

A publication of the International Society for Horticultural Science

Chronica Horticulturae



Horticultural highlights

ISHS Awards – recognising excellence and commitment • Horticultural societies respond to the pandemic • An insight into urban food systems and their social, economic and environmental impacts • Horticulture in Senegal • Medicinal plants, aromatic herbs and fragrance plants in France: a small but thriving sector with a strong traditional base and a dynamic research network • The wild poinsettia: origins of the most beautiful *Euphorbia*

Symposia and workshops

Urban Greenhouse Challenge: exploring the potential of urban farming

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FRUITS AND VEGETABLES

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

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

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

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

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Cover photograph: Wild *Euphorbia pulcherrima*, Sinaloa, Mexico. Picture taken by Mark Olson. See article p.28.

> The changing face of ISHS

Jill Stanley, ISHS Vice-President and Scientific Co-ordinator



> Jill Stanley

Heading off to an ISHS symposium

I really love that moment when I lean back and relax in my seat on the first leg of the journey overseas to an ISHS symposium. It's always a frantic period beforehand, with a huge checklist so that everything is organised at work while I'm away for a couple of weeks, and preparing my presentation for the symposium. Then I have to decide which bag to pack and what clothes will be needed in the location of the meeting. Because I'm located in the Southern Hemisphere and many symposia are in the Northern Hemisphere, it's the complete opposite in weather. It's very difficult to imagine how hot it might be when I'm in the depths of winter. And there is the stress of ensuring I have all the correct documentation: my passport is up to date, I have the necessary visas, and all the computer cords and adapter plugs are packed. But that moment on the first flight is wonderful! There is not much more I can do for work, and I can start to look forward to the experiences ahead.

Of course, it's always great to hear about the latest research being done around the world and the resulting strategic thinking. And attending the associated field trip is an opportunity to actually see the research in action near the symposium location, as well as see what the horticultural industry there is practicing. But the most valuable benefits, in my opinion, are the social interactions at coffee breaks, lunchtime and dinners. These are times when you can catch up with colleagues who, over the years, have become good friends, and when you meet new emerging researchers, who bring new thinking to the mix. These are the times when those new ideas develop, new collaborations are initiated and student visits across the world are planned.

The new world

Twelve months ago, I doubt any of us could have anticipated the different world we would be living in now. COVID-19 has spread around the world over many months and continues to cause havoc and loss of life, and

severely restricts international travel. For ISHS and its members, it has resulted in the postponement of many symposia, and in a few cases cancellation. In the initial phases of the pandemic, we did not realise just how long the effect would last, but now we realise that it will still be many months before a vaccine is available extensively and people are travelling more widely.

If we continue to postpone symposia, they will start to bunch up so that symposia with similar topics will be close together. It also starts to affect students, who want the opportunity to present a paper at an international symposium as part of their career development and PhD experience. Lastly, too many postponements will affect the flow of publication of *Acta Horticulturae*, the proceedings arising from symposia. This would result in a lack of work for our ISHS staff at the Secretariat, and then a huge workload when suddenly lots of symposia are being held.

This has caused us to accept that we, as a society, need to adopt a different strategy.



> The ISHS Executive Committee met for an online meeting in September 2020. The members were caught at a moment of serious contemplation in this image. The attendees of the meeting, which included Board, Executive Committee, and Secretariat, totalled 27.

We now encourage symposia conveners to prepare for fully online or hybrid symposia. A hybrid symposium would mean those who are able to travel to the symposium location are there in person, whilst those unable to travel there can attend online. Other organisations, such as the American Society for Horticultural Science, have already held a fully online conference very successfully. For ISHS however, we have the added challenge of delegates from all time zones around the world.

For both these new formats, the conveners will decide whether all online presenters pre-record their presentation, or if they also have the option to present live. All presentations will need to be available for delegates to watch later if the symposium is during their night time. Of course conveners will still need to charge sufficient registration fees to online participants to cover their costs which will include costs of the Professional Conference Organisers, technical support for the online/video components, the publication of *Acta Horticulturae*, and the costs for the conference centre. Even if the symposium is fully online, there may be loss of the deposit for the physical conference centre or other penalty costs due to caterers or hotels. On the plus side, online attendees will not have to cover the significant personal travel costs. Some conveners have committed to fully online meetings, such as the IV International Symposium on Horticulture in Europe and

the IV International Symposium on Woody Ornamentals of the Temperate Zone. Other conveners are planning hybrid symposia, such as the IX International Strawberry Symposium.

Webinars

In discussion with the ISHS Executive Committee, we, of the Board, are exploring the idea of offering webinars to members on global challenges and topics of interest to particular groups, as mentioned previously by the President in her Editorial in *Chronica Horticulturae* 60 (3), 3–4. We are developing a plan and are identifying top speakers to launch the online series.

New way of working

The ISHS management teams have also had to develop new ways of working. The ISHS Board has met virtually several times. This has worked well because we are a small team. Online discussion panels fit on one screen and are easy to see. One of our difficulties is that someone has to attend the meeting in the middle of the night because we diverse Board members represent five continents. Whilst we addressed the urgent business, we realised that a face-to-face meeting is so much more valuable, as articulated by our Secretary, Silvana Nicola, in the last *Chronica Horticulturae* (60 (3), 7). Less easy has been the meeting of the Executive Committee, which is chaired by the

Vice-President. The Executive Committee comprises the chairs of the 14 Divisions and 3 Commissions, as well as the ISHS Board, and Kelly Van Dijck from the Secretariat, so a total of 27 people. This group drives the scientific programme of the society. Normally the Executive Committee meets annually in person, however, it wasn't possible this year. For the first time in the history of ISHS, the Executive Committee met via Zoom for two 3-hour sessions. To facilitate discussion with such a large group, we divided into four break-out rooms, each of which had a note taker who reported back to the whole group. We had to be extremely concise in reporting and commenting. Whilst we did manage to get through the most vital decisions, it certainly didn't allow us to engage in the in-depth discussion that we can undertake in a face-to-face meeting.

Moving forward

The strength of ISHS is in our ability to bring horticultural professionals together, to share knowledge and friendships. The pandemic is hindering this ability, but we are doing our best to find interim solutions. We look forward to the day when we can be together again face-to-face.

In New Zealand, we have a Māori saying that we tell each other in difficult situations: “Kia kaha”, which means “be strong, keep going”. And so I say to you all: kia kaha! ●



» Did you renew your ISHS membership?

Logon to www.ishs.org/members and renew online!

ISHS Awards – recognising excellence and commitment

Ian Warrington

Introduction

In addition to their primary scientific endeavours, a key role of professional scientific societies is to recognise members who are outstanding in their field or have made exceptional contributions to their society. The International Society for Horticultural Science (ISHS), the premier horticultural society internationally, is no exception. The ISHS has two award options for individual members, **Honorary Member** and **Fellow**. In addition, the Society has the **Horticulture Innovation Award** that is focused on recognising the achievements of individuals, groups and commercial entities.

Discussions with other ISHS members and with staff of the Secretariat have shown that many members are unaware of, or are unfamiliar with, these awards. Significantly, ISHS members may not know that any member is eligible to nominate colleagues to be considered for such recognition. This article has been written to describe these awards and to encourage ISHS members to prepare nominations, as appropriate, for these prestigious awards. The specific procedures, the three types of awards, and the present status of the awards are described. The article concludes with a challenge to all members.

ISHS Awards

The **Honorary Member Award** is presented to an ISHS member to recognize exceptional service to the ISHS over the course of her/his membership. A certificate is given to the recipients of the award. Honorary Members are appointed for life by the General Assembly and the membership comes with complimentary ISHS membership for life.

The **ISHS Fellow Award** is presented to a member of ISHS, in recognition of her/his highly meritorious achievements in horticultural science. A precious metal pin and a certificate is given to the recipients of this award. Awarded by the Council, the total number of living ISHS Fellows shall not exceed 1% of the total membership, averaged over a period of the previous five years. The **Horticulture Innovation Award** is the highest recognition granted by the ISHS Council to a person, group of people, institution, or commercial company for an exceptional contribution to horticulture innovation. This award is especially addressed to those with innovative ideas that create new

products and services which are regarded as important landmarks in the progress of horticulture at an international level. A trophy and a certificate are given to the recipients of this award.

These awards are important to individual members of the ISHS. They provide recognition to those individuals so that they can demonstrate their recognised value internationally to their employer, to their local industries, and to their peers.

For the ISHS, the awards provide the chance to recognise the outstanding contributions of deserving members and to celebrate the scientific achievements of horticultural scientists worldwide. Such awards also have other wider benefits. They:

- Encourage other members of the ISHS to commit to serving the Society,
- Demonstrate publicly the levels of excellence being achieved by ISHS members,
- Demonstrate to wider humankind the contributions being made by horticultural scientists to sustainable food security, innovation, and fundamental science, and
- Reflect in a positive way the levels of professionalism that are achieved within the membership of the ISHS.

Presently, the number of nominations put forward by members annually for each of the three awards detailed above remains very low.

Current status – Honorary Members

There have been 52 members recognised as Honorary Members since 1970. However, of that total, only 28 are living. In addition, the vast majority (i.e., nearly all) of those current Honorary Members are over the age of 65 and are retired. Further examination of those current/living Honorary Members indicates that around 40% were previous ISHS Board members, 40% were previous Executive Committee members, with the balance having been involved with Congresses.

This record also shows that more recently, from 2002 to 2018 (16 years), only 28 awards were made (little more than one per year). Most awards were made in the year of an ISHS Congress. Furthermore, of the 28 current/living Honorary Members, 16 (57%) are from Europe, 7 (25%) from North America, 3 (11%) from Australia and New Zealand, and 2

(7%) from Asia. Hence there are no Honorary Members currently from either South America or Africa.

Only three Honorary Members (11% of the total) are women.

Current status – Fellows

Since 2002, only 23 members have been made Fellows. Of those, 20 are living. However, as with the Honorary Members, most of the Fellows are either retired or over 65 years of age. Of the 20 living Fellows, 7 are from Europe (35%), 6 are from the USA (30%), 5 are from Australia/New Zealand (25%) and 2 are from Asia (10%). There are no Fellows from South America or Africa.

Only two of the 20 Fellows (10%) are women.

Current status – the Horticulture Innovation Award

This is a recent addition to the ISHS Awards, having been introduced in 2014. Three awards have since been made:

- Compac Sorting Equipment Ltd. (New Zealand) 2014
- Suntory Flowers Ltd. (Japan) 2016
- Shaanxi Haisheng Fresh Fruit Juice Co., Ltd. (China) 2018

The challenge

The ISHS has a large number of individual members who actively serve the Society through:

- Membership of the Board – seven voting members per term,
- Membership of the Executive Committee – chairs and vice-chairs of 14 Divisions and 3 Commissions, and others who are chairs of numerous Working Groups,
- Membership of the Council,
- Conveners and committee members of around 40-50 ISHS symposia per year,
- Editors of around 40-50 *Acta Horticulturae* volumes per annum,
- Editors of *Scripta Horticulturae* volumes, and
- Chairs and committee members of the ISHS International and Regional Congresses that are held every four years.

In aggregate, this represents over 200 members who are contributing in some significant way to the various activities and affairs of the Society annually. The majority of these will be recognised through the award of an ISHS Medal. However, with regard to Honor-

ary Membership, a number of these will be providing **exceptional service** that deserves greater recognition. That number will certainly be more than the current level of recognition of only one per year!

No limit to the number of living Honorary Members is set in the Statutes. However, if 1% of the current membership is considered reasonable, clearly 30-40 members could be awarded with Honorary Membership at this time.

Regarding Fellows, the ISHS has a significant number of members who have demonstrated **highly meritorious achievements** in their respective fields in many different countries around the world. That number across the approx. 5500 members will certainly be more than one per year! It is an indictment on the Society that so few active scientists of international acclaim have been recognised through the award of a Fellow, especially when those same members have attained high professional honours in their home countries.

The current number of living Fellows (20) falls well short of the number that is allowed for in the Rules of the Society (1% of total membership averaged over the previous five years). With the current membership number, the ISHS could have around 50-60 Fellows (i.e., three times more than at present).

For both awards, the current age distribution of those holding awards is not representative of the membership. These awards should be career awards and not be awarded only to those who have retired. Similarly, the distribution across geographical regions is not representative of the distribution of the ISHS membership and this imbalance needs to be addressed. Equally, the gender distribution is not representative of the distribution within the ISHS membership and that disparity needs to be addressed urgently.

The Horticulture Innovation Awards that have been made since 2014 are indicative of the exciting developments that occur globally on an annual basis within the wider horticulture sector. This award brings prestige to individuals, groups and commercial organisations who are recipients and can also reflect well on the levels of innovation and excellence that are taking place within horticultural sectors and even countries. It seems reasonable to expect that such an award should be made annually given the diversity of horticulture and the frequent contributions being made on a regular basis within horticultural science.

The Awards Committee

The **ISHS Awards Committee** is a standing committee that evaluates and recommends to Council the nominations for Honorary Members, ISHS Fellows and Horticulture

Innovation Awards. The committee is composed of six voting members plus the chairperson. The President of the ISHS or nominated Board member chairs the committee. Decisions are taken by majority of all voting members. A recommendation for an award must receive five favourable votes. Voting members within the Awards Committee are appointed by the Council for a 4-year term and can be reappointed; the Awards Committee decides about its internal organization and functioning.

Standards for the ISHS Awards

The standards for the awards are set by the Awards Committee and are not disclosed. However, the achievements of current recipients provide some indication of what is expected.

For Honorary Member awards, the candidates should demonstrate exceptional service to the Society. Typically, this is demonstrated as being a:

- Board member for at least two 4-year terms, **plus** membership of either the Executive Committee (two 4-year terms) or of the Council (two 4-year terms) – i.e., 12-16 years of commitment to the ISHS at the highest levels, or
- Division (previously Section or Commission) Chair for at least two 4-year terms, **plus** convener/co-convener of at least two ISHS symposia, **plus** editor/co-editor of at least one *Acta Horticulturae*, or
- Convener/co-convener of at least four ISHS symposia **plus** editor/co-editor of at least four *Acta Horticulturae*.

For Fellows, typical achievements are as follows:

- Sustained output of refereed manuscripts over at least 30 years, with more than 100-120 such manuscripts or books/book chapters, is expected – **plus** significant involvement in international conferences including in the role of an invited speaker, **plus** evidence of leadership at an international level in their specific area of horticultural research, or
- Sustained output of extension/advisory publications over an extended period of time **plus** evidence of outstanding performance in areas relating to technology transfer and adoption, or
- Sustained release of new cultivars **plus** a significant number of refereed manuscripts, **plus** evidence of leadership at an international level in their specific area of horticultural science.

Nominating your colleagues

Each member should consider nominating other ISHS colleagues who can be shown to meet the exemplary standards expected for these prestigious awards. All nominations

are kept confidential throughout the nomination process – including to the nominee.

The key to any nomination is for the proposer to prepare a well-reasoned **nomination statement** showing that the candidate meets the very high standards required for the award. This statement should be supported by a **full curriculum vitae** for a Fellow Award – usually obtainable from the web or on a confidential basis from a colleague of the nominee. For Honorary Member nominations, a **record of the nominee's contributions to the ISHS** can be sought from the ISHS website (ishs.org) using the surname in the search option provided. This is particularly helpful in terms of preparing lists of *Acta Horticulturae* publications, the details of symposia that have been organised and the *Acta Horticulturae* volumes that have been edited. Membership lists detail the roles served on the Board, Executive Committee (including Working Groups) and Council. Some assistance from headquarters staff may be necessary to confirm specific dates of service within these various roles.

Once the nomination is prepared, together with a cover letter, **five letters of support from at least three different countries** are required for each nomination.

The coordinated nomination is submitted to the Executive Director in confidence. Nominations can be prepared and submitted for consideration by the Awards Committee at any time during the year.

Concluding comments

There are currently few nominations submitted annually for ISHS Awards. In fact, less than a handful of members have taken time to seek recognition of their colleagues over the past 50 years. Individual ISHS members should consider nominating those colleagues who have made exceptional contributions to the ISHS and/or those who have made highly meritorious contributions to international science.

These should be career awards and not be limited to retirement awards for only a few members. In particular, the current imbalance in gender, race, ethnicity, and geographical distribution of these awards must be addressed. ●



> Ian Warrington

> About the author

Emeritus Professor Ian Warrington served on the ISHS Council (1990-2002), the Board as Vice-President and Chair of the Executive Committee (2002-2010) and was Congress Co-Chair (2010-2014). He is a Fellow and Honorary Member of ISHS. Before retirement, he was Deputy Vice-Chancellor of Massey University and, previously, Chief

Executive of The Horticulture and Food Research Institute (HortResearch, now Plant & Food Research) in New Zealand. He is currently the editor of Horticultural Reviews, serves on several charitable trusts and runs courses on scientific writing and publishing around the world. E-mail: ianjw@xtra.co.nz



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➤ António Monteiro

Position or previous position

Owner and Managing Director of Quinta do Ermizio winery; Full Professor, University of Lisbon (retired); Past-president of ISHS; Vice-Rector of the Technical University of Lisbon

ISHS honour

ISHS Honorary Member

1. Tell us a bit about yourself (hometown, present location, family, hobbies, and community involvement).

I was born in Batalha, Portugal, a small town 100 km north of Lisbon. Batalha is very well known to the Portuguese people due to the Monastery of Batalha, now designated as a UNESCO World Heritage Center. This Monastery has high historic relevance to Portugal and I am proud to be born in such a renowned location.

I was raised on my father's farm, 2 km from the Monastery. I grew up with milk cows, vineyards, olives, orchards, and pine forests. I attended the grammar school in the village. This was a real rural environment where I had an intense contact with agriculture, the opportunity to learn about the mysteries of nature, and to enjoy interaction with local people.

My parents intended to give me, and my two sisters, a good education, and so we moved to Lisbon where I attended a prestigious Jesuit secondary school. Moving from the village to the big city was a big change physically, emotionally, and personally. In addition, I began living in an apartment with my sisters but far away from my parents, who continued to live in Batalha. As a teenager, I had total freedom and became used to deciding by myself about studies, hobbies, and friendships. This self-responsibility as a young boy made me very independent and able to make decisions, and to suffer their consequences. When I became old enough for college, I took the natural decision to follow my Batalha roots to study agriculture. In 1969, I entered the Instituto Superior de Agronomia (ISA) of the Technical University of Lisbon, the same school where my father graduated in agriculture 25 years before.

At that time, ISA was the only school of agriculture in Portugal! There was no other choice. ISA had a famous rugby team and I



➤ Rugby team of Instituto Superior de Agronomia (ISA), Lisbon, 1972.

started playing rugby. Rugby is a wonderful sport and when you play rugby once, you become a rugby fan for the rest of your life. Team building and fair play are critical. Rugby friends become your best friends. I only realized the importance of playing rugby much later as a team leader during my professional life. Living in a big city like Lisbon gave me the opportunity to attend a diversity of activities such as classical music, cinema, sports, fine arts, and car racing. I particularly remember the movies, the French and Italian "Nouvelle Vague", the Italian neo-realism and the American Westerns. Seeing a movie was very relaxing, particularly the day before important examinations. My other hobbies were fishing, hunting, and sailing. I could not focus on a single hobby because it would become a passion, and not an escape to relax from student and professional activity.

Later on, I developed a particular interest for contemporary art, and spent many happy hours visiting art galleries. I also started a small personal collection of contemporary art. My preference was for the works of artists of my age because those were the only ones I could afford. It is difficult to find more contrast than between contemporary art and horticulture. Not only the subject but particularly the people. It is like speaking a different language. My art collection has been growing for some time. I find it interesting to look back and to see that some

artists that I have collected have now developed international reputation and become famous.

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

I started my career in horticulture by chance. It was something completely outside of my plans when I graduated. However, I do not regret having embraced horticulture, and it was the best professional decision I could have ever taken. I can explain why.

I finished my degree in agriculture in 1974, the year of the Carnation Revolution in Portugal. The revolution was in April and I graduated in July. This was a time of political turmoil and economic difficulties. I worked for one year in a tomato processing company but could not continue. In the summer of 1975, I had no job and was considering the possibility of emigrating. However, I successfully applied to a position of lecturer in horticulture at ISA, the school where I had graduated the previous year. I considered this to be provisional until I could find a "proper" job, but I felt comfortable with the position. I could use my experience of orchard management from my father's farm and the work at the tomato company, as experience for teaching horticulture. However, in October, when the semester started, the professor in charge of the course became ill. The senior lecturer was in England preparing his Ph.D., and I and another junior colleague had the full responsibility for the annual course with 180 students who were almost my age. What an experience!

In 1976, I applied for a position in the Nestle Company, in Portugal, and was selected among a high number of candidates following a quite long and complex process. However, at the meeting with the Nestle CEO to discuss the terms of my contract, I decided to reject their offer. The decision to throw away such a well-paid and prestigious job was difficult for my family and friends to understand. My choice to continue at the university was firm.

The following year, I attended a four-month international course on vegetable production at the International Agricultural Centre (IAC), Wageningen, The Netherlands. This course had little classroom instruction and mainly consisted of visits to growers and horticulture facilities throughout the country. I became dazzled by the new technologies and the potential of horticulture. Horticulture was to be the choice for my future career at the university.



› Visiting a Brassica field with Professor Paul Williams during the 1st ISHS Brassica Symposium, Lisbon, November 1994.

After I returned to Portugal, I realized that I needed a Ph.D. to continue lecturing. In those days, one could start with a five-year contract as lecturer, and acquire their Ph.D. during this time. My thesis was about greenhouse tomato fruit-set and was prepared under the supervision and advice of Professor Carlos Portas.

I still remember his major recommendation. “A Ph.D. thesis,” he said, “is like building a brick wall. You need to add a new brick every day.” In 1983, I defended my thesis and graduated with my diploma, and became definitively involved with horticulture.

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

In practice, the Ph.D. granted me university tenure as an assistant professor of horticulture. The Ph.D. was the biggest obstacle that any lecturer had to overcome to pursue a university career.

My first priority was to develop international experience. I was already a member of ISHS and had attended the International Horticultural Congress in Davis, USA, in 1986. This meeting was fundamental for me to establish contacts for a potential sabbatical leave in the USA.

In 1987, I stayed for one year at the University of Wisconsin-Madison, doing research on Brassica disease resistance with Professor Paul Williams. This was the beginning of a long research project in Brassica diversity

and disease resistance. In Madison I also had the opportunity for close contact with top research groups at the Department of Horticulture, particularly with Professors Warren Gabelman and Fred Bliss. This was a very positive experience that allowed involvement with international groups and paved the way for future research activity at home.

Back to Portugal, I accepted the position of Director of the Department of Vegetable and Flower (DHF) crops at the National Institute for Agrarian Research (INIA). In this position, I was allowed to keep my teaching activity at ISA, something that I could not live without. My priority at INIA-DHF was to invest in the development of a group of young researchers with the objective of creating a coherent research team. Four years later, back to ISA, I was elected Chair of the Department of Crop and Animal Production. The leadership of a department, which included the sections of horticulture, agronomy and animal husbandry, each one in a different building, was a big challenge. The 1990s were a time of full dedication to ISA with new research projects, intensive teaching and various position assignments for me, e.g., Chairman of Scientific Council, Coordinator of undergraduate courses in agriculture, Scientific head of the Centre for Biosystem Engineering, and Coordinator of the Master in Horticulture program.

In 1995, the Ministry of Agriculture launched the Program for the Modernization of

Agriculture and Forestry (PAMAF), a research program that funded many projects involving research institutions and stakeholders. I was invited to coordinate the horticulture branch of the program. This was an interesting experience because the aim of the program was to maximize knowledge transfer to stakeholders and it was a live lab of the challenges and particularities of horticultural research.

I have lectured horticulture related topics throughout my career. This is something I love to do. First, because I like horticulture; second because teaching is an opportunity to interact with students. Many years ago, an older and very prestigious professor of ISA was complaining to me about the student quality and behavior. He became astonished when I immediately replied by saying that students were the most valuable component of the university.

Besides ISA, I have also lectured horticulture at the University of Évora, University of the Azores, and Mediterranean Agronomic Institute of Chania (MAIHC), Chania, Greece.

As full professor, I have participated in countless committees for faculty evaluation and candidate selection. The evaluation of people is one of the most difficult tasks one can be asked to do. Notwithstanding my experience of evaluating students, these committees were very demanding due to the complexity of the evaluation and the omnipresent academic lobbies.

I was President of the Portuguese Horticulture Association (APH) for two terms, from 1988 to 1992. This was my first experience in leadership of a scientific society, which helped a lot when, much later, I became a Board member of the ISHS. In 2013, I was appointed Vice-Rector of the Technical University of Lisbon. The main objective of the Rector's team was to prepare the merge between the Technical University of Lisbon and the Classical University of Lisbon, the two bigger universities in the city. There was much complementarity between the two universities but the negotiations were complex due to huge cultural differences. The new, merged, University of Lisbon created two years later, became the largest in Portugal and is now highly ranked internationally.

I enjoy horticulture teaching and research, but horticultural production is incomparable. In 1982, my cousin and I started a nursery to produce cut-flowers. This nursery is in my home town, Batalha, on land rented from my father. My cousin is the managing director and I visit the nursery during my free time at the university. Flower growing is an excellent field to apply horticultural science to. For me, this project was very useful for teaching. I could use my practical experience to motivate students for learning by doing.



➤ ISHS Board 1998-2002, Toronto, August 2002.

I am now fully retired from academia. In retirement, I work as a wine producer in Quinta do Ermizio, a small wine estate in Minho, Northwestern Portugal. This estate has been in my family for several generations, inherited from my mother's side. We grow the grapes, and produce and bottle the wine, which is mainly exported. Running a winery is quite a challenge. I used to say that selling a bottle of wine is much more difficult than writing a scientific paper. Believe me.

4. What do you consider to be your greatest achievements?

My great achievement was the hundreds of undergraduate students and the almost 50 graduate students that I trained. It is always with great pleasure that I meet former students occupying the most diverse positions in Portugal and abroad. I particularly like teaching but as I have always said to my students, I don't teach them, I just help them to learn. Not all students understand the subtle difference between teaching and learning but those who did have benefited from my "odd" teaching methods.

My most important scientific contribution was the characterization of Portuguese cabbage landraces using molecular markers and the consequent identification of genes for disease resistance. The most important gene that we observed conferred resistance to downy mildew. We determined its expression in the plant at cotyledon and adult plant stages. I was very pleased to know that a method for early detection of downy mildew was put into practice in Brittany, France, using the molecular markers developed by my research team.

Finally, I consider that the organisation of the IHC2010 in Lisbon was a great achievement. I had the pleasure of leading a great team of Portuguese and Spanish colleagues in collaboration with Dr. Víctor Galán Saúco, the other co-president of the congress and

with Professor Luis Rallo, the chair of the Scientific Committee. The high number of participants, the diversity of the numerous presentations and the active participation of people from the horticulture industry was recognised by many as a landmark in the organization of ISHS congresses.

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

Difficulties are part of life and we only value what is hard to obtain. I really do not remember anything in my professional life that was easy to get, particularly when I intended to do the best I could. Here are two examples: Preparing my Ph.D. thesis was very difficult because at that time research support was not established as routine at the university. I was on my own and there was no lab and no infrastructures such as greenhouses for my research. I had to start everything from scratch with a grant from the Ministry of Science. The supervisor was advised solely on the science and remained independent of student work. The only positive aspect of this odd system was the self-confidence one gets at the end of such a difficult process. After having successfully defended my thesis I felt that I was prepared to engage in whatever was needed in my professional activity. The preparation of the IHC2010 was a long up and down process. In 1998, Portugal and Spain first submitted a bid to host the IHC in Seville, Spain. That year we lost to South Korea for their proposal for Seoul 2006. Following this defeat, we changed the concept of congress, moved the venue from Seville to Lisbon, Portugal, and bid again in 2002, with a brand-new proposal, which defeated Turkey

and Australia. In the evening of that day, after the Council dinner, the Portuguese and Spanish group went for a happy celebration of the victory.

However, back in Portugal my happiness was gone with the realization of the reality of putting the actual congress in place. The financial risk was enormous. Getting sponsorship was very difficult. During the planning, I had disparaged being involved in the congress organization and wished it to be done. But the congress was a success. When dreams come true, as ours did, one easily forgets all the difficulties, and thank God, for not having given up.

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

I could remember many experiences, some funny and others unfortunately very sad. My choice goes to a situation that happened when I was working as a consultant to a FAO-funded project on protected cultivation, in Egypt, in the early 1990s.

I confess that I was very negatively impressed by the bureaucracy at FAO headquarters in Rome. As a consultant, I had to submit a written report to FAO Rome every time I visited the project. Then the report had to be cleared by two officers, one responsible for horticultural crops and the other for the Middle East. Due to this delay, the official reports were sent to the project director too late. My previous report was approved when I was almost visiting the project the following time. Very inefficient indeed.

During my visits to the project I made acquaintance with some very nice and interested young horticulturists. Some of them cautiously invited me, off the record,



➤ Chairing the Council meeting as President of ISHS, Lisbon, August 2010.

to visit growers who they were privately advising. They were experimenting with the new methods and growing techniques that they learned during the project. It was funny to see how some of my recommendations were already being successfully implemented before my official reports had arrived at Cairo. This is what I would call a very efficient “extension service”.

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?

When I started teaching horticulture at ISA I felt rather lonely. The horticultural community was incipient in Portugal at the time and international contacts were scarce. Prof. Carlos Portas suggested that I become a member of the ISHS in 1976. My first congress was Hamburg in 1982. I still remember the emotion inside of me when I gave my first oral presentation to a large international audience. This congress was followed by numerous congresses, symposia, council meetings, and other ISHS activities, which became the cornerstone of my international scientific activity during the past 40 years.

There is no need to explain the importance of ISHS meetings and publications for a career fully devoted to horticulture. I would just like to emphasise two benefits.

Firstly, the ISHS gave me the opportunity to meet colleagues of the highest scientific and human quality, some of them outstanding horticultural scientists and professors from whom I have learned greatly. Particularly during Council and Executive Committee meetings I had the opportunity to exchange ideas with the best contacts anywhere in the world. I felt on the cutting edge of horticultural science, teaching trends and new developments.

Secondly, the ISHS was an opportunity to meet people from all over the world and to understand the deep cultural differences between East and West or North and South. It is sometimes very difficult to be in tune during a conversation with a colleague who understands the world in quite a different or even the opposite way. Particularly for somebody like me, from a Southern Europe-



➤ Owner and Managing Director of Quinta do Ermizio winery and vineyards, March 2018.

an Latin country, it took quite a while to fit into a Society designed and run according to Anglo-Saxon culture. It is not a matter of which is better but rather the need to understand how to cope with the different culture and to take advantage of it.

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

I do not give advice to young people because there is no need. They have bright ideas and know what to do. I have always been available to advise on particular topics upon request, but never to say what someone should do. It is a risky business. At the university, I learned that students are usually more informed about career issues than faculty members. Students are on the terrain, have more contact with colleagues, and rapidly understand the sudden changes in career development.

I prefer to promote the opportunities in horticulture, to explain the beauty and potential of horticultural science but to leave to young

people the ability to discover the magic door that gives access to such an amazing world.

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

I see a great future for horticulture worldwide. It is a promising industry due to the positive image of fruits and vegetables, their increasing importance in human diet, and well-known benefits for health. Horticulture interacts with some of the most challenging questions related to human activity such as climate change, environmental impact, sustainability, and preservation of resources. However, the high number and diversity of crops and activities comprised by horticulture make the definition of horticulture borders puzzling. We cannot tag horticulture to a particular type of science. Almost all good science can be relevant to horticulture.

On the other hand, we sadly see horticulture departments and horticulture research institutions being renamed or under pressure particularly in developed countries. Why is horticultural science not showing the same dynamics as horticulture industry? This is a complex and highly relevant question for the ISHS that cannot be answered here. I just want to leave a clue.

Jules Janick wrote that Horticulture is not a science but there is science in horticulture. Where is this science that continues to be important for horticultural, technological and economic development? Young scientists producing relevant research for horticulture do not consider themselves as horticultural scientists. Also, the classical department of horticulture is relatively less important. Yet, relevant horticultural research is being performed in departments of basic sciences or new technologies. So, how can we identify opportunities in horticultural science when this area is so difficult to define?

I see a bright future for science relevant to horticulture. We know that most of the cutting edge and fashionable research is fundamental for horticulture. The science horticulture needs is diverse and dispersed and cannot be tagged as was previously done, but the opportunities for producing top horticultural science are endless. ●



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> Horticultural societies respond to the pandemic

Kim E. Hummer, Editor, *Chronica Horticulturae*

The COVID-19 pandemic has shut down in-person meetings across the world during the past year. Several of us were wondering what horticultural societies in different countries have done to deal with this situation. I asked Professor Dr. K.L. Chadha, the President of the Indian Academy of Horticultural Sciences, Professor Dr. Maurizio Lambardi, the General Secretary of the Italian Society for Horticultural Science (SOI), and Dr. Dennis T. Ray, the President of the American Society for Horticultural Science, to each prepare an article summarizing the activities of their respective societies over the past year. Each of our societies had to refrain from gathering in large groups but found ways to cope and bring their families of horticultural scientists together to communicate and share research results despite all odds. Here are their three summaries. Our Societies will have to be resilient for at least another year, or so it seems, until vaccines release us from the grips of this virus. We all need to be patient and vigilant in wearing masks and keeping social distance until we are able to meet again.

Activities during the COVID-19 pandemic by the Indian Academy of Horticultural Sciences (formerly the Horticultural Society of India), New Delhi

Krishan Lal Chadha

COVID-19 has affected almost all types of activities in a large number of countries during the year 2020. India is not an exception and various activities, including those of scientific societies, have also been affected. There has been an adverse effect on carrying out the regular activities due to a ban on public gathering, non-availability of auditoria/conference halls, restricted transport facilities, and, above all, general fear among the members to expose themselves to COVID-19. As far as the Indian Academy of Horticultural Sciences (IAHS) is concerned, all of its activities have been adversely affected. For instance, the 9th Indian Horticultural Congress 2020, which had been scheduled to be held on 6-9 November 2020, in Jaipur, Rajasthan, India, had to be deferred by a year. It is now proposed to be held in 2021. The congress is normally attended by close to 750-1000 delegates comprised of scientists, academics, students,

farmers, and industry professionals, besides other stakeholders. Similarly, the Executive Council meeting of the IAHS, which is required to be held twice per year, has also been affected. This year, the members could not attend the meeting in person. However, the meeting was held using an online platform. Surprisingly, 18 out of 20 members attended the two and a half hour meeting. It resulted in discussion and decisions on the regular agenda items scheduled for the meeting as well as future plans of the Academy. Even one of the Vice Presidents, who was travel-restricted in New Zealand, could participate online and contribute to the deliberation. The second Executive Committee meeting is proposed to be held on 4 November 2020.

The Academy proposes to hold its Foundation Day celebration on 6 November 2020, with an online platform. This year, Dr. Trilochan Mohapatra, Secretary, Department of Agricultural Research and Education, Government of India and Director General, Indian Council of Agricultural Research (ICAR), who is also the President, National Academy

of Agricultural Sciences, New Delhi, India, has agreed to deliver the prestigious lecture "Next generation revolution in horticulture sector for achieving self-sufficiency." This would be given in a hybrid mode where he would be speaking online, while the local office bearers of the Academy would be assembling together to listen to him personally. They would also coordinate the activities of the Foundation Day celebration.

The Academy has also planned to hold a brainstorming session on "Honeybees and other pollinators in horticulture," sometime in December 2020, in which about 50 scientists related to the subject are proposed to be invited to participate. The recommendation of the deliberation will be published as a strategy paper.

Similarly, the annual general body meeting (AGM) of the Academy will also be held sometime in December 2020 using virtual mode. Here again, while local office bearers would be attending in person, outside members would be participating online. Besides, conducting normal business of the academy,



> Krishan Lal Chadha

> About the author

Dr. K.L. Chadha (Padma Shri Awardee, Govt. of India) is currently President of the Indian Academy of Horticultural Sciences (formerly the Horticultural Society of India). He received an M.Sc. (Hort.) degree from Punjab University (PU), Chandigarh and a Ph.D. from the Indian Agricultural Research Institute (IARI), New Delhi. He has served in various capacities at IARI, New Delhi; Punjab Agricultural University (PAU), Ludhiana; and Central Mango Research Station, Lucknow. He was the Director, Indian Institute of Horticultural Research (IIHR), Bengaluru; Horticulture Commissioner and Executive Director, National Horticulture Board, Govt. of India; Deputy Director General (Hort.), Indian Council of Agricultural Research (ICAR); and ICAR-National Professor (Hort.) at IARI, New Delhi. He is known for development of R&D in horticulture in India through sourcing of funds, building of research infrastructure, promoting research in hi-tech areas and producing literature on different horticultural crops and aspects. E-mail: klchadha@gmail.com

the 11 new Fellows of the Academy would be inducted in virtual presence of the office bearers, members, guests and other eminent personalities.

Even though such type of meetings, seminars, brainstorming sessions are being organized, these cannot effectively substitute for the existing system of inviting relevant experts and making deliberations in person. The academy/societies have no other option but to take full advantage of the virtual alternatives.

This situation is a boon in disguise in that the expenditures of travel and lodging can be eliminated. Scientific deliberation can now be held with a huge participation on different online platforms even across the globe with limited expenses. However, it is expected that the restrictions caused by COVID-19 will be relaxed soon. The routine system of holding in person seminars/symposia and other such scientific meetings will return for the benefit of different stakeholders and members.

Italian Society for Horticultural Science (SOI)

Maurizio Lambardi

The COVID-19 pandemic heavily influenced the activity of the Italian Society for Horticultural Science (SOI) planned for the year 2020. The main conference of the Society (XIII Giornate Scientifiche SOI), two National Congresses (chestnut and micropropagation), the collaboration in the organization of two ISHS Symposia, as well as numerous other Workshops, Seminars, Exhibitions, Conferences, Technical Meetings have been cancelled or postponed to 2021.

Despite the difficulties caused by the long lockdown period and by the ban on organizing participatory events, the Society was committed to providing an important information service to its members. The activities carried out concerned:

- The Annual Assembly (June 25) on the online platform, with the participation of about 50 members. In addition, four General Executive Councils and one Presidential Council were held, again online.
- The programming of webinars, open to all, on topics prepared by the 14 Working Groups of the Society. Some of the webinars have already been held, other are scheduled for the end of 2020 and the first months of 2021. Some topics included in the program are: kiwi problematics, the rational and eco-sustainable management of almond orchards, innovation in the micropropagation of hazelnut, plant breeding's right as a tool for the competitiveness of Italian fruit growing, compulsory and voluntary qualification

systems for nursery productions, olive micropropagation: problems and prospects, teaching and research in the tree systems sector. The webinars held up to now have found considerable interest and wide participation.

- The development of topics related to horticulture, through monthly interviews with scientists and experts, carried out by journalists from an important online platform, Image-Line. The purpose of the agreement between SOI and Image-Line is to improve the effectiveness in the dissemination of data and research results in the agricultural sector. The experimentation activity does not stop and it is therefore essential to work on the speed of diffusion of innovation and technology in agriculture. The search for information is provided more and more from the web, which offers sector operators the possibility of accessing an almost unlimited number of sources and news at any time. For dissemination, it is therefore essential to be able to use digital tools. With this in mind, the agreement between SOI and Image-Line was born. Articles, insights, videos, interviews, tutorials and events will be made, launched and disseminated through the Plantgest® web portal, the reference point for choices related to plant cultivation, from fruit trees to vegetables up to extensive crops. The topics dealt with so far have concerned: the varieties and the defence of citrus (January), the cultivation of blueberry (February), the tropical fruits (March), the fruit nursery (April), almond (May), innovation in vegetables (June), industrial tomato (July), quality micropropagation (August). All the interviews are available on the SOI website.
- The publication of two issues of the journal *Italus Hortus*. *Italus Hortus* (ISSN 1127-3496) is a free Open Access, peer-reviewed online journal published by the SOI, indexed by Scopus. All accepted articles are published free of charge and have a DOI. The journal is published four-monthly (April, August and December). The Journal publishes the most recent research results dealing with all aspects of horticulture. These include a broad range of topics, such as breeding of horticultural plant species, physiology and biochemistry of horticultural crops, propagation and nursery technologies, orchard and vineyard management, multi-functionality of horticultural systems, production techniques, quality of horticultural products, postharvest management of fruit and vegetables. The manuscripts can be freely submitted or invited, and they will undergo a single-blind peer review process. *Italus Hortus*

publishes the following types of papers: original research papers, reviews, brief research reports. The Editor-in-Chief is Prof. Boris Basile of the University of Naples. Issues 1 and 2 of 2020 contain a total of 15 articles, all in English.

- Even during the long lockdown, SOI continued to disseminate the fortnightly Newsletter, both by sending an email copy to all members and by publishing it on the website. The Newsletter contains information on current horticultural initiatives.

Given the ongoing pandemic emergency, SOI will promote future events to be held in a mixed format, with presence in the hall and participation online. Three important events are already planned for 2021 with this form of development: the XIII Giornate Scientifiche SOI, the ISHS IV International Symposium on Woody Ornamentals of the Temperate Zone, and the National Congress on Micropropagation.



> Maurizio Lambardi

> About the author

Maurizio Lambardi is General Secretary of SOI and Senior Researcher of the National Research Council (CNR) of Italy at the Institute for BioEconomy (IBE) of Florence, and has the National Scientific Qualification as 'Full-Professor' in the sector Arboriculture and Forest Systems. Within the ISHS, he is the Vice-Chair of Division Plant Genetic Resources and Biotechnology, and country representative for Italy. He has been invited speaker at many national and international congresses and post-degree courses, and is author or co-author of more than 170 scientific papers, reviews, books and book chapters on plant tissue culture, micropropagation, in vitro conservation and cryopreservation. He is presently member of the Editorial Board of several ISI Journals, such as *Acta Physiologiae Plantarum*, *Plant Cell Tissue and Organ Culture*, and *CryoLetters*. E-mail: maurizio.lambardi@ibe.cnr.it

The 2020 ASHS Annual Conference — rapid transition to a fully virtual meeting

Tracy L. Shawn, Michael W. Neff and Dennis T. Ray

The Annual Conference of the American Society for Horticultural Science (ASHS) brings together about 1000-1200 people from around the world each year to share their research, form new professional collaborations, and strengthen personal and professional relationships with colleagues. The 2020 ASHS Annual Conference was scheduled for 10-13 August, to be held at the Rosen Plaza Hotel in Orlando, Florida, USA. ASHS has held its conference at this facility twice before and was looking forward to realizing the same successful meeting at this always-popular destination.

The ASHS Annual Conference is a full 4-day event showcasing 400 to 500 oral presentations, 400 to 500 poster presentations, 25 to 30 workshops, daily keynote speakers, special symposia, the business meetings of nearly 75 ASHS committees and professional interest groups, as well as many social events. Planning begins a year in advance for the conference, and the 2020 conference was on its usual schedule in December with professional interest groups putting together workshop proposals for review and authors submitting abstracts for posters and oral presentations.

Dozens of people are involved in the planning and organization of the ASHS conference, with the primary responsibilities falling upon the Technical Program Committee for building the scientific content and the dedicated and experienced staff that handles everything else, from selecting potential sites for future conferences to all logistics and myriad details involved in making such a large meeting successful.

By February, preparations for the conference had begun in earnest—workshop proposals were being reviewed for final selection, poster and oral abstracts were rolling into the online submission site, and rough scheduling of social and special sessions was start-



Each recipient of ASHS awards was given the opportunity to submit a pre-recorded acknowledgement response. The image shown is of Dr. Jianjun Chen, who was selected as one of the ASHS Fellows, class of 2020.

ing. Then news from around the world was becoming more apparent about a health threat continuing to spread around the globe: coronavirus—COVID-19.

By early March, ASHS staff and the Board of Directors were still guardedly optimistic, while monitoring the near-daily updates from the World Health Organization (WHO), the US Centers for Disease Control and Prevention (CDC), and the Florida Department of Health, that the conference would be held as scheduled in Orlando in August. By the beginning of April, the situation around the world was becoming more dire, and ASHS staff began exploring options for conducting the conference under various scenarios, including an in-person conference, a hybrid in-person/virtual conference, or a fully virtual conference. ASHS gave regular updates to its membership and conference participants on this constantly evolving situation.

During the early part of April, more and more organizations in the US and around the world were facing the reality that the health crisis was worsening, and many organizations were cancelling their meetings and events or exploring other ways to hold their meetings. Of course, several people were asking for more information on ASHS' plans for the conference as some employers were beginning to place travel restrictions on their employees as the health crisis continued. On 15 April, the ASHS Board of Directors announced that the ASHS Annual Conference would not be cancelled and would occur as scheduled, with a final format to be determined per guidelines from national and state health agencies.

During this time and the ensuing days and weeks, ASHS staff were in close consultation with the company that had hosted the conference abstract submission site for a number of years and did all the on-site recording of sessions—Confex (The Conference Exchange®), which specializes in online and on-site event management. Confex had taken a proactive position to assist all of its clients during this rapidly evolving situation. The company has had virtual options avail-

able for several years and worked with the ASHS staff to develop an option for the ASHS conference. By mid-May, ASHS had committed to a virtual component of the conference to assist those who either could not, or were unwilling to, travel to Orlando in August.

While the virus situation wasn't seeing much improvement in the US, ASHS had a binding contract with the hotel, and by June they, and the city of Orlando and the state of Florida, were continuing their phased "reopening". As ASHS could ill-afford to pay the significant contractual penalties, the organization was in a "holding pattern" as to whether the conference would still be able to be held in person. By 20 June, it was apparent to ASHS staff and the Board of Directors that there was no way the Society would be able to safely hold the annual conference in Orlando, and ASHS decided to cancel the physical conference in Orlando and hold the meeting completely virtually—7 weeks before the conference was due to start. The contractual issues with the hotel were ultimately legally resolved with no penalties to ASHS.

Thus began a period of whirlwind activity for the ASHS staff—while some individuals cancelled their presentations, many more were committed to attending the virtual ASHS conference, and latitude in accepting "late" abstracts was given. Refunds for cancellations were given, many questions and inquiries were answered, and the new format required major adjustments. With roughly 800 speakers, there was a formidable task ahead to convey the necessary changes and "hand-hold" those that were uncomfortable or unfamiliar with the technological requirements of participation. All poster and oral presentations were to be submitted pre-recorded in advance with audio required and slides and video encouraged. Workshops and keynote speakers were going to be broadcast live, so coordination with all the moderators and speakers needed to occur, all the business meetings of committees and professional interest groups were moved to



Dr. Dennis Ray, President of the ASHS gives his virtual Presidential Address to the conference.



Keynote speaker of a live session plays through Zoom with the presenter live in the upper right corner while the slideshow plays.



- ASHS Virtual Conference list of virtual poster sessions followed a standard format, similar to that of previous in-person conferences.

virtual in the weeks ahead of the conference, instead of during the meeting, and instructions to registrants on how to login and participate in the conference had to be done. And somehow, some way, it all happened in that 7 weeks. The 2020 Virtual ASHS Annual Conference began on the morning of 10 August 2020.

Even with the cancellations and pulled presentations due to individual concern that a virtual conference would not meet expectations, more than 900 people attended the ASHS live virtual conference. There were 454 oral presentations, 331 poster presentations, 26 workshops, a career day symposium and fair, resume review sessions, alumni “happy hours”, exhibitor product demonstrations, and four keynote presentations. ASHS also scheduled many “virtual coffee breaks” featuring special topics for discussion and information to attendees.



- During the conference, a Professional Development/Career Workshop special session was held live.

While the many positive aspects of in-person meetings simply cannot be replicated virtually—the “hallway discussions”, dinners and drinks with friends and colleagues, etc., the virtual format did greatly enhance the learning aspects for many attendees. All oral and poster presentations were available online to attendees 3 days prior to the start of the conference, and questions could be asked (and answered) at any time. Oral and poster sessions each had half-hour live Q&A sessions scheduled during the week, which greatly enhanced the “live” feel to the conference.

One of the biggest advantages to the virtual ASHS conference is that....it is still going on! All live sessions were recorded and were made available to all attendees just days after the conference officially ended. Full access to all presentations will be available

to all registrants (only) for 1 year, and full interaction with each author still occurs. Questions can be asked, and answered, through the Confex system. Many attendees commented that a major advantage was the ability to be able to view presentations and posters at any time, according to their own schedule. In fact, people are still registering for the 2020 ASHS Annual Conference to be able to access all the content!

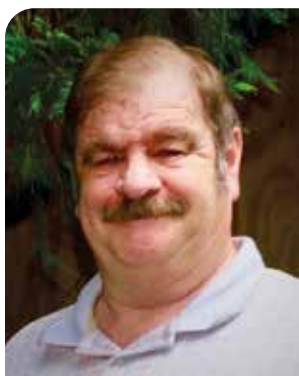
From this successful experience, ASHS anticipates that there will be a virtual aspect to all future annual conferences (a “hybrid” meeting model). While the Society faced a huge challenge in a very short amount of time, ASHS is quite happy with the success of its first virtual conference. Special thanks go to several of the ASHS staff members: Negar Mahdavian (who handled the vast majority of logistics and interacted with all participants); Sara Powell (who scheduled and monitored all the committee and professional interest group meetings); Angie Lower, Heather Hilko, and Cathy Hosek (who handled all the awards coordination, logistics with registration and support in numerous ways—including shipping the conference “swag” to all registrants while masked and gloved at ASHS Headquarters); all the members who moderated the live sessions and organized and participated in workshops; all the presenters who uploaded their presentations *on time* (everyone did!); and all the attendees who “kept the faith” and attended the 2020 Virtual ASHS Annual Conference. ●



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> An insight into urban food systems and their social, economic and environmental impacts

Peter J. Batt

Introduction

For the first time in history, the majority of mankind now resides in an urban environment, with that figure expected to reach two thirds by 2050 (World Bank/FAO, 2017; IFPRI, 2017). Increasing rates of urbanisation are putting more pressure on water and land resources, influencing what foods we eat, where and when we eat them, the way our food is grown, processed and delivered to consumers, and impacting on our health and nutrition (RUAF, 2016).

While increasing urbanisation presents abundant opportunities for food producers, it also presents a number of significant challenges. Cities occupy only 3% of the land area and yet they are responsible for 70% of global GDP, 60% of the energy consumed, 70% of greenhouse gas emissions and 70% of global waste (FAO, 2018). With the demand for food exceeding the capacity of the adjacent agricultural region, cities are largely dependent on external food supplies. With increasing imports, while the diversity and range of food available to consumers increases, food chains become longer and with that, cities become more susceptible to climate induced food shortages, food price hikes, breakdowns in logistics and failures in food safety management systems (IPES-Food, 2017). As the recent COVID-19 pandemic has illustrated, serious disruptions to supply chains have impacted both the availability and the subsequent distribution of food within urban settlements, especially for the more vulnerable members of society.

With increasing urbanisation, both as a result of urban migration and natural population increase, poverty, food insecurity and malnutrition are shifting from a rural problem to an urban problem. Today, more than one billion people reside in informal, low income settlements, where diets are often deficient in terms of calories, diversity and nutrients (World Bank/FAO, 2017). As poor households spend scarce resources to buy more affordable, calorie-dense, micronutrient-poor food with high levels of fat, sugar and salt, the incidence of malnutrition and obesity are increasing, often within the same household.

It is also well understood that urban growth directly impacts on the increasing demand for natural resources (RUAF, 2016). Urbanisation contributes to climatic change, modifying hydrologic and biological cycles, changing precipitation patterns, increasing pollution and reducing biodiversity (World Bank/FAO, 2017). Regrettably, the increasing demand for food is not climate neutral, with an estimated 20% of greenhouse gas (GHG) emissions being generated by agriculture, forestry and land use change. Agriculture and food production, while contributing directly to climate change, are also directly impacted by a changing climate, with yields projected to fall by as much as 7% as a consequence of global warming (Godfray and Garnett, 2014). Post-production, the food system is thought to be responsible for another 6% of GHG emissions, arising both from the need for refrigeration to preserve food and the mounting cost of food waste.

Collectively, these issues have led to a renewed focus on food systems, their sustainability and resilience, the potential to create viable employment and livelihoods, and the ability to provide access to affordable, safe and nutritious food (World Bank/FAO, 2017). While a more systematic consideration of urban food systems will naturally focus attention on the downstream portions of food value chains, helping to enhance their productivity and competitiveness, to improve both the efficiency and sustainability of urban food systems, significantly greater investments in marketing and distribution systems, food quality and safety, transport and logistics, and improved food waste management must occur in parallel.

Food systems

Food systems to cities are a complex combination of activities, functions and relationships. Aragrande and Argenti (2001) describe urban food systems as the complex combination of activities (production, handling, storage, transport, processing, packaging, wholesale and retail) operated by a myriad of dynamic agents (actors) that enable cities to meet their food requirements.

FAO (2013) considers food systems to encompass all the people, institutions and processes by which agricultural products are produced, processed and brought to consumers. This also includes the public officials, civil society organisations, researchers and development practitioners who design the policies, regulations, programmes and projects that shape our food system. Every aspect of the food system influences the availability and accessibility of diverse, nutritious foods and thus the ability of consumers to choose healthy diets. However, the linkages from the food system to nutritional outcomes are often indirect, mediated through income, prices, knowledge and cultural factors. Furthermore, if the food system is to be both efficient and sustainable, the many actors participating in the many activities to bring food from the paddock to plate require infrastructure, facilities, services and both formal and informal regulations to govern their business decisions (FAO, 2014). Because of the complexity of the system, the number of actors and the relationships between actors, where each actor influences and, in turn, is influenced by other actors, a holistic systems-based approach is required.

According to Aragrande and Argenti (2001), an urban food system can be divided into two main subsystems: i) food supply to cities, and ii) food distribution within the urban area. The food supply to cities subsystem includes those activities that take place outside the urban area: production (which includes urban agriculture), storage, marketing, processing and the transport of food to the urban area (either to a wholesale market, to food processors or directly to institutional users). The urban food distribution subsystem consists of those activities required to distribute food within urban areas. These range from wholesale markets to intra-urban transportation to formal and informal retailing.

However, the consumer is the primary driving force for any food market (Gehlhar and Regmi, 2005). Income growth, lifestyle changes brought about by urbanisation and the changing structure of the family result in

significant dietary changes worldwide. With the increase in consumer purchasing power and the increasing opportunity cost of time to prepare food, the demand for high value ready-to-eat and ready-to-heat food products is expanding. In parallel, the consumption of coarse grains, roots and tubers are decreasing with a commensurate increase in the consumption of higher value food products including meat, dairy products, fats and oils, and in most markets, fresh fruit and vegetables (Global Panel on Agriculture and Food Systems for Nutrition, 2016). However, the growth in the consumption of more convenient, highly processed food is of concern. The increasing consumption of sugar, saturated fat and salt contributes to health problems like obesity, type 2 diabetes, hypertension and other diet-related non-communicable diseases (Chicago Council on Global Affairs, 2016). Addressing obesity and other non-communicable food related diseases is an urgent and immediate issue (Global Panel on Agriculture and Food Systems for Nutrition, 2016). As of today, six of the top eleven diseases affecting mankind are diet related (IFPRI, 2017).

To understand food systems and their impact on society and the environment, one needs to embrace the concept of food supply chains. A food supply chain describes the means by which food gets from the paddock to plate, including who is involved and how these processes are structured (ISU, 2015). Simplistically, food producers transform food production inputs into basic foodstuffs, which are either consumed or transferred to food processors, institutional users and market intermediaries for distribution to consumers. In the process, the supply chain produces numerous social and environmental impacts, which, in turn, are influenced by numerous environmental and social factors. Collectively, these elements working simultaneously and together comprise a food system.

The need for an urban food agenda

Urbanisation continues to present challenges in providing a sufficient quantity of accessible, affordable food to support healthy and nutritious diets. How food is produced, processed, distributed, consumed and recovered, and how local food systems complement rural agricultural production are an integral component of urban planning (Carbannes and Marocchino, 2018).

Unfortunately, food and agriculture have largely been absent from the urban planning agenda for decades. Carbannes and Marocchino (2018) note that while food received some attention from urban planners linked to the Garden City movement at the turn of the twentieth century, it was not until 1996,



› A wide array of colorful fruits and vegetables seen at the Central Market in Sisophon, Meanchey, Cambodia. Image taken in October 2019 by P.J. Batt.

at the World Food Summit in Rome, where food security for all was established. However, with the ratification of the 2030 Agenda for Sustainable Development by the Member States of the United Nations in September 2015 and the adoption of the New Urban Agenda in Quito in October 2016, food security and nutrition were prescribed as an integral part of the Declaration on Sustainable Cities and Human Settlements. Under the New Urban Agenda, heads of government agreed to:

- end poverty and hunger in all its forms and dimensions,
- reduce inequalities,
- promote sustained, inclusive and sustainable economic growth,
- achieve gender equality and the empowerment of all women and girls,
- improve human health and wellbeing,
- foster resilience, and
- protect the environment.

Clause 34 specifically addresses the need for cities and human settlements to promote equitable and affordable access, without discrimination, to safe, nutritious and adequate food.

Clause 51 commits the member states to promote the development of urban spatial frameworks, including urban planning and design instruments that support sustainable management and the use of natural resources and land, strengthen food system planning, enhance resource efficiency, urban resilience and environmental sustainability.

Clause 88 subsequently commits the member states to ensure coherence between goals and measures of sectoral policies, inter alia, rural development, land use, food security and nutrition, management of natural resources, provision of public services, water

and sanitation, health, environment, energy, housing and mobility policies, at different levels and scales of political administration, across administrative borders.

In particular, Clause 123 commits the member states to integrate nutritious food into urban planning: “We will promote the integration of food security and the nutritional needs of urban residents, particularly the urban poor, in urban and territorial planning, in order to end hunger and malnutrition. We will promote coordination of sustainable food security and agriculture policies across urban, peri-urban and rural areas to facilitate the production, storage, transport and marketing of food to consumers in adequate and affordable ways in order to reduce food losses and prevent and reuse food waste. We will further promote the coordination of food policies with energy, water, health, transport and waste policies, maintain the genetic diversity of seeds, reduce the use of hazardous chemicals and implement other policies in urban areas to maximize efficiencies and minimize waste.”

In referring to the need for city region food systems (CRFS) to foster the development of resilient and sustainable food systems within urban centres, peri-urban and the rural areas surrounding cities, FAO and RUAF (2015) consider four interconnected elements:

- food security and nutrition,
- livelihoods and economic development,
- sustainable natural resource management,
- social inclusion and equity.

Food security and nutrition

There is overwhelming evidence that the world's current food system is failing to con-

tribute to healthy nutritious diets for an increasingly large segment of the population (World Bank/FAO, 2017).

Food security is defined: *“when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”* (FAO, 1996). Food insecurity is considered by many to be a problem specific to developing nations. Nevertheless, it is also prevalent within Australia where the Australian Bureau of Statistics (ABS, 2015) estimates that 4% of Australians do not have sufficient food to eat. However, more recent studies by Foodbank (2017) report that 3.6 million Australians (15%) have experienced food insecurity at least once in the last 12 months, with three in five of these individuals experiencing food insecurity at least once a month. Butcher et al. (2018) found that as much as one third (36%) of the Australian population had experienced some degree of food insecurity.

Food insecurity impacts a wide range of groups in the community and is not restricted to the unemployed or homeless (Foodbank, 2017). In fact, almost half of food insecure Australians (48%) are employed in some way, whether full-time, part-time or casually. Butcher et al. (2018) identified household income as a strong predictor of food insecurity. For low income households, the ability to purchase a sufficient quantity of healthy nutritious food is a major challenge, for food consumes a large proportion of the household budget. Financial pressures create difficult choices, such as choosing between heating and eating. Two in five food insecure Australians (41%) have not paid bills in order to have enough money to buy food (Foodbank, 2017).

Food insecurity however, is not exclusive to low income households: the problem also exists within higher income households where chronic health conditions, unemployment, or excessive spending on gambling, alcohol, tobacco or substance abuse can create financial instability and put pressure on food budgets (Butcher et al., 2018). Residing in rental accommodation was also found to have a positive association with food insecurity, with divorced and separated people especially at risk because of the division of household income.

Low income households are also at greater risk for a number of chronic diseases. Overweight and obesity rates are 20-40% higher among women who are food insecure (Lindberg et al., 2015). Obesity in Australia is one of the most significant public health challenges facing the nation. More than 60% of Australian adults are obese and at least one quarter of all Australian children and adolescents are obese or overweight

(Australian Institute of Health and Welfare, 2017). Regrettably, low income households tend to prioritize calories over food quality, spending scarce resources to purchase more affordable, calorie-dense, micronutrient-poor food groups with high levels of fat, sugar and salt (World Bank/FAO, 2017). Furthermore, as household incomes rise, there is a general shift in consumption away from staple foods to a more energy-dense diet consisting of refined grains and carbohydrates, vegetable oils, animal products and sugar. Greater disposable income, changing lifestyles and consumer preferences are resulting in a higher demand for more convenience food, the greater consumption of packaged, processed and ultra-processed food, more frequent meals and snacking, and the greater consumption of food away from the home. The appeal of convenient, fast foods means that 93% of Australians are failing to consume sufficient fresh fruit and vegetables every day (Australian Institute of Health and Welfare, 2017).

As observed during the recent COVID-19 pandemic, with the collapse of the food service and hospitality sector, greater numbers of consumers had to resort to home cooked meals. With lock-down measures in place, the increased retail demand for staple foods resulted in frequent stock-outs and with the ensuing panic buying, the imposition of purchasing limits by most major retailers. To reduce their exposure to community transmission of the virus, while some shoppers resorted to purchasing from smaller suburban stores, others shifted to on-line purchasing, and where they could, others sought to produce their own food – with the demand for vegetable seedlings in particular reaching unprecedented levels. However, with levels of unemployment not seen since the Great Depression, the most significant impact of the COVID-19 pandemic has been the increased demand for social support services and emergency relief packages. As a result of shortages in supply and an acute shortage of volunteer labour, as many food banks struggled to meet the increased demand, social protection and community solidarity programs emerged to ensure that more vulnerable groups had access to a sufficient quantity of food.

Even so, food and nutritional security can be realized only when the essential elements of a healthy diet are safe to eat (World Bank, 2019). The safety of food is vital for the growth and transformation of agriculture, for the modernization of national food systems, and the efficient integration into regional and international markets. The safety of food is the result of the actions or inactions of many stakeholders operating under diverse environmental, infrastructure

and socio-political conditions. These stakeholders include farmers, food handlers and distributors, food manufacturers, food service operators, consumers, regulators, scientists, educators, and the media. In turn, their behaviour is shaped by their awareness of food safety hazards; their technical and financial capabilities to apply effective mitigating practices; and prevailing rules, incentives and other motivators.

Food safety outcomes are strongly influenced by policies, investments and other interventions. While the safety of food is a “public good,” governments do not and cannot have the primary responsibility for safe food (World Bank, 2019). Rather, food safety needs to become a shared responsibility. Governments need to establish the vision; provide reliable information to other stakeholders; and effectively deploy a set of policy instruments to involve, incentivize and leverage the actions of farmers, food business operators and consumers. A shared management model implies a move from a regulator-regulated relationship toward efforts by governments to better incentivize and facilitate the safe production, processing and distribution of food.

Livelihoods and economic development

Lack of sufficient and regular income is effectively the root cause of urban food insecurity. As urban residents rely primarily on food purchases, any decline in incomes and/or increases in food prices can have catastrophic consequences in low-income urban areas. Hence, the best way to end food insecurity is by addressing poverty.

Living in an urban area is positively associated with economic wellbeing (World Bank/FAO, 2017), yet the share of poor people living in urban areas is also rising. While income solutions such as a basic income guarantee, a living wage and social assistance rates geared to the real cost of living are needed so that all citizens have sufficient money to provide for basic needs (Davidson et al., 2018), innovative cities are providing opportunities for urban residents to grow some of their own food. Others are supporting alternative value chains such as consumer cooperatives, community supported agriculture schemes, and local independent retail outlets and wholesale markets (ISU, 2015). However, while urban agriculture has the potential to reduce urban food insecurity in times of stress and provide a diversified income stream, its role should not be over-emphasized as the impact is quite limited.

On the other hand, to increase the resilience of the urban food system against external shocks, spreading the food supply to multiple geographic production zones not only

spreads the risk but provides greater employment opportunities in rural and peri-urban areas in food production, processing, transport and logistics, and wholesale and retail food marketing (ISU, 2015).

Although agriculture's relative share of the overall economy generally declines with economic development, the World Bank/FAO (2017) show that the food and beverage industry is the only labour-intensive, low-tech industry that sustains value-added growth as countries develop from upper-middle and high-income status. This growth is attributable to the food industry's relatively higher value-added and sustained employment growth, resulting in sustained labour productivity gains at all income levels. Along with textiles and the apparel industries, the food and beverage industry is one of the three major sources of manufacturing employment, with employment in the food service sector increasing with economic prosperity. The positive impacts of improved city region food systems on regional economic growth are amongst the most consistent (ISU, 2015). When consumers purchase food that has been grown and processed locally, more of the value is retained within the region. Keeping more of the value generated by food chains within the region has the potential to generate greater employment in both urban and rural areas. In the context of city region food systems, policy interventions that encourage short supply chains and enterprise can help generate networks of economically empowered actors and relationships that lead to new business opportunities. This impact is more likely to emerge where the conditions for successful entrepreneurship are in place, including appropriate investments in infrastructure to reduce transaction costs, governance and support systems that favour entrepreneurship, and the free flow of information through ICT. The government also has a role in promoting farmer organizations, financial vehicles that support farmers and agribusiness, green growth investment frameworks, university-led agribusiness incubators, and public programmes of technical assistance to build enterprise capacities (FAO, 2013).

Sustainable natural resource management

It is important to acknowledge that our current food production systems are destroying the environment upon which present and future food production depends. Agriculture is responsible for some 20-30% of anthropogenic greenhouse gas emissions; is the leading cause of deforestation, land use change and biodiversity loss; accounts for 70% of all water consumed; and is a major source of water pollution (Fischer and Garnett,

2016). Similarly, ISU (2015) attributes much of the extensive soil erosion and widespread over-fishing to our current systems of food production.

Agriculture and food production, while contributing directly to climate change, is also directly impacted by a changing climate (Godfray and Garnett, 2014). Garnaut (2008) concluded that climate change is likely to affect agricultural production through changes in water availability, water quality and temperature. While an increase in carbon dioxide concentration may increase the rate of photosynthesis for some plants, the positive impacts of carbon fertilisation are likely to be restricted by higher temperatures and lower rainfall. Further reductions in productivity are anticipated to arise from the more frequent occurrences of severe weather events including cyclones, drought and flooding.

The impact of climate change is expected to exacerbate existing environmental problems such as the widespread loss of native vegetation, overharvesting of water and reduction in water quality, isolation of habitats and ecosystems, and accentuate the adverse impact of introduced plant and animal pests (Garnaut, 2008).

Fortuitously, there is a groundswell of food initiatives by community groups, government and industry to address a variety of issues related to food, agriculture, environmental quality and sustainability, nutrition and employment (World Bank/FAO, 2017). Consumers are demanding more sustainable foods (socially and environmentally responsible) from food producers, food manufacturers and retailers. This has resulted in the emergence of numerous third party certified quality assurance schemes in both the business-to-business and the business-to-consumer market. Indeed, in many markets, accreditation to an approved third party certified quality assurance system is a requirement for market entry. For horticulture, other than the need for producers to adopt good agricultural practice and to provide a safe and fair working environment, consumers are focusing on four key issues: the way in which the product has been produced; the origin of the product; food packaging and food waste (Batt, 2019).

Food is a critically important resource that cannot be wasted and yet an estimated one-third of the food produced for human consumption is never eaten (World Bank/FAO, 2017). Food loss and waste occurs along the entire food supply chain – from production and processing to transport and distribution, retail and consumption. While most food loss and waste in lower-income countries occurs at production and postharvest levels, in the middle and high-income countries, most

of the food loss and waste occurs during distribution and consumption. In Australia, Europe, New Zealand and North America, more than 60% of food loss and waste occurs in retail, the food service sector and in the household. Regrettably, much of the food is wasted because it fails to meet the high aesthetic quality standards established by many of the major food retailers, whereas at the consumer level, poor purchase planning and expiring 'best-before-dates' can result in large amounts of food waste. While some of the reject product is sold to food processors or as animal feed, much of waste product is simply dumped as landfill. Across the world, food waste represents between 23-67% of municipal solid waste.

Important debates are currently underway on how best to balance a city's reliance on longer supply chains with the need to reduce energy consumption and the adverse environmental impact of food miles (Chicago Council on Global Affairs, 2016). Evidence is emerging that with the right improvements in transport and logistics technology, long supply chains can lower transport costs and emissions per ton. However, at a local level, investments in new roads and road maintenance and the regular updating and maintenance of vehicles is also required to reduce the cost of transport and greenhouse gas emissions.

Nevertheless, with the increasing incidence of product recalls and food safety scandals, consumers trust in self-regulatory systems and the business ethics employed by many of the large multi-national food companies is rapidly diminishing. Consumers around the world have begun to embrace food products that support local food producers. While there are many motivating factors behind the trend, it is believed that the demand for local food is largely being driven by anti-globalisation sentiments. However, locally sourced foods are perceived to offer consumers fresher produce, clear provenance, and the ability to support the local economy and the livelihoods of smallholder farmers (Batt, 2019).

ISU (2015) suggests that producing crops for local markets encourages a greater diversity of food crops, and that closer relationships between consumers and producers lead to the more widespread adoption of ecologically sound agricultural practices. In addition, ISU (2015) acknowledges the role the rural hinterland provides in the form of ecosystem services. These services include maintaining water quality, flood protection, maintaining populations of pollinating insects, recreation and amenity values, and air quality. Food planners thus have a strategic role to play in preserving agricultural land in and around cities, and expanding and securing

areas that will provide multiple spaces for an effective food supply chain and hybrid food systems to develop (Carbannes and Marocchino, 2018).

Food packaging is also high on the agenda. While there is the desire to use more packaging as a means of protecting the product from damage and extending shelf life there is an urgent need to reduce the use of plastics. Plastics are an enormous problem in the fresh produce industry, for not only is plastic an affordable and effective method of packaging fresh fruit and vegetables, but considerable technological advances have been made in active and intelligent packaging that moderate the exchange of gases to prolong shelf life, and to communicate with consumers to minimise early disposal and excessive purchasing (PMA, 2017).

Social inclusion and equity

Social inclusion and equity: i) ensures that all rural and urban residents have access to a sufficient quantity of safe, healthy, nutritious and affordable food. This supports a local food culture and sense of identity; ii) fosters improved rural-urban linkages, strengthening social relations between consumers and food producers; and iii) supports participatory governance.

In an equitable food system, all people have access to sufficient healthy and culturally appropriate food, and the benefits and burdens of the food system are equitably distributed. However, creating an equitable food system requires improving people's access to land, water and other natural resources, ensuring labour rights, access to new technologies, local and international markets; and investing in improving gender equality, women's education and status (Carbannes and Marocchino, 2018).

Promoting a local food culture relates to placing greater intrinsic value on regional foods, and on food and food systems in general (ISU, 2015). It implies that people are more knowledgeable about food, and that they derive enjoyment from eating, cooking and sharing food. This can create greater social cohesion: a sense of place and greater solidarity with food producers. It may also provide additional economic value through tourism. A strong food culture is also a key facilitating factor in achieving health and economic benefits.

Rural-urban linkages refer to the constant and necessary flows of people, capital, goods, services and information between rural and urban areas (UN-Habitat, 2017). People are moving from rural to urban areas in search of better opportunities for employment, education, medical, social and basic services, and improved livelihoods. Without appropriate planning, these trends can lead

to increasing social and economic disparities and even a political divide between urban and rural areas.

Enhancing rural-urban linkages is crucial in making food systems more effective and inclusive. Addressing the challenges of urbanization is only possible when the synergies between rural and urban spaces are harnessed through strong physical, political and market linkages (FAO, 2017). However, inclusiveness is not a given – it depends on the availability of infrastructure and services, which are generally lower in both quantity and quality in rural areas as the result of a prevailing metropolitan bias in government policies and investments. Nor is inclusiveness a natural outcome of rural transformation. It requires political will, legal and institutional reforms that strengthen transparency and accountability, and empower local communities to participate in policy and planning processes.

Connectivity is an important factor for enhancing rural-urban linkages and is strongly, but not exclusively, linked to infrastructure. It is imperative to recognize the role of environmentally sound, safe, efficient, reliable and affordable transport and transit corridors for the efficient movement of goods and people in supporting sustainable economic growth, improving the social welfare of people, and enhancing regional and international cooperation and trade (UN-Habitat, 2017). Transport and transit corridors play a key role in regional integration, international cooperation and the promotion of local, regional, national and international trade. Changes in levels of urbanization and in rural markets have multiple implications for rural income opportunities and rural transformation in general (FAO, 2017). By expanding the food system's non-farm segments (trading, processing, packaging, distribution and storage), cities become the hubs of a growing non-farm rural economy. As transformation proceeds, rural areas may become incubators of small-scale off-farm enterprises linked to rapidly expanding markets and a diversifying economy. Fragmented village-level processing and trading gives way to the agglomeration of processing, logistics, wholesaling and retailing in and near intermediate towns, and a lengthening of value chains.

Food has resonance and social meaning in all cultures. It can also be a vehicle for active participation of citizens in decision-making and policy formulation, integrating actions across multiple sectors and regions (ISU, 2015). A city region food system approach places a specific imperative on spatially coherent (city and region) and cross-sectoral (e.g., agriculture, health, water, economy, environment) planning and policy. Theoretically, greater participation in public policy

making should result in greater ownership and an improved food system that better fulfils people's needs. However, there is always a risk that the wider application of such integrated governance initiatives may be limited where they encounter established political and economic interests. ●



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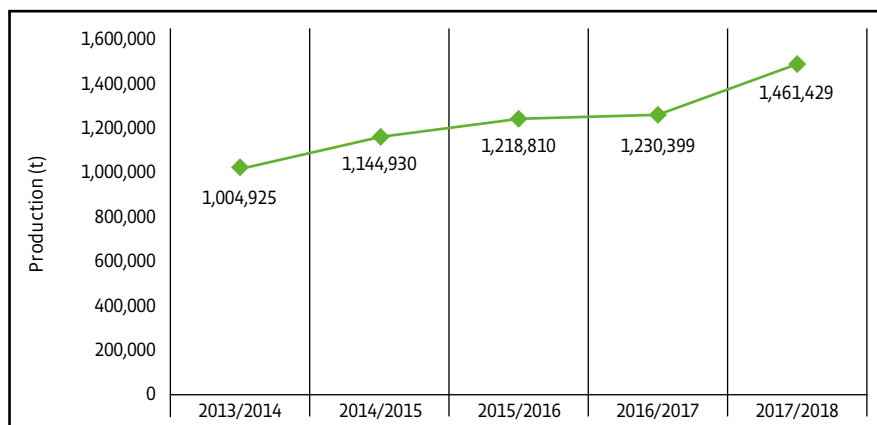


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> Horticulture in Senegal

Idaly Kamara



■ **Figure 1. Horticultural production in Senegal (fruits and vegetables, in tons).**
Source: ANSD (2019).

Horticulture, long considered as a seasonal and secondary activity in Senegal, is today an important pinnacle of economic and social development. Indeed, national horticultural crop production has increased from 1.0 MT of fruits and vegetables for the 2013-2014 season to 1.5 MT for the 2017-2018 period, i.e., an increase of 45% in 5 years (ANSD, 2019) (Figure 1).

This development was also accompanied by a strong increase in exports of horticultural products, which rose from 56,778 t in 2012 to 106,200 t in 2017, an increase of 87% compared to 2012 and 36% compared to the average of the last five years (Ministry of Economy and Finance, 2018). The main products exported were sweet corn (20.16%), mango (15.47%), melon (13.50%), green beans (12.79%), and watermelon (8.21%).

Strengths and areas for improvement

The socio-economic impact of this sector is significant, especially in rural areas. By July 2018, more than 15,000 permanent positions were created (Cabinet MSA, MEPPA, 2017), and the export turnover achieved more than 100 million Euro. Senegal is located at the intersection of maritime routes and is close to Europe (5 hours by plane). Senegal has a significant margin to develop its fruit and vegetable sector with a well-respected, advantageous mark: "Origin Senegal" for produce destined to European Union markets. Despite this strong potential and the dynamism observed, Senegalese horticulture faces structural difficulties that prevent it from reaching its full development. The weak

points include a lack of organizational clarity, a lack of structural investments in infrastructure and production systems, difficulties in logistics and agricultural equipment, insufficient resources allocated to basic and applied research, and the limited opportunities for personnel training.

A dynamic but fragmented sector

The organizational dynamics of the horticultural sector is characterized by many groups of fragmented consultants. This leads to separate dialogues and less synergistic actions. At the professional level, Senegal supports

farmers' organizations, inter-professional groups, economic interest groups (EIG), unions and federations. These organizations exist in different vegetable crops such as onion, industrial tomato, potato, cassava, sweet potato, green bean, cherry tomato, carrot, okra, eggplant, turnip, and beet; in fruit crops, such as mango, banana, melon, watermelon, orange, and grapefruit; and in flowers and ornamentals. This multitude of organizations shows a certain dynamism and testifies to the vitality of horticulture, but it also demonstrates a weakness in the overarching coordination of the facilitation of inter-professional-private and public-private dialogues. This is true especially in the organization of markets and corollary services.

The need for capacity building

Considering the development of human resources capable of meeting the productivity challenges of the horticultural sector, the national vocational system is insufficiently supported. Despite the potential of the horticultural sector, less than 1% of the public training supply is oriented towards agriculture (Ministry of Employment, Vocational Training and Handicrafts, 2015). This unavailability of qualified human resources limits the sector's capacity to modernize and to put mechanisms in place for the trans-



> Master GEDAH – UCAD (2017).



> West Africa Agricultural Productivity Program (Senegal), World Bank.



> Village community garden in the area of Thies developing agroecological practices and management under the supervision of the NGO Agrisud.

fer of skills between research, production, and the market to increase productivity and competitiveness.

The staff for horticultural research is insufficient both organizationally and in human resources. Senegal has nine public agricultural research and development (ARD) organizations. The Institut Sénégalais de Recherche Agricole (ISRA) leads the field in horticulture: in 2011, it employed 76 full-time researchers, equivalent to two-thirds of the total number of human resources dedicated to ARD in Senegal (Gaye and Sene, 2014). The Institute of Food Technology (ITA) is the only other government agency involved in agricultural ARD in Senegal, with research missions focusing on the valorization of agricultural and horticultural products (storage, conservation, processing). In addition to these two government institutes, the horticultural research facility for higher educational institutions is located at the University Cheikh Anta Diop (UCAD) in Dakar, and at the University Gaston Berger (UGB) in Saint Louis.

Strategic role of the Horticulture Cluster

Faced with the major challenges of professional organization, research and training in the horticultural sector, the State of Senegal has set up the Horticulture Cluster, with the mission of creating a link between these three essential areas for the development of the Senegalese horticultural sector. The objective is to provide horticultural production and service companies with a skilled workforce mobilized around the challenges of growth and competitiveness of the sector, to support the process of capitalization and development of research results, by the private sector, particularly through solidly constituted professional branches. The Cluster has been able to launch the process of structuring the sub-sector and mobilize international expertise for the modernization of the training offer. As a result, more than 800 young people have been trained in specialties as diverse as water management, soilless cultivation, and food processing. To complete the research-training-business structure that constitutes its basis for action, the Senegalese Horticulture Cluster joined

the ISHS in 2016. This group has been preparing for the organization of the IV All Africa Horticultural Congress (AAHC) which should have taken place in the Fall of 2020, but had to be delayed due to COVID-19. The AAHC is a major event where the African scientific community, as well as global horticulture, gathers to share the wealth of horticultural knowledge and experience. This event, organized under the auspices of the ISHS, has been held every 4 years in a different African country each time. The preceding three congresses were held in Ibadan, Nigeria (2016), in Skukuza, South Africa (2012), and in Nairobi, Kenya (2009).

Because of the health crisis due to COVID-19, the new date for the AAHC2020 has been established. The congress will be held in Dakar, from 29 March to 1 April 2021, and expects the participation of 500 people with at least 30 countries represented. This congress will be the first one held in an African francophone region and will be a strong moment of exhibition of the capacities and results of African horticultural research. It will also be the first hybrid AAHC, which will combine on-site and online presentations and contributions. The scientific program plans to include between 60 to 70 oral presentations, about 40 posters and plenary lectures of international scope, with prestigious speakers, to be discovered on the congress website: <https://www.aahc2020.org>. I invite you to join us on the African continent! Please save the date and register to join us on-line if you are unable to be there personally. ●



> Organizational diagnosis of the horticulture sector – Horticulture Cluster (2018).



> Idaly Kamara

> About the author

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> Medicinal plants, aromatic herbs and fragrance plants in France: a small but thriving sector with a strong traditional base and a dynamic research network



Annabelle Bergoënd and Joséphine Piasentin

In France, medicinal and aromatic plants (MAP) or herbal, medicinal and aromatic plants (HMAP) industries¹ traditionally refer to culinary herbs, medicinal plants, and plants cultivated for the fragrance and perfume industries. This agricultural sector encompasses several hundred plant species, as compared with field crops, such as cereals, which may include single species grains. The organic production for these crops is significantly larger than traditional crops of global French agriculture. Wild harvest of HMAP continues and is key for a successful economy in rural areas. These relatively small production areas are undergoing fast-

paced growth. This production is very diverse and dynamic, leaning on strong traditional skills and benefiting from new techniques and high value processing. With a growing demand for natural products and unfolding opportunities for new markets, HMAP is facing exciting prospects.

Characteristics of French HMAP

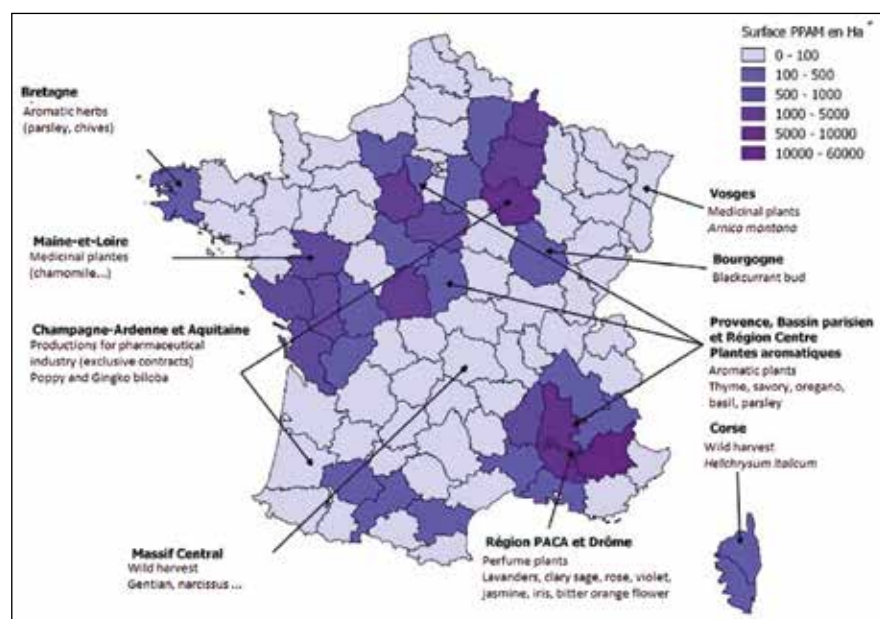
Farm features and production are geographically diverse

The complexity of the production sector for HMAP is difficult to comprehend (France-AgriMer, 2018). Production fields are often

small areas. Many producers reserve some areas as a side crop for their main production. Many of the plants are not referenced in the European common agricultural policy (CAP) nomenclature. About 75% of the producers cultivate HMAPs to diversify their production. The largest amount of land is occupied by fragrance plants, then medicinal plants. Aromatic herbs account for less than 10% of the HMAP cultivated area. In 2018, the estimated average farm was 4 ha for MAP production and 17 ha for perfume plants. If the sector remains relatively well known in continental France, the overseas territories still lack organised bodies to represent producers and structure the market. Mostly in the tropics, farmers grow or gather completely different HMAP species. Many tropical MAP species are extensively used locally in traditional cuisine and medicine. The whole sector continues to develop very professional protocols. For example, about twenty medicinal plants endemic to Reunion Island have been newly registered in the French Pharmacopeia since 2013 (Armefflor, 2019).

Plants for perfume and fragrance

This cultivated production includes several species: lavenders (true lavender, *Lavandula angustifolia* Mill.; lavandin, *L. x intermedia* Emeric ex Loisel; and spike lavender, *L. latifolia* Medik.) and clary sage (*Salvia sclarea* L.) are the most economically important. In 2018, more than 29,600 ha was cultivated. Traditionally the majority of the production occurs in the southeast (Provence and surroundings), but new areas are being planted towards the north (Figures 1 and 2).



■ Figure 1. Surface distribution of HMAPs in continental France in 2018. ©FranceAgriMer (adapted). *1 Ha = 0.01 km².

¹In French, the acronym PPAM (for Perfume, Aromatic and Medicinal Plants) is used at official level.

Producers are mainly structured in cooperatives. This activity enjoys a strong *terroir* effect both at home and globally. Most of the production is internationally exported; 80% of lavandin essential oil, for example, is exported to Europe, the United States, and Asia. The production value generates a turnover of around €40 million. Even though the international essential oil market is highly competitive, France remains the world leader for perfume plant production. The cultivated area for lavenders alone increased by 29% between 2014 and 2018.

Aromatic herbs and medicinal plants

National production occurs throughout, on 23,600 ha. The major areas are noted (Figure 1). Southwest of the Loire River has included a tradition of horticulture and medicinal plants (chamomile) from at least the 19th century. The southeast area is not restricted to lavenders (*Herbes de Provence*, parsley, basil). Aromatic herbs are produced in Brittany, while various areas in the east and north specialize in medicinal plants. Two large areas are dedicated to mono-production of opium poppy (*Papaver somniferum* L.) and *Ginkgo biloba* L. for the pharmaceutical industry. Opium poppy alone accounts for 70% of the medicinal plants' production region.

Producers of MAP are private agricultural companies or organized in cooperatives. A great many different species are cultivated. Basil, thyme, coriander, and green mint are the main production for aromatic plants; lemon balm, chestnut, or mountain arnica are the main crops produced for medicinal plants. Sage generates the most important economic value in this case. Production turnover totals €110 million. Overall volumes of MAP production decreased between 2014 and 2018. However, during the same period, both medicinal and aromatic cultivated surfaces increased. In Reunion Island, the aromatic sector is dominated by cultivated scented-rose geranium (*Pelargonium* sp.) and vetiver (*Chrysopogon zizanioides*). Harvest from wild stands is the predominant procedure to obtain medicinal plants (Association Réunionnaise pour la Modernisation de l'Economie Fruitière, Légumière et Horticole (Armefflor), <http://www.armefflor.fr>).

Processing: downstream economy determines the cultivation strategies

The usual segmentation in medicinal, aromatic and perfume plants is only a functional one related to the product destination. Fennel, for instance, may be cultivated for medicinal or culinary usage. However, industrial applications, production techniques, buyers, prices, etc. are very different, which determines producers' strategies.



■ Figure 2. Lavandin field in the southeast (*L. x intermedia* Emeric ex Loisel). ©Iteipmai. More than 300 species are cultivated; however, two of them represent 70% of HMAP cultivated areas: lavender and opium poppy (*Papaver somniferum* L.); these crops account for 60% of total revenue.

HMAPs are present in more than a thousand different products. Perfume plants provide essential oils and extracts for the fragrance and perfume industry, cosmetics, aromatherapy, cleanliness industry, etc. Aromatic plants provide essential oils and extracts, dry and frozen products for food industry, herbal teas industry, aromatherapy, food supplements and nutraceutical industry, etc. Medicinal plants provide essential oils and extracts, dry and frozen products for herbal medicine, homeopathy, aromatherapy, pharmaceutical industry, cosmetics, herbal tea industry, food and feed supplement and nutraceutical industry. The whole industrial sector reaches a turnover of €5 billion.

The emergence of new markets during the past few years is significant: animal welfare (decreasing stress level and enhancing immune system with plant extracts in a context of antibiotics' reduction regulations), antioxidants, crop elicitation (help protect crops from diseases and stress) and biological control (using plant extracts as deterrent against pests or as attraction agent of pest predators and parasitoids), wine industry (alternatives to sulfites' addition), etc. Ninety percent of the overall production is dedicated to plant extracts. HMAP production can hence be considered as a production

of secondary metabolites (this is less true for aromatic plants) (Box 1). Quality and quantity of essential oils and other active compounds are critical factors to ensure a good harvest for the producer.

The impact of social demands

There is a strong and rapidly growing social demand for natural products. This is true for many industrial sectors. Therefore, the panel of potential usage has increased for HMAPs in recent years. There is also a tendency for consumers at a global level to be willing to pay more for better quality and for natural-based products (The Nielsen Company, 2015). The selling price is already rising on the organic market of aromatic plants and especially for whole plant products certified by a French or European quality sign, e.g. protected designation of origin (PDO), protected geographical indication (PGI), traditional specialties guaranteed (Marecaux and Sauvage, 2019). As an example, the PGI *Thym de Provence* (thyme), obtained in 2018 in Provence, recorded a 9 t sales increase in the first year; likewise, *Herbes de Provence* "Label Rouge" sales increased 33% between 2017 and 2018 (FranceAgriMer, 2018).

A tendency to relocate the production to the national territory can already be noticed:

Box 1. Secondary metabolites

Secondary metabolites are compounds that play no role in the basic biological mechanisms (the primary metabolism) but provide organisms an adaptational advantage. They are produced at some cost to the plant and often under biotic or abiotic stress. For example, inflammable volatile compounds synthesized by Mediterranean subshrubs help vegetation to cool down and make them less palatable to herbivores. Some secondary metabolites are protective against diseases, others are deterrents against herbivores, attract beneficial organisms or are a medium of intra-species communication.

Tens of thousands of molecules are produced this way; they can be separated into large chemical families, such as polyphenols, terpenes and sterols, alkaloids, etc. Their concentration in plants is extremely low (frequently inside specific storage cells or organs). Therefore, production competitiveness relies on active substance proportion in plants. This may be enhanced by plant breeding and the selection of chemotypes, i.e. clones of fixed and well-known chemical composition.



■ Figure 3. Mountain arnica (*Arnica montana* L.). ©Tela Botanica - JJ Houdré. This medicinal species grows spontaneously in mountainous meadows. Experiments for its cultivation are being attempted by the HMAP applied research network to help protect the natural resource.

some leading companies in the pharmaceutical, nutraceutical and perfume industry are taking up the challenge. They expect to meet the consumers' concern and enhance their image. It also reveals a commitment to ensure the regularity in quantity and quality of the supply. Consumers value increasingly traditional products and local production (Iteipmai, 2017).

Perspectives for sustainable production

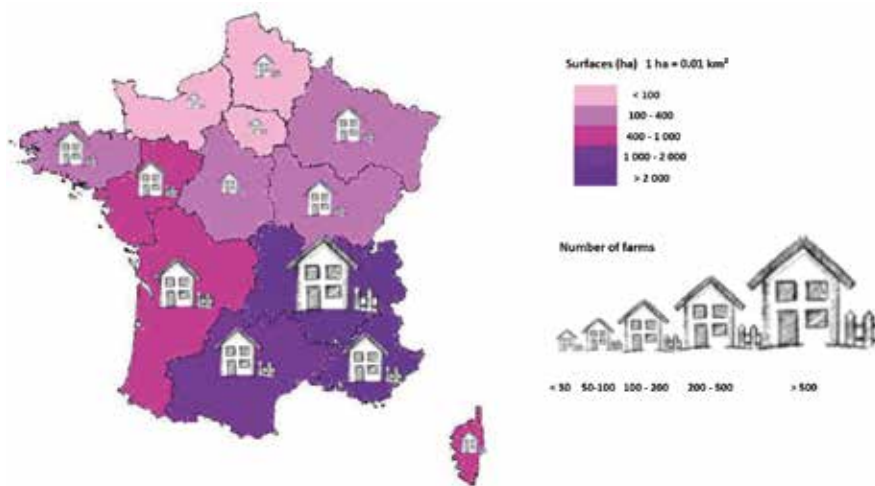
An important activity for mountains

The HMAP sector remains of small economic importance with low employment levels and low social impact. Lavender cultivation is mostly located in dry mountainous areas without many other economic alternatives. Thus, in some parts of France, lavender fields sustain the economy of whole regions. The activity provides direct resources from essential oil extraction (usually carried out locally) and flower sales. Lavender fields also provide substantial revenue from the tourism industry that beneficiate to larger areas. Finally, income generated from lavender honey is equivalent to that of lavender essential oil trade. More generally, one third of HMAP production takes place in disadvantaged mountain areas.

What's more, some areas are dedicated to wild harvest and gathering, especially in the mountains (e.g. Massif Central, Vosges) and inside natural parks. Plants are picked up for the pharmaceutical, cosmetics or herbal/infusions industries (Figure 3). The positive social impact is difficult to estimate; some wild harvesters are farmers harvesting wild plants for extra revenue, others rely entirely on this niche activity.

Low impact agriculture: an asset towards sustainable development

The negative impact of the production activity on the environment is also low. Few chemical inputs are used, partly because high



■ Figure 4. Number and area of farms (organic certified and in conversion) per region in 2018. ©FranceAgriMer; Figures from AgenceBio.

bioactive compound quality is favoured over high biomass yield. Furthermore, the rate of organic farming is high (Figure 4). In 2018, 16.5% of HMAP production was organic (7.5% of overall agriculture in France). Between 2008-2018, organic-cultivated surfaces (certified and in conversion) increased by 173% while the number of organic farms increased by 280% (FranceAgriMer, 2018). Some plants are almost entirely organically produced, such as saffron (*Crocus sativus* L.). Furthermore, HMAP cultivation frequently combines cultivated fields of different plants on the same farm and grows a great many melliferous species. Hence, HMAP agriculture provides positive externalities for biodiversity and the environment in general.

Applied research and field experimentation

A network of associations is dedicated to meet the needs of the HMAP sector, from production to active compound extraction: the national repository of HMAP seeds, CNPMAI (<https://www.cnpmai.net/fr>), a centre for field experimentation, Crieppam (<http://crieppam.fr>) and a technical institute for the sector's development, Iteipmai (<https://www.iteipmai.fr/en>). Among the many activities undertaken by this network, improving technical and agronomical schemes is an important element. Each crop has entirely different agronomic and processing needs, and the network strives to provide farmers with valuable experience and information out of field experimentation. Plant breeding is at the centre of applied research. The genetic diversity of HMAP species is very high. Furthermore, desirable traits are often heritable. Therefore, many projects have resulted in a doubling of the active compound content. This level of improvement is usually far more difficult to achieve when working on other production factors. Therefore, creation of tailor-made varieties is the preferred way to increase bioactive productivity, to adapt to

changing environmental conditions and disease and pest pressure, as well as to better satisfy the market. This process allows the producers access to good-performing seeds or cuttings. It also provides the industry with stable extracts, both in terms of quantity expectations and of phytochemical content. Development of selected plant material presenting the best agronomic, industrial and economic interest is critical to ensure a sustainable and profitable activity for the producers as well as to provide the industry with high-quality ingredients that can be turned into innovative, safe and efficient products.

How applied research can successfully sustain horticulture

A multi-approach project to fight basil downy mildew

The value of basil production amounts to more than €20 million for open field plantations. It is also a flagship container plant product and offers diversification opportunities for flower producers. Basil downy mildew, a fungal disease that emerged in the 2000s with a worldwide dispersion, can spread and destroy a whole field in only a few days (Cohen et al., 2017). Iteipmai, in partnership with several technical and scientific organizations (Bureau Horticole Régional (BHR), <http://bhr-vegetal.com>; Vegenov, <https://vegenov.com>; Variety and Seed Study and Control Group (GEVES), <https://www.geves.fr/geves>; Technical Institute for Horticulture (Astredhor), <https://www.astredhor.fr>) has launched a project to come up with a set of turnkey solutions. This project, called "Basimil", was awarded a special prize (Acta Ita'Innov, <https://www.acta-italainnov.com/>) for its original concept.

Control: lower pathogen pressure instead of seeking eradication

Studies show that infection originates in the seed. The Basimil project thus aims to disinfect seed stock to lower the inoculum pressure. Different approaches are tested:

conventional, using biocontrol, and thermal treatment methods. Meanwhile, a new test has been developed by GEVES to confidently determine the infestation level of seed batches.

Selection

95% of the market is dominated by a cultivar known as 'Grand vert'. The challenge is to create a resistant cultivar able to meet this market's very specific requirements. After a first series of hybrid cultivars showed tolerance to the disease, one was selected and promoted. A repeated backcross of the initial cultivar's parents was carried out with 'Grand vert' to combine the market organoleptic and yield characteristics with the resistance trait. These transitional cultivars are already successfully tested in the field by producers.

Systemic approach

The development of a decision support system through a prediction model tool based on meteorological conditions helps the producers to anticipate the risk. This goes with adapted agronomic practices designed to optimise in-field and container density.

Using genomic tools for the French lavender sector

So far, lavender populations have been obtained with mass selection by collecting the best wild individuals and populations. However, the new environmental challenges, drought, biotic stress (mainly lavender decline caused by *Candidatus Phytoplasma solani*), underlined the need to select new cultivars adapted to these stresses, while keeping good essential oil yields and a quality up to the standards of the market (Iteipmai, CNPMAI, and Crieppam, 2019). In this context, genomic-assisted selection methods appear to be the right way to improve the efficiency and accuracy of breeding programs. That is why, Iteipmai in partnership with Crieppam, Inra Etude du Polymorphisme

des Génomes Végétaux (EPGV) – INRAE (<https://www.inrae.fr/en>) and Vegepolys Valley (<https://www.vegepolys-valley.eu/en/>) carried out a project named "Genoparfum" between 2015 and 2017, to study the genetics of lavender populations.

The purpose of the project was to develop lavender genomic resources and to discover single nucleotide polymorphism (SNP) to set bases for genomics in lavender. The work was carried out on the heterozygous lavender 'Maillette'. This clone was used as a reference for DNA and RNA sequencing. From these data, the complete gene sequences were reconstructed. The research team obtained a cleaned reference of 8,000 genes involved in various biological processes, including the response of the plants to biotic and abiotic stress (Fopa Fomeju et al., 2018). Finally, the team used these resources for SNP mining within a collection of 16 commercial laven-

der clones and tested the SNP within the scope of a phylogeny analysis.

The results from this project were used to launch the "Genolavande" project. This second project was carried out from 2018 by Iteipmai, in partnership with Inra EPGV, Crieppam and the Drôme Chamber of Agriculture (Chambre d'agriculture de la Drôme, <https://extranet-drome.chambres-agriculture.fr>). Now, the purpose of the Genolavande project is to develop a genotyping tool from the SNP detected in Genoparfum and to set up new marker-assisted breeding strategies for *Lavandula angustifolia* Mill. This project is ongoing, but a genotyping tool based on 3,000 SNP has been built and is being tested. Both projects are mainly granted by the French Ministry of Agriculture through *Casdar funds*. The results of these projects will be presented and their impacts will be discussed at the IHC2022 in Angers. ●



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Annabelle Bergoënd is a librarian professional and a botanist. Joséphine Piasentin is a librarian professional and an agricultural engineer. They run the Iteipmai's resource and documentation centre, which gathers highly specialised information about HMAPs, both scientific and technical. The Iteipmai's resource centre has been gathering valuable documents and information for more than 30 years, which makes it the reference for the sector at the European level. E-mail: annabelle.bergoend@iteipmai.fr, josephine.piasentin@iteipmai.fr. Scientific contact: philippe.gallois@iteipmai.fr

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> The wild poinsettia: origins of the most beautiful *Euphorbia*

Laura Trejo

Summary

Poinsettia (*Euphorbia pulcherrima* Willd. ex Klotzsch) is the floral symbol of the end of the year celebrations. Their seasonal sales exceed hundreds of millions of dollars worldwide and, although they are associated with Christianity, their story is more complex as it relates to Mesoamerican peoples and their interaction with wild plants that grew in their natural environment. Poinsettia is mainly distributed in the tropical environments of North and Central America. Its Náhuatl name is *Cuetlaxóchitl* and, before the arrival of the Spaniards, they were used as offerings to deities in religious ceremonies, a practice that continues to this day.

These wild plants have been continuously transplanted to human settlements through a sort of traditional management that caused modifications in the cultivated plants and which the Spaniards documented since their arrival to the New World. For hundreds of years, Mesoamerican traditional management systems have generated *E. pulcherrima* cultivars with special adaptations, such as the “*Cuetlaxóchitl de sol*” (Sun *Cuetlaxóchitl*) or Double *Cuetlaxóchitl*, which can be seen today in Mexican gardens.

Genetic studies have shown that the main source of germplasm of the international commercial cultivars is northern Guerrero,

which partially supports the legend that Joel Roberts Poinsett collected *E. pulcherrima* plants in Taxco, Guerrero, and sent them to the Bartram Botanical Garden in Philadelphia between 1828 and 1829.

The origin of international commercial cultivars is a small source of germplasm, so there is great potential of creating new improved cultivars using the different adaptations of the species. Learning about the genetic local variants would prevent bio-piracy and promote the development of commercial Mesoamerican cultivars.

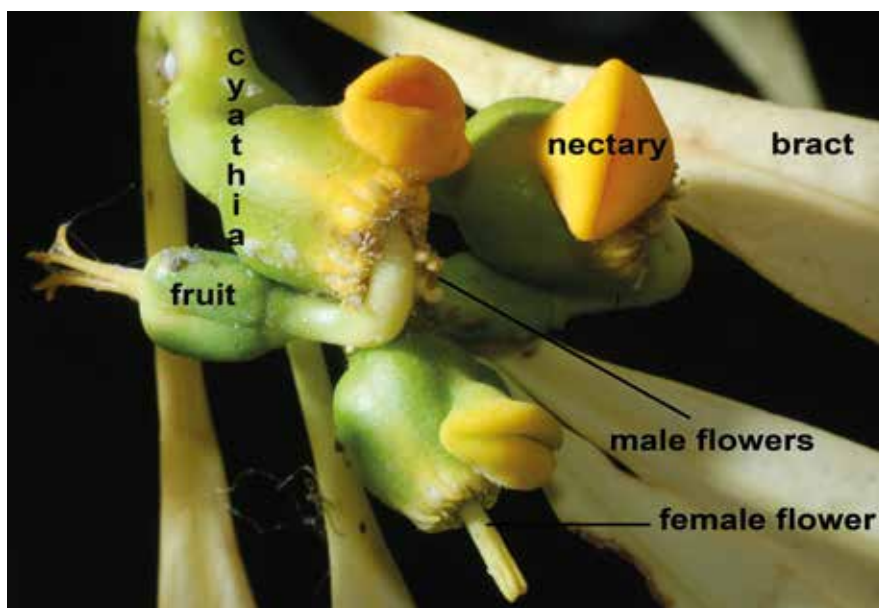
Poinsettia is the floral symbol of the end of the year celebrations; it decorates homes and some gardens (Trejo et al., 2012). As a result of management and biotechnological transformations carried out for hundreds of years (Trejo et al., 2018), most markets will sell poinsettias of many colors, shapes and sizes. Not much is known about the origins of this plant, of its wild relatives, its role in pre-Hispanic cultures and the source of germplasm used in the development of hundreds of cultivars around the world. This paper presents information about the wild poinsettia, with the origin story of this emblematic plant.

The most beautiful *Euphorbia*

The wild poinsettia belongs to a single species (Trejo et al., 2012). The genus *Euphorbia*

L. groups 1,800 species mainly distributed in tropical regions (Zimmermann et al., 2010). One such species is *Euphorbia pulcherrima* which means “the most beautiful *Euphorbia*,” in Latin.

E. pulcherrima has had various species names in many publications. Sessé and Mociño called it *Euphorbia fastuosa* (Mociño, 2010) based on a specimen from Xochitlán (Morelos) that was sent to Madrid in 1786, although this name was not published until 1889 (McVaugh, 2000). In 1833, Rafinesque published a small note in the *Atlantic Journal* about Euphorbias grown in the Bartram Garden. He called them *Pleuradena coccinea* or *Euphorbia poinsettii* (Rafinesque, 1833). In 1834, Johann Klotzsch described the poinsettia based on different materials, including sample 9259 from the Willdenow Herbarium at the Museum Botanicum Berolinense in Berlin-Dahlem, Germany (Klotzsch, 1834). This specimen, collected by Humboldt in 1803-1804, had been previously called *E. pulcherrima* by Willdenow. In 1836, Graham described the *Poinsettia pulcherrima* also using specimens from Willdenow’s herbarium without having any knowledge of Klotzsch’s previous work (Graham, 1836). Finally, the name recognized as valid is *Euphorbia pulcherrima* Willd. ex Klotzsch (Klotzsch, 1834).



■ Figure 1. Sinflorescencia of wild *Euphorbia pulcherrima*, Michoacán, Mexico. Picture taken by Mark Olson.



■ Figure 2. Wild *Euphorbia pulcherrima*, Morelos, Mexico. Picture taken by Elvira Romano.



■ Figure 3. Wild *Euphorbia pulcherrima*, Guerrero, Mexico.

Poinsettia flower

In the poinsettia, the structure known as *flower* refers to an apparent flower found at the end of each branch. However, this structure is not one single flower but rather a set of a group of flowers, which in botanical terms is known as a *sinflorescence* (Figure 1). Each colored leaf or bract, which in the wild can be several shades of white to red, is associated to a *cyathia*. *Cyathias* are the small spheres found in the center section of the apparent flower, each *cyathia* being a female flower (or pistil), five or six male flowers (or stamen) and a nectary (which resembles a duck's yellow). The attractive leaf disk acts as a landing strip to pollinators, be them birds or butterflies, although the issue of pollination is still a mystery in poinsettias.

Wild poinsettias are shrubs with many branches that emerge from the base of the stem. During the flowering season, from October to January, there is a *sinflorescence* on the end point of the flowers. These plants are generally 6 m tall, although some can reach 9-10 m (Figure 2). Sometimes poinsettias grow as vines on the ground or mixed with the rest of the vegetation (Figure 3) (Trejo et al., 2012, 2018).

Habitat in ravines near rivers

Wild individuals of *E. pulcherrima* are naturally distributed near the Pacific coast, from northern Mexico (Sinaloa) to Central America, coming in through the Balsas River basin in central Mexico from where they have reached the state of Morelos (Trejo et al., 2012). Perhaps their original distribution included what today is known as Mexico City (Trejo et al., 2015). The southern limits of its natural distribution may be in Costa Rica, although this is not yet confirmed (Trejo et al., pers. commun.).

Wild poinsettias grow mainly in tropical sub-deciduous forests, although they can also be found in tropical rainforests and gallery forests. They are mainly found as part of groups of individuals in patches along rivers running through deep ravines where they

find shade, water and tropical conditions (Figure 4). They are generally fragile plants that cannot tolerate direct sunlight (Figure 5), although sometimes some individuals can be seen directly under these conditions. This information suggests that wild poinsettias are highly adaptable and have been able to grow in dry and humid forests, at sea level and in very high places (2000 m). It is sometimes possible to see escaped plants growing near streets and in vacant lots, although still within the natural distribution range of the species.

Mesoamerican flower used in ceremonies

The use of *E. pulcherrima* predates the arrival of the Spaniards (Sahagún, 1979). Its name in Náhuatl is *Cuetlaxóchitl*, or “the flower that withers”; it has, and still is, a flower used in ceremonies, as an offering to deities (Trejo et al., 2015). It was also planted in the gardens of Aztec emperors (McGinty, 1980).

Sahagún (1979) recorded some of its medicinal uses that have prevailed to date: the

leaves as poultices to treat “*erisipela*” (a skin condition) or the latex for hair removal. The latex is known to be toxic to the skin, so its use is best avoided (Baas, 1977).

Cuetlaxóchitl in the gardens of New Spain

The Spaniards referred to this species as “scarlet cloth”. It could be seen in the gardens of New Spain as shown in the illustration (Figure 6) reported by Navarro (1992). The illustration shows “double” poinsettias in which the *cyathia* (described above) have become smaller, consisting of only one bract or colored leaf, thus increasing the number of bracts (Figure 7). There are no “double” poinsettias in wild populations. This means that through traditional management systems that have been taking place for more than 500 years in anthropogenic environments, these individuals have been modified (Trejo et al., 2015).

The famous departure of *Cuetlaxóchitl* from Mexico

Joel Roberts Poinsett is credited with introducing *E. pulcherrima* to horticulture outside Mesoamerica, which is why *Cuetlaxóchitl* is known as poinsettia in English-speaking countries. Poinsett was acting Prime Plenipotentiary Minister of the United States of America in Mexico between 1825 and 1830 (McGinty, 1980; Moon, 1956; Rafinesque, 1833). In 1828, Poinsett was asked to leave Mexico and, before doing so, between 1828 and 1829, he organized expeditions in the country with other members of the American Philosophical Society. The plants collected during these expeditions were sent to the Bartram Botanical Garden in four shipments. However, the plants got mixed up along the



■ Figure 4. Wild population of *Euphorbia pulcherrima*, Guerrero, Mexico. Picture taken by Mark Olson.



■ Figure 5. Sinflorescencia of *Euphorbia pulcherrima*, Guerrero, Mexico. Picture taken by Elvira Romano.



■ Figure 6. Illustration of *Euphorbia pulcherrima* with “double” inflorescences in gardens in New Spain (Navarro, 1992).

way, so it was impossible to relate them to their names, origin, or sender. One of these shipments transported the *Cuetlaxóchitl*, which was grown in a greenhouse by the Bartram family (Fry, 1994; Ronaldson, 1828; Say, 1828). James Ronaldson wrote a letter to Poinsett telling him he assumed these shipments had been sent by him (Poinsett) and William H. Keating (Ronaldson, 1828). In 1829, during the Pennsylvania Horticultural Society's first semi-annual fruit, flower and plant show, the Bartram family introduced *Cuetlaxóchitl* as *Poinsettia pulcherrima* (Fry, 1994; Trejo et al., 2015).

There is a legend that says that the *Cuetlaxóchitl* sent by Poinsett to Philadelphia came from Taxco, Guerrero. This magical town, known for its mining tradition and silver crafts, is also assumed to be the site where the ceremonial use of *Cuetlaxóchitl* became



■ Figure 7. Sun *Cuetlaxóchitl* growing in gardens in Guerrero, Mexico. Picture taken by Elvira Romano.

associated, for the first time, with the birth of Jesus. The Franciscan monks of the region used poinsettia flowers as offerings and decoration during the December holidays. Unfortunately, further historical evidence is needed to document this story.

We tested the hypothesis that the plants sent by Poinsett came from this region. We used molecular markers that enabled us to recognize genetic relationships between wild and cultivated *E. pulcherrima* individuals. We identified the source of germplasm of commercial cultivars. Our results indicated that the wild relatives of North American cultivars come from northern Guerrero, where Taxco is located. Therefore, Poinsett's story could be true.

The *Cuetlaxóchitl* in today's Mexican gardens

Poinsettia is known by several names in Mexico. The most common ones are “Nochebuena” (Christmas Eve), “Pascua” (Easter), “Santa Catarina” (Saint Catherine) or *Cuetlaxóchitl*. This plant can be enjoyed throughout Mexico in gardens, backyards, and cemeteries. We learned that, historically, people collected plants from wild populations and moved them to human settlements (Trejo et al., 2019). This practice enabled the *Cuetlaxóchitl* or wild poinsettia to establish outside its natural environment and, by adapting to these sites, the plants acquired characteristics that over time have made them different from their ancestors. Many of these landraces are Mexican cultivars known as Sun *Cuetlaxóchitl* and look like wild plants, but can have “double” flowers and grow outdoors (Trejo et al., 2019).

The story continues

Many, diverse mysteries still need to be solved regarding wild and cultivated *E. pulcherrima* individuals. We have mentioned only a few in this paper, such as which insect or bird pollinates the flowers, and what is the plant's complete natural distribution. These facts would complete their story. Today, cul-

tivars come from a small sample of the germplasm available in *E. pulcherrima*, so it is quite probable that wild *Cuetlaxóchitl* could be used to develop new cultivars that could be adapted to different environments.

Genetic studies would also help us to identify local variants of wild *Cuetlaxóchitl*, which would help fight bio-piracy. Finally, *Cuetlaxóchitl*, or wild poinsettias constitute an excellent model to study the evolution of ornamental plants.

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> Laura Trejo

> About the author

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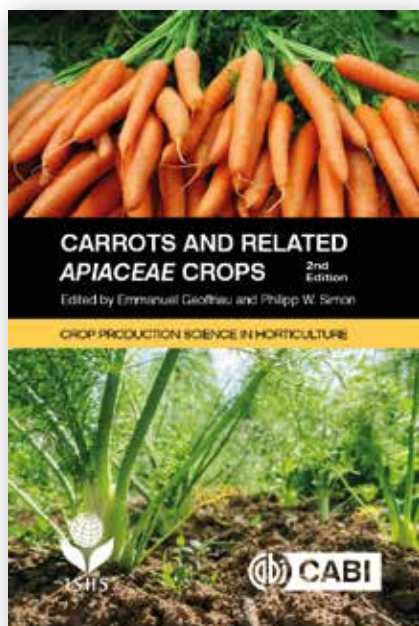


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Geoffriau, E., and Simon, P.W., eds. (2020). *Carrots and Related Apiaceae Crops*, 2nd edn (Wallingford, Oxfordshire, UK: CABI Publishing), pp.368. ISBN 9781789240955 (paperback) / 9781789240962 (ePDF) / 9781789240979 (ePub). €60.00 / £49.99 / \$70.00.

A 25% discount will be received by entering the code “CCISHS25” when ordering through <https://www.cabi.org/bookshop/book/9781789240955/>

The latest in the “Crop Production Science in Horticulture” series, this book provides a truly international and comprehensive look at the group of crops in the family known previously as the *Umbelliferae*. Forty authors working in 13 countries participated to first cover the taxonomy and botany of the family as a whole, followed by detailed coverage of the carrot, the major crop, which takes up

about half of the book. The last 100 pages deal with 13 minor, but commercially important *Apiaceae* crops. In the crop-specific sections, the biology, usage, crop management, disease and pest management, harvest and postharvest handling are detailed.

The most economically important crop, the carrot, is grown world-wide, from temperate areas to tropical, but its production is constrained by several factors. Detrimental effects on root shape prevent the transplanting of the crop, so carrots are only direct-seeded, making them susceptible to competition from weeds during the long early growth period. Weed management is thus an important cultural practice vital for high yields. Further, because many of the dominant carrot cultivars have roots exceeding 10 cm in length, soils in production areas need to be prepared to be friable to at least that depth. An additional constraint limiting where carrots can be grown is the adverse

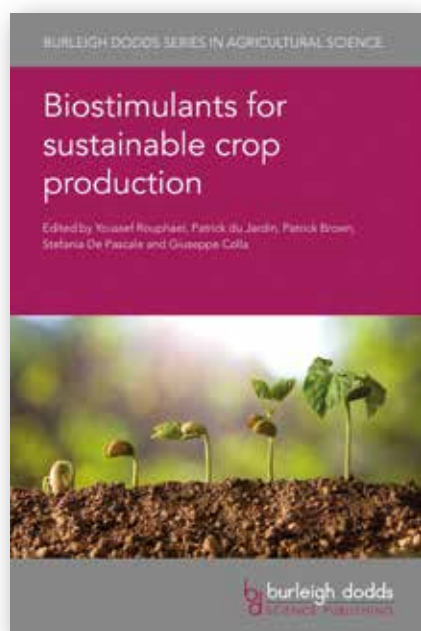
effect of growing season temperatures exceeding the mid-20's °C. The book clearly details the effect of high temperature and water stress on increasing levels of bitter compounds such as terpenes in the harvested roots. It was encouraging to learn that selecting lower levels of these off-flavors has recently received attention from carrot breeders. Overall, the coverage of all aspects of carrot development, management, and utilization is comprehensive in this book, and should satisfy the intended audience of the book series: students and staff of universities, as well as progressive growers, advisors and end product users.

The astonishing diversity of other crops in the *Apiaceae* is well described in the last 13 chapters of the book. For instance, the reader may be surprised to learn that Arracacha (*Arracacia xanthorrhiza*) is a starchy root crop grown in higher elevations of South America, and used as a starchy staple or industrially for starch. So far, this is little known outside the South American continent. Chapters detailing crops grown primarily for the seeds, such as Angelica, caraway, cumin, coriander and dill provide useful details on their major production areas, and how the end products are harvested and handled. Separate chapters on celery, both produced for its leaf

stalks, and for the roots, grown primarily in North America and in Europe, respectively, also illustrate local specialization.

Overall, the quality of the writing in this book is high, although occasionally a tighter editing of the English usage of some authors would have been helpful. Clear, appropriate photographs and drawings improve the clarity of the subject matter. The book is an excellent addition to our knowledge of the horticultural crops in the *Apiaceae* family.

*Reviewed by H.C. Wien,
Emeritus professor of horticulture,
Cornell University, USA*



Rouphael, Y., du Jardin, P., Brown, P., De Pascuale, S., and Colla, G. (2020). *Biostimulants for Sustainable Crop Production*. Burleigh Dodd Series in Agricultural Science Number 84 (Cambridge, UK: Burleigh Dodds Science Publishing Ltd), pp.365. ISBN 978-1-78676-336-5 (hard cover). £150.00.

A 25% discount will be received by entering the code "CHRON25" when ordering through <https://shop.bdspublishing.com/store/bds/detail/workgroup/3-190-84222>

In addition to being well written and structured, this book is edited by some of the most prominent authorities in the field of biostimulants. In the volatile world of biostimulants and alternative products for address-

ing sustainability in commercial agriculture, this book is a welcome addition. It meets the need for a reliable and comprehensive resource on current legislation, challenges, and peer reviewed scientific results.

The book covers a wide range of biostimulant concepts, characteristics of the main biostimulant groups, and current approaches for registration in the USA and Europe (Section 1); an in depth discussion of the main categories of biostimulants, providing supporting evidence along the way (Section 2); and proposed innovations and practical applications for the future (Section 3).

Section 1 motivates the paradigm shift towards a sustainable alternative, while Section 2 explains the distinction between non-microbial and microbial biostimulant products. Detailed information regarding the categorisation, production, and effects of the six categories (humic substances, seaweed extracts, protein hydrolysates, plant growth-promoting rhizobacteria, arbuscular mycorrhiza and silicon) were presented, with references confirming solid outcomes. The authors clearly indicate knowledge gaps and uncertainties, never presenting biostimulants as the comprehensive solution to sustainable alternatives. In contrast to most publications on biostimulants, the book draws on a substantial number of real cases and field studies to complement the known studies on *Arabidopsis*. This is encouraging, as field studies are the Achilles' heel of biostimulants at present.

Section 3 focuses on future development in this field of science. The chapter on development of new products summarises the processes, but no new information is supplied. Similarly, the chapter on the role of biostim-

ulants in increasing nutrient use efficiency is informative, but unfortunately includes substantial repetition from the previous section. The role of the phenological developmental stage of the plant at the time of application of the various biostimulants was not discussed and may be an important factor when these are applied under field conditions, on various crops.

The final chapter addresses the requirement for alternative, non-destructive quantification methods to capture biological and chemical reactions on biostimulant applications. This is especially relevant for field applications and the authors' suggestions create scope for future research. In addition, the time of evaluation may also contribute towards successful capturing of physiological changes initiated by biostimulant applications in the field.

The book is suitable to serve as a comprehensive guide for a scientific introduction to the potential roles of the different biostimulant categories in sustainable agriculture. There is a wealth of peer reviewed references that cover the source, composition, and mode-of-action of the well-known reliable products.

*Reviewed by Elmi Lötze, Chair ISHS Working
Group Mineral Nutrition of Fruit Crops*



➤ Urban Greenhouse Challenge: exploring the potential of urban farming

Marta Eggers, Patricia Duarte de Oliveira Paiva, Francesco Orsini, Alejandro Rueda Gómez, Boudewijn Klose, Wouter van As and Merel Schonagen

The explosion in urban growth presents many opportunities and challenges to our environment and to our food systems. Many cities are looking for ways to feed themselves sustainably and to create a livable and healthy environment for urban dwellers. To support these developments and explore the potential of urban farming, Wageningen University & Research (The Netherlands) initiated the Urban Greenhouse Challenge (<https://urbangreenhousechallenge.nl/>). This unique global challenge is held every two years.

The Urban Greenhouse Challenge is an international competition, open to student teams from all around the world. Students from the same or from different universities may form a team and participate. We encourage students to create teams from differing educational backgrounds, cultures and countries; this includes students from universities of applied sciences.

The two main ambitions of the Challenge are talent development and stimulating innovation on the overall concept as well as at domain-specific level. Interactions between students and partners and cocreation play

an important role in achieving these ambitions. During the competition, students work intensively with coaches from the private, public and social sectors as well as the academic world, to develop their ideas to form a realistic, well-substantiated concept. The Challenge brings together academic institutions, private companies and non-profit organizations active in urban food production.

With the series of Urban Greenhouse Challenges, we contribute to the exploration of the potential of urban farming. Therefore, we set every edition in a different context in one of the world's major metropolises.

In the second Urban Greenhouse Challenge, the teams were asked to design an iconic and circular urban greenhouse for a metropole in China that 1) produces safe and healthy food for the local neighborhood and commercial markets, and 2) stimulates a healthy lifestyle and interactions with city dwellers. The entries had to be supported with a convincing business plan.

This edition's Challenge site was conveniently located in Dongguan, at the heart of the Greater Bay area, which is one of the largest

urban areas in the world and the innovation hub of China. By high-speed train, it is just minutes away from Guangzhou, Shenzhen, and Hong Kong. It is an exciting location, where urban and rural come together, creating a myriad of opportunities. Over the coming years, the site will be developed by Country Garden Agriculture, who was the host partner of the Urban Greenhouse Challenge².

In October 2019, 491 students in 53 teams from 28 countries on 5 continents joined the Challenge. During the intensive ten months, they received the support of international experts, participated in various on-line events, and worked hard on their design, while withstanding the COVID-19 pandemic. After two selection rounds, ten international teams were selected for the Grand Finale that took place on 27 August 2020, on-line at Wageningen Campus. The three best teams were chosen as the winners and collected the 15,000 euro prize pool.

Although this competition was intense and additionally difficult due to the pandemic, students and partners look back at it with



➤ Winners of the Urban Greenhouse Challenge².

satisfaction. To quote one of the participants: “It was a wonderful experience to combine our imagination, innovation and knowledge, and break through the original mode of thinking.” You can read more about the second edition of the Challenge in our magazine (https://issuu.com/nieuweveluwe/docs/student_challenges_2020-def-issuu).

The third Challenge will start in October 2021 and focus on frugal innovation and poverty alleviation. Follow the WUR Student Challenges on social media or subscribe to our newsletter to keep up to date.

The ideas and explanation about the projects of the three winners of the Urban Greenhouse Challenge² are explained below: Team Bagua, Team KAS, and TeAMSPirit.

1st place – Team Bagua – The Bagua: embracing change and the flow of nature to create the Great Food Transformation

Participants: Abdelrahman Mohie, Alejandro Rueda Gómez, Gabriel Malaquin, Maria Alejandra Monroy, Nicole Rodas, Olivia Manzart, Rachel Wilbertz, Ruijie Shi, Sara Samir, Sofie De Brabander.

Great Food Transformation

Our current food system is massively threatening environmental sustainability and human health: it is one of the biggest contributors to climate change, biodiversity loss, and freshwater contamination. Moreover, the COVID-19 pandemic has highlighted the risks and vulnerabilities of our globalised food network, placing millions of people at risk of acute hunger.

We believe that the Great Food Transformation, as proposed by the EAT-Lancet commission, needs to happen. We must support environmental sustainability and nurture human health. Such a transformation is necessary to feed 10 billion people a healthy diet within our planetary boundaries, to achieve the UN

Sustainable Development Goals and meet the Paris Agreement.

Embracing change and the flow of nature

With these challenges in mind, we, an interdisciplinary team of ten students from every corner of the world, designed The Bagua. Our idea was inspired by Taoism. We based our concept on the Dao, ‘the way’ – a way forward into the future in which we embrace change and the flow of nature. For this, we need to be flexible and adaptable, to go with the Dao and appreciate contradictions. Thus, we take in as much solar energy and rainwater as possible, as each food-production area is designed to have an optimal relation with the light it receives. The building is a stacked semi-closed greenhouse – like the Sky Green towers – using the latest proven technologies to produce approximately 665 tons of food per year. This would be enough to provide vegetables to 18,222 people per day.

Educating the next generation of farmers and entrepreneurs

But The Bagua is more. It fosters social cohesion, inclusion and knowledge exchange through its food hub and educational centre. The “Bagua Prospective Producers Programme,” aims to transfer knowledge in the areas of traditional and modern agriculture, business and social skills, circularity and nutrition. Each year, it educates 100 schoolchildren whose parents are rural migrants with limited access to opportunities. Thus it enables them to become entrepreneurs in this field and contribute to the Great Food Transformation towards safer and healthier food.

Giving back to the locals

To bring farming closer to all of Dongguan’s citizens, The Bagua also hosts a competition whose winners will have the opportunity to

conduct research on The Bagua premises. Both food production and social activities take place in a beautifully designed building that aims to achieve maximum circularity. It creates synergies and resource flows between activities and between production and consumption of crops.

The food will be provided to the community in an on-site restaurant and a farmers market, and in cooperation with local shops, delivery services, and farmers. For The Bagua to be successful, the focus will be on entrepreneurial spirit and farmers ready to transfer their knowledge to people needing it, leading to robust profitability.

Tackling current and future food challenges

Our project offers opportunities to many people to change their lives for the better while working on global challenges. If our aim is to achieve the Great Food Transformation and produce healthy and sustainable food, we need to educate the next generation of farmers and entrepreneurs. The Bagua vision is to become an inclusive and tolerant hub for fun, knowledge exchange, education. It will further research on agriculture to tackle current and future food challenges in balance with nature and society, bridging the gap between our food consumption and production, and bringing agriculture back to the cities.

2nd place – Team KAS – KAS Greenhouse: to secure the future for smallholder farmers, rural-urban migrants and consumers

Participants: Adriaan Moerdijk, Bangding Xiong, Benjamin Smits, Boudewijn Klosse, Ivo ten Have, Jurrian Nannes, Kyungchun Kim, Marieke de Haas, Marieke van den Broek, Steven Poos, Wouter van As, Ziyi Zhu.

Our focus

We learned that the groups who are desperately in need of support, smallholder farmers, rural-urban migrants and consumers, were being left out of the new Chinese investment plans. The KAS Greenhouse is therefore designed to include, support and utilise the undervalued potential of smallholder farmers and rural-urban migrants, while improving the quality of life for consumers.

Our solution

The KAS Greenhouse is a synergetic and scalable concept that rebrands agriculture to entice young people to become the next-generation farmers. We showcase increased income potential for farmers by using farming techniques to farm high-value crops like ginseng, dragon fruit and oyster mushrooms. These novel farming techniques have been developed and tailored by our multidisci-



➤ 1st place – Team Bagua – The Bagua.



> 2nd place – Team KAS – KAS Greenhouse.

plinary team in collaboration with various experts in the field.

In support of the increased income potential, skill trainings are offered giving them the tools they need to succeed. These skill trainings are also tailored and offered to rural-urban migrants: improving their prospects and allowing them to gain the skills and experience they need to succeed. At the end of the educational trajectories, groups of farmers and rural-urban migrants can apply for microcredit loans to start or innovate their businesses.

By creating a fully controlled food production system, and focusing on the nutrient quality of our crops instead of large quantities, we can increase consumer well-being as well as consumer trust in locally grown produce. The KAS Greenhouse membership sets a new example of transparency by including access to the livestreamed food production process.

But is providing healthy food enough to also change dietary patterns?

We are convinced consumers need to be taught the tools to properly prepare their own food. Healthy diets are encouraged by focusing on tasty, nutritional foods in our Culinary Innovation and Experience Centre, a place where consumers can not only experience but also learn to prepare delicious dishes.

Setting the bar

Embodied in a building that neatly flows into its surrounding environment, we aim to set the bar for circular and sustainable solutions. Rainwater is collected, the building uses a closed nutrient and water system, and we create value from by-products that are often wasted, such as used coffee and organic and inorganic waste. We transcend material circularity and build upon untouched concepts of circular economies. The KAS Greenhouse is capable of training its own staff, making the entire concept self-sufficient while adding

renewed value to the undervalued potential of individuals.

KAS – creating a mutualistic relationship with the environment

KAS – allowing the continuous creation of opportunities

KAS – Knowledge of Agricultural Sustainability

3rd place – TeAMSpirit – the Turtle: leading the way to the food of tomorrow

Participants: Andrea Johanna Winters, Annie Berendsen, Eleonora Margaretha Thierry, Jens Cornelis Slagter, Lauri Elisabeth Schippers, Liwei Zhang, Merel Schonagen, Nicolás Carvajal Ordóñez, Tearlach Barden, Titus Venverloo, Roberto Carlos Márquez Estrada, Yuanyuan Yin.

The Turtle (独占鳌头): leading the way to the food of tomorrow – come and meet us at the future of global agriculture

Created to fit in and stand out

Welcome to the Turtle, our circular urban farm. In Chinese mythology a turtle represents wisdom, longevity, and resilience. This is exactly what we strive to achieve with our seasonal greenhouse. Standing in the heart of Guangzhou, the largest metropolitan area in the world, the Turtle reconnects urban citizens with the natural environment. The greenhouse exists as a bridge between the field of agricultural innovation and the culinary heritage of the people of China. It serves as an innovation platform in which citizens, researchers and businesses can come together and serve their surrounding community.

Four seasons all year round

Our four-season greenhouse exhibits tailored production systems that minimise resource input requirements as well as guarantee that

our crops are as healthy and nutritious as possible. Our aquaponic system is the first of its kind, designed so that every resource – from nutrients to floor space – is fully utilised. This is achieved through the use of state-of-the-art artificial intelligence, which regulates all environmental parameters and ensures specific crop and system optimisation. While our technologies focus on high-tech urban greenhouse farming, our research is aimed at affordable farming practices that can be applied to suit the wider, ever-changing conditions induced by climate change.

Circular power

The powering of the Turtle required further innovation that would take advantage of any energy flows to their fullest extent. This was achieved through the community-driven Green Power Plant. Here, heat, biogas, and fertiliser are produced from the organic waste of the building and its surroundings. The biogas is fed into the Solid Oxide Fuel Cell technology, which converts the biogas into electricity with 56% efficiency, supplying power to the entire Turtle. For the building's climate control, we developed a circular cooling system using heat flows from the LEDs and hybrid photovoltaic thermal panels. Combined with the heat exhaust from the solid oxide fuel cell, this runs the solar absorption cooling system, keeping the Turtle cool, even on the hottest days.

The Turtle way of life

The Turtle is a place where people from all layers of society can appreciate their culinary heritage while learning about the impact of agricultural innovation. The building includes a living lab, as a means to tackle the lack of resilience in agricultural farming. The living lab is where researchers utilise the chaotic nature of an uncontrolled environment to ensure that all tested crops and farming practices are able to withstand the unpredictable conditions that are present in the natural environment. By adopting an innovation process that has a primary focus on resilience, we ensure that the benefits of our research spread beyond the city of Dongguan, and also reach more vulnerable communities.

Strategy for longevity

We believe that the production of crops should be local, sustainable, safe, and affordable. Our core business focuses on this ambition by leveraging waste streams, innovating energy flows and merging high-end technology with local traditions. This is achieved through the creation of our own sustainable currency: Turtle EGGS. Citizens separate and hand in their waste and in return receive Turtle EGGS, which can be used to buy fresh



> 3rd place – TeAMSpirit – the Turtle.

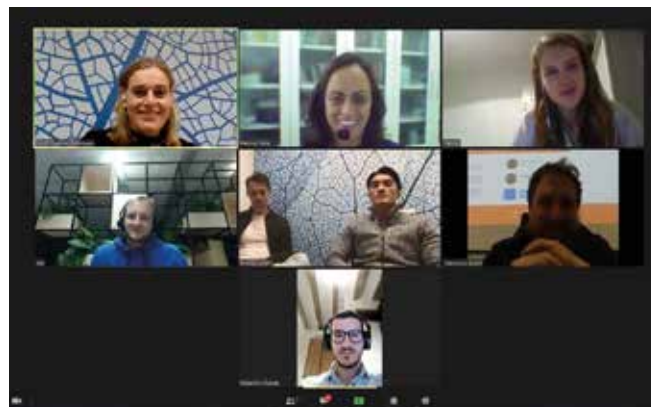
products to support local businesses. This enables citizens to contribute to the city's sustainability goals, while enabling us to leverage waste streams to reduce water and energy usage. The Turtle is powered by the people, for the people, creating a more sustainable and healthy way of living.

Winners of Urban Greenhouse Challenge'2 Webinar

Last October, the participants had an opportunity to show their ideas and projects in a Webinar (<https://youtu.be/KzolW7dRNYQ>), organized by Marta Eggers and Alejandro Caprini from WUR Student Challenges and

moderated by Patricia Duarte de Oliveira Paiva (ISHS Board) and Francesco Orsini (Chair, ISHS Division Landscape and Urban Horticulture). The webinar allowed attendees to meet the winners as well as ask questions and clarifications on their concepts. The teams were asked to talk about the main difficulties they experienced during the Challenge. For them, online meetings, also considering the participation of members from different time zones, seemed at the beginning to require big efforts, also since they needed to learn how to meet each other's expectations. To meet the Challenge's goals, their interaction was necessarily intense to

provide full consideration of interdisciplinary aspects. Some areas were difficult to connect between each other, and the analysis of economic viability was particularly demanding. The Challenge also required a lot of work within tight deadlines, an experience they will take into their professional career. With this opportunity, we may understand that participating in a Challenge is a remarkable experience for younger students, allowing them to practice many professional concepts and behavior while preparing them for a successful future. ●



> Winners of Urban Greenhouse Challenge'2 Webinar, October 27, 2020.

> About the authors



> Marta Eggers

Marta Eggers is project manager at WUR Student Challenges. She is responsible for the organization and communication about signature student competitions of Wageningen University & Research, The Netherlands: Urban Greenhouse Challenge and ReThink Protein Challenge. E-mail: marta.eggers@wur.nl



> Patricia Duarte de Oliveira Paiva

Patricia Duarte de Oliveira Paiva is a Full Professor at the Federal University of Lavras, Brazil, and ISHS Board Member, as the representative from South America and responsible for the Young Minds Program. As a professor, she teaches Landscaping and Floriculture and has authored many publications on these topics. E-mail: patriciaipaivaishs@gmail.com



> Francesco Orsini

Francesco Orsini is Associate Professor at the University of Bologna Alma Mater Studiorum, Italy, and Chair of ISHS Division Landscape and Urban Horticulture. Since 2018, he has been responsible for organizing the International Student Challenge UrbanFarm at Bologna University, and collaborates with the Urban Greenhouse Challenge organized by WUR. Prof. Orsini has authored more than 80 indexed publications on topics related to urban horticulture and vegetable crop production. E-mail: f.orsini@unibo.it



› Alejandro Rueda Gómez

Alejandro Rueda Gómez (Team Bagua). Team Bagua is an international team of interdisciplinary students from the Sustainability Master of the Autonomous University of Barcelona, Spain, and Architecture students from ELISAVA, Spain, and Cairo University, Egypt. E-mail: alejandr ruedagomez@gmail.com



› Boudewijn Klosse

Boudewijn Klosse (Team KAS) is a Master student in Food Technology at Wageningen University, The Netherlands, and research assistant at T.A.S.T.E. (The Academy for Scientific Taste Evaluation). Firmly believing in taste as a carrier for health and vitality, he aims to improve global health through a tastier food system. E-mail: boudewijn.klosse@wur.nl



› Wouter van As

Wouter van As (Team KAS) is a Master student in Plant Biotechnology at Wageningen University and Research, The Netherlands, focussing on molecular plant breeding and pathology. From his childhood on, he has been fascinated by plants, both to feed the planet and due to their massive biodiversity. Alongside his studies, he participates in various organisations, from astronomy to politics. E-mail: wouter.vanas@wur.nl



› Merel Schonagen

Merel Schonagen (TeAMSPiRiT) is a Master student on the MSc MADE (Metropolitan Analysis, Design and Engineering) program at the Amsterdam Institute for Advanced Metropolitan Solutions, a joint degree of the TU Delft and Wageningen University & Research, The Netherlands. She believes that urban challenges demand smart and interdisciplinary solutions which can only be developed in collaboration with citizens, research and industry. E-mail: amsurbangreenhouse@gmail.com



www.facebook.com/ishs.org

> New ISHS members

ISHS is pleased to welcome the following new members:

New Individual Members

Australia: Mr. Tom Flanagan, Mr. Don Graystone, Mr. Mark Hickey, Mr. Jon McCarthy, Mr. David Rothfield, Mr. Martin Vadakekuttu; **Belgium:** Dr. Caroline De Tender, Dr. Pascal Ghyselbrecht, Mr. Hannes Wilms; **Canada:** Nicolas Tirard; **Chile:** Prof. Monica Castro, Dr. Claudia Fassio, Prof. Dr. Ian Homer; **China:** Dr. Ye Han, Dr. Sven Landrein, Prof. Dr. Jiwei Ruan, Bin Wang, Dr. Yajun Wang; **Croatia:** Prof. Dr. Martina Skendrovic Babojelic; **Denmark:** Mr. Rasmus Madsen, Ms. Yi Tan; **Germany:** Dr. Janne Lempe; **Greece:** Mr. Ioannis Tsarouchas; **Guatemala:** Maria Antonieta Castillo Holly; **India:** Mr. Vishwanath Gaddikeri, Mr. Babasaheb Gore, Assist. Prof. Ramudu Jujjuvarapu, Mr. Sapan Parekh, Dr. Jagveer Singh; **Indonesia:** Ms. Rizka Amalia Nugrahapsari; **Ireland:** Mr. Patrick Fitzgerald; **Israel:** Dr. Tamar Azoulay-Shemer, Mr. Hillel

Brukental, Dr. Danielle Duanis-Assaf, Mr. Aviran Nissim, Manish Kumar Patel; **Italy:** Dr. Ania Balducci, Mr. Ahmed Ben Abdelkader, Dr. Giacomo Palai; **Japan:** Asami Hirono, Hideaki Kuroda, Assoc. Prof. Yoshio Makino, Satomi Matsumoto, Ms. Junjira Satitmunnaithum, Prof. Dr. Kotaro Takayama, Dr. Daisuke Tsugama; **Latvia:** Justine Kocere; **Lebanon:** Mr. Raja Abu Hassan; **Malaysia:** Mr. Su Fah Liao; **Mexico:** Mr. Antonio Garza, Dr. Jorge Alberto Osuna Garcia; **Moldova:** Du Mar; **Monaco:** Mr. Daniel Pavel; **Netherlands:** Aike Luring, Hermann Schilt; **New Zealand:** Mr. Simon Lennard; **Nigeria:** Mr. Isaiah Adekanye; **Pakistan:** Dr. Sami Ullah; **Portugal:** Ms. Bárbara Gomes; **Romania:** Mr. Flavius Danila, Eliza Teodorescu; **Russian Federation:** Olga Koroleva, Mr. Igor Kosarev; **Singapore:** Mr. Jovan Tan; **Spain:** Dr. Ana-Rosa Ballester, Dr.

Francisco Montoya, Juan Manuel Sánchez, Mr. Víctor Silva-Alejandre; **Sri Lanka:** Dr. Anton Naduwilage; **Suriname:** Mr. Wensley Romeo Perea; **Turkey:** Mr. Husnu Cemre Ozogan; **United Arab Emirates:** Mr. Edi Sugiyanto; **United States of America:** Justin Brown, Assist. Prof. Matthew Clark, Luis Clavijo Herrera, Timothy Dahle, Dr. Ricardo Delgado Santander, Dr. Irwin Donis-Gonzalez, Mr. Brandon Friesen, Dave Goorahoo, Lloyd Jones, Justin Laird, Ricardo Lesmes, Dan Levin, Susan Martin, Crystal McCrory, Saskia Desiree Mesquida Pesci, Anggi Nindita, Sarah Parker, Andrew Reade, Dr. Jyoti Rout, Christian Silva, Mr. Yolanda Slaught, Janet Slovin, Dr. Neal Smoller, Mr. Caleb Spall, Mr. Michael Straumietis, Dr. Geordie Zapalac; **Zimbabwe:** Sandra Roberts

> In memoriam

Dr. Shmuel Gazit (1929-2020)



It is with great sorrow that I inform you that Dr. Shmuel Gazit passed away on 25 August 2020. Dr. Gazit studied Plant Science and Genetics at the Agriculture Faculty of the Hebrew University in Rehovot, Israel (1949-1954) and graduated from

his academic degree with honors. After a short period (1954-1956) serving as teacher of horticulture and deputy director of the “Kadoorie” agricultural school, he initiated his research activities working from 1957-1961 as a research and assistant student in the Agriculture Faculty, where he obtained his Ph.D. under the guidance of Prof. Hanan Oppenheimer. His thesis was “Differentiation and development of mango flowering bud,” a masterpiece in the understanding of mango flower physiology. By 1967, he began working at the Volcani Agricultural Research Organization Institute in the Subtropical Fruits Department. He was elected as its Director in 1970, and remained for a term of five years. He was also selected as the Subtropical Department management member of the Agriculture Ministry and in 1977, was elected as the head of the Agriculture Faculty. The subject of Dr. Gazit’s research was reproductive biology and productivity of subtropical fruit tree crops, mainly mangoes, avocados, litchis, and *Annona*. He also performed important

work in studying avocado pollination and pollinators, breeding, selection, and evaluation of avocado, mango, and litchi cultivars, as well as selection of mango rootstocks. To a great extent, the selection of the salinity resistant 13-1 rootstock and newly released Israeli mango cultivars, which are now successfully marketed in Europe, are the successful results of his research.

Dr. Gazit was also a well-known expert in tropical fruit outside of Israel, playing a special role as plantation consultant in the development of tropical fruit crops in countries like Nicaragua, Cambodia (1972), Jamaica (1973) and Venezuela (1974). His international prestige was recognized by the reception of the “Wilson Popenoe” award of excellence in the tropical and subtropical fruit trees research on behalf of the American Society for Horticulture Science (ASHS), being also nominated as a committee member of the international organization in the same field. He was an active member of the ASHS, the Interamerican Society

for Tropical Horticulture, the Rare Fruit Council International, and particularly of the International Society for Horticultural Science (ISHS); where he was the Chair of ISHS Working Group Mango from 1996-2010 and also the Convener of the V International Mango Symposium (1996, Israel). His love for this crop is well expressed by the following sentence that he used to repeat: "The mango is the fruit that the peach dreamed to be." Shmuel attended many other international ISHS symposia and many mango researchers all over the world have learned from his

expertise. I had the fortune not only to succeed him as chairperson of the ISHS Working Group Mango, but also to share many hours of friendship and professional exchange both in Israel and in the Canary Islands, through field visits to many subtropical fields. Any of my professional visits to Israel, and also those of other researchers in tropical fruits who frequently visit that country, always arranged a face to face visit with him to discuss research topics in our common interest. In 2014, accompanied by my wife, Ana Luisa, I met

him and his wife, Carmela, for the last time. We had an excellent dinner with them in the company of Dr. Eli Tomer and his wife, Zehava. During that meeting, we remembered many of our research activities and friendship throughout the years. I hope I speak for all who knew him, friends and colleagues, as I express our most sincere condolences to Carmela and the rest of his family. Dr. Gazit will be sorely missed.

Dr. Víctor Galán Saúco, ISHS Honorary Member, Canary Islands, Spain

> Calendar of ISHS events

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

Year 2021

- March 2-5, 2021, Torino [virtual symposium] (Italy): **IV International Symposium on Woody Ornamentals of the Temperate Zone**. Info: Prof. Dr. Valentina Scariot, Università degli Studi di Torino, Dept. Agric., Forestry & Food Sci., Largo Paolo Braccini 2, 10095 Grugliasco, Torino, Italy. Phone: (39)0116708932, Fax: (39)0116708798, E-mail: valentina.scariot@unito.it or Prof. Dr. Gabriele Loris Beccaro, Università degli Studi di Torino, Dept. Agric., Forestry & Food Sci., Largo Paolo Braccini 2, 10095 Grugliasco, Torino, Italy. Phone: (39)0116708802, Fax: (39)116708658, E-mail: gabriele.beccaro@unito.it E-mail symposium: woodyornamentals2020@unito.it Web: <https://www.woodyornamentals2020.com/>

NEW

- March 8-12, 2021, Stuttgart (Germany): **IV International Symposium on Horticulture in Europe - SHE2021**. Info: Prof. Dr. Jens N. Wünsche, University of Hohenheim, Department of Crop Science, Section Crop Physiology of Specialty Crops, Emil-Wolff-Str. 25, 70593 Stuttgart, Germany. Phone: (49)711-459-22368, Fax: (49)711-459-22351, E-mail: jnwuensche@uni-hohenheim.de or Dr. Michael Helmut Hagemann, University of Hohenheim, Department of Crop Science, Section Crop Physiology of Specialty Crops, Emil-Wolff-Str. 25, 70599 Stuttgart, Germany. Web: <https://she-ihf-fav2020.de/>
- March 8-12, 2021, Stuttgart (Germany): **VIII International Symposium on Human Health Effects of Fruits and Vegetables - FAVHEALTH2021**. Info: Prof. Dr. Jens N. Wünsche, University of Hohenheim, Department of Crop Science, Section Crop Physiology of Specialty Crops, Emil-Wolff-Str. 25, 70593 Stuttgart, Germany. Phone: (49)711-459-22368, Fax: (49)711-459-22351, E-mail: jnwuensche@uni-hohenheim.de or Prof. Dr. Bhimanagouda Patil, VFIC, Texas A&M University, Department of Horticulture, 1500 Research Parkway Ste A120, College Station, TX 77845, United States of America. Phone: (1)9794588090, Fax: (1)9798624522, E-mail: b-patil@tamu.edu Web: <https://she-ihf-fav2020.de/>

- March 8-12, 2021, Stuttgart (Germany): **V International Humulus Symposium**. Info: Prof. Dr. Jens N. Wünsche, University of Hohenheim, Department of Crop Science, Section Crop Physiology of Specialty Crops, Emil-Wolff-Str. 25, 70593 Stuttgart, Germany. Phone: (49)711-459-22368, Fax: (49)711-459-22351, E-mail: jnwuensche@uni-hohenheim.de or Dr. Michael Helmut Hagemann, University of Hohenheim, Department of Crop Science, Section Crop Physiology of Specialty Crops, Emil-Wolff-Str. 25, 70599 Stuttgart, Germany. Web: <https://she-ihf-fav2020.de/>
- March 19-22, 2021, Lemesos (Cyprus): **III International Symposium on Soilless Culture and Hydroponics: Innovation and Advanced Technology for Circular Horticulture**. Info: Assist. Prof. Nikolaos Tzortzakakis, Dept. Agricultural Sciences, Biotechnology, Food Science, Cyprus University of Technology, 3036, Lemesos, Cyprus. Phone: (35)7 25002280, Fax: (35)7 25002838, E-mail: nikolaos.tzortzakakis@cut.ac.cy or Prof. Dr. Silvana Nicola, University of Turin, Dept. of Agric., Forest and Food Sciences, Leonardo Da Vinci 44 (L.Paolo Braccini, 2), 10095 Grugliasco (TO), Italy. Phone: (39)0116708773, Fax: (39)0112368773, E-mail: silvana.nicola@unito.it Web: <https://www.hydro2020.com/>
- March 29 - April 1, 2021, Dakar (Senegal): **IV All Africa Horticultural Congress - AAHC2021**. Info: Dr. Moutar Fall, Cluster Horticulture, 2,5 km Route de l'Aéroport, Immeuble MSA - BP 25 852, Dakar, Senegal. Phone: (221)776389171, E-mail: directeur@agroseed.sn Web: <http://www.aahc2020.org>
- May 1-5, 2021, Rimini (Italy): **IX International Strawberry Symposium**. Info: Prof. Dr. Bruno Mezzetti, Dip.Sci. Agrarie, Alimentari ed Ambientali, Università Politecnica delle Marche, Via Brecce Bianche, Ancona 60100, Italy. Phone: (39)0712204933, Fax: (39)0712204856, E-mail: b.mezzetti@univpm.it or Prof. Dr. Maurizio Battino, Dept of Clinical Sciences, Sect Biochemistry, Università Politecnica delle Marche, Via Ranieri, 65 - 60100 Ancona, Italy. E-mail: m.a.battino@univpm.it or Dr. Gianluca Baruzzi, Council for Agric. Research & Economics, via La Canapona, 1 bis, Magliano, 47100 Forlì, Italy. Phone:

(39) 543 89566, Fax: (39) 543 89077, E-mail: gianluca.baruzzi@crea.gov.it Web: <https://www.iss2021.com/>

- May 20-24, 2021, Beijing (China): **IX International Cherry Symposium**. Info: Prof. Dr. Kaichun Zhang, Beijing Academy of Forestry & Pomology Sci., Jia 12, Ruiwangfen, Xiangshan Str, Haidian, Beijing, 100093, China. Phone: (86)1082596007, E-mail: kaichunzhang@126.com E-mail symposium: cherriesymposium9@126.com Web: <http://2021.cherries.org.cn/>

- May 30 - June 3, 2021, Limassol/Lemesos (Cyprus): **VI International Symposium on Postharvest Pathology: Innovation and Advanced Technologies for Managing Postharvest Pathogens**. Info: Assist. Prof. Nikolaos Tzortzakos, Dept. Agricultural Sciences, Biotechnology, Food Science, Cyprus University of Technology, 3036, Lemesos, Cyprus. Phone: (35)7 25002280, Fax: (35)7 25002838, E-mail: nikolaos.tzortzakos@cut.ac.cy Web: <http://web.cut.ac.cy/postharvestpathology2021/>

- May 31 - June 2, 2021, Malmö (Sweden): **IX International Symposium on Light in Horticulture**. Info: Assist. Prof. Most Tahera Naznin, Department of Biosystems and Technology, Swedish University of Agricultural Sciences, Box 103, 23053 Alnarp, Sweden. Phone: (46)40415019, E-mail: naznin.most.tahera@slu.se or Dr. Maria Karlsson, Växtskyddsvägen 3, skne, Hunnestorpsvägen 29, skne, 23053 Bstad Alnarp, Sweden. Phone: (46)40-415370, E-mail: maria.e.karlsson@slu.se or Assoc. Prof. Sammar Khalil, Department of biosystem and technology, Box 103, 23053 Alnarp, Sweden. E-mail: sammar.khalil@slu.se E-mail symposium: ISHSLight2020@slu.se Web: <https://www.ishslight2020.se/>

- June 1-5, 2021, Moscow (Russian Federation): **XV International Symposium on Virus Diseases of Ornamental Plants**. Info: Dr. Tatiana Mitouchkina, Branch of Institute of Bioorganic Chemistry, Science av.6, 142290 Moscow region Pushchino, Russian Federation. Phone: (7)4967731779, Fax: (7)4967731779, E-mail: tatiana@planta.bio Web: <http://isvdop2020.ru/>

- June 28-30, 2021, Ma'ale HaHamish (Israel): **IX International Symposium on Mineral Nutrition of Fruit Crops**. Info: Dr. Uri Yermiyahu, Gilat Research Center, Soil and Water, Mobile Post Negev 85280, Israel. Phone: (972)89928649, Fax: (972)79926485, E-mail: uri4@agri.gov.il or Dr. Arnon Dag, Plant Sciences, Gilat Research Center, Agricultural Research Organization, (The Volcani Center), Mobile Post Negev, 85280, Israel. Phone: (972)506220155, Fax: (972)89926485, E-mail: arnondag@agri.gov.il Web: <https://www.ortra.com/events/mnutrition2020>

- July 12-14, 2021, Bangkok (Thailand): **IX International Scientific and Practical Conference on Biotechnology as an Instrument for Plant Biodiversity Conservation (physiological, biochemical, embryological, genetic and legal aspects)**. 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: biotech2020thailand@gmail.com Web: <http://plantscience.sc.mahidol.ac.th/biotech2020>

- July 12-16, 2021, Hangzhou, Zhejiang Province (China): **III International Symposium on Fruit Culture along Silk Road Countries**. Info: Prof. Dr. Yuanwen Teng, Dept. Of Hort., College of Agric. & Biotech., Zhejiang University, Zijingang Campus, Hangzhou 310058, China. Phone: (86)571-88982803, Fax: (86)571-88982803, E-mail: ywteng@zju.edu.cn or Prof. Dr. Zhen-Hai Han, Institute for Horticultural Plants, China Agricultural University, No. 2 Yuanmingyuanxilu, 100193 Beijing, China. Phone: (86)1062732467, Fax: (86)1062734391, E-mail: rschan@cau.edu.cn or Prof. Dr.

Xingjiang Qi, No. 298 Desheng Middle Road, Hangzhou, China. Web: <http://www.silkroad2021.org/>

- July 20-22, 2021, Bogor, West Java (Indonesia): **II International Symposium on Tropical and Subtropical Ornamentals**. Info: Dr. Syarifah Iis Aisyah, Dept. of Agronomy and Horticulture, IPB, Jl. Meranti, Kampus IPB Darmaga, 16680 West Java Bogor, Indonesia. Phone: (62)2518629353, E-mail: syarifahiis@yahoo.com or Dr. Dewi Sukma, Department of Agronomy and Horticulture, Bogor Agricultural University, Jl. Meranti Kampus IPB Darmaga, 16680 Bogor, Indonesia. Phone: (62)-251-8629353, Fax: (62)-251-8629353, E-mail: dsukma70@yahoo.com E-mail symposium: tso2020indonesia@gmail.com Web: <http://tso2020.ipb.ac.id>
- July 26-30, 2021, Wenatchee, WA (United States of America): **XII International Symposium on Integrating Canopy, Rootstock and Environmental Physiology in Orchard Systems**. Info: Prof. Stefano Musacchi, Washington State University, TFREC, 1100 N. Western Ave., Wenatchee, WA 98801-1230, United States of America. Phone: (1)509-663-8181, Fax: (1)509-662-8714, E-mail: stefano.musacchi@wsu.edu E-mail symposium: info@2020orchardsystems.com Web: <https://2021orchardsystems.com/>

- August 15-18, 2021, Leuven (Belgium): **XIII International Controlled and Modified Atmosphere Research Conference - CaMa2021**. Info: Prof. Bart Nicolai, Flanders Centre for, Postharvest Technology, W. De Croylaan 42, 3001 Heverlee, Belgium. Phone: (32)16322375, Fax: (32)16322955, E-mail: bart.nicolai@biw.kuleuven.be or Dr. Maarten Hertog, BIOSYST-MeBioS, K.U. Leuven, de Croylaan 42 - bus 2428, B-3001 Heverlee, Belgium. Phone: (32)16322376, Fax: (32)16322955, E-mail: maarten.hertog@kuleuven.be Web: <https://cama2020.org/>
- August 18-22, 2021, Uvero Alto, La Altagracia (Dominican Republic): **X International Pineapple Symposium**. Info: Mr. Joelin Santos, AsoproPimopla, C/ Altagracia 100, Monte Plata, Dominican Republic. Phone: (829)745-0318, E-mail: j.santos@asopropimopla.org E-mail symposium: xpineapple2020@gmail.com Web: <http://www.cedaf.org.do/eventos/xpineapple2020/>

- August 22-27, 2021, Ghent (Belgium): **II International Symposium on Growing Media, Soilless Cultivation, and Compost Utilization in Horticulture**. Info: Dr. Bart Vandecasteele, ILVO, Plant Sciences Unit, B. Van Gansberghelaan 109, 9820 Merelbeke, Belgium. Phone: (32)92722699, E-mail: bart.vandecasteele@ilvo.vlaanderen.be E-mail symposium: info@growingmedia2021.com Web: <https://www.growingmedia2021.com/>
- August 28 - September 2, 2021, Halifax, Nova Scotia and Charlottetown, Prince Edward Island (Canada): **XII International Vaccinium Symposium**. Info: Prof. Dr. David Percival, Dalhousie University, Department of Plant, Food, and, Environmental Sciences, PO Box 550, Truro, NS B2N 5E3, Canada. Phone: (1)9028937852, Fax: (1)9028931404, E-mail: david.percival@dal.ca Web: <http://www.Dal.ca/ivs>

- September 13-16, 2021, Palermo (Italy): **II International Symposium on the Role of Plant Genetic Resources in Reclaiming Lands and Environment Deteriorated by Human and Natural Actions**. Info: Prof. Francesco Marra, Department of Agricultural & Forest Science, Viale delle Scienze, Edificio 4 ingresso H, 90128 Palermo, Italy. Phone: (39)09123861236, Fax: (39)09123861211, E-mail: francescopaolo.marra@unipa.it or Dr. Emilio Badalamenti, Viale delle Scienze, Palermo, Italy. E-mail: emilio.badalamenti@unipa.it E-mail symposium: info@ispgr-it2020.it Web: <http://www.ispgr-it2020.it>
- September 13-16, 2021, Palermo (Italy): **International Symposium on Tropical and Subtropical Horticulture in Mediterranean Climate**. Info: Prof. Vittorio Farina, Università degli Studi

- di Palermo, Dipartimento Scienze Agrarie, Alimentari e Forestali, viale delle Scienze edif 4 - 90128 Palermo, Italy. Phone: (+39)09123896090, E-mail: vittorio.farina@unipa.it or Dr. Giuseppe Sortino, Department of Agricultural & Forest Science, University of Palermo, Viale delle Scienze, Edificio 4 ingresso H, 90128 Palermo, Italy. Phone: (39)09123861234, E-mail: giuseppe.sortino@unipa.it E-mail symposium: info@tropmed2020.it Web: <http://www.tropmed2020.it>
- September 14-17, 2021, Zlatibor (Serbia): **XII International Symposium on Plum and Prune Genetics, Breeding and Pomology**. Info: Dr. Darko Jevremovic, Kralja Petra I 9, 32000 Cacak, Serbia. Phone: (381)32321375, Fax: (381)32321391, E-mail: darkoj@ftn.kg.ac.rs E-mail symposium: plum2020@institut-cacak.org Web: <http://www.plum2020.com>
- September 20-24, 2021, Riva del Garda, Trento (Italy): **XIV International Symposium on Plant Bioregulators in Fruit Production**. Info: Dr. Fabrizio Costa, Via Mach 1, 38010 San Michele all'Adige, Trento, Italy. Phone: (39)0461615563, E-mail: fabrizio.costa@fmach.it Web: <https://eventi.fmach.it/ISHS-2021>
- September 20-25, 2021, Almería (Spain): **VI International Symposium on Papaya**. Info: Prof. Dr. Julian Cuevas González, University of Almería, La Cañada de S. Urbano s/n, 04120 Almería, Spain. Phone: (34)950015559, Fax: (34)950015939, E-mail: jcuevas@ual.es E-mail symposium: papaya2021@ual.es Web: <http://www2.ual.es/VI-symposium-on-papaya/>
- September 22-26, 2021, Nara (Japan): **VII International Symposium on Persimmon**. Info: Prof. Dr. Keizo Yonemori, Faculty of Agriculture, Ryukoku University, 1-5 Yokotani, Seta Oe-cho, Otsu 520-2194, Siga, Japan. Phone: (81)775995695, Fax: (81)775995608, E-mail: keizo@agr.ryukoku.ac.jp or Prof. Dr. Satoshi Taira, Lab. of Pomology, Fac. of Agr., Yamagata University, Tsuruoka, Yamagata 997-8555, Japan. Phone: (81)235-282829, Fax: (81)235-282832, E-mail: staira@tds1.tr.yamagata-u.ac.jp E-mail symposium: 2020persimmon@gmail.com Web: <http://kaki2020.jsjsh.jp>
- September 24-26, 2021, Ohrid (North Macedonia): **VIII South-Eastern Europe Symposium on Vegetables and Potatoes**. Info: Prof. Dr. Gordana Popsimonova, Debarca 16, 1000 Skopje, North Macedonia. Phone: (389)70255878, E-mail: gpopsimonova@yahoo.com or Skender Kaciu, Univ. of Prishtina- Faculty of Agri., and Veterinary, Boulevar B.Clinton bb, 10000 Prishtina, Kosovo. E-mail: skenderkaciu@yahoo.com E-mail symposium: contact@ishs8.org Web: <https://ishs8.org/>
- September 27 - October 1, 2021, Malaga (Spain): **XIII International Mango Symposium**. Info: Dr. J. Ignacio Hormaza, EE. La Mayora - CSIC, 29750 Algarrobo-Costa, Malaga, Spain. Phone: (34)952552656, Fax: (34)952552677, E-mail: ihormaza@eelm.csic.es or Dr. Víctor Galán Saucó, Isaac Albéniz 17, 38208 La Laguna, Tenerife, Canary islands, Spain. Phone: (34)922261647, E-mail: vgalan46@gmail.com E-mail symposium: mango2020@ihsm.uma-csic.es Web: <https://en.mango2021.es/>
- September 27-30, 2021, Yalova (Turkey): **X International Symposium on Kiwifruit**. Info: Dr. Arif Atak, Horticultural Central Research Institute, Department of Viticulture, 77102 / YALOVA, Turkey. Phone: (90)2268142520, Fax: (90)2268141146, E-mail: atakarif@gmail.com E-mail symposium: secretariat@kiwifruit2021.org Web: <http://www.kiwifruit2021.org>
- October 4-6, 2021, Bari (Italy): **I International Symposium on Plant Propagation, Nursery Organization and Management for the Production of Certified Fruit Trees**. Info: Prof. Salvatore Camposeo, Università di Bari, Dipt. di Scienze Agro-Ambientali e Territor, Via Amendola 165/a, 70126 Bari, Italy. Phone: (39)0805442982, Fax: (39)0805442982, E-mail: salvatore.camposeo@uniba.it or Prof. Dr. Tiziano Caruso, Department of Agricultural & Forest Science, University of Palermo, Viale delle Scienze, Edificio 4 ingresso H, 90128 Palermo, Italy. Phone: (39) 09123861207, E-mail: tiziano.caruso@unipa.it or Prof. Vito Nicola Savino, University of Bari - Microbiologia Applic., Dip. Protezione delle Piante, Via Amendola 165a, 70126 Bari, Italy. Phone: (39)0805443069, Fax: (39)0805443608, E-mail: viton.savino@gmail.com E-mail symposium: info@certfruit2020.org Web: <http://www.certfruit2020.org>
- October 6-9, 2021, Toluca (Mexico): **V International Conference on Postharvest and Quality Management of Horticultural Products of Interest for Tropical Regions**. Info: Prof. Dr. Omar Franco Mora, Laboratory of Horticulture, Faculty of Agriculture, Universidad Autónoma del Estado de México, Toluca, México, 50140, Mexico. E-mail: franco_omar@hotmail.com E-mail symposium: convener@pqmhp2021.com Web: <https://pqmhp2021.com/>
- October 19-22, 2021, Nanjing (China): **V International Symposium on Biotechnology and Molecular Breeding in Horticultural Species**. Info: Jun Wu, Nanjing Agricultural University, College of Horticulture, Nanjing, Jiangsu, 210095, China. E-mail: wujun@njau.edu.cn or Prof. Dr. Shaoling Zhang, Nanjing Agricultural University, 1 Weigang, 210095 Nanjing, China. E-mail: nnzsl@njau.edu.cn Web: <http://www.bmbh2020.org>
- October 28-30, 2021, Kansas City, MO (United States of America): **XV International People Plant Symposium and II International Symposium on Horticultural Therapies**. Info: Dr. Candice Shoemaker, 2021 Throckmorton, Department of Hort, Forestry, Rec Res, Kansas State University, Manhattan, KS 66506, United States of America. Phone: (1)7855321431, Fax: (1)7855326849, E-mail: cshoemak@ksu.edu Web: <http://ipps2020.org/>
- October 31 - November 4, 2021, Stellenbosch (South Africa): **XI International Symposium on Grapevine Physiology and Biotechnology**. Info: Melané Vivier, Institute for Wine Biotechnology, Department of Viticulture and Oenology, Private Bag x1, Matieland, 7602, South Africa. Phone: (27)218083773, Fax: (27)218083771, E-mail: mav@sun.ac.za or Johan Burger, Stellenbosch University, Department of Genetics, Private Bag X1, Matieland, 7002 Stellenbosch, South Africa. E-mail: jtb@sun.ac.za Web: <http://www.isgpb2020.com>
- November 8-12, 2021, Montpellier (France): **I International Symposium on Reproductive Biology of Fruit Tree Species**. Info: Dr. Evelyne Costes, INRA UMR AGAP, 2, place Viala, 34060 Montpellier Cedex 1, France. Phone: (33)499612787, Fax: (33)499612616, E-mail: evelyne.costes@inrae.fr or Dr. Henryk Flachowsky, Pillnitzer Platz 3a, 01326 Dresden, Germany. E-mail: henryk.flachowsky@julius-kuehn.de Web: <https://symposium.inrae.fr/reproductive-biologyfruittree/>
- December 1-3, 2021, Chiang Mai (Thailand): **V Asia Symposium on Quality Management in Postharvest Systems**. Info: Prof. Dr. Varit Srilaong, Posth.Tech., School of Biores.&Technology, King Mongkut's Univ. of Technol.Thonburi, 126 Pracha-Uthid Road, Bangmod, Thungkru, Bangkok 10140, Thailand. E-mail: varit.sri@kmutt.ac.th E-mail symposium: asqp2021@kmutt.ac.th Web: <http://www.asiapostharvest2021.kmutt.ac.th/>
- December 14-17, 2021, Catania (Italy): **III International Organic Fruit Symposium and I International Organic Vegetable Symposium**. Info: Prof. Dr. Ferdinando Branca, Di3A, Università di Catania, Via Valdisavioia 5, 95123 Catania, Italy. Phone: (39)095234307, Fax: (39)095234329, E-mail: fbranca@unict.it or Dr. Alberto Continella, University of Catania, Via Valdisavioia 5, Catania, Italy. Phone: (39)095-234455, Fax: (39)095-234406, E-mail: acontine@unict.it or Dr. Alessandro Tribulato, via Valdisavioia, 5, 95123 Catania, Italy. Phone: (39) 095 234328, Fax: (39) 095 234329, E-mail: atribula@unict.it E-mail symposium: info@orghort2020.it Web: <https://www.orghort2020.it/>

NEW

December 14-17, 2021, Giarre, Catania (Italy): **VIII International Conference on Landscape and Urban Horticulture**. Info: Prof. Daniela Romano, Università de Catania, Dip. DOFATA, Via Valdisavoia 5, 95123 Catania, Italy. Phone: (39)095234306, Fax: (39)095234329, E-mail: dromano@unict.it or Dr. Francesca Bretzel, CNR, IRET Istituto di Ricerca sugli Ecosist, Via G. Moruzzi 1, Pisa 56124, Italy. Phone: (39)0506212485, Fax: (39)0506212473, E-mail: francesca.bretzel@cnr.it or Dr. Stefania Toscano, Via Valdisavoia 5, 95123 Catania(CT), Italy. Phone: (39)0954783303, E-mail: stefania.toscano@unict.it E-mail symposium: info@luh2021.it Web: <https://www.luh2021.it/>

NEW

March 13-18, 2022, Brena Baja (La Palma) & La Laguna (Tenerife) (Spain): **XIV International Protea Research Symposium**. Info: Prof. Dr. Juan Alberto Rodríguez Pérez, Área de Producción Vegetal, Universidad de La Laguna, calle Dinamarca 29, 38300 La Orotava, Tenerife, Spain. Phone: (34)666695267, E-mail: jarodrip@ull.es Web: <https://proteas2020.asocan.net>

March 25-28, 2022, Guangzhou (China): **IV International Orchid Symposium**. Info: Prof. Dr. Genfa Zhu, Environmental Horticulture Research Inst., Guangdong Academy of Agricultural Sciences, No. 1 East Jinying Street 1, Wushan Road, Tianhe district, 510640 Guangzhou, China. E-mail: genfazhu@163.com

NEW

April 18-21, 2022, Murcia (Spain): **III International Symposium on Beverage Crops**. Info: Rocío Gil Muñoz, Avda Ntra Sra de la Asunción N24, 30520 Jumilla, Spain. E-mail: mariar.gil2@carm.es or Prof. Dr. Encarna Gómez-Plaza, Universidad de Murcia, Fac. Veterinaria, Dep. Tecnología Alimentos, Campus Espinardo, 30071 Murcia Murcia, Spain. Phone: (34) 868887323, E-mail: encarna.gomez@um.es or Prof. Dr. Cristina Garcia-Viguera, Phytochemistry and Healthy Foods Lab, Dept Food Science Technoloy CEBAS-CSIC, Campus Espinardo 25, Espinardo, 30100 Murcia, Spain. Phone: (34) 968396200, Fax: (32)9686213, E-mail: cgviguer@cebas.csic.es Web: <https://www.bevcrops21.es/>

May 23-26, 2022, Pula (Croatia): **VIII International Symposium on Edible Alliums**. 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

NEW

May 30 - June 3, 2022, Naoussa (Greece): **X International Peach Symposium**. Info: Prof. George Manganaris, Anexartisias 57, PAREAS Building, P.O. Box 50329, 3603 Lemesos, Cyprus. Phone: (357)25002307, Fax: (357)25002804, E-mail: george.manganaris@cut.ac.cy or Dr. Athanassios Molassiotis, Pomology lab, Faculty of Agriculture, AUTH, 54 124 Thessaloniki, Greece. Phone: (30)2310 998882, Fax: (30)2310 998882, E-mail: amolasio@agro.auth.gr Web: <https://www.fruitsciences.eu/peach2021>

Year 2022

NEW

February 7-10, 2022, Bangalore (India): **International Symposium on Tropical and Subtropical Viticulture**. Info: Prof. Dr. Dilipraj Patil, Associate director of Research, MHREC, University of Horticultural Sciences, Udyanagiri, Bagalkot, 587104, India. E-mail: adrebagalkot@uhsbagalkot.edu.in or Dr. Girigowda Manjunatha, Officer In-charge, Bio-control laboratories, Directorate of Horticulture, University of Horticultural sciences, Bagal, Karnataka, 570020, India. Phone: (91)9916219697, E-mail: gmanjunath2007@gmail.com Web: <http://iststvbagalkot2020.com/>

NEW

February 14-18, 2022, Stellenbosch (South Africa): **V International Symposium on Pomegranate and Minor Mediterranean Fruits**. Info: Prof. Dr. Olaniyi Fawole, Postharvest Research Laboratory, Department of Botany & Plant Biotechnology, University of Johannesburg, P.O. Box 524; Johannesburg 2006, South Africa. E-mail: olaniyi@sun.ac.za

NEW

March 6-10, 2022, San Juan (Argentina): **XVI International Symposium on Processing Tomato - XIV World Processing Tomato Congress**. Info: Dr. Luca Sandei, SSICA, Tomato Department, Viale f.Tanara 31/a, 43121 Parma (PR), Italy. Phone: (39) 0521795257, Fax: (39) 0521771829, E-mail: luca.sande@ssica.it or Dr. Cosme A. Argerich, Instit. Nac. de Tecnol. Agro., C.C. Nro. 8, La Consulta, 5567 Mendoza, Argentina. Phone: (54)2622470304, Fax: (54)2622470753, E-mail: argerich.cosme@inta.gob.ar E-mail symposium: symposium@worldtomatocongress.com Web: <http://www.worldtomatocongress.com>

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