A publication of the International Society for Horticultural Science

# Chronica Horticulturae

## Horticultural highlights

Harnessing the opinions of young minds • The need for sound strategy based research cooperations • Agroecology and education: socio-ecological resilience to climate change • World record: saffron flowers with most augmented number of stigmata • Persian gardens: then and now

## Symposia and workshops

Horticultural Therapies • Beverage Crops • Pear

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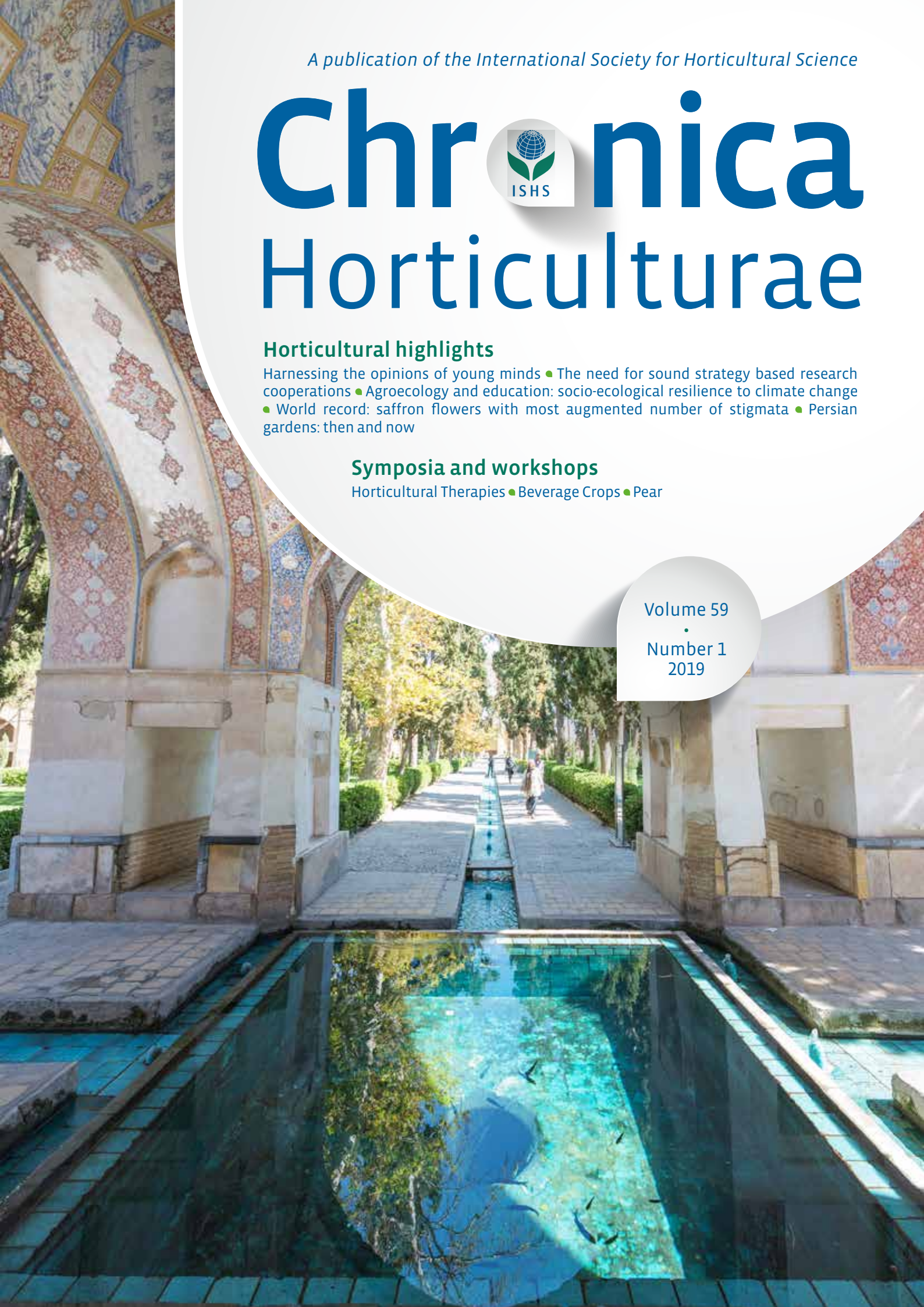

# Chronica Horticulturae

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**Cover photograph: In the Bagh e Fin garden in Kashan is the typical Chahar Bagh layout, with a pavilion and geometric pool (Copyright: imeduard/Shutterstock). See article p.29.**

# Outreach, young minds, and collaboration with industry

› Yüksel Tüzel

Yüksel Tüzel, President of ISHS

We strongly believe in the benefits of a scientific network for horticultural science. ISHS has a key focus on facilitating cooperation and knowledge transfer in all branches of horticultural science on a global scale. Our meetings (i.e., symposia, workshops, and congresses), publications, scientific structure and all other communication tools are a good platform to share, exchange and transfer our knowledge on horticulture. Therefore, the efforts of previous and current ISHS Boards are focused on improving the efficiency and reach of our networking (such as peer reviewed journals, introduction of corporate members, youth outreach, and summer schools).

The new Board, which was elected at the Council meeting prior to the International Horticultural Congress in Istanbul, in August 2018, had their first meeting in early February at the ISHS headquarters in Leuven, Belgium. The questionnaire "Harnessing the opinions of young minds" (see the summary in this issue), aiming to understand the motivations, expectations and challenges of young people, assisted us greatly during our brainstorming session. Thanks to former Board member, Prof. Dr. Jens Wünsche, for his great efforts.

Some of the areas that the new Board would like to focus on in the next three and a half years to improve outreach and impact are to:

- Increase the visibility of the Society,
- Increase networking and connecting people,
- Build ISHS in regions such as Latin America, Africa, East Europe and Central Asia (for instance, we have plans for a summer school in Brazil in 2020),
- Improve communication with members, particularly with young minds,
- Increase activities and benefits for young minds,
- Further develop efficient strategies to network with industry,
- Continue to link with international organizations, national societies, and societies in horticulture related fields,
- Encourage higher participation and submissions to our scientific meetings and publications, by organizing them in symposia 2.0 style, and reduce the time-to-publication for *Acta Horticulturae* and our journals.
- Strengthen the regional congresses (for instance we plan to hold a regional congress in Latin America in addition to those in Asia, Europe, and Africa),
- Keep ISHS financially sound.

As a new Board, we will continue to work on short and medium term plans that will contribute to reaching the goals of our Society and increase efficiency at each level, develop key performance indicators for monitoring progress, whilst allowing flexibility to update them after assessing changing trends and interests. These documents can guide the short-term activities of the next Board and provide a swift transition.

One of the focal points will be our cooperation with related industries. Such cooperation is extremely important for the sustainable and economic development of the Society and for improving connection with industry. Therefore, since 2016, the ISHS portfolio has included corporate membership. The previous Board recommended that a target of 10 corporate ISHS memberships be set. During the previous Board, ISHS initiated a partnership with four corporate members: Bayer Crop Science (Germany), Greenyard (Belgium), Beaulieu Technical Textiles (Belgium) and Hishtil (Israel).

Cooperation with corporate members provides different scientific and practical opportunities for both the industry partner as well as the ISHS. These opportunities include collaboration and networking, development of innovative technologies, and sustainable solutions for horticultural crop production chains. In line with the recommendations of the previous Executive Committee members and of the previous Board, the present Board discussed clear and sensible criteria/guidelines to help ISHS target prospective corporate members. The new Board described the basic qualities for industry partners who wish to become ISHS corporate members.

The corporation must:

- Have activity that is linked to integrated processes of horticulture,
- Have a global or regional (rather than local) impact,
- Operate within international ethical standards,
- Have a sustainability strategy,
- Have a willingness to work with ISHS in a non-exclusive environment,
- Be willing to participate in collaborative engagement.

Jozef Van Assche has been the Executive Director of ISHS for 25 years but decided to step aside on 1 January 2019 from this position at his own request in 2017. He was appointed as Special Advisor by the previous Board. Given that corporate membership requires special care and personal follow-up, it was agreed his main task should be to focus on this aspect. Therefore, his new position is titled "Chief of Corporate Development". Jozef, who is uniquely suited for this position with his knowledge of the history and operation of ISHS, his wealth of contacts in the horticultural corporate world, and his amazingly personable diplomacy and language skills, is excited about the prospects of this new position. He will focus on maintaining the four existing relationships with the corporate members of ISHS and has begun initiating new ones, but will also carry out other tasks as specified and assigned by the Board.

Peter Vanderborght, Assistant Executive Director to the Society for the past 25 years, was promoted to the position of Executive Director, effective on 1 January 2019. In his new position, Peter presented the ED report to the February meeting of the new ISHS Board. I commend Peter, Jozef, and the hard working staff of the Secretariat, for the smooth transition of the ED position, the new Corporate Chief position, and the continued excellent administrative management of the affairs of the Society. I and the ISHS Board extend our heart-felt appreciation for their continued services and contributions to ISHS. We wish both Peter and Jozef good luck in their new positions!

# Harnessing the opinions of young minds

Jens N. Wünsche

## Rationale and project aim

Harnessing the opinions and perception of young minds with an interest in horticultural science is essential to ensure that their voices are heard and taken seriously when identifying and implementing future strategies and requirements within the ISHS. With this in mind, a questionnaire was developed, which aimed at understanding the motivations, expectations and impediments of young people to pursue horticultural careers and to become a member of our Society.

Consequently, students, postdocs and young scientists (≤ 35 years of age) were invited to participate in an on-line questionnaire from 01/10/2016 until 31/07/2017 to capture their voices in relation to ISHS membership and professional careers in the horticultural sector.

Completing the questionnaire took approximately 10 minutes. The majority of the questions were close-ended questions that needed to be answered by a simple "yes" or "no", single or multiple choice, or that needed ranking of the given answer. However, there were also a few open-ended questions, where participants had the opportunity to state briefly their opinions.

All the information provided was analysed anonymously. However, there was some personal background information needed, required for the purpose of statistical analysis to increase the conciseness, clarity and objectivity and to make the research scientifically relevant.

Twenty respondents received a one-year complimentary ISHS membership and ten respondents received an electronic tablet. Winners were selected randomly from all eligible entries (only one entry per person was allowed) and they were notified by email prior to 31/12/2017.

## Sample description

The ISHS questionnaire attracted a total of 814 young respondents, of which 230 were members and 584 were non-members of the ISHS. Overall, there were 43% male and 57% female respondents with an average age of 30.8 years. Respondents from 104 countries participated in the questionnaire with the largest response numbers from India, USA, Brazil, Iran, China, Nigeria, Australia, Pakistan, Germany, Spain, Italy, United Kingdom, South Africa, New Zealand, Kenya, Greece, Ireland, Ghana, Canada, and Philippines (Figure 1).

Non-members tended to have a higher proportion of undergraduate degrees (BSc, BSc with Honours), whereas respondents with ISHS membership had comparatively higher educational degrees (MSc, PhD), as shown in Figure 2. Overall, about half of the respondents (47%) were still enrolled in undergraduate and graduate study programs, whereas the other half were working at postgraduate or young scientist level. The most popular study (major) programs that were selected within respondent's university/college were horticulture (34%), plant biology (16%), agriculture (15%), crop science (7%), postharvest science and technology (7%), plant breeding (6%), plant science (6%), food science and technology (5%) and landscaping design (4%).

## Summary

The overall response to the questionnaire was very positive with approximately 800 valid entries of young minds from more than 100 countries. The respondents were either students or early career scientists with various academic degrees. The nearly gender balanced cohort had an average age of 31 years. At the ISHS membership survey in 2012, less than 5% of all respondents were younger than 30 years, suggesting that the opinion of this age group was little represented. This questionnaire exclusively focused on young minds in an attempt to shape the future of the ISHS according to their needs and requirements!

## Horticultural science career

About half of the respondents (52%) had enrolled in study programs related to plant or horticultural science because of their love of plants and 41% of them thought that these programs represented exciting, multi-faceted career pathways (Figure 3). Close to 20%

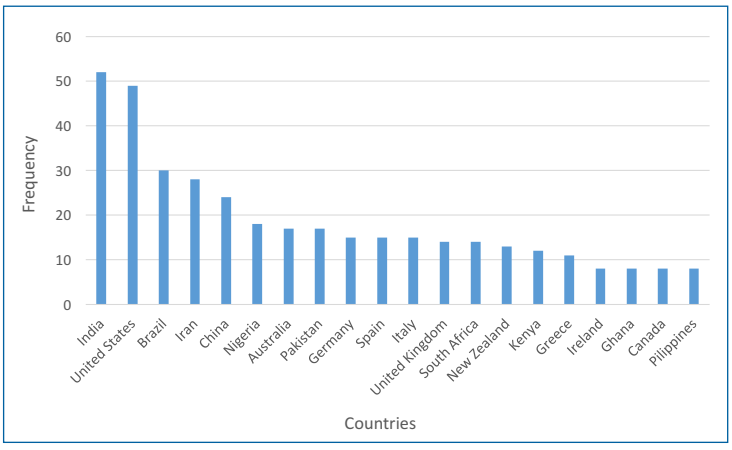


Figure 1. The top 20 countries with the most number of respondents in the ISHS young minds questionnaire (n=814).

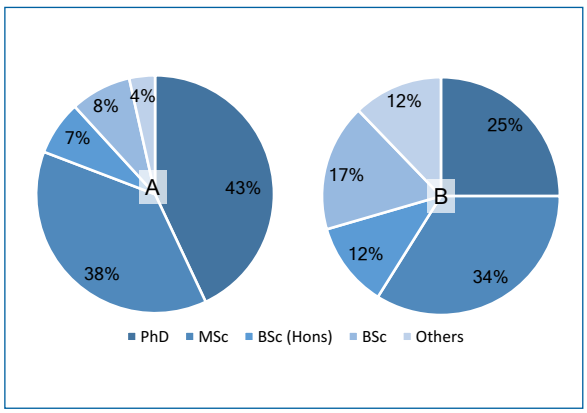


Figure 2. Professional qualifications of respondents in the ISHS young minds questionnaire (A: members, n=230; B: non-members, n=584).

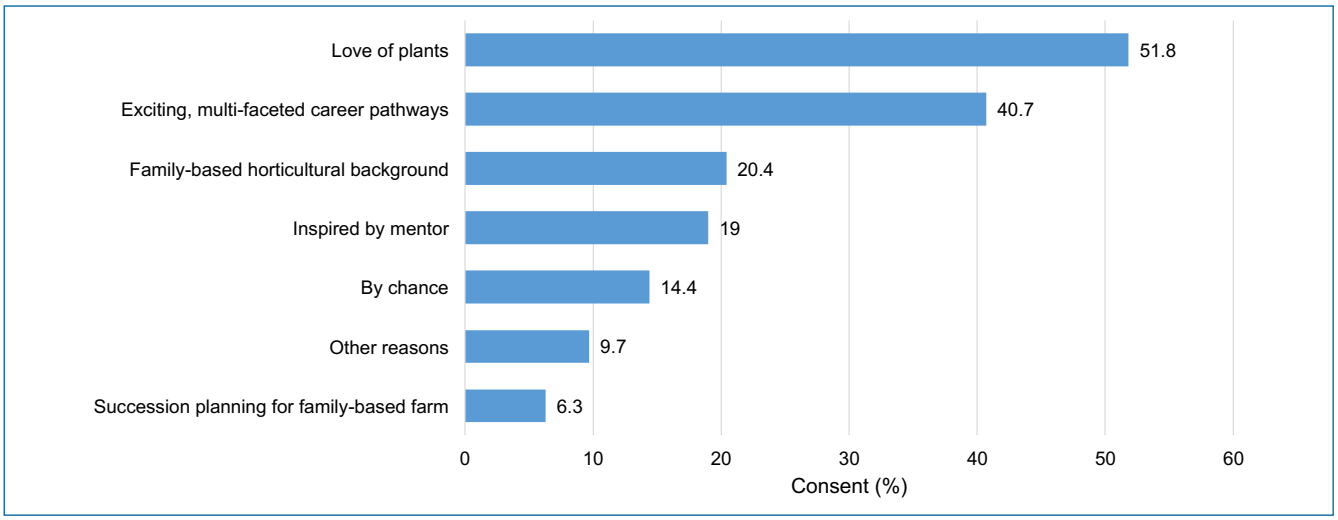


Figure 3. Reasons for respondents choosing an educational study program related to plant or horticultural science (n=814; multiple answers possible).

of the respondents entered these educational pathways because they were inspired by mentors. While 20% of the respondents selected horticultural science due to a family-based horticultural background, only 6% felt that it was needed for succession planning within a family-based farm. Few (14%) studied horticulture by chance, without any strong personal reasons.

The vast majority (90.8%) of all respondents indicated that it is "highly likely" or "likely" that he/she would pursue a professional career in horticulture, while 6.7% were still "undecided" (Figure 4). Only 2.5% of the respondents stated that it is "unlikely" or "highly unlikely" that he/she would find a professional future in horticulture.

When asked which reasons were responsible for taking a professional career in horticulture into consideration, the answers to the open-ended question could be grouped into six categories: social importance (31%), attractive field of interest (24%), working conditions (22%), economic factors (12%), personal reasons (7%) and awareness (4%). Key examples for each category are provided in Table 1.

In contrast, there were also a few opinions stated as to why a career in horticulture should not be pursued (Table 2).

Figure 5 shows the percentage of respondents that rated several statements, linked to horticulture, as "fully applies" or "largely applies". While the first five statements had at least 78.5% of respondents agreeing, only 37.5% of respondents felt that horticulture "has well-paid careers".

How important are specific services of a scientific society for the development of the career of young horticulturists? More than 80% of the respondents rated links to researchers around the world, to universities and private sector (industry) as "very or fairly important" (Figure 6). Access to publication platforms, announcements of career opportunities, attendance and presentation at congresses/symposia and free recruitment service were also seen as "very or fairly important" by 86, 83, 75 and 72%, respectively, of the respondents. In contrast, only 54% of the respondents felt that summer schools are "very or fairly important".

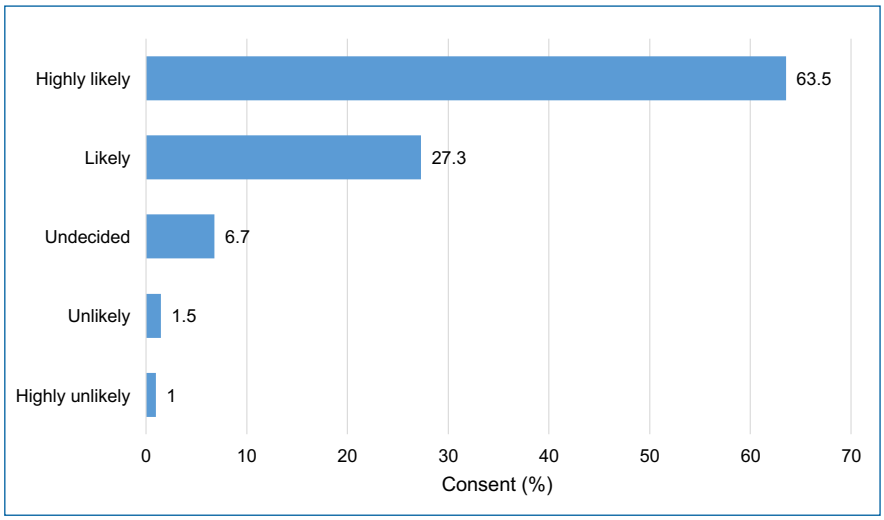


Figure 4. Likelihood of respondents considering a professional career in horticulture (n=814).

## Summary

Understanding and evaluating the reasons for selecting or not selecting study programs and professional career pathways in horticulture is critically important to ensure that the worldwide "withering field" is not further eroding to the point of insignificance. Mentorship, role models and patience are needed to encourage young minds to enter this excitingly complex, innovative and multi-faceted career pathway and to educate competent, highly qualified young professionals. The vast majority of respondents agreed that horticulture is a high-tech, multidisciplinary and multifunctional profession with many career opportunities, thereby contributing to sustaining lives, livelihoods, landscapes, human health and sustainable development goals (SDGs). However, this does not (yet) translate to a fundamentally new image of horticulture that is widely recognized as a viable and also well-paid professional career. There are many important and very attractive services that the ISHS is providing to young horticulturists, yet the potential benefits may not be clear or fully visible to them. For example, the inaugural ISHS Summer School in 2018 was a huge success and very positively received by all participants (see *Chronica Horticulturae* 59/1); however, the importance of summer schools was not rated highly by respondents to this questionnaire. This indicates that we need to communicate more effectively and precisely to harness the attention of young minds and to attract them to specific services of our Society.

## Non-member responses

Of the 584 participating non-members, 82% had heard of the ISHS but were not familiar in any detail with the Society. They were specifically asked to rate several features

■ Table 1. Reasons (categories in alphabetical order) for respondents taking a professional career in horticulture into consideration (valid total [T] answers; members [M] n=216 and non-members [NM] n=569).

| Category | Description | Examples of respondent's feedback | Frequency | | |
|---|---|---|---|---|---|
| | | | T | M | NM |
| Attractive field of interest | A field of general attraction with future potential | | 188 | 58 | 130 |
| | (A) General interest | "It's directly related to my fields of interest" | | (24) | (52) |
| | (B) Diversity | "There are so many things to do and it seems impossible to get bored"; "There are many opportunities" | | (15) | (36) |
| | (C) Future | "It is a highly demanding field that has a great future"; "It is a better long-term bet than many other careers" | | (18) | (39) |
| | (D) Others | "Moral imperative to protect plant heritage, biodiversity, and historical horticultural sites" | | (1) | (3) |
| Awareness | Raising awareness of horticulture and the transfer of knowledge to other people | "Raising horticultural awareness among the young generation" | 32 | 11 | 21 |
| Economic factors | Job opportunities, ownership and financial motives | | 91 | 25 | 66 |
| | (A) Job opportunity | "There are lots of job opportunities"; "It is easy to get employment" | | (10) | (30) |
| | (B) Provision to others | "My goal is to create colourful flowers, own a garden and attract large numbers of people to visit" | | (10) | (19) |
| | (C) Payment | "High paying jobs"; "Making quick money" | | (2) | (10) |
| | (D) Job stability | "It seems that the future of the horticultural industry is not endangered by the economic crisis" | | (2) | (6) |
| Personal reasons | Origin or horticultural family background | "Due to my family background and care for the family business, it's only natural to have the desire to learn the trade I'm passionate about" | 56 | 15 | 41 |
| Social importance | Conviction that horticulture is of societal importance | | 244 | 71 | 173 |
| | (A) Food availability | "Food production will be a major problem to be solved in future years and I want to participate in solving this issue" | | (23) | (62) |
| | (B) Nature, climate & biodiversity | "I want to contribute to reduce environmental pollution and do something to improve sustainability" | | (8) | (20) |
| | (C) Local farmers | "Be able to participate in solving horticultural challenges facing farmers in my country" | | (11) | (18) |
| | (D) Lifestyle, beauty & well-being | "Horticulture is a key for a happy world through the supply of nutritious produce and beautiful flowers" | | (7) | (16) |
| | (E) Health and medical sector | "Medicinal plants are important for our health and can contribute to the discovery of new medicines" | | (2) | (9) |
| | (F) Others | "The waste of horticultural produce impacts negatively on societies; I am committed to finding innovative approaches to minimize waste" | | (7) | (8) |
| Working conditions | A field that connects to the outdoors and nature | | 174 | 36 | 138 |
| | (A) Love of plants | "Plants are cool"; "Because I am loving plants" | | (18) | (68) |
| | (B) Working outside | "It is not an office job, you come in real contact with nature" | | (9) | (33) |
| | (C) Others | "Horticultural practices are less abstract and require tenable skills"; "Horticultural jobs are satisfactory jobs full of joy, it enriches the quality of my soul" | | (9) | (28) |

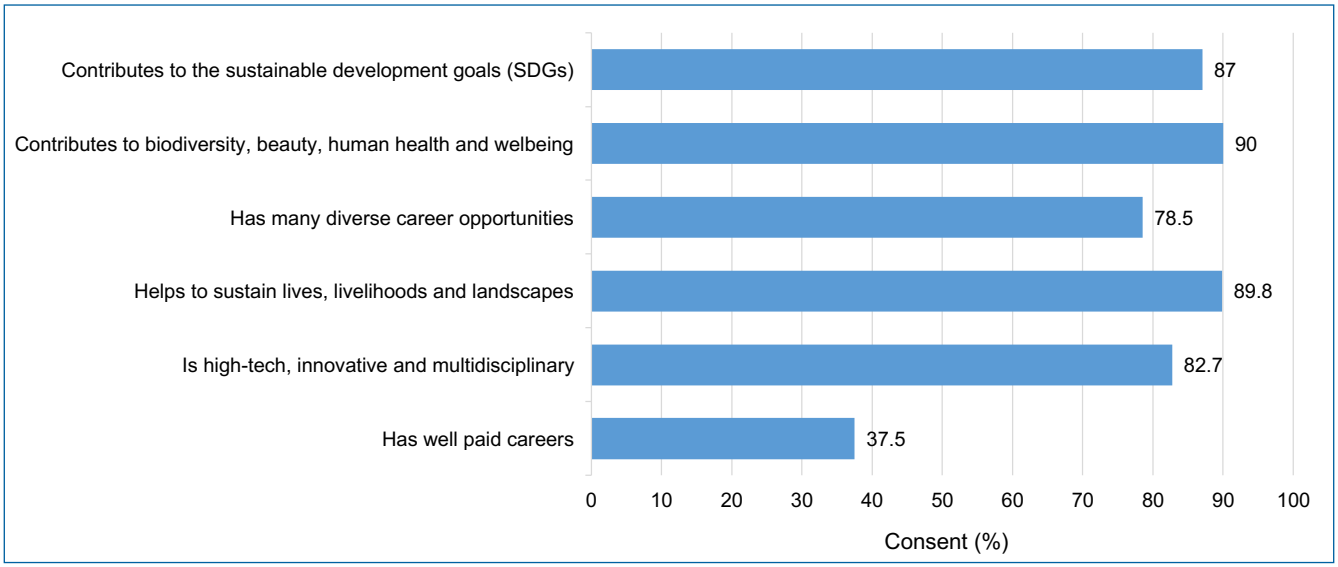


Figure 5. Statements, linked to horticulture, that "fully apply" or "largely apply" to respondents (n=814; multiple answers possible).

that contribute to the attractiveness of the ISHS and may entice them to join the Society. Between 80-85% of the non-members felt that the following items are "very or fairly important": access to international network of students and colleagues, support by enhancing career development, customized access to science publications, attendance at congresses and symposia as well as competitive postgraduate scholarships for members (Figure 7). Opportunity to contribute to the SDGs and member awards were slightly less significant, with about three quarters of the non-members rating it as "very or fairly important". Only a little more than half of the non-members felt that membership dues are "very or fairly important".

## Summary

About 70% of the respondents were non-members of the ISHS, which provided the unique opportunity to receive an outsider's view that begins with understanding why they are (not) attracted by professional scientific societies and what may (not) entice them to join the ISHS. There is undoubtedly a great need for the ISHS to gain increased visibility and recognition by young minds. It is worrying that about 20% of the respondents have not heard of the ISHS and 80% have heard but were not familiar in any detail with the Society. We are not focusing adequately and intensely enough on the lifeblood of our Society's future. The Society's services are apparently appealing to young people but information about it is not easily attained by them. The ISHS should consider becoming more proactive in reaching out to young minds through perhaps a custom-made public relations campaign.

Table 2. Reasons for respondents not taking a professional career in horticulture into consideration (valid answers for members n=9, non-members n=16).

| Members | Non-members |
|---|---|
| Feeling unqualified | Feeling underqualified |
| Limited career prospects | Lack of advancement options in position and pay |
| Doubtful career chances (local) | Local job availability (2) |
| Low payment | Low payment (4) |
| Too much work, not enough payment | Seasonal work |
| Not easy to develop a profitable career | Lack of understanding from others |
| Uncertain economy | Difficult for woman to pursue a career in this area |
| Limited job opportunities outside large scale agriculture | Lack of information |
| | Difficult to keep going on the research sector |
| | Long-term physical impacts on the body |
| | Difficulty of obtaining land (cost) |
| | Difficult to travel with family during growing season |

## Member responses

Since the 230 ISHS members, participating in the questionnaire, were familiar with the Society's structure and aims, this cohort was asked several additional questions. The majority of members learned about the ISHS from faculty members (52%), ISHS members (44%) and to a lesser degree through communication channels (22%) and printed media (15%) (Figure 8). Consistently with that, the majority of members were first put in contact with the ISHS at university (70%) and ISHS symposia (41%).

There were three main reasons why they joined the ISHS (Figure 9): attendance of congresses and symposia (83%), links to researchers around the world in their field of interest (58%) and customized access to science publications (48%). Other reasons for signing membership with the ISHS were support of career development (35%), links to universities (31%) and links to the private sector (18%).

The young members judged profile statements of the ISHS such as the Society is modern/old fashion, (not) useful, (not) supportive, (not) creative, well/poorly structured and (in) visible, in each case with a score of about 2.2 on a 1 (positive image) to 4 (negative image) scale.

Rating the level of satisfaction with the services provided by the ISHS, 16% of the respondents were "extremely satisfied" and 78% were "very satisfied" or "satisfied" (Figure 10). In contrast, only 6% were "partly satisfied" and 1% were "not at all satisfied".

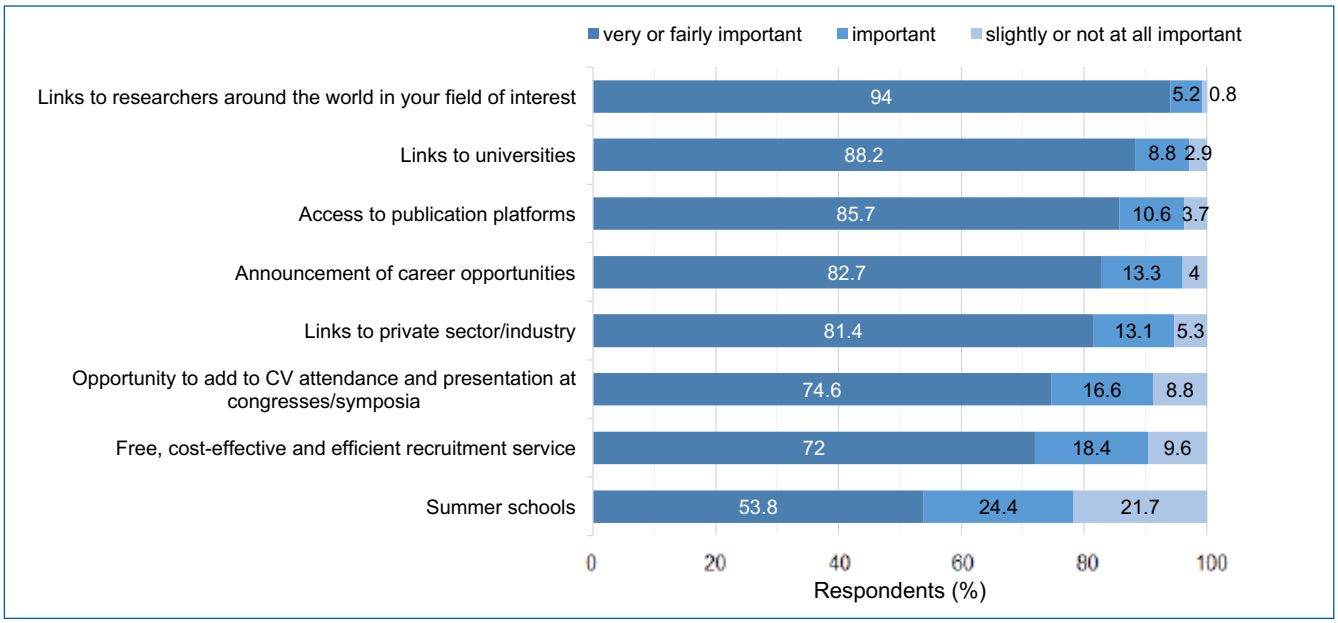


Figure 6. Importance of specific services provided by a scientific society for young horticulturists or scientists (n=814).

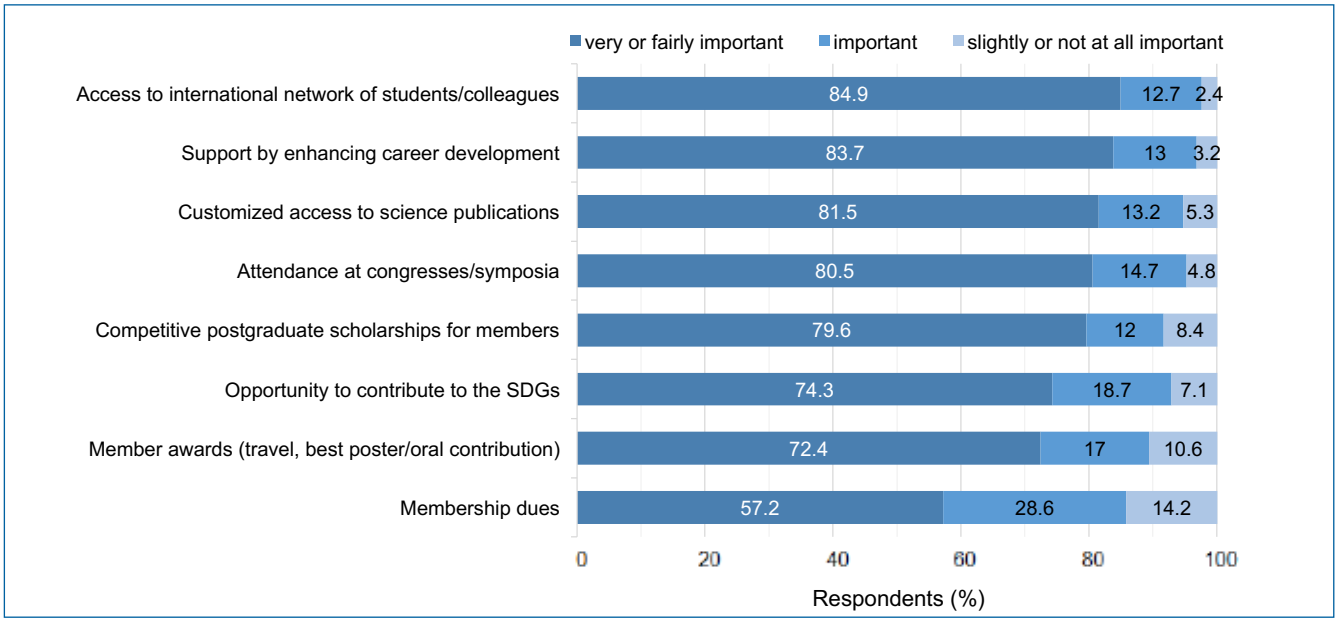


Figure 7. Importance of specific features that contribute to the attractiveness of the ISHS and may entice non-member young minds to join the Society (n=584).

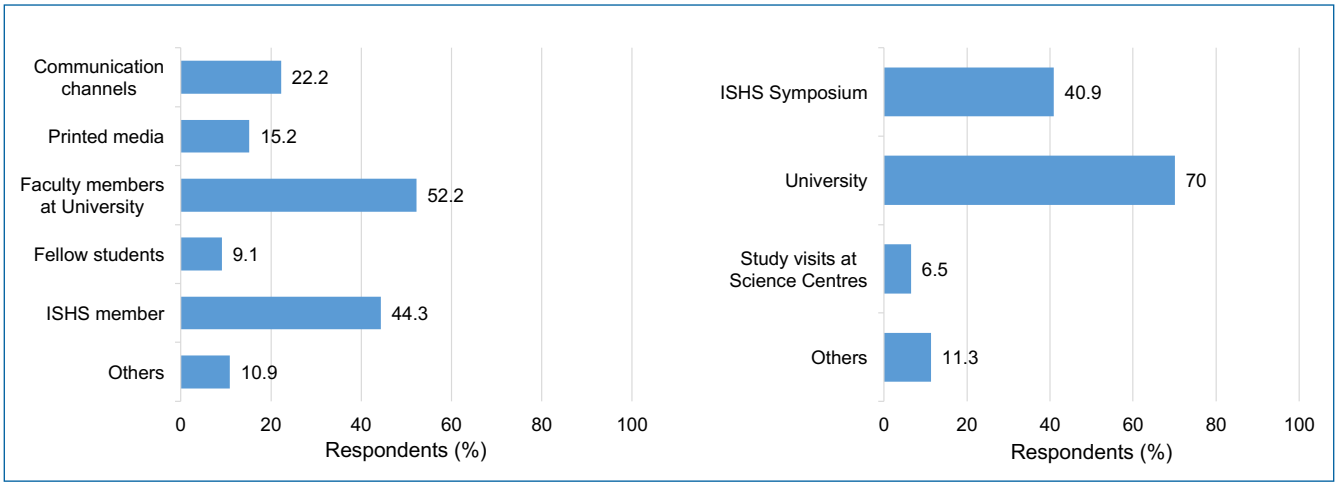


Figure 8. How (A) and where (B) respondents learned about the ISHS (n=230; multiple answers possible).

■ Table 3. Reasons (categories in alphabetical order) for why member respondents were/were not satisfied with the services provided by the ISHS (positive [pos.] and negative [neg.] valid answers; n=177).

| Category | Positive feedback | Negative but constructive feedback | Frequency | |
|---|---|---|---|---|
| | | | Pos. | Neg. |
| Communication | "There is communication and patience in all steps of the way, if I contact the ISHS"<br>"I can receive a lot of symposia announcements in my field of research"<br>"I can mostly get information easily and quickly"<br>"Website is very useful and attractive" | "There is poor communication via social media"<br>"Share non-academic data more frequently"<br>"Expand the database for horticultural jobs"<br>"Forum to discuss scientific writing and working"<br>"It is difficult to navigate the website and to retrieve specific information" | 63 | 12 |
| Costs | "Bonus of a one-year subscription at registration" | "High membership fee"<br>"Cost to download *Acta Horticulturae* papers is too high" | 1 | 13 |
| Networks | "Being a member opened many doors for me and gave opportunity to broaden my horizons and meet interesting people" | "ISHS needs to widen their membership scope, especially in Africa and other developing countries" | 18 | 2 |
| Publications | "Great chance to publish own research findings"<br>"The *Acta Horticulturae* is a very attractive bonus at symposia!"<br>"Provides access to research work and findings; found it important as a source of information while at university" | "Limited free downloads"<br>"It would be nice if publications were more easily accessible on-line"<br>"Posters and oral presentations from previous symposia need to be available on the website"<br>"I recently experienced that the reviewing process is too slow; especially PhD students rely on fast publication of their papers" | 26 | 11 |
| Science events | "Well organised and versatile symposia!"<br>"I enjoy the wide selection of meetings around the world" | "More events/activities, encouraging the participation of young researchers would be nice" | 25 | 6 |

When asked why members were/were not satisfied with the services provided by the ISHS, answers to the open-ended question could be summarized as "communication" (42%), "costs" (8%), "networks" (11%), "publications" (21%) and "science events" (18%). Key examples for each category are provided in Table 3.

Members were asked to rate the importance of specific services provided by the ISHS and in each case a large majority felt they are "very or fairly important" (Figure 11). However, the awards and the career centre were ranked slightly less favourably than other ISHS services, with a higher proportion rating them as "slightly or not at all important".

These services were rated quite differently based on the level of satisfaction (Figure 12). The greatest proportion of members were "extremely or very satisfied" with scientific meetings (68%) and publications (63%), about half of the members were "extremely or very satisfied" with technology transfer (57%), people connections (57%), communication (54%) and access to the latest findings in science and technology (50%), and the smallest proportion of the members felt "extremely or very satisfied" with awards (40%) and career centre (35%). However, while all services reached at least 80% satisfaction, up to 20% of the members felt "partly or not at all satisfied" with some of the services provided by the ISHS.

The level of satisfaction was similarly high for symposia and congresses, with about one third of the respondents being "extremely satisfied", about 40% "very satisfied" and one quarter "satisfied". Less than 5% of the young members were "partly satisfied" or "not at all satisfied".

Judging the various issues around ISHS symposia and congresses, exchange of research findings, meeting with specialists from around the world and scientific level were all rated by more than 90% of the respondents as "very or fairly important" (Figure 13). When combined with the "important" rating, the positive response was close to 100%. A considerably lower proportion of respondents rated registration cost (81%), location (75%), poster session (71%) and pre-/post-symposium tour (62%) as "very or fairly important". Seventeen percent of the respondents felt that pre-/post-symposium tours are "slightly or not at all important", however, the level of dissatisfaction was much lower in all other cases.

Respondents were also asked to indicate the maximum level of symposium registration cost they would feel comfortable with. There was a wide spread in response, with a minimum of 4 €, a maximum of 2,000 € and an average of 263 € by 145 valid answers.

The publication service provided by the ISHS was highly rated (Figure 11); however, Figure 14 provides a more detailed look at the various publication outputs. All publications are well received by young members with over 80% stating that these are "important" or better, and that they are at least "satisfied". However, *Acta Horticulturae* is, by some margin, the most preferred publication, with 83% of the respondents rating it "very or fairly important" and 75% of them were "extremely or very satisfied". *Chronica Horticulturae* was rated by 64% of respondents as "very or fairly important" and 57% of the respondents felt "extremely or very satisfied" with this membership magazine. Both *Scripta Horticulturae* and the eJHS were rated as "very or fairly important" and "extremely or very satisfied" by about 50% of the participating young members.

Free downloads of papers, open access journal and journal impact factor were all rated highly, with around 90% of respondents rating them as "very or fairly important" and combined with the "important" votes, nearly 100% of the respondents gave their positive consent to these publication criteria (Figure 15). However, the percentage of respondents that were "extremely or very satisfied" was 56% for free downloads of papers, 47% for open access journal and 38% for journal impact factor. The respondents that were "partly or not at all satisfied" ranged between 17 and 26% on these publication issues. In contrast, just over half of the respondents felt that paper journals were "very or fairly

important" and close to 20% felt that they were "slightly or not at all important". About 83% of the respondents were at least "satisfied" and 17% felt "partly or not at all satisfied" with the paper journals. Publication cost was a "very or fairly important" issue to 70% of the respondents whereas 10% felt it was "slightly or not at all important". In agreement with that, about one third of the respondents were "partly or not at all satisfied" with the cost of publication, with the remainder being at least "satisfied".

It was indicated (n=114 valid answers) that, on average, 32 free downloads of papers were required per annum and nine respondents asked for an unlimited number of downloads. The average publication cost per manuscript was calculated at €127 (n=112 valid answers), with a minimum of zero and a maximum of €1000.

Of all the communication tools provided by the ISHS, the website was still the most preferred method, with 90% of respondents rating it as "very or fairly important" (Figure 16). In contrast, social networks such as Facebook, LinkedIn and YouTube were all rated as "slightly or not at all important" by about one third of the young members, a view that even increased to 54% for Twitter.

How appropriate are the current ISHS individual membership dues? The question was answered in five rating criteria with the following percentages of 230 respondents: 16% too expensive, 48% expensive, 31% exactly right, 4% inexpensive, 1% too inexpensive.

If additional services were provided by the ISHS, respondents would be happy to increase their individual membership dues by €25 (85%), €50 (13%), €75 (1%) and €100 (1%). Specific points they suggested were related to publication, symposia, training and communication services (Table 4).

Two thirds of the respondents (n=230) would like to actively contribute to societal issues such as organising symposia or workshops, contributing to networks, information platforms, training and education schemes, and providing input to the publication portfolio.

## Summary

The ISHS young member responses reveal commonality and differences to that of non-members. The vast majority of respondents were introduced to the ISHS through faculty members at their respective universities, ISHS members or attending ISHS symposia. The dominating factor for joining the Society is the attendance of ISHS science symposia with a fairly high level of satisfaction on how these are organised. While there is an unambiguously high acceptance of the various services provided by the ISHS, the level of satisfaction with these services was not as strong. The Society should consider the specific feedback provided by the respondents when aiming for better connectivity to

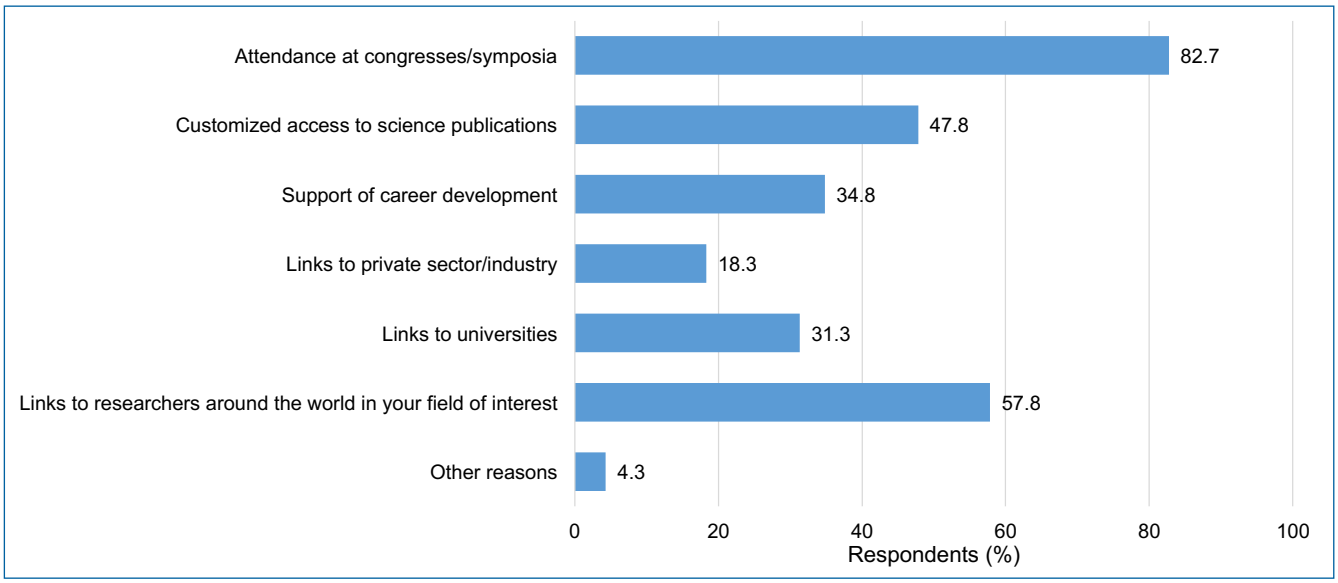


Figure 9. Reasons for respondents joining the ISHS (n=230; multiple answers possible).

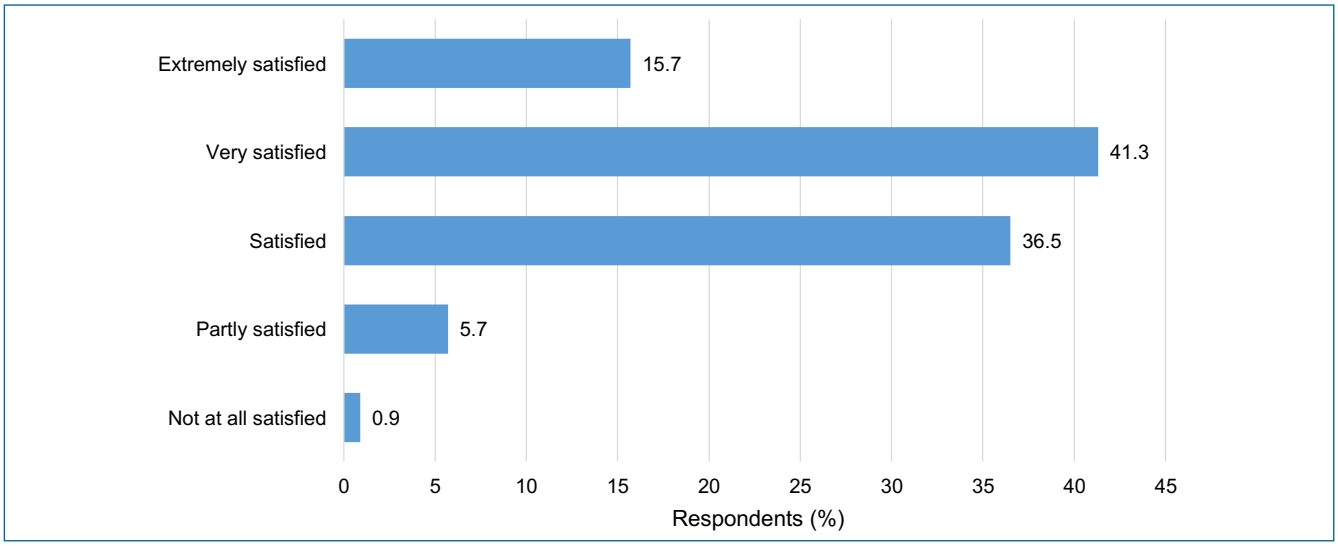


Figure 10. Level of satisfaction of member respondents with overall services provided by the ISHS (n=230).

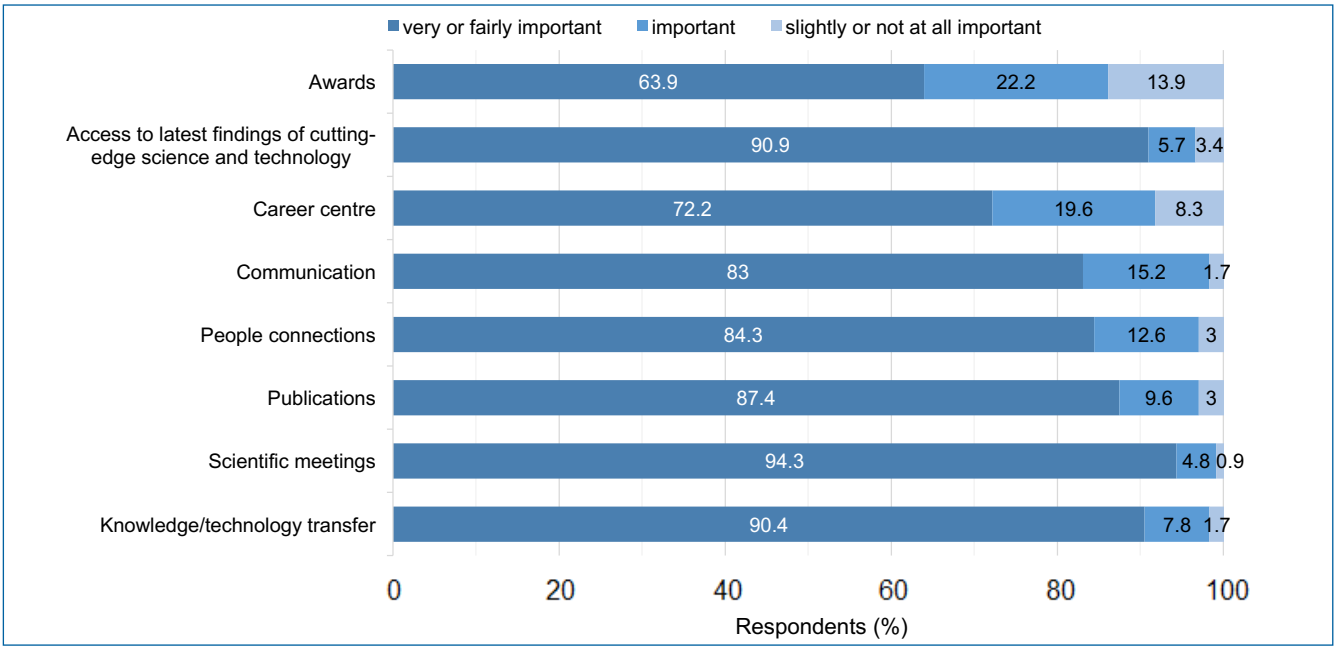


Figure 11. Importance of specific services provided by the ISHS to member respondents (n=230).

young minds and providing tailor-made solutions to their needs. It requires some re-evaluation of not only which service packages are provided, but also how appealingly these are structured and thus perceived by the young members. This also entails re-thinking about how the services are communicated and delivered to young minds, to catch their attention and to ensure they can recognise the benefits from the added-value of ISHS membership. The publication portfolio is of paramount importance for the Society and, despite numerous additional features and improvements, there has to be continuous endeavour to increase the reputation of printed and on-line sources of horticultural information and to deliver exceptionally good value for money to the young minds. Communication channels that the ISHS is currently offering seem to be less important or relevant. New ways of chatting with young people need to be accommodated to be better in tune with them. It is encouraging to realise that young members are willing to provide their services and to actively contribute to societal issues; thus the Society should seek opportunities to better involve them.

## Overall conclusion

The young minds have spoken and provided excellent, forward-directed recommendations to the future shape and content of the ISHS. It is now up to the Board to listen to their voices, carefully evaluate their feedback and, wherever the need is felt, modify existing services as well as implement and offer new services. The ISHS is not a rigid entity, but a flexible partner that modifies and adapts its wide range of services constantly in response to members' needs and requirements. A few brief recommendations with some action points to consider:

### Membership

To keep societies alive and to avoid extinction, young members need to be attracted by unique and user-friendly societal services they cannot access elsewhere. To entice and maintain young minds, a short introductory video clip should be developed to explain the structure, processes, procedures and most

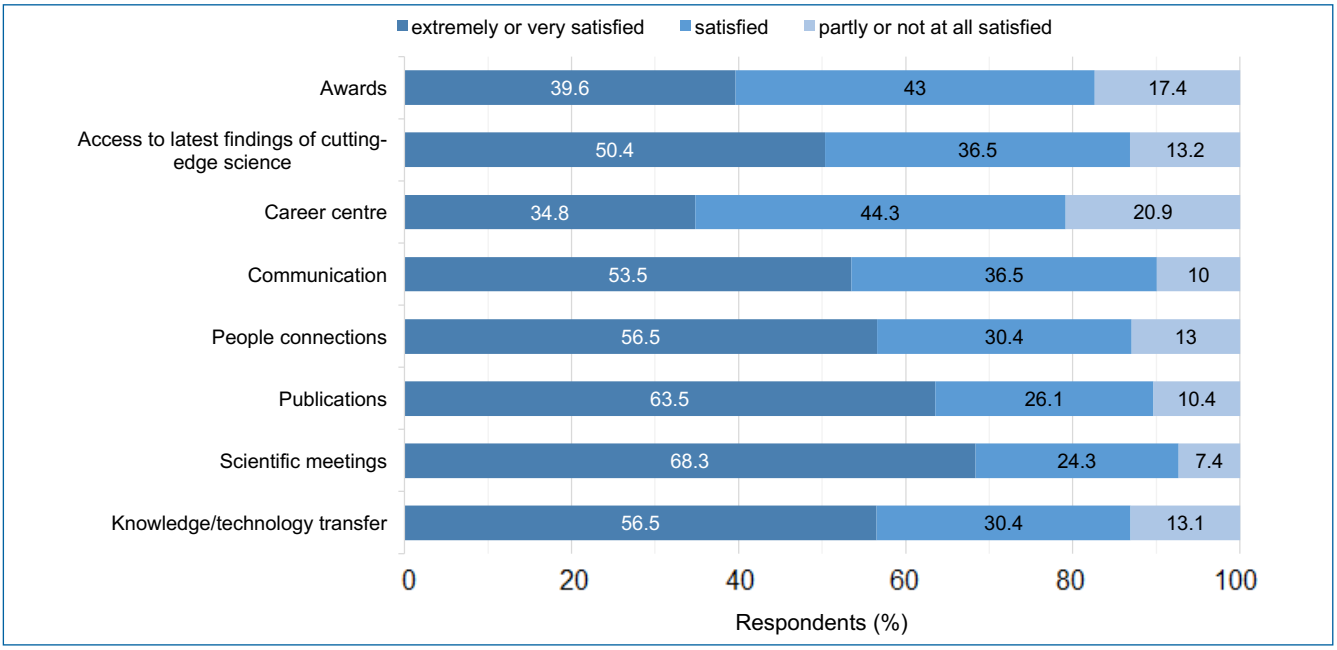


Figure 12. Level of satisfaction of member respondents with specific services provided by the ISHS (n=230).

Table 4. Feedback on additional services, summarized in four categories (in alphabetical order), from young member respondents of ISHS (valid answers n=106).

| Category | Feedback |
|---|---|
| Communication | Platform for on-line discussion groups<br>Forum for sharing information, questions, ideas<br>Opportunities for active participation within the Society<br>Career opportunities<br>Translation service |
| Symposia | More meetings for young scientists; youth congress<br>On-line meetings<br>Live stream symposium presentations<br>Increased discount for members<br>Waive symposium fees for students<br>Symposium scholarships<br>Subsidized registration fees for attending symposia<br>Provision for travel grant awards |
| Publications | Free downloads of journal and *Acta Horticulturae* papers<br>More free downloads per subscription and transfer to next year if not used<br>Greater and easier access to journal articles<br>Free English language proof reading<br>Student publishing fees<br>Endnote style for writing manuscripts |
| Training | Mentorship program<br>Internships<br>More activities that involve young researchers |

importantly the added-value features of the ISHS. This could be viewed at symposia, congresses or through the social network. It cannot be assumed that new members (but also long-standing members!) are familiar with the functionality of a professional society. Membership dues are always a "hot" topic; however, preference should be given to graded entry and young member dues, depending on age, level of qualification, gross domestic product (GDP) of the home country, etc. It is also recommended that outstanding young members (student awardees, participants of ISHS summer schools or postgraduate conferences) are invited on a Youth Council advisory committee, to be closely aligned with the Board and Divisions of the Society, and to become active as ISHS ambassadors.

## Symposia

All efforts must be aimed at attracting young minds and students to symposia and congresses. This will ultimately enhance their professional development through meeting experts from around the globe, accessing a range of cutting-edge science issues and exchanging the latest research findings. Young people have inquiring minds; thus they want to discuss in detail their science topics with world-renowned specialists and not only rely on the brief and often senior-led discussion time following oral or poster presentations. This requires new knowledge exchange platforms that are led by excellent moderators. Events, such as the first European Congress of Post Graduate Horticultural Scientists in 2016 and the inaugural ISHS Summer School in 2018, should become a series, where young minds present and discuss their research work or are educated on a specific subject in an intellectually stimulating and informal setting.

## Publications

Publishing is a key activity for each scientist as they are nowadays increasingly evaluated and promoted based on the author-level metric "h-index". As it measures both the productivity and citation impact of the publications of a scientist, the ISHS needs to continually improve the journal impact factor that appeals more and more to young minds for submitting and publishing their manuscripts. In contrast, *Acta Horticulturae* is necessary to fill the gap between peer-reviewed journals and project reports. This peer-reviewed symposium proceeding is a good publishing entry-point for students and early career scientists with a small publication record, and it now counts towards an author's h-index. The reviewing and editing by experienced senior scientists and "well-disposed" mentors is definitely an added-value for young minds, to quickly build some writing and publishing skills. In addition, young minds no longer use book shelves but hard drives,

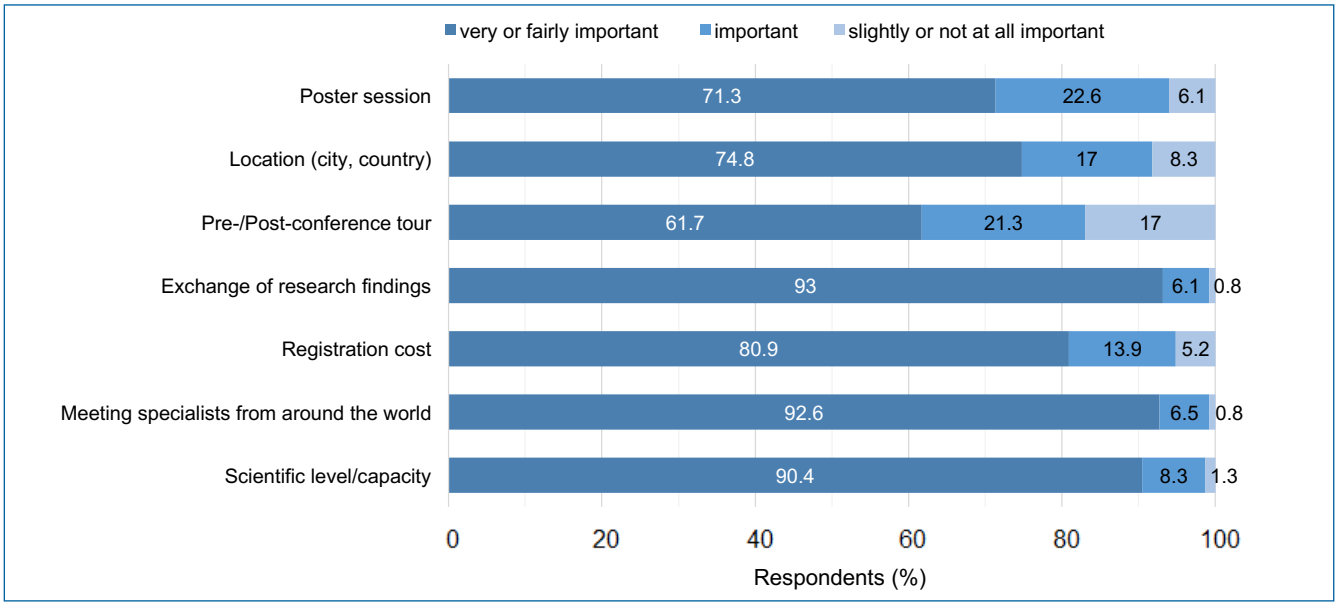


Figure 13. Level of satisfaction of member respondents with symposium services provided by the ISHS (n=230).

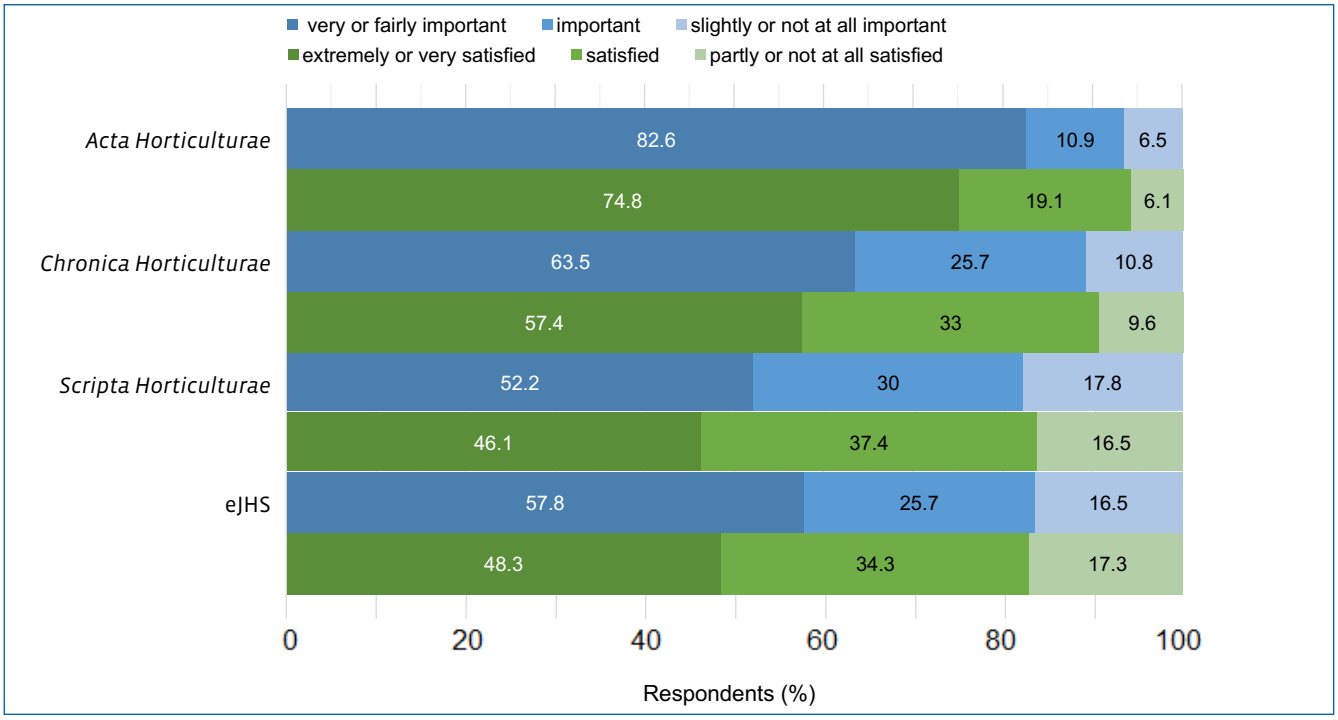


Figure 14. Level of importance and satisfaction of member respondents with ISHS publications (n=230).

thus the need for paper publications will likely decline in the future at the expense of the increasing demand for electronic publications. Moreover, it needs to be evaluated whether manuscripts that have gone successfully through the review process could be immediately published on-line (journal and *Acta* manuscripts).

## Communication

Communication brings people together to share information and while this is of advantage, young minds have often not been taught how to communicate effectively, concisely and consciously, despite and perhaps because of the modern communication channels. Face to face conversation is still the most powerful tool to get any messages across! Young minds need to access appropriate communication tools to actively spread and share scientific news, not only via hash-tag, tweet and Facebook, but also opposite one another in round table discussions. Often, research and extension issues are neither thoroughly discussed within the horticultural science community nor appropriately disseminated to the general public. The ISHS can change this by considering the following recommendations. Despite all the social media the ISHS is currently using (e.g. newsfeed for Twitter and Facebook, YouTube, LinkedIn, etc.), the website of the Society is still well perceived by the young minds. It should routinely be updated to ensure an appealing layout and user-friendly search tools to easily access relevant information.

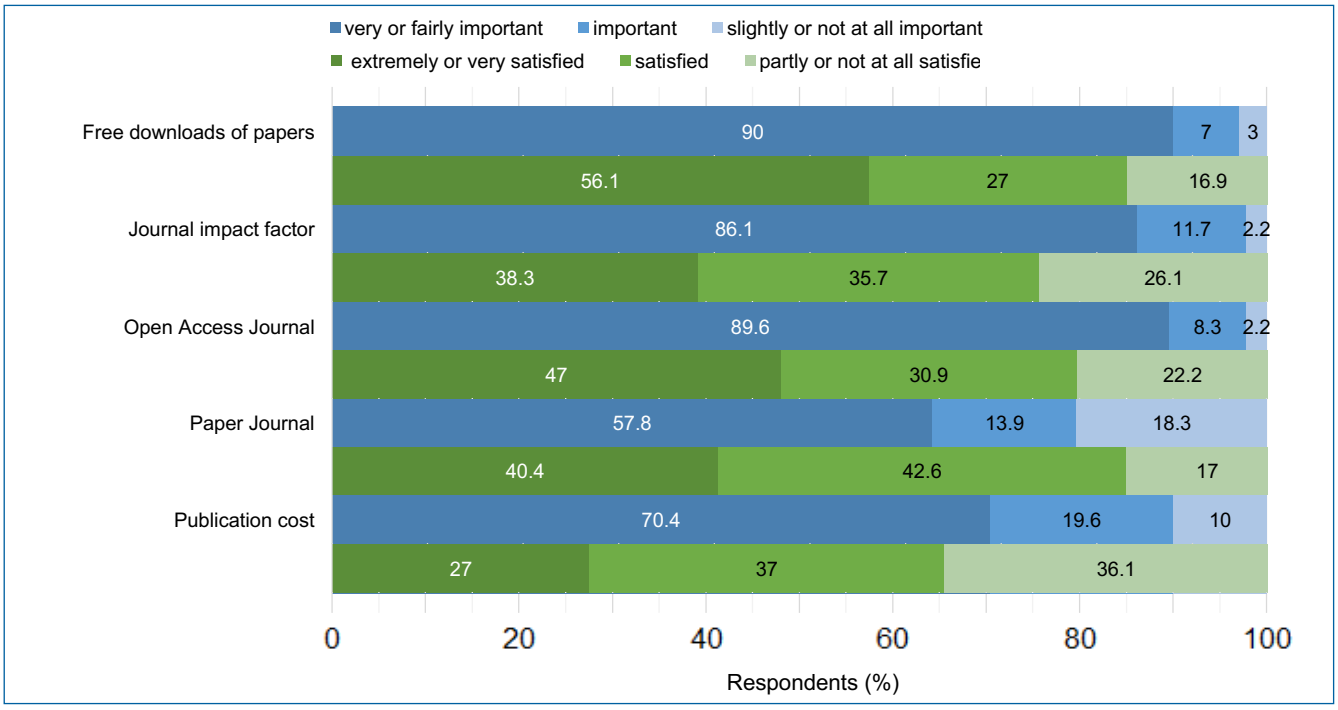


Figure 15. Level of importance and satisfaction of member respondents about several ISHS publication issues (n=230).

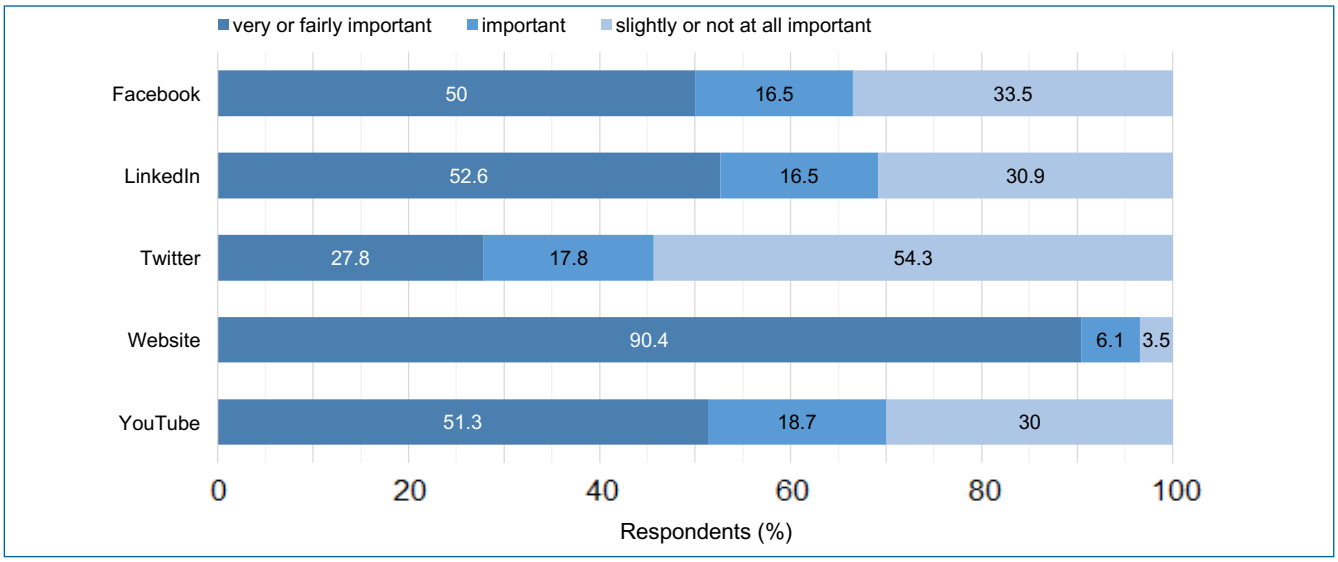


Figure 16. Importance of various communication tools to member respondents (n=230).

YouTube is a wonderful educational tool that is widely unexplored by the Society with only "Harvesting the Sun: A Profile of World Horticulture" and a few keynotes on-line; yet sadly the number of views is low. The ISHS should consider "content marketing" that focuses on creating, publishing and distributing content for a targeted audience on-line to attract attention, to increase awareness or credibility of the Society, to engage an on-line community of young minds, expand the membership base and perhaps to generate on-line sales. YouTube training videos on methods, procedures, processes and crop management practices or animations of complex biological processes could be produced by considering enriching, incisive words and eye-catching and inspirational graphical material, which could be well absorbed and thought-through by young minds. Such videos could easily and cheaply be produced during pre- and post-symposium tours, field days or summer schools. The ISHS should also consider creating a science platform that enables the Society to reach a target audience (e.g. young minds) with the right message, while they engage with scientific content. That way, young minds from virtually every field of horticultural specialization will be linked across the globe and thereby drastically change how research is conducted and disseminated in the digital age.

**We need to make implicitly sure that we closely engage with the young minds, to capture their imagination and views that will help direct the Society into the future. Advancing together in horticultural science can help to make the world a better and safer place!**

## Acknowledgements

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› Jens N. Wünsche

## › About the author

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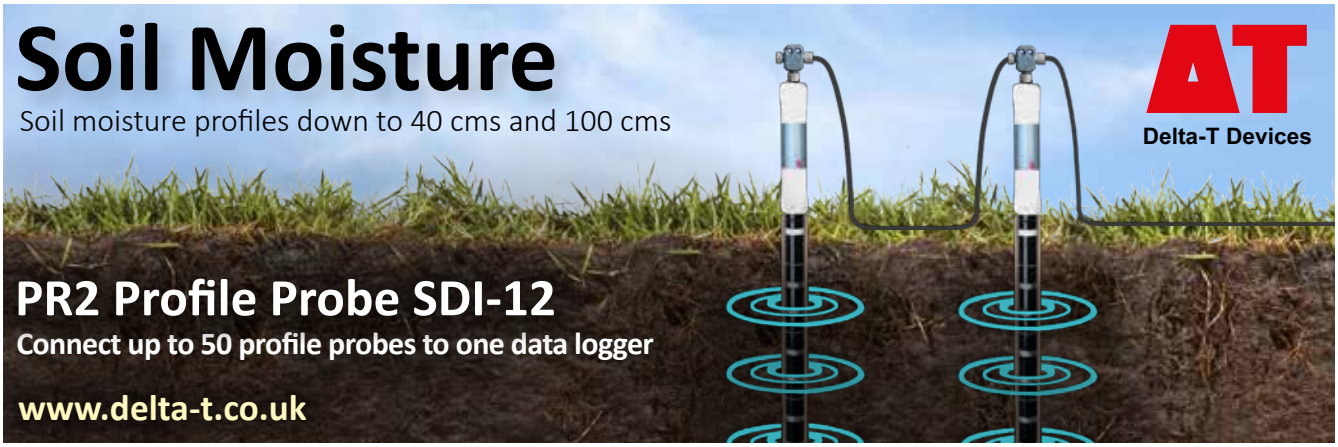

# The need for sound strategy based research cooperations

Lukas Bertschinger and Michael Weber

## A topic stimulated by the XXX International Horticultural Congress (IHC2018)

The motto of the XXX International Horticultural Congress (IHC2018) from August 12-16, 2018 in Istanbul was 'Bridging the World through Horticulture'. Congress colloquia were to bridge industry with research and production and form a platform to share experiences from different disciplines and actors of society to envision the future. One of the colloquia had the title: "Technologies for meeting the challenges of the future – the role of a research cooperation strategy". Its key message: in public applied research institutions, strategy-based cooperation development and implementation is a vital "technology" to meet the up-coming challenges particularly in technology and knowledge intensive, sustainable horticulture. This colloquium motivated the present article.

## Applied research and development in the early days

Science has been a driver of success of modern societies and in particular of agriculture over the past 150 years. Research became the tool for achieving the scientific understanding of problem contexts and for problem solving. Justus von Liebig's book "Organic Chemistry in Its Applications to Agriculture and Physiology", published in 1840, represents the dawn of the development and exploitation of agricultural science for boosting productivity in agriculture. Industry took care of market rewarded aspects of this development, while governments across the world established national institutes for applied agricultural R&D to address aspects that were not taken care of by the private sector and institutions for fundamental research. Private and public institutions achieved remarkable breakthroughs with their *intra muros* R&D. Horticulture was always at the forefront and a driver of this development, often because horticulture is producing close to market with comparatively little regulation from governments, and because problem-solving pressure was, and still is, particularly high in horticulture due to challenging quality standards of fresh and processed produce. For decades and until the middle of the 20$^{th}$ century, the existence of these institutions *per se* was an achievement and an important driver for adapting fundamental ground-breaking innovations, e.g. in plant nutrition, soil fertility management, crop protection or plant breeding and selection, to meet regional requirements. Often, visionary leaders were at the head of such institutions, with a remarkable footprint of their leadership at the national and international level. Only two examples of the many outstanding, pioneering research personalities of these days are mentioned here: Hermann Müller-Thurgau, a plant physiologist, breeder, phytopathologist and microbiologist and the first director of the Swiss Federal Research Station Wädenswil. He was the breeder of the grapevine cultivar 'Müller-Thurgau', which is worldwide still the most widespread modern cultivar for white wines, but also a driver of alcohol free beverage research. Another such example is Nihat Şevket İyriboz, founder and first director of the Turkish Plant Protection Institute at Izmir Bornova and later Minister of Agriculture, who was successful at introducing and using parasitoids against insect pests in the early 20$^{th}$ century, e.g. in figs.

## Diversity now!

The institutional setting of science, and particularly of applied R&D in agriculture, has changed dramatically in the last three to four decades. The above mentioned development allowed for a stunning increase of food production. However, negative impacts on the environment and the need for a more holistic view of agriculture than the principally technology driven approach mentioned above has led to the creation of further private, non-industry driven R&D institutions since the middle of the 20$^{th}$ century. Globalisation and digitalisation led to a further diversification of the agri-food R&D landscape, thanks to an increasingly knowledge-based society and to increasingly affordable emerging new technologies, Small and Medium-sized Enterprises (SMEs) and non-governmental organisations engaged in applied R&D. While knowledge and technologies became increasingly specialized and developed increasingly rapidly, the science community got into difficulties in communicating effectively with the public and with decision makers. New types of science are emerging nowadays, e.g. citizen science, intending to deliver outputs to the public, with a simple and objective vocabulary, for reinforcing the collaboration between public and research actors (Brito et al., 2012). Eventually, the institutional landscape of R&D actors and approaches became very diversified, dynamic and complex. Government funded national research institutions have in many countries lost their role as the almost exclusive provider of progress-relevant knowledge and innovation. In the dynamic evolution of problem-related contexts, they compete or collaborate with other sources of new knowledge and innovation in delivering solutions for pressing challenges of the horticultural sector.

## Breakthroughs needed and potential solutions

The agricultural value chain is confronted with several megatrends, all of which have their particular importance and expression in specific national and regional contexts. Population growth and demographical changes, changing societal demands and consumption patterns, climate change, increasing pressure on natural resources, increasing food demand and food waste, globalisation, fast technical developments and increasing systemic risks are such megatrends among others. An exemplary, very comprehensive and recently published report on the challenges of agri-food research (The National Academies of Sciences, Engineering, Medicine, 2018) defines nine future key research challenges, two of which relate to animal production, while horticulture is related directly with the following seven: 1) increasing nutrient use efficiency in crop production systems; 2) reducing soil loss and degradation; 3) mobilizing genetic diversity for crop improvement; 4) optimizing water use in agriculture; 5) early and rapid detection and prevention of plant and animal diseases; 6) early and rapid detection of foodborne pathogens;

and 7) reducing food loss and waste throughout the supply chain.

These challenges seem to ask for the impossible: produce more food quantity and quality with fewer resources while not impairing the environment, increasing biodiversity, avoiding losses and paying the price needed to the agri-food sector for covering cost and improving rural livelihoods! Luckily, an increasing number of studies provide further clarity: solutions are at hand, the potential for breakthroughs exists! The chosen production system makes a big difference in terms of land use, deforestation, pesticide use, water use, greenhouse gas emissions, N- and P-surplus and other indicators. Sustainable production methods may feed 9 billion people by 2050, but only if consumption patterns change (Muller et al., 2017). This is supported by further studies on how food's environmental impact may be altered through producers' and consumers' behavioural changes. Interestingly, many horticultural foods can contribute beneficially to lowering greenhouse gas emissions and to reducing land use, terrestrial acidification, eutrophication and scarcity-weighted freshwater withdrawals (Poore and Nemecek, 2018). However, no single measure, such as dietary change towards more plant-based diets, improved technologies and management, or reductions in food loss and waste, will be able to keep negative effects within boundaries that define a safe operating space for humanity. A synergistic combination of measures is needed (Springmann et al., 2018).

Agriculture and more specifically horticulture will play an important role in feeding the world sustainably while addressing the above mentioned challenges, if we want to meet the following goals: 1) improving the efficiency of food and agricultural systems; 2) increasing the sustainability of agriculture; and 3) increasing the resilience of agricultural systems to adapt to rapid changes and extreme conditions (The National Academies of Sciences, Engineering, Medicine, 2018). To address these three goals, convergence is needed, i.e. an "approach to problem solving that cuts across disciplinary boundaries for achieving the necessary breakthroughs", as the report states. Consequently, the principal breakthrough that is required is applying a systems approach, based on the understanding of the nature of interactions among the different elements of the food and agricultural system, which then can be leveraged to increase overall system efficiency, resilience, and sustainability. In terms of research methodology, such systems approaches, involving transdisciplinary science, are recommended as priorities in solving agriculture's most vexing problems.

This is easier to identify than to effectively practice it. What does this mean specifically for a scientist? How do I practice a systems approach with transdisciplinary science? Progress in this respect will depend on how well we succeed in developing robust and simple protocols for coping with such a systems approach. While still many questions remain open, it is evident that an individual researcher or a single institution or a single research discipline will not be able to deliver the expected progress. That's where cooperation, between scientists and institutions and disciplines, comes in!

## A cooperation strategy is vital

Cooperation is particularly indispensable for a public applied research institution. They are operating in a complex stakeholder environment and are implicitly and explicitly confronted with many divergent expectations from this environment. They need to deliver solutions to science-based problems in a way that often goes beyond their competence and capacity. A prioritization of problems to be addressed and decisive collaborations needed is unavoidable in being able to develop useful solutions based on the institution's limited competences and capacities, combined with those of the cooperation partners. In other words: a cooperation strategy is needed.

A strategy is a plan of action designed to achieve a long-term or overall aim (English Oxford living Dictionaries, 2018). Cooperation partners usually change dynamically for each research project, while also, for certain research topics or disciplines, some complementary cooperation partners may be identified for a long-lasting strategic alliance. The plan, i.e. strategy, shall define which partnerships are to be built up in the coming years, while some existing cooperation partnerships should be consolidated.

To avoid dissipation of resources and efforts and make efficient use of the often shrinking resources of public applied research institutions, a sound cooperation strategy is a decisive success factor, particularly in the above mentioned challenging context. The strategy-based management of partnerships may be understood as "technology" needed for success, like any other technology. This applies, not exclusively, but particularly to highly specialized technology and knowledge intensive horticulture. However, what are the important earmarks related with a successful cooperation strategy?

## The cooperation strategy development process – a success factor

How to develop a strategy? And what is a strategy? In the present case we define the term strategy as a plan of action designed to achieve a long-term or overall aim. It provides guidelines and orientation for management and scientists to move toward a defined aim in the increasingly complex environment of national and international research and research cooperation. A simple and classic strategic planning approach may be used to develop such a research cooperation strategy (Figure 1).

The figure shows the three basic steps of a strategic planning process. Before launching a strategy development process, a clear statement of purpose and overall goal should be defined and approved by the management board. This is of great importance in making sure that the strategy will be supported by the institution and may create

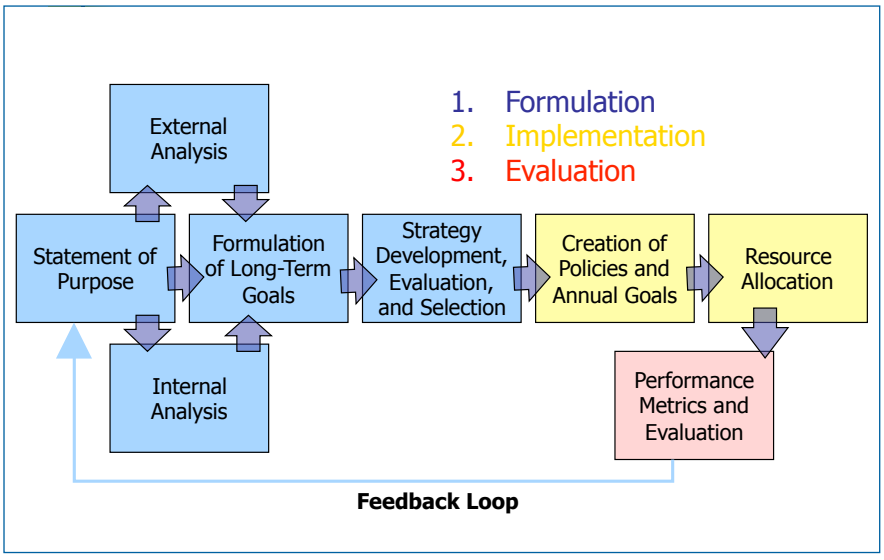


Figure 1. The strategic planning process. Source: Slezak (2018), adapted from Bryson and Roering (1987).

Table 1. Incentives to engage in research cooperation for scientists and research managers in public applied research institutions. Summarized from Beaver (2001), Bertschinger (2017), Bozeman and Corley (2004), and Seongkyoon et al. (2014); adapted from Guimon (2013).

| Incentives | Externally controlled factors |
|---|---|
| Reputation<br>Attractive objectives<br>New knowledge and skills set, novel instruments, tools and methods<br>Additional resources<br>Attractive collaboration and project type<br>Attractive research support services | Incentivising policy instruments being part of the innovation and R&D policy of public and private bodies (e.g. grant design, matching grants, tax-incentives, innovation vouchers, reward systems, technology transfer offices (TTO), spin-off facilitation) |
| **Cooperation instruments** | **Internally controlled factors** |
| Mutual visits and colloquia<br>Researchers' exchange<br>Participation in conferences and research group activities<br>Seed money<br>Performing cooperation support | Advocacy and policy influencing<br>Establishing a powerful research cooperation support<br>Management briefs on innovation and grant policies<br>Consequent fund raising and cooperation policy |

impact later on. The first step then is an internal and external analysis, meaning that the internal and the external environment of the institution are studied. Classically, a SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) can be the result of this step. It makes sense to involve the perspectives of internal and external stakeholders. Furthermore, the expected purpose and goals of research cooperation represented in the strategy under development have to be defined.

Compellingly, the strategy for research cooperation must be deduced from, and harmonized with, the general strategy of the organization. The first step also includes the development and evaluation of different strategy options. It leads to the selection of the preferred strategic option for cooperation and to the choice of cooperation partners.

In a second step, an implementation plan is developed and the needed resources are allocated. The implementation plan may be documented as a road map with action lines (e.g. management of the strategy, building strategic alliances, etc.) that are specified with work packages that define aims, foreseen actions and the team involved.

Because most research organizations act in an environment with proliferating internal and external complexity, the content of the strategy for research cooperation can't be set in stone for years. That's why the third step comprises the evaluation of the results of all actions undertaken. This evaluation is the basis for a feedback loop for adjusting purpose and overall aim of the strategy, if appropriate, representing the next iteration of the strategic planning process. Typically, there is an evaluation of the strategy and revision every year or every second year.

## Traditional vs. evolutive strategy development process

The ambiguity of future developments leads to the necessity to diversify the responses to the various strategic risks. Hence, it's recommended that a portfolio of different strategic actions be pursued, not just one single direction of action. These different actions may be smaller but broader (portfolio of strategic action lines/pilot schemes). This might not be the most efficient way to implement the strategy, but it is the most resilient and therefore successful one, with the advantage of absorbing more potential risks that emerge unexpectedly and enabling the institution to reacting in a timely and appropriate way.

Malik's visualization of traditional and evolutive problem solving represents well the above mentioned approach (Malik, 1996) (Figure 2).

Defining and implementing a strategy for research cooperation has several advantages, as long as it is based on an iterative process that involves management board and selected key actors of the institution:

- it's a guideline for management and for scientists of the organization;
- it strengthens a deliberate focus on important partnerships and avoids unnecessary dispersal and consequently dissipation of efforts;
- it is a reference and guideline for positioning project ideas on the "our-job-not-our-job"-matrix;
- it has a steering effect and thus allows for relieving the system from unnecessary efforts;
- it leads to less "micro-management" and less administration.

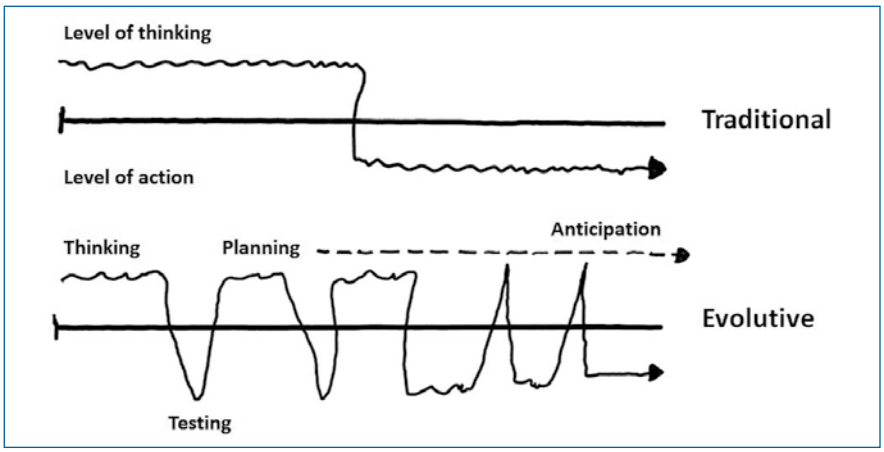


Figure 2. Methodologies of problem solving (adapted from Malik (1996)).

## The human factor: particularities of public applied research institutions

Public applied research institutions are so-called "expert organizations". These are generally characterized by some particular characteristics (Mintzberg, 1983; Egloff and Bogenstätter, 2016) that must be taken into account for the strategy development to be successful. Such organizations are based on the knowledge and skills of well-educated, often self-reliant research experts with a high intrinsic motivation. A high recognition in such an organization is often based on professional technical competence. Experts have

much autonomy at their own command in their daily business. The project organization is based on technical criteria, with a management structure that is usually quite flat.
These characteristics are of great importance for the success of the development of a cooperation strategy. The involvement of researchers in the strategy development process is mandatory. It is an inevitable bottom-up-component that ensures an immediate connection to research community and on-going research activities, while the inevitable top-down-component comes from the management of the organization. To launch the development of a cooperation strategy, management needs to define a mandate with clear objectives. This will ensure that the research cooperation strategy is embedded properly into the general strategy of the organization and also other relevant partial strategies (e.g. infrastructure strategy or fundraising strategy). Both components are essential. The bottom-up and bottom-down processes ensure the necessary quality of the process and its results. It's not the fastest way to define a research cooperation strategy but it's the best way to ensure suitable and relevant results, particularly if effective implementation of the strategy is needed.
Such a process may be seen in an expert organization as a change process. Expert organizations have their own terms (Egloff and Bogenstätter, 2016) that need to be respected to ensure a productive strategy development process (adapted from Häfele (2009)):

- transparency;
- clear setting in terms of timing, resources and expected results;
- mutual respect among involved actors;
- participatory process involving researchers and management;
- coherent process design with regard to involved human and organizational actors (goals, interests, potentials);
- building on strengths instead of circumventing weaknesses;
- continuous learning attitude (learning organization).

## The win-win-win needed

Another aspect to be respected when developing the strategy is the fact that this process must be of mutual benefit, i.e. for the institute's management, for its administration, as well as for the researchers. To make this happen, the strategy development must not only be motivated by a management decision and a participatory process (see above), but also needs to offer incentives for the involved actors (management, administration, researchers). The strategy must be seen as something supportive to those who must eventually implement it. Incentivising the implementation of the strategy strengthens the strategy's impact.
Scientist and research managers are encouraged to engage in research collaborations for various reasons. It is recommendable to build on these when developing an implementation plan for the cooperation strategy and to allocate the necessary amount of resources.
Table 1 summarises, from several sources, how scientists and research managers may be encouraged to engage for research cooperations.

## Conclusions

To cope with the demands of future societies in a healthy environment, horticulture needs breakthroughs in agro ecology, mitigation and adaptation to climate change and the digitalization of its value chains. Nowadays, the institutional landscape of R&D actors is very diversified, dynamic and complex. A steadily accelerating technological and cost intensive innovation process is an important driver of the knowledge-based economy. Nowadays, R&D institutions need resilient and flexible cooperation with competent complementary actors for impactful science-based problem solving. In public R&D institutions, such cooperation must be based on a sound cooperation strategy to invest the often shrinking resources efficiently and effectively.
Strategy-based cooperation development and implementation may be seen as a technology like any other technology needed for knowledge intensive, sustainable horticulture. The development of such a strategy must meet certain prerequisites in order to be successful: 1) the strategy must be a sub-strategy of the institute; 2) a clear mandate from the management board is needed to launch the development of such a strategy; 3) the strategy must meet the needs of the institute's management, administration and researchers (win-win-win) and be developed in a participatory process. Hence, a cooperation strategy simplifies the management of the organization. Actors from management to the project level are provided with a clearer orientation as to what extent a specific cooperation is important and desirable for the organization from a strategic point of view. A strategy allows a focus on few actions and fostering strengths, while not exclusively restricting the institution on one sole aspect. It maintains flexibility and the capacity needed for a resilient organization, resulting in a focused, but nevertheless broad portfolio. The strategy must provide incentives for researchers and management, as well as administration, since the support of all three actors is needed in order to implement the strategy. Continuous questioning of the strategy and flexible adaptation are vital to address a changing reality. Strategy development and implementation need resources that must be considered from the outset. Not taking them into account is a common reason for lack of strategy implementation.

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# Agroecology and education: socio-ecological resilience to climate change

Maria Claudia Dussi

The XXX International Horticultural Congress held in Istanbul was the first congress to introduce agroecology as a topic for discussion at a workshop. Agroecology is gaining importance around the world. For example, in 2017 the VI Latin American Agroecology Congress was held in Brasilia, Brazil, bringing together about 5000 people, with over 1900 presentations by delegates from 25 countries.

## Introduction

Agroecology is a scientific discipline, a social and political movement and an agricultural practice that synthesizes and applies knowledge of agronomy, ecology, sociology, ethnobotany, and other related sciences, with a holistic and strong ethical component, in order to generate knowledge, validate and apply adequate strategies to design, manage and evaluate sustainable agroecosystems (Figure 1). Scales and dimensions of agroecological research range from plot and field scale to agroecosystem and farm scales, and expand into the full dimensions of the food system.

The transdisciplinary and multidimensional character of agroecology makes it possible to: overcome the fragmentation and segmentation of knowledge in agricultural and teaching practices; enable participatory processes between social actors and the community as a whole; and contribute to establishing a holistic overview that enables different solutions to problems in a particular ecosystem to be presented.

Agroecology is conceived as a holistic model of global change that includes technical, social, organizational and political dimensions. It favors new learning conditions by abandoning old, compartmentalized models of knowledge in which disciplines often ignore the complex realities of human, agricultural, and natural environments. Learning from action research provides answers to immediate questions and contributes in the long run to the consolidation of a sustainable food system based on local reality knowledge, and with students prepared to deal with complex problems in the future.

Teaching of agroecology, due to its systems approach, enables students to learn how to integrate what has been acquired in various disciplines at a local and regional scale, and provides them with tools for decision-making on the management of natural resources and climate change. That is, it enables them to develop and then prioritize clear, medium- and long-term strategies in relation to ecological, social, political and cultural aspects that promote sustainable agriculture (Dussi and Flores, 2018).

Agroecology provides the principles for rural communities to reach food sovereignty, but also energy and technological sovereignty, within a context of resiliency (Figure 2). Food sovereignty focuses on local autonomy, local markets, local production-consumption cycles, and farmer-to-farmer networks that promote agroecological innovations and ideas.

By taking advantage of the environment derived from biodiverse agroecosystems and using locally available resources, farmers are able to produce without external inputs; this may be termed technological sovereignty. The application of such local technologies to production systems allows for the production of crops and animals to satisfy household and community demands (food sovereignty). Energy sovereignty is the right for people inhabiting farms, cooperatives or rural communities to have access to sufficient energy within ecological limits from local and sustainable sources, such as plant biomass produced on farm, without sacrificing food crops. Agroecology provides the principles to design resilient agroecosystems capable of withstanding variations in climate, markets, etc., while ensuring the three broadly distinct but inter-linked sovereignties (Altieri and Toledo, 2011).

This approach raises some questions. Is agroecology a strategy for climate change? Why is it necessary to change to a new agricultural paradigm? How important are territorial agroecological networks in agricultural production systems? What is the importance of diversity? Should agricultural sciences be taught from the paradigm of agroecology? Have universities been pressured to endorse the model of industrial agriculture? Is multidimensional analysis necessary?

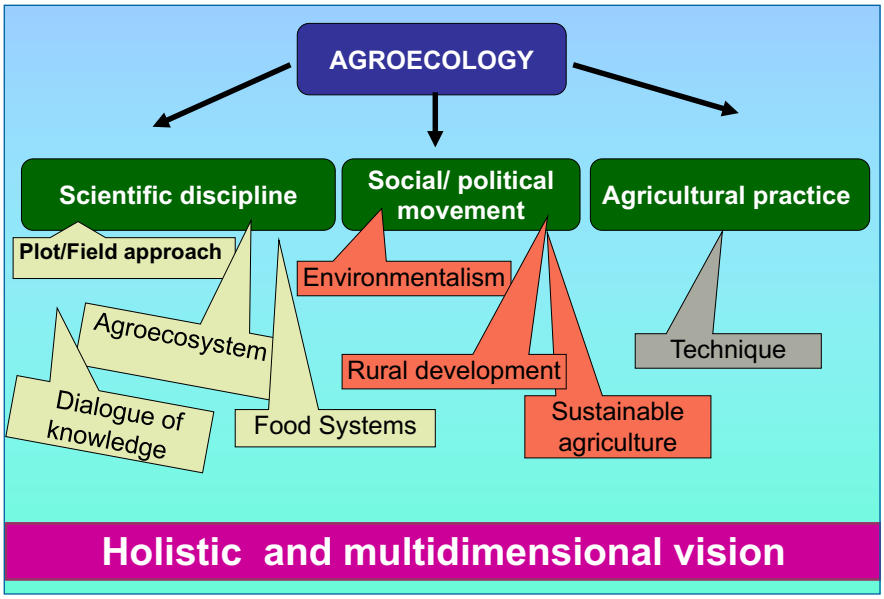


Figure 1. Agroecology meanings (Dussi and Flores, 2018, adapted from Wezel et al., 2009).

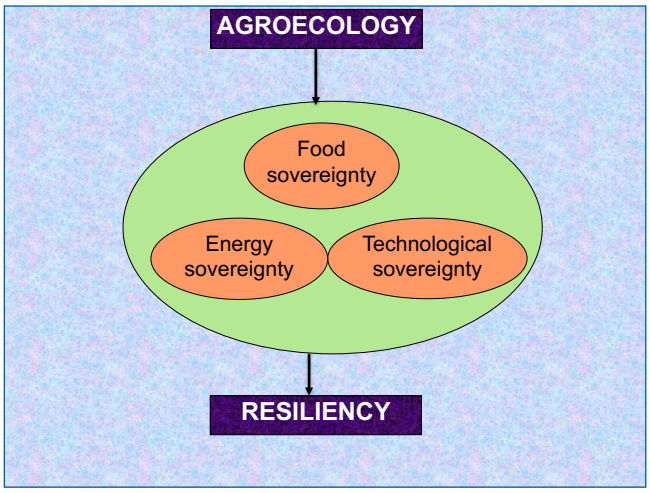


Figure 2. Agroecology, resiliency and the three types of sovereignties to be achieved in rural communities (Altieri and Toledo, 2011).

| Agroecological food system | Industrial food system model |
|---|---|
| Science of complexity, multi and interdisciplinary | Specialized science analytical and reductionist |
| Technological self-sufficiency | Technological dependence |
| Dialogue of knowledge, local innovations, socially-oriented horizontal exchanges via social movements | Top down, technicist extension schemes, corporate controlled, scientific research |
| Diversified use | Specialized use |
| Based directly on natural sources of energies: solar, eolic, hydraulic, animal, human | Based on fossil fuel oil and gas sources |
| Reciprocity with natural processes | Control of natural processes |
| Low or no use of inputs | High use of inputs |
| Polyculture | Monoculture |

Figure 3. Contrasts between agroecological and agroindustrial models (adapted from Altieri and Toledo, 2011).

## Agroecology and the current agricultural model

The current economic productive system relies on significant inputs of energy, almost all from fossil fuels. Certain aspects of farming are especially energy intensive and accelerate energy flow and circulation of matter in the farm. In some rural communities, there are high rates of poverty, migration, hunger and environmental conflicts, intensified by climate change, financial and energy problems, the expansion of monocultures, and the intensive use of chemicals and agrofuels. This increase in entropy produces contamination and loss of biological-cultural diversity.

According to FAO et al. (2017), hunger affects 11% of the world's population. The food security situation has worsened, particularly in parts of sub-Saharan Africa, South-East Asia and Western Asia. In contrast, the world produces food for more than 12,000 million people (Caparros, 2014) generating a great inequity.

So, there is a need for a new agriculture: more biodiverse, resilient and socially fair, and this new agricultural paradigm should be carried out with less inputs, less availability of arable land and within a scenario of climatic change and economic and social uncertainty. Some of the differences between agroecological food systems and industrial ones are summarized in Figure 3.

The fundamental philosophy of agroecology is to take an integrated approach, being open to new approaches, criteria and ways of understanding reality, as well as involving ethical, participatory and attitudinal aspects (Dussi et al., 2006). Through the application of ecological concepts, agroecosystems can be designed similarly to natural ecosystems in terms of diversity, nutrient cycling, energy flow and habitat heterogeneity, among other aspects, taking into account structural and functional differences between both (Flores et al., 2018).

## Agricultural sciences in higher education

Agricultural education institutions previously trained professionals, technicians and scientists by focusing mainly on an agricultural model that has sought: high crop productivity, an increase in agricultural mechanization, intensive use of fossil fuels and agrochemicals, cultivation of improved cultivars of plants and animals that need a large amount of inputs, and low input/product ratio, and apparently profitable but potentially unsustainable models. However, there have been some changes in the past few decades, which includes an increasing emphasis on some sustainable practices such as reducing agrochemical use through integrated production systems (e.g. pest monitoring, biological control), developing new cultivars that have disease resistance, and using cover crops and mulching to improve soil health, and these are now included in programs within some education institutes.

Whilst there does appear to be an increase in some focus on the environment in modern educational programs, it tends to be fragmented knowledge without considering the functioning of the agroecosystem as a whole, and there appears to be an inadequate evaluation of the economic "success" of agricultural activities, and insufficient thought given to the social and environmental cost.

It seems necessary that professionals and scientists training in agricultural sciences should face the challenge of sustainable agriculture in a much more holistic way. We are in the presence of a paradigm shift in thinking about the environment, with new ingredients, sustainability, environmental complexity, uncertainty and ethics. Agriculture is not just the production of goods; the satisfaction of needs must be restricted by the biophysical limits of the natural systems that support them and not the other way around.

Therefore, according to Leff (2012), the characteristics of new professionals should include having a critical spirit, and a holistic and systemic vision, with a strong ethical component. We need to change from purely production-oriented goals and short-term objectives to long-term sustainable objectives: ecologically adequate, economically viable and socially fair. We need to change from simplistic, reductionist and mechanistic thinking, to a thought of complexity, which will make greater progress towards facing the environmental challenges.

A university course that encompasses agroecology would need to include agroecological multifunctionality, ecological footprint/biocapacity, carbon and water footprinting, agroecosystem diversity and technology, energy efficiency, ecological economics, rethink the sense of development, human values (commitment, ethics, dignity and respect), environmental costs, sustainable food systems studies and food sovereignty.

Long-term goals would include an interdisciplinary approach and methods of managing uncertainty. Thus agroecology, as a new scientific discipline in agricultural education institutions, would provide a new approach to learning (Figure 4).

In summary, strategies that incorporate agroecology as a discipline should be developed within university programs, taking into account the sustainability analysis, social, spatial and temporal inequity in the human use of resources. That is, proposing that students consider an ecological approach to the pursuit of the construction of a sustainable

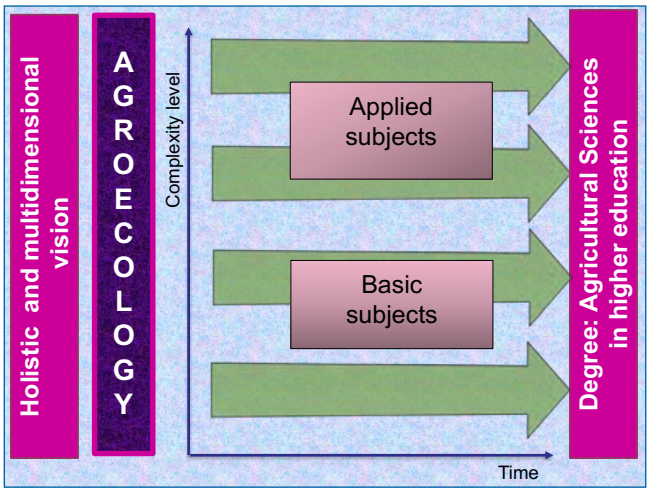


Figure 4. Approach of including agroecology in higher education.

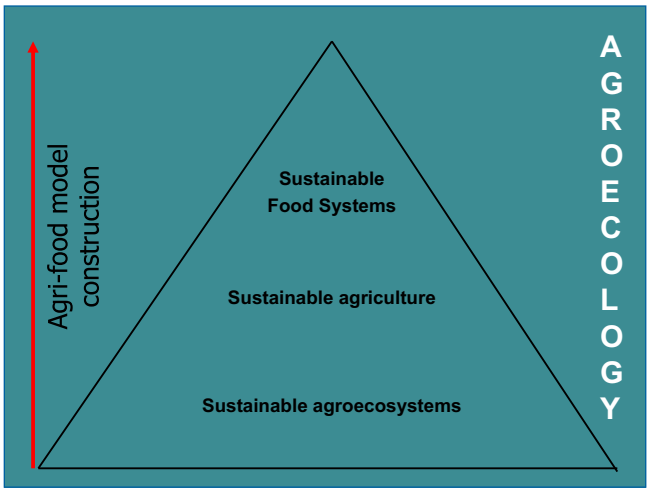


Figure 5. Complexity of the agri-food model construction.

agri-food model (Figure 5). Analysis can be carried out starting at the farm level towards sustainable food systems where agroecology is the discipline that studies this construction over time.

Resilience and resistance strategies must be based on agroecological principles, solidarity and innovation. This may provide a new alternative to assist small farmers to obtain more equitable and sustainable possibilities, instead of systems that degrade social welfare, land, water and ecological diversity.

Resistance to climate disasters is closely related to the biodiversity present in productive systems. Greater diversity increases resilience and homeostatic capacity in the face of climate change, so one should think of designing agroecosystems surrounded by a complex landscape, with diversified production systems, and covered soils that are rich in organic matter.

We should think of an agriculture that allows "adequate" levels of production to be compatible with the conservation of nature, taking into account social, territorial and temporal asymmetries. The new paradigm should promote biodiverse, resilient and equitable forms of agriculture. In conclusion, agroecology provides some strategies of resistance and resilience against climate change.

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Spotlight on Honoured ISHS Members

# › Dyno Keatinge

### Position or previous position

Retired. Last position held was Director General of the World Vegetable Center.

### ISHS honour

Fellow

› Dyno Keatinge at the ICRISAT Board Meeting at Bamako, Mali, in 2007.

**1. Tell us a bit about yourself (hometown, current locale, family, hobbies, community involvement).**

I did not have a hometown for much of my life as I was born in Cyprus and was transported round the globe far and wide by the demands of my father's medical military career. Yet, advantageously this did familiarize me early on to foreign parts. However, I am now firmly established in the rural haven of Wensleydale, which is one of the most beautiful landscapes in the UK (famous for sheep and horses) and I think I am perhaps now somewhat accepted as a visiting eccentric by the local community. Now that my wife Rosi and I are heading towards our golden wedding anniversary and with four well established offspring, I can safely say than an eclectic agricultural career has been a contributory factor to a good, long lasting family background. We are now, aided by a couple of Labradors, involved in home gardening, music and speech festivals and trying to maintain the historic building of our local and ancient church – St Oswald's, Hauxwell.

**2. What got you started in a career in horticultural science?**

I was started in my agri-hort career by taking the only local job I could get in the year after school and before university, which was at a rural flower nursery near Effingham in Surrey. To my surprise, I enjoyed it very much and I rose after a few months to the dizzying heights of being the Charge-Hand in the Christmas cactus/Hyacinth/Poinsettia house. This horticultural training helped to lead to my choice of an undergraduate thesis in the Geography Department of Bristol University. This involved the measurement of the thermal diffusivity of a parsnip compared to the surrounding soil in a variable range of moisture regimes, as I was confident in growing and measuring such things. From there, I won an MSc scholarship in soil physics/agronomy at the University of Manitoba in Winnipeg, Canada, for introductory work on broad beans. After that, I completed a PhD at Queens University of Belfast in Northern Ireland on the agroclimatic influences on forage grass production.

**3. Give a brief overview of your career/achievements.**

I was lucky to get my first proper job, funded by British Aid, at the Trinidad campus of the University of the West Indies working on the agroclimatic influences of newly introduced dual purpose pigeon peas (*Cajanus cajan*). This led onto a job that lasted more than a decade at the International Center for Agricultural Research in the Dry Areas (ICARDA) in Syria working on the agronomy and agro-climatology of lentils, chickpeas and forage legumes. I was later posted by ICARDA, firstly to the highlands of Pakistan, and then subsequently to Turkey where I mostly worked with improving local food and forage legume crops. In 1993, I was head hunted by The University of Reading to be Professor of Agricultural Systems and Management. This University's reputation in Tropical Agriculture was second to none in the UK but their staff was beginning to run dry of people with appropriate resident tropical experience and thus I seemed to fit the bill. Seven good years later, having continued research work in food legumes and initiated new efforts involving tropical cover crop legume species, I was tempted to depart by the offer of a Directorship of the Crop and Management Research Division of the International Institute of Tropical Agriculture (IITA) at Ibadan, Nigeria, and with sub-offices throughout sub-Saharan Africa. This involved work on food species such as banana, yam, cassava and soybean.

In 2002, I then encountered one of the major disappointments of my career when the incoming new DG of IITA wished to dispense with all the senior managers associated with the previous regime and it looked like I was to be made redundant. This is not a pleasant feeling and I wondered then if that was the end of agriculture for me. However, to my good fortune at that precise moment, when it seemed I was doomed to the ranks of the unemployed, ICRISAT (the International Crops Research Institute for the Semi-arid Tropics) in Hyderabad, India, was undergoing one of its "historically cyclic" budgetary and managerial crises. They were also facing an imminent External Program and Management Review (EPMR) called for by the Board and by the "overlord" CGIAR authorities (Consultative Group for International Agricultural Research). This placed ICRISAT in quite a vulnerable and threatened position as their budget had approximately halved in the previous few years. The Director General badly needed a Deputy Director General for Research who had already successfully experienced the trials and tribulations of such an EPMR process. I had previously survived several of these undoubted torments during the ICARDA, Reading University (Research

› Dyno Keatinge viewing crops at ICRISAT, Hyderabad, India, during his position as Deputy Director General for Research, in 2008.

› Fire in the building of a large extension to our seed genebank at the World Vegetable Center HQ at Shanhua, Taiwan, in 2010.

Assessment Exercise and Teaching Quality Assessment) and IITA years and thus was hired in a bit of a rush to get the Center over the crisis.

Happily, this moment also turned out to be the extreme low ebb of the budgetary cycle for the Center and in the next seven years ICRISAT had good and stable management with an excellent Financial Director, Human Resources manager and high-quality scientific Program Leaders and the Center thus experienced an ongoing considerable increase in budget from around $US22 million to $US50+ million and was eventually rated as "outstanding" by the CGIAR. On the wave of this "success", I was then able to persuade the Board of the World Vegetable Center (AVRDC) to hire me as its Director General in 2008 and this appointment was the culmination of my career in horticulture as two four-year terms as DG took me conveniently to my 65th birthday and retirement.

### 4. What do you consider were your greatest achievements?

In 2018 I was much honoured to receive the award of a fellowship of the ISHS at the Istanbul Congress. I have been much rewarded recently for my long agricultural and horticultural service in the tropics and sub-tropics worldwide, and the award of this ISHS fellowship, plus an honorary DSc from The University of Reading, an MBE from the hands of Queen Elizabeth at Buckingham Palace and an award from the Government of the Republic of China in Taipei (Order of Brilliant Star with Violet Grand Cordon), amount to a very satisfying career-ending recognition, which I sincerely did not expect.

In truth, I enjoyed pretty well all of my career and the chance to visit more than 100 countries globally and work with world-leading scientists was a special bonus for a person who graduated in physical geography from Bristol University with a poor 2:2 degree, which meant the UK authorities deemed me unsuitable for a research career! So much for "The Authorities".

I look back with some satisfaction to money well spent on the launching and promulgation of hundreds of thousands, now millions, of home gardens and the creation and marketing of the cheap seed packs needed for their maintenance provided by the private sectors in Africa, Southeast Asia, and Oceania in the long term. The evident beneficial impact on the incomes of rural women and the greatly improved nutrition of their families continue to be a highlight memory for me. Likewise, in the period 2008-2016 I did my utmost to engender and support the Central Asian and Caucasus vegetable and breeding network (CACVEG). This has been demonstrably successful in improving the badly needed biodiversity of vegetable production across the region. The WorldVeg coordinator based in Tashkent is truly a miracle worker as she successfully introduced many new lines from the Center's germplasm collection over the last ten years and established effective and cordial relations throughout the network, allowing easy germplasm interchange amongst often warring countries! The booming private sector vegetable production in this globally-neglected region is now an economic exemplar for the further development of this region.

### 5. Did you encounter difficulties along your career path and how did you deal with them or how did you turn them into opportunities?

At the beginning of my time with AVRDC, in 2008-2009 I experienced a further lowlight in my career when a very large grant from a donor Foundation, designed to improve the breeding and agronomy of several African indigenous vegetables, which my predecessor at WorldVeg had won for a proposed nine years, was cut short after only three years. It seemed to WorldVeg that the Foundation people had misunderstood the inevitable time required to produce new cultivars of crops and bulk up seed and wanted results in farmer's hands then and there. We therefore had to terminate the contracts of 20+ African breeders, pathologists, etc., which was emotionally hard for them, and for us, and substantially set back African vegetable horticultural research for some time. Nevertheless, in the years after this, new improved cultivars of indigenous eggplants, nightshades and tomato started to flow out of the WorldVeg production pipeline and now it is hard to find a tomato throughout eastern and southern Africa that does not have its origins in either 'Tenguru 97' or 'Tanya'. Good, nutritious cultivars of many indigenous vegetables are also now freely available in most African markets. By 2016, when I retired, I am happy to say that the budget of WorldVeg had gone from a low point of ca. $US12 million to above $US20 million thanks mostly to increased contributions from our good, committed friends in the Republic of China, USAID, British Aid and AusAid. Life lesson number one is, therefore, seek to try to join organizations when

they are struggling for budget rather than when they are thriving if you want a good career! Life lesson number two is ensure that you actively cherish your faithful supporting donors to the greatest extent possible.

**6. Tell us about one funny/exciting/interesting experience that happened to you during your career.**

The most exciting/terrifying day of my career was on the 31st May 2010. We had almost finalized the building of a large extension to our seed genebank at the World Vegetable Center HQ at Shanhua in Taiwan when by considerable mischance a spark from a welder's torch, who was working on the roof, set the new insulating material stored below on fire. The fire rapidly took hold and the excellent Taiwanese fire brigade was summoned and they responded immediately from their nearby station about 2 km from the Center. However, the fire rapidly developed out of control and eventually it was a major blaze with 13 fire engines in attendance (see photo). Very luckily the wind direction was blowing away from the old genebank building and with many hoses plying constantly onto the gap between the old building and the new extension, no damage was suffered by the germplasm collection or its laboratories and offices. The loss of 66,000 accessions of tropical vegetables would have been devastating to the Center in the short term. However, at least the Center had been prudent enough to have this material previously backed up in a range of other genebanks such as the Taiwanese and South Korean national collections and also in the Svalbard collection. The building contractor's insurance company met the replacement costs of the extension in full and the newly extended genebank was opened a few months later, which included new, fully fireproof insulation material! Nevertheless, I think I aged a few extra years as a result of the unexpected events of that day.

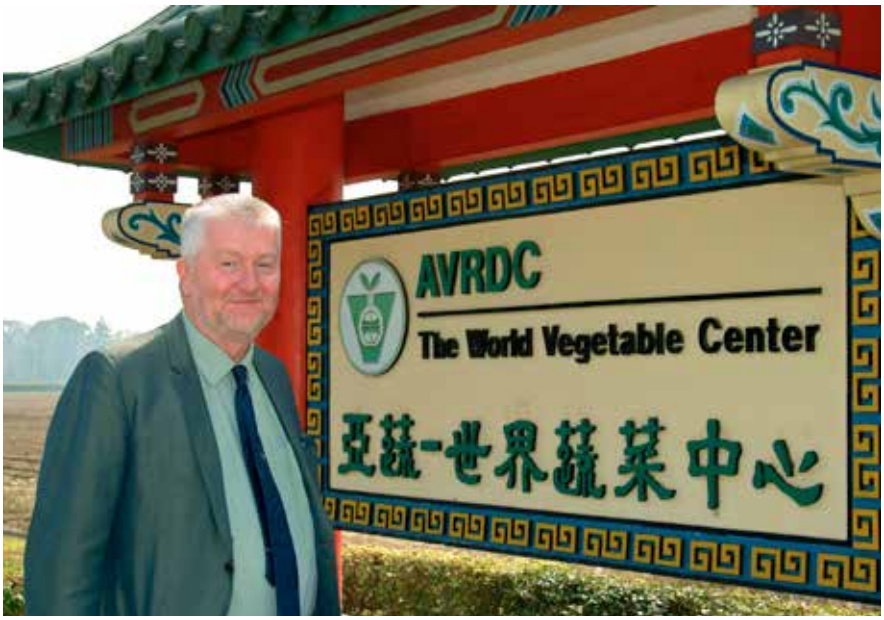
**7. What made you become a member of ISHS and why did you keep the membership? What contribution or role has ISHS played in your career?**

I joined the ISHS as a member in 2008. I previously had become a member of the European Society of Agronomy, the UK Society of Biology, etc. ISHS membership was a sensible requirement for employment at WorldVeg and the personal support that the ISHS Secretariat provided to me in helping to become sufficiently known and a major player amongst the global horticultural community was immense, especially during the recent four-year congresses in Portugal, Brisbane and Istanbul. Likewise, the availability of quality publication outlets such as *Acta Horticulturae* and eJHS was a considerable blessing from ISHS as frankly it is not that easy to have any horticultural papers accepted in the main stream "Agricultural Journals". I continue my membership of the ISHS in retirement as the Society has engendered my loyalty and I look forward to my potential participation at the next Congress in Angers in 2022.

**8. What advice would you give to young people interested in a career in horticulture/horticultural science?**

What advice might I then give to aspiring horticulturists and horticultural science graduates? I firmly believe that fruit and vegetables will become much more important components in people's diets in the future as the shadow of malnutrition and type II diabetes looms over people's health if current diets remain unchanged. It is also an intransigent fact that poverty and obesity are now globally closely linked. So overcoming "food poverty" does not mean more and more maize and rice in people's diets but rather it requires the consumption of sufficient fruit and vegetables to overcome generic micronutrient malnutrition. There are around 2000 plant species that can be used as vegetables for food or medicine but only a tiny fraction of these have received any research attention to date. Yet, seeds and advice on agronomy are available through the WorldVeg website (www.avrdc.org). An example of such a species would be *Momordica charantia* (bitter gourd), which has demonstrable potential as a dietary supplement to help address the current global epidemic of type II diabetes as it seems to improve the efficiency of insulin use in humans.

› Dyno Keatinge evaluating the commercial greenhouse sector in Qatar in 2010.



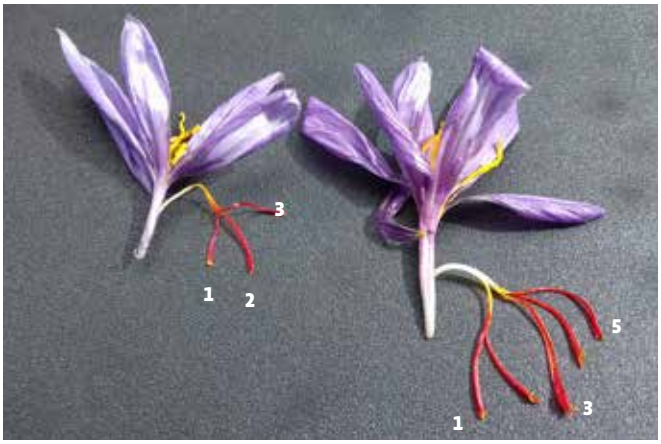

› Dyno Keatinge at the entrance to the World Vegetable Center, Taiwan, in 2016.

**9. What are the most interesting new roles or opportunities you see emerging in the future within horticultural science?**

To make fruit and vegetable production attainable at prices suitable for the poor, it will require further substantial investment in all aspects of horticultural science and production, therefore good job opportunities should abound in this field in the future. We should all realize that there is little point in "feeding the world in 2050", which is one of the UN's sustainable development goals, if it is not at the same time adequately nourished. I hope this lesson is clearly absorbed by all donor agencies and foundations, but presently I fear it is not!

# World record: saffron flowers with most augmented number of stigmata

Mahmoud A. Sharaf-Eldin




Left: Normal saffron flower with three stigmata per flower. Right: Saffron flower with an augmented number of stigmata per flower, harvested and photographed by Prof. Mahmoud A. Sharaf-Eldin.

Dr. Abdulrahman I. Al-Khedhairi, Vice President for Graduate Studies and Scientific Research, Prince Sattam bin Abdulaziz University (right), and Prof. Mahmoud A. Sharaf-Eldin (left), showing saffron flowers with an augmented number of stigmata per flower.

Saffron (*Crocus sativus* L.) is an expensive crop belonging to *Iridaceae* and is one of the most luxurious spices, with many medically important bioactive compounds. Day-to-day, people in Saudi Arabia consume a large amount of saffron. It is one of the main ingredients in the Gulf States cuisine, where it is used for colouring (rice and other dishes), flavouring (Arabic coffee and tea), and health and wellness. The saffron flower normally has a three [x3] stigmata per flower. Over five growing seasons in Alkharj, KSA, Prof. Mahmoud A. Sharaf-Eldin (member of ISHS since 2005) and his team at the Sara Alghonaim Research Chair (SRC) harvested flowers with an augmented number of stigmata per saffron flower. The SRC records are x4, x5, x6, x7, and x8 stigmata per flower, which has not been previously reported. This will lead to an increment in world saffron yields by using the SRC new technology named AN007.

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# › ISHS Young Minds Award winner summaries

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

## Estimation of leaf chrorophyll content of butterfly pea (*Clitoria ternatea*) as a function of fertilization utilizing a non-destructive, hand-held spectral analyser

› Sean Campbell

Having grown up around horticulturists – my grandfather Dr. Carl Campbell was a Professor Emeritus of Horticulture (tropical fruit crops) for the University of Florida (UF) – a strong passion for researching and consuming horticultural crops has always been inherent. A three-time UF gator, I received both my bachelor's and master's degrees from UF, studying food science with a focus on the sensory sciences. Currently I'm pursuing my PhD at the UF Mid-Florida Research and Education Center (MREC) researching medicinal and beverage crop production in the state of Florida, with an emphasis on butterfly pea (*Clitoria ternatea*). Florida is normally associated with large scale citrus production, but the industry has been devastated by disease. The USDA reports that for 2016-2017 the state had a decline of 16, 28, and 17% in the previous season in orange, grapefruit, and total citrus production, respectively, due to the incursion of Huanglongbing (HLB) disease. Affected growers and producers are actively seeking replacement crops. Growers want crops with multiple economic values, one of which is an elevated concentration of important secondary metabolites that can be extracted, as is the case for the anthocyanin content of butterfly pea. An important forage legume in SE Asia, use of the fresh or dried flowers has become increasingly popular due to anthocyanin's unique ability to convert from deep blue to light purple instantaneously when exposed to a mild acid such as lemon or lime juice. As a function of our extension appointment, research is currently being conducted to assist growers as they transition to these new crops, primarily through development of improved cultivation practices. In one example, our results instruct growers how to use a Konica Minolta SPAD-502Plus hand-held meter to non-destructively estimate leaf chlorophyll concentrations. Using a known SPAD index-value, producers can determine the relative leaf chlorophyll content of their plants with 99.89% accuracy. This can then be correlated to overall plant growth and function. By developing techniques like these, we're able to directly assist growers and producers in our area, saving them valuable time and resources while diversifying the horticultural portfolio of the state of Florida.

Sean Campbell won an ISHS Young Minds Award for the best oral presentation at the II International Symposium on Beverage Crops in China in October 2018.

### › Contact

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## A comprehensive analysis of the interplay between ethylene and other hormones during growth and development of 'Conference' pears

› Violeta Lindo García

Ms. Violeta Lindo García is a PhD student at the Institute for Food and Agricultural Research and Technology (IRTA) in Lleida (Spain) working in the field of postharvest physiology. The main objective of her thesis is to study the biochemical and physiological basis of superficial scald in different pear cultivars as well as to elucidate some key aspects of pear ripening. Superficial scald is a physiological disorder affecting the peel of both apples and pears after cold storage and leading to important economic losses. 'Conference' is one of the most important pear cultivars in Spain and is a cultivar that needs a short chilling treatment to induce ethylene production after harvest and thereby ripening. In contrast, 'Blanquilla', a typical summer pear, is able to achieve normal ripening just after harvest. Ethylene is well known to be the main hormone involved in many physiological processes related to fruit ripening, but scarce information exists describing the role of other hormones during fruit growth and maturation and their specific role in the postharvest behavior of pears. The objective of the work presented by Ms. Lindo García was to study the interplay between the main plant hormones and the relationship with the most important biochemical and physiological events occurring during 'Conference' development and on-tree ripening. Abscisic acid and ethylene were the most important hormones in earlier stages of development, and sugars and malic acid tended to accumulate only when abscisic acid concentrations were low. Gibberellins were predominant at later stages of development, showing an opposite behavior to that of indole-3-acetic acid. By comparing the changes occurring in these two pear cultivars that have contrasting behaviors, the latter two hormones appeared to play a decisive role in determining why some cultivars can ripen normally once detached from the tree, whereas others need a chilling or ethylene treatment to

initiate ripening. Even though ethylene is known to play a key role in postharvest, it may also be of paramount importance at earlier developmental stages of fruit development.
Ms. Violeta Lindo García won an ISHS Young Minds Award for the best oral presentation at the XIII International Pear Symposium in Uruguay in December 2018.


## › Contact

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## Effect of the ground cover management on *Cacopsylla bidens* (Šulc, 1907) populations in pear orchards

› Diana Valle

Ms. Diana Valle is currently a PhD student at the Instituto Nacional de Investigación Agropecuaria (INIA Las Brujas) in Uruguay. For her master's studies she focused on finding alternative strategies to the chemical control of *Cacopsylla bidens*, one of the main pests in pear orchards. Following that work in her PhD, she is mapping the trophic networks that involve *C. bidens* as a prey, because the information is scarce on which of the generalist predators is effectively feeding on *C. bidens*. She will use molecular ecology techniques based on PCR to determine which of the predators present in the agroecosystem have psylla residues in their stomach. Jointly, she will investigate if the parasitoid of the genus *Trechnites*, which has been associated worldwide with parasitism of nymphs, is present in Uruguay. Finally, she will attempt to characterize the volatiles induced by herbivory and their possible use as synomones to attract the third trophic level. This work aims to lay the foundations of an agroecological management of pear orchards, with emphasis on the conservation biological control. The results presented in the symposium were derived from the studies carried out during her master's thesis. The objective was to evaluate if a greater biodiversity, derived from the flowering plants present between rows, favored the presence of natural enemies of *C. bidens*, to reduce the population of the pest. To achieve this goal, the spontaneous flora present in the orchards was allowed to grow. This was compared with a conventional treatment of inter-row mowing plus maintaining a herbicide strip. The results were encouraging, as there was a significant increase in the number of natural enemies present in the orchards in the spontaneous flora treatment, which suggests there is potential to reduce the population of the pest. In addition, it was possible to determine that the natural enemies are naturally present in this agroecosystem. These results encouraged us to further these studies, to obtain an agroecological control of *C. bidens* and increase sustainability of pear production.
Diana Valle won an ISHS Young Minds Award for the best poster at the XIII International Pear Symposium in Uruguay in December 2018.


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## Sequential application of budbreak promoters in 'Baigent' apple trees under anti-hail nets in orchards of southern Brazil

› Leonardo Soldatelli Paim

Leonardo Soldatelli Paim is an agronomist, who graduated from the Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brazil (2016). After graduation, he started his master's studies in plant science at the same institution (2017), working through a well-established partnership with the Brazilian Agricultural Research Corporation, Grape and Wine (EMBRAPA) and the State University of Rio Grande do Sul (UERGS). As a member of the 'Management and physiology of temperate fruit trees' research group, formed by graduate, postgraduate students and researchers, his goal is to develop and improve the cultivation of temperate fruit crops, i.e., berries, peaches, plums, apples, under the southern Brazilian climatic (tropical-subtropical) and orchard management conditions. Apple is one of the most important temperate fruit crops cultivated in Santa Catarina and Rio Grande do Sul States; their annual production of ~ 1 million tons is more than 95% of the Brazilian total. A high incidence of hailstorms over the last few years in the apple-producing region of southern Brazil, however, is leading to an increasing use of hail nets, the most effective method of protecting against hail damage. In spite of its efficiency, hail nets promote micrometeorological alterations in the orchard, changing the plant-environment relationship and intensifying the vegetative growth of the plants. As a consequence, this greater vegetative growth may hamper budbreak induction, necessitating that the standard use of budbreak promoters (in a single application) be optimized. Application of budbreak promoters is a necessary practice to compensate for part of the physiological chilling requirement to overcome dormancy of 'Gala' apple trees and other high-chill deciduous fruit trees cultivated under the southern Brazilian mild winter climate. According to the author's goals, the awarded presentation 'Sequential application of budbreak promoters in 'Baigent' apple trees under anti-hail nets in orchards of southern Brazil' is a part of his master's research aiming to improve budbreak induction of 'Gala' cultivar, under black hail net, by using two applications of budbreak promoters, instead of the standard single one.
Leonardo Soldatelli Paim won an ISHS Young Minds Award for the best oral presentation at the XI International Symposium on Protected Cultivation in Mild Winter Climates & I International Symposium on Nettings and Screens in Horticulture in Canary Islands, Spain, in January 2019.


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# Persian gardens: then and now

Ghazaleh Rouhani

Figure 1. Shazdeh Mahan garden in Qajar era (around 1902).

On the great plain of Marvdasht in Iran, east of Zagros Mountains, lies the scattered remains of the earliest garden of which we have a record; in the ruined foundations, fragments of carvings are still visible. Here, in a once fertile plain watered by the river Polvar North East of Shiraz, Cyrus the Great decided to build his capital in 550 BC.

His reign (558-528) heralded a new civilization, and was marked by luxury unheard of in previous eras. Gardens then began to assume great importance in the cultural life of rulers. Designed with a formal quadripartite ground plan, it seems probable that the garden created by Cyrus the Great 2500 years ago represents the origins of Persian gardens. Incorporating architecture and planting, water rills and shade giving pavilions, Cyrus's garden offered the epitome of what gardens would become.

These first ideas of a garden as a paradise were to be vital in the history of spiritual Islamic and Indian gardens of the Mughal's Empire as they have been central in the gardens of Renaissance Europe and Western civilizations.

Persia is a vast plateau circled by the Alborz Mountains to the north and the Zagros to the west and south. With the exception of narrow stretches along the Caspian Sea and the Persian Gulf, the land is high and cruelly dry. Land may be cultivated naturally only in valleys or along the Caspian Sea. Creating a lavish garden was always a challenge for Persian gardeners.

Throughout history, great gardens were built in different parts of the Persian Empire. A few of these paradisiacal gardens have survived the test of time, fires, earthquakes, etc. From their remains, one can conclude that no matter where they were established in different parts of Iran, they followed a common basic concept. Gardens such as Shazdeh Mahan (Figure 1), Fin, Dolat Abad and Eram all harmoniously integrated the four elements of site, water, plant and structure.

Persian gardens were typically enclosed by high walls, to protect it from the desert or, as was often the case, the garden was in a city, so the walls shielded it from the dust and clamor of crowded baking streets.

During the centuries after the fall of the Sasanians, there was a renaissance in which poetry, textile, architecture and gardens entered a golden age, their form enriched by Islamic mystical tradition. Since then, every Muslim has an ultimate goal of reaching Paradise. Thus, the earthly garden gained eternal resonance, offering a perfect union of the earthly and the divine. In such gardens, all was held in balance by the sacred geometry of confining walls or courtyard facades. These defined a rectangular space quartered by intersecting canals or pathways; the term for this design was Chahar Bagh, meaning four gardens. At the intersection of the Chahar Bagh, one could find a pavilion, a palace, a tree or a geometric pool (Figure 2). Infinite harmonies were possible within this space; trees provided shade and fruit while flowers added color and scent. Above all, water played a key role. The Persian gardeners were very capable artists in the use of water. They designed their space with enough slope to direct water from rivers, irrigation canals or quanats (a gently sloping underground channel to transport water from an aquifer or water well to the surface) into holding pools or tanks (Figure 3). These, set above ground, were built so that the water was always brimming, a shining unbound mirror. Water from the pool might overflow as silvery sheets into a surrounding channel, to be directed through other channels.

Figure 2. In the Bagh e Fin garden in Kashan is the typical Chahar Bagh layout, with a pavilion and geometric pool (Copyright: imeduard/Shutterstock).

Figure 3. An irrigation channel in Bagh e Fin garden in Kashan to transport water through the garden (Copyright: BalkansCat/Shutterstock).

Figure 4. Hasht Behesht pavilion and reflecting pool.

At the edge of the great Salt Desert where the mountains begin, remains the oldest living garden in Persia. The Fin garden (Bagh e Fin). This is considered to be a typical Persian garden. Legend and historians tell how "Goshtasb, father of Darius I, had the Fin village built near Kashan, and brought forth water by means of quanats." Others attribute this wonderful spring, called Solaymanieh, to the legendary King Jamshid. The garden covers over 2.5 ha, and is confined by a high wall and monumental towered gates. A spring and a quanat provide its precious water, which is also used to irrigate fields outside the premise of the garden. Inside, the garden is a variant of the Chahar Bagh, with primary and secondary axes defined by blue tiled watercourses. The water enters the garden from the spring and moves down a water course to the reflecting pool. Throughout the water courses, across the terraces and pools and from the little fountains, the water rushes and bubbles, all in shade and piney scent of four hundred year old cypress trees.

The garden has several basins located on the axes of its walks, including a large basin that occupies the center of the square tract along with the pavilion. Four other pools of water are covered by cupolas both for shade and as sign of respect for water.

By 1597, Shah Abbas had moved its capital from Ghazvin to Isphahan. The site was on a high central plateau, on a fertile plain, surrounded by mountains and watered by the river, Zayandeh Rud.

The birth of Isfahan goes back to Achaemennian, who was a Sasanian satrapy (governor of the province) in ca. 58 BC. However, it was Shah Abbas that made Isfahan into a capital renowned throughout the world. The beautiful gardens covered a vast area close to the river on the edge of the old city. He turned them in to a royal garden quarter oriented along three axes, thus creating a multiplicity of patterns and contrasts.

A series of intertwined gardens around pavilions were built, serving various functions, such as the King's residence, guest house, and Harems. Chahar Bagh, Chehel Sotun, Hasht Behesht (Figure 4) are the remains of that glorious era. They all fit into the pattern of the Persian gardens, quartered space with water rills and reflecting pools and pavilions. The most famous ones that still exist are Hasht Behesht (eight paradises) and Chehel Sotun (forty pillars).


Figure 5. Waterways and fountains in A) Shazdeh garden, Kerman, and B) Eram gardens, Shiraz.

Built in 1670 under Shah Solayman, the pavilion of the Eight Paradises or the Garden of Nightingales is one of the most beautiful examples of 17th century Iranian architecture. Its plan consists of four octagonal rooms surrounded by four more identical rooms, surrounding an octagonal central space covered by a dome with a lantern.

Throughout time, many gardens were established around Iran to recreate part of "Heaven on Earth". Gardens in Shiraz (Bagh e Eram, Afif Abad), Yazd (Dolat Abad, Tabas gardens), Tabriz (El Goli) are good examples of this beautiful living art.

Persian gardens were not exclusive to the kings. According to the existing gardens, one can categorize them as:

- Royal gardens (Fin, Shazdeh and Eram garden);
- Religious gardens (Shah Nematollah, mosques, Zorestrian places of worship);
- Residential gardens (Omery house, Tabatabaii house in Kerman);
- Public gardens (Chahar Bagh, Maydan Naghsh-e Jahan);
- Hunting grounds (Nakh jeer were the first natural parks).


Figure 6. Plants and flowers were represented on paintings on the walls and ceiling and on ceramics in buildings in Iran. A) Ceramic tilework at Golestan palace, Teheran (Copyright: Sulo Letta/Shutterstock). B) Tilework at Shazdeh garden, Mahan (Copyright: Inspired By Maps/Shutterstock).

## Four basic elements of Persian gardens

### Site

Realizing the vital role of water for the garden's existence, the sites of gardens were chosen close to a source of water, be it a spring or river. Fin garden in Kashan and Shazdeh garden in Kerman are the best examples. Most of Iran's large gardens were created on hillsides, valleys or as sunken beds. The slopes helped the water distribution; also, the constant running fountains were possible (without mechanical help).

The gardeners of ancient times did not fight the environment by building greenhouses in hot regions such as Kerman, Yazd, Zabol, but by planting trees and shrubs in sunken beds (Chahar Bagh), they preserved water and created a favorable micro-climate. In this way, they were able to grow almost all kinds of fruit trees.

### Water

Donald Wilber, an American writer and spy who wrote histories and travelogues, wrote in his book "Persian Gardens and Garden Pavilions" (Wilber, 1962) that the most important reasons for considering the Persian garden as "paradisiacal sites" were their rich water systems and luxuriant vegetation in an environment characterized by extremely hot weather and arid deserts in Iran. Therefore, a garden is a representation of paradise and it has always held a sacred position in Persian beliefs. Water plays two main roles in Persian gardens: functional and decorative.

Irrigation is a major functional aspect of water in the Persian garden. Dividing the garden into a square or a rectangular shape, and using straight lines, facilitated irrigation of the garden. Water from an aqueduct, a reservoir, or water-lifting device flowed to the channels and was distributed through the quadrants. Water flooded each quadrant long enough to reach plant roots. Where the water was scarce and rate of evaporation was high, a genius system of subterranean irrigation kept the garden alive.

In Fin and Shazdeh gardens, two large underground reservoirs were built to store the water. In the first reservoir, sand or other sediments were allowed to settle and the clean overflow would go to the second reservoir and feed the pools, waterways and the fountains.

Water was also used as a decorative element in the gardens. It was used in many shapes and forms in a Persian garden, such as waterways, reflecting pools, and fountains (Figure 5). The sound of running water and fountains was used to create a soothing effect and increased the humidity, hence affected the climate. Waterways, and generally the use of water in the garden, were ways to lead the visitor into the Persian garden.

### Plants

Plants, as any horticulturist may expect, are one of the key elements of Persian gardens. The type of plants composing the ancient gardens were recognized by the paintings on the walls and ceilings (Figure 6), rugs and in poetry; also by the account of the travelers who wrote about the color and beauty of the plants they saw.

Apart from their beauty, plants were used for specific functions, such as windbreaks, shading, medicinal purposes, and as meadows for livestock grazing. They definitely were not chosen at random; plants served a specific purpose in a specific region. In different climates of vast Iran, each garden designer used appropriate plants, usually native plants. Shade trees were dominant parts of walkways and rest areas (Figure 3). Fruit trees were used in the square divisions.

Flower beds and shrubs were planted close to the pavilion, usually in so-called "flower rugs". The beauty, color and scent of flowers were appreciated by the residents of the palace. The flowers and shrubs were also used for medicinal purposes.

### Structure

The first structure seen in a Persian garden is the wall (Figure 7). As mentioned before, all Persian gardens were enclosed by a high wall. Hence the term, *Paradiso* (enclosed garden). The primary wall shielded the garden from negative outside factors, being environmental or security related. High walls usually had four towers on the four corners, possibly for soldiers guarding the Royal Garden. The high walls had several entrances. Two main entrances included one for the residents and one for the workers and commoners.

In the very large gardens that had several pavilions and residential structures, inner walls were built to separate each section. A few refurbished walls can be seen in Chehel Sotun, Isfahan.

Pavilions were built at a prominent point of the garden, on crossroads of water features (e.g. Fin garden, Figure 2), on the highest point of the site (e.g. the pavilion over the tomb of Hafez, Figure 8) or in the middle of a water basin (e.g. El Goli garden). In all Persian gardens, the pavilion, being the residence of a king or of the owner of the garden, always had a view to the heavenly garden. Each pavilion usually had two terraces, one facing the south garden to be used in winter and one facing north, to be used in summer.

Figure 7. The wall surrounding Jahan Nama garden, Shiraz (Copyright: eFesenko/Shutterstock).

Figure 8. The open pavilion over the tomb of Hafez, the associated Musalla Gardens, and the Hāfezieh memorial hall in the background, Shiraz.

Gardens were very important, even in winter months when residents could not use the gardens as much. Therefore, paintings on the walls and ceiling of these structures, and on the rugs used in them, were a reminder of the beauty of the gardens.

## Gardens today

Today Iranians are showing a renewed interest in the Persian gardens. The large number of visitors is a good indicator of their popularity. In ancient cities like Isfahan, Kashan, Yazd, Shiraz and Gavin, Iranian Cultural Heritage is refurbishing the buildings, bazaars and middle gardens. In recent years, a very positive look into our ancient history, architecture and gardens has encouraged the private citizens to refurbish old houses and use them as hotels. When possible, the gardens are renovated to be traditional Persian gardens. Also, several public parks with Persian garden design concepts have been established in Iran. With water shortages on the horizon, the Persian garden concept using native plants, could be the answer to creating “Heaven on Earth”.

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› Ghazaleh Rouhani

## › About the author


Dr. Ghazaleh Rouhani completed her PhD on Urban & Regional Planning at California State Polytechnic University, Pomona, USA in 1980. She has taught at a number of universities in Iran and has extensive experience as a landscape designer. She has been project manager and head designer for many significant gardens and landscape projects, including most recently the Japanese Garden, Flower Garden and Ghazi Abad Park in Lavasan, and a number of roof gardens. E-mail: grouhani@gmail.com



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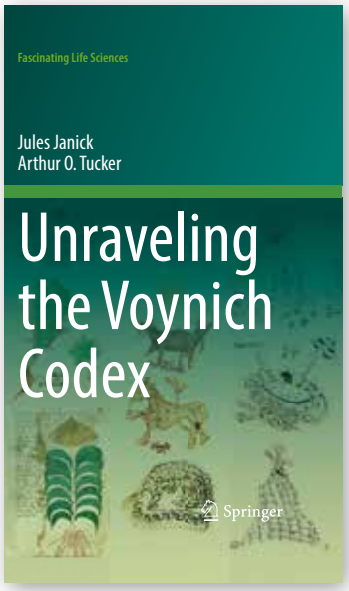
# › New books, websites

## 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**




**Janick, J., and Tucker, A.O. (2018). Unraveling the Voynich Codex (Cham, Switzerland: Springer), pp.412. ISBN 978-3-319-77293-6 (hardcover), ISBN 978-3-319-77294-3 (eBook). $49.99 (hardcover), $39.99 (ebook). https://www.springer.com/us/book/9783319772936**

Jules Janick, a renowned horticulturist, author, editor, and teacher from Purdue University, and Arthur O. Tucker, a retired botanist and herbarium director from Delaware State University, have produced a monumental work on the mysterious Voynich Codex, an ancient manuscript that has left scholars from many fields, including the world's greatest cryptographers and codebreakers, puzzling over its origin and meaning since its rediscovery over 100 years ago. Their book, *Unraveling the Voynich Codex*, is both intriguing in content and magnificent in scope as it examines every aspect of this enigmatic manuscript.

The book is divided into four parts, with the first serving as an introduction to this mysterious manuscript. Part II lays out the evidence for a Mesoamerican origin of the Codex and includes discussions of plants, animals, nymphs, zodiac signs, astronomical images, and a Kabbalistic map. Part III focuses on cryptography and languages associated with the Codex, and Part IV attempts to describe the author and artist of the Codex. An intriguing element of Part IV is a detailed list and description of potential authors of the Codex, which will be of immeasurable value to scholars studying this manuscript. But perhaps of greatest value to scholars and hobbyists alike is Table 1.1, which chronicles and describes in exhaustive detail each hypothesis about the Voynich Codex's origin, the author of that hypothesis, their accumulated evidence, and references for these claims. This invaluable table is, in and of itself, a masterful resource for anyone interested in the mystery of the Voynich Codex.

The manuscript was purchased in 1912 in Italy by the Polish book dealer, Wilfrid Voynich, from a Jesuit University. Voynich wanted to sell it but was unsuccessful. The manuscript once belonged to the Holy Roman Emperor Rudolf II, nephew of Philip II of Spain, but it now resides in the Beinecke Rare Books and Manuscript Library of Yale University.

The Codex appears to be both a herbal and fantastical work of art, written in an as-yet undecipherable language, and filled with images of animals, plants, symbols, bathing nymphs, and striking zodiac signs. Some have even suggested the manuscript is a remarkable hoax or forgery completed in Europe, whose images and language were completely fabricated. The authors advance a persuasive argument that draws heavily on taxonomic observations of the wild and cultivated herbaceous plants in the Codex, placing many of the images in the New World and positing a 16th century origin of the Codex. While several authors have examined the Codex from the point of view of its depiction of plant materials, Tucker and Janick in Chapter 4 delve far deeper and with considerably more expertise than other treatments of this idea. The result is a substantial comparative analysis, whose implications resonate far beyond the taxonomic conclusions.

The authors' hypothesis contradicts conventional wisdom, which has characterized the Voynich Codex as an early 15th century European manuscript. New World flora would be inexplicable in a European manuscript dated from the early 15th century since this was prior to the Columbian exchange. Tucker and Janick, along with colleagues from a variety of disciplines including animal science, have used their extensive expertise to painstakingly evaluate the traits that appear to be shared between New World plant and animal species and images found in the Codex. Their argument places the Codex more reliably in 16th century New Spain, in what is today Mexico. While the manuscript's vellum has been carbon dated to the early 15th century, there is evidence that the vellum may have been washed and re-used, rendering the Codex a palimpsest. Vellum and parchment were precious and often recycled, a common practice during this period.

It was first conjectured that the author of the manuscript was a member of Aztec nobility who trained in one of the colleges that were established in New Spain by the Franciscans, who had established themselves as protectors of the indigenous population in what is now Mexico. Such an individual, they argue, would have had the training and knowledge necessary to create such a detailed manuscript. In Chapter 15, based on initials and a name embedded in the first botanical illustration, Tucker and Janick identified the manuscript's illustrator as the indigenous artist Juan Gerson and the author as Gaspar de Torres, a Spaniard born in Santo Domingo who was Master of Students from 1568-1572 at the Colegio of Santa Cruz, where sons of the Aztec nobility were to be trained as priests. Gaspar de Torres was also a grandson of Jewish conversos, a fact that may explain the presence of kabbalistic imagery found in the Codex.

Two of the most famous examples of plant identification in the Codex have their origin in a 1944 paper by the botanist Rev. Dr. Hugh O'Neill, a herbarium director at the Catholic University of America in Washington D.C. O'Neill identified two New World species in the Codex, *Helianthus annuum* and *Capsicum annuum* and further suggested a possible New World origin of the manuscript. Tucker and a co-author Talbert postulated a New World origin for 35 additional plants in the Codex in 2013, and these are further described in Tucker and Janick in a 2016 paper in *Horticultural Reviews*. Tucker and Janick's new volume now extends that to 60.

Some of these comparisons are extremely persuasive. For example, *Viola bicolor* is a New World plant that appears to be very similar to the image in folio 9v of the Codex. Until 1961, this species was classified as a derivative of the Eurasian *Viola kitaibeliana* and often confused with other species in the genus. However, the comparison to *V. bicolor* is striking in two ways. One is the physical similarity between the image and the plant species itself; the other is the fact that this

species was only recently identified as a New World plant. If the Codex were a European forgery, it would be impossible to explain the existence of what is now known as a New World plant species.

Many other botanical comparisons were compelling. For example, the drawing in folio 23v is a good match for *Penthorium sedoides*, an American plant. The image in folio 65r with forked taproots and palmate leaves does seem to match *Valeriana albonervata,* a native of Mexico. A plant with very rounded, notched leaves, white flowers, and thick rhizomes in folio 2v appears to closely resemble *Nymphoides aquatica*, a North American plant. The images of various *Dioscorea* species, typified by their sagittate leaves, were well-matched with New World species. Critics may take issue with some of these comparisons, and it would be fair to say that the precision of the drawings in the Codex is such that complete identification of species from the point of view of taxonomic accuracy can be very difficult. Many of the plant images (called phytomorphs) in the Codex have an almost watercolor-like quality to them, rendering their leaf, stem, and flower margins somewhat inexact. In addition, there are only a few colors used in the plant images in the Codex, and besides fading over time these are not enough to fully represent the color of flowers, fruits, and other plant parts.

Despite these limitations, Tucker and Janick have proposed matches for 60 of the plant images in the Codex. Even if some of their interpretations are incorrect, it is quite likely that some of the comparisons do indeed match New World plant species. And if *some* New World species are present here, it is difficult to argue for a 15th century European origin for the Codex. This section of the book on plant identification may be of greatest interest to horticulturists and taxonomists. It also represents the most unique aspect of the author's approach and is at the core of a truly compelling argument for a New World origin for the Codex.

Some surprising and thought-provoking interpretations of the Codex's content are developed here for the first time. For example, the authors assert that the 6-page foldout diagram containing eight large elaborately drawn circles is a representation of the "Tree of Life" diagram known as sephirot, which is commonly found in Kabbalistic teachings. The Kabbalah is a mystical part of ancient Jewish thought that expanded significantly in 13th century Europe, particularly in Spain, with the publication of one of its central texts, the Zohar. One of the primary images in Kabbalistic thought is the sephirot, which is said to represent the ten attributes of God. These are often presented as ten connected descending circles placed in three columns in a tree-like form. Tucker and Janick describe how a kabbalistic map is centered around the city of Puebla, where the Franciscan friar Toribio de Benavente, also known as Motolinia, established the city of Angelopolis as the New Jerusalem in 1530. They assert that the map also contains four other Mexican cities, Huejotzingo, Vera Cruz, Tecamachalco and Tlaxcala, as well as three volcanoes, Popocatepetl, La Malinche and Pico de Orizaba. Such place-based identifications further tie this manuscript to New Spain. The idea that this diagram in the Codex could be modeled on the sephirot and placed in the context of Mexican cities is highly intriguing but will likely require further analysis by religious scholars and historians to determine the strength of this hypothesis.

Elizabeth Flaherty, an animal scientist at Purdue University, contributed a chapter in which she compares the 21 animal images or zoomorphs in the Codex with existing animal species from the New World. Her arguments are as persuasive as those for the phytomorphs concerning a New World origin of the animals in the Codex, many of which are part of the natural fauna of Mexico. The existence of Spanish breeds of cattle and sheep are also consistent with the hypotheses advanced by Tucker and Janick.

Further research is needed to resolve all of the hypotheses put forth in this volume. The suggestion that a blue mineral, drawn encased in a cube in the Codex, is boleite, a mineral native to New Spain, is entirely reasonable and has the support of experts in the field. This argument is further bolstered by the fact that boleite often co-exists with atacamite, the likely source of the green pigment in many of the plant drawings. However, it is not always possible to know the mind of the artist, and until the mineral on the manuscript itself can be examined, it will be difficult to prove. One of the areas in the Codex with the greatest need of attention has also stymied some of the most determined codebreaking efforts: deciphering the Voynichese symbols and language. Tucker and Talbert (2013) had proposed a decoding of these symbols based on the botanical evidence. Tucker used the Mesoamerican names of labeled plants to unlock the mystery of the text. In *Unraveling the Voynich Codex*, a number of words including plants, cities and apothecary jars based on Nahuatl and Spanish words have been deciphered. Experts have suggested that the Voynichese symbols may be a synthetic language composed of multiple indigenous languages. Tucker and Janick believe that a Nahuatl dialect is involved, but much remains to be done in this area. Fernando A. Moreira has contributed chapters in the book on the historical context of Aztec culture as well as Mesoamerican languages and the Voynich Codex, which provides excellent background and analysis on this subject.

The overall impression one has of this remarkable work is that botanical expertise has significantly advanced our understanding of the Voynich Codex. Looking at the Codex from a plant angle provides fresh insight into the likely origins of the text and re-arranges our understanding of the geography of its provenance. Similarly impressive is the attention to the hypotheses and ideas advanced by hundreds of other Voynich detectives over the last century, providing what will undoubtedly be a critical reference for all scholars of this unique document. The cumulative weight of the additional evidence they provide in the form of animal species, zodiac signs, minerals, and language forms a strong case for a Mesoamerican origin of the Voynich Codex. Tucker and Janick have given those who have taken an interest in unraveling this mystery outstanding material with which to continue their lively debate over its origins and meaning.

***Reviewed by Irwin Goldman,***
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***University of Wisconsin-Madison, USA***

## New titles

Keinath, A.P., Wintermantel, W.M., and Zitter, T.A., eds. (2017). Compendium of Cucurbit Diseases and Pests, 2nd edn (St. Paul, MN, USA: APS Press), pp.228. ISBN 978-0-89054-573-7 (softcover). $169.00. www.shopapspress.org

Stanghellini, C., Van 't Ooster, B., and Heuvelink, E. (2019). Greenhouse Horticulture: Technology for Optimal Crop Production (Wageningen, The Netherlands: Wageningen Academic Publishers), pp.300. eISBN 978-90-8686-879-7 / ISBN 978-90-8686-329-7. €69.00. https://doi.org/10.3920/978-90-8686-879-7.

Taylor, J. (2019). A Five Year Plan for Geraniums: Growing Flowers Commercially in East Germany 1946-1989 (Bloomington, IN, USA: Xlibris), pp.242. ISBN 978-1-9845-7617-0. $29.99 (hardcover) / $19.99 (paperback). www.xlibris.com

# › Courses and meetings

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

International Summer School on Methodological Approaches to System Experiments, 23-28 June 2019, Volterra, Italy. Info: Dr. Françoise Lescourret, Inra, Environment and Agronomy Division, Plants and Horticultural Cropping Systems Unit (PSH), Avignon, France, e-mail: francoise.lescourret@inra.fr, or Dr. Jean-Noël Aubertot, Inra, Environment and Agronomy Division, Agroecology, Innovations and Territories Unit (AGIR), Toulouse, France, e-mail: Jean-Noel.Aubertot@inra.fr, web: https://workshop.inra.fr/system-experiments/. Visit the website for updated information, especially on registration process and dates (https://workshop.inra.fr/system-experiments/Practical-information).

XIII Master in Olive Growing and Oil Technology, September 2019 to May 2020, Cordoba, Spain. Info: Secretariat of the Master in Olive Growing and Oil Technology, Universidad de Córdoba, Campus de Rabanales, Edificio C4, Carretera de Madrid km. 396, 14071 Córdoba, Spain, phone: +34 957 218351, fax: +34 957 218569, e-mail: masterolivicultura@uco.es, web: http://www.masterolivicultura.org

InterFresh2019 – Fresh Vegetable and Fruit, Storage, Packaging and Logistics Exhibition, 16-18 October 2019, Antalya, Turkey. Info: ANTEXPO Fuarcılık ANTALYA, Avni Tolunay Cad. Alkış Sitesi, A Blok, Kat 3, D: 7, Murat Paşa- Antalya, Turkey, phone: +90 (242) 502 00 22, fax: +90 (242) 502 00 22, e-mail: info@antexpo.info, web: www.euroasiainterfresh.com

Symposia and Workshops

# › First International Symposium on Horticultural Therapies: Past, Present and Future

**Division Horticulture for Human Health #ishs_dhea**
**Division Landscape and Urban Horticulture #ishs_durb**

The First International Symposium on Horticultural Therapies: Past, Present and Future was held in Taichung, Taiwan from 13-16 November 2018, under the aegis of the International Society for Horticultural Science (ISHS). With the support of the Council of Agriculture (COA), Executive Yuan, Republic of China, the symposium was organized by the Taichung District Agricultural Research and Extension Station (TCDARES), the Taiwan Society for Horticultural Science (TSHS), the National Museum of Natural Science (NMNS), the Department of Horticulture and Landscape Architecture, the National Taiwan University (NTU), the Health Science and Wellness Center, NTU, the Taiwan Horticultural Well-being Association, the Formosa Green Care Association, the Chinese Taiwan Landscape Architecture Society and the International Association for Traditional and Complementary Medicine. Over 170 researchers, doctors, students and association representatives from various countries including Taiwan, Italy, USA, Korea, Hong Kong, Japan,


› Chair of ISHS Division Landscape and Urban Horticulture, Dr. Francesco Orsini (second from left), presenting the ISHS medal award to Symposium Conveners Dr. Hsueh-Shih Lin (left), Dr. Sheng-Jung Ou (second from right), and Dr. Chun-Yen Chang (right).

› Dr. Orsini presenting ISHS Young Minds Awards to A) Ms. Chia-Ching Wu for the best oral presentation, and B) Ms. Hong-Hsuan Lee for the best poster.


› Visit to world flora exposition.

China and Sweden attended the symposium. During the pre-symposium tour, participants visited central Taiwan and the National Taiwan Craft Research and Development Institute for a relaxing change of scenery and relief from stress caused by flying. The second day of the symposium was opened by the Chief Secretary of COA, Dr. Chih-Sheng Chang, the Director of TCDARES, Dr. Hsueh-Shih Lin, and the Head of Department of Horticulture and Landscape Architecture, NTU, Dr. Chun-Yen Chang. A welcome remark was also given by the Chair of ISHS Division Landscape and Urban Horticulture, Dr. Francesco Orsini.

Horticultural therapy has become more prevalent in recent years because of the increase of stress and tension in daily life. Therefore, the aim of the symposium was to provide insight into horticultural therapy as well as knowledge and expertise. Six scientific sessions were held, including 16 oral and 11 poster presentations on the following topics:

- Training and education in horticultural therapy;
- Evaluation and research methods;
- Certification and promotion of horticultural therapy;
- Horticultural therapy in special groups;
- Horticultural well-being;
- Horticultural therapy programming.

Each session was introduced by one outstanding guest speaker and one well-known local speaker. For instance, in the first session Dr. Candice A. Shoemaker (Kansas State University, USA) gave an introduction on horticultural therapy in USA, while Dr. Sheng-Jung Ou (NTU, Taiwan) presented a comparison of certification and education in different countries. In addition, the contribution of invited speakers Dr. Chun-Lin Chen, Dr. Kenshi Nishino and Dr. Ta-Chen Su focused the audience's attention on the combination of medical issues and horticultural therapies. The oral reports given by students and researchers in each scientific session added further details to the subjects covered in the keynote addresses. ISHS Young Minds Awards were presented to Ms. Chia-Ching Wu (NTU, Taiwan) for the best oral presentation entitled "Analysis of psychophysiological benefits of therapeutic agricultural landscapes" and to Ms. Hong-Hsuan Lee (NTU, Taiwan) for the best poster entitled "Design principle of water space in therapeutic landscape."

On the last day of the symposium, two workshops were designed for networking with horticultural therapists. One of the workshops was organized by the President of the Hong Kong Association of Therapeutic Horticulture, Ms. Connie Yuen-Yee Fung, who taught the attendees how to make their own seed paper. The other workshop, led by Ms. Winnie Jui-Lin Shen, connected and engaged with plant materials while creating hands-on tablecloths. These activities were useful to attendees in learning how people-plant interaction brings therapeutic change.

The post-symposium visit to the "Blossom Pavilion" in the 2018 Taichung World Flora Exposition gave the participants a view of the construction, which included cladding of versatile three-dimensional metal grills and they had an excellent experience of a beautiful atmosphere when entering the floral hall. This symposium provided opportunities for participants to enhance their knowledge on horticultural therapy and potential for international cooperation in the future.

***Ching-Hsia Wu***

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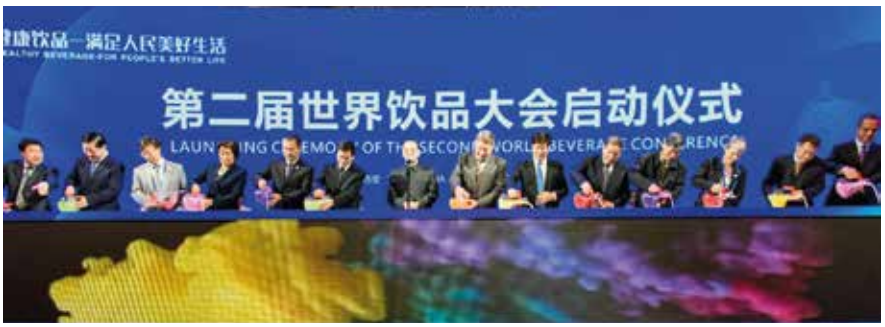
› Participants of the symposium.

# › II International Symposium on Beverage Crops

**Division Postharvest and Quality Assurance** #ishs_dphq
**Division Horticulture for Human Health** #ishs_dhea
**Division Temperate Tree Fruits** #ishs_dfru
**Division Tropical and Subtropical Fruit and Nuts** #ishs_dtro
**Division Vine and Berry Fruits** #ishs_dvin
**Division Vegetables, Roots and Tubers** #ishs_dveg




› Opening ceremony.

The II International Symposium on Beverage Crops was held at the Quijang International Convention and Conference Centre in Xi'An, Shaanxi Provence, China from 22nd to 25th October 2018. The symposium was organised by the Northwest Agriculture and Forestry University and the Fruit Industry Bureau of Shaanxi Provence under the aegis of the International Society for Horticultural Science and the Chinese Society for Horticultural Science. The symposium was well supported by all levels of government in China, in particular those in the Shaanxi Provence. Symposium conveners were Emeritus Professor Roderick Drew (Australia) and Professor Zhenhai Han (China).

The symposium was attended by 150 delegates from 25 countries. The symposium program included scientific sessions, which were addressed by invited keynote speakers: Professors Duan Changqing, Chen Zongmao, and Li Hua, and Mr. Ye Yi (China), Professor Cristina Garcia-Viguera (Spain), Dr. Hugues Guichard (France), Drs. Bruno Holzapfel and John Mason (Australia), Professor Paul Read (USA), and Dr. Richard Smart (UK). A comprehensive "History of beverages" was presented by John Mason. Oral presentations covered a wide range of research from beverages made from Amazonian fruits to juniper berries for the production of the "Borovička" in the Slovak Republic, coffee production in Nepal and rare tropical fruits in Australia. There were presentations on the world wine industry from many countries including India and Thailand in the tropics to the temperate zones of Australia and New Zealand, the Mediterranean climate of Spain, and cold regions, e.g. "Viticulture and wine making in Midwest USA". The growing global cider industry was represented by speakers who described the latest research in China, France and Japan. All oral presentations were of a high standard and there was a great spirit of camaraderie between delegates, which started at the first symposium in Cairns, Australia and will continue to the third symposium in Murcia, Spain.


› Dr. Jill Stanley presenting the ISHS Young Minds Award to Sean Campbell for the best oral presentation.

There were a number of forums on: fruit wine technology, product promotion and exchange; fruit wine industry development; wine and beverage equipment industry; and fruit wine technology innovation. These forums were well attended by delegates from many countries and represented company representatives, trade representatives, academics, politicians and policy advisors, and provided excellent opportunities for discussions on international cooperation, technology transfer and trade of beverages.

An extensive exhibition of beverages and products was held during the symposium and provided good opportunities for delegates to view and sample many alcoholic and non-alcoholic beverages. The exhibition contained many local products from Shaanxi Provence.

Sean Campbell from the University of Florida received the ISHS Young Minds Award for the best oral presentation entitled "Estimation of leaf chlorophyll content of butterfly pea (*Clitoria ternatea*) as a function of fertilization utilizing a non-destructive, hand-held spectral analyser". We received many positive comments both during and after the symposium, however, the one from Sean Campbell is noteworthy, particularly as ISHS is keen to reach out to students and young scientists. Sean wrote "I wanted to send you a follow-up email to reiterate how appreciative I am of ISHS and yourself for the opportunity to attend the II International


› Speakers and other dignitaries at the closing ceremony

› Examples of the wide diversity of beverage products that were displayed and available for sample at the II International Symposium on Beverage Crops.

Symposium on Beverage Crops and present my research. As a graduate student, conferences like these allow me to gain experience in scientific presenting on an international scale, which really does help to increase my merit as a scientist while interacting with some of the top professionals in the field. Chances to engage in this type of interaction tend to be few and far between, which is why I truly believe that honors like being awarded the ISHS Young Minds Award will allow me to pursue even more opportunities in the future. I look forward to working with you in the future, and hopefully I'll see you at another conference soon".

Global beverage sales are estimated at ›2 trillion litres per year. Beverages and beverage crops have a massive impact on our world population in terms of employment, income, nutrition and lifestyle and for their therapeutic (relaxation) and social role. They provide an important source of income for the rural population in many developing and developed countries. Many of the beverage crops are horticultural species, thus horticulture and horticultural science plays an important role in the beverage industry. It is expected that this series of ISHS symposia will continue to increase in status and be a valuable source of cutting edge research and information for the beverage industry worldwide while providing forums for technology transfer, product and equipment development, innovation and trade.

At the ISHS business meeting, chaired by Dr. Jill Stanley, Vice President of ISHS, it was decided that the III International Symposium on Beverage Crops will be held in Murcia, Spain in 2021.

***Roderick A. Drew and Zhen-Hai Han***

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# › XIII International Pear Symposium

## Division Temperate Tree Fruits #ishs_dfru

The "XIII International Pear Symposium – Growing in diversity" took place between the 3rd and 7th of December 2018 in the "Salón Azul" of the Municipal Palace in downtown Montevideo, Uruguay. Scientific sessions were attended by more than 120 pear specialists from 23 different countries. This shows the value of this meeting, which takes place every four years.

Most topics related to pear research and production were covered in the different sessions: genetics and breeding, rootstocks and cultivars, training systems and pruning, crop management, pest and disease protection, fruit quality and postharvest, agroecology and system design, mechanization, information and communication technology, and precision fruit growing. Both oral and poster sessions took place with high quality presentations and cutting-edge information.

The efforts being carried out by academia and industry to offer new pear products, different from the common ones, were reflected in the number of papers presented that covered genetics, breeding programs, and new cultivar evaluations. It appears that the market will shortly be seeing an increase in offerings with much more diversity from which to choose.

The invited speakers were diverse in their origin and topic. The list can be checked on the symposium webpage www.pear2018.uy. DNA sequences, rootstocks, plant growth regulators, pruning, training systems, light interception, and orchard design, were discussed by specialists from China, Italy, South Africa, Spain, and USA.

A specific session was included for agroecology and system design, as well as one for information and communication technolo-

› ISHS representative Prof. Luca Corelli-Grappadelli (center) presenting the ISHS Medal award to Symposium Conveners Dr. Danilo Cabrera (left) and Dr. Roberto Zoppolo (right).

› Participants of the symposium.


› Prof. Luca Corelli-Grappadelli presenting ISHS Young Minds Awards to A) Violeta Lindo García for the best oral presentation, B) Diana Valle for the best poster.

gies and robotics. Even though more papers were expected, there is clear belief in the increased importance that these areas have for sustainable development of pear growing and production.

On Wednesday 5th December, an open day was planned. Local growers, advisers, and students were especially invited to participate. Oral presentations on this day were selected because of their scope and information content, which was mostly of direct application to the field and highly useful for the growers. The increased participation during this day and the exchange proved that this strategy was valuable in order to integrate the local industry into the scientific activities.

During the morning of Thursday 6th December, a visit to the Experimental Station of INIA Las Brujas took place. After a welcome by authorities and an overview of the whole institute, field trials were visited through a circuit including a comprehensive presentation of research activities and experiments being done. Lunch was a good opportunity for exchange and interaction in a relaxed environment. During the afternoon, the visit to two fruit growers gave the possibility to learn first-hand about the main problems and challenges the pear industry in Uruguay is going through, and how pear production is being carried out in this part of the world with its specific issues as a result of local conditions.

A balance between the scientific and field production activities, as well as the social events, was pursued by the organizers and the offerings provided a good diversity. Pre- and post-symposium technical tours were available, giving the opportunity to visit different production areas in southern Uruguay, as well as the metropolitan region of Montevideo, one of the main fruit growing areas. Interesting olive groves, vineyards, apple, peach, kiwi, citrus, plum, nectarine, and pear plantations were visited. During the tours it was also possible to visit important tourist destinations like Punta del Este, Montevideo, and Colonia del Sacramento cities. The social events were a great opportunity to have exposure to a diversity of Uruguayan culture and traditions: tango, candombe, wine and mate drinking!

› Research presentation at INIA Las Brujas.

ISHS Young Minds awards were presented to Ms. Violeta Lindo García from the Institute for Food and Agricultural Research and Technology (IRTA), Spain, for the best oral presentation entitled “A comprehensive analysis of the interplay between ethylene and other hormones during growth and development of ‘Conference’ pears”, and to Ms. Diana Valle from the Instituto Nacional de Investigación Agropecuaria (INIA Las Brujas), Uruguay, for the best poster entitled “Effect of the ground cover management on *Cacopsylla bidens* (Šulc, 1907) populations in pear orchards”.

During the ISHS business meeting, it was decided that the XIV International Pear Symposium will be organized by Prof. Karen I. Theron in January 2023 in Stellenbosch, South Africa. Prof. Stefano Musacchi was elected as Chair of ISHS Working Group European and Asian Pears.

The symposium developed in a very friendly and positive environment, where it was easy to interact and exchange, strengthening the links within the international community of people interested in the development of pear culture. It gave also the opportunity to visit and learn about Uruguay and its people. The organization was carried out by the Instituto Nacional de Investigación Agropecuaria (INIA) under the aegis of the International Society for Horticultural Science (ISHS), with the leadership of Conveners Roberto Zoppolo and Danilo Cabrera, and a very professional team, achieving a successful event that gave every participant of the symposium the possibility to “grow in diversity”.

***Roberto Zoppolo***

## › Contact

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From the Secretariat

# › New ISHS members

**ISHS is pleased to welcome the following new members:**

## New Individual Members

**Australia:** Mr. Jon Caleo, Mr. John Fitzgibbon, Mr. Thomas Frankcomb, Mr. Damien McMahon, Dr. Niranjani Saverimuttu; **Belarus:** Yauheni Kasandrovich, Prof. Dr. Vladimir Soldatov; **Belgium:** Dr. Lien Bosmans, Mr. Kris Coen, Dr. Kris De Jonghe, Dr. Fjo De Ridder, Mr. Jonas De Win, Elisa Driesen, Dr. Oliver Grunert, Dr. Marlies Huysmans, Mr. Bayu Nugraha, Ms. Chanjun Sun, Dr. Inge Van Daele, Dr. Jeroen van Roy; **Brazil:** Dr. Rita Mercia Borges, Ms. Danyelle de Sousa Mauta, Dr. Alice Kazuko Inoue-Nagata, Prof. Eduardo Mizubuti; **Cambodia:** Ms. Socheath Ong; **Canada:** Ms. Erika DeBrouwer, Ms. Hannah Gass, Mr. Diego F. Martinez Manay, Mr. Pierre Plante, Mr. Francois-Simon Robert, Laura Thériault; **Chile:** Dr. Alejandro Antunez, Dr. Enrique Ferrada; **China:** Fengxiang Dong, Ms. Meiling Gao, Prof. Dr. Xiaoming He, Prof. Guibing Hu, Prof. Shuhua Li, Prof. Yue Lin, Prof. Dr. Wei Liu, Xi Ouyang, Prof. Guohui Yang, Prof. Dr. Xingping Yang, Dr. Lixian Yao, Assoc. Prof. Xiefeng Yao, Guodong Zhang, Prof. Qinghua Zhang, Prof. Yaqin Zheng, Assoc. Prof. Yichen Zong; **Chinese Taipei:** Dr. Ying-Huey Cheng, Assoc. Prof. Chien-Jui Huang, Assoc. Prof. Mohamed Rakha, Mr. YuanKai Tu, Mr. San-Tai Wang, Yu Huei Wang, Dr. Ming-Hwi Yao; **Czech Republic:** Ms. Veronika Danková, Dr. Bozena Sedlakova, Ms. Martina Subrtova; **Finland:** Prof. Timo Vesala; **France:** Mr. Patrick Baudouin, Mr. Enrico Casagrande, Dr. Jerome Chopard, Mr. Antoine Drouillard, Mr. Omar Failli, Mr. Michel Giraud, Vincent Stauffer; **Germany:** Elisabeth Abele, Prof. Dr. Frank Eulenstein, Ms. Gabriele Fiene, Daniel Hauck, Prof. Thorsten Kraska, Dr. Katharina Leiber-Sauheitl; **Greece:** Dr. Ioannis Lycoskoufis, Mr. Georgios Trypanagnostopoulos, Ms. Maria Zografou; **Hungary:** Ildikó Ehretné Berczi; **India:** Mr. Sumant Bindal, Mr. Surbhit Godha, Dr. Sanjay Kumar Singh, Mr. Sumeet Singh, Mr. Visvesh Sumathy, Mr. Shivaji Thorat; **Ireland:** Mr. Alan McCann; **Israel:** Ziv Omer; **Italy:** Dr. Anna Aldrighetti, Dr. Dario Angeli, Mr. Farahmand Babellahi, Dr. Roberto Beghi, Dr. Daniela Beretta, Assist. Prof. Lucia Bortolini, Mr. Gianmarco Bortolotti, Dr. Antonio Carlomagno, Dr. Giovanni Caruso, Mr. David Casini, Filippo Catalano, Prof. Pasquale Catalano, Dr. Silvia Celletti, Dr. Chiara Cevoli, Dr. Nunzia Cicco, Dr. Lorenzo Comba, Dr. Marco Cossu, Dr. Gabriele Daglio, Dr. Sonia Demasi, Ms. Maria Concetta Di Bella, Mr. Marco Fiore, Dr. Loris Franco, Dr. Rina Iannacone, Dr. Emilia Lamonaca, Prof. Alessandro Leone, Prof. Elisabetta Loffredo, Dr. Piernicola Masella, Dr. Attilio Matera, Dr. Rosario Paolo Mauro, Dr. Giuseppe Carlo Modarelli, Assist. Prof. Roberto Moscetti, Dr. Saverio Orsucci, Dr. Bianca Ortuani, Dr. Bernardo Pace, Assoc. Prof. Simone Pascuzzi, Dr. Eleonora Peruzzi, Mr. Ambrogio Pigoli, Prof. Dr. Fabrizio Sarghini, Dr. Costantino Sirca, Assist. 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ISHS

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# › In memoriam

## August (Gus) De Hertogh

With sorrow we announce the death of Dr. August (Gus) De Hertogh, professor emeritus of Horticultural Science at North Carolina State University (NCSU), USA, who passed away on October 26, 2018. Dr. De Hertogh, born in Chicago, was the son of Frank Joseph and Marie Louise De Hertogh, who emigrated from Belgium to the United States in 1926. His love of agriculture stemmed from work on the family tobacco farm in Canada and from studies leading to a BS degree in field crops (1957), MS degree in weed science (1961) at NCSU and PhD degree in plant physiology (1963) at Oregon State University. Upon graduation he served as a plant physiologist at Boyce Thompson Institute in New York followed in 1965 by his 13-year tenure on the faculty at Michigan State University (MSU). In 1978 he assumed the head of the Department of Horticultural Science at NCSU, which he held for ten years, after which he remained active in research and teaching until his death.

Dr. De Hertogh was a preeminent world authority in the handling, production, and forcing of flowering bulb plants (geophytes). Upon arrival at MSU, he was selected by the Florists' Committee of the Dutch flower bulb industry to lead a research program in support of flower bulb forcing in North America. To facilitate interchange of existing production technology from The Netherlands and new research results to The Netherlands, an intern program was established. During his tenure at MSU and NCSU, 44 interns from the Dutch flower bulb industry spent one year each in his research program. Paramount among the many achievements of his research program were the refinement of trans-Atlantic shipping conditions, selection of appropriate cultivars for climates of Canada and the USA, establishment of rooting room requirements, and development of precise forcing regimes for every major flowering bulb species.

A striking attribute of Dr. De Hertogh was his zeal to communicate with all segments of the flower bulb world, including scientists, bulb producers, bulb forcers, and the public. His 345 publications attested to this point. The five editions of his Holland Bulb Forcers Guide became the bulb forcers "bible". His Holland Bulb Garden Guide presented his results to gardeners and to extension personnel who served them. One of his greatest literary contributions to the scientific world was the treatise co-authored with Dr. Marcel Le Nard, entitled "The Physiology of Flowering Bulbs".

Dr. De Hertogh received numerous awards and honors throughout his career. Notable among these were Fellow of the American Society for Horticultural Science, Medal of Honor from The Netherlands Ministry of Agriculture and Fisheries, Floriculture Hall of Fame and Alex Laurie Research and Education Awards from the Society of American Florists, and the Nicolaas Dames Golden Medal.

His dedicated drive and John Wayne persona will long be felt in the accomplishments of his colleagues, the careers of the many students he educated, the commercial successes of an entire geophyte industry he supported, and the pleasures of a worldwide gardening public who, through his efforts, find their lives a shade brighter than before. Gus was truly an ambassador for horticulture.

*Paul Nelson and Sylvia Blankenship,*
*North Carolina State University, USA*

# › 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 Division 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 2019

- May 1-3, 2019, Seoul (Korea (Republic of)): **XIII International Symposium on Flower Bulbs and Herbaceous Perennials**. Info: Prof. Dr. Ki-Byung Lim, Department of Horticulture, College of Agriculture and Life Sciences, Kyungpook National University, 41566 Daegu, Korea (Republic of). Phone: (82)53-9505726, Fax: (82)53-9505722, E-mail: kblim@knu.ac.kr E-mail symposium: info@flowerbulb2019.org Web: http://flowerbulb2019.org/
- May 6-9, 2019, Taichung (Chinese Taipei): **VI International Symposium on Tomato Diseases**. Info: Dr. Lawrence Kenyon, World Vegetable Center, PO Box 42, Shanhua, 74199 Tainan, Chinese Taipei. Phone: +886 6 5837801, Fax: +886 6 5830009, E-mail: lawrence.kenyon@worldveg.org or Dr. Ruey-Jang Chang, 189, Chung-Cheng Road,, 41362 Taiwan Wufeng, Taichung City, Chinese Taipei. Phone: (886)4-23317500, Fax: (886)4-23302803, E-mail: raychang@tari.gov.tw or Prof. Dr. Fuh-Jyh Jan, Department of Plant Pathology, National Chung Hsing University, 250 Kuo Kuang Road, 40227 Taichung, TAIWAN, Chinese Taipei. Phone: +(886)4-22854145, Fax: +(886)4-22854145, E-mail: fjjan@nchu.edu.tw E-mail symposium: info@2019tomato.org Web: https://2019tomato.org/
- May 19-24, 2019, Liège (Belgium): **V International Symposium on Postharvest Pathology: From Consumer to Laboratory - Sustainable Approaches to Managing Postharvest Pathogens**. Info: Prof. Dr. Haissam Jijakli, Integrated and Urban Plant Pathology Lab, Gembloux Agro bio tech, Passage des Déportés, 2, 5030 Gembloux, Belgium. Phone: (32)81-622431, Fax: (32)81-622432, E-mail: mh.jijakli@uliege.be Web: https://events.uliege.be/postharvest2019/

NEW

- June 3-7, 2019, Prague (Czech Republic): **XV Eucarpia Symposium on Fruit Breeding and Genetics**. Info: Dr. Jiri Sedlák, Res. &Breeding Inst. of Pomology Holovousy, Holovousy, 50801 Horice,

Czech Republic. Phone: (420) 435 692 821, Fax: (420) 435 69 33, E-mail: sedlak@vsuo.cz Web: https://www.eucarpiafruit2019.org/

- June 7-11, 2019, Hanoi (Vietnam): **VI International Symposium on Lychee, Longan and Other Sapindaceae Fruits**. Info: Ms. Thi Ha Le, Fruit and Vegetable Research Institute, Trau Quy town, Gia Lam district, Hanoi, 84 Hanoi, Vietnam. Phone: (84)934347046, Fax: (84)2438276148, E-mail: leharifav2001@yahoo.com E-mail symposium: secretariat@lycheelongan2019.com Web: http://lycheelongan2019.com
- June 9-12, 2019, Molfetta (Italy): **VI International Symposium on Applications of Modelling as an Innovative Technology in the Horticultural Supply Chain - Model-IT 2019**. Info: Dr. Maria Luisa Amodio, Via Napoli 25, 71100 Foggia, Italy. Phone: (39)0881-589105, Fax: (39)0881-589244, E-mail: m.amodio@unifg.it or Prof. Giancarlo Colelli, Dip.SAFE Università di Foggia, Via Napoli 25, 71100 Foggia, Italy. Phone: (39) 320 4394535, E-mail: giancarlo.colelli@unifg.it Web: http://www.unifg.it/modelit2019 NEW
- June 16-20, 2019, Angers (France): **Greensys 2019 - International Symposium on Advanced Technologies and Management for Innovative Greenhouses**. Info: Prof. Dr. Pierre-Emmanuel Bournet, Agrocampus Ouest, 2, rue Le Nôtre, 49045 Angers, France. Phone: (33) 2 41 22 55 04, Fax: (33) 2 41 22 55 53, E-mail: pierre-emmanuel.bournet@agrocampus-ouest.fr or Dr. Hicham Fatnassi, INRA 400 Route des Chappes, 06903, Sophia Antipolis, France. Phone: (33)492386400, E-mail: hicham.fatnassi@inra.fr or Eric Brajeul, Centre CTIFL de Carquefou, Zl Belle Etoile Antarès, 35 Allée des Sapins, 44483 Carquefou Cedex, France. Phone: (33)240508165, Fax: (33)240509809, E-mail: brajeul@ctifl.frE-mailsymposium:greensys2019@agrocampus-ouest.fr Web: https://www.greensys2019.org/
- June 17-20, 2019, Matera (Italy): **IX International Symposium on Irrigation of Horticultural Crops**. Info: Prof. Dr. Bartolomeo Dichio, Università degli Studi della Basilicata, DICEM, Via S.Rocco, 75100 Matera, Italy. Phone: (39)08351971422, E-mail: bartolomeo.dichio@unibas.it or Prof. Cristos Xiloyannis, Università degli Studi della Basilicata, DICEM, Via S.Rocco, 75100 Matera, Italy. Phone: (39)08351971416, Fax: (39)0971205378, E-mail: cristos.xiloyannis@unibas.it E-mail symposium: info@irrigationmatera2019.com Web: http://www.irrigationmatera2019.com
- June 24-28, 2019, Milan (Italy): **III International Symposium on Growing Media, Composting and Substrate Analysis**. Info: Dr. Patrizia Zaccheo, DISAA, University of Milan, Via Celoria 2, 20133 Milano, Italy. Phone: (39)0250316536, E-mail: patrizia.zaccheo@unimi.it or Dr. Costantino Cattivello, ERSA-FVG, Via Sabbatini 5, 33050 Pozzuolo del Friuli (UD), Italy. Phone: (39)0432529241, Fax: (39)0432529273, E-mail: costantino.cattivello@ersa.fvg.it or Prof. Dr. Francesco Giuffrida, Di3A - Catania University, Via Valdisavoia 5, 95123 Catania, Italy. Phone: (39)095234323, Fax: (39)095234329, E-mail: francesco.giuffrida@unict.it E-mail symposium: susgro2019sci@promoest.com Web: http://www.susgro2019.com
- June 25-28, 2019, Zürich (Switzerland): **XII International Rubus and Ribes Symposium: Innovative Rubus and Ribes Production for High Quality Berries in Changing Environments**. Info: Dr. Christoph Carlen, Agroscope, Route des Vergers 18, 1964 Conthey, Switzerland. Phone: (41) 27 345 35 11, Fax: (41) 27 346 30 17, E-mail: christoph.carlen@agroscope.admin.ch or Dr. Erika Krüger, Hochschule Geisenheim University, Dept. of Pomology, Von-Lade-Strasse 1, 65366 Geisenheim, Germany. Phone: (49)6722502561, Fax: (49)6722502560, E-mail: erika.krueger@hs-gm.de or Gunhild Muster, Staatliche Lehr- und Versuchsanstalt, Wein- und Obstbau Weinsberg, Traubenplatz 5, D-74189 Weinsberg, Germany. E-mail: gunhild.muster@lvwo.bwl.de Web: http://www.rubusribes.agroscope.ch
- June 30 - July 4, 2019, Ghent (Belgium): **VI International Symposium on Cucurbits**. Info: Dr. Peter Bleyaert, Landmansstraat 51, Rumbeke 8800, Belgium. Phone: (32)51-273270, Fax: (32)51-240020, E-mail: peter.bleyaert@inagro.be or Prof. Dr. Marie-Christine Van Labeke, Department of Plant Production, University of Gent, Coupure links, 653, 9000 Gent, Belgium. Phone: (32) 9-2646071, Fax: (32) 9-2646225, E-mail: mariechristine.vanlabeke@ugent.be or Mr. Raf De Vis, Stuivenbergvaart 85, 2800 Mechelen, Belgium. E-mail: raf.de.vis@proefstation.be E-mail symposium: info@cucurbits2019.org Web: http://cucurbits2019.org/
- July 1-3, 2019, Angers (France): **Chenin Blanc International Congress**. Info: Ms. Evelyne de Pontbriand, chateau des Vaults, 1 place du Mail, 49170 Savennières, France. Phone: 33241718100, E-mail: academieduchenin@gmail.com or Mr. Patrick Baudouin, Académie du Chenin, 1 Place du mail, 49170 Savennières, France. E-mail: scientifique@cbic2019.com E-mail symposium: contact@cbic2019.com Web: https://www.cbic2019.com
- July 6-10, 2019, Malatya (Turkey): **XVII International Symposium on Apricot Breeding and Culture**. 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 Web: http://www.apricot2019.org
- July 14-18, 2019, Charlotte, NC (United States of America): **II International Symposium on Vegetable Grafting**. Info: Prof. Frank Louws, 2721 Founders Dr; 118 Kilgore Hall BOX 7609, NC State University, Raleigh, NC, 27695-760, Campus Box 7609, NC State University, Raleigh, NC 27695-7609, United States of America. Phone: (1)9195156689, E-mail: frank_louws@ncsu.edu or Dr. Chieri Kubota, The Ohio State University, Department of Horticulture and Crop Science, 330 Howlett Hall, 2001 Fyffe Ct, Columbus, OH 43210-1086, United States of America. Phone: (1)614 292-3175, Fax: (1)614 292-3505, E-mail: kubota.10@osu.edu or Dr. Penelope Perkins-Veazie, NC Research Campus, 600 Laureate Way, Suite 1329, Kannapolis, NC 28081, United States of America. E-mail: pmperkin@ncsu.edu or Dr. Xin Zhao, 1301 Fifield Hall, Horticultural Sciences, University of Florida, Gainesville, FL 32611, United States of America. Phone: (1)352-392-1928, Fax: (1)352-392-5653, E-mail: zxin@ufl.edu Web: https://projects.ncsu.edu/mckimmon/cpe/opd/VGRAFTING/
- August 12-17, 2019, Taian, Shandong (China): **IV International Conference on Fresh-Cut Produce**. Info: Prof. Qingguo Wang, Room 304, No.61 Daizong Street, Taian, 271018, China. Phone: (86)538-8249204, E-mail: wqgyyy@126.com E-mail symposium: freshcut2019@126.com Web: http://www.fresh-cut2019.com
- September 1-4, 2019, Erfurt (Germany): **XXVI International Eucarpia Symposium Section Ornamentals: Editing Novelty**. Info: Prof. Dr. Philipp Franken, Erfurt Research Centre for Horticultural, Crops, University of Applied Sciences, Erfurt, Kühnhäuserstraße 101,, 99090 Erfurt, Germany. E-mail: philipp.franken@fh-erfurt.de Web: https://www.eucarpia-ornamentals2018.org/
- September 2-5, 2019, Rovinj (Croatia): **VI International Symposium on Fig**. Info: Smiljana Goreta Ban, Institute of Agriculture and Tourism, Department of Agriculture and Nutrition, Karla Huguesa 8, 52440 Porec, Croatia. E-mail: smilja@iptpo.hr or Zeljko Prgomet, Collegium Fluminense Polytechnic of Rijeka, Trpimirova 2/V, HR-52210 Rijeka, Croatia. Phone: (385)98255791, E-mail: skink@pu.t-com.hr E-mail symposium: fig2019@iptpo.hr Web: http://fig2019.iptpo.hr
- September 14-18, 2019, Istanbul (Turkey): **IV Balkan Symposium on Fruit Growing**. 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 Web: http://www.balkanfruit2019.org

- September 30 - October 3, 2019, Guadalajara (Mexico): **IX International Symposium on New Ornamental Crops**. Info: Dr. Rodrigo Barba Gonzalez, CIATEJ a.c., Av. Normalistas # 800, Colinas de la Normal, Guadalajara Jalisco CP 44270, Mexico. Phone: (52)3333455200, Fax: (52)3333455245, E-mail: rbarba@ciatej.mx Web: http://www.newornamentalcrops.com
- October 7-11, 2019, Palermo (Italy**): International Symposium on Precision Management of Orchards and Vineyards**. Info: Dr. Riccardo Lo Bianco, Università degli Studi di Palermo, Dipartimento SAAF, Viale delle Scienze, Ed 4, 90128 Palermo, Italy. Phone: (39) 09123896097, Fax: (39) 09123860813, E-mail: riccardo.lobianco@unipa.it or Dr. Antonino Pisciotta, viale delle Scienze, 11, 90128 Palermo, Italy. E-mail: antonino.pisciotta@unipa.it or Assist. Prof. Luigi Manfrini, Università di Bologna, 40127 Bologna, Italy. E-mail: luigi.manfrini@unibo.it E-mail symposium: info@pmov2019.it Web: http://www.pmov2019.it

NEW

- October 7-11, 2019, Hyytiälä (Finland): **XI International Workshop on Sap Flow**. Info: Dr. Yann Salmon, P.O.Box 68, Faculty of Science, Department of Physics, FI-00014 University of Helsinki, Finland. E-mail: yann.salmon@helsinki.fi or Prof. Teemu Hölttä, University of Helsinki, Helsinki, Finland. E-mail: teemu.holtta@helsinki.fi Web: http://www.atm.helsinki.fi/sapflow/

NEW

- October 13-15, 2019, Wageningen (Netherlands): **VertiFarm2019: International Workshop on Vertical Farming**. Info: Prof. Dr. Leo F. M. Marcelis, Wageningen University, Horticulture & Product Physiology, Droevendaalsesteeg 1, 6708 PB Wageningen, Netherlands. Phone: (31)317485675, E-mail: leo.marcelis@wur.nl or Dr. Murat Kacira, Dept. of Agric. and Biosystems Enginering, 1177 East 4th Street, Room 403, Shantz Building, 38, Tucson, AZ 85721-0038, United States of America. Phone: (1) 520-626-4254, Fax: (1) 520-626-1700, E-mail: mkacira@email.arizona.edu or Dr. Francesco Orsini, University of Bologna, Viale fanin, 44, Bologne 40127, Italy. Phone: (39)0512096677, Fax: (39)0512096241, E-mail: f.orsini@unibo.it Web: http://www.wur.eu/vertifarm2019
- November 10-13, 2019, Pretoria (South Africa): **II International Symposium on Moringa**. Info: Ms. Sunette Laurie, ARC - Roodeplaat, Private Bag x293, 0001 Pretoria, South Africa. Phone: (27)128419639, Fax: (27)128080844, E-mail: slaurie@arc.agric.za Web: http://www.ism2019.co.za/
- December 2-4, 2019, Bangkok (Thailand): **I International Symposium on Botanical Gardens and Landscapes**. Info: Dr. Kanchit Thammasiri, Department of Plant Science, Faculty of Science, Mahidol University, Rama VI Road, Phyathai, Bangkok 10400, Thailand. Phone: (66)89-132-7015, Fax: (66)2-354-7172, E-mail: kanchitthammasiri@gmail.com E-mail symposium: bgl2019thailand@gmail.com Web: http://www.sc.mahidol.ac.th/scpl/bgl2019

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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, Fruits 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**
Kim Hummer, Editor, **hummerk@oregonstate.edu**
Kelly Van Dijck, Associate Editor, **kelly.vandijck@ishs.org**

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