

A publication of the International Society for Horticultural Science

Chronica Horticulturae



Horticultural highlights

Cold storage facilities in Turkey • Microgreens – a multi-mineral and nutrient rich food
• Next-generation greenhouse horticulture in Japan • Olive and olive oil industry in Turkey

Symposia and workshops

Fruit Culture along Silk Road Countries • Chestnut • Almonds and Pistachios
• Rose Research and Cultivation • Cherry • Pineapple • Asparagus • Bonsai
• Survey of Uses of Plant Genetic Resources to the Benefit of Local Populations • Quality Management in Postharvest Systems in Asia

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Chronica Horticulturae



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

Fruits – International Journal of Tropical and Subtropical Horticulture

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

Scripta Horticulturae

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

PubHort – crossroads of horticultural publications

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

Additional information can be viewed on the PubHort website www.pubhort.org.

Cover photograph: Red beetroot being grown as a microgreens' crop
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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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> ISHS partnerships: working together for sustainable horticulture

Jens N. Wünsche, ISHS Board Member Responsible
for Innovation, Outreach and Strategy



> Jens N. Wünsche

ISHS continues to build productive partnerships based on mutual respect, trust and understanding. True partnerships make each individual stronger than staying on its own by pooling money, skills, insight and other resources, and share the associated risks and rewards or gains and losses in accordance with terms of the partnership agreement. This Board of the ISHS has identified and focused on two key partners; students or early career scientists and Corporate Members. Expanding our partnerships in both directions is necessary: building a strong, durable and future-oriented relationship with young minds – the societal lifeblood – and with key industry partners – the societal transfer vehicles for technology and science innovations into practical reality. This Editorial briefly outlines some of the new initiatives we launched for establishing new and fostering existing partnerships.

Questionnaire

The ISHS questionnaire for early career scientist was accessible from 01/10/2016 until 31/07/2017 to capture their voice and ideas in relation to professional careers in the horticultural sector as well as ISHS membership. About 1000 respondents from all continents and regions have participated in the questionnaire, which is an excellent response! With the support of the Institute of Communication Science for Media Research and Media Use at the University of Hohenheim, Stuttgart, Germany, we are now analysing the big data set and preparing a full overview report for *Chronica*. Undoubtedly, the respondent's feedback will be of great help in shaping the future of the ISHS and in enabling us to develop initiatives that really matter to you and your colleagues. As a modest reward for taking the time and effort to share their valuable insights with the ISHS, twenty respondents received a one-year free ISHS membership and ten respondents received a tablet computer. The winners were selected randomly from all eligible entries.

Ideas contest

Unfortunately, we only received a few video clips for the ideas contest, which was also open from 01/10/2016 until 31/07/2017. However, the truly inspirational contribution of Débora Prudente from the Federal University of Lavras, Brazil, encapsulates some of the exciting opportunities that exist in horticultural sciences and within our Society. Please refer to <https://vimeo.com/227286231> (password YOUNGMINDS) and watch this great video clip. As a token of appreciation for her enthusiasm, we invited her to participate in IHC2018 and to attend the ISHS General Assembly.

Summer School

Another early career scientist event that was launched by the current Board of the ISHS is a Summer School for graduate (MSc) students interested in varying horticultural topics. The first ISHS Summer School "Fruit **CRISP** – Fruit **Crop Responses to Innovations for Sustainable Production**" is open to 25 MSc students from around the world. It will be hosted by the University of Hohenheim and the Centre of Competence for Fruit Cultivation at Lake Constance in Germany from 22 July - 4 August 2018, just prior to the International Horticultural Congress 2018 in Istanbul. The Summer School will provide a complete overview of pre- and postharvest physiological aspects of perennial fruit tree species, in particular of pome (apple, pear) and stone fruit (cherry, plum) but also nut crops, under different orchard management and environmental conditions. It will offer a full schedule of keynotes, discussions, group work, field trips and industry visits. The educational course is aimed at making students 'fit for tomorrow's market opportunities' and to attract them to become members of the ISHS. The course, taught in English, offers interactive relationships between teaching fundamental and applied fruit science and practical components of the fruit production

process. Summer School leaders are Prof. Dr. Jens Wünsche, University of Hohenheim and Board member of ISHS, Prof. Dr. Chris Watkins, Cornell University and Chair of ISHS Commission Quality and Postharvest Horticulture, and Prof. Dr. Theodore DeJong, University of California and Chair of ISHS Section Pome and Stone Fruits. The German Academic Exchange Service (DAAD) is supporting the Summer School with 25,000 EUR, following a 15-page proposal. The first applications are now coming in and the selection process will commence in March 2018. If this proves successful, we hope it will be the first in a series of Summer Schools, which will focus on a different topic each time.

Corporate Members

This Board of the ISHS promised to work hard on identifying Corporate Members to strategically align the relationships of ISHS with global partners in the field of "Horticulture for sustainable Development" (H4sD) and to better realize the high potential of the horticultural sector towards environmental and economic Sustainable Development Goals (SDGs). Through global partnerships, we engage in committed universal vision and cooperation, create more visibility in science leadership, provide opportunities and connect people across the field of horticulture. We live and practice "Corporate Social Responsibility" on a daily basis for the benefit of our members and of our Society at large. A great place to engage with leading companies and to search for Corporate Relationships is FRUIT LOGISTICA. About 3,100 exhibitors and over 75,000 visitors attend this event every year in Berlin to realise their full business potential within the international fresh produce trade. This event covers every single sector of the fresh produce business and provides a complete picture of the latest innovations, products and services at every link in the international supply chain. It thus offers superb

networking and contact opportunities to the key decision-makers in every sector of the industry. At the Board level, we are spurred by a genuine belief that closer cooperation between our Society and Corporate Clients has many valuable outcomes for our customers and our members.

At FRUIT LOGISTICA, for the past three years, we were kindly hosted without cost at the booth of Obst vom Bodensee (OvB), a large fresh fruit distribution company in Southern Germany. At their booth, with the ISHS banner clearly visible, we were able to interact with our guests from around the globe and outlined potential benefits to those who were interested in becoming Corporate Members. It has been a privilege to meet many representatives of global leaders within the food sector; however, establishing true and meaningful partnerships is tough and con-

tractual arrangements are often based on personal relationships. Many initial briefings ran according to our expectations and follow-up meetings have been planned, whilst others unfortunately came to nothing.

It has become a custom that we meet and further cultivate our existing Corporate Members, Bayer CropScience, Greenyard and Hishtil at FRUIT LOGISTICA. At review meetings, we discuss new initiatives, capacity building, joint publications and upcoming events – everything that is of common interest and mutual benefit.

Concluding remarks

Reaching our set goals of building future-proof bridges to corporations and early career scientists is challenging, but there is no other choice if we want to secure the livelihood of our Society and to work together on

sustainable horticulture. We need to spread the net wide in search of talented young people and world-leading companies and ensure that the structure and the services of our Society are well aligned with the ever-changing mindsets of our new partners. The major challenge is indeed to understand and cater for their requirements and needs! Establishing exciting and workable partnerships for the benefit of science and innovation is also based on personal dedication, genuine interest, perseverance and commitment to dialogue; attributes we all know too well but do not exercise adequately enough. By exploring unconventional pathways and testing different approaches, we will have the best chance of finding what is required to help secure the future of horticultural science and its link to sustainable horticulture. ●

> ISHS governance meetings at the Istanbul Congress: important announcements and information

Dear member of the International Society for Horticultural Science,

2018 is a Congress year and according to the Society bylaws there must be a General Assembly where members receive formal reports from the Board, consider amendments to the ISHS Statutes, recognize worthy colleagues and confirm important future events. The following information includes pre-Congress announcements and invitations required by the ISHS Statutes.

A. ISHS General Assembly – invitation to the membership

ISHS is experiencing exciting times and the outgoing Board is looking forward to reporting on the health and development of the Society during the last four years. This meeting also provides an opportunity for members to accept or reject important Council decisions or recommendations and to voice their comments, concerns and suggestions for Board considerations.

The 2018 ISHS General Assembly will take place at the Camlica Hall, Congress Venue, Istanbul, Turkey on Wednesday, 15 August 2018, 11.00-12.30. This is the penultimate day of the Congress.

The Agenda for this meeting is as follows:

- 1 Opening by the President of ISHS
- 2 Board reports for the years 2014-2017 time period
 - 2.1 General report
 - 2.2 The new science structure of the Society
- 3 Proposed amendment to the ISHS Statutes
- 4 XXXI International Horticultural Congress – France
 - 4.1 Inauguration of the President of the XXXI IHC
 - 4.2 Information about the XXXI IHC

- 5 Announcement of the date and place of the XXXII IHC
- 6 ISHS Fellows, Honorary Members and other awards
- 7 Confirmation and inauguration of the new ISHS President and the Members of the Board
- 8 Other business
- 9 Adjournment

B. ISHS management meetings (*) at the time of the Congress

- a) Meetings of the Board
Monday, 6 August and Tuesday, 7 August 2018
- b) Meeting of the Executive Committee
Wednesday, 8 August and Thursday, 9 August 2018, 8.30-18.00, Divan Hotel (address: Asker Ocağı Caddesi 34367 No:1 Taksim), Istanbul
- c) Joint Meeting of the Council and Executive Committee
Friday, 10 August and Saturday, 11 August 2018, 8.30-18.00, Divan Hotel, Istanbul
Thursday 16 August 2018, 10.00-12.00, Congress Venue

(*) Time schedules and Agenda available from the ISHS Secretariat

C. Bids welcomed for future ISHS Congress hosts

The Council, meeting in Istanbul this coming August, will evaluate proposals for the Congress to be held in 2026. Representatives of ISHS Country/Region Members interested in bidding for that Congress are invited to provide the ISHS Secretariat with a letter of intent. The Secretariat will, upon receipt of this letter, provide more detailed information and instructions. ●

› Amendments to the ISHS Statutes

As an international organization, the Society expects Board members to be elected from all corners of the world, and bring matters of importance to our local membership to the attention of the Society. We wish to stress that Board members do not represent the interest of any particular region of the world. The Board should continue to be elected by Council based on the skills of the candidates. It is important that 'all' members are heard in the Society. So far, a geographical balance has been achieved (as described in article 5(a) of the Rules of Procedure) with one Board member coming from (i) Africa-Oceania, (ii) North and South America, (iii) Asia, and (iv) Europe. The President and the fifth member were elected at large. Nevertheless, the Board and Council agreed that the representation by Board members should be broader, without increasing the number of Board members.

At its meeting in August 2016, the ISHS Council recognized that the Society wishes to provide more visibility to Asia, Africa and South America, and this therefore brings the following amendment to the attention of the members:

The Statutes determine that the Board may have between five and nine elected members (see Article 9.1). Acting according to article 9.1, the Council decided to amend the geographical representation on the Board, not by increasing the number of Board members, but to elect, with the exception of the President, all other elected Board members from six regions: one from each of the following regions (i) Africa, (ii) Oceania, (iii) N. America (including Caribbean and C. America), (iv) S. America, (v) Asia, and (vi) Europe. The President would be elected at large.

While the Statutes already allow 7 elected members and 2 ex officio members (see article 9.1), the text of Statutes needs to be amended to accommodate the description of the geographical regions.

At IHC2018, a revised scientific structure is to come into place, which replaces the existing Sections and Commissions by introducing a series of 'Divisions'. The rationale behind this change was initiated on a demand from the members to optimize symposia, to improve the scientific experience of each member, to create more exciting and fun meetings, to improve the relevancy of our meetings, to be inclusive in innovative issues, and, last but not least, to rationalize resources of the Society. The principle is to change the concept of Sections and Commissions and to use the term 'Division' for all. The concept of 'Commission' will be used for special commissions only.

This new structure was initiated by the ISHS Council, and discussed in detail by the ISHS Executive Committee, and received the consent of all Section and Commission Chairs. Therefore, the General Assembly, at its meeting on August 15, 2018 in Istanbul, Turkey, will be invited to discuss and approve the modification to the Statutes as shown below.

INTERNATIONAL SOCIETY FOR HORTICULTURAL SCIENCE – STATUTES (full version from www.ishs.org/statutes-constitution-funding)

Articles related to the Board elections and to above geographical balance from Statutes as published March 24th, 2015 including Amendments of the ISHS Council of 2010 and 2014, subject to amendments. Articles related to 'Sections and Commissions' to become 'Divisions'.

3.3. The Society will establish Divisions according to commodities within horticulture and according to subjects of horticultural science and technology, that range across several commodity sectors. In addition, the concept of

'Commission' will be used for 'special ad hoc commissions' only.

6.5., 10.1., 11.1., 11.2., 13.2.

To change the words 'Sections and Commissions' to 'Divisions'

8.6.1. The quorum for a Council meeting is reached:

- if one third of the Country/region representatives, entitled to vote, are present or represented
- and if at least one representative of each of the geographical regions (i) Africa, (ii) Oceania, (iii) N. America (including Caribbean and C. America), (iv) S. America, (v) Asia, and (vi) Europe (i) Africa-Oceania, (ii) North and South America, (iii) Asia, and (iv) Europe is present or represented.

9.1. The Board consists of not less than five, nor more than nine, members who are elected by the Council and confirmed by the General Assembly. In addition, the Executive Director and the Congress President are *ex officio*, non-voting members.

15.2. At that Council meeting there must be 50% of the voting member countries present, or by proxy, in accordance with the geographical divisions specified in the Rules of Procedure. There must be a two-thirds majority of the votes of this Council in making the recommendations. In addition, the amendments will only be adopted with the support of:

- either twenty individual members
- or six institutional members distributed over the six four geographical regions (i) Africa, (ii) Oceania, (iii) N. America (including Caribbean and C. America), (iv) S. America, (v) Asia, and (vi) Europe (i) Africa-Oceania (ii) North and South America, (iii) Asia, and (iv) Europe.



› Did you renew your ISHS membership?

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> ISHS student award winner summaries

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

Impact of elevated CO₂ and high temperature on strawberry micronutrients



> Himali Balasooriya

Climate change has become a major challenge in modern agriculture because of its negative impact on both quantity and quality of the crops. Rising atmospheric temperatures and CO₂ concentrations appear to have direct and indirect effects on the nutritional quality of fruits and vegetables. However, most studies evaluated the effect of either temperature or CO₂ concentration, but not their combination. Strawberry (*Fragaria* ×

ananassa Duch.) is well known for its high phytochemical content and proven health benefits. The current project aims to investigate the combined effect of high CO₂ concentration and temperature on plant growth and development, physical and nutritional quality of fruits, and the *in vitro* bioavailability of major nutrients in strawberries. Common strawberry cultivars 'Albion' and 'San Andreas' were exposed to combinations of two different temperatures (25 and 30°C) and three different CO₂ levels (400 (ambient), 650 and 950 ppm) for two months in controlled environment chambers. After the first month, physiological performances, growth and development of plants were measured. Since physical fruit quality of strawberry plays a major role, due to high consumer preference for its attractive visual appeal with bright red colour and unique shape, the final yield was calculated on a fresh weight basis and the fruits were analysed for their physical and nutritional qualities. Results showed that the high temperature negatively affected plant growth and development and was responsible for producing lower

quality, small fruits with irregular shapes. In contrast, the high growth temperature remarkably enhanced the polyphenols in fruits. Nonetheless, the final yield was significantly reduced by higher temperatures of over 35°C. Therefore, it will be interesting to find out whether increasing CO₂ concentrations may compensate for these losses in warmer environments to produce strawberries with high physical and nutritional quality.

Himali Balasooriya won an ISHS student award for the best oral presentation at the IV International Conference on Postharvest and Quality Management of Horticultural Products of Interest for Tropical Regions in Sri Lanka in April 2017.

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Effect of last irrigation time and harvest date on some physiological characteristics and cold hardiness in grapevine buds



> Hassan Hoseinabadi

The "Khzandeh" system is one of the traditional systems for grape training in Iran. In this system, the roots of the plants are laid

down in a trough (depth: 80 cm and width: 100 cm), and the trunk is placed on a small mound formed after digging the streams. The amount of water used in this system is considerable, and the time of the last irrigation and harvesting in this method is more important than for other systems. This training system is widely used in many parts of Iran such as "Shazand", "Khondab" and "Malayer" and some years, the vineyards occasionally suffer from severe frost damage in autumn, winter and early spring. The objective of this research was to evaluate the effect of the time of the last irrigation and of the last harvest date on physiological and fruit quality parameters and cold hardiness of grapevine buds ('BidaneSefid' cultivar).

This experiment was performed in a randomized complete block design (RCBD) for two years (2015-2016). Treatments consisted of three different dates for final irrigation (from

23rd August to 29th September). Harvesting was carried out 10-12 days after final irrigation. Results showed that delaying the time of the last irrigation and of the last harvest in the fall improved bud cold tolerance as well as fruit quality. In general, early interruption of irrigation and earlier harvest reduced the percentage of total soluble solids on the one hand and increased acidity and electrolyte leakage on the other hand. It can thus be concluded that early interruption of irrigation and harvesting when the fruit quality parameters are not optimal will lead to increased electrolyte leakage in artificial cold conditions. In other words, when the percentage of soluble solids and the pH are lower than 26 and 3, respectively, the possibility of damage increases in grape buds.

According to the results of this two-year experiment, harvesting with a delay not only increases the quality of fruit, but also

increases the vine tolerance against winter freezing and chilling. While the process of drying raisins in Iran is performed outdoors, it is important to determine the best harvest time to avoid autumn rainfall during this process. For this reason, it is recommended that we adjust the suitable irrigation cycle and fertilization to promote fruit ripening as well

as fruit quality in grapes, because farmers do not dry their raisins indoors.

Hassan Hoseinabadi won an ISHS student award for the best poster at the I International Conference & X National Horticultural Science Congress of Iran (IrHC2017) in Iran in September 2017.

> Contact

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Biological control by entomopathogenic nematodes in Bosnia and Herzegovina



> Branimir Nježić

I am Branimir Nježić, a PhD student at the University of Banja Luka, Faculty of Agriculture, Bosnia and Herzegovina. I am in the last year of my PhD thesis supervised by Prof. Dr. Ralf-Udo Ehlers.

I work on biological control of the most important pests of plum (plum sawflies, *Hopllocampa flava* and *H. minuta*) using entomopathogenic nematodes (EPN). The only currently available measure for farmers to control plum sawflies are synthetic insecticides. They are applied at the time of petal fall, when beneficial organisms are present in the orchards. Moreover, farmers in organic production do not have available methods to control these pests.

Since plum sawflies spend part of their life cycle in the soil, they are potentially a good target for EPN. In this study, larval and adult stages of plum sawflies have been shown to be susceptible to EPN, in both laboratory and field conditions.

For registration of biological control agents in Bosnia and Herzegovina, it is required by law that presence of the species has been confirmed in natural habitats of the country. A national survey on presence of EPN has been conducted for species *S. feltiae*, *S. car-*

pocapase, *S. kraussei* and *H. bacteriophora*. To have a more efficient control by EPN, it is necessary to apply nematodes as close as possible to the appearance of the target stage. To optimize application, a temperature-dependent model of adult plum sawfly emergence was developed.

Branimir Nježić won an ISHS student award for the best oral presentation at the II International Symposium on Fruit Culture along Silk Road Countries in Bosnia and Herzegovina in October 2017.

> Contact

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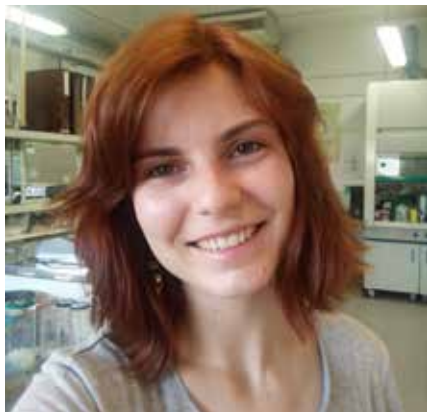
Bridging the World through Horticulture



A number of *Chronica horticultrae* articles that feature Turkish horticulture and horticultural science may be found on the IHC2018 website at

<http://ihc2018.org/en/HORTICULTURE-IN-TURKEY.html>

Understanding the *Castanea* spp. – *Phytophthora cinnamomi* pathosystem: a histopathological approach



> Patrícia Fernandes

Castanea sativa, the European chestnut, is an important forest species of great economic value. However, it is declining due to its susceptibility to *Phytophthora cinnamomi*, while *C. crenata*, the Japanese chestnut, demonstrates resistance to this aggressive pathogen that causes root rot, also known as ink disease. To face this problem, in 2006 a breeding program was initiated in Portu-

gal based on the introgression of resistance genes from the Asian species into the European chestnut, through controlled crosses. Hybrid segregating progenies obtained were phenotyped through inoculation with the pathogen (Santos et al., 2015). Hybrids showing different levels of susceptibility to *P. cinnamomi*, together with the contrasting phenotypes regarding disease resistance (*C. crenata*; *C. sativa*), will be used to understand the cellular and molecular modifications induced by the pathogen.

The initial steps of this study aim to clarify the pattern of infection and histological changes induced by *P. cinnamomi* in the susceptible (*C. sativa*) and resistant (*C. crenata*) chestnut species. The experimental procedure consisted of the inoculation of the roots of six-month-old plantlets (obtained by in vitro culture) with a *P. cinnamomi* zoospore suspension. Inoculated and healthy roots were collected at four time points after inoculation (3.5, 24, 48 and 72 hours after inoculation - hai) and prepared for light microscopic observations. Zoospore encyst-

ment, germination and root penetration were observed at 3.5 hai in both susceptible and resistant chestnut genotypes. The cortex of *C. sativa* roots were colonized by hyphae at 24 hai, proposing thin roots as a possible entry point. At more advanced stages of the infection process, the collapse of cortex cells became evident. Also, the hyphae reached the vascular system, demonstrating the high *P. cinnamomi* virulence.

The next steps of this study will include the interspecific hybrid genotypes selected from the on-going breeding program and the histopathology results will be used to select the key time-points to collect root samples after inoculation for transcriptome analysis, in order to identify candidate genes linked with the resistance to the pathogen.

This work was funded by Fundação para a Ciência e Tecnologia through the PhD grant SFRH/BD/115424/2016.

Patrícia Fernandes won an ISHS student award for the best oral presentation at the VI International Chestnut Symposium in Turkey in October 2017. ●

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Questionnaire – IX International Strawberry Symposium

3-6 May 2020, Rimini, Italy

In August 2016 during the VIII International Strawberry Symposium (Quebec City, Canada), Italy was selected to host the IX International Strawberry Symposium (ISS2020). Firstly, we thank all the organizers of the 8th ISS for the great work they did and also all the participants of this important symposium. Our organizing committee will work hard to maintain the quality of the excellent strawberry symposia held within ISHS to date.

The Polytechnic University of Marche and CREA, in conjunction with the ISHS, have taken the legal and administrative responsibility for organizing this event, with the support of the Rimini Riviera Convention Bureau (for the Symposium event), and MACFRUT International fair (for the Technical Day). The ISS2020 will take place in Rimini, May 3-6, 2020 with guided tours to our Southern (pre-symposium, April 30-May 2) and Northern (post-symposium, May 7-8) production areas and the Berry School (Ancona, May 7-8).

The aim is to organize an attractive and low-cost ISS2020, that is accessible to experts from around the world, including all regions where strawberry production is expanding and represents an opportunity for rural development and the improvement of quality of life.

In addition, we would like to recognize the link that our country has with the strawberry industry, by highlighting its scientific, technical and commercial excellence.

We think that these important achievements may be attained by developing a broad consensus among national and international experts in this sector. We plan to use a collaborative approach to collect ideas and suggestions for identifying the key objectives and topics for the Symposium, and define strategies to reach and engage the largest number of experts and professionals in the strawberry industry.

With this in mind, and being aware of how precious your time is, we would kindly ask for your contribution in filling in the questionnaire available at <https://tinyurl.com/ISS2020rimini>

All the information collected will be used to structure the scientific, technical and organizational program of ISS2020.

Thank you in advance for your important and valued contribution.

Bruno Mezzetti, Maurizio Battino and Gianluca Baruzzi
Symposium Conveners



> Cold storage facilities in Turkey

Mustafa Erkan



Introduction

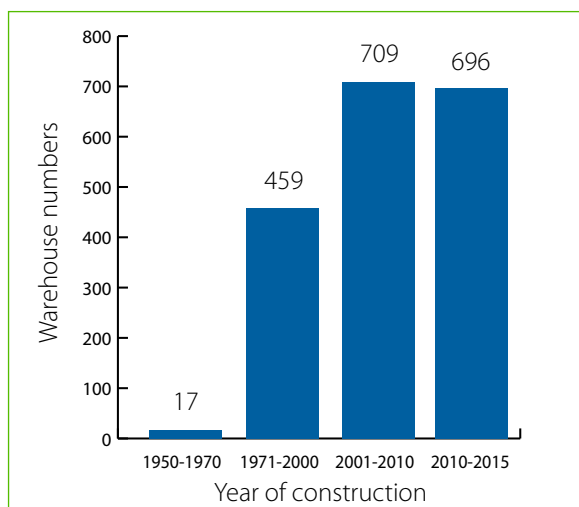
Horticultural production, including fruits, vegetables and flowers, has been emerging as a major economic activity in Turkey. The diverse ecosystems make it possible to grow a wide range of horticultural crops economically. Annual production has reached over 45 million t of fruit and vegetables, accounting for approximately 3% of total global production, with a rapid increase in production over the last few decades. However, this large volume of production has, unfortunately, not been matched by developments in cold chain management and storage technologies. The postharvest losses in Turkey have ranged between 10 and 30% depending on products and postharvest technologies used (Erkan, 2013). When these losses are taken into account, approximately 5-13 million t of fruit and vegetables have been wasted annually before even reaching the consumers. These losses are actually greater than the total fruit and vegetable production of many countries. Reduction in such a huge amount of losses, and maintenance of postharvest quality of fruits and vegetables, can only be achieved by implementation of appropriate handling of harvest and sorting, cold chain and storage technology. Furthermore, consumers are now demanding a year-round supply of fruits and vegetables, and this demand also can only be met by using advanced storage technology.



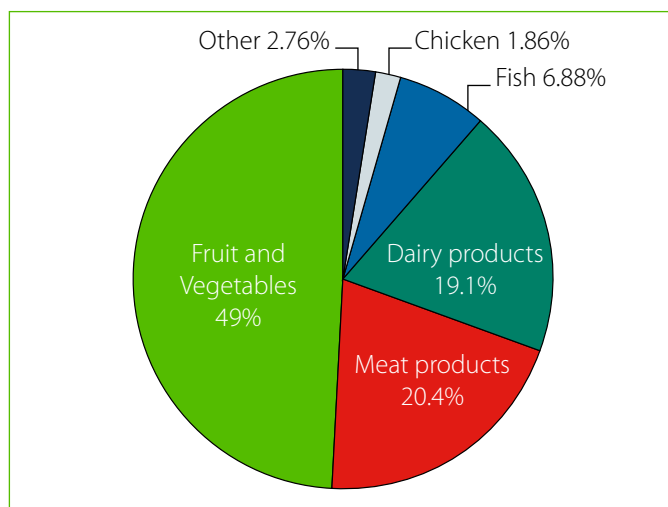
■ Figure 1. Gulbudak, in Isparta province, has the highest capacity refrigerated warehouse for apples in Turkey, being able to store up to 23,000 t.

Postharvest handling and storage practices for fruits and vegetables are designed with the goal of maintaining quality and delaying ripening and senescence. Low temperature storage has been used as an effective means of extending marketing and shelf-life periods of fresh fruits and vegetables. It also helps to manage marketing and distribution of produce in times of peak production in an orderly manner. Therefore, without the development of advanced cold storage technology in any country, exportation cannot be

improved in the fruit and vegetable industry. The history of mechanically cooled fruits and vegetables storage in Turkey dates back to 1904. But, little progress was made over the next 40 years in terms of building refrigerated warehouse facilities. New storage facilities did not gain momentum until the 1950s. When the Meat and Fish Board was founded in 1952, the requirement for storage facilities became unavoidable. Thus, from 1952 until 1970, 156 public storage facilities were constructed, with a total capacity of 348.601 m³.



■ Figure 2. Number of storage facilities and their construction years in Turkey (Turk, 2015).



■ Figure 3. Distribution of storage facilities based on usage (Turk, 2015)

Further progress in the construction of storage facilities was made between 1971 and 1980. These facilities made a significant contribution towards successful exports of fruits and vegetables from Turkey (Kaynas and Sakaldas, 2009; Turk, 2015).

In the last decade, the cold storage business has become one of the vital parts of the agricultural industry. According to the capacity report published in 2014 by the “International Association of Refrigerated Warehouses (IARW)” and “the Global Cold Chain Alliance’s Core Partner (GCCA)”, India had the largest cold storage capacity in the world, with 131 million m³, whereas Turkey ranked 14th, with 7 million m³ capacity. According to the same reports, cold storage capacity increased in Turkey by 68% between 2008 and 2014. Turkey became the country with the highest rate of increase in capacity of cold storage facilities (Turk, 2015). The increase in support for rural development has resulted in new facilities being built with large storage capacity (Figure 1). However, there is still a dire need to increase the number of cold storage facilities because capacity is still insufficient to cope with the amount of fruits and vegetables being produced in Turkey.

According to recent statistics, there are 1881 cold storage facilities in Turkey. The total capacity of these facilities is approximately 2.2 million t and built in two distinct periods, 1950-1970 (17 facilities) and 2010-2015 (696 facilities) (Figure 2). Fruit and vegetables are stored in 49% of the facilities, 20.4% are used for meat and meat products, 19.1% for dairy products, 6.88% for fish and 1.86% for chick-

■ Table 1. Provinces with the highest number of refrigerated warehouses in Turkey (Turk, 2015).

Province name	Number of warehouses
Istanbul	146
Antalya	145
Izmir	120
Bursa	116
Isparta	114

■ Table 2. Provinces with the largest refrigerated warehouse capacity in Turkey (Turk, 2015).

Province name	Storage capacity (t)
Isparta	505,000
Bursa	219,562
Antalya	191,210
Karaman	108,950
Mersin	92,315



■ Figure 4. Apple has the greatest storage requirement in Turkey, with 1,000,000 t of fruit stored annually.

en (Figure 3) (Turk, 2015). Private companies operate 93.33% of the facilities, cooperatives operate 3.39%, while 3.28% are operated by the public.

Istanbul and Antalya have the highest number of refrigerated warehouses (146 and 145, respectively), followed by Izmir with 120 refrigerated warehouses (Table 1). However, in terms of cold storage capacity within Turkey, Isparta province ranks first with 505,000 t (about 7 million m³; Table 2) (Turk, 2015). Between 2001 and 2014, government support enabled 488,628 m³ of cold storage capacity to be established. Within this period, about 453 million Euro of subsidies were made available by the government (Tuzun, 2015; Gunes et al., 2017). Furthermore, government support during this same period was

extended to some pack house facilities (total of 83 facilities), which enabled them to install electronic sorting lines (Tuzun, 2015; Gunes et al., 2017). Apple is the most stored fruit in Turkey at a total of 1,000,000 t (Figure 4). Other crops stored for long periods are pear, quince, pomegranate and orange (Figure 5).

Conventional cold storage

Conventional cold storage facilities are commonly used for long term maintenance of fruit with the quality standards required for both international and domestic markets. It is likely that many of these facilities will be converted to controlled atmosphere (CA) storage, and possibly include partial conversion to dynamic controlled atmosphere (DCA) storage, in the near future.



■ Figure 5. Quince and pear require long term storage in Turkey.



■ Figure 6. Controlled atmosphere storage technology is mostly used for apple, pear and pomegranate in Turkey.



■ Figure 7. Pomegranate has one of the largest volumes of fruit in Turkey that is stored using modified atmosphere packaging.

Controlled atmosphere storage

Although CA storage is a fairly old storage technique, it has only been used relatively recently in Turkey and has had limited usage. The first experiments on CA storage in Turkey began in the early 1980s at Ataturk Central Horticultural Research Institute in Yalova city near Istanbul. The first commercial CA storage was constructed and used for apple storage in 1990. The most significant and accelerated expansion of CA storage technology began in the last decade and the total CA storage capacity for fruit and vegetables reached 200,000 t. Main crops stored in CA facilities are apple, pear and pomegranate (Figure 6).

Of the 2,200,000 t of cold storage capacity, only 10% of them use CA storage. The newest storage technology in the world, DCA, has

also recently been introduced in Turkey, with a total capacity of 10,000 t. Apple is the only fruit stored in DCA storage in Turkey to date (Erkan, 2013).

Modified atmosphere packaging

Modified atmosphere packaging (MAP) is a very common method widely used for fruit and vegetable storage in Turkey. Pomegranate, cherry, apricot, grape, cucumber and leafy vegetables are the most prevalent MA-stored products (Figure 7). Low density polyethylene film (LDPE) is generally used for the packaging of fresh fruits and vegetables, owing to its high permeability and softness compared to high density film. MAP storage requires minimum capital and energy and is much more economical to operate compared with CA storage (Erkan, 2012).

Ethylene inhibition

Ethylene inhibition through 1-methylcyclopropene (1-MCP) is the basis of a new technology that is increasingly being used to improve storage potential and maintain quality of fruit and vegetables all around the world. 1-MCP is registered for commercial use for a number of crops in Turkey, including apple, kiwifruit, pear, persimmon, plum and quince. Since there is still limited availability of CA storage capacity in Turkey, the use of 1-MCP has rapidly expanded, especially for storage of climacteric fruits such as apples and pears. After the registration of 1-MCP in 2003, its use has boomed and is utilized by many storage operators. The registration studies of this growth regulator are still ongoing for other unregistered fruits and vegetables. Additional research for many fruits and vegetables will still be required for precise determination of the optimum 1-MCP applications.

Natural storage facilities

‘Cappadocia’ is one of the unique tourism centers in Turkey and its landscape contains soft volcanic mountainous rocks, shaped into towers and valleys by erosion. They are easily processed by hand to convert into underground caves (Figure 8). They are one of the most important storage facilities in the region. These underground caves are carved into tufa rock and have been used for centuries as storage facilities of different fruits and vegetables. In most cases, no mechanical cooling system was required for them. They are considered to be as effective as mechanically cooled warehouses. However, they are still named as “ordinary or natural storage rooms”. In this storage system, cold air is supplied completely from outside at cooler night times and the natural insulation of the rock



■ Figure 8. The underground cave storage unit in Nevsehir region (Courtesy of Okan Yilmaz and Husnu Bas from Ministry of Food, Agriculture and Livestock in Nevsehir, Turkey).



■ Figure 9. Lemons wrapped with biphenyl-impregnated paper are stored in underground caves (Courtesy of Okan Yilmaz and Husnu Bas from Ministry of Food, Agriculture and Livestock in Nevsehir, Turkey).



■ Figure 10. The underground cave storage facilities in Nevsehir region (Courtesy of Okan Yilmaz and Husnu Bas from Ministry of Food, Agriculture and Livestock in Nevsehir, Turkey).

walls blocks the temperature rise during relatively warmer day periods. This results in a constant underground temperature of about 10-15°C and 80-90% relative humidity, which converts the caves into an ideal storage environment for different fruits and vegetables. These types of warehouses are extensively located in Nevsehir province in Cappadocia region and mostly used for lemon, onion and potato storage (Kaynas, 2016).

Lemons can be stored for about 8-9 months in these warehouses if they are wrapped in biphenyl-impregnated papers (Figure 9). These stored lemons are named as “cave stored lemon (yatak)” and it is still the most common lemon storage method in Turkey. The total capacity of these cave warehouses has reached about 300,000 t (Figure 10). Storage capacity in any single cave can be up to 20,000 t. This type of warehouse system has huge cost advantages over the mechanically cooled storage technologies. They are able to provide significant contributions to the local and national economy by saving energy and providing employment opportunities in the region.

Furthermore, a huge amount of fruit and vegetables are stored in basements of houses without using any cooling systems. Melons can be stored by hanging from the roof in this type of ordinary storage room for up to three months. Onion, potato and pumpkin are some other common crops stored in this type of storage room (Figure 11).

In addition to underground storage, some fruit crops are being stored in different types of uncooled old fashion storage rooms. For example, Turkey produces 70% of the world’s hazelnuts and exports 85% of its production. Hazelnuts account for around 12% of total agricultural exports of Turkey. Therefore, hazelnut is one of the most important nut crops in Turkey and is stored mostly in linen sacks (Figure 12) or in bulk in storage rooms without a cooling system.

Packing houses

Increasing demand for high quality fruit and vegetables has resulted in significant changes in packing house facilities in Turkey. Packing houses range from simple packing sheds with limited equipment and minimal oper-

ations up to large complexes that are well equipped with facilities for specialized operation systems, including electronic sorters (Figure 13). Produce for export or supermarket outlets are usually required to be packed using these more specialized operations.

Conclusion

The fruit and vegetable sector has a vital role in Turkey’s economy. Currently, however, production in Turkey merely contributes 2% of total international trade of fruits and vegetables. Whilst productivity levels are one point of possible intervention, the postharvest chain of food supply cannot be neglected. Fruits and vegetables are generally produced and marketed by small-scale farmers in Turkey. It is crucial to maximize profitability of these small-scale commercial farmers. One of the bottle-necks is a shortage of proper storage facilities available to these farmers. Therefore, it is necessary to implement new postharvest techniques and increase storage facilities to reduce postharvest losses. For that reason, the horticultural industry in Turkey needs to focus more on



■ Figure 11. Melon and onion storage in ordinary storage rooms under houses.



■ Figure 12. Hazelnuts are mostly stored in linen sacks (Courtesy of Aysun Akar from Hazelnut Research Institute in Giresun, Turkey).



■ Figure 13. New packing houses with electronic sorting and grading.

expanding storage and packing house facilities, to enable an increase in exports of fruits and vegetables. The maintenance of the cold chain system will also help in reducing these losses and retain the quality of fruit and vegetables. The competition existing in

international markets requires year-round supply of high-quality fruit and vegetables. Improved postharvest technology available in Turkey can play a vital role in assisting to accomplish these goals. ●



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> Microgreens – a multi-mineral and nutrient rich food

N.A. Tamilselvi and T. Arumugam

Introduction

Mineral malnutrition (e.g., Fe and Zn) is one of the most important global challenges affecting two-thirds of the world's population (Weber, 2017) from every economic status, and the problem is intensified by current agricultural practices. The lack of soil, space, outdoor garden sites, and time to commit to traditional vegetable cultivation, as well as the high cost of production, are some of the challenges that need innovative approaches. Current efforts to mitigate mineral malnourishment have focused on developing bio-fortification methods (White et al., 2009), genetic engineering and manipulation of the crops to maximize nutrient uptake (Grusack, 2002). Yet, other strategies exist to solve these problems. For instance, microgreens, a new category of salad crops gaining popularity and interest over the past few years, represent a rich source of nutrients and vitamins with nutraceutical properties (Mir et al., 2017). They do not rely on bio-fortification or genetic engineering/manipulation. They can play an important role in human health. This may explain their recent popularity and increased consumption. Moreover, these young seedlings contain lower nitrate concentrations compared with baby leaf or adult plants of the same species (Bulgari et al., 2017). Xiao et al. (2012) found that microgreens contain

much higher concentrations of vitamins and carotenoids than the respective adult species. Similarly, Sun et al. (2013) reported that microgreens of five *Brassica* species displayed more complex polyphenol profiles compared with their mature counterparts. Microgreens are seedlings and edible cotyledons of many vegetables, herbs and flowers used to provide a range of colors, textures and flavors to a wide variety of dishes (Xiao et al., 2012; Pinto et al., 2015; Mir et al., 2017). They represent a new culinary trend; they are particularly popular with gourmet chefs around the world. However, most people who cook their own food find microgreens too expensive to purchase. Growing of microgreens in residential gardens can however be an affordable alternative.

What are microgreens and how are they used?

Microgreens are a new class of edible greens of vegetables, herbs (basil, cilantro), and flowers that are young and tender, having two fully developed cotyledon leaves with or without the emerging first true leaves. According to Kou et al. (2013), they are harvested at the first true leaf stage, just above the roots, and consumed fresh as salad greens. These are typically a special category of greens by their size and age (Pinto et

al., 2015) among the wide variety of greens available in the market. They are larger than sprouts but smaller than baby versions of popular vegetables such as lettuce, spinach, baby salad leaf and baby corn. Microgreens can be eaten raw at the seed leaf (cotyledon) stage, except the root, or often, one to two true leaves are allowed to form and provide more plant weight. Microgreens are 2.5-10 cm in height depending on the species and can provide a wide array of intense flavors, colors and textures (Xiao et al., 2012). Production can vary by species, but often microgreens can be harvested within 7-14 days after sowing under optimum growing conditions (Lee et al., 2004; Xiao et al., 2012, 2014a). The seeds are sown at a high density to maximize yields. Arugula (rocket), spinach, radish, celery, cilantro, purple mustard, chard, red beet, green pea and pepper cress are examples of typical microgreens. Some of these, like arugula, fennel, cilantro and basil, have distinct flavors that intensify the taste profile of the dominant greens in a salad or other dishes.

Microgreens versus sprouts

Microgreens are different from sprouts and are harvested before they develop into larger plants and are grown in a shallow container of soil. The unique differences between

■ Table 1. Differences between microgreens and sprouts.

Microgreens	Sprouts
Microgreens are defined as leafy vegetables and herbs shoots used to enhance salads or as edible garnishes to embellish a wide variety of other dishes (Mir et al., 2017)	Sprout seeds are usually nuts, grains or beans and are consumed after germination or partially after germination
Microgreens are harvested just above the roots; the stem, cotyledons and first true leaves are eaten	Sprouts are eaten with their roots intact. Hence these seeds are washed properly to remove foreign substances and soil particles
Microgreens are grown over soil surface or other growing medium such as peat moss, vermiculite and perlite (Murphy et al., 2010; Xiao et al., 2014b)	Sprouts are grown entirely in water in an enclosed container such as a glass jar. The seeds are soaked in water in various time-temperature schedules depending on the type and size of seeds (Bergquist et al., 2006; Xiao et al., 2014a)
Seed density is low as the young greens need space to grow	Seed density is high
Microgreens take more time to grow than sprouts as leaves are larger and greener (Poorva and Aggarwal, 2013)	It takes relatively less time to grow than microgreens
These greens require sunlight for their efficient growth	Sprouts are grown in high moisture, humidity levels, optimum temperature and dark or low-light conditions
Microgreens present relatively less risk of food borne illness than sprouts	Sprouts have a high risk of food borne illnesses because their growing conditions are also ideal for the growth of bacteria



■ Figure 1. Red cabbage microgreens at cotyledon stage after 16 days.



■ Figure 2. Harvested white cabbage microgreens.

microgreens and sprouts enumerated by different authors are listed in Table 1.

Benefits of microgreens

Microgreens are a much richer source of functional components such as antioxidants, phenolics, vitamins and minerals than their respective mature greens or seeds (Xiao et al., 2012; Janovska et al., 2010). Besides normal nutritional values, they have health promoting or disease preventing properties, and are thus highly prized and considered as “functional foods”. Microgreens add unique textures, and unusual flavors to meals (Xiao et al., 2012; Pinto et al., 2015; Mir et al., 2017). Microgreens get their color from naturally occurring pigments found in plants. Microgreens are a rich source of antioxidants and other phytonutrients potentially beneficial to human health and have been shown to lower the risk of certain cancers and heart diseases (Xiao et al., 2012). The most common phytonutrients found in microgreens are β -carotene and other carotenoids and vitamins K, C and E. These tiny plants can be used to brighten up a wide variety of main dishes with their vivid color ranges (Treadwell et al., 2010; Wallin, 2013). Microgreens are added to various dishes

whole or chopped. Coarsely chopping herb microgreens help to bring out their unique flavors and aroma. Microgreens should not be heated since they quickly deteriorate when cooked, although they can be added as garnish on top of hot dips or dishes. They can be used generously in cold dishes like salads, smoothies and sandwiches (Kou et al., 2014).

Microgreens production and utilization

Microgreens can be grown commercially and at a smaller scale by individuals for home use, either as sole crop or mixed crop (Poorva and Aggarwal, 2013). Identifying the right stage of harvest is one of the most important production practices to obtain an appropriate mix of microgreens. The time required for germination to attain a harvestable stage greatly varies from crop to crop (Allende et al., 2004; Pinto et al., 2015). For mixed cropping, the growers have to select the crops with similar growth rates, so that the entire crop can be harvested at once. Sometimes the growers raise various crops as monocultures and then mix them after harvest (Mir et al., 2017). Commonly cultivated microgreens are spinach (Lester and Hallman, 2010), table

beet (Murphy et al., 2010; Pill et al., 2011), mustard (Kopsell et al., 2012), buckwheat (Kou et al., 2013), arugula, celery, red cabbage (Figure 1), white cabbage (Figure 2), broccoli, radish and lettuce (Xiao et al., 2012; Chandra et al., 2012; Sun et al., 2013; Kou et al., 2014; Xiao et al., 2014a, b; Pinto et al., 2015).

Microgreens production at home

Microgreens may be produced in home gardens or backyards under optimum growing conditions. They can also be grown in greenhouses or indoor in urban situations, if the temperature ranges from about 18-25°C and light levels and day lengths are sufficient. Such small-scale home production could be encouraged in nutrient-deficient populations (e.g. in keyhole gardens that are being encouraged in Africa (www.sendacow.org)).

Growing media and production sites

Since microgreens are fragile and sensitive to physical damage, they should be protected from rainfall and other environmental stresses. They can be grown in greenhouses, high tunnels, shade structures or indoors. Microgreens have a short growing cycle and are mainly produced hydroponically or

■ Table 2. Common vegetable and herb species suitable for microgreens production and suitable seasons/growing conditions (Bumgarner and Metallo, 2018).

Cool-season vegetables	Warm-season vegetables	Herbs grown as microgreens
Kale, broccoli, cabbage, beets, Swiss chard, pea, lettuce, mizuna, arugula, pak choy, turnip, radish, endive, mustard, cress, carrot	Amaranth, sweet corn	Basil, cilantro, parsley, fennel, dill, marjoram
Growing conditions		
Requires temperatures around 21-23°C and slightly lower temperatures and light conditions		Requires temperatures around 24-27°C and bright sunshine

semi-hydroponically. Under hydroponic systems, microgreens can be produced using perlite or vermiculite. Sterilized growing media should be used to avoid the risk of pest and disease development. Depending on the requirements they are also produced in garden beds, in window sills as well as in containers (Mir et al., 2017). Microgreens may also be produced in flat nursery beds or plug trays with soil or compost mixed with vermicompost under conventional systems. They may be produced in plastic trays with bottom holes to allow drainage. According to Kou et al. (2013) they can be grown in a standard, sterile, loose soil and many mixes have been used successfully with peat, vermiculite, perlite and bark.

Growing conditions

Different vegetables and herbs used for microgreens have different growing requirements (Table 2). Cool-season crops, such as broccoli, lettuce (Figure 3) and arugula, will germinate well in temperatures of around 21-23°C, but can also grow at slightly lower temperatures. The growth rate of cruciferous vegetables, such as broccoli, arugula, radish and pak choy, will be higher at moderate light and temperature conditions. Quick germination and higher germination percentages were noticed when warm season crops, such as amaranth (Figure 4) and basil (Figure 5), were sown at temperatures from 24-27°C. Cool-season crops, such as lettuce and arugula, may grow well under slightly lower light conditions, compared with herbs like basil and some other warm-season crops.

Seeds and sowing

The vegetable and herb seeds used for microgreens production should not be treated with any plant protection chemicals (Weber, 2017). Seeds are sown either in rows or are broadcasted. To maximize production, dense sowing is advised but sowing seeds too densely provides an ideal environment for pests (e.g. aphids and thrips) and diseases, particularly *Pythium*, *Phytophthora* and damping-off. However, *Sclerotinia* and *Rhizoctonia* diseases may also pose a problem to some hosts (Kaiser and Matt, 2012). Moreover, overcrowding encourages elongated stems (Mir et al., 2017). To avoid the pest and disease load, and also to reduce excessive stem elongation, the seeds should be sown at optimum spacing. The seeds of larger-seeded crops, such as pea (Figure 6), beet and chards, are soaked in water prior to sowing, to speed up the germination. These seeds are covered with 0.5-0.6 cm of growing media to prevent drying during germination. From a grower's point of view, total shoot fresh weight (FW) is often the preferred yield determinant to achieve high return. Uniformity and speed of crop establishment indirectly increases the total fresh weight of the crop. Lee et al. (2004) examined several seed treatments to advance greenhouse establishment of table beet and chard microgreens. The most pronounced seedling emergence advancement was gained by germinating seed balls in fine-grade exfoliated vermiculite (150% water [weight per vermiculite dry weight (DW)] for 3 days at 27°C) and sowing the germinated seed ball vermiculite

mixture. Similarly, Murphy and Pill (2010) and Murphy et al. (2010) found that pre-sowing germination (pregermination) of arugula/rocket seeds (*Eruca vesicaria* subsp. *sativa*) in fine-grade exfoliated vermiculite, moistened with 200% water (weight per vermiculite DW) for 1 day at 20°C, produced the greatest shoot FW m⁻² 15 days after planting (10.14 kg m⁻²).

Watering

After germination, the seedlings should be watered using a watering can or micro sprinklers. Bottom watering is best because it keeps stems and leaves dry and reduces disease risk. However, the growing media should be kept moist, but not saturated. Overwatering can lead to stunted or deformed growth and there is a risk of pest and disease development. Flooding encourages fungal disease incidence in foliage. During the summer months, the growing area may be covered with a shade net or microgreens containers may be moved to shady areas to avoid photo-bleaching.

Nutrient supplements

Since microgreens are harvested at an immature stage and consumed as such, fertilizers are not usually necessary because the seeds have sufficient nutrition for the young crop (Xiao et al., 2015). Organic supplements such as compost, vermicompost mixed with growing media mostly increase the yield of microgreens (Murphy et al., 2010). In addition, water soluble organic nutrients derived from compost teas may be used to enhance the growth of microgreen seedlings. However,



■ Figure 3. Speckled loose-leaf lettuce microgreens.



■ Figure 4. Amaranth microgreens.



■ Figure 5. Basil microgreens at true leaf stage.

soilless media may be supplied with small amounts of water soluble fertilizers. This can be particularly useful for speeding up the growth of slow growing microgreens, such as parsley and basil.

Pest and diseases

There are few pest and disease problems associated with microgreens because the growth cycle is short, and soilless mixes and paper pads are essentially free of pathogens. Microgreens that are too densely planted can have issues of poor air flow and water saturation in the root zone. Moreover, over-seeding, overwatering, poor airflow, low light levels and extreme temperatures can cause poor germination or seedling death. Algal growth around the young plants can become a problem in production of microgreens, which hampers the growth of seedlings, but it poses little threat to plants. Low light levels and overcrowding can also cause yellowing of leaves, and stretching and thinning of stems. Continuous exposure to high temperatures will cause leaf curling, stunting, yellowing of leaves and seedling death. Potential pests that can affect microgreens' production include thrips, whitefly,

and aphid. Dense sowing of seeds provides an ideal environment for these pests and for damping-off diseases, particularly *Pythium* and *Phytophthora*. However, *Sclerotinia* and *Rhizoctonia* diseases may also pose a problem to some hosts (Kaiser and Matt, 2012). Many of these diseases can be prevented through sparse sowing, good sanitation practices, adequate air circulation and proper water management.

Harvesting and storage

Microgreens are commonly harvested at one time for convenience, using clean scissors or small hand pruners. The harvested fresh microgreens should be marketed and consumed as rapidly as possible, and home-grown microgreens should only be harvested immediately prior to consumption. Cutting height is important to ensure that growing media particles do not contaminate the product. Microgreens are harvested when the first set of cotyledon leaves and true leaves have developed, usually at about 5 cm tall, but it is dependent on the type of crop (Mir et al., 2017). The time from germination to attain a harvestable stage greatly varies from 1-3 weeks depending on the crop (Allende et al.,

2004; Xiao et al., 2014a). The approximate time required for different species to attain a harvestable stage, and the most suitable storage temperatures, are listed in Table 3. Microgreens are delicate seedlings that should be handled with care when harvested. After harvesting, they should be thoroughly washed with clean water to remove any residual soilless mix and plant debris. Mir et al. (2017) stated that harvested microgreens are highly perishable and need to be washed and cooled as quickly as possible using good handling practices for food safety. They should then be patted dried gently or rolled with paper towels to remove excess water before placing in containers for storage. Microgreens should be placed in rigid plastic containers to protect against crushing and to prolong the shelf life of the packaged product. According to Kou et al. (2014) and Xiao et al. (2014b) microgreens are usually packed in polyethylene packages and cooled to recommended temperatures before supplying to the market or consumers. Since microgreens are harvested at the cotyledon stage, the immature tissue structure of microgreens has a very short shelf life at ambient temperature and various techniques are used to enhance the shelf life of the pro-

■ Table 3. Commonly grown microgreens: time required to attain harvestable stage and storage conditions.

Crop	Harvestable stage	Storage	References
Spinach	10 days	Polyethylene film at 5°C	Allende et al., 2004
		Oriented polypropylene at 2 or 10°C for 5 or 9 days	Bergquist et al., 2006
Table beet	15 days		Murphy et al., 2010
Buckwheat	5 cm height	Polyethylene films, stored at 1, 5, 10, 15 or 20°C for 14 days and at 5°C for 21 days	Kou et al., 2013
Broccoli	9 days	Polyethylene film at 5°C	Kou et al., 2013
Radish	7 days	Polyethylene film at 1°C	Xiao et al., 2014a
Lettuce	14 days	Freeze dried	Pinto et al., 2015



■ Figure 6. Pea microgreens ready for harvest.

duce. The two important techniques used for increasing the postharvest shelf life are storage temperature and storage atmospheric conditions. Microgreens can be stored in the refrigerator (4°C) from a few days to two weeks depending on the species.

Conclusion

In the last few years, microgreens have gained popularity because of changes in life

style patterns and health consciousness of consumers. Due to their high concentration of antioxidants, vitamins and minerals, and low nitrate content, which are linked with the promotion of good human health, microgreens have great potential to be a positive and simple way to reduce the number of people suffering from mineral malnutrition. ●

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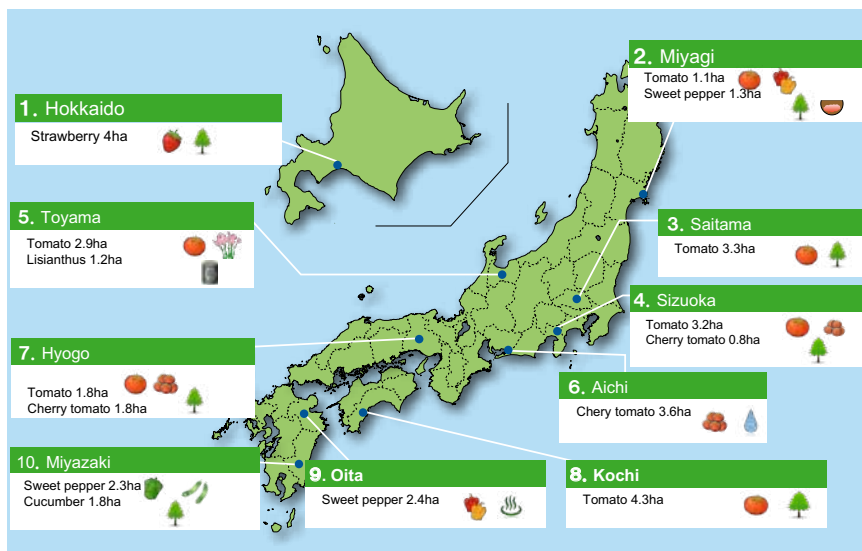
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- Water Content
- EC of Pore Water
- Temperature



> Next-generation greenhouse horticulture in Japan

Tadahisa Higashide



■ Figure 1. The location of the next-generation type of base facilities in ten prefectures in Japan and crops grown in each facility.



■ Figure 2. The base facilities in Hokkaido. Year-round production of strawberry in a cold weather region is possible.

Issues of greenhouse horticulture in Japan

Greenhouse horticulture can be profitable even within small areas of land. Japanese farmers cultivate various crops in greenhouses. The total area of greenhouses, including glasshouses, in Japan accounts for 46,500 ha and the total number has slightly decreased recently. Seventy percent of greenhouses in Japan are used for growing vegetables. The number of farming households who operate greenhouse horticulture are 107,000 for vegetables and 25,000 for ornamental plants. Tomatoes are the most important crop in the vegetable category, with the highest total value of production for many years in Japan. Tomato production in Japan is 65,000 t per year; the area of tomato greenhouses is 7,300 ha (MAFF, 2015). Tomato yield and labor time per area are lower and higher in Japan than in The Netherlands, respectively. However, income per area is higher for Japanese growers than for Dutch growers. This is because of low investment cost, and the farm gate price of tomatoes in Japan is 3-4 times the price in The Netherlands, being ¥250-450 kg⁻¹ (~\$US2.25-4.00 kg⁻¹).

Although Japanese tomato breeders have improved and released many tomato cultivars, the yield of greenhouse tomatoes in Japan has only slightly increased over the past 30 years (MAFF, 2012). Since Japanese

consumers and retailers have demanded improvements in fruit taste more strongly than in yield, Japanese breeders have therefore focused on fruit quality such as soluble solids content rather than quantity. Soluble solids content per unit of dry matter content was higher in Japanese popular cultivar 'Momotaro' (released in 1985), and even higher in 'Momotaro colt' (released in 2003) than most of the older cultivars (Higashide et al., 2012). High-yielding cultivars have not been a priority for Japanese tomato breeders. In contrast, breeding for higher yielding cultivars would have played a role in the increase in yield in The Netherlands. The increase in yield over the past 50 years in Dutch tomato cultivars resulted from the increase in total above ground dry matter production, which resulted from high light use efficiency (Higashide and Heuvelink, 2009). The number of greenhouse growers in Japan has been decreasing recently, because of the retirement of aging growers. To maintain the production of greenhouse vegetables, improvements in yield and labor efficiency are urgent issues in greenhouse horticulture in Japan.

The next-generation type of base facilities in ten prefectures

Recently, the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan has funded the

development of the "base facilities of the next-generation type of greenhouse horticulture" as a higher profit model of greenhouse horticulture, by adapting the Netherlands model to Japan, to increase the horticultural profits in Japan. These large-scale base facilities, in which comprehensive and seamless operations have been developed, are using integrated facilities for production, food preparation, shipping and for electric power supply, by utilizing local energy resources such as woody biomass, with the aim of reducing dependence on fossil fuels, reducing cost, and creating local jobs. An important feature has been collaboration that utilizes knowledge in other industries, including ICT technology, in the integration of comprehensive facilities. Advanced environmental control technology can be utilized to enable year-round production according to farmers' plans. The "base facilities of the next-generation type of greenhouse horticulture" are resulting in: (1) productivity improvement by introduction of advanced environmental control technology, (2) reduction in dependence on fossil fuels by utilization of local energy resources, and (3) comprehensive integration of facilities from production to shipping, including private power generation, along with an increase in the size of the greenhouse. MAFF expects that these activities made by the "base facilities of the



■ Figure 3. The base facilities in Shizuoka. Large-scale production of high Brix tomato.



■ Figure 4. The base facilities in Toyama. A. Single-span greenhouses in a snow-covered region. B. Lisianthus production with assimilate LED.

next-generation type of greenhouse horticulture” hold promise for income improvement and local job creation.

The “base facilities of the next-generation type of greenhouse horticulture” were built in ten prefectures throughout Japan (Figure 1). Daily average temperatures at the base facilities range from between -3.8 and 7.5°C, and between 20.3 and 27.2°C in January and August, respectively. Daily solar radiations range from between 5.7 and 10.8 MJ m⁻² d⁻¹, and between 18.0 and 24.1 MJ m⁻² d⁻¹ in January and August, respectively. Crop, cropping style, greenhouse type and area, and local energy source in each facility are as follows:

- Hokkaido: Strawberry, elevated bench, Japanese multi-span greenhouse, 4 ha, woody chip (Figure 2).
- Miyagi: Tomato and sweet pepper, long-term cultivation, Venlo type, 2.4 ha, woody pellet.
- Saitama: Tomato, low-truss cultivation, Japanese multi-span greenhouse, 3.3 ha, woody pellet.
- Shizuoka: High Brix tomato, low-truss cultivation, Japanese multi-span greenhouse, 4.0 ha, woody pellet (Figure 3).

- Toyama: High Brix tomato and lisianthus, long-term cultivation, Japanese single-span greenhouse, 4.1 ha, industrial residue (Figure 4).
- Aichi: Cherry tomato, long-term cultivation, Venlo type, 3.6 ha, sewerage facility (Figure 5).
- Hyogo: Tomato, long-term cultivation, Venlo type, 3.6 ha, woody chip (Figure 6).
- Kochi: Tomato, long-term cultivation, Venlo type, 4.3 ha, sawn wood (Figure 7).
- Oita: Tomato and sweet pepper, long-term cultivation, Venlo type, 2.4 ha, hot spring (Figure 8).
- Miyazaki: Cucumber and sweet pepper, soil cultivation, multi-span greenhouse, 4.1 ha, woody pellet (Figure 9).

Research projects supporting the next-generation type of greenhouse horticulture

To develop and innovate greenhouse horticulture, several research projects have been conducted as follows: “Cross-ministerial strategic innovation promotion program (SIP) technologies for creating next-generation agriculture, forestry and fisheries,” by Council for Science, Technology and Inno-

vation (CSTI), “The special scheme project on advanced research and development for next-generation technology,” “Development of mitigation and adaptation techniques for global warming in the sectors of agriculture, forestry, and fisheries,” and “Optimization of crop and labor management in a greenhouse by using artificial intelligence” by MAFF. In particular, a large-scale greenhouse project on “The special scheme project on advanced research and development for next-generation technology” is being conducted by the National Agriculture and Food Research Organization (NARO), the base facilities, companies, local governments in Japan, and Wageningen UR in The Netherlands. This research project is targeting improvements in yields and labor efficiency in a large-scale greenhouse including the “base facilities of the next-generation type of greenhouse horticulture”.

Even in a greenhouse, yield fluctuates daily. Prediction of the daily yield is required for efficient labor management, but that is not easy. Kaneko et al. (2015) showed that total above-ground dry matter production is strongly related to photosynthetically active



■ Figure 5. The base facilities in Aichi. A. Venlo type greenhouse. B. Heat is supplied from a sewerage facility.



■ Figure 6. The base facilities in Hyogo. Efficient labor management planning has been developed.



■ Figure 7. The base facilities in Kochi. A. Year-round tomato production. B. Sawn wood for heating boiler.

radiation interception, which is achieved by modifying the plant stage at transplanting in combination with planting density (Figure 10). Accordingly, based on the intercepted light and light use efficiency, dry matter production can be estimated (Higashide, 2015). In this large-scale greenhouse research project,

to support yield prediction, prediction of dry matter production is being developed. The successful prediction of yield fluctuations would support labor planning and improve labor efficiency (Figure 11). These predictions will also assist in controlling the product sales and improve efficiency.

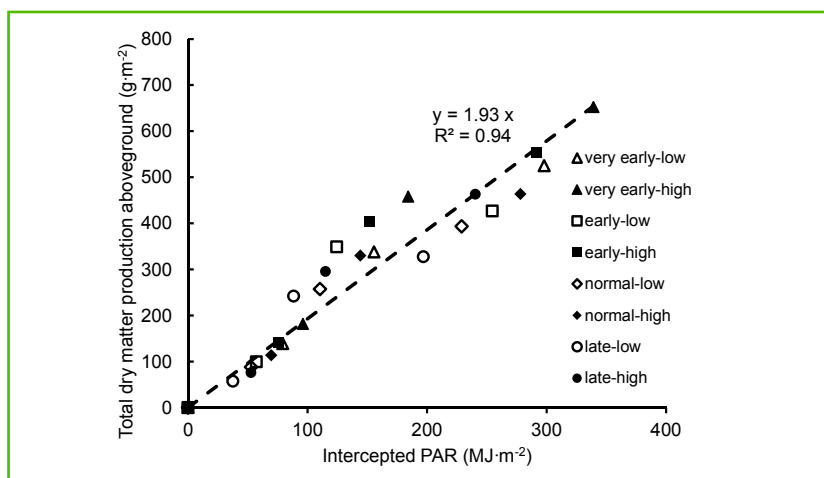
Although labor management has been developed at industrial factories, such as the car industry in Japan, the management in a greenhouse has been less developed. Operations in a greenhouse are recorded and arranged manually, based on growers' experience. In some greenhouses with



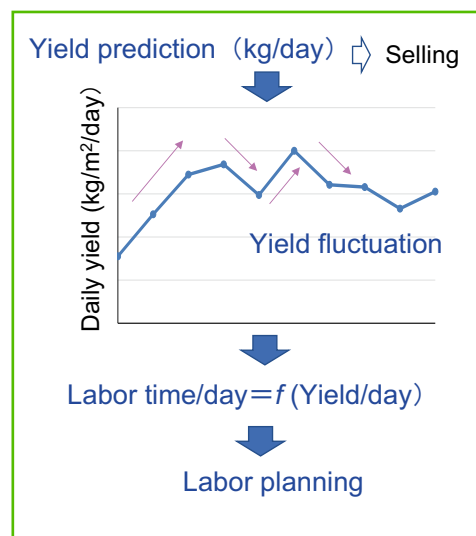
■ Figure 8. The base facilities in Oita. A. Heat from hot springs. B. Year-round production of sweet pepper.



■ Figure 9. The base facilities in Miyazaki. A. Greenhouses with storage tanks for wood pellet. B. Cucumber production in the greenhouse.



■ Figure 10. Dry matter production as a function of intercepted photosynthetically active radiation (PAR) by tomato plants grown at different plant densities and transplanted at different plant stages. Plant stage (very early, early, normal, and late)-density (high and low) (Kaneko et al., 2015).



■ Figure 11. Daily yield prediction would help labor planning and improve labor efficiency.

multi-cropping, there are crops at several stages and processes of operation at the same time. Therefore, it is complex to arrange labor and processing plans. In this large-scale greenhouse research project, recording systems for laboring operations have been developed by using ICT technology, such as bar codes, and Wi-Fi. Application software for an arrangement of labor operations has also been developed. Combination of these systems along with yield predictions will enable improvements in efficiency of labor and crop production. Moreover, in the near future, the system will be able to record the plant and labor data as big-data, and be used with artificial intelligence. ●

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► Olive and olive oil industry in Turkey

Muzaffer Kerem Savran and Ünal Kaya

Introduction

Turkey is rightly considered the homeland of olives. Indeed, the plant has spread from the original Mesopotamia region to most of the Mediterranean basin, and has converted to a unique culture, venerated for centuries. As a matter of fact, olive trees are being protected by law in Turkey, and encroaching of olive lands, cutting or uprooting of the trees and neglecting the olive groves are strictly forbidden. There are countless monumental hundreds of years old olive trees in various parts of Turkey (Figure 1). For more than 10 years now, the Turkish government has implemented a comprehensive program to support olive growing, promoting production on suitable uncultivated areas. Through this unique program, Turkey aims at becoming the second world produc-

er of olive in the world; it now ranks fourth. According to 2017 figures of IOC (International Olive Council), Turkey ranks third for table olive, and fourth for olive oil production in the world. It is estimated that 186,000 families are making a living from olive growing, and about 2 million people directly make their livelihood with olive and olive products (GTHB, 2013). The number of olive trees has shown a steady increase from below 100 million in the 1990s to the 170 million believed to exist now (Figure 2). Particularly olive orchards planted after 2005 were managed under modern and advanced techniques, including irrigation, soil tillage, pruning, fertilisation, pest and weed control. Turkey's olive production should continue to increase as recently established young olive



orchards are steadily reaching bearing stage (Figure 3). Consequently, the country is on the way to becoming an even more important player in the international market. There are some serious differences between table olive and olive oil growing with respect to cultivar selection, pest control, fertilisation, pruning, soil cultivation and harvest. While 23% of total olive production is used for table olive purposes, 77% is being processed for olive oil.

Olive production regions and spreading areas

In a comprehensive report entitled “Turkish Olive Sector Report”, which was completed in 2016, the distribution of cultivars among districts and regional variations, the number of olive oil enterprises, the agricultural prac-



■ Figure 1. The monumental olive trees in various parts of Turkey (Adana, Balıkesir, Hatay, İzmir, Manisa, Mersin and Muğla provinces).

tics used and the grower's management techniques were investigated in detail. In Turkey, olive growing is being carried out in six distinct production areas according to geographical, ecological, cultivar dynamics and production model differences (Figure 4).

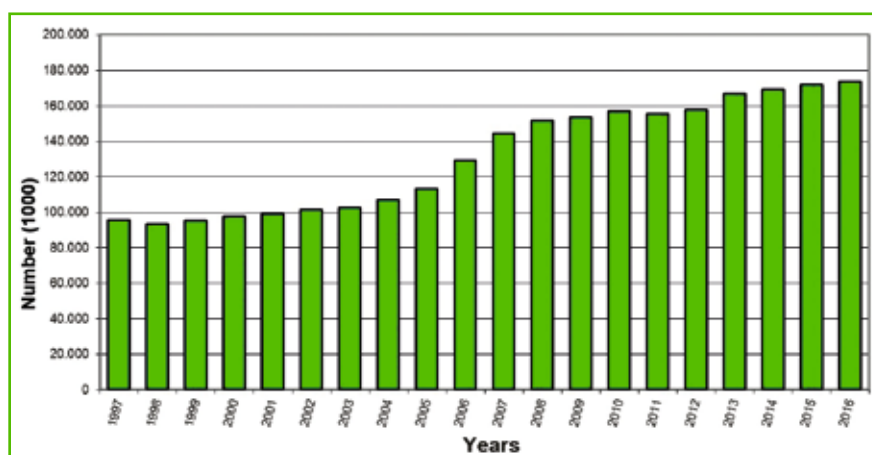
Table olive production

As observed in many olive growing countries, increasing the olive and olive oil production comes with problems. Turkey is no different in this matter. In particular, dealing with waste generated by the table olive and olive oil production industry is an issue that has been tackled by scientific studies and results have been successfully transferred to the sector. For example, installing the modern purification facilities to table olive processing plants, converting the olive oil producing establishments to 'two phases' system, and supporting programs to 'organised olive industry areas' have been implemented. As is being done in leading olive countries, developing and sustaining an environmentally friendly production model is also a major concern of the Turkish olive industry. In Figure 5, the evolution of grain olives, table olive and olive oil production in Turkey in the last two decades are shown.

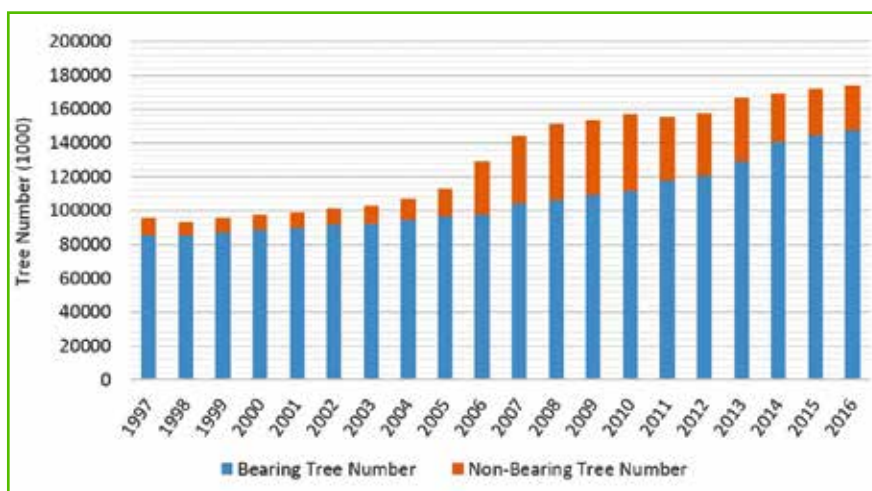
Germplasm and cultivars

Being at the centre of origin of olives, Turkey has an impressive and unique germplasm. Currently, 91 native olive cultivars are registered and taken under conservation. Other yet unknown cultivars are constantly being identified and registered. There are significant differences in the relative production distribution of the Turkish olive cultivars. In Figure 6, the latest production percentages of Turkish olives are given.

Under the impulse of governmental support after 2005, many saplings have been



■ Figure 2. The number of olive trees between 1997 and 2016 (TUIK, 2017).



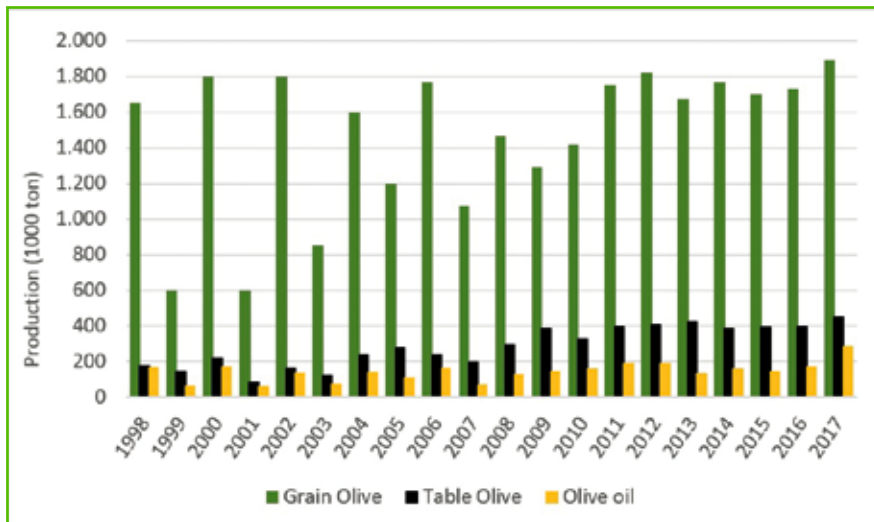
■ Figure 3. Number of bearing and non-bearing olive trees between 1997 and 2016 (TUIK, 2017).

established with cultivars like 'Gemlik' and 'Ayvalık' that are easy to propagate. As a result, while the majority of trees were cultivar 'Memecik' (45.5%; Canözer, 1991) in the past, this cultivar only amounts to about 19% today (Figure 6).

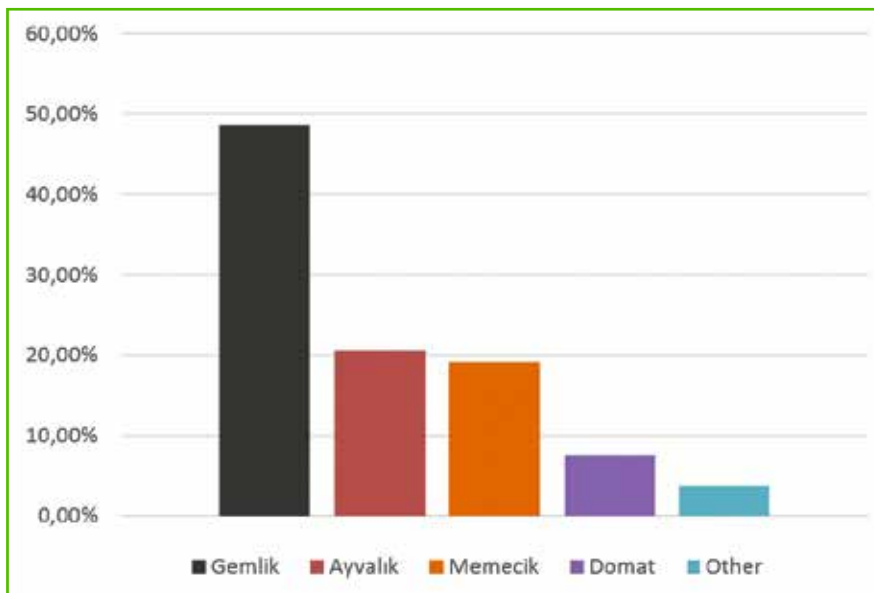
The IOC recently launch a project to create a new 'International olive cultivar collection' to complement the ones already established in Italy and Morocco. Turkey declared its interest in setting-up such a collection and was successfully selected for a new site.



■ Figure 4. Olive production regions of Turkey (Özaltaş et al., 2016).



■ Figure 5. Grain olive, table olive and olive oil production of Turkey between 1998 and 2017 (FAO, 2017; IOC, 2017; TÜİK, 2017).



■ Figure 6. Production percentages of outstanding native olives of Turkey (Özaltaş et al., 2016).

Fields are being prepared and olive cultivars are being planted for this purpose.

Properties of important Turkish olive cultivars

‘Gemlik’

It is one of the most important table olives grown in the world. It is a dual-purpose cultivar since it can also be used for oil production if the table olive market is saturated. It accounts for 49% of the total olive trees in Turkey. With wide adaptation capability, early bearing habit, low alternate bearing tendency, a fairly satisfying yield and high oil content, it has been spread over a very large geographical area. Since it has a medium-small canopy volume, the trees can be trained easily by pruning, and can be planted more densely (Kaya et al., 2015) (Figure 7).

‘Ayvalık’

It is also one of the most important olive cultivars grown in Turkey. This cultivar represents 21% of all olive trees of the country. In particular, it is widely grown in the Northern Aegean region and Mersin province. It has its own trade mark value in olive oil markets with its name deriving from a very special aroma and lightness of the oil, which is liked by the consumer. Growers prefer this high yielding cultivar because, although it is generally produced for oil, it may also be used for table olive purpose. On the other hand, trees generally develop large canopy and the alternate bearing tendency is high (Kaya et al., 2015) (Figure 8).

‘Memecik’

This cultivar is widely grown, especially in the Southern Aegean region, due to its



■ Figure 7. 'Gemlik' olive cultivar.



■ Figure 8. 'Ayvalik' olive cultivar.



■ Figure 9. 'Memecik' olive cultivar.



■ Figure 10. 'Domat' olive cultivar.



■ Figure 11. Olive orchards on a flat land (A) and olive groves on a mountainous area (B).

high oil ratio and strong aroma. It is generally used for oil production but can also be consumed as a table olive. In Turkey, 19% of the total olive trees are 'Memecik'. This drought tolerant cultivar is generally propagated by budding on the seedling or on wild 'Delice' olives because its cuttings root poorly. Although it has a high alternate bearing tendency, it is possible to reach high harvest with correct growing conditions (Kaya et al., 2015) (Figure 9).

'Domat'

It is generally considered a green table olive due to its rather large fruits, but in some exceptional situations it is also processed for oil, in spite of the low oil ratio. This cultivar is special for the diversification of the table olive industry. It has a large canopy and high yields in optimal conditions. It shows high tolerance to frost, but is not recommended for non-irrigated areas. It accounts for 8% of the total olive trees. 'Domat' is also propagated by budding (Kaya et al., 2015) (Figure 10).

Olive growing practices in Turkey

More than half (55%) of the olive growing lands in Turkey are on flat fields, while 45% are on hilly terrains. In the past, olive groves were mostly on slopes, however, since the 1990s they have been planted mostly on flat fields (Figure 11).

Intensive rejuvenation of very old olive trees has been undertaken, and considerable yield increases are expected from these orchards. Recently, consumer demand for quality olives has increased, and growers and producers are becoming more sensitive towards this request. Great achievements have been made, particularly in timing and techniques of harvest, transport conditions, immediate

process, and controlled storage facilities. As stated in the "Olive Report of Turkey", olive growers are spraying the trees and making soil tillage three times a year, and pruning every two years on average. Yield per tree averages 27.6 kg in a good orchard condition; yet, the overall country average is only 12.2 kg.

Olive oil production

In a survey undertaken in 2016, it was determined that there are 1,187 olive oil producing facilities and 15 olive-pomace (Prina) factories in Turkey. The olive oil industry is growing fast due to increasing use of local machinery and impressive interest from the industry. Various laboratories have been accredited for controlling the production of

high quality olive oil and table olives according to the standards determined by IOC, and professional tasting panels have been established. Turkish olive oils have participated in various respected quality competitions both in Turkey and abroad, and have received many important awards, contributing to the "Quality Turkish Olive Oil" image.

Except for a few large enterprises, the Turkish olive oil industry is generally operated by small and medium sized enterprises. The average production per factory is around 280 ton per year. 56% of the facilities are three phases, 35% two phases, and 9% is mixed. With the adoption of advanced technologies, old and simple olive oil houses have almost disappeared (Figure 12). 54% of the olive oil industry is accredited for quality manage-



■ Figure 12. Modern olive oil facilities operating in Turkey.

ment and a food safety system, and 71% of them have their own trade mark.

Training, research and extension

In Turkey there are a number of old and specialised training centres such as Edremit, Çine and Akhisar Professional High Schools, which promote the development of the olive culture and industry. These schools meet the technical need of the sector by helping young, well-trained professionals to graduate. On the other hand, under the umbrella of the Ministry of Food, Agriculture and Livestock, in addition to the departments of other research institutions, there are two specialized research institutes and one sapling

propagation station. Particularly, the Olive Research Institute, which was established in 1937, located in Bornova-İzmir province, has gained an excellent reputation. This institute has long been the R&D centre of the Turkish olive and olive oil industry. By undertaking national and international research projects, it has been dealing with almost all aspects of olive growing and olive oil technologies, except that of plant protection. Plant protection R&D studies are being carried out by the İzmir-Bornova Plant Protection Research Institute. In addition to R&D studies, these institutes also organize training courses for junior researchers, extensionists, industry people and pioneer farmers.

Conclusion

In conclusion, Turkey has a dynamic olive industry with constantly increasing tree numbers and ever more trained growers and industry people. It will very likely achieve its targets and contribute significantly to the development of this very valuable product, which has no surplus in the world.

Acknowledgement

The authors would like to thank Dr. Sahin Anil for his valuable contributions to this article. ●

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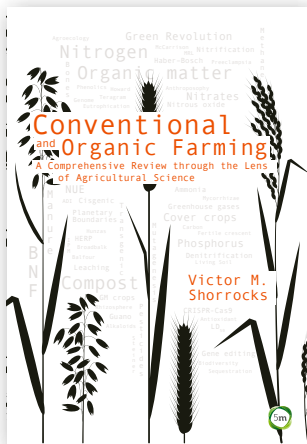


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> New books, websites

Book reviews

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



Shorrocks, V.M. (2017). Conventional and Organic Farming. A Comprehensive Review through the Lens of Agricultural Science (Sheffield, UK: 5m Publishing Ltd), pp.574. ISBN 9781910455999 (hardback). £55. www.5mpublishing.com

This multi-chaptered book contains a huge amount of information collected on a single site that compares the history of, and leading personalities involved in the development of organic, biodynamic, and conventional farming. The starting point was to look closely at the claims of those who promote the benefits to agriculture of organic farming and the virtues of organic products for human health. These products that are generally higher priced have been compared with those produced by conventional agriculture, where yields are universally higher due to the use of fertilisers, pesticides, herbicides and new plant cultivars. Although crops produced in this way tend to be different, there is little evidence to support the notion that they are not as healthy as their organic counterparts.

A fascinating historical perspective is provided about the development of organic farming, which occurred in Europe in the first half of last century. Lord Northbourne first suggested the connotation “organic” be used, and Lady Eve Balfour spent much of her adult life promoting the value of organic agriculture in the UK, USA and Australia. At that time, our knowledge of the sciences basic to agriculture, such as plant physiology, nutrition, protection and crop improvement, was limited. Organic farming appealed as a credible option. Over the past 50 years, conventional agriculture has made major advances, many of which organic cropping failed to adopt.

It is relevant here that the exploitive agriculture practiced in the new worlds of the Americas, Australia and Africa was essentially organic. It involved the grazing of native pastures by cattle and sheep with no inputs. This is still the case in much of the northern half of Australia and in the pampas of Argentina. Also, cereal and maize cropping was based, for a number of years, on the high initial fertility of these previously un-farmed lands.

There is a good description of the procedures farmers must adopt to qualify to become biodynamic producers. The origin of the movement, which evolved primarily in Switzerland and Germany, is given. It is possible to obtain biodynamic certification in quite a short period of time, rather than waiting the extended time required for complete organic approval. It is difficult to test the validity of many of Steiner’s rules and regulations, but biodynamic crop yields are generally reduced. A comment shared by many is that Steiner’s instructions are occult and dogmatic and do not contribute to the development of a sustainable form of agriculture. Surprisingly, increasing amounts of Australian wine are now marketed as being made from biodynamically grown

grapes. The claims by producers of improved wine quality are hard to dispute, as it is well known that there is an inverse relationship between the yield of grapevines and the quality of the wine made from them.

The book stresses the central importance of nitrogen as a controlling element in plant production and human nutrition, with the suggestion that the world’s supplies of this fertiliser may in time become limiting. It is possible that green sources of energy may assist with the capturing of our limitless supplies of atmospheric nitrogen. In many countries either phosphorous or potassium could become limiting for farming, but alternative sources may yet be found. In considering our ability to continue to feed ourselves, perhaps more attention may have been given to the use of hydroponics and nutrient film techniques. The products from these growing systems fall outside of all categories of agriculture, although they supply us with much of our fresh vegetables that are centrally important in human nutrition.

There is a lot of information in this wide-ranging book that will be of value to agricultural science students. I am sure it will also be useful to graduates of a few years standing seeking to keep themselves informed of new developments. It is an easy-to-read book and may find its way onto the coffee tables of those who want to be better informed about contentious agricultural topics that extend to aspects of human health. I found the layout used throughout of listing at the end of each chapter both the salient points made and the references used, particularly helpful.

*Reviewed by John V. Possingham
Honorary Member of ISHS,
Formerly, Chief CSIRO’s Division of
Horticulture, Adelaide, Australia*

> Courses and meetings

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

Conference on Healthy Landscapes: Green, Regeneration, Safety, 6-8 June 2018, Bologna, Italy. Info: Prof. Patrizia Tassinari, University of Bologna, Italy, e-mail: patrizia.tassinari@unibo.it Web: <https://events.unibo.it/healthylandscapes2018>

2019 North American Strawberry Growers Association (NASGA) Meeting and 9th North American Strawberry Symposium, 3-6 February 2019, Orlando, Florida, USA. Info: Kevin Schooley, e-mail: info@nasga.org, web: <https://nasga.org/n-american-strawberry-growers-conference.htm>



II International Symposium on Fruit Culture along Silk Road Countries

Section Nuts and Mediterranean Climate Fruits

#ishs_senu

Section Tropical and Subtropical Fruits

#ishs_sets



Participants of the symposium.

The II International Symposium on Fruit Culture along Silk Road Countries "Fruits for the Future" was held in Trebinje (Bosnia and Herzegovina) from October 2-6, 2017, under the aegis of the International Society for Horticultural Science. The host of this symposium was the Society for Horticultural Sciences of Bosnia and Herzegovina with support of the University of Banja Luka, Institute of Genetic Resources and Faculty of Agriculture; the Society for Pomology of Republic of Srpska; the Government of the Republic of Srpska, Ministry of Science and Technology and Ministry of Agriculture, Forestry and Water Management; and the Government of the Federation of Bosnia and Herzegovina, Ministry of Education and Science.

The aim of this symposium was to improve the knowledge of fruits, as well as the cooperation between western and eastern countries.

The symposium discussed various topics that were divided into five sessions:

- Biology, genetics and breeding; Sustainable use of fruit genetic resources;
- How climate change affects fruit culture along silk road countries;
- Economic and social impact of fruit culture along silk road countries; Traditional uses of fruits in relation with health and nutrient traits;



Prof. Tiziano Caruso, Chair of ISHS Section Nuts and Mediterranean Climate Fruits, welcoming the participants.

- Orchard systems – cultivars, rootstocks, cultural practices, training systems;
- Pollination and pollinators; Phytosanitary issues in fruit culture.

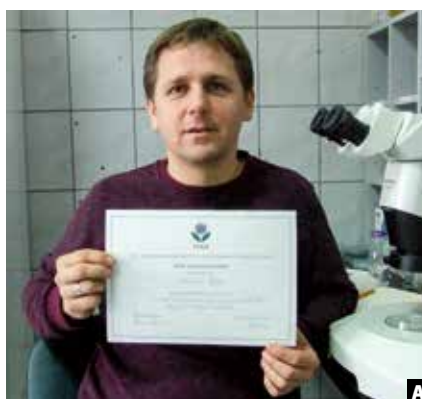
The first day of the symposium was reserved for the opening session and welcome cocktail. The participants were greeted by the organizers, by representatives of the City of Trebinje, the Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska and the Ministry of Science and Technology of the Republic of Srpska, as well as by Prof. Tiziano Caruso, Chair of ISHS Section Nuts and Mediterranean Climate Fruits. During the second and third day of the symposium,

five introductory lectures, 24 oral and 47 poster presentations were given. On the last day of the official part of the symposium, the organizers gave an ISHS student the award to Branimir Nježić, PhD student at the University of Banja Luka, Faculty of Agriculture, Bosnia and Herzegovina, for the best oral presentation entitled "Biological control by entomopathogenic nematodes in Bosnia and Herzegovina", and to Orsolya Borsai, PhD student at the University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, Romania, for the best poster entitled "In vitro propagation of *Aronia melanocarpa* (Michx.) Elliott".

As part of the symposium, a technical tour was organized to visit the fruit plantations of "Popovo Polje" a.d. company, a wine cellar of the Tvrdoš Monastery, the "Vinogradi Vukoje" (Vukoje Vineyards), a company located at "Carski Vinogradi" (Imperial Vineyards) and the vineyard of the "Vukoje 1982 Cellars" company.

Since the participants were from different parts of the world (as far as China and Canada), the contacts that were established among the participants will have significant impact on the dissemination of the scientific and practical knowledge on fruits. Hopefully, the symposium has had a positive influence on the scientists that were present and will be an excellent base for their future research.

Gordana Đurić



A



B

ISHS student award winners: A. Branimir Nježić for the best oral presentation, B. Orsolya Borsai for the best poster.



› Visit to Popovo Polje.

› Contact

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› VI International Chestnut Symposium

Section Nuts and Mediterranean Climate Fruits

#ishs_senu

The VI International Chestnut Symposium was held October 9-13, 2017, in Samsun, Turkey at Ondokuz Mayıs University under the aegis of the International Society for Horticultural Science. This international meeting follows a lineage of international symposia held every four to five years in chestnut growing regions around the world including Spoleto, Italy (1993); Bordeaux, France (1998); Chavez, Portugal (2004); Beijing, China (2008); and Shepherdstown, West Virginia (2012). In four years, the next symposium will be held in northwest Spain.

Over 60 people attended the symposium, representing 10 different countries including Azerbaijan, Croatia, Italy, Japan, Portugal, Romania, Slovakia, Slovenia, Turkey and the United States. Others in attendance included students from Turkey, Somalia, Bosnia and

Liberia. Attendees were mostly scientists, but the symposium also included processors, nurserymen and growers.

It was significant that Turkey hosted this symposium as Turkey is now the lead chestnut producing country in Europe, with 62,000 ton in production with over 30 chestnut processing companies, not counting numerous fresh chestnut and chestnut honey cooperatives scattered around the country. The tree is valued for its nuts, timber and honey. In many countries around the world, chestnut is a livelihood and has a great impact on the socioeconomic and cultural life of people.

There were 33 oral and 34 poster presentations. The different themes covered during the symposium included tree genetics and breeding, physiology, chestnut postharvest storage, orchard management, propagation,

food processing, economics, pests and diseases, and marketing. The talks described a number of activities in orchards and forests such as pollination, irrigation, and pest management. The importance of wild trees and the biodiversity found in wild trees in Europe continue to be important topics at the chestnut symposium.

Highlights of the symposium included visits to the Black Sea Horticultural Research Institute, the Ali Nihat Gökyigit Chestnut Research Station, and a trip to Nebiyan Mountain where we observed large surviving native European chestnut trees. These large surviving trees were suffering from chestnut blight cankers, but were surviving and producing a good nut crop. It is thought that the natural biological control called hypovirulence is responsible for their survival,



› Participants of the symposium.



A



B



> A. Symposium Convener Prof. Dr. Umit Serdar (right) presenting the ISHS student award to Patricia Fernandes (left) for the best oral presentation. B. Başak Özdemir, winner of the ISHS student award for the best poster.

> A large old chestnut tree on Nebiyan Mountain next to the tour bus for size comparison.

but research on these unique trees is yet to be done.

Many reports focused on issues relating to production statistics and crop management. Overall, as acreage continues to increase in European countries, yields continue to decline. Researchers cannot yet explain this fact but focus their attention on soil-borne root rots, fungal nut rots, and introduced insect pests and diseases such as chestnut blight. Countries, like Portugal, reported warmer and drier growing conditions leading to horrific wild fires; in these countries, irrigation and adding supplemental micronutrients have become a focus.

Major pests and diseases of chestnut trees such as Asian chestnut gall, caused by *Dryocosumus kuriphilus* and the parasitoid *Toryamus sinensis*, *Phytophthora* root rot and chestnut blight, caused by *Cryphonectria parasitica*, were the focus of several presentations. Presentations and posters on tree genetics and improvement of the species for nut production and pest and disease resistance were not only discussed during



> Field tour to the Black Sea Agricultural Research Institute was led by Professor Umit Serdar and his graduate student Burak Akyüz. They showed different species and cultivars of chestnut and their response to chestnut blight.

the formal sessions, but were also largely talked over during the field trips to the research stations.

The last international symposium was held in West Virginia, where the focus was pri-

marily on restoring the American chestnut tree (*Castanea dentata*) to the Appalachian Mountains of Eastern United States. There were fewer reports on the restoration of the American chestnut at this symposium and most of the presentations dealt with *C. sativa*, *C. crenata*, and *C. mollissima*.

ISHS student awards were presented to Patricia Fernandes from Instituto Nacional de Investigacao Agraria e Veterinaria (INIAV), Portugal, for the best oral presentation entitled "Histopathology of infection of *Castanea* spp. roots by *Phytophthora cinnamomi*", and to Başak Özdemir from Ankara University, Turkey, for the best poster entitled "Molecular studies conducted in chestnut".

Dennis W. Fulbright



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› VII International Symposium on Almonds and Pistachios

Section Nuts and Mediterranean Climate Fruits

#ishs_senu

Adelaide, South Australia, came 'ALIVE' with 144 almond and pistachio research and/or extension personnel, industry representatives and growers attending the VII International Symposium on Almonds and Pistachios, held from the 5-9 November 2017 under the auspices of the ISHS. Delegates from Australia, Argentina, Bangladesh, China, Chile, Spain, France, Germany, Iran, Portugal, Serbia, Turkey and USA descended on the unique and easily accessible city of Adelaide. Many came early, and some stayed later to enjoy the 'barmy' spring weather and the beauty of the city and the surrounds.

Several overseas researchers agreed to give their time, expertise and wealth of knowledge to the Australian almond, pistachio and walnut industries and growers by visiting a number of regional areas in Victoria and South Australia. This was most appreciated by the industries and further reinforced the collaboration and cooperation that exists in the almond and pistachio research and grower communities.

The aim of the symposium was to "strengthen international cooperation and collaboration in these two important crops for human health and food".

Dr. Alyson Mitchell, Professor of Food Chemistry, UC Davis, USA, gave the keynote address on "relation to investigating chemical reac-



› Participants of the symposium.

tions and changes in the composition that occur in fruits, nuts, vegetables and grains as a result of pre- and postharvest processes".

Her laboratory work aims to identify strategies and processing innovations for retaining and optimising levels of beneficial compounds in finished food products and decreasing toxic constituents in finished foods.

What followed were 54 oral presentations and the display of 47 posters across the following four different segments:

- Breeding and cultivar performance;
- Physiology and biology;
- Orchard management and production;
- Plant protection.

While the research and extension was presented in these four specific areas, for an industry person like myself, they all linked back to the theme from Dr. Mitchell about achieving high quality almonds and pistachios from 'orchard to the consumer'.

A new idea offered by the organising committee was a 'grower' day built around the 'orchard management and production' presentations. Some seventeen growers and agronomists registered and participated on that day.

Delegates participated in a field day that saw them visit Walker Flat Almonds at Walker Flat and then Costa Brothers processing facility at nearby Swan Reach. Part of the day was dedicated to having the two buses cross the Murray River on a mobile punt. For safety

purposes the buses went one at a time on the punt.

While the symposium was very much about the research and extension within the world's almond and pistachio industries, networking and enjoying the Australian 'culture' was just as important. There were many highlights in this part of the program including:

- Welcome drinks at the symposium venue with some unique Australian fauna including snakes, lizards and birds.
- The welcome reception at the historic Adelaide Town Hall hosted by the Lord Mayor of the City of Adelaide, the Hon Martin Haese and the Chancellor of the University of Adelaide, Rear Admiral the Hon Kevin Scarce AC CSC RAN-Rtd. Delegates had the opportunity to visit the Council Chamber and many took the opportunity for a photo while sitting in the Lord Mayor's chair.
- Visiting the unique Banrock Station wetlands on the Murray River at Kingston-on-the-Murray and then enjoying some unique wines and very old fortified wines (port) at the iconic Seppeltsfield Winery.
- The gala dinner at the historic Mortlock Chamber at the State Library of South Australia. Delegates enjoyed pre-dinner drinks and dinner with some hundreds of thousands of library books. (Some may have included early almond and pistachio research.)



› ISHS representative Prof. Ted DeJong (right) presenting the ISHS medal award to Symposium Convener Dr. Michelle Wirthensohn (left).



› Dr. Michelle Wirthensohn (left) and Prof. Ted DeJong (right) presenting the ISHS student awards to A) Leslie Holland for the best oral presentation and B) Michael Coates for the best poster.

• Ten delegates were taken, by Dr. Wirthensohn, on a post conference tour through the Riverland of South Australia and the Sunraysia area of Victoria. Of course, almonds and pistachios were the main topics throughout the three days. From all accounts, the discussion did not stop throughout the long trips between orchards/processing facilities.

The ISHS student award winners were:

- Leslie Holland, PhD student at UC Davis, USA. Title of winning oral presentation was “Re-examination of Ceratocystis canker in California almond orchards”.
- Michael Coates, PhD student at the University of South Australia, Australia. Title of winning poster presentation was

“The development of a dehydration model to prevent damage during the mechanical drying of high moisture almond fruit in bulk”. Congratulations to Dr. Michelle Wirthensohn and her organising committee for preparing and presenting a most valuable research and extension almond and pistachio symposium. Also, thanks to Lara Malcolm and her team, from ‘The Meeting People Pty Ltd’, for the most professional organisation leading up to and during the symposium. ‘All in all,’ a highly successful and enjoyable symposium and much to now translate into practical information for my Australian growers.

Trevor M. Ranford



› USA plant pathologist, Dr. Themis Michailides, University of California-Davis, Kearney Agricultural Research and Extension, talking to growers about disease cankers in nut trees.

› Contact

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› VII International Symposium on Rose Research and Cultivation

Section Ornamental Plants

#ishs_seop

The VII International Symposium on Rose Research and Cultivation was held in Angers, France, from July 2-7, 2017. Angers is located within the most important production region for garden roses in France, as well as being the location of INRA, Agrocampus-Ouest and the University of Angers, which are important French centers for horticultural research and training. The 120 attendees came from more than 20 countries and represented a broad diversity of the rose community, including researchers, breeders, producers, rose garden managers and rosarians. This diversity of participants encouraged interactions among

people working across activity areas within the rose community.

The main objective of the scientific program was to provide an overview of the research done on rose in different fields: genomics, genetics, physiology, production, and also social sciences (as history or economy). One striking change, compared with the previous symposium held in Hanover five years ago, was the increase in rose genomics research reported from Europe, North America and Asia. Updates from the different sequencing projects signal that the first rose genome sequence will be soon released. Genomic

approaches are being used to understand important traits such as flowering and disease resistance. The importance of interdisciplinary work was highlighted as an effective research approach in three talks. One talk combined genetics and history to study the rose selection process, the second combined psychology, brain physiology and marketing in the neuro-marketing approach to describe consumer preferences, and the third combined genetics, photography and engineering for the development of high-throughput phenotyping methods with both aerial and ground-based systems. High-

ly original results were presented during the symposium, for example, the discovery of a new metabolic pathway for monoterpene synthesis in rose, the description of segmental allopolyploid chromosome inheritance in rose and the complex physiology of petal development and senescence. These original results will open new roads for rose breeding.

During the symposium, a round table was organized to discuss how research could be useful for breeders, producers and rose managers. Important issues discussed were the need of an international inventory network for rose genetic resource collections, the emergence of new research fields such as root architecture (development of rose on their own roots, tolerance to abiotic stresses), and the development of carefree and sustainable roses for traditional gardens, and for new garden uses (e.g. little gardens in town, balcony gardens). The problem of

funding research for garden and cut flower roses was also discussed. This discussion emphasized the greater need of strong private sector support to successfully obtain government sources of research funding.

The technical tour around the city of Doué-la-Fontaine gave the participants a view of how garden roses are produced today and which main challenges the producers have to face. The visit of the 'Loubert' rose garden in Les-Rosiers-sur-Loire displayed the tremendous history of rose selection, with more than 2500 old garden and modern cultivars. During the post-symposium tour, participants visited the city of Nantes and explored the importance of gardens in the development of the city, with visits to the rose garden of 'La Beaujoire', the collective gardens in the suburb of Nantes and the recent urban development of the 'Isle de Nantes'.

ISHS student awards were presented to Lizbeth Peña Zuñiga from the National Institute

for Microbial Forensics & Food and Agricultural Biosecurity, Department of Entomology & Plant Pathology, Oklahoma State University, USA, for the best oral presentation entitled "Broad detection strategies for multiple targets of rose virome using next generation sequencing and bioinformatics" and to Adrien Corot from the Institute of Research in Horticulture and Seeds, INRA, France, for the best poster entitled "What are the contributions of cytokinins, abscisic acid and sugars in bud outgrowth regulation by light intensity in rose?".

During the ISHS business meeting, it was decided that the VIII International Symposium on Rose Research and Cultivation will be convened by Dr. Deborah Golino and Dr. Brent Pemberton in Davis, CA, USA, in April 2021. Dr. Fabrice Foucher was elected as new Chair of ISHS Working Group Roses.

Fabrice Foucher and Dave Byrne



› Participants of the symposium (credit: Nathalie Mansion, INRA).



› Lizbeth Peña Zuñiga, winner of the ISHS student award for the best oral presentation.



› Visit to rose producers in the Doué la Fontaine area.

› Contact

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> VIII International Cherry Symposium

Section Pome and Stone Fruits

#ishs_sefr



> Participants of the symposium.

The VIII International Cherry Symposium held on June 5-9, 2017, in Yamagata, Japan, was convened by Prof. Hideki Murayama (Yamagata Univ.), Prof. Satoshi Taira (Yamagata Univ.), and Prof. Ryutaro Tao (Kyoto Univ.) under the auspices of JSHS and ISHS. The Cherry symposium was held in Asia for the first time. The symposium provided a unique opportunity for scientists, students, growers, and the cherry industry to present and share their latest findings and knowledge on the crop. Yamagata Prefecture is the largest cherry producer in Japan and the “Technical Seminar for Cherry Growers” was also held in the same venue along with the symposium. During this technical seminar, Prof. Gregory Lang from Michigan State University and Dr. Senih Yazgan from Alara Agri Business gave enlightening lectures for local cherry growers.

The symposium was opened by Prof. Satoshi Taira and welcome messages were given by the Governor of Yamagata Prefecture, Ms. Mieko Yoshimura, the Mayor of Yamagata City, Mr. Takahiro Sato, and the President of Yamagata University, Mr. Kiyohito Koyama. A welcome message was also given by the ISHS President, Prof. Rod Drew, and JSHS Board member, Dr. Yoshiki Kashimura. There were 245 participants from 27 countries on the five continents of the world.

Plenary lectures were given by Prof. Gregory Lang from Michigan State University on “The cherry industries in the USA: current trends and future perspectives”, Dr. Kaichun Zhang from the Beijing Academy of Agriculture

and Forestry Sciences on “Cherry growing in China”, and Mr. Makoto Ishiguro from the Yamagata Prefecture Horticultural Experimental Station on “Sweet cherry growing in Japan: history, characteristics and future perspectives”.

There were seven sessions: Breeding, genetics and biotechnology; Crop production and orchard management; Rootstock and cultivar evaluation and propagation; Nutrient and irrigation; Tree fruit physiology, plant growth, and floral biology; Physiological disorder and pest and disease management; and Postharvest technology, fruit quality, health related issues. Each session was introduced by a world-renowned keynote speaker. For instance, Dr. L.E. Long and Dr. M.D. Whiting gave an introduction on new cultivars and orchard management systems in the US, while Dr. D.C. Close presented cherry cultivation in Australia. Dr. J.Q. Garica, Dr. R. Tao, and Dr. H. Silva discussed biotechnological aspects of cherry breeding, reproduction biology, and fruit development. Dr. A.F.G. Arco, on behalf of Dr. D. Valero, discussed post-harvest technology and fruit quality issues.

During the business meeting, ISHS members voted for the venue

of the next Cherry symposium and China was selected by the majority. Dr. Kaichun Zhang of the Beijing Academy of Agriculture and Forestry Sciences will host the IX International Cherry Symposium. The ISHS student awards were presented to Ms. Noémie Vimont from INRA, French National Institute for Agricultural Research, France, for the best oral presentation entitled “Towards a better understanding of dormancy in sweet cherry flower buds using molecular and epigenetic approaches”, and to Ms. Kanae Masuda from Kyoto University, Japan, for the best poster entitled “Effects of chilling accumulation on *DORMANCY-ASSOCIATED MADS-box* gene expressions in sweet cherry Satonishiki”.

Participants visited cherry production areas and the historical temple Yamadera



> Traditional “Hanagasa” dance performance during the dinner.



› ISHS student award winners: A) Ms. Noémie Vimont for the best oral presentation, B) Ms. Kanae Masuda for the best poster.

in Yamagata Pref during the technical tour. The VIII International Cherry Symposium was very successful and all participants hope to meet once again in China in 2021.

Ryutaro Tao



› Excursion to visit local cherry growers.

› Contact

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› IX International Pineapple Symposium

Section Tropical and Subtropical Fruits

#ishs_sets

The IX International Pineapple Symposium was organized on October 15-19, 2017, in Havana City, Cuba, by the Tropical Fruit Research Institute (IIFT) and the Agricultural Enterprise Group from the Ministry of Agriculture from the Republic of Cuba, under the aegis of the International Society for Horticultural Science (ISHS). The symposium had 143 participants from different countries. Institutions of the Agricultural Enterprise Group, as well as international projects, scientific societies and commercial firms (Stoller) were the sponsors of the event. The five-day symposium provided a framework for academic and technical exchanges about

pineapple management technologies and gathered prestigious personalities, researchers, producers and commercial firm representatives from several countries. This forum looked at ways to improve pineapple production, conservation, processing and commercialization. Four principal themes were covered during the event: Management of pineapple agro-ecosystems; Genetic resources, breeding and biotechnology; Postharvest, industrialization and commercialization; and Plant protection. Many collaborations between several of the participating institutions have been established in areas as diverse as crop management, in vitro propa-

gation, processing and commercialization, to name a few. A proposal to form a pineapple network was widely debated as an alternative to support not only the research but also to favour the exchange of plant material, information, and resources. The excellent agronomic conditions of the plantations of pineapple 'MD-2' visited in the "Agroindustrial Enterprise Ceballos" (Cuba) during the technical tour motivated a wide debate regarding the management of this crop in the country, which has allowed the opportunity to position Cuban pineapple 'MD-2' on the international markets with very good acceptance and price. A project of organiz-



› Participants of the symposium.

ing a future workshop in Cuba arose from the technical tour where specific aspects could be deepened. In addition to the scientific activities, an exhibition fair was held as a peripheric event to the symposium. The display of the different products and the promotional materials in the stands of the different participating institutions, were very informative and allowed us to foresee the trends and future work, and to identify the possibility of collaborations to foster the development of pineapple growing in the coming years. Of particular note is the large participation of Cuban and international producers and commercial firm representatives to the event. Their technical knowhow and experience significantly contributed to enrich the debates. Many meetings and reunions also took place

in the context of the pineapple symposium. For instance, the Pineapple Working Group of the ISHS, the Agricultural Enterprise Group, the Tropical Fruit Research Institute and the Stoller Chemical Company of Central America S.A. met during the meeting. This edition of the pineapple symposium included 34 scientific oral presentations and 34 poster presentations and was attended by 95 participants from commercial firms. Four prizes were awarded to the best oral and poster presentation with relevant results in both basic and applied science. Among the main international collaboration actions developed during the event are: the joint research actions in the management of pineapple cultivation between Cuban and Brazilian institutions; the evaluation of products of the

INNOVAK GLOBAL commercial firm through experiments on the growth and reproduction of pineapple in conditions of Cuba and Brazil; the purchase of in vitro propagated pineapple plants, as well as the investment or donations to improve the infrastructure of research institutes, programs of technical advice and research to develop the cultivation of pineapple.

Juliette Valdes-Infante Herrero and Lester Hernandez Rodriguez



› Opening ceremony. From left to right: Dr. Guillermo R. Almenares Garlobo, Chairman of the event and General Director of IIFT, Cuba; Dra. Maria del Carmen Perez, General Coordinator of RIAC (InterAmerican Citrus Network); Sr. Frank Castañeda Santalla, Honorary Chairman of the event and President of the Agricultural Enterprise Group from the Ministry of Agriculture, Cuba; Sr. Ulises Rosales del Toro, Vice-President of the Ministry Council, Cuba; MSc. Raixa Llauger Riverón, Sub-regional FAO Office in Mesoamerica, Panama; and Dr. Domingo Haroldo Reinhardt, from EMBRAPA, Brazil and Chair of ISHS Working Group Pineapple.



› Visit to the mini-industry where 'MD-2' pineapple is processed in the Base Enterprise Unit (BEU) for pineapple production from the agro-industrial Ceballos Enterprise, Cuba.

› Contact

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› XIV International Asparagus Symposium

Section Vegetables, Roots, Tubers, Edible Bulbs, Brassica, Asparagus

#ishs_sevr

The ISHS Working Group Asparagus, together with the Leibniz-Institute for Vegetable and Ornamental Crops in Großbeeren, Germany, organized the XIV International Asparagus Symposium from September 3-9, 2017. The symposium was held at the University of Potsdam, in the village Golm, near Potsdam, Germany.

Altogether 196 researchers, breeders, advisers and company representatives from 24 countries attended the symposium. A large contingent of delegates came from China, Germany, The Netherlands, Japan and the United States of America. There were 66 scientific contributions delivered during the 2.5 days of formal meetings, with 31 oral presentations and 35 posters. Papers and posters were organized along four broad themes including asparagus breeding and genetics, physiology and agronomy, pathology and mechanization, and postharvest handling and quality.

Prof. Mikolaj Knaflewski (Poland) opened the symposium with the plenary lecture entitled “Research on asparagus and its application into practice – a 50-year overview”. During the presentation, he highlighted significant

events associated with his 50 years of active asparagus research. Each of the scientific fields was then introduced by a keynote lecture. Dr. Ulrike Lohwasser (Germany) began with an enlightening presentation focused on “Genetic resources of asparagus including maintenance, taxonomy and availability”. Prof. James Leebens-Mack (USA) widened the view of asparagus genetics with his talk on how the “Genome sequence sheds light on the origin and early evolution of sex chromosomes”. In the asparagus physiology and agronomy session, Prof. David Wolyn (Canada) focused the audience’s attention on the “Adaption of asparagus to overwinter in cold climates”. Asparagus pathology and replant problems are common to most asparagus production areas. Prof. Wade Elmer (USA), used his presentation to help the delegates “Look back and look forward at strategies for mitigating losses associated with asparagus decline and replant problems”. In the final mechanization and postharvest session, Dr. Martin Geyer (Germany) provided the audience with “An overview and perspectives on the mechanization of white asparagus harvest”. Subsequent papers given in each

session added further details to the topics covered in the keynote addresses and each oral paper highlighted recent findings, further adding to the delegates understanding of asparagus.

The scientific contributions of young asparagus researchers were highlighted with the selection of the best student oral and poster presentation for the symposium. The winners of the ISHS student awards were Mr. Daniel Wambrauw from Iwate University, Japan, for the best oral presentation entitled “Effect of light on spear quality and gene expression of flavonoid biosynthetic genes cultivated by “fusekomi” forcing culture”, and Ms. Gurleen Sidhu from the University of Guelph, Canada, for the best poster entitled “Genotyping-by-sequencing and its application to asparagus breeding programs”. There was a total of six student papers presented and each student did an outstanding job defending and explaining their projects. During the ISHS Working Group business meeting, an ISHS student award certificate was presented to each winner by Prof. Ferdinando Branca (Chair ISHS Section Vegetables, Roots, Tubers, Edible Bulbs, Brassica,



› Participants of the XIV International Asparagus Symposium, University of Potsdam, Golm Campus.



› Poster sessions and coffee breaks allowed ample time for discussion.

Asparagus) and Prof. Daniel Drost (Chair ISHS Working Group Asparagus).

Additional highlights of the symposium were the pre- and post-symposium tours. In the pre-conference tour, the owner of Buschmann & Winkelmann Asparagus Farm, Klaistow, welcomed the participants, before showing and discussing all practical aspects of white asparagus growing. In addition to a field visit, the innovative packing and cooling facility was described and direct marketing aspects of the operation were outlined. Later that evening, the welcome reception provided the opportunity to greet old friends, make new acquaintances, and talk about asparagus. In addition to sampling German food, drinks, music and hospitality, a visit to the Potsdam Film Museum with the many historic exhibits of the Babelsberg Studios was organized.

At the conclusion of the symposium, a three-day post-symposium tour started with a bus ride to the city of Bremen. A major highlight of the post-tour was touring “Interaspa Praxis”, one of the largest exhibition and trade fairs for special crops, direct marketing and practical demonstrations in Germany.

A large focus of the exhibition addressed all that would be needed to grow asparagus (seed to selling) with representatives from hundreds of companies available to answer the delegates’ questions. Over the remaining days, the tour visited the Julius Kühn Institut (Quedlinburg), a Federal Research Institution for breeding research, and the Jacobs-Hof Asparagus Farm (Beelitz). In addition, each evening, the delegates were encouraged to stretch their legs as guided city tours of historic Potsdam, Bremen, Quedlinburg and Halberstadt were arranged. The walks highlighted the unique characteristics of these old villages and towns, outlined their significance to Germany and afforded the participants an opportunity to exercise before the evening meal.

During the closing ceremony, the audience was delighted to accept the application of Professor Juan Gil and his colleagues (University of Cordoba, Spain) to host, organize and convene the XV International Asparagus Symposium tentatively set for 2021...

Bernhard Brückner, Carmen Feller, Jan Gräfe and Daniel Drost



› Prof. Ferdinando Branca (left) and Prof. Daniel Drost (right) presenting ISHS student awards to A) Mr. Daniel Wambrauw for the best oral presentation, B) Ms. Gurleen Sidhu (Canada) for the best poster.



› Asparagus experimental farm field trip during post-tour in Lower Saxony.

› Contact

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> First International Symposium on Bonsai

Commission Landscape and Urban Horticulture
Section Ornamental Plants

#ishs_cmuh
#ishs_seop

The First International Symposium on Bonsai was successfully held in Taichung, Taiwan from 4-7 November 2017. The symposium was organized by the Taiwan Society for Horticultural Science (TSHS), the Taichung District Agricultural Research and Extension Station (TDARES), the National Museum of Natural Science (NMNS), the Department of Horticulture and Landscape, National Taiwan University (NTU), and the National Bonsai Association of Taiwan under the auspices of the International Society for Horticultural Science (ISHS) and with the support of the Council of Agriculture (COA), Executive Yuan, ROC. At the same time, the 2017 Bonsai Club International (BCI) Convention and the 14th Asia-Pacific Bonsai and Viewing Stone Convention & Exhibition were conducted in Changhua, Taiwan. More than one hundred bonsai-related researchers, technicians, creators, and enthusiasts from 16 countries shared their knowledge and information in this first ever bonsai symposium. 'Bonsai' is one of the most traditional and unique horticultural techniques from the 6th century until today in Asia, as well as worldwide. It connects with cultivation and

art. Its marketable demand and value are increasing gradually with the raising income, as along with life aesthetics of consumers. In the past few years, Taiwan has played an important role in the development of the bonsai industry. Therefore, the organizers invited both distinguished researchers and industrial experts to deliver their research results and experience. The symposium covered studies on many aspects and aimed to provide a platform to report on all information and to offer an opportunity to share knowledge for a better understanding of bonsai.

The opening ceremony included welcome addresses by the Deputy Minister of COA, Dr. Chi-Chung Chen, the Deputy Director of NMNS, Dr. Wen-Hao Chou, the President of the National Bonsai Association of Taiwan, Mr. Po-Sung Hsueh, the President of BCI, Mrs. Glenis Bebb (Australia), and the Chair of ISHS Commission Landscape and Urban Horticulture, Prof. Giorgio Prosdocimi Gianquinto (Italy).

Among them, Dr. Chi-Chung Chen, on behalf of COA, indicated that Taiwan has committed to supporting and participating in international

organizations for a long time. He said that he expected to collaborate with international partners and make some contributions to global agricultural problems. From the First International Orchid Symposium in 2010, the International Symposium on GA3 Tropical Fruit (Guava, Wax Apple, Pineapple and Sugar Apple) in 2015, and the First International Symposium on Bonsai in 2017 to the Interna-



> Figure 1. Scan to download symposium program and abstract book.



> Participants of the symposium.



> Chair of ISHS Commission Landscape and Urban Horticulture, Prof. Giorgio Prosdocimi Gianquinto (second from right) presenting the ISHS medal award to Symposium Conveners Dr. Hsueh-Shih Lin, Dr. Sheng-Chung Huang, and Dr. Hsin-Fu Yen (from left to right).



> Deputy Minister of COA, Dr. Chi-Chung Chen, welcoming the participants and thanking ISHS for its support during the opening ceremony.

tional Symposium on Horticultural Therapies: Past, Present and Future coming in 2018, COA was pleased to get support from ISHS. COA hoped to share its horticultural development experience as well as unique cultivated models with the world, and also learn something from others, in this way promoting international cooperation.

The program started with two keynotes. The first lecture was given by Mr. Bogdan Pociask (Poland), who addressed the impact of climate on bonsai care in Eastern Europe. The second keynote speaker was Prof. Shu-Hua Li from the Department of Landscape Architecture, Tsinghua University, China. His topic was related to the comparative study of artistic features of Chinese penjing and Japanese bonsai. The keynote lectures were followed by bonsai country reports. Six delegates from USA, Singapore, Japan, Israel, India, and Taiwan shared the characteristics, development and future prospects of bonsai in their countries. Another special arrangement by the organizers was a bonsai master demonstration, showing a full spectrum of techniques such as cutting, pruning, and shaping. Three world famous bonsai creators, Mr. Moshe Emergui (Israel), Mr. Lindsay Bebb (Australia) and Mr. Michael

Hogedorn (USA), were invited to perform and make a brief introduction to participants.

The scientific topics of the symposium were grouped into four sessions: History, genera, and aesthetics; Technologies; Genetic diversity; and Application and development. In total, there were four invited lectures, and 22 oral and poster presentations. The symposium program and abstract book can be downloaded at <https://indd.adobe.com/view/c4ae2f6f-8ddb-41f5-a293-35273b2a4767> or by scanning the QR code (Figure 1).

The majority of presenters shared their research and experience on cultivation management and flower forcing techniques, including typical bonsai trees such as *Ficus microcarpa*, *Pinus massoniana* Lambert, *Juniperus chinensis* L. var. *sargentii* A. Henry, *Zelkova serrata* (Thunb.) Makino, and *Premna serratifolia* Linn. as well as potential species such as *Bougainvillea*, *Rhododendron*, *Psidium guajava*, and *Pyrus pyrifolia*. There were also presentations on germplasm diversity research with emphasis on taxonomy and application. In addition, according to the report by Ms. Juan Wang (China) from Shanghai Botanical Garden, the world has spent about 10 billion US\$ annually on special flow-

ers since the turn of the 21st century. The market prospect of special flowers is promising, including penjing industry primarily based on modeling.

During the technical tour, participants visited Taichung city and Changhua county, which is the main productive area of bonsai in Taiwan. The tour included visits to four bonsai gardens and exhibition locations, i.e. Taichung Bonsai Village, Cheng Mei Culture Park, Wan Jing Art Garden, and Chuanshi Landscape Garden. Mr. Yung-Yu Ho, Vice Chairman of International Affairs, National Bonsai Association, explained bonsai management skills and how to enjoy as well as judge bonsai. Participants had an opportunity to visit a Japanese-style landscape with 500-year-old Sandalwood, precious *Podocarpus*, Taiwan *Keteleeria*, and many bonsai pots. And finally, all symposium activities were concluded with these beautiful bonsai gardens.

The organizers are grateful to all committees, speakers, and participants for their contributions to the success of the symposium and thank the financial support from COA's project.

Wei-Ling Chen



> Mr. Yung-Yu Ho during the technical tour explained to the participants how to take care of bonsai.



> World Bonsai Friendship Federation Chairman, Mr. Lindsay Bebb, showing bonsai techniques to symposium participants.

> Contact

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› International Symposium on Survey of Uses of Plant Genetic Resources to the Benefit of Local Populations

Commission Plant Genetic Resources

Commission Economics and Management

Commission Education, Research Training and Consultancy

Commission Fruits and Vegetables and Health

Section Ornamental Plants

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› Participants of the symposium at the opening ceremony.

The First International Symposium on Survey of Uses of Plant Genetic Resources to the Benefit of Local Populations was held in Antananarivo (Madagascar) from 18-22 September 2017, under the aegis of the International Society for Horticultural Science (ISHS). It was supported by the Ministry to the Presidency in charge of Agriculture and Livestocks (MPAE), the Ministry of Higher Education and Scientific Research, the University of Antananarivo and ESMIA (Ecole Supérieure de Management et d'Informatique Appliquée) and technical and financial support was provided by FAO Representation-Madagascar, Comoros, Mauritius, Seychelles. The symposium was sponsored by FORMAPROD (a project of MPAE), CIRAD (Centre de coopération Internationale en Recherche Agronomique pour le Développement)

in Antananarivo, ESMIA, and Agro-Management. This symposium was organized by Convener Prof. Dr. Romaine Ramanarivo from ESMIA and Agro-Management of the École Supérieure des Sciences Agronomiques, Vice Chair of ISHS Commission Education, Research Training and Consultancy, by Dr. Damiano Avanzato, former researcher at CREA (Consiglio per la Ricerca in agricoltura e l'analisi dell'Economia Agraria)-Centro di Frutticoltura di Roma, Italy, Chair of ISHS Commission Plant Genetic Resources, Symposium Promoter and Co-editor, and by Dr. Rémi Kahane from CIRAD, France, Chair of ISHS Commission Education, Research Training and Consultancy, Symposium Endorser and Co-editor.

In this symposium, attended by 27 international participants from various countries,

more than 60 oral and poster presentations were discussed, addressing issues of use, cultivation, defense, conservation, risks of plant genetic resource (PGR) erosion or genetic pollution, marketing chains and other specific themes (e.g. the botanical classification of species not perfectly identified). The symposium was honored by the intervention of three invited speakers: Prof. Lamis Chalakh from Lebanese University, Faculty of Agriculture, Dr. Mba Chikely from FAO's Plant Production and Protection Division (AGP) and Prof. Julian Heyes from Massey Institute of Food Science and Technology, University of New Zealand.

A special session was devoted to the national strategy to be applied for rational management of genetic resources in comparison with the methodologies adopted in other



› ISHS President Prof. Rod Drew presenting the ISHS medal award to Symposium Convener Prof. Dr. Romaine Ramananarivo.

countries that are more advanced than Madagascar.

A parallel comparison between the use of genetic resources in Sicily and Madagascar – distant islands with different cultures and different stories – showed that the use of flora by farmers has had and continues to have many things in common in obtaining useful products in the home, in sheep raising, in culinary art, etc. The importance of the traditional uses as the basis for modern use was highlighted (such as the production of plant colorants to obtain hypoallergenic tissues reported by a Malagasy researcher). The study of plants for medicinal purposes is still a very important area for both family-traditional use and also for extracting chemical principles. This is the case with famelona (*Chrysophyllum boivinianum*) in Madagas-

car (active against *Candida*, *Escherichia* and *Salmonella*), but also with many other species studied in Lebanon. The ornamental and gardening sector is still not fully exploited. For example, a new form of commercial exploitation has emerged, as is the case with *Pachyposium* (the so-called “Dwarf Baobab”), which is of great interest to the Japanese who are studying the mechanisms that regulate its propagation. Relationships between malnutrition and vegetarian food shortages and cultivation patterns (seed distribution, intelligent water use) were highlighted. In some Eastern African communities, in fact, malnutrition of children is still very high. For cultivation and marketing, many researches addressed the set-up of plant cultivation techniques suitable to emerging crop species in Madagascar (e.g. *Aloe*) or use-



› Mamadou Mboup, winner of the ISHS student award for the best oral presentation.

ful to be spread in other areas (e.g. many tropical and subtropical fruits and temperate fruits in the Indian Ocean Region). Some important contributions concerned plant protection, such as the effects of abiotic factors on the diffusion of flies and the traps to achieve integrated protection in many fruits species, or the use of plant extract to control plant viruses (e.g. pepper extract to control mosaic viruses in zucchini). A lot of research focused on the problems of horticultural product distribution; approaches aimed at reducing the steps from the producer to the consumer and maintaining minimum quality standards were discussed. To this effect, various papers were presented showing the acceptance of rural communities producing the seeds themselves to obtain a minimum uniformity of the products. Very useful in this regard is the work of Semana, which produces seeds subject to government control.

Some research in Madagascar highlighted the important role played by beekeeping in the conservation of PGR. It has been found that collecting and preserving vegetable germplasm, landraces and obsolete cultivars is an essential activity. Vegetable genetic resources play an important role in the diversification of consumption and production systems. Some research focused on diversifying products with experimental trials using old non-native genotypes (“Zanatanany”) considered “autochthonous” as having been reproduced from seed for a long time. Research, however, points to the danger that the introduction of new species or cultivars could trigger the loss of many of the current genetic resources and therefore may lead to their disappearance, since there is no germplasm bank in Madagascar.

For monitoring PGR, the Chinese delegate’s contribution focused on the risks associated with the uncontrolled introduction of



› Dr. Damiano Avanzato, Chair of ISHS Commission Plant Genetic Resources (left) and Dr. Rémi Kahane, Chair of ISHS Commission Education, Research Training and Consultancy (right) presenting the ISHS student award for the best poster to Raharinaivo Volantiana.

non-native flora, which does not always perform well and sometimes may even be detrimental to the environment (e.g. invasive performance, weed-like behavior) and the genetics pool. This research confirmed the need to be cautious in the introduction of non-native species. Some research focused on a better understanding of physiology and propagation mechanisms, which are still not fully known for some plants (e.g. *Dalbergia*). In some cases, comparative research was conducted on the genome of cultivated species and spontaneous species to understand the relationship between gene expression and the area in which they were found (as is the case with the *Brassicaceae* model). The contribution of invited speaker Prof. Lamis Chalak to the identification and management of genetic resources, with some examples of strategies to be adopted because of climate change and the close relationship between food and health, worked as a common thread to many of the presentations. The technical tour allowed the participants to gain a better understanding of the Madagascar production systems, with visits to the city wholesalers and flowers retailers, fruits and vegetables, a communal fruit and vegetable market, a watercress and strawberry field, cheese-makers, and traditional weaving.

On top of this, a one-day training session was organized on “scientific writing for publishing in horticulture” by Dr. Rémi Kahane, with some twenty participants registered. An ISHS student award was given to Mamadou Mboup from École Supérieure des Sciences Agronomiques, Madagascar, for the best oral presentation entitled “Sustainable management and cultivation establishment of *Aloe macroclada* in Madagascar upland” and to Volantiana Raharinaivo from École Doctorale Gestion des Ressources Naturelles et Développement, Madagascar, for the best student poster entitled “Potential vegetables, fruits and/or pulses to be promoted in Indian Ocean Commission region for nutrition situation improvement”.

As a final celebration, a gala dinner was offered gathering all members of the ISHS Executive Committee and participants of the symposium. Malagasy culture (dance during the royalty and special music from bamboo instruments) and artisan products were featured.

The ISHS delegates decided to host the II International Symposium on Survey of Uses of Plant Genetic Resources to the Benefit of Local Populations in Bali (Indonesia), in 2021, under the leadership of Prof. W. Arsanti from the Indonesian Center for Horticulture Research and Development.

Romaine Ramanarivo



› Technical tour: A) View on communal market, B) Strawberry field.



› Closing ceremony of the symposium. From left to right: Rivo Rakotovoao, Minister from the Ministry to the Presidency in charge of Agriculture and Livestocks, Dr. Talla Patrice, FAO Representation-Madagascar, Comoros, Mauritius, Seychelles, ISHS President Prof. Rod Drew, Symposium Convener Prof. Dr. Romaine Ramanarivo.

› Contact

Prof. Dr. Romaine Ramanarivo, Vice-Chair of ISHS Commission Education, Research Training and Consultancy, Director General of ESMIA, Chairman of Agro-Management, Sustainable Development and Territories (AM 2DT) of Ecole Doctorale Gestion des Ressources Naturelles et Développement (ED GRND), Université d'Antananarivo, Madagascar, e-mail: r.ramanarivo@esmia-mada.com, agromanagement1@yahoo.fr

› IV Asia Symposium on Quality Management in Postharvest Systems

Commission Quality and Postharvest Horticulture
Section Vegetables, Roots, Tubers, Edible Bulbs, Brassica,
Asparagus

#ishs_cmph

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The IV Asia Symposium on Quality Management in Postharvest Systems was held in Jeonju, Republic of Korea, from 12-14 September 2017 under the aegis of the ISHS. The symposium was attended by 161 participants, including 63 Koreans and 98 international attendees from Asia, Africa, North and South America, and Europe. The symposium was held at the National Institute of Horticultural and Herbal Science (NIHHS), Rural Development Administration (RDA), in order to celebrate the relocation of NIHHS from Suwon to Jeonju in 2015. NIHHS opened the Asian Postharvest Center with the intention of promoting integrated postharvest management and basic and applied postharvest research for Asian countries and beyond. For this reason, plenary and keynote presentations were held at NIHHS during the first day of the symposium. The following day, the symposium continued at Le Win Hotel in Jeonju, an area in the city that is extremely popular due to the well maintained traditional Korean village in the middle of the modernized city. The main topic of the symposium focused on reducing postharvest loss of horticultural commodities from harvest to consumption. Overall, 144 presentations were delivered during the two days of the symposium. There were 8 keynote speakers, 43 oral and 93 post-

er presentations. In the plenary sessions, five speakers gave lectures on postharvest loss, postharvest technology, fresh-cut and postharvest physiology, postharvest pathology, bioactive compounds, preharvest technology, quality prediction, and packaging. As part of the symposium, 19 presentations derived from the Asian Food and Agriculture Cooperation Initiative (AFACI) and the Korea-Africa Food and Agriculture Cooperation Initiative (KAFACI) projects were made; most were oriented towards reducing postharvest loss of horticultural products.

ISHS student awards were presented to Ms. NaRae Han from Chung-Ang University, Republic of Korea, for the best oral presentation entitled “Distribution of major glucosinolates during growth of Baemoochae (*×Brassicoraphanus*), an allopolyploid from Chinese cabbage (*Brassica napa* L.) and radish (*Raphanus sativus* L.)”, and to Mr. Sitthisak Intarasit from Chiang Mai University, Thailand, for the best poster entitled “Protective effects of chlorine dioxide solution on postharvest pericarp browning and oxidative damage of longan fruit”.

During the symposium, there were two group meetings held for Asian and African regions regarding regional reduction of postharvest loss of horticultural commodities.

The Asian group mainly discussed strategies for reducing postharvest loss and how to enhance favorable relationships between the horticultural industry and the public in each Asian country. The African group talked about the contribution and effect of KAFACI projects on the reduction of horticultural product loss in African countries.

On the last day of the symposium, technical tours and traditional culture experience sessions were provided. The participants had the opportunity to visit an Agrifood distribution center, a pepper processing center, a fruit packing house, a local food processing center, a rose packing house, a local farmers market and the headquarters of RDA. In addition, traditional Korean cultural programs, including Korean traditional wedding ceremonies and making Korean paper fans, were provided for the attendees to expose them to Korean traditions.

This symposium provided opportunities for developing countries to consider strategies to reduce postharvest losses of horticultural products. Furthermore, the symposium provided the opportunity for participants to enhance their human resource network with respect to research in postharvest biology and technology in Asian and African countries.



› The symposium participants at the National Institute of Horticultural and Herbal Science.

The 40 manuscripts resulting from this symposium will be published as a volume of *Acta Horticulturae*. The V Asia Symposium on Quality Management in Postharvest Systems will be organized by Prof. Varit Srilaong in Thailand in 2021.

Jinwook Lee and Ji Gang Kim

> Contact

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Dr. Ji Gang Kim, Convener, Director of Postharvest Technology Division, National Institute of Horticultural and Herbal Science, 100, Nongsaeongmyeong-ro, Wanju 55365, Republic of Korea, e-mail: kjg3@korea.kr



> A. Prof. Chris Watkins, Chair of ISHS Commission Quality and Postharvest Horticulture, presenting the ISHS student award to Ms. NaRae Han for the best oral presentation. B. Dr. Ji Gang Kim, Symposium Convener, presenting the ISHS student award to Mr. Sitthisak Intarasit for the best poster.



> Participants at Korean traditional wedding ceremony.



> Participants at a packing house in Imsil, Republic of Korea.



> International Forum on Horticultural Product Quality (HortiAsia2018)

22 August 2018, Bangkok, Thailand



www.horti-asia.com/ishs-conference

> New ISHS members

ISHS is pleased to welcome the following new members:

New Individual Members

Albania: Dr. Gjovalin Gjeloshi; **Argentina:** Dr. Sebastian Gomez Talquenca, Dr. Maria Dolores Raffo Benegas, Ms. Beatriz Stein; **Australia:** Dr. Jake Dunlevy, Mr. M Haraz, Corina Horstra, Ms. Ruby Ishinjerro, John Magarey, Doriana Mangili, Dr. David Monckton, David Peasley, Mr. Phillip Ritchie, Diane Robinson, Ms. Liz Singh; **Belgium:** Valerie Bouckaert, Marc Brouwers, An Ceustermans, Mr. Luk De Maeyer, Mr. Raf De Vis, Maria Teresa Tomaselli, Sophie Vandewalle, Ms. Wendy Vanlommel, Franky Viane; **Brazil:** Prof. Dr. Amauri Bogo, Dr. Biane de Castro, Ms. Mara Cecília de Mattos Grisj, Ms. Stella Aurea C. Gomes da Silva, Dr. Patrícia Leão, Dr. Mara Moura, Ms. José Luiz Petri, Prof. Dr. Marcelo Rocha dos Santos, Mr. Gabriel Soares Miranda; **Bulgaria:** Ms. Marieta Nesheva, Ms. Elena Topalova, Dr. Milena Yordanova; **Canada:** Dr. Pervaiz Abbasi, Ms. Erika DeBrouwer, Dr. Mostafa Khosravy, Zhiyuan Ma, Dr. Elena Popova, Mr. stephen potts, Prof. Edward Yeung; **Chile:** Dr. Rolando Chamy, Mr. Jose Silva; **China:** Prof. Dr. Tianyue Bo, Assoc. Prof. Jinxiu Chen, Tom Chen, Carl Ding, Xiaotong Gao, Ms. MeiLing Han, Dr. Lei He, Dr. Bingling Li, Prof. Li Li, Prof. Dr. Xingang Li, Dr. Chaojie Liu, Dr. Xiaoman Liu, Prof. Dr. Jiang Lu, Prof. Dr. Canbin Ouyang, Prof. Dr. Liangzuo Shu, Assist. Prof. Shiren Song, Dr. Lei Sun, Lifang Sun, Mr. Ling-Jun Sun, Assoc. Prof. Luming Tian, Dr. Huiling Wang, Prof. Dr. Lijun Wang, Mr. Yu Wang, Prof. Dr. Xuexia Wu, Dongdong Yan, Prof. Dr. Qiaosong Yang, Prof. Dr. Yongbing Yuan, Assoc. Prof. Jinmei Zhang, Prof. Dr. Maojun Zhang, Assoc. Prof. Miao Zhang, Dr. Weiwei Zhang, Assoc. Prof. Xuewu Zhang, Mr. Wen-Dong Zhao; **Chinese Taipei:** Dr. Ruey-Jang Chang, Ting-Chieh Chen, Dr. Yuhsin Chen, Assist. Prof. Yi-Lu Jiang, Prof. Dr. Sheng Jung Ou, Ms. Erzhena Tsyrendorzhieva, Ms. Ching-Hsia Wu; **Colombia:** Maria Eugenia Martinez; **Costa Rica:** Mr. Jose Manuel Dominguez ; **Croatia:** Dr. Dean Ban, Dr. Ana Mucalo, Dr. Maja Zulj Mihaljevic; **Denmark:** Ms. Helle Kelly, Ms. Lisbet Dahl Larsen, Finn Plauborg; **Ecuador:** Jose Flores Cedeo; **Finland:** Mr. Sebastian Anttila, Ms. Saara Tuohimetsä; **France:** Mr. Cyrille Abonnel, Laurent Audeguin, Mr. Christophe Berthou, Mr. Raphael Colicci, Dr. Marie-France Corio-Costet, Franck Curk, Dr. René De Vaumas, Mr. Lionel Delbac, Ms. Mathilde Feydeau, Ms. Emilie Floch, Dr. Emmanuelle Gastaldi, Gilbert Labourdette, Nicolas Le Roch, Dr.

Francois Luro, Dr. Didier Merdinoglu, Mr. Paul-Hector Oliver, Dr. Jean-Pierre Renou; **Georgia:** Dr. Vazha Tabidze; **Germany:** Mr. Rolf Christian Becker, Ms. Ulrike Cavael, Katharina Diehl, Mr. Mohamed Elsherif, Mr. Laurent Gouzou, Andreas Kalik, Mr. Klaus Kirsch, Corina Lierzer, Mr. Joachim Meyer, Dr. Manuela Nagel, Dr. Marc Rist, Ms. Juliane Schurig, Dominique Steiger, Prof. Dr. Reinhard Töpfer; **Guadeloupe:** Dr. Raphael Morillon; **India:** Dr. Anuradha Agrawal, Mr. Parthiban Ammamuthu, Dr. M.M. Kaveriamma, Dr. Thangavelu Raman, Neelam Sharma, Mr. T. Ramakrishna; **Indonesia:** Dr. Tri Martini Patria, Prof. Dr. Zulkarnain Zulkarnain; **Iran:** Assist. Prof. Hamid Mohammadi, Ali Nazari, Ms. Saeideh Rostami; **Iraq:** Dr. Khalid Jameel Shamkhi; **Ireland:** Mr. Robert Shine; **Israel:** Dr. Navot Migal Galpaz, Dr. Yaakov Goldwasser, Ms. sarah salomon; **Italy:** Dr. Manna Crespan, Dr. Marco Dreni, Marco Grasso, sara guerrini, Mr. Vincent Lefebvre du Prey, Dr. Mario Malinconico, Monica Marilena Miazzi, Dr. Chiara Pagliarani, Dr. Irene Perrone, Prof. Giancarlo Polizzi, Dr. Andrea Primavera, Dr. Leo Sabatino, Dr. Marco Stefanini, Mr. Ermanno Traietta, Dr. Silvia Vezzulli; **Japan:** Mr. Indra Fardhani, Mr. Md. Saiful Islam, Mr. Taro Isoyama, Dr. Yuso Kobara, Dr. Atsushi Kono, Dr. Noriaki Momma, Ms. Arisa Nakano, Prof. Dr. Ryo Ohsawa, Dr. Yoshio Oya, Mr. Koki Sawada, Mr. Tatsuya Seki; **Jordan:** Mr. Ibrahim Alamad, Dr. Sawsan Hassan; **Kenya:** Dr. Tawanda Muzhingiri, Mr. Harish Tolia; **Korea (Republic of):** Dr. Kyung Choi, Dr. Thanh-Tam Ho, Dr. Soon-Chun Jeong, Mijin Joneg, Dr. Il-Kwon Kim, Mr. Keon-Il Kim, Dr. Miyoung Kim, Mr. Seongjun Kim, Hye Jin Lee, Jong Won Lee, Mi-Sang Lim, Ha Kyung Oh, Ms. Heesoon Park, Junhyung Park, Ms. Pue Hee Park, Dr. Juhee Rhee, Dr. Sungwon Son, Dr. Ju-Yeon Yoon; **Kuwait:** Dr. Hossam Ashiri; **Lebanon:** Mr. Jad Abdallah, Mr. Hani Mdeihli; **Malaysia:** Ms. Norziha Abdullah, Ms. Nashatul Zaimah Noor Azman; **Malta:** Mr. Christian Camilleri ; **Mexico:** Prof. Oscar Gerardo Valentin Paz; **Mongolia:** Dr. Noov Bayarsukh, Mr. Darjaa Nasanjargal, Dr. Dechinkhundeov Oyungerel, Mr. J. Tumurkhuyag; **Morocco:** Prof. Ahmed Bamouh; **Nepal:** Prof. Dr. Bijaya Pant; **Netherlands:** Mr. Chaniel Bakker, Mr. Levi Bin, Mr. Peter Cox, Ms. Claire Peusens, Mr. Dionysios Tarnavas, Mr. peter van der stap; **New Zealand:** Dr. David Pattemore; **Nigeria:** Ayoola Monsur Abdul-Rafiu, Mr. Olawale Alamu, Dr. Ifeoluwa Amapo, Mr. Kayode Bamimore, Dr. Bolanle Fagbola, Ms. Oladayo

Idowu-Agida, Dr. Omoniyi Lawal, Mr. Abiola Oladigbolu, Mr. Barry Oyewole; **Norway:** Minrui Wang, Dr. Zhibo Zhang; **Oman:** Ms. Safa Al Hinaj; **Pakistan:** Dr. Saeed Chishti; **Philippines:** Mr. Koronado Apuzen, Mr. Jose Reve Suico; **Portugal:** Prof. Elsa Gonçalves, Dr. Ivo Oliveira, Mr. Paulo Pereira; **Romania:** Anca Barcu, Mr. Ionel Lucian Dumitrescu, Mr. Vasile Nedelcu, Ms. Oana Venat; **Russian Federation:** Dr. Elena Ilnitskaya; **Rwanda:** Ms. Gaudence Nishimwe; **Saudi Arabia:** Prof. Dr. Fahed Almana; **Serbia:** Dr. Radosav Cerovic; **Singapore:** Dr. Nigel Taylor; **Slovenia:** Assoc. Prof. Natasa Stajner; **South Africa:** Dr. Manuela Campa, Mr. Hugh Campbell, Mr. Zenzile Peter Khetsha, Mr. Willie Kotze, Mr. Rodrigo Oliva, Ms. Jessica Vervalle, Christo Viljoen; **South Sudan:** Sinethemba Ximba; **Spain:** Alberto Arnal Olivares, Aurora Díaz Bermudez, Mireia Ercilla-Montserrat, Jaime González Buesa, Mr. Santiago Hernández Hernández, Juan Ignacio Macua Gonzalez, Guerrero Maria del Mar, Mr. Angel Marín, Mr. Javier Mariscal, Mr. Juan Miguel Ramírez Cuesta, Dr. Diego Redondo Taberner, Mr. Jose Luis Robles, Dr. José Salvador Rubio-Asensio; **Sweden:** Mr. Johan Lindqvist; **Switzerland:** Mr. Andi Schmid; **Thailand:** Dr. Parichart Burns, Dr. Somsak Kramchote, Mr. Boworn Kunakhonnuruk, Ms. Kullanart Obsuwan, Ms. Kedsirin Pungam, Mr. Thanawat Sannongmueang, Assist. Prof. Kanogwan Seraypheap, Mr. Bulakorn Suppiat, Assist. Prof. sumet treesaksri, Dr. Surawit Wannakrairoj, Dr. Phenchan Whijitara, Dr. Bancha Wiangsamut; **Turkey:** Melike Ada, Ms. Aysun Akar, Dr. Baris Albayrak, Dr. Beyza Biner, Aysegul Burgut, Dr. Banu Dal, Assoc. Prof. Adem Özarslandan, Ms. Sefika Ozcan, Assoc. Prof. Ulas Senyigit, Seval Taskin, Assoc. Prof. Ozlem Tuncay, Dr. Oguzhan Tuncel, Garip Yarsi; **Uganda:** Dr. Enoch Kikulwe; **Ukraine:** Dr. Svitlana Goryslavets, Ms. Ahnesa Horvat; **United Kingdom:** Dr. Daniel Ballesteros Barges, Mr. Alastair Blyth, Charles Negus; **United States of America:** Ms. Kahlil Apuzen-Ito, Aly Badruddin, Mr. Howard Barnes, Dr. Nathan Boyd, James Briard, Jean Broadhvest, Mr. Maurice Cameron, Erica Casagrande Biasuz, Li-Ling Chen, Ron Christie, Dr. Francesco Di Gioia, Dr. Greg Douhan, Leslie Eliel, Prof. Akif Eskalen, Josh Freeman, Alastair Fyfe, Dr. Stefan Gafner, Aretha Huggins, Dr. Matthew Krause, Denise Manker, Marcy Martin, Dr. Melanie Massonnet, James McDonald, Mr. William Moerbe, Dr. Timothy Murrell, Assoc. Prof.

Dilip Nandwani, Dr. Camila Ribeiro, Mr. Lance Roberson, Veronica Sondervan, Kiley Soule, Ms. Mary Stevens, Dr. Lena Struwe, Prof. Krishna Subbarao, Dr. Lisa Tang, Mr. Justin Tanner, Prof. Dr. Violeta Tsoлова, Dr. Tara Wade, Julie Weisenhorn, Mr. mark Winsor, Mr. Martin Zahra; **Zambia:** Mr. Malcolm Duncan

> In memoriam



Nicolás Franck (1971-2017)

Nicolás Franck Berger (27 November 1971 – 20 October 2017, Chile) was an Associate Professor at the Faculty of Agronomy, University of Chile. He obtained his M.Sc. degree in Plant Development and Adaptation, École Nationale Supérieure Agronomique de Montpellier, France (2001) and his Ph.D. in Ecophysiology, École Nationale Supérieure Agronomique de Montpellier, France (2005). He was the Director of the Arid Zones Study Center (CEZA) at the University of Chile (<http://www.ceza.uchile.cl>).

Nicolás developed his career in the area of Plant Physiology and Ecophysiology and dedicated a major portion of his research to plants adapted to arid and semiarid regions, including cacti. Nicolás was a bright young scientist, among the most capable researchers in the new generation of scientists in his area. Along with Prof. Carmen Sáenz, he coordinated the IX International Congress on Cactus Pear and Cochineal “CAM crops for a hotter and drier world” held in Coquimbo, Chile on March 26-30, 2017. He took part in and led many committees such as the Agronomy Study Group at the National Fund for the Development of Sciences and Technology - FONDECYT, Chile (since 2014, Director since 2016), Academic Committee of the Doctoral Program in Silvoagricultural and Veterinary Sciences, South Campus, University of Chile (since 2014), Advanced Study Center for Arid Zones (CEAZA) as Board member, La Serena, Chile (since 2010), International Society for Horticultural Science (since 2010), Interamerican Society for Tropical Horticultural Sciences (since 2010), FAO-ICARDA International Technical Cooperation Network on Cactus Pear and Cochineal (since 2010), Chilean Agronomical Society (since 2010), International Scientific Committee of the Journal of the National Faculty of Agronomy of Medellín (SciELO, since 2013), Editorial Committee of IDESIA Journal (SciELO, since 2006), Editorial Committee of the Semente Journal (since 2013), International Review Committee of the Annals of Botany Journal (ISI, impact factor: 4.030, 2006-2007), and was Chair of the ISHS Working Group Cactus Pear and Cochineal (since 2017). He was the leader of several research projects in his area and published in the best scientific journals.

Nicolás will be missed not only by his family, but also by all his students, friends and colleagues. His working ethics, dedication, intelligence, sense of humor, and friendship will certainly be an inspiration for all of us and for future researchers. We extend our heartfelt condolences to his family, friends, colleagues, and students.

Carmen Saenz, FAO-ICARDA CACTUSNET and Universidad de Chile, Chile
Paolo Inglese, University of Palermo, Italy



Giuseppe La Malfa (1937-2018)

Born February 5, 1937 in Milazzo (Italy); died January 12, 2018 in Acireale (Italy).

It is with great sadness that we announce the death of Professor Giuseppe La Malfa. He has left the world a better place through his contributions to horticultural science and his mentorship of generations of colleagues in Italy and in all regions of the world. Prof. La Malfa was a strong supporter of ISHS and was collecting all volumes of *Acta Horticulturae* since the first one at the University of Catania, where they have been well utilized all these years by many students and researchers from all disciplines. He was an active ISHS member, initiating the series of the International Symposium on Protected Cultivation in Mild Winter Climates in Catania in 1985, and, 17 years later, convening the VI edition under the theme Product and Process Innovation in 2002.

Giuseppe was full professor of Vegetable and Flower Crops in the Department of Agricultural Production and Food Sciences (DOFATA) – today the Department of Agriculture, Food and Environment (Di3A) – of the University of Catania. He was nominated “Professor Emeritus” by the Italian Minister of Education, Stefania Giannini, in 2015.

Throughout his 50 year career, Professor La Malfa successfully achieved the highest standards in teaching, research and institutional representation. Over this period, he managed to identify and initiate new areas of training, from vegetable and flower crops to new topics related to landscape and green space management, to the sustainability of agricultural processes, to the exploitation of agro-biodiversity and to the qualitative and healthy characteristics of the vegetable products.

His outstanding scholarly activities have been widely recognized by his peers. For example, he received numerous and prestigious scientific recognitions from the many scientific societies he was involved in: *Società Orticola Italiana*, *Società Italiana di Agronomia*, the ISHS, the ASHS, the *Accademia dei Geogofilli*, the *Accademia Gioenia* of Catania, the *Accademia dei Zelanti e dei Dafnici* of Acireale. Prof. La Malfa was also a member of committees, commissions and advisory groups promoted by FAO, EU and by the Italian Research Council (CNR). He was an honorary member of the *Società Orticola Italiana*.

We wish to express all our condolences to his wife Sara and to his daughter Grazia and to his two sons Stefano and Rosario. His death deprives us of a much appreciated master of Italian horticulture.

Ferdinando Branca, Chair ISHS Section Vegetables, Roots, Tubers, Edible Bulbs, Brassica, Asparagus

> Calendar of ISHS events

For updates and extra information go to www.ishs.org and check out the calendar of events. Alternatively use the “science” option from the website navigation menu for a comprehensive list of meetings for each Section, Commission or Working Group.

To claim reduced registration for ISHS members your personal membership number is required when registering - ensure your ISHS membership is current before registering. When in doubt sign in to your membership account and check/renew your membership status first: www.actahort.org or www.ishs.org

Year 2018

■ April 16-18, 2018, Canelones (Uruguay): **IV International Symposium on Citrus Biotechnology**. Info: Dr. Fernando Rivas, Ruta 3, Camino al Terrible SN, Salto 50000, Uruguay. Phone: (598) 47332300, E-mail: cfrivas@inia.org.uy E-mail symposium: info@citrusbiotechnology2018.uy Web: <http://www.citrusbiotechnology2018.uy/>

■ May 29-31, 2018, Bordeaux-Arcachon (France): **XXI CIPA Congress on Agriculture, Plastics and Environment**. Info: Mr. Bernard Le Moine, CIPA-CPA-APE, Platiculture in Agriculture, 125, rue Aristide Briand, 92300 Levallois Perret, France. Phone: (33)144011649, E-mail: b.lemoine@plastiques-agriculture.com Web: <http://cipa-congress.com/>

■ June 11-15, 2018, Athens (Greece): **XV International Symposium on Processing Tomato - XIII World Processing Tomato Congress**. Info: Prof. Dr. Montaña Cámara, Dpto. Nutrición y Bromatología II, Facultad Farmacia. UCM, Plaza Ramón y Cajal sn, 28040 Madrid, Spain. Phone: (34) 913941808, Fax: (34) 913941799, E-mail: mcamara@farm.ucm.es or Dr. Luca Sandei, ssica, Tomato area, Viale f.Tanara 31/a, 43121 Parma PR, Italy. Phone: (39) 0521795257, Fax: (39) 0521771829, E-mail: luca.sandei@ssica.it or Dr. Panagiotis Kalaitzis, Dept Horticultural Genetics & Biotechnology, Mediterranean Agronomic Inst. Of Chania, Macedonia Str. 1, P.O. Box 85, 73100 Chania, Greece. Phone: (30)2821035030, Fax: (30)2821035001, E-mail: panagiot@maich.gr E-mail symposium: wpct2018@tomate.org Web: <http://www.worldtomatocongress.com>

■ July 15-20, 2018, Bordeaux (France): **XII International Conference on Grapevine Breeding and Genetics**. Info: Prof. Serge Delrot, ISVV, 210 Chemin de Leysotte, 33882 Villenave d'Ornon, France. Phone: (33) 631122791, Fax: (33)557575903, E-mail: serge.delrot@inra.fr E-mail symposium: gbg2018@u-bordeaux.fr Web: <http://gbg2018.u-bordeaux.fr/en>

■ August 12-16, 2018, Istanbul (Turkey): **XXX International Horticultural Congress: IHC2018**. Info: Prof. Dr. Yüksel Tüzel, Ege University, Agriculture Faculty, Department of Horticulture, 35100 Bornova Izmir, Turkey. Phone: (90)2323111398, Fax: (90)2323881865, E-mail: yuksel.tuzel@ege.edu.tr E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org>

Symposia at IHC2018:

■ August 12-16, 2018, Istanbul (Turkey): **International Symposium on Ornamental Horticulture: Colour Your World**. Info: Prof. Dr. Rina Kamenetsky, Institute of Plant Sciences, Agricultural Research Organization, The Volcani Center, Rishon LeZion, 7528809, Israel. Phone: (972)39683511, Fax: (972)39660589, E-mail: vhrkamen@volcani.agri.gov.il or Prof. Dr. Yüksel Tüzel, Ege University, Agriculture Faculty, Department of Horticulture,

35100 Bornova Izmir, Turkey. Phone: (90)2323111398, Fax: (90)2323881865, E-mail: yuksel.tuzel@ege.edu.tr or Ass. Prof. Soner Kazaz, Ankara University, Faculty of Agriculture, Department of Horticulture, Diskapi - Ankara, Turkey. Phone: (90)312-596 12 87, Fax: (90)312-317 91 19, E-mail: skazaz@ankara.edu.tr E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S15.html>

■ August 12-16, 2018, Istanbul (Turkey): **III International Symposium on Innovation and New Technologies in Protected Cultivation**.

Info: Dr. Murat Kacira, Dept. of Agric. and 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@cals.arizona.edu or Dr. Silke Hemming, Wageningen UR, Plant Research International, PO Box 16, 6700 AA Wageningen, Netherlands. Phone: (31)317 4 86921, Fax: (31)317 423110, E-mail: silke.hemming@wur.nl or Prof. Dr. Yüksel Tüzel, Ege University, Agriculture Faculty, Department of Horticulture, 35100 Bornova Izmir, Turkey. Phone: (90)2323111398, Fax: (90)2323881865, E-mail: yuksel.tuzel@ege.edu.tr or Dr. Hatice Filiz Boyaci, Demircikara Mah. Pasakavaklari Cad. P.O35, Muratpasa, 07100 Antalya, Turkey. Fax: (90)242-3211512, E-mail: filiz_boyaci@yahoo.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S17.html>

■ August 12-16, 2018, Istanbul (Turkey): **XIX International Symposium on Horticultural Economics and Management and VII International Symposium on Improving the Performance of Supply Chains in the Transitional Economies and II International Symposium on Horticulture Economics, Marketing and Consumer Research**. Info: Prof. Dr. Ismet Boz, OMU Faculty of Agriculture, Department of A, OMU Faculty of Agriculture, Department of A, OMU Faculty of Agriculture, 55139 Samsun, Turkey. Phone: 3623121919, E-mail: ismet.boz@omu.edu.tr or Prof. Dr. Peter J. Batt, 3 Rodondo Place, Shelley, WA 6148, Australia. Phone: (61)401636242, Fax: (61)8 9266 3063, E-mail: peterjbatt@gmail.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S24.html>

■ August 12-16, 2018, Istanbul (Turkey): **VII International Symposium on Tropical and Subtropical Fruits**. Info: Prof. Dr. Sisir Kumar Mitra, B-12/48, Kalyani, Nadia, West Bengal 741235, India. Phone: (91)9432174249, Fax: (91)3325828460, E-mail: sisirm55@gmail.com or Dr. Hannah Jaenicke, Burghof 26, Schloss Gelsdorf, 53501 Grafschaft-Gelsdorf, Germany. Phone: (49)2225-8389895, E-mail: hannah.jaenicke@t-online.de or Prof. Dr. Mustafa Akbulut, Recep Tayyip Erdogan Universitesi, Ziraat ve Doga Bil. Fak. Bahce Bit. Bol., Faculty of Agricultural and Nature Science, Depart. of Horticulture Pazar / Rize, 53300, Turkey. Phone: +90(464)6127317, Fax: +90(464)6127316, E-mail: makbuluttr@gmail.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S05.html>

■ August 12-16, 2018, Istanbul (Turkey): **I International Symposium on Avocado**. Info: Prof. Dr. Sisir Kumar Mitra, B-12/48, Kalyani, Nadia, West Bengal 741235, India. Phone: (91)9432174249, Fax: (91)3325828460, E-mail: sisirm55@gmail.com or Assist. Prof. Hatice Ikten, Akdeniz University Agricultural Faculty, Department of Agricultural Biotechnology, 07070 Antalya, Turkey. Phone: (90)242 3106557, E-mail: hikten2@hotmail.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S06.html>

- August 12-16, 2018, Istanbul (Turkey): **International Symposium on Nuts and Mediterranean Climate Fruits: Advances in Breeding and New Strategies of Horticultural Management for Sustainable Production.** Info: Prof. Dr. Tiziano Caruso, Department of Agricultural & Forest Science, University of Palermo, Viale delle Scienze, Edificio 4 ingresso H, 90128 Palermo, Italy. Phone: (39) 09123861207, E-mail: tiziano.caruso@unipa.it or Dr. Moshe A. Flaishman, Department of Fruit Trees Sciences, ARO - The Volcani Center, PO Box 6, 50-250 Bet Dagan, Israel. Phone: (972)39683394, Fax: (972)39683793, E-mail: vhmosea@volcani.agri.gov.il or Dr. Louise Ferguson, 2037 Wickson Hall, Plant Sciences Department Mail Stop II, UC Davis 1 Shields Ave. Davis CA 95616, United States of America. Phone: (1) 559 737 3061, Fax: (1) 530 752 8502, E-mail: lferguson@ucdavis.edu or Deniz Sanal, Alata Horticultural Research Station, Mersin, Erdemli, Turkey. E-mail: denizsanal06@gmail.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S11.html>
- August 12-16, 2018, Istanbul (Turkey): **International Symposium on Evaluation of Cultivars, Rootstocks and Management Systems for Sustainable Production of Deciduous Fruit Crops.** Info: Dr. Gregory L. Reighard, Department of Plant & Environmental Science, 161 Poole Agricultural Center, Box 340310, Clemson, SC 29634-0310, United States of America. Fax: (1)8646564960, E-mail: grghrd@clemson.edu or Brunella Morandi, Università di Bologna, Viale Fanin 44, 40127 Bologna, Italy. E-mail: brunella.morandi@unibo.it or Prof. Dr. Ayzin B. Küden, University of Cukurova, Dean of the Faculty of Agriculture, Department of Horticulture, 01330 Adana, Turkey. Phone: (90)3386364/3386447, Fax: (90)3386364/3386447, E-mail: abkuden@cu.edu.tr E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S09.html>
- August 12-16, 2018, Istanbul (Turkey): **International Symposium on Viticulture: Primary Production and Processing.** Info: Prof. Dr. Zeki Kara, Selcuk University Faculty of Agriculture, Department of Horticulture, 42003 Konya Selcuklu, Turkey. Phone: (90)332-2232899, Fax: (90)332-2410108, E-mail: zkara@selcuk.edu.tr or Prof. Dr. Gökhan Söylemezoglu, Ankara University, Faculty of Agriculture, Department of Horticulture, Ankara 06110, Turkey. Phone: (90)3125961304, Fax: (90)3123179119, E-mail: soylemez@agri.ankara.edu.tr or Prof. Dr. Ahmet Altindisli, Ege University Faculty of Agriculture, Department of Horticulture, 35100 Bornova Izmir, Turkey. Phone: (90)2323882622, Fax: (90)2323881865, E-mail: ahmet.altindisli@gmail.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S13.html>
- August 12-16, 2018, Istanbul (Turkey): **II International Symposium on Soilless Culture.** Info: Prof. Dr. Michael Raviv, Agric. Res. Organization, Newe Ya'ar Research Center, PO Box 1021, Ramat Yishay 30095, Israel. Phone: (972)49836464, Fax: (972)49836936, E-mail: mraviv@volcani.agri.gov.il or Prof. Dr. Ayse Gül, Department of Horticulture, Faculty of Agriculture, Ege University, 35100 Bornova Izmir, Turkey. Phone: (90)2323884000, Fax: (90)2323881865, E-mail: ayse.gul@ege.edu.tr or Prof. Dr. H. Yildiz Dasgan, Cukurova University, Agricultural Faculty, Horticultural Department, 01330 Adana, Turkey. Phone: (90)3223386388, Fax: (90)3223386388, E-mail: dasgan@mail.cu.edu.tr E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S18.html>
- August 12-16, 2018, Istanbul (Turkey): **II International Symposium on Root and Tuber Crops: Value Added Crops for the Next Generation.** Info: Dr. Ali Fuat Gokce, Nigde Ömer Halisdemir University, Faculty of Agric. Sci. and Technologies, Department of Agri. Genetic Engineering, 51240 Nigde, Turkey. Phone: (90)05365434241, E-mail: gokce01@yahoo.com or Prof. Dr. Umezuruike Linus Opara, University of Stellenbosch, Faculty of AgriSciences, Private Bag X1, Stellenbosch 7602, South Africa. Phone: (27) 21 808 4064, Fax: (27) 21 808 2121, E-mail: opara@sun.ac.za E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S19.html>
- August 12-16, 2018, Istanbul (Turkey): **International Symposium on Advances in Production and Processing of Medicinal and Aromatic Plants.** Info: Prof. Dr. Bhimanagouda Patil, VFIC, Texas A&M University, Department of Horticulture, 1500 Research Parkway Ste A120, College Station, TX 77845, United States of America. Phone: (1)9794588090, Fax: (1)9798624522, E-mail: b-patil@tamu.edu or Dr. Fatma Uysal Bayar, BATEM, Antalya, Turkey. E-mail: uysal.fatma@tarim.gov.tr E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S29.html>
- August 12-16, 2018, Istanbul (Turkey): **IV International Conference on Turfgrass Management and Science for Sports Fields: Bridging the Needs and Research on Turfgrass at the Age of Climate Change.** Info: Prof. Dr. Giorgio Prosdocimi Gianquinto, Dip. Scienze Agrarie, DiPSA, Università degli Studi di Bologna, Viale Fanin, 44 - 40127 Bologna, Italy. Phone: (39) 0512096663, Fax: (39) 0512096245, E-mail: giorgio.gianquinto@unibo.it or Erik Ervin, Virginia Polytechnic Inst. & State University, Dept of Crop and Soil Environment Sciences, 335 SMY TH, Blacksburg 24061, VA, United States of America. Phone: (1)5402315208, Fax: (1)5402313431, E-mail: eervin@vt.edu or Assoc. Prof. Songul Sever Mutlu, Akdeniz University, Ziraat Fakültesi, Peyzaj Mimarligi bolumu, Antalya, Turkey. Phone: (90)242-2455, E-mail: songulmutlu@akdeniz.edu.tr E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S26.html>
- August 12-16, 2018, Istanbul (Turkey): **VIII International Symposium on Seed, Transplant and Stand Establishment of Horticultural Crops.** Info: Prof. Dr. Daniel Leskovar, 1619 Garner Field Rd., Texas A&M AgriLife Research, Texas AM Univeristy, Uvalde Texas 78801, United States of America. Phone: (1)830-278-9151, Fax: (1)830-278-1570, E-mail: daniel.leskovar@agnet.tamu.edu or Prof. Dr. Ahmet Korkmaz, KSU, Faculty of Agriculture, Dept. of Horticulture, Kahramanmaras, Turkey. Phone: 90-344-2802035, E-mail: akorkmaz@ksu.edu.tr or Prof. Dr. Halit Yetisir, Department of Horticulture, Faculty of Agriculture, University of Erceyes, 38039 Kayseri, Turkey. E-mail: yetisir1@erciyes.edu.tr E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S35.html>
- August 12-16, 2018, Istanbul (Turkey): **International Symposium on Tropical and Subtropical Vegetable Production: Tackling Present and Future Global Biotic and Abiotic Stressors.** Info: Prof. Dr. Hakan Aktas, Suleyman Demirel University, Agriculture, Faculty, Horticulture Dept, 32260 Isparta, Turkey. Phone: (90)2462118533, Fax: (90)2462118533, E-mail: aktashakan33@gmail.com or Dr. Srinivasan Ramasamy, AVRDC-The World Vegetable Center, 60 Yi Minga Liao, Shanhuia, 74151 Tainan Tainan, Chinese Taipei. Phone: (886)6-5852499, Fax: (886)6-5830009, E-mail: srini.ramasamy@worldveg.org or Prof. Dr. Umezuruike Linus Opara, University of Stellenbosch, Faculty of AgriSciences, Private Bag X1, Stellenbosch 7602, South Africa. Phone: (27) 21 808 4064, Fax: (27) 21 808 2121, E-mail: opara@sun.ac.za or Assoc. Prof. Golgen Bahar Oztekin, Ege University, Faculty of Agriculture, Department of Horticulture, 35100 Bornova Izmir, Turkey. Phone: (90)2323112577, Fax: (90)2323881865, E-mail: golgen.oztekin@ege.edu.tr E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S16.html>
- August 12-16, 2018, Istanbul (Turkey): **II International Symposium on Mechanization, Precision Horticulture, and Robotics.** Info: Prof. Reza Ehsani, Department of Mechanical Engineering, University of California, Merced, 5200 N. Lake Road, Merced, CA 95343, United States of America. Phone:

(1)2092283613, Fax: (1)2092284047, E-mail: rehsani@ucmerced.edu or Assoc. Prof. Selçuk Arslan, Uludag University Faculty of Agriculture, 16059 Bursa, Turkey. Phone: +90 224-2941606, E-mail: sarsilane@uludag.edu.tr E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S31.html>

- August 12-16, 2018, Istanbul (Turkey): **International Symposium on Applied Functional Molecular Biology**. Info: Prof. Dr. Rosario Muleo, Dept.. Crop Production, Università della Tuscia, Via S.C. De Lellis snc, Viterbo 01100, Italy. Phone: (39)0761357532, Fax: (39)761357531, E-mail: muleo@unitus.it or Assoc. Prof. Birsen Cakir, Ege University Faculty of Agriculture, Department of Horticulture, Bornova, 35100 304zmir, Turkey. Phone: (90) 232 3112633, Fax: (90)2323881865, E-mail: birsencakir@hotmail.com or Prof. Dr. Ali Ergul, Ankara University Biotechnology Institute, Central Laboratory, 06100 Ankara, Turkey. Phone: +90-312-2225816, Fax: +90-312-2225872, E-mail: ergul@ankara.edu.tr E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S03.html>
- August 12-16, 2018, Istanbul (Turkey): **XI International Symposium on Banana: ISHS-ProMusa Symposium on Growing and Marketing Banana under Subtropical Conditions**. Info: Prof. Dr. Hamide Gubbuk, Akdeniz University, Faculty of Agriculture, Department of Horticulture, 07058 Antalya, Turkey. Phone: (90)2423102422, Fax: (90)2422274564, E-mail: gubbuk@akdeniz.edu.tr or Dr. Thierry Lescot, CIRAD, RU GECO, Persyst Department, Boulevard de la Lironde, TA B26/PS4, 34398 Montpellier, France. Phone: (33)467615666, Fax: (33)467615821, E-mail: thierry.lescot@cirad.fr or Dr. Victor Galán Sauco, Isaac Albéniz 17, 38208 La Laguna, Tenerife, Canary islands, Spain. Phone: (34)922261647, E-mail: vgalan46@gmail.com or Dr. Inge Van den Bergh, Bioversity International, C/O KULeuven, W. De Croylaan 42 bus 2455, 3001 Leuven, Belgium. Phone: (32)16377067, E-mail: i.vandenbergh@cgiar.org E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S04.html>
- August 12-16, 2018, Istanbul (Turkey): **International Symposium on Strategies and Technologies to Maintain Quality and Reduce Postharvest Losses**. Info: Dr. Mustafa Erkan, Akdeniz University, Department of Horticulture, 07058 Antalya, Turkey. Phone: +90 242 3102428, Fax: +90 242 2274564, E-mail: erkan@akdeniz.edu.tr E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S32.html>
- August 12-16, 2018, Istanbul (Turkey): **International Symposium on Water and Nutrient Relations and Management of Horticultural Crops**. Info: Prof. Dr. Esmaeli Fallahi, University of Idaho, Parma Res. & Extension Center, 29603 University of Idaho Lane, Parma, ID 83660-6699, United States of America. Phone: (1)2087226701 ext225, Fax: (1)2087226708, E-mail: efallahi@uidaho.edu or Prof. Dr. Dilek Anaç, Kaz305mdirik mahallesi 156 sokak No. 132, Nur Apt. Bornova-304zmir, 35040 Bornova, Turkey. E-mail: dilek.anac@ege.edu.tr or Dr. Alon Ben-Gal, Environmental Physics and Irrigation, Gilat Research Center, Agricultural Research Organization, Mobile Post Negev 2 85280, Israel. Phone: (972)8 9928644, Fax: (972)8 9926485, E-mail: bengal@agri.gov.il or Mr. Janjo de Haan, Soesterweg 410, 3812BK Amersfoort, Netherlands. Phone: (31)320291211, E-mail: janjo.dehaan@wur.nl or Dr. Clive Rahn, 60 Ettington Close, Wellesbourne, Warwick, CV35 9RJ, United Kingdom. E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S33.html>
- August 12-16, 2018, Istanbul (Turkey): **International Symposium on Quality and Safety of Horticultural Products**. Info: Prof. Dr. Güner Arkun, Istanbul Aydin University Engineering Facul, Besyol Mah Inonü cad no 38 Küçükçekmece, 34295 Istanbul, Turkey. Phone: (90) 4441428, Fax: (90) 212 4255759, E-mail: gunerozay@aydin.edu.tr or Dr. Kamer Betül Ozer,

Ege University, Faculty of Agriculture, Department of Horticulture, Evka-3, 35100 Izmir Bornova, Turkey. Phone: (90)232-3112631, E-mail: betul.sintra@gmail.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S21.html>

- August 12-16, 2018, Istanbul (Turkey): **VII International Symposium on Human Health Effects of Fruits and Vegetables - FAVHEALTH2018**. Info: Prof. Dr. Julian Heyes, Inst of Food, Nutrition & Human Health, Massey University, Private Bag 11222, Palmerston North, New Zealand. Phone: (64)63505963, Fax: (64)63517050, E-mail: j.a.heyes@massey.ac.nz or Dr. Trevor George, King's College London, 150 Stamford Street, London, SE1 9NH, United Kingdom. Phone: (44)2078484433, E-mail: trevor.george@kcl.ac.uk or Prof. Dr. Uygün Aksoy, Ege University, Faculty of Agriculture, Department of Horticulture, 35100 Bornova - Izmir, Turkey. Phone: (90)2323884000x2742, Fax: (90) 2323881864, E-mail: uygunaksoy@gmail.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S22.html>
- August 12-16, 2018, Istanbul (Turkey): **II International Symposium on Jackfruit and Other Moraceae**. Info: Prof. Dr. Sisir Kumar Mitra, B-12/48, Kalyani, Nadia, West Bengal 741235, India. Phone: (91)9432174249, Fax: (91)3325828460, E-mail: sisirm55@gmail.com or Dr. Hannah Jaenicke, Burghof 26, Schloss Gelsdorf, 53501 Grafschaft-Gelsdorf, Germany. Phone: (49)2225-8389895, E-mail: hannah.jaenicke@t-online.de or Prof. Dr. Mustafa Akbulut, Recep Tayyip Erdogan Üniversitesi, Ziraat ve Doga Bil. Fak. Bahce Bit. Hort., Faculty of Agricultural and Nature Science, Depart. of Horticulture Pazar / Rize, 53300, Turkey. Phone: +90(464)6127317, Fax: +90(464)6127316, E-mail: makbuluttr@gmail.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S07.html>
- August 12-16, 2018, Istanbul (Turkey): **II International Symposium on Date Palm**. Info: Dr. Yuval Cohen, Volcani Research Center, Department of Fruit Tree Sciences, Institute of Plant Science, Bet Dagan 50250, Israel. Phone: (972) 3-9683407, Fax: (972) 3-9669583, E-mail: vhyuvalc@volcani.agri.gov.il or Assist. Prof. Hatice Ikten, Akdeniz University Agricultural Faculty, Department of Agricultural Biotechnology, 07070 Antalya, Turkey. Phone: (90)242 3106557, E-mail: hikten2@hotmail.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S34.html>
- August 12-16, 2018, Istanbul (Turkey): **International Symposium on Fruit and Vegetables for Processing**. Info: Prof. Dr. Mehmet Ali Koyuncu, Süleyman Demirel University, Agriculture Faculty, Department of Horticulture, 32260 Isparta, Turkey. Phone: (90)246 2118529, Fax: (90)246 2118696, E-mail: koyuncu.ma@gmail.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S27.html>
- August 12-16, 2018, Istanbul (Turkey): **II International Symposium on Micropropagation and In Vitro Techniques**. Info: Dr. Maurizio Lambardi, IVALSA/Trees and Timber Institute, National Research Council (CNR), Polo Scientifico, via Madonna del Piano 10, I-50019 Sesto Fiorentino, Firenze, Italy. Phone: (39) 055 5225685, Fax: (39) 055 5225656, E-mail: lambardi@ivalsa.cnr.it or Aylin Ozudogru, CNR-IVALSA, Via Madonna del Piano 10, 50019 Sesto Fiorentino, FI, Italy. E-mail: elifaylinozudogru@yahoo.it or Prof. Dr. Yesim Yalcin Mendi, Department of Horticulture, Faculty of Agriculture, University of Cukurova, Adana, Turkey. E-mail: ymendi@gmail.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S02.html>
- August 12-16, 2018, Istanbul (Turkey): **II International Symposium on Plant Breeding in Horticulture**. Info: Prof. Dr. Nebahat Sari, Cukurova University, Agricultural Faculty, Dept. of Hort/ Balcali, 01330 Adana, Turkey. Phone: (90)3223386497, Fax: (90)3223386388, E-mail: nesari@cu.edu.tr or Prof. Dr. Yildiz

Aka Kacar, University of Cukurova, Faculty of Agriculture, Horticulture Dept. Lab for Plant Biotech., 01330 Adana, Turkey. Phone: (90)322-3386388, Fax: (90)322-3386388, E-mail: ykacar@cu.edu.tr E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S20.html>

- August 12-16, 2018, Istanbul (Turkey): **II International Symposium on Organic Horticulture for Wellbeing of the Environment and Population.** Info: Prof. Martine Dorais, Centre de recherche & d'innovation-végétaux, Laval University, Envirotron Bldg, Room 2120, Quebec G1K 7P4, Canada. Phone: (1)418-6562131, Fax: (1)418-6563515, E-mail: martine.dorais.1@ulaval.ca or Prof. Dr. Uygun Aksoy, Ege University, Faculty of Agriculture, Department of Horticulture, 35100 Bornova - Izmir, Turkey. Phone: (90)2323884000x2742, Fax: (90) 2323881864, E-mail: uygunaksoy@gmail.com or Prof. Dr. Roberto Ugás, Universidad Nacional Agraria La Molina, Programa de Hortalizas, Apartado 12-056, Lima, Peru. Phone: (511)3485796, Fax: (511)3485796, E-mail: rugas@lamolina.edu.pe E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S23.html>

- August 12-16, 2018, Istanbul (Turkey): **II International Symposium on Innovative Plant Protection in Horticulture.** Info: Dr. David Hunter, 13 Graves Crescent, St. Catharines, Ontario, L2S 3Y7, Canada. Phone: (1)9056853851, E-mail: davidmhunter13@gmail.com or Prof. Dr. Ana Paula Ramos, Instituto Superior de Agronomia - ULisboa, Tapada da Ajuda, 1349-017 Lisboa Lisboa, Portugal. E-mail: pramos@isa.ulisboa.pt or Prof. Dr. Kadriye Caglayan, Mustafa Kemal University, Agriculture Faculty, Plant Protection Department, 31034 Antakya-Hatay, Turkey. Phone: (90)326 2455836 Ext.1347, Fax: (90)326 2455832, E-mail: kcaglayan@yahoo.com or Assoc. Prof. Feza Can Cengiz, MKU. Agriculture Faculty Plant Protection D, Mustafa Kemal University, Hatay, 31000 Antakya, Turkey. Phone: (90)3262455845/1328, Fax: (90)3262455832, E-mail: cezaflan_onurcan@hotmail.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S28.html>

- August 12-16, 2018, Istanbul (Turkey): **XI International Symposium on Postharvest Quality of Ornamental Plants.** Info: Prof. Dr. Fisun G. Çelikel, Ondokuz Mayıs University, Faculty of Agriculture, Dept. Horticulture, Kurupelit, Atakum, 55200 Samsun, Turkey. Phone: (90)362-3121919, Fax: (90)362-4576034, E-mail: fgcelikel@omu.edu.tr or Dr. Shimon Meir, Dept. Postharvest Sci.Fresh Pr., The Volcani Center, ARO, PO Box 6, Bet Dagan 50250, Israel. Phone: (972)39683667, Fax: (972)39683622, E-mail: shimonm@volcani.agri.gov.il E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S14.html>

- August 12-16, 2018, Istanbul (Turkey): **International Symposium on Carob: a Neglected Species with Genetic Resources for Multifunctional Uses.** Info: Prof. Dr. Hamide Gubbuk, Akdeniz University, Faculty of Agriculture, Department of Horticulture, 07058 Antalya, Turkey. Phone: (90)2423102422, Fax: (90)2422274564, E-mail: gubbuk@akdeniz.edu.tr E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S37.html>

- August 12-16, 2018, Istanbul (Turkey): **International Symposium on Understanding Fruit Tree Behaviour in Dynamic Environments.** Info: Dr. Evelyne Costes, INRA UMR AGAP, 2, place Viala, 34060 Montpellier Cedex 1, France. Phone: (33)499612787, Fax: (33)499612616, E-mail: evelyne.costes@inra.fr or Dr. Pasquale Losciale, Council for Agric. Research & Economics, Research Centre for Agric. & Environment, Via Celso Ulpiani 5, Bari, Italy. Phone: (39)0805475036, Fax: (39)0805475023, E-mail: pasquale.losciale@crea.gov.it or Prof. Dr. Ayzin B. Küden, University of Cukurova, Dean of the Faculty of Agriculture, Department of Horticulture, 01330 Adana, Turkey. Phone:

(90)3386364/3386447, Fax: (90)3386364/3386447, E-mail: abkuden@cu.edu.tr E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S10.html>

- August 12-16, 2018, Istanbul (Turkey): **IV International Jujube Symposium.** Info: Prof. Dr. Mengjun Liu, Research Center of Chinese Jujube, Agricultural University of Hebei, Baoding, Hebei, 71001, China. Phone: (86)312754342, Fax: (86)3127521251, E-mail: lmj1234567@aliyun.com or Prof. Dr. Florin Stanica, University of Agronomic Sciences, Faculty of Horticulture, B-dul Marasti, 59, Sector 1, 011464, Bucuresti, Romania. Phone: (40)722641795, Fax: (40)213182888, E-mail: flstanica@yahoo.co.uk or Assoc. Prof. Kazim Gunduz, Mustafa Kemal University, A287riculture Faculty, Department of Horticulture, 31034 Hatay Antakya, Turkey. Phone: +90 0326 245 5845, Fax: +90 0326 245 5832, E-mail: kgunduz44@gmail.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S08.html>

- August 12-16, 2018, Istanbul (Turkey): **VI International Symposium on Saffron Biology and Technology.** Info: Prof. Dr. Saliha Kirici, Cukurova University, Agriculture Fac., Field Crops Dept., 01330 SARICAM, Turkey. Phone: (90)5324018575, E-mail: kirici@cu.edu.tr or Prof. Dr. Yesim Yalcin Mendi, Department of Horticulture, Faculty of Agriculture, University of Cukurova, Adana, Turkey. E-mail: ymendi@gmail.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S39.html>

- August 12-16, 2018, Istanbul (Turkey): **VIII International Symposium on Education, Research Training and Consultancy.** Info: Dr. Rémi Kahane, CIRAD, Dept Persyst TA B-DIR/09, Avenue Agropolis, 34398 Montpellier cedex 5, France. Phone: (33)467614938, E-mail: remi.kahane@cirad.fr or Prof. Dr. Ismet Boz, OMU Faculty of Agriculture, Department of A, OMU Faculty of Agriculture, Department of A, OMU Faculty of Agriculture, 55139 Samsun, Turkey. Phone: 3623121919, E-mail: ismet.boz@omu.edu.tr E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S36.html>

- August 12-16, 2018, Istanbul (Turkey): **V International Symposium on Plant Genetic Resources: Sustainable Management and Utilization for Food, Nutrition and Environmental Security.** Info: Dr. Sandhya Gupta, National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi, Delhi, 110 012, India. Phone: (91)9958499781, Fax: (91)11-25842495, E-mail: sandhya_gupta87@yahoo.com or Hülya İlbi, Ege University, Faculty of Agriculture, Dept. Of Horticulture, 35100 Bornova Izmir, Turkey. E-mail: hulya.ilbi@ege.edu.tr or Assoc. Prof. Birsan Cakir, Ege University Faculty of Agriculture, Department of Horticulture, Bornova, 35100 304zmir, Turkey. Phone: (90) 232 3112633, Fax: (90)2323881865, E-mail: birsencakir@hotmail.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S01.html>

- August 12-16, 2018, Istanbul (Turkey): **III International Berry Fruit Symposium.** 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@atauni.edu.tr or Prof. Dr. Sedat Serçe, Nigde Omer Halisdemir University, Faculty of Agricultural Sciences and Techn., Dept. Agricultural Genetic Engineering, Nigde, 51240, Turkey. Phone: (90) 388 2254463, Fax: (90) 388 2254440, E-mail: sedatserce@gmail.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S12.html>

- August 12-16, 2018, Istanbul (Turkey): **International Symposium on Culinary Herbs and Edible Fungi.** Info: Prof. Dr. Lyle Craker, Dept. of Plant & Soil Science, University of Massachusetts, Stockbridge Hall, Amherst, MA 01003-7245, United States of America. Phone: (1)413-545-2347, Fax: (1)413-545-3958, E-mail: craker@pssci.umass.edu or Prof. Dr. Aysun Peksen, Ondokuz

Mayis University, Faculty of Agriculture, Department of Horticulture, Samsun 55139, Turkey. Phone: (90)3624576020/1137, Fax: (90)3624576034, E-mail: aysunp@omu.edu.tr or Mr. Mustafa Kemal Soyulu, Atatürk Central Horticultural Research Inst, 77102 Yalova, Turkey. Phone: (90)2268142520, Fax: (90)2268141146, E-mail: mksoylu@hotmail.com E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S30.html>

■ August 12-16, 2018, Istanbul (Turkey): **VII International Conference on Landscape and Urban Horticulture**. Info: Federica Larcher, Largo P. Braccini 2, 10095 Grugliasco, Torino, Italy. E-mail: federica.larcher@unito.it or Jesus Ochoa, Universidad Politécnica de Cartagena, Paseo Alfonso XIII, 48, 30203 Cartagena, Murcia, Spain. E-mail: jesus.ochoa@upct.es E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S25.html>

■ August 12-16, 2018, Istanbul (Turkey): **X International Symposium on Temperate Fruits in the Tropics and Subtropics**. Info: Dr. Giuliano Finetto, Institute for Agricultural Sciences, Via A. Milani 19, 37124 Verona, Italy. Phone: (39)045942439, Fax: (39)045942439, E-mail: giulianofinetto@tin.it or Dr. Maria Luisa Badenes, Secretary General EUCARPIA, IVIA, 4 Apartado Oficial, 46113 Moncada (Valencia), Spain. Phone: (34)9634 24049, Fax: (34)9634 24106, E-mail: badenes_mlu@gva.es or Prof. Dr. Ali Kuden, Cukurova univ. Fac.of Agric., Dept. of Horticulture, 01330 Adana, Turkey. Phone: (90)322 3386748, E-mail: akuden@cu.edu.tr E-mail symposium: secretariat@ihc2018.org Web: <http://www.ihc2018.org/en/S38.html>

NEW ■ August 22-22, 2018, Bangkok (Thailand): **International Forum on Horticultural Product Quality (HortiAsia2018)**. Info: Prof. Dr. Errol W. Hewett, Professor of Horticultural Science Emeritus, Institute of Food, Nutrition & Human Health, Massey University - 212/141 Bethlehem Road, Tauranga 3110, New Zealand. Phone: (64)75622672, E-mail: ewmrhewett@xtra.co.nz or Dr. Surawit Wannakrairoj, Department of Horticulture, Kasetsart University, Bangkok, Thailand. E-mail: agrsuw@ku.ac.th Web: <http://www.horti-asia.com/>

NEW ■ September 2-5, 2018, Erfurt (Germany): **XXVI International Eucarpia Symposium Section Ornamentals: Editing Novelty**. Info: Philipp Franken, Institute for Veget. & Ornamental Crops, 14979 Grossbeeren, Germany. E-mail: franken@igzev.de E-mail symposium: eucarpia-ornamentals2018@igzev.de Web: <https://www.eucarpia-ornamentals2018.org/>

■ September 9-13, 2018, Heraklion, Crete (Greece): **IX International Symposium on Soil and Substrate Disinfestation**. Info: Eleftherios Tjamos, Agricultural University of Athens, Iera Odos 75, 118 55 Athens, Greece. E-mail: ect@aua.gr E-mail symposium: secretariat@sd2018crete.gr Web: <http://www.sd2018crete.com/>

■ September 19-22, 2018, Krakow (Poland): **II International Symposium on Carrot and Other Apiaceae**. Info: Prof. Dariusz Grzebelus, Institute of Plant Biology and Biotechnolog, Faculty of Biotechnology and Horticulture, University of Agriculture in Krakow, 31-425 Krakow, Poland. Phone: (48)12-6625399, E-mail: d.grzebelus@ogr.ur.krakow.pl E-mail symposium: Carrot-symposium2018@targi.krakow.pl Web: <http://carrot-symposium2018.pl/gb/>

NEW ■ October 1-5, 2018, Yalta (Russian Federation): **VIII International Scientific and Practical Conference on Biotechnology as an Instrument for Plant Biodiversity Conservation (physiological, biochemical, embryological, genetic and legal aspects)**. Info: Prof. Dr. Irina Mitrofanova, Nikita Botanical Gardens, Nikita, 298648, Yalta, Russian

Federation. E-mail: irimitrofanova@yandex.ru E-mail symposium: yaltabiotech2018@mail.ru Web: <https://biotech2018.yolasite.com/>

■ October 15-17, 2018, Plovdiv (Bulgaria): **III International Symposium on Horticultural Crop Wild Relatives**. Info: Assist. Prof. Stefan Gandev, Fruit Growing Institute, Ostromila 12, 4004 Plovdiv, Bulgaria. Phone: (359)32 69 23 49, E-mail: s.gandev@abv.bg E-mail symposium: symwildfruits2018@abv.bg Web: <http://symposium.fruitgrowinginstitute.com>

■ November 13-16, 2018, Taichung (Chinese Taipei): **International Symposium on Horticultural Therapies: Past, Present and Future**. Info: Dr. Hsueh-Shih Lin, Director, TDAIS, Council of Agriculture, No.370 Song-Hwai Road, 51544 Changhua Tatsuen Village, Chinese Taipei. Phone: (886)48522624, Fax: (886)48521148, E-mail: hslin@tdais.gov.tw or Prof. Dr. Sheng Jung Ou, 168 Jifeng E. Rd., 41349 Taichung, Chinese Taipei. E-mail: sjou@cyut.edu.tw or Prof. Dr. Chun-Yen Chang, No. 138 Sec. 4, Keelung Road, National Taiwan University, Taipei, 10673, Chinese Taipei. Phone: (886)233664859, Fax: (886)223699085, E-mail: cycmail@ntu.edu.tw E-mail symposium: hortitherapy2018@gmail.com Web: <http://www.2018hortitherapy.com.tw/>

NEW

NEW

■ December 4-7, 2018, Montevideo (Uruguay): **XIII International Pear Symposium**. Info: Dr. Roberto Zoppolo, INIA, Km. 10 Ruta 48, Rincon del Colorado (Canelones), 90200 Las Piedras, Uruguay. Phone: (598)23677641, Fax: (598)23677609, E-mail: rzoppolo@inia.org.uy or Dr. Danilo Cabrera, INIA Uruguay, Cno. Redención esq. Cno Buxareo, 12500 Melilla, Montevideo, Uruguay. E-mail: dcabrera@inia.org.uy E-mail symposium: info@pear2018.uy Web: <https://www.pear2018.uy/>

Year 2019

NEW

■ January 27-31, 2019, Tenerife (Spain - Canary Islands): **XI International Symposium on Protected Cultivation in Mild Winter Climates & I International Symposium on Nettings and Screens in Horticulture**. Info: Prof. Dr. Juan A. Fernandez, Dpto. Producción Vegetal, Univ. Politécnica de Cartagena, Paseo Alfonso XIII, 48, 30203 Cartagena (Murcia), Spain. Phone: (34)968325446, Fax: (34)968325435, E-mail: juan.fernandez@upct.es or Dr. Francisco Moisés Del Amor Saavedra, Instituto Murciano de Investigación y Desarrollo Agrario (IMIDA), C./Mayor s/n. La Alberca, 30150 Murcia, Spain. E-mail: francisco.com.delamor@carm.es or Dr. Avi Sadka, ARO, The Volcani Center, Department of Fruit Trees Sciences, 68 HaMaccabim Rd., P.O. Box 15159, Rishon LeZion 7528809, Israel. Phone: (972)3-9683343, Fax: (972)3-9669583, E-mail: vhasadka@volcani.agri.gov.il Web: <http://www.mildwinter2019.org>

NEW

■ February 25 - March 1, 2019, Singapore (Singapore): **VII International Symposium on the Taxonomy of Cultivated Plants**. Info: Dr. Nigel Taylor, National Parks Board, 1 Cluny Road, Singapore Botanic Gardens, 259569 Singapore Singapore, Singapore. Phone: (65) 64719901, Fax: (65) 64674832, E-mail: nigel_taylor@nparks.gov.sg

NEW

■ March 9-12, 2019, Tehran (Iran): **International Symposium on Cut Flowers**. Info: Assist. Prof. Sasan Aliniaiefard, Department of Horticulture, College of Aburaihan, University of Tehran, Imam Reza Blvd., 3391653755 Pakdasht, Tehran, Iran. Phone: (98)2136041089, Fax: (98)2136041089, E-mail: aliniaiefard@ut.ac.ir Web: <https://iscf2019.com>

NEW

■ March 12-15, 2019, Orihuela (Spain): **X International Symposium on Artichoke, Cardoon and their Wild Relatives**. Info: Prof. Dr. Daniel Valero, University Miguel Hernandez, Ctra. Beniel Km. 3,2, 3312 Orihuela (Alicante), Spain. Phone: (34)966749743, Fax: (34)966749677, E-mail: daniel.valero@umh.es

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› *Chronica Horticulturae* author information

Chronica Horticulturae is the quarterly publication of the International Society for Horticultural Science (ISHS) and is received by all members of the Society and numerous libraries throughout the world. Members and non-members are urged to contribute articles for consideration. However, it needs to be understood that *Chronica* is not to be construed as a scientific journal that publishes original research. Research articles appropriate for *eJHS* or *Acta Horticulturae* are usually inappropriate for *Chronica*. We seek horticultural articles of interest to a broad audience composed of ISHS members and the horticultural, scientific, and academic communities.

Chronica Horticulturae is currently made up of as many as nine sections as follows:

News & Views from the Board. This section is usually confined to editorials from Board Members as well as general announcements of the Society.

Issues. Articles of a broad focus that often involve controversial topics related to horticulture, including broad social issues and economic development, are appropriate for this section. These articles are intended to stimulate discussion. Often, guest writers are invited to contribute articles.

Spotlight on Honoured ISHS Members. ISHS Fellows and Honorary Members complete an interview on how they started and progressed in their careers, what affected their decisions and attitudes and how their involvement with ISHS assisted them. In addition, they are invited to comment on how they see the future of horticultural science for young people. Articles in this section are by invitation only.

Horticultural Science Focus. This section is intended for in-depth articles on a topic of horticulture that is generally, but not always, scientific in nature. Many articles are mini-reviews and will provide up-to-date information on current topics of interest to the horticultural community. We encourage these articles to be illustrated.

Horticultural Science News. Shorter articles about current topics including horticultural commodities and disciplines are welcome.

History. This section includes articles on the history of horticulture, horticultural crops, and ISHS.

The World of Horticulture. Articles in this section highlight horticultural industries and research institutions of particular countries or geographic regions throughout the world. Illustration with figures and tables is extremely helpful and highly advised. This section also includes book reviews that are requested by the Editor. Members who wish to recommend a book review should arrange for a copy of the book to reach the Secretariat.

Symposia and Workshops. Meetings under the auspices of ISHS are summarized, usually by a participant of the meeting. These articles are arranged by the symposium organizers.

News from the ISHS Secretariat. This section contains information on membership, memorials of deceased ISHS members, and a calendar of ISHS events. Brief memorials (up to 500 words) should be sent to the Secretariat.

Authors who wish to submit articles for publication in *Chronica* should contact ISHS headquarters and their request will be transmitted to the Editor. Authors should be aware that most articles should have a broad international focus. Thus, articles of strictly local interest are generally unsuited to *Chronica*. Illustrated articles are usually 1500 to 5000 words long. There are no page charges for *Chronica Horticulturae*. Photographs submitted should be of high resolution (≥ 300 pixels per inch). Send articles or ideas for articles to:

Jill Stanley, Editor, jill.stanley@plantandfood.co.nz
Kelly Van Dijck, Associate Editor, kelly.vandijck@ishs.org

