn Børve, Norwegian Institute of Bioeconomy Research, Ullensvang Research Center, Lofthus 5781, Norway. E-mail: jorunn.borve@nibio.no E-mail symposium: isphpp2026@nibio.no Web: https://nibio.pameldingssystem.no/isphpp2026
- June 7-10, 2026, Monterey, CA (United States of America): **XVIII International Symposium on Processing Tomato - XVI 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 Zach Bagley, PO Box 2437, Woodland CA 95776, United States of America. Phone: (1)53-04059469, E-mail: zach@tomatonet.org or Dr. Brenna Aegerter, Univ of California Coop Extn., UCCE San Joaquin County, 2101 E Earhart Ave. Ste 200, Stockton, CA 95206, United States of America. E-mail: bjaegerter@ucanr.edu E-mail symposium: symposium@worldtomatocongress.com Web: https://www.16thworldtomatocongress.com/
- June 22-24, 2026, Iksan, Jeonbuk (Korea (Republic of)): **XVI International Asparagus Symposium.** Info: Prof. Dr. Yang Gyu Ku, Department of Horticulture Industry, College of Agriculture and Food Sciences, Wonkwang University, Iksan-city, Korea (Republic of). Phone: (82)638506672, Fax: (82)638507308, E-mail: ygku35@wku.ac.kr or Prof. Dr. Young Yeol Cho, Collage of Applied Life Sciences, Department of Horticultural Science, Jeju National University, Jeju, Korea (Republic of). Phone: (82)647543325, Fax: (82)647254905, E-mail: yycho@jejunu.ac.kr or Prof. Dr. Jong Hyang Bae, Department of Horticulture Industry, College of Agriculture and Food Sciences, Wonkwang University, Iksan-city, Korea (Republic of). Phone: (82)638506671, Fax: (82)638507308, E-mail: bae@wku.ac.kr or Prof. Dr. Young Rog Yeoung, Department of Plant Science, College of Life Science, GangneungWoju National University, Gangwon-Do, Korea (Republic of). Phone: (82)336402356, Fax: (82)336402909, E-mail: yryeoung@gwnu.ac.kr E-mail symposium: secretariat@ias2026.org Web: https://ias2026.org/
- August 23-28, 2026, Kyoto (Japan): **XXXII International Horticultural Congress: IHC2026.** Info: Prof. Dr. Ryutaro Tao, Lab. Pomology, Fac. Agric., Kyoto University, Kitashirakawa Oiwake-cho, Sakyo-ku Kyoto 606-8502, Japan. Phone: (81)757536053, Fax: (81)757536497, E-mail: tao.ryutaro.8c@kyoto-u.ac.jp E-mail symposium: ihc2026@convention.co.jp Web: https://www.ihc2026.org/

Symposia at IHC2026

- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Horticultural Genetic Resources and their Usefulness for Breeding.** Info: Dr. Sandra Correia, InnovPlantProtect, Estrada de Gil Vaz, 7350-478 Elvas, Portugal. E-mail: sandra.correia@iplantprotect.pt or Dr. Nobuko Mase, Citrus Research Station, Institute of Fruit, Tree and Tea Science, NARO, 485-6 Okitsunaka-cho, Shimizu, Shizuoka City, Shizuoka 424-0292, Japan. E-mail: mase.nobuko909@naro.go.jp or Dr. Yoichi Kawazu, Inst. of Vegetable & Floriculture Sci. NARO, 360 Ano, Tsu, Mie, Japan. E-mail: kawazu.yoichi958@naro.go.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s01/

- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Challenges and Perspectives on Innovative Technologies for Breeding of Horticultural Crops.** Info: Prof. Byoung-Cheorl Kang, Seoul Natl. Univ., San 56-1, Sillim 9-dong, Gwanak-gu, Seoul 151-742, Korea (Republic of). E-mail: bk54@snu.ac.kr or Prof. Isobe Sachiko, University of Tokyo, Bunkyo 1-1-1, Yayoi, Tokyo, 113-8657, Japan. E-mail: sisobe@g.ecc.u-tokyo.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s02/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Innovative Technologies and Production Strategies for Smart Greenhouse.** Info: Prof. In-Bok Lee, Lab. of Aero-Environmental Engineering, College of Agric. and Life Science, Seoul National University, San 56-1, Silim-dong, Gwanak-Gu, Seoul, Korea (Republic of). E-mail: iblee@snu.ac.kr or Dr. Tadahisa Higashide, National Agric. & Food Res. Organization, 3-1-1, Kannondai, Tsukuba, Ibaraki, 305-8519, Japan. E-mail: ton@affrc.go.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s03/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: II International Symposium on Advances in Vertical Farming.** Info: Prof. Dr. Qichang Yang, Institute of Urban Agriculture, CAAS, No. 36, Lazidong Street, Shuangliu District, Chengdu, Sichuan, China. E-mail: yangqichang@caas.cn or Prof. Dr. Eiji Goto, Graduate School of Hort.,Chiba University, 648 Matsudo, Matsudo, Chiba 271-8510, Japan. E-mail: goto@faculty.chiba-u.jp or Prof. Dr. Naoya Fukuda, Inst. Life Environ. Sci., T-PIRC, University of Tsukuba, Tennodai 1-1-1, Tsukuba city, Japan. E-mail: fukuda.naoya.ka@u.tsukuba.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s04/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Sustainable Plant Production in Greenhouse Horticulture and Protected Cultivation.** Info: Dr. Silke Hemming, Wageningen University & Research, Business Unit Greenhouse Horticulture, Droevendaalsesteeg 1, 6708 PB Wageningen, Netherlands. E-mail: silke.hemming@wur.nl or Dr. Yasunaga Iwasaki, 2060-1 Kurokawa Asao ward, Kawasaki city 2150035, Meiji University, Faculty of Agriculture, Japan. E-mail: iwasakiy@meiji.ac.jp E-mail symposium: p-ihc2026 @convention.co.jp Web: https://www.ihc2026.org/symposia/s05/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Modeling and Digital Approaches to Explore the Diversity of Crop Physiology and Management in Field Conditions.** Info: Dr. Evelyne Costes, INRA UMR AGAP, Avenue Agropolie, 34398 Montpellier Cedex 5, France. E-mail: evelyne.costes@inrae.fr or Takayoshi Yamane, 2-1 Fujimoto, Tsukuba 3058605, Japan. E-mail: yamane.takayoshi156@naro.go.jp or Dr. Koji Sugahara, 3-1-1 Kannondai, Tsukuba 3058519, Japan. E-mail: sugahara.koji783@naro.go.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s06/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Developmental and Molecular Responses of Horticultural Plants to Abiotic Stress, including Temperature.** Info: Dr. Erika Varkonyi-Gasic, PFR, Private Bag 92169, Auckland mail Centre, 1142 Auckland, New Zealand. E-mail: erika.varkonyi-gasic@plantandfood.co.nz or Prof. Dr. Nobuhiro Kotoda, Fruit Science lab, Saga University, 1 Honjo-machi, Saga 840-8502, Japan. E-mail: koto@cc.saga-u.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s07/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Advances in Postharvest Biology and Technology of Horticultural Crops.** Info: Assoc. Prof. Kietsuda Luengwilai, Dept. Horticulture, Fac. Agriculture at Kamphang Saen, Kasetsart University, Kamphang Saen campus, Kamphang Saen 73140, Thailand. E-mail: kietsuda.l@ku.ac.th or Prof. Eriko Yasunaga, 3-5-8 Saiwai-cho, Tokyo University of Agriculture and Technol, Fuchu 183-8509, Japan. E-mail: erikoy@go.tuat.ac.jp or Dr. Yasuo Suzuki, Faculty of Agriculture, Meijo University, Shiogamaguchi 1-501, Tenpaku-ku, Nagoya 468-8502, Japan. E-mail: yasuosuzuki@meijo-u.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s08/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: XI International Symposium on Human Health Effects of Fruits and Vegetables - FAVHEALTH2026.** Info: Prof. Mariusz Piskula, Wadowskiego 15, 10-761 Olsztyn, Poland. E-mail: m.piskula@pan.olsztyn.pl or Prof. Kaeko Murota, 1060 Nisikawatsu-cho, Matsue 690-8504, Shimane, Japan. E-mail: murota@life.shimane-u.ac.jp or Dr. Kentaro Matsumiya, Graduate School of Agriculture, Kyoto University, Kitashirakawa-Oiwakecho, Sakyo, Kyoto 606-8502, Japan. E-mail: matsumiya.kentaro.6w@kyoto-u.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s09/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Medicinal, Aromatic Plants and Natural Colorants – incl. ISSBT2026.** Info: Prof. Mahmoud A. Sharafeldin, National Research Centre, Egypt. E-mail: sharafeldin99@yahoo.com or Dr. Po-An Chen, No. 3, Aly. 35, Ln. 191, Jiannan Rd., Pingtung City, Pingtung County 900, Taiwan, 900 Pingtung, Chinese Taipei. E-mail: chenpoan@mail.atri.org.tw or Assist. Prof. Ryosuke Munakata, Lab. Plant Gene Expression, RISH, Kyoto Uni, Uji, Japan. E-mail: munakata.ryosuke.3z@kyoto-u.ac.jp or Assist. Prof. Toshiyuki Waki, Aramaki Aza Aoba, Aoba-ku, Tohoku University, Sendai 9808579, Japan. E-mail: waki@tohoku.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s10/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: XVII International People Plant Symposium and IV International Symposium on Horticultural Therapies (HortTherapy2026).** Info: Prof. Dr. Sin-Ae Park, Konkuk University, 225 Life and Environment Science building, 05029 Seoul, Korea (Republic of). E-mail: sapark42@konkuk.ac.kr or Takuya Kenmochi, Awaji Campus, University of Hyogo, 954-2 Nojimatokiwa, Awaji 656-1726, Japan. E-mail: takuya_kenmochi@awaji.ac.jp or Assoc. Prof. Fumie Tazaki, Awaji campus, University of Hyogo, 954-2 Nojimatokiwa, Awaji 656-1726, Japan. E-mail: fumie_tazaki@awaji.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s11/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: II International Symposium on Urban Horticulture for Sustainable Food Security: Toward Food-Secure Cities (UrbanFood2026).** Info: Dr. Giuseppina Pennisi, University of Bologna, Viale Giuseppe Fanin 44, 40127 Bologna, Italy. E-mail: giuseppina.pennisi@unibo.it or Mr. Masakazu Yamada, 1-1 Owashi, Tukuba 3058686, Japan. E-mail: yamadam0172@jircas.go.jp or Dr. Sayuri Teramoto, University of the Ryukyus, 1 Senbaru, Nishihara, Okinawa, 9030213, Japan. E-mail: teramoto@cs.u-ryukyu.ac.jp or Yasuhiko Koike, Tokyo University of Agriculture, 1737 Funako Atsugi, Kanagawa 243-0034, Japan. Phone: (81)462706527, E-mail: koike@nodai.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s12/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: IV International Symposium on Greener Cities: Re-imagining Urban Landscapes (GreenCities2026).** Info: Prof. Dr. Luis Pérez-Urrestarazu,

Agro-Forestry Engineering, Universidad de Sevilla, ETSIA Ctra. Utrera km.1, 41013 Sevilla, Spain. E-mail: lperez@us.es or Assoc. Prof. Tomoko Takeuchi, 648 Matsudo, Matsudo-shi, Chiba, 271-8510, Japan. E-mail: tomoko_takeuchi@chiba-u.jp or Assoc. Prof. Shoko Hikosaka, 648 Matsudo, Matsudo city 271-8510, Japan. E-mail: s-hikosaka@faculty.chiba-u.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s13/

- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Evaluating the Impact and Scaling of Innovations for Sustainable Horticulture.** Info: Dr. Melinda Knuth, NC State University, 2721 Sullivan Drive, Campus Box 7212, Raleigh, NC 27695, United States of America. E-mail: mjknuth@ncsu.edu or Prof. Dr. Shusuke Matsushita, Kitashirakawa Oiwake-cho, Sakyo-ku, Kyoto, Japan. E-mail: matsushita.shusuke.7z@kyoto-u.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s14/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: II International Symposium on Agroecology and Systems Approaches for Sustainable and Resilient Horticultural Production.** Info: Prof. Dr. Maria Claudia Dussi, Universidad Nacional del Comahue, Facultad de Ciencias Agrarias, CC 85 (8303) Cinco Saltos, Rio Negro-Patagonia, Argentina. E-mail: mcdussi@yahoo.com or Prof. Rachel Bezner Kerr, 262 Warren Hall, Department of Global Development, Cornell University, Ithaca, NY 14853, United States of America. E-mail: rbeznerkerr@cornell.edu or Prof. Dr. Rie Miyaura, 1-1-1, Sakuragaoka, Setagaya 156-8502, Japan. E-mail: mia@nodai.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s15/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: II International Symposium on Innovations in Ornamentals: From Breeding to Market.** Info: Prof. Junping Gao, China Agricultural University, Beijing, 100193, China. E-mail: gaojp@cau.edu.cn or Dr. Kenichi Shibuya, 2-1 Fujimoto, Tsukuba 305-0852, Japan. E-mail: shibuya.kenichi573@naro.go.jp or Dr. Masafumi Yagi, Ins. of Vegetable and Floriculture Science, NARO, 2-1 Fujimoto, Tsukuba, Japan. E-mail: yagi.masafumi967@naro.go.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s16/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Innovative Use of Diverse Traits (Color, Shape and Fragrance) in Ornamentals.** Info: Prof. Dr. Zhanao Deng, University of Florida, IFAS, Gulf Coast Research and Education Center, 14625 County Road 672, Wimauma, FL 33598, United States of America. E-mail: zdeng@ufl.edu or Dr. Ayumi Deguchi, 648, Matsudo, Matsudo-shi 271-8510, Japan. E-mail: deguchia@chiba-u.jp or Prof. Dr. Munetaka Hosokawa, Nakamachi, Nara-shi, Nara 631-0052, Japan. E-mail: mune@nara.kindai.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s17/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Vegetable Breeding for Sustainable Field and Greenhouse Production through Modern Selection Techniques and Molecular Tools (BreedVegs2026).** Info: Prof. Dr. Yuling Bai, WUR, Drovendaalsesteeg 1, 6700 AJ Wageningen, Netherlands. E-mail: bai.yuling@wur.nl or Dr. Pasquale Tripodi, Via Cavalleggeri 25, 84098 Pontecagnano Faiano, Italy. E-mail: pasquale.tripodi@crea.gov.it or Prof. Dr. Masayoshi Shigyo, Faculty of Agriculture, Yamaguchi University, Yoshida 1677-1, Yamaguchi 753-8515, Japan. E-mail: shigyo@yamaguchi-u.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s18/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Diversification of Vegetable Production and New Growing Techniques for Sustainable Farming Systems (GreenVegs2026).** Info: Assoc. Prof. Francesco Di Gioia, The Pennsylvania State University, Shortlidge Road, Tyson Building 207, University Park PA 16802, United States of America. E-mail: fxd92@psu.edu or Dr. Megumu Takahashi, 3-1-1, Kannondai, Tsukuba 3058519, Japan. E-mail: takahashi.megumu000@naro.go.jp or Dr. Fumio Sato, Kannondai 3-1-1, Tukuba 3058519, Japan. E-mail: sato.fumio525@naro.go.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s19/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Berries: New Tools for Crop Improvement.** Info: Prof. Lisa DeVetter, WSU, 16650 Washington 536, Mount Vernon, WA 98273, United States of America. E-mail: lisa.devetter@wsu.edu or Dr. Sarah Pilkington, 120 Mt Albert Road, Mt Albert, 1025 Auckland, New Zealand. E-mail: sarah.pilkington@plantandfood.co.nz or Dr. Takeshi Kurokura, 350 Mine, Faculty of Agriculture, University of Utsunomiya, Utsunomiya 321-8505, Japan. E-mail: kurokura@cc.utsunomiya-u.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s20/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Advances in Grapevine Genetics and Physiology: Innovation and Adaptation for the Next-Generation Resilient Viticulture.** Info: Prof. Giovanni Battista Tornielli, DAFNAE, University of Padova, Viale dell'Università, 16, 35020 Legnaro (PD), Italy. E-mail: giovannibattista.tornielli@unipd.it or Prof. Dr. Jinggui Fang, No. 666, Binjiang Avenue, Jiangbei New Area, Nanjing, Jiangsu, P.R.China, 211800, China. E-mail: fanggg@njau.edu.cn or Dr. Akifumi Azuma, Institute of Fruit Tree and Tea Science, NARO, Akitsu Mitsu 301-2, Higashi-Hiroshima Hiroshima 739-2494, Japan. E-mail: azuma.akifumi128@naro.go.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s21/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Sustainable Production Systems in Temperate Tree Crops.** Info: Prof. George Manganaris, Anexartisias 57, PAREAS Building, P.O. Box 50329, 3603 Lemesos, Cyprus. E-mail: george.manganaris@cut.ac.cy or Hideki Murayama, Faculty of Agriculture, Yamagata University, 1-23 Wakabamachi Tsuruoka, Yamagata 997-8555, Japan. E-mail: mhideki@tds1.tr.yamagata-u.ac.jp or Prof. Dr. Takuya Tetsumura, Department of Agriculture, Faculty of Agriculture, University of Miyazaki, 889-2192, Japan. E-mail: tetsumur@cc.miyazaki-u.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s22/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Application of Genetics and Breeding Approaches to Improve Temperate Tree Crops.** Info: Prof. Dr. Fabrizio Costa, Via Mach 1, 38098 San Michele all"Adige, Trento, Italy. E-mail: fabrizio.costa@unitn.it or Dr. Atsushi Kono, 2-1, Fujimoto, Tsukuba, Ibaraki 305-8605, Japan. E-mail: kono.atsushi993@naro.go.jp or Dr. Miyuki Kunihisa, Fujimoto 2-1, Tsukuba, Japan. E-mail: kunihisa.miyuki700@naro.go.jp or Dr. Norio Takada, Institute of FruitTree and TeaScience, NARO, Fujimoto 1-2, Tsukuba, Ibaraki 305-8606, Japan. Phone: (81)298386464, E-mail: takada.norio513@naro.go.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s23/
- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Bridging Science and Practice for Tropical and Subtropical Fruits and Nuts.** Info: Prof. Dr. Zora Singh,

Edith Cowan University, Horticulture, School of Science, 270 Joondalup Drive, Joondalup 6027, Western Australia, Australia. E-mail: z.singh@ecu.edu.au or Assoc. Prof. Shu-Yen Lin, 1, 4th sec., Roosevelt Road, Da-an district, Dept. of Horticulture, National Taiwan University, Chinese Taipei. E-mail: sylin@ntu.edu.tw or Dr. Naoko Kozai, Kagoshima University, Korimoto 1-21-24, Kagoshima, Kagoshima 890-0065, Japan. E-mail: nkozai@agri.kagoshima-u.ac.jp or Dr. Shingo Goto, 2-1 Fujimoto, Tsukuba, Ibaraki 305-8605, Japan. Phone: (81)29-838-6474, E-mail: goto.shingo184@naro.go.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s24/

NEW

- August 23-28, 2026, Kyoto (Japan): **IHC2026: XIII International Symposium on Banana: Exploring Banana Diversity for Improved Livelihoods.** Info: Dr. Sebastien Carpentier, Bioversity International, Willem de Croylaan 42 - bus 2455, 3001 Heverlee, Belgium. E-mail: sebastien.carpentier@biw.kuleuven.be or Assoc. Prof. Yasuaki Sato, Global Humanities and Social Sciences, Nagasaki University, 1-14 Bunkyo, Nagasaki 852-8521, Japan. E-mail: y-sato@nagasaki-u.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s25/

NEW

- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Recent Advances in Horticulture in East Asia, Southeast Asia and the Pacific.** Info: Prof. Dr. Roderick A. Drew, Griffith Sciences, Griffith University, Kessels Road, Nathan, QLD 4111, Australia. E-mail: roderick.drew646@gmail.com or Prof. Dr. Zhen-Hai Han, Institute for Horticultural Plants, China Agricultural University, No. 2 Yuanmingyuanxilu, 100193 Beijing, China. E-mail: rschan@cau.edu.cn or Dr. Sota Koeda, Lab. Horticultural Science, Kindai University, 3327-204 Nara 631-8505, Japan. E-mail: 818sota@nara.kindai.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s26/

NEW

- August 23-28, 2026, Kyoto (Japan): **IHC2026: International Symposium on Innovation in Horticulture, via Fundamental Science on Reproductive Biology of Annuals and Perennials.** Info: Prof. Avi Sadka, ARO, The Volcani Center, Department of Fruit Trees Sciences, 68 HaMaccabim Rd., P.O. Box 15159, Rishon LeZion 7528809, Israel. E-mail: vhasadka@volcani.agri.gov.il or Prof. Hisayo Yamane, Laboratory of Pomology, Graduate School of Agriculture, Kyoto University, Kyoto 606-8502, Japan. E-mail: yamane.hisayo.6n@kyoto-u.ac.jp or Prof. Dr. Masahiro Kanaoka, Prefectural University of Hiroshima, Nanatsuka5562 Shobara 7270023, Japan. E-mail: mkanaoka@pu-hiroshima.ac.jp E-mail symposium: p-ihc2026@convention.co.jp Web: https://www.ihc2026.org/symposia/s27/

NEW

- October 29 - November 1, 2026, Antalya (Turkey): **IV International Symposium on Fruit Culture along Silk Road Countries.** Info: Prof. Dr. Sezai Ercisli, Ataturk University Agricultural Faculty, Department of Horticulture, 25240 Erzurum, Turkey. Phone: (90) 442-2312599, Fax: (90) 442 2360958, E-mail: sercisli@gmail.com
- November 17-19, 2026, Bastia, Corsica (France): **V International Symposium on Citrus Biotechnology.** Info: Dr. Francois Luro, AGAP Corse Equipe SEAPAG, station INRAE, 20230 San Giuliano, France. Phone: (33)495595946, E-mail: francois.luro@inrae.fr
- November 18-20, 2026, Kathmandu (Nepal): **V International Orchid Symposium.** Info: Prof. Dr. Bijaya Pant, Central Department of Botany, Tribhuvan University, Kathmandu Nepal, Research Director, Annapurna Research Center, Kathmandu, Nepal. Phone: (977)9801203357, E-mail: b.pant@cdbtu.edu.np E-mail symposium: orchidsymposiumnepal@gmail.com Web: https://www.annapurnaresearch.org/internationalorchidsymposium
- November 23-27, 2026, Montagu, Western Cape (South Africa): **XIII International Workshop on Sap Flow.** Info: Dr. Phumudzo Charle Tharaga, office 1.220 Agriculture Building, University of the Free State, 205 Nelson Mandela Drive, 9300 FS Bloemfontein, South Africa. Phone: (27)514012882, E-mail: tharagac@arc.agric.za or Assoc. Prof. Robert Skelton, 1 Jan Smuts Avenue, Braamfontein, 2000 Gauteng Johannesburg, South Africa. Phone: (27)711109778, E-mail: rob.skelton@wits.ac.za or Mr. Muthianzhele Ravuluma, 20 Lelie st, Idasvallei, 7609 Western Cape, Stellenbosch, South Africa. E-mail: ravulumam@arc.agric.za
- November 24-27, 2026, Udon Thani (Thailand): **International Symposium on Utilization and Cultivation of Medicinal and Aromatic Plants & VII International Symposium on Plant Genetic Resources and Breeding Research on Medicinal and Aromatic Plants.** Info: Mr. Rapibhat Chandarasrivongs, Department of Agriculture, 50 Phaholyothin Rd., Chatuchak 10900, Thailand. Phone: (66)25790583, E-mail: interudonexpo2026@gmail.com E-mail symposium: info.map2026@gmail.com Web: https://www.doa.go.th/MAP2026/

Year 2027

- January 19-22, 2027, Udon Thani (Thailand): **IV International Symposium on Tropical and Subtropical Ornamentals.** Info: Mr. Rapibhat Chandarasrivongs, Department of Agriculture, 50 Phaholyothin Rd., Chatuchak 10900, Thailand. Phone: (66)25790583, E-mail: interudonexpo2026@gmail.com E-mail symposium: info.tso2027@gmail.com Web: https://www.doa.go.th/TSO2027/
- January 31 - February 4, 2027, Ghent (Belgium): **VertiFarm2027: IV International Workshop on Vertical Farming.** Info: Dr. Bruno Gobin, Schaessestraat 18, 9070 Destelbergen, Belgium. Phone: (32)93539480, Fax: (32)3539495, E-mail: bruno.gobin@viaverda.be or Annelies Christiaens, Viaverda vzw, Schaessestraat 18, 9070 Destelbergen, Belgium. E-mail: annelies.christiaens@viaverda.be

NEW

- March 30 - April 3, 2027, Palermo (Italy): **V International Symposium on Soilless Culture and Hydroponics.** Info: Dr. Leo Sabatino, Viale delle Scienze, 90100 Palermo, Italy. E-mail: leo.sabatino@unipa.it or Assist. Prof. Georgia Ntatsi, Agricultural University of Athens, Laboratory of Vegetable Crops, Iera Odos 75, 11855 Athens, Greece. Phone: (30)2015294532, E-mail: ntatsi@aua.gr or Dr. Beppe Benedetto Consentino, Viale delle Scienze, 90100 Palermo, Dep. Agricultural, Food and Forest Science, University of Palermo, Palermo, Italy. E-mail: beppebenedetto.consentino@unipa.it or Dr. Murat Kacira, Dept. of Biosystems Engineering, 1177 East 4th Street, Room 403, Shantz Building, 38, Tucson, AZ 85721-0038, United States of America. Phone: (1) 520-626-4254, Fax: (1) 520-626-1700, E-mail: mkacira@email.arizona.edu

NEW

- May 3-7, 2027, Murcia (Spain): **II International Symposium on Apricot and Plum.** Info: Dr. David Ruiz, Departemento de Mejora Vegetal, CEBAS (CSIC), Campus de Espinardo, P.O. Box 164, 30100 Murcia, Spain. Phone: (34)968396237, Fax: (34)968396213, E-mail: druiz@cebas.csic.es or Dr. Manuel Rubio, CEBAS-CSIC PO box 164, 30100 Espinardo Murcia, Spain. E-mail: mrubio@cebas.csic.es

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