

A publication of the International Society for Horticultural Science

Chronica Horticulturae



Horticultural highlights

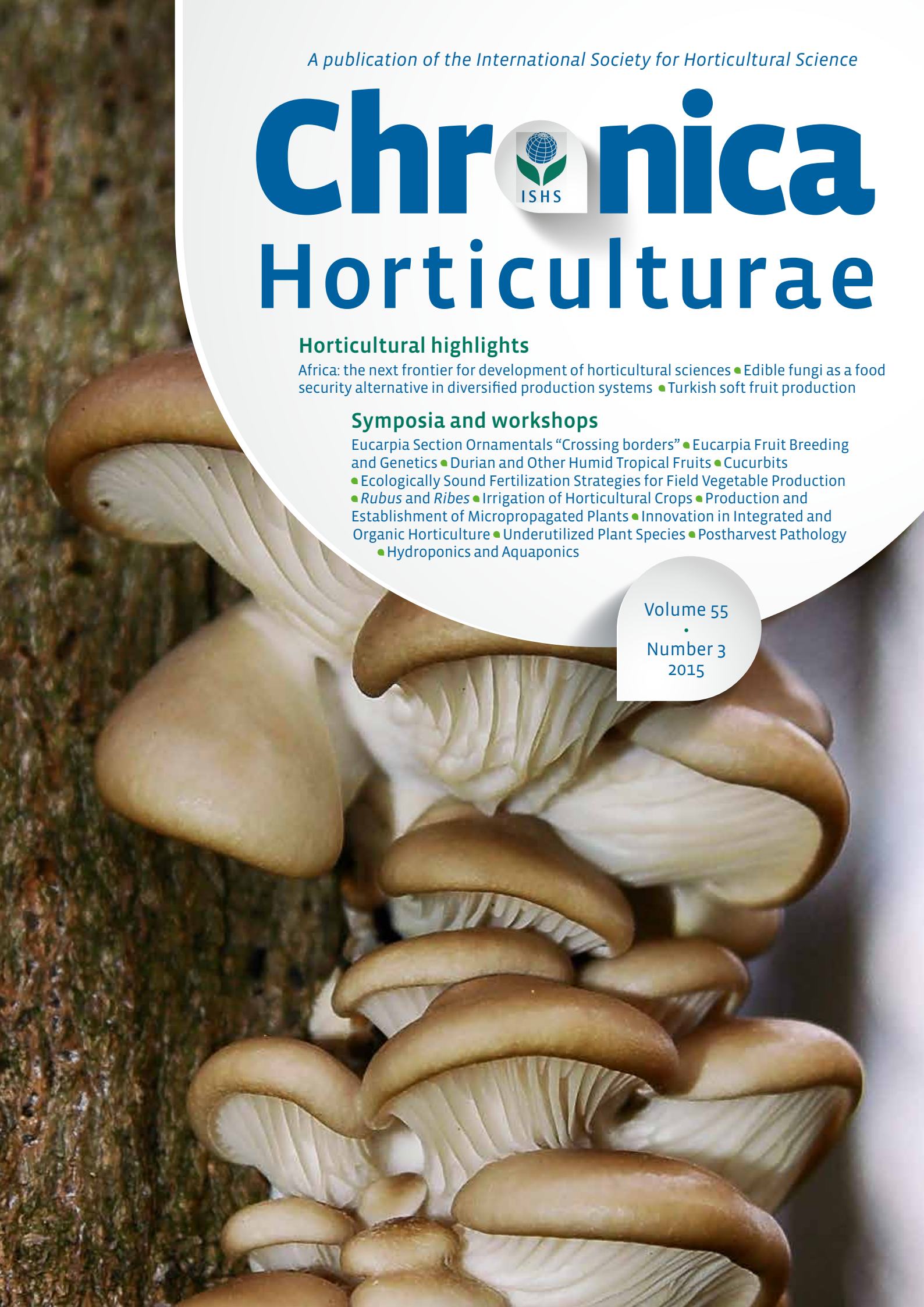
Africa: the next frontier for development of horticultural sciences • Edible fungi as a food security alternative in diversified production systems • Turkish soft fruit production

Symposia and workshops

Eucarpia Section Ornamentals “Crossing borders” • Eucarpia Fruit Breeding and Genetics • Durian and Other Humid Tropical Fruits • Cucurbits • Ecologically Sound Fertilization Strategies for Field Vegetable Production • *Rubus* and *Ribes* • Irrigation of Horticultural Crops • Production and Establishment of Micropropagated Plants • Innovation in Integrated and Organic Horticulture • Underutilized Plant Species • Postharvest Pathology • Hydroponics and Aquaponics

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

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Photo by Hamilton from <http://mushroomobserver.org>. See article p. 9.

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> Let's drive some changes and be ambitious: Symposia 2.0, Student Award and more news



> Silvana Nicola

Silvana Nicola, ISHS Vice-President and Scientific Co-ordinator, @ishs_VP

There has never been a better time to be a member of the International Society for Horticultural Science. We are living in challenging times, so if you like challenges, this is the time for you. As a Society, our greatest change is in our operation model. We are moving from a 'scientist-symposium-proceedings'-oriented model to a more comprehensive model, in which we include flexible and interactive means of engagement, without undermining the premise that we are, and will remain, a scientific Society. The current Board considers the ISHS to be a 'platform for horticultural science' and we plan to continue further along the path started by the previous Board and supported by the Council. We aspire to engage with everyone interested and/or involved in horticultural science.

ISHS has fully entered the Publication 2.0 era, with the Acta 2.0 project already implemented, including all past and future papers having a DOI and all new papers enabled for cross-referencing (see Editorial in *Chronica Horticulturae* 54(4) by Prof. Dr. Yves Desjardins, Board member responsible for publications, @prof_yves). In addition, ISHS now has an in-house peer-reviewed open access journal, the eJHS, in which ISHS members may publish at a discounted rate. Manuscripts of outstanding quality from ISHS symposia can potentially be included in eJHS after selection by our Science Editor, Dr. Kim Hummer, and completion of the regular peer-review process (see Editorial in *Chronica Horticulturae* 55(1) by Yves Desjardins, @prof_yves). The Board is also keen to pursue an expansion of our journal portfolio as new opportunities arise.

ISHS has already signed an agreement with our first corporate member (see Editorial in *Chronica Horticulturae* 55(2) by Prof. Dr. Jens Wünsche, Board member responsible for Innovation, Outreach and Strategy). This is a step toward our goal of bridging the gap between academia and horticultural industries. We plan to increase corporate membership in the future, and discussions are underway with a second potential member. Corporate members do not need to be from industry; there is ample opportunity to provide benefits for the special needs of agencies, organizations and institutions. The ISHS can offer many services to corporate members and they can help us to better serve our members and horticulture as a whole. We are moving forward at high speed toward being a scientific Society that is inclusive of younger scientists and postgraduate students,

Significance of this article

What is already known on this subject?

- Publication 2.0 era is in place: ISHS has new #actahort project implemented, with DOI and crossref enabled; outstanding manuscripts from ISHS symposia can potentially be included in #eJHS.
- We have signed an agreement with our first Corporate Member.
- In 2016 a Youth Task Force will be established.

What are the new findings?

- Innovation, outreach and strategy programming are speeding up at ISHS. We are increasing the number of Corporate Members. There will be a strategic meeting with Board members, Executive Committee members and a selection of members of the Youth Task Force to discuss together the future of our Society.
- #Symposia2.0 is proposed to become a new standard for ISHS events in the future, creating cluster events.
- Modern social media communication tools will be used to enhance the impact of the ISHS: follow @ishs_hort for continuous and fast updates.
- #StudentAward has been created for students attending a symposium for best poster and best oral presentations.

What is the expected impact on horticulture?

- #thisishorticulture. ISHS can become a platform for horticultural science, where young scientists and experienced fellows can together promote research in horticulture for the benefit of livelihoods.

by enabling them to be part of the restructuring and strategic planning of the Society. A new Youth Task Force to be established next May will have an important role in shaping the future of our Society (see Editorial in *Chronica Horticulturae* 55(2) by Jens Wünsche).

This is a short list of some of the implementations that are occurring and for full details I suggest our members review the full editorials written by Board members in the previous issues and keep following our news on the website as well as on Twitter at @ishs_hort. Now it is time to consider other projects and new ideas that will take place.

Be ambitious

You can contribute to making a difference in horticulture.

I am currently spending three months as visiting professor at Hokkaido University. One of the people I have been hearing about since I arrived is William S. Clark, an American colonel who was hired by the Japanese government to establish a college in Hokkaido, Japan's northernmost island. He was the first president of the Sapporo Agricultural College (1876-1877). When he left Japan, after less than a year as

president, he shouted at the students, 'Boys, be ambitious'. The college later developed into the famous University of Hokkaido, and Clark is still fondly remembered on campus. As I write this editorial I am wearing a T-shirt bought at the campus bookshop, with the exact motto: 'Be ambitious'.

Yes, we need to be ambitious and consider what we can do for our Society more than what our Society can do for us, just to paraphrase the famous citation by J.F. Kennedy. First, we need to think about our structure to ensure we serve all members as well as possible. We must consider what is needed to enhance science in horticulture in the current age and to promote horticulture to the top of the agenda for influential leaders, funding agencies and policy makers. The Board is reviewing the scientific structure of the Executive Committee and studying how it can best cover the diverse and complex field of studies that horticulture encompasses. Next year, we will hold a strategic meeting with all Board and Executive Committee members to interactively brainstorm our scientific structure. At that time we will include a selection of members from the newly formed Youth Task Force. We will have young scientists actively participating in

our planning towards an inclusive and modern scientific Society. In addition, we must continue to consider how to make our symposia attractive and efficient (see below for more details on Symposia 2.0 section). And finally, we need to be not only progressive and ambitious as a society, but also proud of our members and champions of our successors. We must value the achievements of our experienced members and recognize the potential of our new young members, so we can build a legacy of which we all can say, 'I am proud to be a member of the ISHS' (see below for more details on the honours and awards section).

Symposia 2.0

Yes, we are living in challenging times. There has never been a better time to organize or attend an ISHS symposium. ISHS members and the horticultural community are telling us of the difficulties our discipline is facing. Due to lack of funding for research and downsizing of horticultural programs at several universities, scientists and academics are reducing their investment in activities outside pure scientific research and paper publication, considering it to be "less essential". At the same time, in many developing countries university departments and research programs are expanding and there is a need for up-skilling and support of many new graduates. Attendance at symposia has started to be considered a less rewarding means of exchanging scientific knowledge. This implies that attending a symposium was almost exclusively about the opportunity to present our scientific results.

We should be mindful of the many other benefits that arise from attending a symposium:

- Meeting colleagues with whom we start to exchange scientific information or have serious discussions about new ideas, and/or plan to send one of our students to their lab for some months
- Getting new ideas to apply to our research hypothesis or new projects for collaborating in educational programs
- Starting to plan an application for new research projects at an international level
- Learning different ways of communicating science in front of an audience
- Visiting the world of horticulture during field trips organized by the convener or even extra field trips organized with local colleagues you've met at the symposium
- Gaining an appreciation of the horticultural marketplace in the host country of the symposium
- Experiencing some of the local culture
- Getting to know the local food and other horticultural products, among many other cross-cultural benefits.

It is often the informal discussions we have at coffee break or lunch time that ultimately result in the greatest impact on our research. This cannot occur if we simply publish our results in

a journal or read about someone else's discoveries. Unfortunately, not all these benefits occur at every symposium, and sometimes there is a limited number of participants, which reduces the opportunities.

Maybe it is time to consider structuring the activities at a symposium according to the different opportunities, creating one-of-a-kind meetings. In addition, we could have larger and smaller symposia join into bigger events, rescuing low-attendance symposia and combining them with a high-attendance symposium. We can foresee joining several symposia that have a common focus in different commodities or that share common geographical and climatic areas. Thus, we need to develop a second generation symposium structure. We have already begun the development of Publication 2.0, so now let's move to Symposia 2.0. An example of the future style of Symposia 2.0 is already evident: in 2016 a cluster of 9 different symposia is being organized in Australia that will cover temperate and tropical topics in horticultural science. Many different reasons drove the decision to merge these separate events, including climate, timing, creation of critical mass, new initiatives and common themes.

The Board has created a template for future symposia. It has firstly been proposed to the Chairs of Sections and Commissions of the Executive Committee, who are the scientific core group of the Society. Secondly, it will go to all proposing conveners, to create broader, more multi-purpose events. The types of elements to seriously consider including are:

- Traditional scientific sessions
- Business sessions, hopefully led by people from industry and designed in collaboration with the convener
- Specific workshop sessions, during which specific topics on critical issues can be debated, possibly requesting delegates to carry out homework assignments in preparation for the discussion
- Student sessions, student contests, and specific activities that embrace the needs of students, according to what the Youth Task Force decides as priorities
- Specific sessions dedicated to economic, management and consumer aspects of the theme of the symposium, to make these aspects part of our inclusive, systems-approach, even though they may not always be specifically related to that horticultural science symposium
- Research network sessions, to exchange information on ongoing projects and plan future partnerships
- Training sessions, organizing courses such as training of trainer classes, transferring technology through practical courses, etc., for the benefit of professionals and/or stakeholders
- 'Summer schools', for undergraduate, graduate or post-graduate students

Each organized event does not need to include all sessions, but this can become the portfolio

for the Symposia 2.0 platform. The aim is to include scientists from other fields of study, to have the industry more involved and to include active participation of students. We will be encouraging conveners and all participants to use modern social media dissemination tools to promote all events prior to the meeting and during the meeting, thereby enhancing the impact of the ISHS on the general public.

However, there is one session that the Board has planned to make compulsory: the Student Award session. It is designed to foster the ambition of the leaders of tomorrow, firstly by creating the opportunity to present posters and oral talks at an international symposium and then by awarding them for their initiative. Student awards will be mandatory for all newly-approved symposia, according to the details explained below.

Let's meet the challenges of ISHS Symposia 2.0 in the years to come and make our symposia even more memorable and worthwhile than they have been in the past.

Honours and Awards

For many years, ISHS has given recognition to honorary and fellow members. We should nominate more members for their contribution to the Society (Honorary Members) and to horticultural science (ISHS Fellows). The previous Board initiated the Horticulture Innovation Award dedicated to companies that have made a significant contribution in horticulture. Allow me to remind members to nominate companies that you think deserve this prize. The call is continually open and the award committee will be happy to review any nominations received.

The new Board has set the course for a new award, the Student Award. The first stage of this award will take place during a symposium, when two awards will be given: one for the best oral presentation given by a student as presenter and first author of the submitted manuscript and one for the best poster presented by a student who is first author of the work. A special committee, set up by the convener and an ISHS representative, will be responsible for selecting the awardee. The second stage will take place in *Chronica Horticulturae*, where the awards will be reported, including a photo and a brief outline of the winners. The third stage will be carried out by the awardees, who will write an article on their research, to be published in *Chronica Horticulturae* or *eJHS*. A one-year complimentary membership of the ISHS and a Certificate will also be awarded to the winners. We hope that these awards will be sought after by young scientists and students, so they can improve their CVs and advance their careers. Let's stand up for our young horticultural scientists!

I am looking forward to seeing the bright future of our scientific Society. I am confident that as fellow members we will be more than happy and proud to contribute to making it happen. 🍎



> Africa: the next frontier for development of horticultural sciences

Wariara Kariuki



> A Masters student from Jomo Kenyatta University of Agriculture and Technology in a Van den Berg Roses commercial greenhouse in Naivasha, where she conducted research for her thesis. She was explaining her project that compared the effects of soil and cocopeat on rose cultivation, to visitors, mostly from The Netherlands.

Introduction

Horticulture is a labour intensive sector that is important for human well-being. Nevertheless, in many countries, faculties of agriculture and their departments of horticulture have been absorbed into schools of life or earth sciences. As a result, horticulture gets attention only as a side subject when specific crops are being addressed. However, in Kenya, the horticultural sub-sector has emerged as the most important in the agricultural sector, providing not only food and foreign export earnings but also many new jobs. This development is reflected in Kenyan universities establishing departments of horticulture and increased undergraduate enrolment in horticultural sciences. In view of the need to create 74 million jobs in Africa over the next decade to prevent youth unemployment from rising, can Kenya lead the way for other African countries?

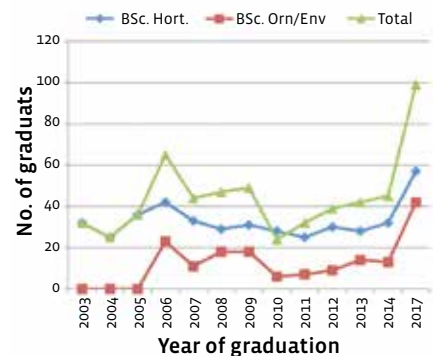
There is no doubt that horticulture as a science and art, and in its contribution to food, health, environmental protection/conservation, education, psychological wellbeing, recreation, architecture and socio-cultural activities, is very important for human wellbeing (http://www.aiph.org/site/index_en.cfm?act=download.aanbieden&dl=132). The President of the International Society for Horticultural Science (ISHS), Prof. Rod Drew, noted that *"Agriculture supplies protein, it supplies carbohydrates, it supplies staple crops – but we'd have a pretty boring life without horticulture. Horticulture gives colour, horticulture gives us the flavours, it gives us all the health benefits of a balanced diet."* (<http://www.ishs.org/news>).

During the 2014 International Horticultural Congress held in Brisbane, Australia, the plenary speakers left no doubt about the importance of horticulture in the 21st Century. The revolutionary video 'Harvesting the Sun' by Prof. Errol Hewett, an immediate former Board member of ISHS, explains horticulture in a very

simple way. It demonstrates the economic, social and community importance of horticulture and horticultural science. It explains how horticulture is a sustainable source of healthy nutritious food, and a source of income with a critical role in beautifying our environment and enhancing wellbeing (<https://www.youtube.com/user/HorticulturalScience>). Many horticultural products are rich sources of vitamins, minerals and phytochemicals. Dark green leafy vegetables and yellow-fleshed fruit, such as pumpkins and mangoes, are recommended to correct vitamin A deficiency, a major cause of blindness in African children. An FAO/World Health Organization (WHO) report has established that eating at least 400 g of fresh fruit and vegetables a day helps to alleviate micronutrient deficiencies and to prevent chronic diseases associated with unhealthy urban diets and lifestyles (WHO, 2004). Nevertheless, horticultural professionals agree that we do not declare the importance of horticulture for human wellbeing loudly enough. In many countries, schools/faculties of agriculture have been subsumed

into schools of life or earth sciences. As such, horticulture receives attention only when specific crops are addressed in teaching and research but is not a major area of study in itself (Bogers, 2007).

In Kenya, the horticultural sub-sector has emerged as the most important in the agricultural sector and is the second largest foreign exchange earner. Total horticultural production is close to 3 million tonnes. The total value of horticultural exports in 2012 was Ksh87 billion (US\$1 billion), Kenya having exported 380,000 MT of produce (HCDA, 2013). The total domestic value in the horticulture sector in 2012 amounted to Ksh217 billion (US\$2.5 billion) and occupied an area of 662,835 ha, with a total production quantity of 12.6 MT. Compared to 2011, the total value, area and production increased by 6, 9 and 38%, respectively (HCDA, 2013). Many citizens are aware that horticulture is a lucrative industry. This is also reflected in the increased number of Kenyan universities establishing departments dealing with horticulture and the increased undergraduate enrollment in horticultural sciences (Figure 1).



■ Figure 1. Number of students graduating from horticultural sciences in Kenyatta University of Agriculture and Technology between 2003 and 2014. Numbers for 2017 are estimates based on admissions in 2014. BSc Hort is focused on horticultural production, BSc Orn/Env is focused on ornamental and environmental horticulture.

Horticulture as a solution for African social-economic problems

The youth population of Africa is growing faster than that of any other region. In 2010, 695 million Africans (68%) were under 30 years old. By 2030, their numbers could reach 986 million. Around 74 million jobs will need to be created in Africa over the current decade to prevent youth unemployment from rising (FAO, 2012). Horticulture generates local employment, reduces food transport costs and pollution, creates urban green belts, and recycles urban waste as a productive resource (FAO, 2012). The first



› The research project of a horticulture student from Kenyatta University of Agriculture and Technology on postharvest treatments of *Alstroemeria*, which is an important export cut flower for Kenya.



› Undergraduate horticulture students from Kenyatta University of Agriculture and Technology collecting leaf water potential data using a Scholander pressure bomb. Photo: Osia Odula (HORTINLEA PROJECT, 2015).

status report on urban and peri-urban horticulture in Africa (FAO, 2012) describes how commercial production of fruit and vegetables provides livelihoods for thousands of urban Africans and food for millions more. In addition to urban food production, a common feature in many East African cities is the numerous roadside plant nurseries that supply fruit and vegetable seedlings, as well as landscape plants. They provide livelihoods for many people, especially urban youth and those from surrounding rural areas. The benefits are multiplied by the jobs that are created because of the need for products

and services associated with horticultural crop production and use, such as agro-inputs, financial and landscaping services. In Kenya, many young people are becoming entrepreneurs in horticulture. This includes graduates in various fields (many unrelated to horticulture) and middle/upper middle class urban youth, as highlighted in 'Seeds of Gold', a joint-venture publication between Egerton University and Nation media among other media (<http://www.nation.co.ke>). This scenario is also captured in an article entitled 'Youth Changing the Face of Agriculture in Kenya' (<http://blog.plantwise.org/2014/05/19/>

youth-changing-the-face-of-agriculture-in-kenya/). We can expect more high school graduates to choose horticultural sciences in Kenyan universities. However, further growth in university graduate numbers may be slow and gradual, given that, apparently, to be a successful horticultural producer, an agricultural degree is not required.

In its third report on the state of African cities, the United Nations Human Settlements Programme (UN-HABITAT) advocates for a new vision of African urbanism, including “greener” and more sustainable growth that employs uniquely African solutions to the continent’s present and future urban challenges (UN-HABITAT, 2013). The FAO (2012) report seeks to contribute to that discussion by drawing the attention of policymakers to

by absorbing harmful gases from the urban environment (AIPH, 2006).

Potential of growth in horticultural sciences in Africa

Several international forums have considered horticultural training, especially in tertiary education. Among others, they include the ISHS International Horticultural Congresses (2006, 2010, 2014), the All Africa Horticultural Congresses (1st in 2009, 2nd in 2012), the Higher Education for Development in Horticulture International Seminar and the 2nd International Symposium on Horticulture in Europe in Angers, France (2012), and the workshop on Tertiary Agricultural Education in Africa in Wageningen, The Netherlands (2012). It was noted that more visibility for

University and Technical Training Institutes (TTIS) Teaching Staff at Master’s and Doctorate levels in Engineering and Applied Sciences”, to be funded by the African Development Bank. The programmes that might receive future funding include MScs and PhDs in Horticulture, Landscape Planning and Conservation and Biotechnology among others. These graduates will hopefully develop horticultural science programmes that are market-driven and that will attract more students. Useful information on the status of horticultural science education in African horticulture is summarized by the Global Horticulture Initiative (<http://www.globalhort.org/>).

Opportunities for horticultural sciences

Today’s challenges are also opportunities for horticulture. The role of the horticulturist is critical in addressing these challenges. They include:

Increasing urban population

FAO estimates that by 2020, 24 of the world’s 30 fastest growing cities will be African (FAO, 2012). Within 18 years, the urban population of sub-Saharan Africa will double to almost 600 million. This population must be fed and must have green spaces.

Food and nutrition security

The proportion of undernourished people in Africa is 21%, but in sub-Saharan Africa it has reached 23.8% (FAO, IFAD and WFP, 2014). Undernourishment is described by FAO as a state, lasting for at least one year, of inability to acquire enough food, defined as a level of food intake insufficient to meet dietary energy requirements. Sub-Saharan Africa has more than a quarter of the world’s undernourished people, owing to an increase in population of 38 million since 1990-92 (FAO, IFAD and WFP, 2014).

Sustainable livelihoods

Horticulture has greatly contributed to livelihoods in many rural areas of Africa. Manufacturing and service industries common in urban areas cannot adequately support the large population and more jobs will be needed. The high-value, high-turnover nature of horticulture makes it a good source of livelihoods as urban populations increase.

Need for good quality environment

Most people, especially in urban areas, spend a substantial time in indoor spaces. Many materials used in construction and as furnishings emit toxic substances such as benzene and formaldehyde. Landscape plants are able to clean the air by absorbing these toxins while releasing harmless byproducts. Indoor and outdoor spaces will need to be



› PhD student, Osia Odula, working on strategies to increase water use efficiency of African indigenous vegetables (AIV) at the Kenyatta University of Agriculture and Technology greenhouse (HORTINLEA PROJECT, 2015).

urban and peri-urban horticulture (UPH) and how it can help to grow greener cities in Africa. UPH is essentially, a “local food” system that provides urban populations with a wide range of horticultural crops, mainly fruit and vegetables, but also herbs, roots, tubers, ornamental plants and mushrooms (FAO, 2012). Specifically, FAO states that UPH is contributing to human health, food security, sustainable livelihoods, improved incomes and therefore lower poverty levels and cleaner environments. UPH can also contribute to climate change mitigation by reducing urban heat, increasing carbon sequestration and

horticulture and support for agricultural/ horticultural education in Africa is needed. This has resulted in funding for projects such as EDULINK, ECOHORT, HORTINLEA, PAEPARD and Intra-ACP Academic Mobility Project; mostly supporting African students at post-graduate level. Some projects are horticultural in focus, while others have direct benefits for horticulture. Recently, Jomo Kenyatta University of Agriculture and Technology won an Expression of Interest for ‘Support to Enhancement of Quality and Relevance in Higher Education Science and Technology (HEST)’ Project for “Training of Existing



> African horticulturists were among participants at a workshop on higher education in horticulture for development, held in Angers (author in the middle on the front row). Many of the other participants were ISHS members, including Norman Looney, Remi Kahane, Isaac Aiyelaagbe and Amanda Crump of Horticulture CRSP.

professionally landscaped to enhance the quality of life of urban citizens, especially to clean the air from a likely rise in pollution.

Environmental sustainability

Important aspects of sustainability include clean air, unpolluted water and preservation of biodiversity. Horticultural scientists and landscape architects make important contributions to climate change adaptation/mitigation. Large natural landscape areas as well as designed spaces contain trees, shrubs and groundcovers that contribute to carbon sequestration, absorption of harmful substances in the atmosphere and cooling (AIPH, 2006). This helps to mitigate the effects of climate change.

UN-HABITAT (2013) recommended that cities should maximize the natural benefits of sites

(sunlight, water bodies, winds, etc.) and plan for restoration of ecosystems. This should include enhancing public parks, waterfront and 'green' areas for recreational and productive purposes. As horticultural and indeed agricultural production increases to support growing populations, demand for natural resources will grow. Technologies will be needed that ensure efficient and reduced use of natural resources as well as conservation of biodiversity, reduced use of inputs, and development of drought-resistant crops and those that can grow with less water. Improved/high-yielding cultivars are needed to increase yield per unit of resources such as land, water and nutrients. Horticultural scientists will be required to develop the necessary production technologies that ensure sustainability of the environment.

> References

AIPH (International Association of Horticultural Producers) (2006). Flowers and plants – more than just beautiful. <http://www.aiph.org>. Accessed on 16/10/14.

Bogers, R.P. (2007). The future of horticultural science and education: a European perspective. *Chronica Horticulturae* 47(2), 4–6.

FAO (2012). Growing greener cities in Africa. First status report on urban and peri-urban horticulture in Africa. Food and Agriculture Organization of the United Nations, Rome, Italy.

FAO, IFAD and WFP (2014). The state of food insecurity in the world 2014. Strengthening the enabling environment for food security and nutrition. Food and Agriculture Organization of the United Nations, Rome, Italy.

HCDA (2013). Expert statistics. Horticultural crops development authority. <http://www.hcda.ck.ke>. Accessed on 16/10/14.

UN-HABITAT (2013). The state of African cities. Prosperity of cities 2012/2013. UN-HABITAT, Nairobi, Kenya. <http://mirror.unhabitat.org/pmss/listItemDetails.aspx?publicationID=3387>. Accessed on 16/10/14.

WHO (2004). Food and health in Europe: a new basis for action. In WHO regional publications. European series; No. 96. A. Robertson, C. Tirado, T. Lobstein, M. Jermini, C. Knai, J.H. Jensen, A. Ferro-Luzzi and W.P.T. James, eds. (Geneva, Switzerland: World Health Organisation). http://www.euro.who.int/__data/assets/pdf_file/0005/74417/E82161.pdf. Accessed on 16/10/14.

Green spaces

Many African countries have recorded strong, sustained economic growth over the past decade, raising hopes of a new era of shared prosperity (UN-HABITAT, 2013). This has led to an increased proportion of middle-class citizens, as observed in Kenya. These citizens are demanding 'green' cities (especially green spaces and green residential areas). Parks and green spaces are associated with a better quality of urban life (UN-HABITAT, 2013; AIPH, 2006). In Praia, Cape Verde's capital where such spaces are very scarce, a newly opened, small public square has become a major place for recreation, leisure and socialization (UN-HABITAT, 2013).

Conclusion

I am optimistic about the future of horticultural science in Africa. Kenya, as considered here, is a prime example of a developing African country. The contribution of horticulture to economic, health, social, psychological and environmental wellbeing of humans cannot be over-emphasized.

The need for food security, environmental protection/conservation and industrialization means that any serious government in Africa must invest more in agriculture and especially horticulture, including education. More cooperation and exchange of information, as well as joint research, will greatly contribute to a bright future for horticultural science in Africa.

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➤ Edible fungi as a food security alternative in diversified production systems

Peter Brown

The integration of edible fungi within diversified farming systems faces a number of constraints, but also offers significant prospects for helping to build increased food security throughout the world if these constraints can be overcome.

The challenge may lie in developing small-scale production systems for edible fungi (i.e. household or village scale) that offer significant nutritional benefits without significant barriers to adoption, such as high capital or input requirements. Given the capacity to achieve this, edible fungi may have the potential to attain a similar “Mortgage Payer” status (especially in resource-poor regions), comparable with chickens or silk; and to substantially alter the nutritional profile of local or regional communities, akin to the benefits of keyhole gardens in Africa. Fungi also have the advantage that they can be produced without the need for fertiliser and other non-renewable inputs. They even have the capacity to make use of locally available waste-streams such as crop wastes or even spent coffee grounds.

Some examples of new production systems are emerging, with prospects for the development of others over relatively short time-frames, but these developments will not come from mainstream agriculture or ‘Big’ science. Just as we have (to a certain extent) lost focus on small scale production systems, we have similarly lost the capacity to support such systems through more “grass-roots” level innovation and development. A concerted effort to encourage further development of small farm systems using edible fungi is needed if this field of production is to realise its potential in contributing to global food security.

How do we feed the world?

There has been some discussion in the media and elsewhere regarding Global Food Security, but many of these discussions appear to consider only limited options about how we should address the issue. A common percep-

tion seems to be that all farming enterprises should simply be scaled up to a point where they may be seen to be “pulling their weight” (so to speak). For instance, a recent television current affairs show did a story about a Free Range Pork producer and the inter-

viewer asked, “Do you think we can really feed the world this way?” Clearly, we cannot feed the world on gourmet pork sausages, but a lack of intensity of production does not make any form of farm production less worthy or less valid.

I would offer another perspective we may consider. It is based on what we know as the 80:20 rule. In other words, we may expect that about 20% of the world’s farmers will contribute 80% of the global food supply – but mostly comprising the output from just a few crop species. Conversely, the other 80% of farmers will contribute only 20% of the food supply overall, but this will include all the colours, flavours and secondary nutrients needed to make it possible to maintain an adequate quality of life from a diet based on cereal grains and perhaps a few other items.

However, it may well be a mistake to expect that productivity among the 80% of farmers who deliver much of the diversity in the food supply can simply be intensified and scaled up as we have done for our food staples. One example of the pitfalls inherent in attempting this can be seen in the development of Golden Rice (Figure 1). Although this is without doubt an amazing scientific achievement, like others previously (Enserink, 2008), I wonder at its potential for improving nutrition within developing countries. After all, we already have Red Rice that is available in only small quantities as a higher value speciality. Why should we not expect a similar market performance from Golden Rice? Could it be that village farmers in need of income and perhaps presently facing regular no-food days will sell their Golden Rice as a higher-priced luxury item and use the extra income to buy more white rice to help keep their plates full?

It may seem a little odd when speaking to a scientific audience, but there is a simple observation that should not be overlooked and one that was best expressed by my former mentor and friend, the late Prof. Derek Tribe: “There are many problems in the world that cannot be solved by science alone, but this should not mean that by requiring largely social, cultural or political solutions this category of ‘no-technical-solution-problems’ is any less important”. Without an accep-



■ Figure 1. Golden Rice grain compared to white rice grain in screenhouse of Golden Rice plants. Photo by International Rice Research Institute.



■ Figure 2. A keyhole garden is a circular structure with raised sides often used in Africa for growing vegetables. Photo from: Send a Cow, www.sendacow.org.

tance of the inherently non-technical nature of issues associated with non-staple food production, we will always struggle to be effective in this sector of the industry. Rather than engineer a technical solution to a social problem (as Golden Rice attempts to do), perhaps we need to find ways of increasing diversity in production at all levels, but most especially for small and subsistence farmers. The inherent vitamin A deficiency of a rice diet can quite easily be remedied in other ways, for example, a few hens laying eggs for the village, or some keyhole vegetable gardens run by local children (Figure 2) (Send a Cow Education, 2015). Such alternatives tend to attract less attention, but often have the advantage that they can be implemented easily and often without having to divert land away from existing production. The keyhole garden example is an especially important one, since such gardens are often managed by the children of the village or household. When these children grow up they will likely teach their children to run keyhole gardens and this one, simple, inexpensive, easily adopted innovation not only improves quality of life quickly, but has the potential to do so for generations to come! It is within this context that I believe edible fungi may have an important role to play. Fungi may be cultivated using waste materials, with no significant operating costs or capital requirements. The area required is small and production does not require the diversion of existing land away from other productive enterprises. In addition, the fungi produced offer significant nutritional benefits, often unobtainable by other means in resource-poor regions.

A place for edible fungi

For people in many English-speaking countries like Australia, wild fungi may be regarded more with alarm than as a resource – much less an important dietary inclusion. It is not uncommon to see people walking their dogs in a park trampling wild mushrooms into the ground. Ask them why they do this and they will say something like, “In case they are poisonous and children try to eat them”. In reality however, wild edible fungi remain an important food source in more than 80 countries around the world (Boa, 2004). Their main importance is as subsistence or famine foods, although a few, such as truffles, shiitake and porcini, have attained a higher cultural importance. Unfortunately, none seem to yet provide a significant nutritional role in human diets on more than a seasonal basis. Many underlying factors could be attributed to this situation, but it remains true that edible fungi could make a significant contribution to human nutrition if wider acceptance and availability could be achieved. Although apparently difficult to measure, this can be seen in the importance of local trade in wild edible fungi to the food supply and economy of areas with weak food security (Boa, 2004). Furthermore, it has also been noted that, “Saprobic species are the basis for the hugely valuable global business in cultivated mushrooms, currently valued at around US\$23 billion each year. This is an increasing source of income for small-scale enterprises in developing countries.” (Boa, 2004). Fungi of the genus *Pleurotus* (Figure 3) are of particular interest due to the broad

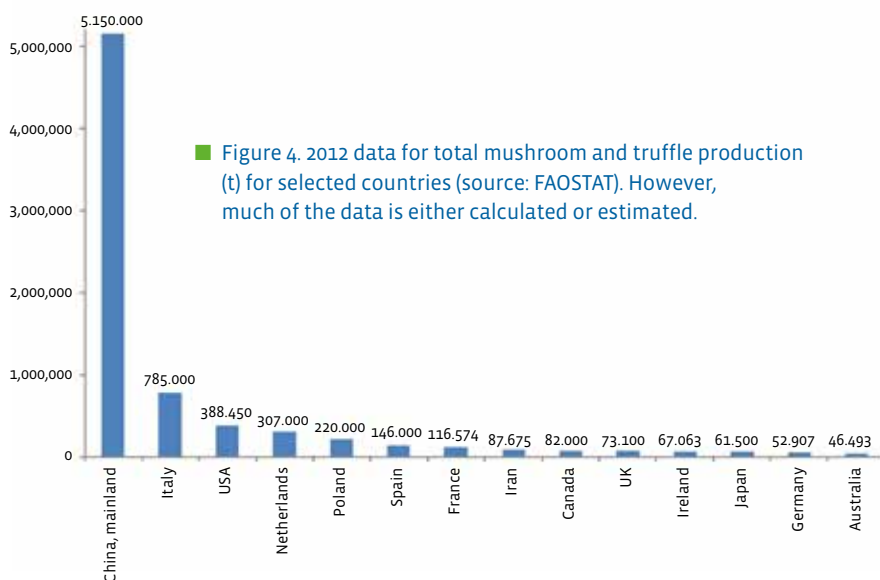


■ Figure 3. *Pleurotus ostreatus* (Jacq.) P. Kumm. Image location: Westmoreland Co., Pennsylvania, USA. Photo by Hamilton from <http://mushroomobserver.org>.

range of substrates on which they can be produced. They represent an efficient method for bioconversion of low-value cellulosic waste such as straw, rice hulls, saw dust, cassava peel, or cotton waste (Amunike et al., 2011; Philippoussis and Diamantopoulou, 2011) into high value human food, with the spent medium also useful as a soil amendment for further use in other farm production. Given adequate temperature and humidity, this system can achieve a biological efficiency of up to 95% (Sharma et al., 2013), without diverting land from any existing production.

Current edible fungi production

Currently, the cultivation of edible fungi is mainly confined to a few species. Although accurate figures can be difficult to find, overall production of cultivated edible fungi in 1997 was estimated to be a little over 6 million tonnes (Chang, 1999). FAO estimates indicate this had increased to almost 8 million tonnes by 2012, with the bulk of production coming from mainland China (Figure 4). Of the earlier estimates (Chang, 1999), cultivated *Pleurotus* spp. (commonly referred to as oyster, abalone or tree mushroom) comprised 876,000 tonnes, or a little over 14% of world production (ShuTing, 1999). Currently, *Pleurotus* spp. are believed to be the second most cultivated of the edible fungi after the button mushroom (*Agaricus*), accounting for 25% of world production (International Society for Mushroom Science, 2015).



■ Figure 4. 2012 data for total mushroom and truffle production (t) for selected countries (source: FAOSTAT). However, much of the data is either calculated or estimated.

■ Table 1. Nutritional composition of selected edible fungi expressed as dry matter percentages. Adapted from Cheung (2013).

Species	Common name	Crude protein	Crude fat	Carbohydrate	Crude fibre	Ash
<i>Agaricus bisporus</i>	Button mushroom	29.4	4.9	56.9	9.2	9.9
<i>Boletus edulis</i>	Porcini mushroom	29.7	3.1	51.7	8.0	5.3
<i>Cantharellus cibarius</i>	Chanterelle	21.5	5.0	64.9	11.2	8.6
<i>Lentinula edodes</i>	Shiitake	15.5	6.5	72.8	7.7	5.4
<i>Pleurotus ostreatus</i>	Oyster mushroom	20.5	1.9	69.7	8.1	8.0
<i>Tuber melanosporum</i>	Black truffle	23.3	2.2	66.2	27.9	8.3
<i>Volvariella volvacea</i>	Straw mushroom	30.1	6.4	50.9	11.9	12.6

■ Table 2. Vitamin content of three Chanterelle species (Figure 5) (Çağlarirmak, 2011). Protein values expressed as % (wet weight), N x 4.38; Vitamin values expressed as mg/100 g (wet weight).

Nutrient	<i>Cantharellus subalbidus</i> (White Chanterelle)	<i>Craterellus cornucopioides</i> (Siyah Chanterelle)	<i>Cantharellus cibarius</i> (Sari Chanterelle)
Protein	0.24 ± 0.01	0.76 ± 0.00	0.33 ± 0.04
Vitamin C	1.64 ± 0.06	1.89 ± 0.04	1.96 ± 0.04
Folic acid	82.83 ± 1.11	17.83 ± 0.81	96.83 ± 2.47
Thiamine	0.12 ± 0.017	0.11 ± 0.04	0.12 ± 0.00
Riboflavin	0.21 ± 0.01	0.06 ± 0.01	0.11 ± 0.00
Pyridoxine	0.62 ± 0.01	0.86 ± 0.01	0.90 ± 0.01
Niacin	3.75 ± 0.13	3.34 ± 0.32	6.42 ± 0.31

Nutritional potential of edible fungi

Unfortunately, edible fungi are often regarded as not much more than simply a flavour ingredient, which obscures the significant nutritional benefits they have to offer.

These benefits come from both the innate composition of fungi and their bio-absorption ability. For example, data suggests that fungi could be used as an effective dietary iodine source in some regions if kelp has been included in the growing media (Molloy et al., 2003). There is also growing interest in the use of UV-B irradiation to boost the Vitamin D2 content of mushrooms (Mattila et al., 2000; Lee, 2009; Stephensen, et al., 2012). However, the most undervalued nutritional component of edible fungi may be protein, as shown in Table 1.

It is difficult to find consistent and reliable information in the literature on the nutritional value of many edible fungi species, as the fresh weight content is often reported rather than dry matter content. However, as they are low in both kilojoules and fat, the only remaining primary nutrients that fungi can contribute to human diets are protein and fibre. A general range for protein content in edible fungi is 20-30% on a dry matter basis (Moore and Chui, 2001), which compares with skinless chicken fillets at about 24-25% dry weight. Moreover, the protein is of high nutritional quality (Çağlarirmak, 2011). Data on minerals, vitamins and other secondary nutrients are also difficult to find. One example (Çağlarirmak, 2011) is presented in Table 2. Unfortunately, the data is given on wet weight basis, making comparisons with other species or foods difficult.

Production systems

Although a number of edible fungi offer significant nutritional benefits and can be produced on a wide range of cellulosic wastes with high bio-efficiency, their full potential

■ Figure 5. Three Chanterelle edible fungi species. Left to right: *Cantharellus subalbidus*, *Craterellus cornucopioides* and *Cantharellus cibarius*. The first two photos by Drew Henderson and Anneli Salo, respectively, from <http://mushroomobserver.org>.





■ Figure 6. Shitake mushrooms growing on Konara (*Quercus serrata*) logs in Japan. Photo by Sakurai Midori.

for improving human diet has yet to be realised. Various systems are available or under development, including log culture of Shitake, Maitake and other forest species (Figure 6), but this form of production may be based only on traditional methods as detailed research and reference material is difficult to find. Another area of development seeks to also use edible fungi for bioconversion of farm wastes into either stockfeed or biofertiliser (Amunike et al., 2011; Beckley et al., unpublished report). However, a major problem associated with the production of cultivated fungi in resource-poor areas may be the availability of production systems that have both low capital and low technical requirements. The most difficult issue to overcome in developing such systems may well be that of the perceived technical requirements. Many cultural guides and factsheets published

on production of various edible fungi begin with setting up a laboratory, needing HEPA filters, microscopes, clean rooms, etc. However, this should not be necessary except on a regional scale. Growers should only need to order media and spawn in much the same way that a nurseryman may order plantlets and potting media that he/she needs from various suppliers.

What is needed is the development of simplified production systems that can be utilised with a range of edible species to suit a range of climates and cultures around the world. Like the keyhole gardens of Africa (Send a Cow Education, 2015) that can be set up on any small area of unused ground, effective mushroom production units need to be suitable for operation in almost any small room or shed and available for people to utilise with no more than a micro-loan and a few simple instructions.

This then is the challenge – to overcome the barriers to adoption for edible fungi production at the household or village level and thereby improve nutrition and standards of living in many regions around the world. ●

References

- Amunike, E.H., Dike, K.S., and Ogbulie, J.N. (2011). Cultivation of *Pleurotus ostreatus*: an edible mushroom from agro base waste products. *J. Microbiol. Biotech. Res.* 1(3), 1–14.
- Boa, E. (2004). Wild edible fungi - a global overview of their use and importance to people. <http://www.fao.org/3/a-y5489e.pdf>. UN Food and Agriculture Organisation. ISBN 92-5-105157-7.
- Çağlarımak, N. (2011). Edible mushrooms: an alternative food item. *Proceedings of the 7th International Conference on Mushroom Biology and Mushroom Products 1*, 548–554. <https://colloque4.inra.fr/var/icmbmp7/storage/fckeditor/file/ICMB-MP7-2011-Arcachon-France-Volume1.pdf>
- Chang, S. (1999). World production of cultivated edible and medicinal mushrooms in 1997 with emphasis on *Lentinus edodes* (Berk.) Sing. in China. *Intl. J. of Medicinal Mushrooms* 1(4), 291–300.
- Cheung, P. (2013). Mini-review on edible mushrooms as source of dietary fibre: Preparation and health benefits. *Food Sci. and Human Wellness* 2, 162–166.
- Enserink, M. (2008). Tough lessons from Golden Rice. *Science* 320(5875), 468–471.
- International Society for Mushroom Science (2015). Edible mushrooms. <http://www.isms.biz/edible-mushrooms/> (accessed June 2015).
- Lee, G. (2009). Dietary calcium and vitamin D₂ supplementation with enhanced *Lentinula edodes* improves osteoporosis-like symptoms and induces duodenal and renal active calcium transport gene expression in mice. *Eur. J. Nutr.* 48, 75–83.
- Mattila, P., Suonpää, K., and Piironen, V. (2000). Functional properties of edible mushrooms. *Nutrition* 16, 694–696.
- Molloy, F.J., Critchley, A.T., Kandjengo, L., and Mshigeni, K.E. (2003). The use of the valuable oyster mushroom, *Pleurotus sajor-caju*, for conversion of waste materials produced from seaweed and brewing industries: preliminary investigations. *Ambio* 32(1), 76–78.
- Moore, D., and Chui, S.W. (2001). Fungal products as food. Chapter 10. p.223–251. In: S.B. Pointing and K.D. Hyde (eds.), *Bio-exploitation of Filamentous Fungi*. Fungal Diversity Press, Hong Kong.
- Philippoussis, A., and Diamantopoulou, P. (2011). Agro-food industry wastes and agricultural residues conversion into high value products by mushroom cultivation. *Proceedings of the 7th International Conference on Mushroom Biology and Mushroom Products 1*, 339–351. <https://colloque4.inra.fr/var/icmbmp7/storage/fckeditor/file/ICMB-MP7-2011-Arcachon-France-Volume1.pdf>
- Send a Cow Education (2015). Making a keyhole garden. www.sendacow.org.uk/lessonsfromafrica/resources/keyhole-garden (accessed June 2015).
- Sharma, S., Yadav, R.K.P., and Pokhrel, C.P. (2013). Growth and yield of oyster mushroom (*Pleurotus ostreatus*) on different substrates. *J. New Biol. Reports* 2(1), 3–8.
- ShuTing, C. (1999). World production of cultivated edible and medicinal mushrooms in 1997 with emphasis on *Lentinus edodes* (Berk.) Sing. in China. *International Journal of Medicinal Mushrooms* 1(4), 291–300.
- Stephensen, C., Zerofsky, M., Burnett, D.J., Yan-ping, L., Hammock, D.J., Hall, L.M., and McHugh, T. (2012). Ergocalciferol from mushrooms or supplements consumed with a standard meal increases 25-hydroxyergocalciferol but decreases 25-hydroxycholecalciferol in the serum of healthy adults. *J. Nutr.* 142, 1246–1252.



► Peter Brown

About the Author

Peter Brown is a horticulturist and ecologist by training, with specialist experience in soil science and agronomy. He has a passion for “Open-Source Agriculture” – productive alternatives that can positively impact people and their standard of living, but don’t require high levels of capital, technology, training or labour to establish. This includes things like keyhole gardens, aquaponics, edible fungi and free-range chooks. He currently works as Senior Field Agronomist with Seasol International and Farm System Developer for a number of private clients. E-mail: dirtdoctor@optusnet.com.au



> First European Conference of Post Graduate Horticulture Scientists (ECPHS)

May 12-13, 2016 - Palermo, Italy



> Delegates will be able to visit the sights in Palermo, including the Cathedral.

In different fields of research, from humanities to basic and applied science, new opportunities for dedicated, young post graduate scientists have recently been created. The cost of attending many congresses and symposia can be financially challenging for students and young scientists, reducing their chances of attending. This limits their opportunity for reciprocal discussion at the beginning of their career. Moreover, the sense of participating within a scientific community needs to be fostered. This may seem controversial in the age of social networks, but young scientists do not feel they are part of a large community compared to those in the past and most of their scientific interaction is made through ISI papers or within web communities such as *Academia.edu* or *ResearchGate.net* rather than at meetings. Indeed, traditional scientific societies now strongly compete with new on-line

research communities that most young scientists perceive as the “real” networks they need to be part of, because it enables them to link with researchers from all over the world, making their research ‘visible’ (see *ResearchGate* motto). *ResearchGate.net* or *Academia.edu* send daily messages that uploading information is important for a young career, because it may boost their number of citations by being part of an on-line research community. For example, the front page of *Academia.edu* quoted that, ‘A recent study found that papers uploaded to *Academia.edu* receive a 73% boost in citations over 5 years’. Moreover, papers can be freely downloaded and *ResearchGate* claims that 80 million publications can be found in its network. This clearly results in young scientists underestimating the value of being a ‘real’ member of a scientific society. In response to this situation, I believe we need to create more opportunities specifi-

cally for young researchers where they can share ideas, create friendships and simply meet together. For this reason I proposed to the ISHS Board that we run the 1 European Conference of Post Graduate Horticulture Scientists (ECPHS) to be organized by the International Society for Horticultural Science (ISHS), the Network of European Societies of Horticultural Science (NESHS) and the Department of Agricultural and Forestry Science of the University of Palermo, jointly with the Italian Society for Horticultural Science (SOI). The idea was approved and I am pleased to announce a two-day conference aimed at bringing together in an affordable way post graduate students (PGS) in horticulture from a wide range of research areas, to provide an interdisciplinary forum for students to present and discuss their work in an intellectually stimulating and informal setting.

The conference is open to MSc and PhD students, together with Post Doc young scientists and will be held in Palermo (Italy) on May 12-13, 2016.

The Scientific Committee (SC) consists of 2 Senior Scientists and 6 PGS representing National Horticultural Societies that are members of NESHS (Benelux, Greece, Germany, Italy, Portugal, Spain, Romania) (see http://www.soihs.it/ecphs/ecphs_venue.aspx).

Over two days participants will attend four oral sessions with 20 selected presentations (each being 20 minutes plus 10 minutes of question time), two poster sessions open to all fields of horticulture, and two opening lectures given by a senior scientist chosen by the SC. One workshop will be organized on a topic selected by the SC.

All contributions will be published online and reviewed by the scientific committee and the most relevant five papers that list the student as first author, will be evaluated by the SC to be submitted to the ISHS Journal eJHS (<http://www.ishs.org/ejhs>) for potential publication. The reviewing and fee policies of the eJHS however will stand. The best oral presentation, as judged by members of the SC present at the conference, will be awarded a 'special ISHS recognition', which will contribute to the cost of registration and travel to this conference or to a subsequent ISHS event chosen by the

student, plus 1 year ISHS membership (up to a maximum of 750 € in total).

Palermo is one of the oldest and most beautiful European cities. It was founded by the Phoenicians, and after the Arab age in Sicily, became the exotic capital city of the Norman Kingdom near the end of the 10th century. For centuries it remained the capital city of the Norman Kingdom and the Kingdom of Sicily. Located on the northern coast of Sicily, Arab-Norman Palermo is the site of a series of nine civil and religious structures dating from the era of the Norman Kingdom of Sicily (1130-1194): two palaces, three churches, a cathedral, a bridge, as well as the cathedrals of Cefalù and Monreale. Collectively, they have been recognized as UNESCO World Heritage structures and are examples of the social-cultural synchronization between Western, Islamic and Byzantine cultures on the island, which gave rise to new concepts of space, structure and decoration. They also represent the result of the coexistence of people of different origins and religions (Muslim, Byzantine, Latin, Jewish, Lombard and French).

Important dates

- Abstract submission: Abstracts should be received by the end of January 2016.
- Abstract acceptance decision: The Scientific Committee will examine the abstracts and make a decision concerning acceptance

and type of contribution (oral or poster) by the end of February 2016. A submission form will be available online.

Registration fees (in €)

Registration fees are fixed at 100 € and include: secretariat assistance, the introductory social event, the official conference programme, all lunches and mid-session refreshments, and conference material (conference bag with badge, folders, papers and pen).

The Book of Abstract will be in electronic format.

Presenting authors of oral presentations will be hosted for two nights in double rooms in a three star hotel or at the University dorms.

We look forward to seeing you in Palermo! ●

Paolo Inglese

> Contact

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> Prof. Janick contributes over 65 years to horticultural science

Prof. Dr. Jules Janick was honored recently for his 65 years at Purdue University, USA. This in itself is an impressive achievement, but his contributions to horticulture and horticultural science during that time are even more outstanding. Indeed his CV on the Purdue University website extends to 74 pages (<https://ag.purdue.edu/hla/cv/Janick-CV.pdf>), and is filled with honors and awards, as well as recording his role as editor of many prestigious journals, books and review volumes and the publication of hundreds of scientific publications, conference presenta-

tions and other articles. He has long served the International Society for Horticultural Science and for this he was awarded both an ISHS Fellowship and Honorary Membership. ISHS congratulate him for his long service to Purdue University, to horticultural science and to the Society. ●

- > Prof. Dr. Jules Janick was honored for his 65 years at Purdue University, USA. ISHS wishes him all the best for his future career!



> Prof. Opara presented IMPRESSA Award

Professor Umezuruike Linus Opara was recognised recently with an IMPRESSA 2015/2016 Award by the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM). He currently holds the DST-NRF South African Research Chair in Postharvest Technology in the Department of Horticultural Science at Stellenbosch University. The award was presented to him in Windhoek in Namibia during the RUFORUM annual general meeting. RUFORUM is a continent-wide network of 46 African universities in Eastern, Southern, Central and Western Africa. The IMPRESSA Award recognises the impact of research and science in Africa, and honours outstanding university scientists who have made a significant contribution in the field of agricultural research and science for development in Africa, including human and institutional development. Prof. Opara currently chairs the Section Vegetables, Roots, Tuber, Edible Bulbs, Brassica, Asparagus on the Executive Committee of the International Society for Horticultural Science. More details can be seen at <http://www.ishs.org/news/prof-umezuruike-linus-opara-honored-imprensa-20152016-award>



> Prof. Linus Opara (right) received the IMPRESSA Award from Prof. Levy Nyagura, outgoing Chairman of the Board of Trustees of RUFORUM and Vice Chancellor of the University of Zimbabwe.

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The world
of Horticulture

➤ Turkish soft fruit production

Sedat Serçe and Mustafa Özgen



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Compared to other major fruit species, the soft fruit culture in Turkey is relatively recent. Strawberry is the most important soft fruit grown in Turkey, with significant commercial plantings, production and exports. Although blackberries, raspberries and blueberries are grown, production is still small. Turkey has suitable ecological conditions and rich genetic resources for *Rubus* and *Vaccinium* and therefore has great potential for expansion of these species. Utilization of

area in 1990 was 5,358 ha, producing 51,000 tonnes. Production has continued to expand, so that 376,070 tonnes were harvested from 13,423 ha in 2014 (Table 1). Currently, it is possible to grow strawberries in all parts of Turkey. However, production is concentrated in the Mediterranean, Aegean and Marmara Regions (Table 2). Silifke, Anamur and Gazipaşa are important production centers in the Mediterranean Region, while the area around Sultanhisar is the main cen-

tial years, several chemicals are applied to protect plants against soil-borne pathogens. However, none of these chemicals have been sufficient to reach the desired level of protection. Because of this, an increase in the incidence and severity of soil-borne pathogens has become a major problem in production.

■ **Table 1. Turkish strawberry production area and quantity by year. Source: Turkish Statistics Institute. www.tuik.gov.tr.**

Year	Production area (ha)	Production (t)
1990	5,358	51,000
1995	7,150	76,000
2000	9,465	130,000
2005	10,000	200,000
2010	11,679	299,940
2011	11,967	302,416
2012	12,793	351,834
2013	13,549	372,498
2014	13,423	376,070



➤ Open and greenhouse strawberry production.

primocane production, thornless blackberry cultivars with high fruit quality, and adaptation of a wide range of blueberry cultivars outside the Black Sea Region, may help to realize this potential. In this article, we provide a short summary of the current status of soft fruit production in Turkey.

Strawberry

Although strawberry production in Turkey is known to date back to Ottoman times, it was restricted to Istanbul and its surrounding regions and consisted mainly of cultivars such as 'Ottoman', possibly a pure *Fragaria chiloensis*. Later, with the introduction of cultivars like 'Aliso', 'Tioga' and 'Tufts' to the Mediterranean Region, strawberry production gained significance. With the advancement of production techniques such as drip irrigation and protected cultivation, strawberry production became a major crop species, especially in the Mediterranean and Aegean Regions of Turkey. The production

ter for the Aegean Region. Protected cultivation is becoming popular for commercial production, especially because of its effect on precocity and fruit quality. High tunnels are the most common protected cultivation type followed by mini tunnels, especially in Sultanhisar. There are some plastic greenhouses in Antalya, producing early fruits in late winter and early spring (Table 3).

The average size of strawberry farms is very small in Turkey. The raised bed annual system is common practice. Black plastic coverage and double-line drip irrigation are also common. Although this is an annual growing system, some growers keep their plantings for a second year. Consequently, yield is significantly reduced in the second year and the incidence and severity of soil-borne fungal diseases increase. Crop rotation is utilized against soil-borne pathogens when no pre-planting fumigation, such as chloropicrin, has been applied. When the same farms are used for strawberry production in sequen-

All three nursery plant types are used in strawberry production. Frigo plants continue to dominate production. They are usually planted in August or September, depending on the climatic conditions of the year. Frigo-planted strawberry harvest occurs for several weeks starting in the second or third week of April in the Silifke Region. Depending on the season, the harvest in Sultanhisar follows this for another 2-3 weeks. This is the main period of Turkish strawberry production. It is possible to extend the production period by using fresh plants in both locations. However, the utilization of fresh plants is not as common as in Spain and Italy. The reasons for this are mainly two-fold. Firstly, there is nowhere suitable for fresh plant seedling propagation in Turkey. Secondly, early strawberry production areas have hotter autumns and colder winters than in Huelva, Spain. Therefore, a lack of warm temperatures during December and January prevents significant production from fresh plants. The planting dates of fresh plants



> Strawberry production under tunnels.



> Strawberry harvest inside a greenhouse.

■ Table 2. Turkish strawberry production area and quantity by region in 2014.

Source: Turkish Statistics Institute. www.tuik.gov.tr.

Region	Production area (ha)	Production (t)
Mediterranean	55,826	195,999
West Anatolia	7,109	17,924
West Black Sea	3,332	3,157
West Marmara	1,696	3,859
East Black Sea	625	1,049
East Marmara	34,322	50,129
Aegean	24,966	92,769
Southwest Anatolia	515	1,430
Istanbul	4	5
Northeast Anatolia	483	382
Central Anatolia	1,510	1,507

■ Table 3. Turkish strawberry production area and quantity by production type in 2014. Source:

Turkish Statistics Institute. www.tuik.gov.tr.

Production type	Production area (ha)	Production (t)
Mini tunnel	813	30,183
Glasshouse	17	684
Plastic greenhouse	128	5,603
High tunnel	3,177	122,094

> Soilless strawberry production.



in Turkey are usually later than those in Spain and Italy. Fresh plants also have an extensive production period in April and May. Experimental plantings of plug plants are currently being trialed in Turkey. Possible issues with plug plants include an associated high labor cost and the fact that the climate may not be suitable for early strawberry production. Most nursery strawberry plants are produced in Turkey. Nurseries are mainly located in Central Anatolia, around the Cappadocia Region, because of its light soil and high chilling hours. The elevation of the area varies between 800-1,200 m. However, the region still has warm Septembers, making the area unsuitable for fresh plant production.

There are several strawberry cultivars registered in Turkey. Ataturk Horticultural Central Research Institute has a strawberry breeding program. Several strawberry cultivars have been developed from this program ('Yalova-15', 'Yalova-104', 'Eren 77', 'Ata 77', 'Erenoğlu 77', 'Hilal 77', 'Dorukhan 77', 'Doruk 77', 'Bolverim 77'). Similarly, the cultivars 'Kaşka', 'Sevgi' and 'Ebru' were developed from the Çukurova University breeding program. However, the majority of commercial cultivars are almost exclusively from foreign origins. 'Camarosa' was the dominant cultivar until recent years, while cultivars from the University of Florida breeding program, such as 'Festival', 'Flor-

ida Fortuna' and 'DPI Rubygem', are performing well in several regions in Turkey. 'Sabrina' and 'Sabrosa' are also grown to a significant extent. 'Festival' is preferred for its high fruit quality, while 'DPI Rubygem' is thought to be very sweet and tasty by Turkish consumers. 'Florida Fortuna' is the most common cultivar for early production areas. It is a high yielding cultivar under optimum conditions, but is highly susceptible to soil-borne diseases. Although 'Amiga' does not have great taste, it is still produced because of its exceptional fruit firmness. It is surprising that these low-chill cultivars are not only grown as frigo plants but also as fresh plants.



> Blackberry trial in Mediterranean Region.



> Raspberry trial in Mediterranean Region.



> Blueberry production in Black Sea Region.



> Blueberry nursery plants in Black Sea Region.

There have been continuous improvements in the horticultural practices for strawberry production in Turkey. For example, sorting berries during harvest is now a common practice. There are now great efforts to minimize the time between harvest and precooling. Precooling is almost exclusively conducted using forced-air. Although modified atmosphere is not used, the cold chain is never broken during transportation. To increase fruit quality, protected cultivation is becoming more and more common. There are efforts to educate growers that Spanish tunnels are more suitable for strawberry production than single-unit tunnels because of improved air movement. The short production season (in April and May) is a major obstacle that is preventing further expansion of strawberry production in Turkey. There are several attempts to overcome this problem. These include: using open and protected cultivation to spread time of harvest, using both frigo and fresh planting material, and planting a range of cultivars in different growing regions. Indeed, the demand for strawberries after the main production period has fin-

ished is still significant. However, hot temperatures in early summer do not allow production in current growing locations. Thus, it is expected that the next development in Turkish strawberry production will be in continental, high-elevation locations, possibly using day-neutral cultivars. Fresh plants are becoming more and more popular in the Mediterranean Basin. However, it is difficult to produce high quality fresh plants ready to be planted at the preferred time (September) because of a lack of suitable nursery production areas within close vicinity of production areas. For this reason, it is expected that frigo plants will continue to be used in Turkish strawberry production. The significance of soil-borne pathogens is increasing. Not having an efficient fumigant has become a major problem. Solarisation, rotation and some chemical treatments are used, however, none of these solve the problem. Therefore, it is expected that soilless culture will become more common as it is one of the ways to deal with soil-borne diseases. Soilless culture has usually been conducted in higher structures than tunnels and plugs

or fresh planting materials are normally used. The price of inputs like fertilizers and drip irrigation systems are constantly increasing. In addition, labor is becoming less available and more expensive. The competitiveness of strawberry production is under pressure. As a result, there has been a shift away from production by family businesses on small areas to production on larger areas by big growers and companies. This trend is expected to continue in the future. Exports of strawberries from Turkey began in 2000. Export volumes have increased in recent years and have stabilized at around 20,000 tonnes (Table 4). The main market for Turkish strawberries is Russia and export is highest during April (Table 5). It usually takes about a week to transport strawberries from farms to Russian markets. The main problem facing export is the distance between production areas and the market. This results in fruit losses from decay and decline in fruit quality. In addition, there is competition in both local and international markets from other countries that also produce high-quality strawberries.



> The fruits of 'Ottoman' strawberry.



> Rubus genotypes sampled from Black Sea Region of Turkey exhibiting different thorn characteristics.

■ Table 4. Turkish strawberry export quantity and value by year. Source: Turkish Statistics Institute. www.tuik.gov.tr.

Year	Amount (t)	Value (\$US)
2000	60	83,175
2005	6,260	6,009,930
2010	25,832	28,045,662
2011	21,104	20,441,625
2012	21,426	19,855,779
2013	19,553	24,774,878

Blueberry

Publicity about the health benefits of consuming blueberries has continued to drive the demand for blueberries upwards and this has increased worldwide blueberry production. Given these production trends, the Turkish industry has made considerable efforts to encourage the expansion of blueberry production. North America has the highest production, however, production is developing gradually in Mexico, Chile, Argentina, Spain, South Africa and China (Anonymous, 2014). Turkey is con-

■ Table 5. Turkish strawberry export quantity and value by destination country in 2013. Source: Turkish Statistics Institute. www.tuik.gov.tr.

Country	Amount (t)	Value (\$US)
Russia	11,871	17,003,658
Romania	3,332	3,228,364
Iraq	1,277	1,309,120
Bulgaria	944	999,376
Ukraine	170	194,139
Saudi Arabia	4	16,713

sidered one of the promising regions as well, because of its close vicinity to main markets, wide range of climatic conditions, relatively low labour costs and its agricultural history. However, the low soil pH requirements of blueberries have limited production in Turkey. Most of the fruit production areas located in the Mediterranean and Aegean Region of Turkey have high soil pH and require low-chill cultivars. Only the Black Sea area of the North Eastern part of Turkey has suitable soil requirements for blueberry production.

The first commercial blueberry production attempt was made by Professor Çelik in the Black Sea area where some of the native *Vaccinium* species are present (Özgen et al., 2014). Over the past 15 years several, mostly small-scale, blueberry plantations have been established in this area using high-chill, high-bush blueberry cultivars.

Following new developments in growing techniques of blueberries and new low-chill cultivars, a further attempt was organized by Professor Serçe in collaboration with James F. Hancock from Michigan State University. They are in the initial stages of setting up several studies to initiate widespread blueberry cultivation in Turkey. These include testing of several low- and high-chill high-bush blueberry cultivars with different chilling requirements and maturation periods, optimizing growing techniques under Turkish conditions, and testing several segregating breeding populations in order to identify superior genotypes under local conditions. The project is being supported by the Ministry of Food, Agriculture and Livestock, General Directorate of Agricultural Research and Policies (TAGEM). By using different cultivars grown at different elevations, a wide window of blueberry fruit production should be established, ranging from the Mediterranean coast to valleys in the Taurus Mountains and some parts of Central Anatolia.

Raspberry and blackberry

Raspberry and blackberry cultivation in Turkey is centered in the Marmara Region. This production is considered to have been initiated by Turkish people who migrated back to Anatolia from the Balkans. There have been nationwide projects led by Yalova Atatürk Central Research Institute to adapt new cultivars to varying environments across Turkey. Although these studies have contributed to overall raspberry and blackberry cultivation, current production is still considered to be too low. The introduction of new techniques, such as long cane raspberry production, and new cultivars and types, such as thornless blackberries and primocane cultivars, are expected to be important for increasing production in Turkey. Therefore, several new blackberry and raspberry cultivars are being trialed in other parts of Turkey, such as the Mediterranean coast. Initial results indicated that the region may be too hot during the floriculture production period of raspberry, however, the climate appears to be very suitable for primocane blackberry cultivars. The production of such cultivars in the Mediterranean Region may result in a significant boost to Turkish blackberry production. Both fresh and processed blackberry and raspberry markets are expected to expand significantly in coming years.



› Wild *Vaccinium* species from Black Sea Region.

Genetic resources

Turkey has rich genetic resources of *Fragaria*, *Vaccinium*, *Rubus* and *Sambucus* species. There have been several attempts to collect and characterize these genetic resources. Most of these studies were supported by The Scientific and Technological Research Council of Turkey (TÜBİTAK). Serçe et al. (2005) sampled many populations of *Fragaria* representing *F. xananassa*, *F. vesca* and *F. viridis*. Samples were grown in a common environment, an unheated greenhouse, and were evaluated for several horticultural traits as well as molecular variation determined by RAPD markers. The samples exhibited a great deal of variation in both evaluations. In another project, Çekiç and Özgen (2010) sampled and evaluated *Rubus* species from the Black Sea Region of Turkey. Their evaluation included morphological, molecular and chemical properties of wild blackberry genotypes as well as known standard cultivars. They discovered a wide range of variation for many horticultural traits. Many of the wild

blackberries had significantly higher phytonutrient contents than cultivated blackberries. Wild blackberries had 64% higher phenolics, 172% higher ferric reducing ability of plasm (FRAP), 129% higher trolox equivalent antioxidant capacity (TEAC) and 32% higher anthocyanin content than cultivated blackberries (Çekiç and Özgen, 2010). Similarly, some of the wild accessions of red raspberries exhibited higher antioxidant capacity and phytonutrient content than existing domesticated cultivars.

Turkish flora also includes several species of *Vaccinium*. These species include Caucasian whortleberry (*Vaccinium arctostaphylos*),

bilberry (*Vaccinium myrtillus*), lingonberry (*Vaccinium vitis-idea*) and bog bilberry (*Vaccinium uliginosum*). These wild *Vaccinium* species have different distribution areas mostly correlated with elevation. Although there is no commercial cultivation of these wild species in Turkey, over the centuries inhabitants of the Black Sea Region have picked these berries from forests and plateaus. Local inhabitants utilize the fruit of these species in a number of ways, including consuming them fresh or frozen, and making jelly, jam and juice. These species are currently being sampled and characterized for several horticulturally important traits. ●

› References

Anonymous (2014). Blueberry industry in figures. In: Blueberries of the World 2014, International Special Edition.

Çekiç, Ç., and Özgen, M. (2010). Comparison of antioxidant capacity and phytochemical properties of wild and cultivated red raspberries (*Rubus idaeus* L.). *Journal of Food Composition and Analysis* 23, 540–544.

Özgen, M., Celik, H., and Saracoglu, O. (2014). Less known *Vaccinium*: antioxidant and chemical properties of selected Caucasian whortleberry (*Vaccinium arctostaphylos*) fruits native to black sea region of Turkey. *Acta Sci. Pol., Hortorum Cultus* 13(2), 59–66.

Serçe, S., Gündüz, K., Paydaş, S., Kaşka, N., Özdemir, E., and Hancock, J.F. (2005). Collection and preliminary evaluation of Turkish strawberry germplasm. *HortScience* 40, 1109.



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> Courses and Meetings

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XII Biennial African Crop Science Society Conference, 12-15 October 2015, Abuja, Nigeria. Info: African Crop Science Society, Faculty of Agriculture, Obafemi Awolowo University, Ile-Ife, Nigeria, Phone: +2348165582711 or +2348067830144, E-mail: dele_fakorede@yahoo.com or mfakored@oauife.edu.ng, web: www.acss2015.ng

2015 Annual Symposium of the BeNeLux Society for Horticultural Science: Plant control by LED light, 15 October 2015, Wageningen, The Netherlands. Info: Prof. Dr. Leo Marcelis, Wageningen University, Horticulture & Product Physiology, Droevendaalsesteeg 1, 6708 PB Wageningen, The Netherlands, E-mail: leo.marcelis@wur.nl, web: www.beneluxshs.eu

Global Plant Council/SEB Plant Section Symposium on Stress Resilience, 23-25 October 2015, Foz do Iguacu, Brazil. Info: Dr. Ruth Bastow, E-mail: ruth@globalplantcouncil.org,

Web: www.sebiology.org/meetings/Plant_Symposium_2015/Plant_2015.html

Advanced Course on Integrated Production of Olive Crops, 9-14 November 2015, Zaragoza, Spain. Info: Mediterranean Agronomic Institute of Zaragoza (IAMZ) – CIHEAM, Avenida Montañana 1005, 50059 Zaragoza, Spain, Phone: +34 976 716000, Fax: +34 976 716001, E-mail: iamz@iamz.ciheam.org, Web: www.iamz.ciheam.org

Postgraduate Programme in Ecological Food Systems. A unique postgraduate programme that explores the thinking and practice that will revolutionise food production for a sustainable 21st Century, January 2016, Devon, UK. Info: Michelle North, Schumacher College, The Old Postern, Dartington, Totnes, Devon, TQ9 6EA, UK, E-mail: postgradadmin@schumachercollege.org.uk, Web: <https://www.schumachercollege.org.uk/courses/postgraduate-courses/ecological-food-systems>

Advanced Course on Genomic Prediction and Selection in Plant Breeding, 18-22 January 2016, Zaragoza, Spain. Info: Mediterranean Agronomic Institute of Zaragoza (IAMZ) – CIHEAM, Avenida Montañana 1005, 50059 Zaragoza, Spain, Phone: +34 976 716000, Fax:

+34 976 716001, E-mail: iamz@iamz.ciheam.org, Web: www.iamz.ciheam.org

Advanced Course on Use of Sensors in Precision Agriculture, 7-12 March 2016, Zaragoza, Spain. Info: Mediterranean Agronomic Institute of Zaragoza (IAMZ) – CIHEAM, Avenida Montañana 1005, 50059 Zaragoza, Spain, Phone: +34 976 716000, Fax: +34 976 716001, E-mail: iamz@iamz.ciheam.org, Web: www.iamz.ciheam.org

International Tomato Conference “Tomatoes, trends towards 2020”, 13-15 April 2016, Antwerp, Belgium. Info: Prof. Bart Nicolai, Department head, Flanders Centre of Postharvest Technology BIOSYST-MeBioS, KU Leuven, Box 2428, de Croylaan 42, B-3001 Leuven, Belgium, E-mail: info@tomatoconference2016.be, web: www.tomatoconference2016.be

XVIII Reinhardsbrunn Symposium on Modern Fungicides and Antifungal Compounds, 24-28 April 2016, Friedrichroda, Germany. Info: Christian Carstensen, Deutsche Phytomedizinische Gesellschaft, Messeweg 11/12, 38104 Braunschweig, Germany, Phone: +495312993213, Fax: +495312993019, E-mail: info@reinhardsbrunn-symposium.de, Web: www.reinhardsbrunn-symposium.de



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> XXV International Eucarpia Symposium Section Ornamentals “Crossing borders”

Section Ornamental Plants

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> Participants of the symposium.

EUCARPIA aims to promote scientific and technical co-operation in the field of plant breeding in order to foster its further development. To achieve this purpose, the Association organizes meetings on a regular basis to discuss general or specific problems from all fields of plant breeding and genetic research. The XXV International Eucarpia Symposium Section Ornamentals was held from June 28 to July 2 in Melle, Belgium. Around 220 participants attended the symposium, representing 24 countries.

“Crossing borders”, the central theme of the symposium, explored the opportunities to go beyond traditional ornamental plant breeding. Recent boosts in fundamental knowledge and new tools, including gene expression and genome sequencing, offer opportunities for more efficient selection and breeding in ornamentals. The symposium held seven sessions covering molecular breeding, flower, stress, plant morphology, biodiversity, interspecific breeding and disease resistance breeding.

In the plenary session Jaap van Tuyl (The Netherlands) outlined how the progress in breeding technology and the use of interspecific breeding during the past 40 years formed the basis of the boom in lily cut flower production. A new palette of various colors and forms was introduced and the impact of

the research was demonstrated by the shift in the top selling commercial cultivars. The importance of biodiversity for ornamental breeding was highlighted in several other talks. China is a hotspot for many ornamental species, as was shown by Chunlin Long. Access to plant material remains, however, an important issue now the implementation of the Nagoya protocol has commenced. The consequences of this protocol for the breeding sector was explained by Anke van den Hurk (The Netherlands).

Compact growth is a desirable trait in many ornamental species. Natural transformation with rol genes has provided very promising results, especially as these plants are not considered to be genetically transformed. Renate Müller (Denmark) gave an overview of the current status and showed the first commercial introductions of *Kalanchoe*. Regulation of plant morphology and shoot branching is important for the final plant habit. Ottoline Leyser (United Kingdom) described the hormonal control of shoot branching in *Arabidopsis*. Other contributions reported on similar hormonal regulatory mechanisms in rose and chrysanthemum, demonstrating that there are future opportunities to use this knowledge in breeding programs.

Nature can inspire plant breeders and horticulture. This was shown by Scott Hodges

(USA) who studied the evolution and ecology of floral morphology in *Aquilegia*. The diversification in flower color, orientation and spur length was caused by adaptations to different pollinators. Now the genetic basis of some of these traits has been dissected and has led to an understanding of floral organ identity.

Today, classical crossbreeding is still the most important method to obtain new cultivars in almost all ornamentals species. This was also demonstrated in many posters and short presentations.

Active interaction and discussion between the private plant breeding industry and academia was attained in two workshops. The first one dealt with ‘Future perspectives for ornamental breeding’. Participants were introduced to the current status of the vegetable breeding industry and how modern breeding tools are incorporated into these programs. It was suggested that ornamental breeders are still living in “the eighties” compared to vegetable breeding companies, and there is an urgent need to close this gap. Jochen Kumlehn (Germany) introduced some of these modern breeding techniques in his talk on synthetic endonucleases. The hypothesis that disease-resistant cultivars could be profitable for breeding companies was discussed, and that if this is true then they should start today to increase efforts



The second workshop on ‘Intellectual property for plants – hot topics’ was hosted by the International Community of Breeders of Asexually Reproduced Ornamental and Fruit Varieties (CIOFORA). It comprised a discussion on three issues: (1) Minimum dis-

› **Dr. Margrethe Serek, Chair of ISHS Section Ornamental Plants, and Dr. Jozef Van Assche, ISHS Executive Director, handing out the ISHS medal award to Symposium Convener, Dr. Johan Van Huylenbroeck.**

During the symposium, participants had the opportunity to visit the ornamental breeding facilities at the Institute for Agricultural and Fisheries Research (ILVO). The breeding activities in woody ornamentals, azalea and roses were presented, as well as the tissue culture, cytological and biotech-related research. Finally, post-symposium tours provided the opportunity to discover the ornamental breeding industry in Belgium. ●

Johan Van Huylenbroeck and Emmy Dhooghe



› **Technical visit to the Institute for Agricultural and Fisheries Research (ILVO).**

in resistance breeding in order to survive tomorrow. Monica Höfte (Belgium) discussed the opportunities of fundamental knowledge on basal and induced resistance mechanisms in plants and how this can be applied to obtain disease resistance in ornamentals.



› **The local ILVO organizing team.**

tance or how similar should varieties be?, (2) Essentially Derived Varieties (EDV) – are all mutants and GMO cultivars considered to be EDV?, and (3) Patents for plant innovations – evil or blessing? The outcome of this workshop showed that intellectual property will remain a key issue for plant breeders.

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› XIV Eucarpia Symposium on Fruit Breeding and Genetics

Section Pome and Stone Fruits

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The XIV EUCARPIA Symposium on Fruit Breeding and Genetics was held in Bologna, Italy, from 14 to 18 June 2015. The symposium offered the chance to strengthen cooperation between Eucarpia and the International Society for Horticultural Science (ISHS), two scientific organizations that pursue common goals. The symposium was organized by the ‘Fruit Section’ of the ‘European Association for Research in Plant Breeding’ that aims to promote scientific and technical co-operation in the field of plant breeding in order to foster its development. The meeting lasted five days and included a day for technical visits. Excel-

lent introductory lectures were presented on three topics that are important to fruit tree breeders and geneticists. On Sunday evening, June 14, Prof. Lars Ove Dragsted (Professor of Biomedicine and Nutrigenomics, University of Copenhagen, Denmark) officially opened the symposium with a lecture on ‘The role of fruit consumption in human health’. During the program, Prof. Cesare Gessler (Emeritus of the ETH, Zurich, Switzerland) presented a lecture on ‘Biotechnology for a pesticide free orchard: a promise or an utopia?’ to open the session on ‘Breeding and genetics for resistance to biotic stresses’. Finally, Prof. Michele Mor-

gante (Professor of Genetics, Udine University, Italy) opened the ‘Advances in ‘OMICS’ and new technologies’ session with a talk entitled ‘Lessons learned from the sequencing of fruit tree genomes’.

The meeting included 52 oral presentations and more than 130 posters organized into 6 scientific sessions.

Three parallel technical visits were organized on June 16 in three different fruit tree producing areas of the Emilia-Romagna Region. The visit to Ferrara was devoted mainly to apple and pear orchards, the one to Faenza focused on apricot and peach orchards, and the last one, to Vignola, visited cherry orchards.



› Majority of symposium participants.

The symposium attracted more than 180 delegates from 31 countries belonging to four continents. Most of the delegates were from Europe whilst the remainder came from Asia (30), North and South America (13) and Oceania (5). As expected, many delegates were from Italy (more than 50) and the closest countries (especially Spain and France). The presence of various delegates from other countries like South Korea (12), Hungary (8), USA (7), Israel, Chile and Czech Republic (6) is further proof of the international breadth of the symposium. A large proportion of the delegates were students and young researchers and this highlights the vitality of the Eucarpia fruit breeding and genetics section. The last day of the symposium was dedicated to the presentation of the main results of the EU project FruitBreedomics ("Eucarpia-hosted FruitBreedomics International Confer-



› Technical visit in the Ferrara apple and pear producing area.

ence") and an additional 30 European delegates joined the symposium for this session. The Organizing Committee wishes to thank the Scientific Committee and all participants for the high quality of presentations and posters that greatly contributed to the success of the symposium. Moreover, the convenor would like to thank the sponsors for their

financial support, which greatly contributed to the success of the event.

The proceedings of the symposium will be published in *Acta Horticulturae*, following the agreement between Eucarpia and ISHS. The XV Eucarpia Symposium on Fruit Breeding and Genetics will be hosted by Dr. Jiří Sedlák from the Research and Breeding Institute of Pomology Holovousy Ltd. in Czech Republic in 2019. ●

Stefano Tartarini

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› International Symposium on Durian and Other Humid Tropical Fruits

Section Tropical and Subtropical Fruits

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The International Symposium on Durian and Other Humid Tropical Fruits, held on 2-4 June 2015 in Chanthaburi, Thailand, was organized under the aegis of the International Society for Horticulture Science (ISHS) by the Ministry of Agriculture and Cooperatives, Thailand, through its Department of Agriculture and Department of Agriculture Extension, the Horticultural Science Society of Thailand (HSST) and the FAO Regional Office for Asia and the Pacific. The local government, Chanthaburi Provincial Government, and the Prin-

icipal Administrative Organization of Chanthaburi, also supported the event. One hundred and seventy-nine local and 25 foreign participants, composed of lecturers, researchers, students, farmers, brokers and traders, extension officers, journalists, and media press, attended this symposium. Seven sessions of oral and poster presentations covered the following topics: Genetic resources and breeding, Biotechnology, Cultural practices and physiology, Plant protection, Postharvest technology, Processing and

processed products, and Production and marketing. Diversity, production, hybridization and utilization of durian in major durian-producing countries like Malaysia, Indonesia and Thailand were presented. An overview of the durian market in China and trends in Asian and Western consumer perception were given. Information was exchanged and ideas/experiences were shared in an open discussion. The following highlights on durian were presented: conservation of red durian trees in East Java, Indonesia, potential



> Opening ceremony.



> Visit to Chantaburi Horticulture Research Center.

for commercial plantings, off-season durian production in the Mekong Delta by flowering induction, effect of climate variability (with $\leq 20^{\circ}\text{C}$) on durian flowering, absence of Monthong durian fruit set at 15°C night temperature, Thai quality standards for commercial sales of durian, and utilization of durian husk for bio-plate production. Highlighted topics of humid tropical fruits were: the effect of growth regulators on mangosteen seed development, processed instant powder of mangosteen pulp for use as a food ingredient, jackfruit and rambutan genetic resources in South Asia, diversity and commercialization of *Garcinia atroviridis*, and production and marketing survey of salak fruit in Thailand.

More than 30 cultivars of Thai durian were exhibited during the symposium. Six companies from the private sector participated in this event. A durian competition was organized by the Department of Agriculture Extension to assist durian growers/produc-



> Durian tasting.

ers/traders to understand the characteristics of high quality commercial durian. This event drew the attention of the media and the durian industry was promoted. In addition, other humid tropical fruits, e.g. mangosteen, slug, langkong, and rambutan, were exhibited and available for tasting. Various sweets and snacks made from durian were served to participants throughout the symposium. Participants were very impressed by these activities and it gave them an appreciation of how to utilize durian for food industry purposes.

At the opening ceremony, plaques of recognition were given to respected researchers and “gurus” of durian, and to outstanding, pioneer durian farmers, who have been contributors, innovators and/or have had influence on the national or global durian industry. The awardees were from Indonesia (1), Malaysia (1) and Thailand (7).

During the field trip, participants visited frozen durian and fruit processing sites, a fruit production cooperative, a GAP certified durian plantation, a durian packing house and the Chantaburi Horticulture Research Center, where fresh fruit marketing, durian and rambutan varietal collections, and mangosteen research and development were presented and explained to the participants.

Dr. Songpol Somsri, Chief of the Senior experts of the Department of Agriculture and durian breeder, who was instrumental in enabling this symposium to be held in Thailand, expressed his satisfaction and admiration of the successfully-organized symposium that was attended by various sectors, resulting in a very informative outcome. He expressed his hope that new knowledge from the symposium would result in technology advancement and increasing fruit production and market trends of durian and other tropical fruits in Thailand and Southeast Asian countries, especially in durian-producing countries. The outcomes of this symposium will benefit farmers who apply technology, entrepreneurs who conduct market planning and consumers who will be served safe food of good quality. In addition, the networking and collaboration opportunities at this symposium will have a long-lasting



> Mangosteen packing house.

impact on the development of durian and tropical fruit production and industries in the near future. ●

Wilaiwan Twishri

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> V International Symposium on Cucurbits

Section Vegetables, Quality Production Systems, Leafy Green and Non-Root Vegetables

#ishs_sevq



> Participants of the symposium.



> Granting of ISHS medals and certificates to the Conveners, María Luisa Gómez-Guillamón and Francisco Pérez-Alfocea.

The V International Symposium on Cucurbits was held in Cartagena, Spain, from 22 to 26 June 2015 under the auspices of the ISHS. It was organised by the Centre for Applied Soil Science and Biology of the Segura-Spanish National Research Council (CEBAS-CSIC), the Technical University of Cartagena (UPCT) and the Murcia Institute for Agricultural Research and Development (IMIDA). The UPCT made available the historical 'Antiguo Hospital de Marina' as the venue. This symposium followed former events held in Australia (2005) and China (2009). The Region of Murcia was an ideal place to hold this event given the economic importance of the *Cucurbitaceae* family in the region. Murcia is the 2nd largest exporter of melon in Spain with Cartagena being in the main production area known as 'Campo de Cartagena'. Melon is the most popular and widely distributed cucurbit crop



> Tour around the cucumber greenhouse.

in the Region of Murcia, standing out for its high quality and special characteristics. Last year, melons were grown on 2,500 ha, with a production volume of 214,000 t and an economic value of more than 130 million €. More than 150 delegates from 26 countries attended this meeting, with a program that included 41 oral and 56 poster presentations. The symposium was divided into five sessions: Genetics and Breeding; Genomics and Biotechnology; Crop Production, Physiology and Management; Biotic and Abiotic Stresses; and Fruit Quality and Postharvest. On the last day, a technical workshop was organized under the title 'New Tendencies in Vegetable

Grafting'. The program also included a field visit to three trials carried out by companies specialized in the production of different cucurbit crops: a greenhouse of cucumber at 'Agrícola Perichán' (Mazarrón), an open field of watermelon at 'Pozo Sur' (Águilas), and an open field of melon at 'Procomel-El Abuelo' (Torre-Pacheco).

According to FAO, the main cucurbit crops in major producing countries represent about 8 million hectares yielding more than 150 million tons. Cucurbits are an increasingly important component of the human diet and, indeed, the worldwide production of the major species such as cucumber, water-

melon and melons has increased 4-fold in the last 40 years. As in many other crops, this important rise has been possible mainly due to the increase in yields resulting from genetic improvement of cultivars and the optimisation of growing systems and management practices worldwide. International events such as this one aim at contributing to this continuous development by bring-

ing together academia and industry experts in genetics, genomics, breeding, physiology and agronomy. The opening session included the presentation of the conveners, a UPCT representative, and the ISHS representative, Prof. Dr. Daniel Leskovar – Chair of the ISHS Section Vegetables, Quality Production Systems, Leafy Green and Non-Root Vegetables, who outlined the ISHS scope and the interest in maintaining the activities of this successful ISHS Working Group on *Cucurbitaceae*. During the session on Genetics and Breeding, the keynote speakers, Nurit Katzir (Israel) and Emilio Sarría (Spain), showed the latest advances in the identification of molecular, genetic and evolutionary factors underlying fruit quality

traits. The future global challenges in breeding melon and watermelon, cucumber and other species, including cucurbit rootstocks, were also discussed. In the session on Genomics and Biotechnology, Zhangju Fei (USA) and José Blanca (Spain) presented the most recent information and tools related to the content and structure of watermelon and pumpkin genomes, which is of high value for breeding purposes. Other speakers introduced new useful genomic and biotechnological information for increasing resistances to some pathogens and viruses in different species. Concerning the session on Crop Production, Physiology and Management, Yiqun Weng (USA) and Manuel Jamilena (Spain) highlighted the importance of identifying and exploiting genomics tools for the control of genetic traits of high agronomic interest by using existing and new genetic diversity. An interesting case study of ethylene-related genes in zucchini is also worth mentioning. Within the session on Abiotic and Biotic Stresses, the keynote speakers Daniel Leskovar (USA) and Miguel Aranda (Spain) focused on the impact of genetic, environment and management strategies and approaches to mitigate the negative effects of water stress, salinity, organic pollutants, viruses and pathogens on different cucurbit species. Lastly, in the session on Fruit Quality and Postharvest, Jordi García-Mas (Spain) and Antonio Monforte (Spain) presented the latest genomic, biochemical and technological information and tools for the identification and control of valuable agronomic traits such as fruit morphology, ripening, composition, aroma and postharvest properties in melon.

On the last day, a technical workshop under the framework of the EU project ROOTPOWER (#289365) dealing with new tendencies in vegetable grafting was held. Speakers shared the most recently-available information on the past, present and future of vegetable grafting, as well as on the control of pathogens and environmental constraints. An interesting and fruitful discussion about the current status and new perspectives in developing new rootstocks in vegetable crops took place among plant propagators from nurseries, farmers, breeders and scientists. During the ISHS business meeting, members of the *Cucurbitaceae* Working Group (WG) made decisions concerning the next Cucurbits symposium, scheduled for 2019, and the chairmanship of the WG. With regard to the selection of the Chair of the WG *Cucurbitaceae*, the candidature presented by María Luisa Gómez-Guillamón (ISHM-UMA-CSIC, Spain) was accepted unanimously. ●

**María Luisa Gómez-Guillamón
and Francisco Pérez Alfócea**

>Contact

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> Tour around the main processing facilities of Procomel, market leader in the production of melon.

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› V International Symposium on Ecologically Sound Fertilization Strategies for Field Vegetable Production

Section Vegetables, Quality Production Systems,
Leafy Green and Non-Root Vegetables

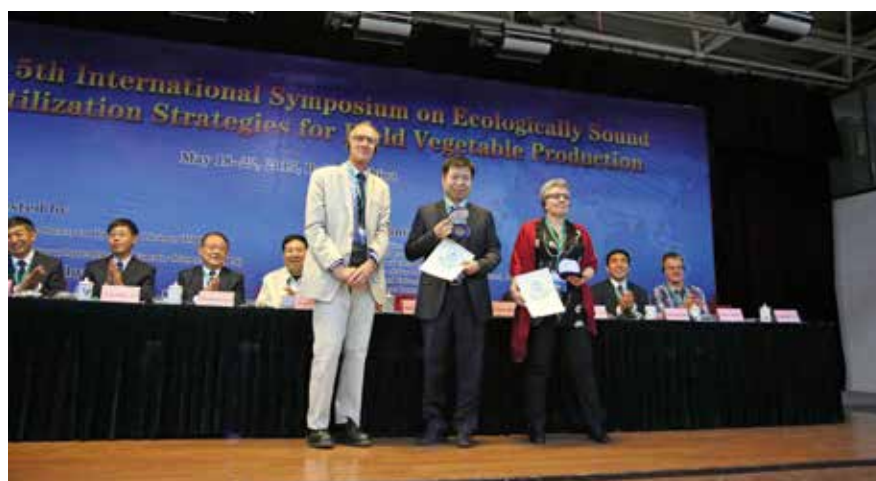
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› Delegates of the symposium.

The V International Symposium on Ecologically Sound Fertilization Strategies for Field Vegetable Production was held from 19-21 May 2015 in Beijing, China. The event was organized by the Beijing Academy of Agriculture and Forestry Sciences (BAAFS) under the aegis of the International Society for Horticultural Science (ISHS). This was the first international symposium on field vegetable fertilization held in China. Professor Guoyuan Zou (BAAFS) and Professor Silvana Nicola (University of Turin, Italy) convened the event, which attracted more than 230 professionals and academics from 14 countries (Belgium, Italy, UK, Spain, Japan, Australia, Kenya, The Netherlands, Turkey, Malaysia, Denmark, Korea, Saudi Arabia and China).

The scientific issues covered the following four areas: optimization management of nutrients, ecological application of organic fertilizers, fertigation application and environment, fertilization and ecology. Ten keynote lectures and 29 oral presentations were given, plus 33 scientific posters and 8 technical posters were exhibited at the symposium. Innovative and efficient technologies were highlighted and explored. The symposium demonstrated how innovative technologies and optimal



› From left to right: Dr. Clive Richard Rahn handed over the ISHS medal to Dr. Guoyuan Zou and Dr. Silvana Nicola, Symposium Conveners.

fertilization strategies can be applied to create a sustainable field vegetable ecosystem for a better world. This symposium highlighted possible topics for cooperation between different research teams and also put forward beneficial, cutting-edge resolutions, which can positively accelerate the development of the open field vegetable sector.

Ten keynote speakers during the symposium delivered the following lectures: “Vegetable

industry present situation and prospect in China” by Prof. Zhenhe Zhang from the National Agricultural Technology Extension and Service Center, China; “Field vegetable fertilization strategies for establishment of ecological farming system in Japan” by Prof. Shinichi Tokuda from the National Institute of Vegetable and Tea Science, Japan; “Strategies for optimal fertilizer management of vegetable crops in Europe” by Prof. Rodney Thompson from the University of Almeria,

Spain; “Environmental effects and threshold values of nitrogen fertilizer input of Chinese cabbage field in Beijing suburb” by Prof. Baocun Liu from the Institute of Plant Nutrition and Resources, BAAFS, China; “Situation, problems and counter-measures in nitrogen fertilization in vegetable field of Taihu Lake region” by Prof. Weiming Shi from the Institute of Soil Science, Chinese Academy of Sciences, China; “Management options for maximizing nutrient recycling from vegetable crop residues” by Prof. Ste-

the Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, China.

The 29 oral presentations and 41 posters contributions were related to the four topic areas. They stimulated important cross-exchange of ideas, and highlighted remaining challenges.

On the third day of the symposium, a well organized and very interesting field trip took the group to Yanqin and Shunyi County, Beijing, to view a demonstration project

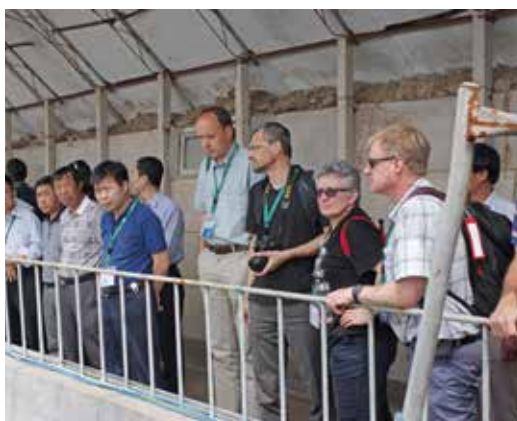
of Warwick and Plant Nutrition company) was unanimously elected as the Vice-Chair of the same Working Group. Istanbul, Turkey was selected to host the next symposium in 2018 during the International Horticultural Congress (IHC2018).

More information and a free copy of the Book of Abstracts can be obtained from the website (<http://ishs2015beijing.csp.escience.cn>). ●

Guoyuan Zou and Silvana Nicola



› Symposium keynote speakers. From left to right: Stefaan De Neve, Shaowen Huang, Baocun Liu, Silvana Nicola, Clive Richard Rahn, Weiming Shi, Rodney Thompson, Shinichi Tokuda, Zhengqin Xiong, Zhenhe Zhang.



› Field trip to Yanqin and Shunyi County. Demonstration project of slurry drip irrigation in Yanqin County (left); Water-soluble fertilizer comparative test in lettuce production in Shunyi County (right).

faan De Neve from the University of Ghent, Belgium; “Challenges of devising N recommendation systems for open field vegetables” by Prof. Clive Rahn from the University of Warwick, United Kingdom; “Vegetables toward fertigation” by Prof. Silvana Nicola from the University of Turin, Italy; “Greenhouse gas intensities and benefit in vegetable ecosystems and mitigation options” by Prof. Zhengqin Xiong from the Nanjing Agricultural University, China; “Restrains in soil and fertilization for field vegetable production and corresponding measures in China” by Prof. Shaowen Huang from

of slurry drip irrigation, a demonstration of cleaner production technologies, a safe application technique of organic fertilizer, a high-temperature composting pilot-scale experiment and leafy vegetable cultivation, and a water-soluble fertilizer comparative test in lettuce production.

During the ISHS business meeting, Mr. Janjo de Haan (Wageningen UR - Applied Plant Research) was unanimously elected as the new Chairperson of the ISHS Working Group on Vegetable Nutrition and Fertilization by all the ISHS members who attended the symposium and Dr. Clive Rahn (Universi-

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› XI International *Rubus* and *Ribes* Symposium

Section Vine and Berry Fruits
Commission Fruits and Vegetables and Health

#ishs_sevi
#ishs_cmfv



Scientists and industry representatives from around the world gathered in the Appalachian mountains of western North Carolina, USA, to attend the XI International *Rubus* and *Ribes* Symposium on June 21-24, 2015. The symposium was hosted by North Carolina State University (NCSU) on behalf of the *Rubus* and *Ribes* Species Working Group and the Section Vine and Berry Fruits of the International Society for Horticultural Science (ISHS).

The symposium list included 184 full and 6 one-day attendees, representing 26 countries. The official theme for this symposium was Healthful Harvests, Global Reach, and Local Roots. Talks in nine sessions covered these broad themes over a three-day period. In total, scientists gave 93 poster and 50 oral presentations, which were divided into these sessions: Breeding and Physiology, Genetic Improvement, Bioactive Compounds and Fruit Quality, Physiology and Production Systems, Pests and Diseases, Intellectual Property, Storage Life and Bioactive Compounds, Plant Nutrition and Yield, and Diseases. Five invited speakers from Portugal, Finland, and the United States (North Carolina, New York, and Arkansas) updated the participants on research going on in their labs or region.

We were welcomed to the symposium by Dr. David Monks from NCSU and Jeff Chandler from the North Carolina Department of Agricul-

ture and Consumer Sciences. Jeff is well known in the US caneberry research community as he is Co-Chair of the North American Bramble Growers Research Committee. Dr. Bernadine Strik, Chair of the Section Vine and Berry Fruits, gave the ISHS welcome. Drs. Jim Ballington and John Clark gave overviews of the *Rubus* breeding industry in the southern US. A special presentation in memory of Dr. Hugh Daubney was delivered by Prof. Strik. Dr. Daubney recently passed away, and this symposium was dedicated to his significant accomplishments in *Rubus* and to honor and acknowledge how instrumental he was in the early development of these symposia. He attended every *Rubus* and *Ribes* symposium from the first official one in Belgrade (1973) to the ninth symposium in Chile (2005), prior to his retirement. He will be greatly missed by all.

Authors were asked to have their manuscripts submitted one month prior to the symposium. We received 88% of the manuscripts prior to the symposium and about 75% were in review by the end of the meeting. Thanks to all the authors and reviewers who responded so well and in a timely manner. We hope to have the manuscript review completed by October 2015 and the *Acta Horticulturae* published shortly thereafter. This great task could not have been done without the tremendous efforts of ISHS Science Editor, Dr. Kim Hummer.

› Participants of the symposium.

The unofficial theme of the program was Southern Hospitality. Along with the Local Organizing and Scientific Committees, Southern Hospitality was evident throughout the symposium, with food, drink, social activities, and even climate. Symposium organizers made sure that the record high temperatures did not impede the activities, so attendees were frequently reminded to drink lots of water, wear hats, and apply sunscreen. Despite the heat, the warm, friendly atmosphere throughout the meeting allowed participants to renew old and build new professional and personal relationships.

During the symposium, a half-day grower tour was included to visit local sites. A 30-minute bus trip delivered the participants to the first stop, where the hosts Mike Pack Jr. and Sr. of M&M Farms, near Hendersonville, NC, put on a great show highlighting their blackberry fields and high tunnel production of blackberries and raspberries. The attendees then visited the Fruit of the Spirit Orchard and Vineyard, a farm owned by Steve, Gennee and Matana Dalton. The steep climb to the top of the hill showed participants high elevation blackberry production and a great view of the Appalachian Mountains. Upon their return down the hill, they were then treated to blackberry lemonade and lemon pound cake with blackberries.

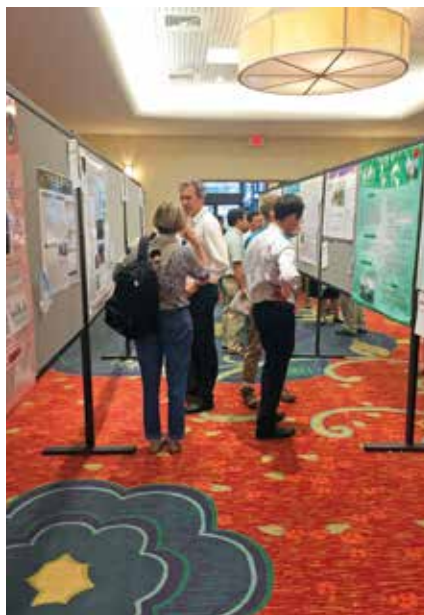
A graduate student mixer was co-hosted by Christine Bradish (NCSU) and Alejandra Salgado (Univ. Arkansas) on Monday evening. Naturally, the science-minded group of 16 students and post-docs representing five countries and six states chose the “LAB” (Lexington Avenue Brewery) in downtown Asheville for their meeting, and were able to meet each other in a casual environment and share ideas over food and drink.



➤ Ervin Lineberger, a grower, is talking about his farm to the pre-symposium tour participants.

Amanda McWhirt (NCSU) brought us all into the 21st century with her Facebook, Twitter and Instagram posts. She kept participants and those not able to make the meeting up-to-date as she shared posts during the pre-symposium tour, and the symposium. In case you want to relive the memories, they can be viewed at <https://www.facebook.com/ISHS-RubusAndRibes>, <https://twitter.com/Rubus-Ribes2015> and under ‘RUBUSRIBES2015’ on Instagram. In early July after the meeting, the group picture taken at the Folk Art Center had over 806 views, 24 likes, and 3 shares. Our symposium photographer, Dr. Zvezdana Pesic-VanEsbroeck (NCSU), along with Amanda McWhirt kept their cameras focused and ready to shoot day and night. Participants of this symposium were invited to visit a site in the cloud to view and download pictures. A hospitality room hosted each evening by Debby Wechsler, Executive Secretary for the North American Raspberry and Blackberry Association, drew many participants for conversation – and to watch games of the Women’s Soccer World Cup. Debby assembled a range of North Carolina-produced food and beverages, including wine from five NC wineries, Asheville area beers and hard cider,

chocolates, crackers, sweet potato chips, and goat cheeses. Raspberries and blackberries and currant products were also prominently featured in meals and breaks, all donated by growers, producers, and berry organizations. Informative and enjoyable tours of the *Rubus* industry in North and South Carolina preceded the symposium. The first day-long tour highlighted research activities at North Caro-



➤ Poster session.

lina State University. The first stop was at the NC Department of Agriculture and Consumer Sciences Piedmont Research Station. Guests were shuttled on trams to several field locations to see *Rubus*, blueberry and muscadine breeding plots, trellis systems, and entomology trials. The station superintendent, Joe Hampton, gave participants an overview of how the state’s 18 research stations cover all aspects of farming. The group then traveled to a nearby church, St. Luke’s Lutheran Church in Mt. Ulla, NC, to enjoy a lunch prepared by church members. In the afternoon, we toured the Plants for Human Health Institute (PHHI), where participants toured Dr. Penelope Perkins-Veazie’s lab facilities and then were the audience for the third class of the Plant Pathways Elucidation Project (P²EP). P²EP is a collaborative training and education program designed to advance research on key crops while preparing students for successful careers in Science, Technology, Engineering and Math (STEM) fields. In the evening, the group enjoyed dinner served at Pity Sake’s Lodge, the home of David Murdock, the spearhead of the PHHI and owner of Dole Foods. The second day of our pre-symposium tour was focused on visiting growers. We started out at Mitchem Farms, where Wayne Mitchem and his brother Carroll grow blackberries. They

had several pruning and herbicide demonstrations that local Cooperative Extension Agents, Tom Dyson and Daniel Shires, had helped to install earlier in the year. We then took a short trip to Knob Creek Farms in Lawndale, NC. Jeff Crofts and his family grow blackberries for the local and commercial markets. Lunch and blackberry ice cream were served under a breezy shelter at his farm. We then headed to South Carolina after lunch to visit two farms where we were joined by Clemson Extension Agent, Andy Rollins. At the first farm, Bob Hall showed us his tunnel production of blackberries and raspberries while we dodged large afternoon thunderstorms. Bob’s farm is near a Revolutionary War battleground and he remarked that “they,” meaning the British, won. It was quickly pointed out that some of “them” were in the audience and everyone had a good laugh, indicating that the stigma of that battle did not deter *Rubus* and *Ribes* camaraderie. Our final stop was Strawberry Hill USA in Chesnee, SC, where grower James Cooley was our host and evening chef. Attendees also participated in a peach taste test that was part of an on-farm trial with Clemson University. We then boarded trams pulled by tractors with a “YeHaa” and set off to tour the blackberry fields.

On the final day, we toured the Daniel Stowe Botanical Gardens, and had a behind-the-scenes tour of orchid production and lunch on the lawn. Our next stop was in Kings Mountain, NC, at Killdeer Farm to hear blackberry patriarch Ervin Lineberger share his thoughts and perspectives on the industry. He and his wife, Debby, have been growing blackberries for over 30 years. Attendees also viewed muscadine grape plantings and saw on-going NCSU research on Spotted Wing Drosophila that Ervin is hosting at his farm. We were fortunate to have many industry sponsors of this symposium. We would like to especially thank the gold sponsor, North Carolina Biotechnology Council, who provided funds for invited speakers and supplies. Bronze level sponsors included Planasa, Ekland Marketing, North American Raspberry and Blackberry Association, Nourse Farms, North Bay Produce, and Naturipe. Luncheon sponsors were Dole and Plant Sciences. Coffee sponsors were Driscolls and Sun Belle. General program sponsors included North Carolina Commercial Blackberry and Raspberry Association, Gurneys Nursery and Seed, Giummara, Washington Red Raspberry Council, Oregon Raspberry and Blackberry Commission, NC Department of Agriculture, NC Research Campus in Kannapolis, Northwest Plant Company and Meiosis. Additional support was provided by the Farm Bureau of North Carolina, Lewis Nursery and Plants, and Berry Hill Irrigation. Special thanks go to Debby Lienhart of Useful Plants Nursery for designing our logo. All of

these sponsors and their financial support made it possible to have a high quality program. Marietta Ellis Wheaton and her staff at New Beginnings Management provided outstanding services from organizing registration to helping with accommodation bookings. I also wish to thank the members of our organizing committee for their assistance before and during the meeting. Finally, Debby Wechsler, the Executive Secretary of the North American Raspberry and Blackberry Association, was instrumental in helping work through the tours and the program and

made suggestions along the way that really helped make the symposium a great success. Thank-you, Debby.

At the business meeting, Dr. Pedro Brás Oliveira was elected to a second term as the *Rubus* and *Ribes* Species Working Group chair (2015-2019). The members then voted to have the XII International *Rubus* and *Ribes* Symposium held in Switzerland with a pre-symposium tour scheduled in southern Germany. The proposed conveners are Dr. Christoph Carlen (Switzerland) and Drs. Erika Krueger and Gunhild Muster (Germany).

I look forward to seeing everyone in Germany and Switzerland in 2019, where I hope it will be cooler! ●

Gina E. Fernandez

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> VIII International Symposium on Irrigation of Horticultural Crops

Commission Irrigation and Plant Water Relations
Section Pome and Stone Fruits
Section Vine and Berry Fruits

#ishs_cmir
#ishs_sefr
#ishs_sevi



> Participants of the symposium.

Agriculture alone accounts for 70% of all fresh water use, according to United Nations data. Questions relating to water-fed agriculture present more and more challenges as the human population continues to increase and drought affects more and more areas of the world and with increasing frequency. Irrigation is now crucial for food production, but must be carried out with less available water. Adopting different irrigation strategies and techniques would have a major impact on the amount of water consumed by farms. Improving the efficiency of irrigation systems, and considering questions relating to both plant management and plant physiology, were central to the objectives of the VIII International

al Symposium on Irrigation of Horticultural Crops. The symposium was organized by the IRTA (Institut de Recerca i Tecnologia Agroalimentaries) in Lleida, Spain, from 8th to 11th June, 2015, under the aegis of the International Society for Horticultural Science (ISHS). The main public sponsor was the Diputació de Lleida. The main industry sponsors were Decagon LabFerrer, Li-Cor Geónica and Codorniu. There were 155 participants from 4 different continents and from a large number of countries. In this edition of the symposium a special effort was made to focus on current and future requirements in the field of irrigation



> Technical visit to the weighing lysimeters.

and these were discussed in the different sessions. These subjects included remote sensing, the modeling of irrigation and geostrategic constraints on irrigation. Based on the number of abstracts submitted, the session on remote sensing appeared to be particularly well-represented. In contrast, it may have been possible to organize a more compact session on modeling if the individual contributions had not been spread across so many different sessions. The session on geostrategic considerations probably needed greater economic investment in order to attract more speakers. Each of these 3 sessions attracted considerable interest amongst the delegates who attended the symposium. An additional monographic session was devoted to the subject of soil evaporation. This is a subject that is not traditionally dealt with in this symposium but one that attracted a lot of attention, probably because its importance is often downplayed in favor of focusing on plant transpiration.

The meeting included a total of 11 sessions on the following subjects: Evapotranspiration and irrigation requirements; The modeling of irrigation; Soil and plant water stress assessment; The use of remote sensing applications in irrigation; Irrigation of tree crops; Drought in tree crops; The irrigation of herbaceous crops; Salinity and irrigation in the age of desalination; Soil evaporation; Vineyard irrigation in relation to grape and wine quality; and, Social and geostrategic constraints on irrigation.

Eight invited speakers presented papers to open their corresponding subject sessions. Posters were also summarized in the plenary sessions and there were three poster reporters present during the first 15 minutes of each poster session. This responsibility was assumed by Prof. Isabel Ferreira, Prof. Riccardo Gucci and Dr. Diego Intrigliolo. On the first day of the scientific program, Prof. Richard Snyder presented an invited contribution with the title “Evapotranspiration and irrigation requirements: successes and needs”. On the third day, the following invited papers were presented: “Remote sensing for farm irrigation management”, by Elias Fereres; “Water application for optimum yield, quality and mineral partitioning in apples under different irrigation schemes”, by Esmail Fallahi; “Drought water management: an Australian perspective”, by Ian Goodwin; and “Sustainable irrigation and N management of fertigated vegetable crops”, by Rodney Thompson. On the fourth day of the program, the invited contributions were:

“The challenge of sustainable irrigation with water high in salts”, by Alon Ben-Gal; “Direct evaporation from the soil: are we giving it the right relevance?”, by Luca Testi; and “Irrigation of vineyards in California: optimizing productivity and fruit quality with limited water supplies”, by Larry Williams.

On the second day, a technical tour was organized in order to introduce those attending the symposium to the usage of irrigation and constraints on its use in the Lleida area. The sites visited included the Lleida-IRTA Experimental Research Station (where there was a visit to the weighing lysimeter on growing apple trees), the vineyards of Ràimat, the Unitat-Mixta Codorniu-IRTA and three different irrigation districts (the Canal d’Urgell, Segarra-Garrigues Canal and Aragón and Catalonia Canal).

After the report by Dr. Amos Naor, who summarized the major findings presented at the symposium, a discussion/debate was opened amongst the delegates during the final session. There was general consensus regarding the significant advances that have been made over the last few decades and about the novel approaches that are available to help improve the efficiency of the irrigation systems in each of the cases studied. Applying a full irrigation strategy often results in more water being wasted than is necessary to produce the highest crop yield. The alternative lies in the use of deficit irrigation, which can help to save substantial volumes of water but which should be managed by applying technology and knowledge in order

to avoid negative impacts on yield. However, its adoption in real farming situations is often considered to provide inadequate results or to be too expensive. There was consensus that producers need economic support if they are to adopt this technology and that they often do not have the right knowledge about how to apply it. For this reason, it is sad to say that the most sensible choice for irrigation, when water is available and cheap, is to continue to apply full irrigation strategies. An evident problem that was identified in this regard is the underfunding of research devoted to the study of irrigation strategies in favor of other fashionable disciplines. This disregard for irrigation research is partially related to a lack of interest, or lack of awareness, on the part of policy makers. In fact, the solution to the water problem and to that of future food security lies in improving the efficiency of irrigation in agriculture. The organizers would like to extend their thanks to all participants and contributors for a very fruitful and enjoyable meeting. We look forward to the next meeting, which will be held in southern Italy in 2019. ●

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› VI International Symposium on Production and Establishment of Micropropagated Plants

Commission Molecular Biology and In Vitro Culture
Section Ornamental Plants

#ishs_cmmv
#ishs_seop

The VI International Symposium on Production and Establishment of Micropropagated Plants (PEMP) was held in Sanremo, Italy, the so-called “City of flowers”, from 19-24 April 2015. Sanremo is known worldwide for the production and export of flowers, thanks to its mild climate and proximity to the sea. The economic impact of the ornamental sector (yearly gross production of Liguria Region: 529,8 M€) accounts for the development of breeding programs and nursery activities for which tissue culture applications have been shown to be essential. Therefore, the

symposium focused on plant tissue culture by encouraging free and open exchanges about scientific research and ideas relating to the management of different aspects of in vitro plant culture, with particular attention to classical and advanced micropropagation technologies.

The symposium, arranged according to the previous editions of the same series of “Acclimatization and Establishment of Micropropagated Plants”, was organized by the Regional Institute of Floriculture (IRF, Sanremo) under the scientific sponsorship of

the International Society for Horticultural Science (ISHS) and it was convened by Margherita Beruto, director of IRF. The event was endorsed by the ISHS Commission Molecular Biology and In Vitro Culture and supported by the ISHS Section Ornamental Plants. Scientific sponsorship came also from SOI (Società di Ortoflorofruitticoltura Italiana) and CIOPORA (International Community of Breeders of Asexually Reproduced Ornamental and Fruit Varieties). Different institutions and private companies provided sponsorship and support which were greatly appreciated.



> Group picture of the 6th PEMP symposium held at Londra Hotel, 19-24 April 2015, Sanremo.



> Welcome speech by Prof. Dr. Roderick A. Drew, ISHS President.

About 250 participants from academia and industry from 50 different countries attended the symposium. The multicultural atmosphere was one of the most important features. It added value to the symposium and supported the concept developed by the convener of “*creating an atmosphere where science could meet industry*”. The scientific sessions were divided into four different key topics: (1) Understanding in vitro growth; (2) Managing micropropagation process; (3) Rooting and establishment of micropropagated plants; (4) Micropropagation industry: new niches and roles for tissue culture companies.

Sessions were introduced with key lectures that focused on the relevant aspects of each theme: (1) the role of stress in modulating embryogenic competence (S. Ochatt, INRA/PCMV, Dijon, France); (2) key factors influencing the micropropagation of woody plants (I. Iliev, University of Forestry, Sofia, Bulgaria); (3) contamination in plant tissue cultures and how to deal with it through innovative approaches (E. Herman, Agricell Report, Shrub Oak, New York, USA, and S. Werbrouk, University of Ghent, Belgium); (4) the genetic and epigenetic changes occurring in micropropagated plantlets (R. Muleo, University of Tuscia, Italy); (5) physiological and technological approaches to improve the efficiency of acclimatization of ex TC plantlets (D. Neri, University of Marche, Ancona, Italy); (6) the commercial use of endophytes in micropropagation (C. Schneider, Institut für Pflanzenkul-



A



B

> Some moments of the technical visits arranged during the symposium. A. Biotechnological greenhouse fitted with photobioreactor for the production of different microalgae species at Microalghie Camporosso - Società Agricola Srl (MAC). B. Ranunculus blooming at Biancheri Creations®, which is a company specializing in the production, preparation and marketing of ranunculus and anemone bulbs with particular attention to the micropropagated lines.

tur, Schnega, Germany) and (7) the potential of bioreactor technology for large-scale plant micropropagation (R. Ibrahim, Malaysian Nuclear Agency - Banji, Malaysia, Asia).

The program was made more meaningful thanks to nine endearing presentations, “*From bench to market*”. These presentations provided the industry and commercial point of view and widened the scope of discussions on the state of the plant tissue culture field.

Some of the most recent and innovative advances in plant tissue culture methodologies were presented at the symposium. In particular, strategies to enhance micropropagation were explored through: (1) the application of low-level infrared laser beams or a static low frequency magnetic field; (2) the use of multi-walled nanotubes (MWNTs) of graphene; (3) the treatment of shoots at rooting and acclimatization phase with bacteria and arbuscular mycorrhiza; (4) the use of response surface methodology to assess a new culture medium; and (5) the application of LED lighting during rooting and acclimatization.

Different presentations dealt with the application of temporary immersion systems recognized as useful to enhance the micropropagation system. The use of the (already known) Plantform system (Welander et al., *Scientia Horticulturae* 179:227-232, 2014) was shown

for different plant models. In addition, details about new bioreactors were presented. They result in improved in vitro growth whilst also saving space on culture shelves and reducing the initial cost of containers.

An important event at the symposium was the award ceremony supported by IRF, which recognised four deserving students for their research activity at their respective universities: (1) Cosic Tatjana, Institute for Biological Research, Serbia; (2) Gatti Enrico, University of Modena and Reggio Emilia, Italy; (3) Keshavarzi Marzieh, Massey University, New Zealand; and (4) Michalec-Warzecha Zaneta, Polish Academy of Sciences, Poland.

Three technical tours provided participants with the opportunity to view the production activities of Liguria, namely production of cut flowers, pot plants and aromatic plants.

During the week, the participants were able to discover some beautiful corners of the “Riviera dei Fiori” together, particularly relevant because the convener reminded them that the word “Symposium” is a modern metaphor for its real meaning: “share moments together”. As indicated in the symposium logo, *leitmotiv*, this edition of the symposium was not only about science; music also played a key role. The participants were given the opportunity to listen to opera music and to the famous symphonic orchestra of Sanremo.

The remarkable number of participants, the high value of the scientific contributions and the potential influence of the above described events on the international scientific and horticulture industry community was also highlighted in two special issues of *Agricell Report* by Edwin B. Herman and this confirms the success of the symposium. The 7th edition in

this symposium series will take place in 2017 at the Universidade Federal de Lavras, Brazil.

Details on the symposium can be read also at the website: <http://www.regflor.it/ISHS2015/> and on the Facebook page created for the 6th PEMP. ●

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> International Symposium on Innovation in Integrated and Organic Horticulture (INNOHORT 2015)

Commission Organic Horticulture

#ishs_cmor

INNOHORT Symposium was successfully held in Avignon, on June 8-12, 2015. It was organized jointly by INRA (French National Institute for Agricultural Research) and the Federative Research Structure (FRS) TERSYS (“Development of natural plant products. Quality and Environment”) under the auspices of ISHS. The University of Avignon hosted the 120 participants who came from 20 countries in an historical and convenient working space, and provided delicious French cuisine. Avignon is located in one of the leading European regions for horticultural production, and with the symposium embedded in an academic context, it helped us to rethink together the foundations and orientation of horticultural production.

Aims and scope of the symposium

Tackling challenges related to global changes, environmental issues, and consumer expectations requires new knowledge and progress in biology and ecology. Scientific breakthroughs will not only depend on new disciplinary findings, but also on the integration of different forms of knowledge. More interdisciplinary approaches are required to develop integrative approaches and to bridge several gaps: gaps between technology and ecology, between scientific and lay knowledge (research and practice), between fruits and vegetables (horticulture as a whole), and between integrated and organic systems (or other forms of ecologically-based farming systems).

Innovation was indeed a guiding keyword of the symposium, but its title also reflects the ambition to create bridges between integrated and organic (IN&O, like B&B), both aiming to limit our dependence on external inputs, to promote high standards of produce quality, to support farm financial viability, and to maximize ecosystem services.



> Symposium participants in front of the venue, University of Avignon (new building).

Organization and highlights of the symposium

Overall, 100 oral and poster presentations were offered, with a total of 400 co-authors. Participants were enthusiastic about the mixture of communities and the opportunity to build bridges in the historical city of Avignon. “Take-home” messages, delivered in short oral presentations of posters, enabled participants, including students, to present their results to the larger audience. Parallel workshops gave smaller groups the opportunity to discuss topics in-depth and exchange their viewpoints. A diversity of small workshops was offered, including: “Traditional tomato cultivars in Europe”, “Innovative approaches of crop load regulation in horticultural fruits”, “Ethylene absorbers along the food chain”, the practical use of “DEXIFruit” and “Supporting transitions towards ecological horticulture”. About 50 papers are being reviewed for publication in *Acta Horticulturae*, and we

will also maintain the INNOHORT website (<https://colloque.inra.fr/innohort2015>).

Three invited speakers introduced the diverse topics of “Key concepts related to technological innovation in fruit training systems”, “A conceptual framework for the ecological control of pests in horticulture”, and “New perspectives on the role of phytochemicals in human health”.

Two field trips were conducted midway through the symposium. They facilitated interactions among participants, with scientists in experimental stations and with various stakeholders. The trips allowed participants to move outside to the fields, which is always appreciated.

The symposium was organized around five topics. We briefly present their rationale, conclusions and perspectives.

Topic 1 dealt with the biological dimensions of production, considering quantity and quality, nutritional and organoleptic dimensions.



› Views from field trips in experimental stations and farmers' orchards.

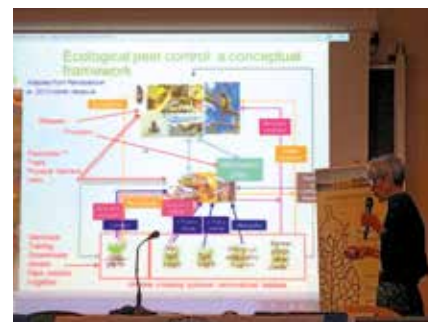
Knowledge domains ranged from genes to the fresh product, and are considered to be an asset in mastering fruit production. Contributions mostly addressed the characterization of genetic variability based on the expression of genes or phenotypical traits. This background is important to master processes, especially when research work is done in situations of integrated or organic production. Specific questions addressed to/by plant breeders and physiologists in such situations should be clarified, beyond resistance to pathogens. The role of modelling as an integrated and predictive tool should also be clarified.

Topic 2 addressed the effects of abiotic and biotic stress on plants and crop performance. The general assumption was that in organic systems a certain level of stress is accepted, which benefits both plant natural defenses and the quality of products (e.g. through concentrations in phytonutrients that are often plant defense compounds). Several presentations dealt with the effect of biotic stress on biological components of the cropping system other than plants themselves. Other presentations were about the prospects for designing cultivars with multiple resistances and tolerances. Global change will entail an increase in the intensity, frequency and duration of stressing events. Therefore, it would be interesting to address the issue of the resilience of cropping systems in relation to their plant and structural complexity (e.g. agroforestry vs. current orchards).

Topic 3 covered crop and quality management, considering cultural and postharvest practices at various organizational levels. Presentations on postharvest technologies were scarce. Many presentations discussed either how one management decision or technique (e.g. compost amendments or fruit thinning) affected the agroecosystem (carbon sequestration or disease management), or how a management system (e.g. organic) affected one part of the whole (such as soil biology or fruit quality). Both perspectives – reductionist or holistic – are important

and complementary. It could be valuable to consider more interactions among a number of management methods, which would contribute to the combined perspective inherent in integrated and organic systems.

Topic 4 addressed the design and evaluation of integrated and organic horticultural cropping systems, with innovative crop management and cropping methods in view. Two sessions highlighted the diversity of assets. Some key practices were identified: cover



› Keynote addresses by F. Lescouret et al. (left), and Y. Desjardins (right).

crops and composting (effects of soil fertility, biocontrol...), crop sequences, choice of cultivars and training systems. We also learned about interesting design experiences, especially in the posters, showing the innovative potential of mixing species in multi-layered systems. Conversely, only a few presentations were given on design approaches (co-design, co-innovation, eco-design). We therefore need cleverness and imagination to gather, integrate and circulate relevant knowledge and know-how to (re)design agro-ecological horticultural systems at various scales, including time dimensions (transitions).

Finally, topic 5 dealt with system performance and evaluation criteria: from field to food (including qualities and standards). Levels of investigation ranged from field to supply chain, but more emphasis is needed on the latter, especially at the international level or in touch with industry. Evaluation

criteria have been extended beyond productivity or production costs, but organizational and institutional issues should also be considered, since they generate transaction costs. Finally, many presentations referred to organic systems, but other initiatives also produced fruit without chemical residues. Acknowledging competitive fields can also support specific development pathways.

Position in a trajectory of ISHS symposia

INNOHORT draws upon previous symposia also conducted under the umbrella of ISHS Commission Organic Horticulture (e.g. Vignola, Italy, 2008, and Leavenworth, USA, 2012, on organic fruits; Avignon, 2013, on Organic Greenhouse Horticulture). These symposia are benchmarks on a pathway we shared and shaped during this week in Avignon and in the fields. The ISHS Organic Fruit Working Group met to discuss future plans, and no consensus was reached. A number of options were proposed, including holding a meeting like INNOHORT, with both vegetables and fruit included, but with a focus on organic, as there is ample activity in that area by itself. Such a meeting could have joint sessions on common topics (e.g. soils, biodiversity) and separate sessions



to discuss more crop-specific topics. Working group members and INNOHORT attendees will be asked for their opinion in the near future to help set the future direction. ●

Stéphane Bellon, Jean-Marie Codron, Nadia Bertin, David Granatstein, Eric Malézieux, Gregory Peck, Servane Penvern, Sylvaine Simon, Marc Tchamitchian and Laurent Urban

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› III International Symposium on Underutilized Plant Species

Commission Plant Genetic Resources
Section Medicinal and Aromatic Plants
Section Tropical and Subtropical Fruits
Commission Organic Horticulture

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The III International Symposium on Underutilized Plant Species, “Exploration and Conservation for Future Generations”, was held at the Agricultural College and Research Institute (AC & RI), Madurai, Tamil Nadu, India from 5th to 8th of August, 2015. The meeting was organized by Tamil Nadu Agricultural University (TNAU), Coimbatore, under the aegis of ISHS – Commission Plant Genetic Resources, Indian Council of Agricultural Research, New Delhi and Bioversity International. The Organizing Secretary of the committee, Dr. K. Velayudham, Dean, AC & RI, Madurai, and the Convener, Dr. C. Ravindran, Assistant Professor (Horticulture), Department of Fruit Crops, Horticultural College and Research Institute, Periyakulam, welcomed the delegates.

Dr. H. Philip, Director of Extension Education, TNAU, Coimbatore, Dr. M. Jawaharlal, Dean, Horticultural College and Research Institute for Women, Trichy, Dr. G. Pushpa, Dean, Home Science College and Research Institute, Madurai, and Dr. John Joel A, Professor and Head, Department of Plant Genetic Resources, Center for Plant Breeding and Genetic, TNAU, Coimbatore, offered felicitations.

The symposium was attended by 250 participants from seven different countries: Australia, India, Malaysia, Mozambique, Slovenia, Thailand and USA. The theme of this symposium, “Exploration and Conservation for Future Generations”, was organized into seven different sessions. During the inaugural session, Prof. Dr. Bhimanagouda Patil,

Director, Vegetable & Fruit Improvement Center, A&M University, Texas, USA, and Chair, ISHS Section Medicinal and Aromatic Plants, delivered the keynote address on “Underutilized plant species to address nutritional security: challenges and opportunities”.

Dr. Sandhya Gupta, Principal Scientist (ICAR-National Bureau of Plant Genetic Resources) and Vice-Chair, ISHS Commission Plant Genetic Resources, presented an overview on the ISHS to the symposium participants and awarded an ISHS medal to the Convener, Dr. C. Ravindran. This was followed by an invited special session on “Biodiversity, genetic potential and germplasm conservation of horticultural crops” organized by Bioversity International. In this session, seven invited papers on genetics and market potential of pulses, fruits, vegetables, flowers, medicinal and aromatic plants, spices, and root and tuber crops were presented.

The first session, entitled “Scenario of underutilized plant species and market potential”, started with two keynote speakers, Dr. M.A. Shankar and Dr. M. Jawaharlal, followed by ten oral and 34 poster presentations. An enlightening presentation was delivered by Dr. Jawaharlal on potential flower crops for the future, particularly those with availability during the off season (*Jasminum nitidum*, *J. multiflorum*, *J. calophyllum* and *J. flexile*) and that may be suitable for commercial production of essential oils.

Dr. Bruce French from Australia described the establishment of a database on food crops, which can be used to obtain information on

› Participants of the symposium.

specific functional foods and their medicinal values. The database also provides information on growing crops at an appropriate time, malnutrition, problems with naming of plants and hidden hunger.

The second session on “Biodiversity, germplasm conservation and utilization”, consisted of nine oral and 35 poster presentations. Dr. Sandhya Gupta presented a keynote paper on “Genetic resources management of underutilized and minor fruits of temperate and sub-tropical regions in India” with detailed information about the status of in situ conservation of underutilized and minor fruits by ICAR-NBPGR across the country. Dr. M. Sankaran gave a presentation on “Genetic resources of underutilized horticultural crops in Bay Islands of India”. The presentation on “Genetic diversity of Zombie pea (*Vigna vexillata*) assessed by microsatellite markers” by Prakrit Somta, Thailand, was also of particular interest to many delegates.

In the third session on “Crop improvement, physiology, biochemistry and biotechnology including nano technology”, two keynote speakers, L.K. Bharathi and Surendra Malik, presented “Harnessing the genetic potential of dioecious *Momordica* species through wide hybridization” and “Genetic resources management of tropical underutilized fruits in India: present status and challenges”, respectively. From the ten oral and 64 poster presentations, the best oral and poster were



> Prof. Dr. B. Patil lighting the lamp during the inaugural ceremony.



> Symposium Convener Dr. C. Ravindran (left) receiving the ISHS medal award and certificate from Dr. Sandhya Gupta (right), Vice-Chair, ISHS Commission Plant Genetic Resources.



> Dr. Bruce French (left) receiving the best oral presentation award.



> From left to right: Dr. K. Velayudham, Dr. M. Jawaharlal, Dr. H. Philip, Prof. Dr. B. Patil, Dr. K. Ramasamy, Dr. D.P. Biradar, Dr. Sandhya Gupta, Dr. S.B. Dandin and Dr. G. Pushpa presenting the abstract and souvenir publication of the symposium.



> Dr. J. Rajangam explaining the underutilized medicinal plants during the field visit.

chosen and awarded. One of the recommendations in this session was that more hybrids of *Memordica sachyadrica* and *M. sabamgulata* need to be developed for cultivation in mid and high altitude areas. Session four covered “Production and management techniques (propagation, inter cultivation, moisture conservation, wasteland development, mineral nutrition and organic production)”. Dr. E.V.S. Pakasa Rao and Dr. T.N. Balamohan presented their keynote papers on “Underutilized aromatic plant species for wasteland development” and “An overview of underutilized fruit crops of south India”, respectively. In addition, there were eight oral and 67 poster presentations. Dr. Balamohan emphasized that many minor fruits are high in nutritional value from a global perspective and have potential use in Indian systems of medicine. The presentations on “Grafting techniques in cucumber in wild and cultivated cucurbits as rootstocks” and “Growth performance of Bambara groundnut as influenced by phosphorus application using rock phosphate in the sub humid tropical regions of Malaysia” were notable. Session five on “Crop protection” started with invited lectures on “Biological control options for insect pests of underutilized crops” by Dr. Mohan, and “Scope of integrated crop protection strategies for underutilized fruit crops in the tropics: harmonizing endophytic microorganisms and plant health approaches” by Dr.

V. Ambethgar. These lectures were followed by seven oral and 27 poster presentations. The sixth session on “Nutritional security, postharvest, processing, value addition and utilization of end products”, began with a keynote presentation by Prof. Asgar Ali, The University of Nottingham Malaysia Campus, Malaysia, on “Novel biodegradable coating to control postharvest anthracnose and maintain quality of fresh fruits and vegetables”. In this session 11 oral and 53 poster presentations were given, and the underlying theme that emerged was the importance of value addition and waste utilization of underutilized plant species. The seventh session on “Socio-economic and upliftment of nomadic tribes” began with a keynote paper on “Socio-economic upliftment of tribal farmers through underutilized crop species – efforts and experiences with Grain Amaranth”, which was followed by six oral and seven poster presentations. In this session, the involvement of farmers/tribes in intensive minor millet cultivation was emphasized. On the third day of the symposium, a tour to the Horticultural College and Research Institute in Periyakulam and Kodaikanal was arranged. The name refers to the “Princess of Hill Station” and has a long history as a retreat and popular tourist destination. Participants were taken to various parts of Kodai Hill, such as Bryant Park and the Horticultural Research Station.

On the last day, the ISHS business meeting was conducted by Dr. Sandhya Gupta, Vice-Chair, ISHS Commission Plant Genetic Resources, and Prof. Dr. Franc Bavec, University of Maribor, Faculty of Agriculture and Life Science, Slovenia, was elected to hold the IV International Symposium on Underutilized Plant Species in Slovenia in 2019. Overall, the symposium was quite successful and the organization was well appreciated by the delegates. This symposium was indeed a good opportunity for those involved in underutilized plant species to (i) share their experience and knowledge, (ii) connect with the scientific community working on neglected underutilized species (NUS), and (iii) develop further NUS research by involving policy and decision making. ●

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› III International Symposium on Postharvest Pathology

Plant Protection
Commission Organic Horticulture
Commission Quality and Postharvest Horticulture

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The III International Symposium on Postharvest Pathology under the theme “Using science to increase food availability” was successfully held on 7-11 June 2015, in Bari, Italy, in a beautiful location in the center of the city.

The symposium was organized by Prof. Antonio Ippolito from the Department of Soil, Plant, and Food Science, University of Bari “Aldo Moro”, southern Italy, under the auspices of two international scientific societies: the International Society for Horticultural Science (ISHS) and the International Society of Plant Pathology (ISPP), and also under the patronage of the Italian Phytopathological Society (SIPaV), the Italian Society of Plant Protection, the Apulia Region, and the universal exposition “Expo Milano 2015”, along with the support of several national and international industry sponsors.

Two hundred participants from 44 countries of the five continents came to share their expertise and know-how. The conference website (www.postharvestbari2015.it) received ca. 13000 unique visits from almost 170 countries. The symposium started with an informal welcome by Antonio Ippolito, the Convener, Samir Droby and Michael Wisniewski as co-Chairs, Pervin Kinay as past Convener of the ISHS symposium held in Kuşadası, Turkey, and Josep Usall as past-Convener of the ISPP meeting held in Lleida, Spain. They presented a summary of the activities of both ISHS and ISPP postharvest working groups. The scientific program comprised 17 invited lectures, 41 oral presentations and 121 posters. Sponsors displayed



› Samir Droby (left), Antonio Ippolito (center) and Michael Wisniewski (right) posing with the ‘postharvest pathology symposium mascot pear’ during the gala dinner.

their products and services in eight stands creating particular interest among delegates. In the inaugural lectures the importance of innovative techniques of next generation sequencing for obtaining next generation crops was addressed by Massimo Delledonne, University of Verona, Italy, and the impact of social media on research networks was given by Lorenzo Mannella, University of Modena e Reggio Emilia, Italy. The symposium addressed a wide range of topics in seven sessions, and each session included 1-3 invited lectures. In the session “Studies on Host-Pathogen Interactions” the importance of ‘omics in unraveling pathogenicity mechanisms and developing resistance markers was discussed. In “Microorganisms as Biocontrol Agents” the ecological fitness and control mechanisms used by antagonistic yeasts as well as their efficacy on different crops were reported. In “Microbiome and its Relation to

› Participants of the symposium.

Postharvest Pathology” the metabarcoding analysis of plant microbiome and its use to control pathogens was addressed. In “Toxic Fungal Metabolites and Postharvest Pathology” the role of mycotoxins and other signal molecules in host-mycotoxigenic pathogen interaction was highlighted. In “Epidemiology and Detection of Postharvest Pathogens” bases for a better knowledge of pathogen behaviour to prevent postharvest contamination even by human pathogens were investigated. In “Alternative Means for the Management of Postharvest Pathogens” various alternative treatments were reviewed and new approaches were proposed. Finally, in “Integrated Approaches and New Products to Reduce Food Waste”, the importance of management of the supply chain to avoid postharvest losses was introduced. Poster sessions were presented each day according to the topics related to the oral sessions and gained particular attention of the delegates. A round table on “Innovations in the Management of Table Grape Diseases” was of interest to local extension services, packing-house operators, and producers. Moreover, the most likely influence of fruit microbiome on different aspects of postharvest pathology was thoroughly discussed.

At the end of the symposium a business meeting was held concerning the prospects for continuing the joint activities of the working groups of the two societies, ISHS and ISPP. It was agreed to meet jointly every two years and it was enthusiastically



› ISHS business meeting during which it was decided that the IV International Postharvest Pathology Symposium (IPPS) will be held in South Africa, in May 2017. The convener will be Prof. Lise Korsten (third from right).



› Delegates visiting the packinghouse Giuliano srl in Turi, Italy.

voted that the IV International Symposium on Postharvest Pathology will be held in South Africa, May 2017. It was further agreed that Prof. Lise Korsten, University of Pretoria, will be the next Convener. Prof. Pervin Kinay, Head of the Turkish Phytopathology Society, was the representative of the ISHS Working Group Biological Control of Postharvest Diseases. She spoke about the ISHS and its activities and congratulated the organizers. Dr. Michael Wisniewski awarded the ISHS medal to the Convener, Prof. Ippolito. During the gala dinner at the Sala Zonno, overlooking the beautiful Bari Bay, Antonio Ippolito expressed his appreciation to all delegates for participating in the symposium and to all the members of the Scientific and Organizing Committees for their efforts and contributions.

During the event, four awards for the best poster in each session were presented. Awarded authors also received a free annual subscription to the SIPaV, including free access to the “Journal of Plant Pathology” for one year. On the last day of the symposium, a full day tour was conducted. The delegates visited a large Apulian packinghouse (Giuliano s.r.l.) processing sweet cherries and other fruit and vegetables for local and international markets and tested locally-produced organic food in a farmhouse. On the way back to Bari, the delegates had the opportunity to visit Alberobello, a monumental Trulli village of the 1400s, UNESCO World Heritage Site, and Polignano a Mare, a fascinating medieval village perched on a high and jagged coastline, in which the Italian singer-songwriter Dome-

nico Modugno, author of “Volare”, was born. The oral and poster papers presented during the symposium will be published as a special issue of *Acta Horticulturae*. ●

Antonio Ippolito and Simona M. Sanzani

› Contact

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› ICESC2015 – Hydroponics and aquaponics at the Gold Coast

Commission Plant Substrates and Soilless Culture
Commission Protected Cultivation

#ishs_cmps
#ishs_cmpe

Jupiter’s Convention Centre on the Gold Coast, just south of Brisbane, Australia, proved to be an ideal venue on 5-8 July 2015 for the ISHS symposium “ICESC2015 - Hydroponics and Aquaponics at the Gold Coast”. In a break from tradition, the biennial Protected Cropping Australia (PCA) conference was also held at the same time and venue to enable the “knowledge makers” to meet with the “knowledge users”. Over 450 delegates registered for the joint meetings – a measure of the developing importance in Australia of protected cropping.

The small number of delegates (64) attending ICESC was probably due to the fact that many international scientists had been to Brisbane the previous year for the very successful International Horticultural Congress. Combined with the two conferences were 60 exhibitors from throughout the world who filled a total of 71 sites – a most impressive display. The ISHS meeting began on Sunday with the President of ISHS (Professor Rod Drew who lives in Brisbane) formally welcoming the delegates, and then Dr. Gordon Rogers (Vice Chair

of Commission Protected Cultivation) presented the two organisers with ISHS medals. This was followed by a keynote paper by Erik van Os (The Netherlands) who discussed “European developments in soilless cultivation”. Van Os emphasised that, in the final analysis, the objective was to use a recirculating hydroponic system, and minimize (or even eliminate) the discharge of any nutrients and plant protection chemicals into the environment. This is the proposed trend in NW Europe, and we suspect that it is only a

question of time (when, not if) that the rest of the world will have to follow suit.

Professor He Jie (Singapore) was the second keynote speaker of the day, and she explained her work on developing an aeroponic farming system for a country with limited space, using LED illuminated vertical farming. She said that the key was the provision of sufficient uniform light intensity of the appropriate wavelengths using LEDs. Aeroponics is an important component, in order to reduce weight of the different layers.

Other papers on aeroponics included two presentations from Kobe University, Japan, where researchers have developed what is described as a fog dry aeroponic spray fertigation.



> Co-Conveners Mike Nichols (right) and Graeme Smith (center) receiving ISHS medals from Gordon Rogers (left).



> ISHS President (Professor Rod Drew) opened the conference.



> The PCA and ISHS delegates combined at the end of the final day.



> Snacking tomatoes being sorted during the field visits.

The third keynote speaker was Dr. Wilson Lennard (Australia) who set the scene with a paper on “Recent advances in aquaponics”. Interestingly, Wilson presented a non-purist view of aquaponics, suggesting that for some crops the feed from fish would have to be supplemented in order to achieve satisfactory crop production, and the development of “decoupled” systems. He stated that one of the problems with a “new” industry such as aquaponics was trusting the people and information available, and being mindful of the propensity of people to call themselves experts or consultants without in-depth knowledge of the subject.

The conference continued with papers on such diverse topics as, “Strawberry transplant production in Australia”, “Foam, the next artificial growing medium?” and “Hydroponic leek production”; and a description of the proposed “University of Western Sydney R&D and training greenhouse”.

Professor Wendell Ela (Australia) demonstrated that as horticulturists we have a great deal to learn about “desalination and water treatment for hydroponics and aquaponics”, and Graeme Barnett (Australia) suggested that there was much more to hydroponics than crop plants, when he described his company’s (Qponics) development of algae for

the production of omega 3 – an essential fatty acid for human health.

Finally, John Phinney (Australia) from Sundrop Farms introduced us to the first commercial scale solar thermal greenhouse operation, which is being developed in South Australia near Port Augusta. We will be hearing much more about this development in the future.

In the evening, the conference dinner was held at the Southport Yacht Club, overlooking a marina full of multi-million dollar boats. Wednesday was used for the field visits; an integral part of any conference. We visited two hi-tech greenhouse tomato operations, Tomato Bros at Eumundi and the new 2-ha project at Nora Valley near Yandina. At Tomato Bros we saw snack tomatoes (‘Perino’ cultivar) being automatically packed for market. The only downside of this product is of course the additional cost of harvesting fruit that are smaller than standard tomatoes.

The Nora Valley Trust initially (from 2006) grew truss tomatoes, but then shifted towards snacking tomatoes, which appear to be more suited to the local climate, and the focus is now on winter product marketed through Costas. Hanging gutters, Grodan® rockwool, Priva control equipment, supplementary carbon dioxide, energy saving screens, and UV treatment of all irrigation water (60% of

which comes off the roof into two large reservoirs) must put this property at the top end of current greenhouse technology.

Were the joint conferences a success? Did it enable the knowledge makers to adequately mix with the knowledge users? Only time will tell, but we consider that it is a valuable concept to consider for other conferences. The opportunity for scientists to rub shoulders with producers is really too good an opportunity to forgo, as it is essential that we fully appreciate that both groups are mutually dependent on each other for success.

We acknowledge the financial support of University of Western Sydney, Protected Crops Australia, and Horticulture Innovation Australia. ●

Mike Nichols and Graeme Smith

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Mr. Graeme Smith, PO Box 789, Woodend, Victoria 3442, Australia, e-mail: graeme@graemesmithconsulting.com



From the
Secretariat

> New ISHS members

ISHS is pleased to welcome the following new members:

New Individual Members

Argentina: Ms. Josefina Grünwaldt, Dr. Pablo Monetta, Prof. Maria Ochoa, Assist. Prof. Patrick Smith; **Australia:** Graeme Barnett, Bill Bellotti, Cornelis Disselkoe, Stuart Doyle, Wendell Ela, Sohum Gandhi, Mr. Stuart Gardner, Dr. David Hall, Robert Hayes, Sandy King, Wilson Lennard, Mr. John Lopresti, Nigel McLean, John Phinney, Mr. Naresh Singh, Julian Stoller, Klaas Voogt, Graeme Wernowski, David Windsor; **Austria:** Sumith Peduruhewa; **Bangladesh:** Dr. Shaikh Abdul Quader; **Belgium:** Dr. Jane Debode, Hans Van de Put, Mr. Bart Van de Wal; **Bosnia and Herzegovina:** Assist. Prof. Miljan Cvetkovic; **Brazil:** Ms. Renata Luiz Ursine, Mr. Antonio Morschbacker, Prof. Tania Pires da Silva, Mr. John Sinden; **Bulgaria:** Ms. Teodora Georgieva; **Burkina Faso:** Dr. Safietou Sanfo; **Canada:** Tom Baumann, Glen Fox, Dr. Xiaobin Guo, Timothy Kendrick, Dr. Kamal Gurmit Kumar, Dr. Most Tahera Naznin; **Chile:** Mr. Juan Ramsay; **China:** Prof. Cheng Liu, Prof. Dr. Chunlin Long, Mr. Yongxiang Wei, Dr. Jiping Xuan; **Colombia:** Mr. Jeronimo Herrera, Prof. Adriana Matiz Villamil; **Ecuador:** Mr. Mauricio E Laniado, Dr. Silvia Valencia Chamorro, Dr. Rosa Vilaplana Ventura; **Finland:** Ms. Towe Backman; **France:** Prof. Serge Delrot, Ms. H el ene Vedio; **Germany:** Sophie Arnim, Elisabeth Freudenmacher, Nora Huxmann, Mr. Oliver Krafka, Prof. Dr. Petra Scheewe; **Greece:** Prof. Efthimia Mina Tsagris, Dr. Evangelos Tsormpatsidis; **Guatemala:** Mr. Jorge Figueroa; **Hungary:** Prof. Jozsef

Felfoldi; **India:** Dr. Kiran Kumar Adapa, Mr. Ish Budhiraya, Mr. Saranyan Krishnamoorthi, Mr. Pounraj Kulandaivel, Mr. Ravi Nakka, Mahendra Patel, Dr. Ruby Rani, Yatindra Sharma, Dr. Rewati Raman Singh; **Indonesia:** Mr. Johan Bijlmer, Dr. Darwin H. Pangaribuan, Mr. Nafi Ananda Utama, Dr. Ramal Yusuf; **Iran:** Dr. Asghar Ramezani; **Ireland:** Mr. Andy Wilson; **Italy:** Prof. Bruno Bisceglia, Mr. Mulugheta Solomon; **Japan:** Ms. anussara chopsri, Ms. Huyen Dao, Prof. Dr. Hiroshi Gemma, Dr. Chikako Honda, Mr. Hisayuki Hoshi, Ms. Miyu Kitayama, Mr. Syed Mostafizul Haque, Mr. Rafael Muchanga, Shuji Shiozaki, Hideo Yoshida; **Korea (Republic of):** Jin Su Lee; **Lithuania:** Dr. Ausra Brazaityte, Giedre Samuoliene, Dr. Akvile Virsile; **Malaysia:** Mr. Muhammad Najib Othman Ghani, Ms. Siti Fairuz Yusoff; **Malta:** Mr. Anthony Muscat; **Mozambique:** Ms. Marcia Maposse; **Nepal:** Mr. Mohan Bahadur Thapa; **Netherlands:** Mr. Elias Kaiser, Dr. Erik Persoon, Mr. Johannes van der Slikke; **New Zealand:** Mr. Geoff Jewell, Ms. Nicola Rochester; **Nigeria:** Mr. Adedapo Adediji, Modupe Adeyomo; **Norway:** Ketil Stoknes; **Pakistan:** Prof. Dr. Faheem Aftab; **Panama:** Mr. Hipolito Vergara; **Philippines:** Lorna Frances Filipino, Dr. Gina Pangga, Mr. Harlan Sunada; **Poland:** Prof. Dr. Eugenia Czernyszewicz, Ms. Natalia Skubij; **Romania:** Dr. Florin Oancea, Mr. Gabriel Pantiru; **Saudi Arabia:** Mr. Ghali Abdullah; **Serbia:** Ms. Biljana Bozanic Tanjga, Prof. Dr. Vlado Licina, Dr. Ana Vucurovic; **Singapore:** Michael Lim; **Slovenia:** Prof. Dr. Franc Bavec, Assist.

Prof. Tatjana Unuk; **South Africa:** Mr. Gerrit Nieuwoudt, Dr. Viresh Ramburan; **Spain:** Mr. Abderrahman Benamour, Nuria Carazo G omez, Prof. Dr. Mar a-Teresa S anchez; **Sweden:** Linn ea Ahlman, Anna-Maria Carstensen; **Switzerland:** Dr. Bernd B uter, Dr. Sibylle St ockli; **Thailand:** Dr. Wittaya Apai, Chairat Burana, Ms. Chayanit Distabanjong, Dr. Kannapon Lopetcharat, Assist. Prof. Nattaya Montri, Dr. Manoj Potapohn, Dr. Inthawoot Suppavorasatit, Dr. Chantalak Tiyaon; **Turkey:** Prof. Dr. Izzet Acar, Assist. Prof. Oguzhan Caliskan, Mr. Adem Dogan, Dr. Mustafa Erkan, Dr. Deniz Erogul, Prof. Dr. Sadettin Gursoz, Prof. Dr. Mehmet Ali Koyuncu, Dr. Kamer Betul Ozer, Ms. Asiyan Ozkok, Dr. Hasan Pinar, Tuba Secmen, Dr. Fatih Sen, Hacer Tuncel Hascelik; **United Kingdom:** Dr. Mohammed Al-Kalbani, Mr. Doug Chaplin, Ms. Lucia Foresi, Ms. Philippa Jones, Mr. Md. Harun Ar Rashid; **United States of America:** Dr. James Adams, Dr. Brenna Aegerter, Dr. Hamid Ashrafi, Dr. M. Margaret Barth, Dr. Florian Braich, Prof. Dr. Bruce Bugbee, Mr. Hector Cabrera Farjat, Mr. Marc Clark, Diana Cochran, Tomomi Eguchi, Macarena Faruh, Dr. Kevin Folta, Mr. Eric Hager, Gaye Hammond, Prof. Dr. Abdullah Jaradat, Karen LeGrand, Bubba Lomolinare, Dr. Gioia Massa, Jason Neumann, Dr. Robert Oakes, Dr. Morgan Pattison, Roberto Quintanal, Dr. Lakhwinder S. Randhawa, Ms. Alexandra Roberts, Reid Robinson, Mr. Joshua Sherman, Dr. Jonathan Sinclair, Lauren Stauber, Mr. Charles Whiting; **Vietnam:** Mr. Hoang Luong



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> Calendar of ISHS events

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

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

Year 2015

- September 28 - October 2, 2015, Darwin, Northern Territory (Australia): **XI International Mango Symposium**. Info: Mr. Bob Williams, 3 Hayward Place, Durack, Darwin 0830, Australia. Phone: (61)8 89314013, E-mail: rcekwilliams3@bigpond.com or Dr. Lucy Tran-Nguyen, NTDPF, GPO Box 3000, Darwin Northern Territory 0801, Australia. Phone: (61)8 8999 2235, Fax: (61)8 8999 2312, E-mail: lucy.tran-nguyen@nt.gov.au or Dr. Ian Bally, Agri-Science Queensland, Dept. of Agriculture Fisheries and Forestry, PO Box 1054, Mareeba QLD 4880, Australia. Phone: (61)740484644, Fax: (61)74093593, E-mail: ian.bally@daff.qld.gov.au E-mail symposium: mango2015symposium@conlog.com.au Web: <http://mango2015.com.au>
- September 29 - October 2, 2015, La Plata (Argentina): **IX International Symposium on Artichoke, Cardoon and their Wild Relatives**. Info: Stella Maris García, Campo Experimental J.F. Villarino, C.C. 14, Zavalla S 2125 ZAA, Argentina. Phone: (54)341-4970080, Fax: (54)341-4970080, E-mail: sgarcia@unr.edu.ar or Vanina Pamela Cravero, Campo Experimental J.F. Villarino, C.C. 14, Zavalla S 2125 ZAA, Argentina. Phone: (54)341-4970080/85, Fax: (54)341-4970080/85, E-mail: vcravero@unr.edu.ar E-mail symposium: contacto@alcachofa2015.com Web: <http://www.alcachofa2015.com/>
- October 5-8, 2015, Bahía Blanca, Buenos Aires (Argentina): **XXXVIII Argentinian National Congress on Horticulture**. Info: Roberto Rodríguez, Dpto. Agronomía, Universidad Nacional del Sur, San Andrés 850, Altos Palihue, 8000 Bahía Blanca, Argentina. E-mail: asah015secretaria@gmail.com Web: <http://38congresohorticultura.wix.com/congresohorticultura>
- October 11-14, 2015, Wageningen (Netherlands): **V International Symposium on Applications of Modelling as an Innovative Technology in the Horticultural Supply Chain - Model-IT 2015**. Info: Rob Schouten, Horticultural Production Chains, Wageningen University, Droevendaalsesteeg 1, 6708 Pd Wageningen, Netherlands. E-mail: rob.schouten@wur.nl or Prof. Dr. Leo F. M. Marcelis, Wageningen University, Horticulture & Product Physiology, Droevendaalsesteeg 1, 6708 PB Wageningen, Netherlands. Phone: (31)317485675, E-mail: leo.marcelis@wur.nl Web: <http://www.model-it.info/>
- November 15-18, 2015, Manila (Philippines): **I International Symposium on Moringa**. Info: Dr. Manuel C. Palada, Central Philippine University, College of Agriculture, Res & Env Sciences, Lopez Jaena St, Jaro, Iloilo City, Philippines. Phone: (63)333331795, Fax: (63)333203685, E-mail: mpalada@gmail.com or Dr. Andreas Ebert, AVRDC - The World Vegetable Center, 60 Yi-Min Liao, Shanhua, 74151 Tainan, Chinese Taipei. Phone: (886)65837801, Fax: (886)65830009, E-mail: ebert.andreas6@gmail.com Web: <http://ism2015.moringaling.net/>
- November 16-19, 2015, Florence (Italy): **II World Congress on the Use of Biostimulants in Agriculture**. Info: New Ag International SARL, Jean-Pierre Leymonie, Managing Director, 12 rue du

Hagueneck, 68000 Colmar, France.

E-mail: newag@newaginternational.com E-mail symposium: biostimulants@newaginternational.com Web: <http://www.biostimulants2015.com/>

- November 17-20, 2015, Valdivia (Chile): **LXVI Congress of the Chilean Society for Horticultural Science**. Info: Mr. Rodrigo Echeverría P., Universidad Austral de Chile, Independencia 641, PO: 5110566, Valdivia, Chile. E-mail: rodrigoecheverria@uach.cl E-mail symposium: congresoagronomico66@uach.cl Web: <http://66congresosach.cl>

Year 2016

- January 24-27, 2016, Ambalavayal, Wayanad, Kerala (India): **International Symposium on Succulents and Other Ornamentals**. Info: Prof. Dr. P.V. Balachandran, Director of Extension, Directorate of Extension - KAU, Mannuthy, Thrissur, Kerala, 680651, India. Phone: (91)487-2370150, E-mail: balachandran.pv@kau.in or Prof. Dr. Rajendran Pangath, Associate Director of Research, Regional Agricultural Research Station, Kerala Agricultural University, Ambalavayal, Wayanad, 91, 673593, India. Phone: (91)4936 260421, Fax: (91)4936 260421, E-mail: adramb@kau.in Web: <http://issorars.org>
- March 6-9, 2016, Santiago (Chile): **XIV International Symposium on Processing Tomato - XII World Processing Tomato Congress**. Info: 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 or Prof. Dr. Montaña Cámara, Dpto. Nutrición y Bromatología II, Facultad Farmacia. UCM, Plaza Ramón y Cajal sn, 28040 Madrid, Spain. Phone: (34) 913941808, Fax: (34) 913941799, E-mail: mcamara@farm.ucm.es or Dr. M.Teresa Pino, Rosario Norte 400 D53, Las Condes, Santiago, Chile. Phone: (56)-2-7575148, E-mail: mtpino@inia.cl E-mail symposium: wptc2016@tomate.org Web: <http://www.worldtomatocongress.com>
- March 7-9, 2016, Krabi Province (Thailand): **I International Symposium on Tropical and Subtropical Ornamentals**. 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: tso2016thailand@gmail.com Web: <http://www.sc.mahidol.ac.th/scpl/tso2016>
- March 13-18, 2016, Giza (Egypt): **IX International Symposium on In Vitro Culture and Horticultural Breeding**. Info: Adel A. Abul-Soad, Horticulture Research Institute, 9 Cairo University St., 12619 Giza, Egypt. E-mail: adelaboelsoad@gmail.com E-mail symposium: givchbegypt16@gmail.com Web: http://www.hortinstitute.com/index.php?option=com_content&task=view&id=172&Itemid=113
- April 10-14, 2016, Orlando, FL (United States of America): **XI International Vaccinium Symposium**. Info: James Olmstead, University of Florida, 2211 Fifield Hall, Gainesville, FL 32611, United States of America. E-mail: jwolvmsstead@ufl.edu Web: <http://conference.ifas.ufl.edu/vaccinium/>
- April 11-14, 2016, Izmir (Turkey): **III International Symposium on Organic Greenhouse Horticulture**. Info: Prof. Dr. Yüksel Tüzel, Ege University, Agriculture Faculty, Department of Horticulture, 35100 Bornova Izmir, Turkey. Phone: (90)232311398, Fax: (90)2323881865, E-mail: yuksel.tuzel@ege.edu.tr or Assist. Prof. Golgen Bahar Oztekin, Ege University, Faculty of Agriculture, Department of Horticulture, 35100 Bornova Izmir, Turkey. Phone: (90)2323112577, Fax: (90)2323881865, E-mail: golgen.oztekin@ege.edu.tr Web: <http://www.oghsymposium2016.org/>

NEW

NEW

■ April 27 - May 1, 2016, Antalya (Turkey): **III International Symposium on Biotechnology of Fruit Species.** Info: Prof. Dr. Ahmet Naci Onus, Department of Horticulture, Faculty of Agriculture, Akdeniz University, 07059 Antalya, Turkey. Phone: (90) 242-3102441, Fax: (90) 242- 2274564, E-mail: onus@akdeniz.edu.tr E-mail symposium: fruitbiotech@gmail.com Web: <http://fruitbiotech2016.org>

■ May 9-12, 2016, Antalya (Turkey): **International Symposium on Carob: a Neglected Species with Genetic Resources for Multifunctional Uses.** Info: Prof. Dr. Hamide Gubbuk, Akdeniz University, Faculty of Agriculture, Department of Horticulture, 07058 Antalya, Turkey. Phone: (90)2423102422), Fax: (90)2422274564, E-mail: gubbuk@akdeniz.edu.tr Web: <http://www.carob2016.org>

NEW

■ May 9-13, 2016, Antalya (Turkey): **III International Symposium on Plum Pox Virus.** Info: Prof. Dr. Kadriye Caglayan, Mustafa Kemal University, Agriculture Faculty, Plant Protection Department, 31034 Antakya-Hatay, Turkey. Phone: (90)326 2455836 Ext.1347, Fax: (90)326 2455832, E-mail: kcgayano@yahoo.com or Dr. Birol Akbas, Tarimsal Arastirmalar ve, Teknoloji Gelistirme Kampüsü, Istanbul Yolu Üzeri No 38, P.K. 51, 06171 Yenimahalle Ankara, Turkey. Phone: (90) 312 3271793, Fax: (90) 312 32708024, E-mail: bakbas@tagem.gov.tr E-mail symposium: k_degirmenci@hotmail.com Web: <http://isppv2016.org>

■ May 12-13, 2016, Palermo (Italy): **I European Conference of Post Graduate Horticulture Scientists (ECPHS).** Info: Prof. Dr. Paolo Inglese, Department Agriculture and Forest Sciences, Università degli Studi di Palermo, Viale delle Scienze, ED. 4, 90142 Palermo, Italy. Phone: (39)09123861234, Fax: (39)09123860820, E-mail: paolo.inglese@unipa.it E-mail symposium: ecphs2015@unipa.it Web: <http://www.soihs.it/ecphs/default.aspx>

■ May 16-20, 2016, Shiraz (Iran): **International Symposium on Role of Plant Genetic Resources on Reclaiming Lands and Environment Deteriorated by Human and Natural Actions.** Info: Dr. Ali Gharaghani, Department of Horticultural Science, College of Agriculture, Shiraz University, 12th Kilometers of Shiraz to Isfahan Road, 71441-65186, Shiraz, Iran. Phone: (98)7136138145, E-mail: agharghani@shirazu.ac.ir or Prof. Morteza Khosh-Khui, Department of Horticultural Science, College of Agriculture, Shiraz University, Shiraz, Iran. Phone: (98)7116243978, Fax: (98)7116246165, E-mail: mkhoshkhui@yahoo.com E-mail symposium: convener@ispgr-iran2016.com Web: <http://www.ispgr-iran2016.com>

■ May 22-26, 2016, Port-au-Prince (Haiti): **International Symposium on Valorisation, Preservation and Processing of Tropical Fruits and Vegetables.** Info: Dr. Marie Thérèse Charles, 430 Boulevard Gouin, Saint-Jean-sur-Richelieu QC J3B 3E6, Canada. Phone: (1)450-346-4494, Fax: (1)450-346-7740, E-mail: marietherese.charles@agr.gc.ca or Prof. Harold Corantin, Damien, route Nationale #1, Port-au-Prince, BP: 1441, Haiti. Phone: (509)48927198, E-mail: hcorantin@yahoo.fr Web: <http://fruitsvegetableshaiti2015.com>

■ May 22-26, 2016, East Lansing, MI (United States of America): **VIII International Symposium on Light in Horticulture.** Info: Prof. Erik Runkle, 1066 Bogue Street, Michigan State University, East Lansing, MI 48824, United States of America. Phone: (1)5173530350, Fax: (1)5173530890, E-mail: runkleer@msu.edu or Prof. Roberto G. Lopez, Purdue University, 625 Agriculture Mall Drive, West Lafayette, Indiana, USA 47907, United States of America. Phone: (1) 765 4963425, Fax: (1) 765 4940393, E-mail: rglopez@purdue.edu Web: <http://www.lightsym16.com>

NEW

■ May 23-26, 2016, Murcia (Spain): **II International Workshop on Floral Biology and S-Incompatibility in Fruit Species.** Info: Dr. Encarnación Ortega Pastor, Dpto. de Mejora Genética, CEBAS-CSIC, Campus Universitario de Espinardo, Apdo 164, 30100 Espinardo, Murcia, Spain. E-mail: eortega@cebas.csic.es Web: <http://www.fbsi2016.org>

NEW

■ May 31 - June 3, 2016, Sabour, Bihar (India): **V International Symposium on Lychee, Longan and Other Sapindaceae Fruits.** Info: Prof. Dr. Vishaw Bandhu Patel, Professor and Chair, Department of Horticulture (F&FT), Bihar Agricultural University, Sabour, Bhagalpur, Bihar, India. Phone: (91)112451011, Fax: (91)112452613, E-mail: patelvb7@gmail.com or Dr. Rewati Raman Singh, Department of Horticulture FFT, Bihar Agricultural University, Sabour, Bhagalpur, Bihar, 813210, India. Phone: (91)641-2451011, E-mail: drrsinghbau@gmail.com or Dr. Ruby Rani, Department of Horticulture and Fruit, Bihar Agricultural College, Bihar Agricultural University, Sabour, Bhagalpur, Bihar, 813210, India. Phone: (91)0641-2451011, E-mail: rruby92@yahoo.co.in E-mail symposium: lychee2016@gmail.com

■ June 12-17, 2016, Verona (Italy): **X International Symposium on Grapevine Physiology and Biotechnology.** Info: Mario Pezzotti, University of Verona, Strada Le Grazie 15, 37134 Verona, Italy. E-mail: mario.pezzotti@univr.it Web: <http://www.grapevine2016.org>

■ June 13-16, 2016, Málaga (Spain): **V International Symposium on Tomato Diseases: Perspectives and Future Directions in Tomato Protection.** Info: Dr. Enrique Moriones, IHSM-UMA-CSIC, Algarrobo-Costa, Málaga, Spain. E-mail: moriones@eelm.csic.es or Dr. Rafael Fernández-Muñoz, IHSM La Mayora UMA-CSIC, Camino de La Mayora sn, E-29750 Málaga Algarrobo-Costa, Spain. Phone: (34)952-548990, E-mail: rfern@eelm.csic.es E-mail symposium: tomatodiseases2016@ihsm.uma-csic.es Web: <http://www.tomatodiseases2016.es>

■ June 20-25, 2016, Athens (Greece): **VI International Conference on Landscape and Urban Horticulture.** Info: Prof. Dr. Maria Papafotiou, Dept. Floriculture & Landscape Architecture, Agricultural University of Athens, 75, Iera Odos, 118 55 Athens, Greece. Phone: (30)2105294555, Fax: (30)2105294553, E-mail: mpapaf@aua.gr or Dr. Panayiotis Nektarios, Dept Floriculture & Landscape Architecture, Agricultural University of Athens, 75, Iera Odos, 118 55 Athens, Greece. Phone: (30)2105294554, Fax: (30)2105294553, E-mail: pan@aua.gr or Dr. Angeliki Paraskevopoulou, Dept. Floriculture & Landscape Architecture, Agricultural University of Athens, 75, Iera Odos, 118 55 Athens, Greece. Phone: (30)2105294554, Fax: (30)2105294553, E-mail: aparas@aua.gr E-mail symposium: secretariat@luh2016.org Web: <http://www.luh2016.org/>

■ June 21-24, 2016, Cartagena, Murcia (Spain): **VIII International Postharvest Symposium: Enhancing Supply Chain and Consumer Benefits - Ethical and Technological Issues.** Info: Francisco Artes, ETSIA Paseo Alfonso XIII, 48., 30203 Murcia Cartagena, Spain. Phone: (34) 68-325510, Fax: (34) 68-325433, E-mail: fr.artes@upct.es E-mail symposium: postharvest@upct.es Web: <http://www.postharvest2016.org>

■ June 26-29, 2016, Singapore (Singapore): **XIV International Symposium on Virus Diseases of Ornamental Plants.** Info: Dr. Sek-Man Wong, Department of Biological Sciences, National University of Singapore, 14 Science Drive 4, Singapore 117543, Singapore. E-mail: dbswsm@nus.edu.sg Web: <http://www.dbs.nus.edu.sg/Plant2016/>

■ June 28 - July 2, 2016, Kunming (China): **XII International Symposium on Flower Bulbs and Herbaceous Perennials.** Info: Prof. Ding Mu, No.12 Zhongguancunnandajie, Haidian District, Beijing City, 100081, China. Phone: (86)10-82105944, Fax: (86)10-62174123, E-mail: muding2011@126.com Web: <http://www.flowerbulbs2016.org>

■ July 17-21, 2016, Freising and Hallbergmoos (Germany): **XI International Symposium on Plum and Prune Genetics, Breeding and Pomology.** Info: Prof. Dr. Dieter Treutter, Am Brauereberg 7, 85410 Haag a/d Amper, Germany. Phone: (49)8161713753, Fax: (49)8161715385, E-mail: dieter.treutter@wzw.tum.de or Dr. Michael

- Neumüller, Am Süßbach 1, 85399 Hallbergmoos, Germany. Phone: (49)8119933558, Fax: (49)8119933656, E-mail: nm@obstzentrum.de
- August 2-5, 2016, Minneapolis, MN (United States of America): **III International Symposium on Woody Ornamentals of the Temperate Zone.** Info: Dr. Stan C. Hokanson, Univ. of Minnesota, Dept. Of Horticulture, Breeding&Genetics, Woody Landscape Plants, 258 Alderman Hall, 1970 Folwell Ave., St. Paul, MN 55108, United States of America. Phone: (1)6126241203, Fax: (1)6126244941, E-mail: hokano17@umn.edu Web: <http://www.woodyornamentals2016.org/>
 - August 7-12, 2016, Ibadan (Nigeria): **III All Africa Horticultural Congress.** Info: Prof. Dr. Isaac Ore Aiyelaagbe, Department of Horticulture, University of Agriculture, PMB 2240 Abeokuta, Ogun State, Nigeria. Phone: (234)8033815606, Fax: (234)39243045, E-mail: ola_olu57@yahoo.com E-mail symposium: aahc2016@yahoo.com Web: <http://www.aahcng.net>
 - August 8-12, 2016, Atlanta, GA (United States of America): **II International Symposium on Germplasm of Ornamentals.** Info: Prof. Dr. Donglin Zhang, University of Georgia, Dept. Of Horticulture, 1111 Plant Science Building, Athens, GA 30602-7273, United States of America. Phone: (1)7065420776, Fax: (1)7065420624, E-mail: donglin@uga.edu or Prof. Dr. Zhang Qixiang, Nat'l Engineering Res.Center Floriculture, Beijing Forestry University, No.35, Qinghua East Road-Haidian Dist., Beijing 100083, China. Phone: (86)1062338005, Fax: (86)1062336321, E-mail: zqx@bjfu.edu.cn or Prof. Dr. Byoung Ryong Jeong, Department of Horticulture, 501 Jinjudaero, Gyeongsang National university, Jinju, Gyeongnam 660-701, Korea (Republic of). Phone: (82)55-772-1913, Fax: (82)55-757-7542, E-mail: brjeong@gmail.com Web: <http://woodies.uga.edu/conference.html>
 - August 14-17, 2016, Québec City (Canada): **VIII International Strawberry Symposium.** Info: Prof. Dr. Yves Desjardins, Horticulture Research Center/INAF, Faculty of Agriculture and Food, 2440, Blvd. Hochelaga, # 2736, Laval University, Québec, QC G1V 0A6, Canada. Phone: (1)418-656-2131x2359, Fax: (1)418-656-3515, E-mail: yves.desjardins@fsaa.ulaval.ca or Prof. André Gosselin, Université Laval, Pavillon ENVIROTRON, Ste-Foy (Quebec), G1K 7P4, Canada. Phone: (1)4186562131ext2068, Fax: (1)4186567871, E-mail: andre.gosselin@fsaa.ulaval.ca E-mail symposium: iss2016@conferium.com Web: <http://www.iss2016-quebec.org>
 - August 23-25, 2016, Kuala Lumpur (Malaysia): **III International Conference on Agricultural and Food Engineering.** Info: Dr. Samsuzana Abd Aziz, Dept. of Biological Agricultural Eng., Faculty of Engineering, 43400 Selangor UPM, Serdang, Malaysia. Phone: (60)3 89464455, Fax: (60)3 89466425, E-mail: samsuzana@upm.edu.my E-mail symposium: eng.cafei2016@upm.edu.my Web: <http://www.cafei.upm.edu.my>
 - August 28 - September 2, 2016, Bologna (Italy): **XI International Symposium on Integrating Canopy, Rootstock and Environmental Physiology in Orchard Systems.** Info: Prof. Dr. Luca Corelli-Grappadelli, Department of Agricultural Sciences, Università di Bologna, Via Fanin 46, 40127 Bologna, Italy. Phone: (39)0512096400, Fax: (39)0512096401, E-mail: luca.corelli@unibo.it
 - September 19-22, 2016, Avignon (France): **HortiModel2016: Models for Plant Growth, Environment Control and Farming Management in Protected Cultivation.** Info: Dr. Nadia Bertin, UR 1115 PSH, INRA, Domaine St Paul, 228 route de l'aérodrome, Site Agroparc, 84914 Avignon, France. Phone: (33)0432722324, E-mail: nadia.bertin@avignon.inra.fr or Dr. Valentina Baldazzi, UR 1115 PSH, INRA, Domaine St Paul, 228 route de l'aérodrome, Site Agroparc, 84914 Avignon, France. Phone: (33)0432722447, E-mail: valentina.baldazzi@avignon.inra.fr Web: <https://colloque.inra.fr/hortimodel2016/>
 - September 26-28, 2016, Chengdu City (China): **II Asian Horticultural Congress - AHC2016.** Info: Prof. Dr. Yongchen Du, Institute of Vegetables and Flowers, Chinese Academy of Agricultural Sci., 12 Zhongguancun Nandajie, Beijing 100081, China. Phone: (86)1068919515, Fax: (86)1062174123
 - September 26-30, 2016, Mendoza (Argentina): **IX International Congress on Cactus Pear and Cochineal.** Info: Dr. Juan Carlos Guevara, Argentine Institute for Arid Land Research, (IADIZA), Adrian Ruiz Leal s/n, Parque General San Martín, 5500 Mendoza, Argentina. Phone: (54)02615244103, Fax: (54)02615244101, E-mail: jguevara@mendoza-conicet.gob.ar or Prof. Maria Ochoa, Delibano Chazarreta 544, Santiago del Estero 4200, Argentina. Phone: 54 385-4315885, E-mail: mariajudith8a@gmail.com or Ms. Josefina Grünwaldt, Argentine Institute for Arid Land Research, (IADIZA), Adrian Ruiz Leal s/n, Parque General San Martín, 5500 Mendoza, Argentina. Phone: (54)02615244103, Fax: (54)02615244101, E-mail: jgrunwaldt@mendoza-conicet.gob.ar E-mail symposium: cactus2016@mendoza-conicet.gob.ar Web: <http://cactus2016.mendoza-conicet.gob.ar>
 - September 26-28, 2016, Kafr El-Sheikh (Egypt): **VI International Symposium on Tropical and Subtropical Fruits.** Info: Dr. Ali R. El-Shereif, Horticulture Department, Faculty of Agriculture, Kafrelsheikh University, 33516 Kafr El-Sheikh, Egypt. Phone: (20)473254315, Fax: (20)479102930, E-mail: aelshereif@agr.kfs.edu.eg
 - October 3-7, 2016, Antalya (Turkey): **VI International Chestnut Symposium.** Info: Prof. Dr. Umit Serdar, Ondokuz Mayıs University, Faculty of Agriculture, Horticultural Department, 55139 Samsun, Turkey. Phone: (90)3623121919, Fax: (90)3624576034, E-mail: userdar@omu.edu.tr Web: <http://chestnut2016.org/>
 - October 5-7, 2016, Potsdam (Germany): **International Symposium on Sensing Plant Water Status - Methods and Applications in Horticultural Science.** Info: Dr. Werner B. Herppich, Leibniz-Inst. Agricult. Eng. Potsdam-Bornim, Max-Eyth-Allee 100, 14469 Potsdam, Germany. E-mail: wherppich@atb-potsdam.de or Prof. Dr. Manuela Zude, Leibniz Institute for Agricultural Engineering, Max-Eyth-Allee 100, 14469 Potsdam-Bornim, Germany. Phone: (49)331-5699-612, Fax: (49)3315699849, E-mail: zude@atb-potsdam.de E-mail symposium: spws2016@atb-potsdam.de Web: <http://www.spws2016.atb-potsdam.de/>
 - October 10-14, 2016, Split (Croatia): **VIII International Olive Symposium.** Info: Dr. Slavko Perica, Director, Institute for Adriatic Crops, Put Duilova 11, 21000 Split, Croatia. Phone: (385) 21 434434, Fax: (385) 21 316584, E-mail: slavko@krs.hr E-mail symposium: ios2016-info@krs.hr Web: <http://ios2016.krs.hr/>
 - October 16-20, 2016, Valencia (Spain): **VI International Symposium on Persimmon.** Info: Dr. Maria Luisa Badenes, Secretary General EUCARPIA, IVIA, 4 Apartado Oficial, 46113 Moncada (Valencia), Spain. Phone: (34)9634 24049, Fax: (34)9634 24106, E-mail: badenes_mlu@gva.es E-mail symposium: convener@persimmonsymposium.es Web: <http://www.persimmonsymposium2016.es/>
 - October 17-21, 2016, Chania, Crete (Greece): **III International Symposium on Horticulture in Europe - SHE2016.** Info: Dr. Panagiotis Kalaitzis, Mediterranean Agronomic Inst. Of Chania, 85, Macedonia Str. P.O. Box 85, 73100 Chania, Greece. E-mail: panagiot@maich.gr or Prof. George Assist. Manganaris, Anexartiasias 33, P.O. Box 50329, 3603 Lemesos, Cyprus. Phone: (357)25002307, Fax: (357)25002804, E-mail: george.manganaris@cut.ac.cy Web: <http://she2016.org/>
 - October 24-29, 2016, Antalya (Turkey): **VIII International Symposium on Mineral Nutrition of Fruit Crops.** Info: Prof. Dr. Bekir Erol Ak, University of Harran, Faculty of Agriculture, 63200 Sanliurfa, Turkey. Phone: (90)4143183698, Fax: (90)4143183682, E-mail: beak@harran.edu.tr

■ November 9-12, 2016, Agadir (Morocco): **V International Symposium on Saffron Biology and Technology: Advances in Biology, Technologies, Uses and Market.** Info: Prof. Mohammed Badraoui, Institut National de Recherche Agronomique, Avenue Ennasr, BP 415 Rabat, Morocco. Phone: (212)53772654, Fax: (212)537770049, E-mail: mohamedbadraoui@gmail.com Web: <http://www.inra.org.ma/def.asp?codelangue=23&info=-1124&rub1=1124&rub=1099>

NEW ■ November 20-25, 2016, Cairns, Queensland (Australia): **International Symposia on Tropical and Temperate Horticulture.** Info: Prof. Dr. Roderick A. Drew, Griffith University, Nathan Campus, Nathan Q4111, Australia. Phone: (61)737357292, Fax: (61)737357618, E-mail: r.drew@griffith.edu.au or Dr. Robin Elaine Roberts, Griffith University, Unit 14/1 McNaughton Street, Redcliffe, QLD 4020, Australia. Phone: (61)7 373 57885, E-mail: robin.roberts@griffith.edu.au E-mail symposium: istth2016@griffith.edu.au Web: <http://www.istth2016.org>

NEW ■ November 20-25, 2016, Cairns, Queensland (Australia): **II International Symposium Tropical Horticulture: Now is the Era for Tropical Horticulture.** Info: Prof. Dr. Roderick A. Drew, Griffith University, Nathan Campus, Nathan Q4111, Australia. Phone: (61)737357292, Fax: (61)737357618, E-mail: r.drew@griffith.edu.au or Prof. Dr. Robert E. Paull, Dept. Tropic Plant & Soil Sci., University of Hawaii, 3190 Maile Way, Honolulu, HI 96822-2279, United States of America. Phone: (1)808-956-7369, Fax: (1)808-956-3894, E-mail: paull@hawaii.edu or Dr. Alain Rival, CIRAD Resident Regional Director, Southeast Asian Island Countries, Graha Kapital 1 - jalan Kemang Raya # 4, 12730 Jakarta, Indonesia. Phone: (62)217198641, Fax: (62)2171794652, E-mail: alain.rival@cirad.fr E-mail symposium: istth2016@griffith.edu.au Web: <http://www.istth2016.org>

NEW ■ November 20-25, 2016, Cairns, Queensland (Australia): **I International Symposium on Beverage Crops.** Info: Prof. Dr. Roderick A. Drew, Griffith University, Nathan Campus, Nathan Q4111, Australia. Phone: (61)737357292, Fax: (61)737357618, E-mail: r.drew@griffith.edu.au or Prof. Dr. Umezuruike Linus Opara, University of Stellenbosch, Faculty of AgriSciences, Private Bag X1, Stellenbosch 7602, South Africa. Phone: (27) 21 808 4064, Fax: (27) 21 808 2121, E-mail: opara@sun.ac.za or Prof. Dr. Renato Paiva, Alameda dos Flamboyants 103, Condomínio Jardim das Palmeiras, 372000-000 Lavras-Minas Gerais, Brazil. Phone: (55)3538291359, Fax: (55)3538291100, E-mail: renpaiva@dbi.ufla.br or Prof. Dr. Yves Desjardins, Horticulture Research Center/INAF, Faculty of Agriculture and Food, 2440, Blvd. Hochelaga, # 2736, Laval University, Québec, QC G1V 0A6, Canada. Phone: (1)418-656-2131x2359, Fax: (1)418-656-3515, E-mail: yves.desjardins@fsaa.ulaval.ca E-mail symposium: istth2016@griffith.edu.au Web: <http://www.istth2016.org>

NEW ■ November 20-25, 2016, Cairns, Queensland (Australia): **I International Symposium on Tropical Plant Breeding.** Info: Dr. M.R Dinesh, Principal Scientist, Division of Fruit Crops, Sadashivanagar - IIHR, Bangalore, Karnataka, 560089, India. Phone: (91)80- 23611198, Fax: (91)80-28466291, E-mail: drmrinesh@gmail.com or Dr. Wen-Li Lee, Taiwan Agricultural Research Institute, No.530, Wenlong E.Rd., Fengshan Dist., 83052 Kaohsiung City, Chinese Taipei. E-mail: leewenli@fthes-tari.gov.tw or Dr. Songpol Somsri, Senior Advisory in Plant Production, Department of Agriculture, Chatuchak, Bangkok 10900, Thailand. Phone: (66)25790574, Fax: (66)29405472, E-mail: songpolsom@yahoo.com E-mail symposium: istth2016@griffith.edu.au Web: <http://www.istth2016.org>

NEW ■ November 20-25, 2016, Cairns, Queensland (Australia): **IV International Symposium on Guava and Other Myrtaceae.** Info: Prof. Dr. Sisir Kumar Mitra, B-12/48, Kalyani, Nadia, West Bengal 741235, India. Phone: (91)3325823017, Fax: (91)3325828460,

E-mail: sisirm@vsnl.net or Andrew East, Massey University, Private Bag 11222, Palmerston North, New Zealand. E-mail: a.r.east@massey.ac.nz E-mail symposium: istth2016@griffith.edu.au Web: <http://www.istth2016.org>

NEW ■ November 20-25, 2016, Cairns, Queensland (Australia): **I International Symposium on Urban Landscapes in Tropical Cities.** Info: Prof. Dr. Gert D. Groening, Universitaet der Kuenste Berlin Institut GTG, Gartenkultur und Freiraumentwicklung, Postfach 12 05 44, 10595 Berlin, Germany. Phone: (49)3031852278, Fax: (49)3031852499, E-mail: groening@udk-berlin.de or Prof. Patrícia D Duarte de Oliveira Paiva, Alameda dos Flamboyants 103, Cond. Jardim das Palmeiras, Lavras-MG, 37200-000, Brazil. Phone: (55)35 3829 1786, Fax: (55)35 3829 1301, E-mail: patriciapaiva@dag.ufla.br E-mail symposium: istth2016@griffith.edu.au Web: <http://www.istth2016.org>

NEW ■ November 20-25, 2016, Cairns, Queensland (Australia): **International Symposium on Poverty, Hidden Hunger and Horticulture.** Info: Dr. Detlef Virchow, GlobalHort, co Center for Development Research ZEF, Walter-Flex-Str. 3, 53113 Bonn, Germany. Phone: (49)228-734476, Fax: (49)228-731889, E-mail: dvirchow@globalhort.org or Prof. Dr. Umezuruike Linus Opara, University of Stellenbosch, Faculty of AgriSciences, Private Bag X1, Stellenbosch 7602, South Africa. Phone: (27) 21 808 4064, Fax: (27) 21 808 2121, E-mail: opara@sun.ac.za E-mail symposium: istth2016@griffith.edu.au Web: <http://www.istth2016.org>

NEW ■ November 20-25, 2016, Cairns, Queensland (Australia): **I International Symposium on Protected Cultivation in Tropical and Temperate Climates & X International Symposium on Protected Cultivation in Mild Winter Climates.** Info: Prof. Dr. Gordon Rogers, University of Sydney, Biomedical Building 1 Central Ave, Eveleigh, NSW 2015, Australia. Phone: (61) 2 8627 1040, Fax: (61) 2 9544 3782, E-mail: gordon@ahr.com.au or Dr. Sophie Parks, Industry NSW, Locked Bag 26, Gosford, NSW 2250, Australia. Phone: (61)243481914, Fax: (61)243481910, E-mail: sophie.parks@dpi.nsw.gov.au or Prof. Dr. Yüksel Tüzel, Ege University, Agriculture Faculty, Department of Horticulture, 35100 Bornova Izmir, Turkey. Phone: (90)2323111398, Fax: (90)2323881865, E-mail: yuksel.tuzel@ege.edu.tr E-mail symposium: istth2016@griffith.edu.au Web: <http://www.istth2016.org>

NEW ■ November 20-25, 2016, Cairns, Queensland (Australia): **I International Symposium on Tropical Plantation Crops.** Info: Prof. Dr. Sisir Kumar Mitra, B-12/48, Kalyani, Nadia, West Bengal 741235, India. Phone: (91)3325823017, Fax: (91)3325828460, E-mail: sisirm@vsnl.net or Dr. Luseane Taufa, Senior Plant Pathologist, Ministry Agric., Food, Forests & Fisheries, P.O Box 14, Nuku'alofa, Tonga. Phone: (676) 23038, Fax: (676) 24271, E-mail: luseane.taufa@maff.gov.to E-mail symposium: istth2016@griffith.edu.au Web: <http://www.istth2016.org>

Year 2017

■ March 7-10, 2017, Napier (New Zealand): **IV International Symposium on Molecular Markers in Horticulture.** Info: Dr. Vincent Gerardus Maria Bus, Plant and Food Research, Private Bag 1401, Havelock North 4157, New Zealand. Phone: (64)69758946, Fax: (64)69758881, E-mail: vincent.bus@plantandfood.co.nz E-mail symposium: Yvonne.McDiarmid@plantandfood.co.nz

■ May 23-26, 2017, Pontevedra (Spain): **VII International Symposium on Brassicas.** Info: Elena Cartea, CSIC, PO BOX 28, 36080 Pontevedra, Spain. Phone: (34)986854800, E-mail: ecartea@mbg.csic.es or Pablo Velasco, Misión Biológica de Galicia (CSIC), Apartado 28, 36080 Pontevedra, Spain. Phone: 34 986854800, E-mail: pvelasco@mbg.csic.es or Pilar Soengas, Misión Biológica de Galicia (CSIC), Apartado 28, 36080 Pontevedra, Spain. Phone: (34)986854800, E-mail: psoengas@mbg.csic.es or Dr. Victor

Rodriguez, Mision Biologica de Galicia, Palacio de Salcedo, Carballeira, 8 (Salcedo), 36143 Pontevedra, Spain. Phone: (34)986854800, E-mail: vmrodriguez@mbg.csic.es E-mail symposium: brassica2017@csic.es

- June 5-9, 2017, Yamagata (Japan): **VIII International Cherry Symposium**. Info: 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 or Prof. Dr. Ryutaro Tao, Lab. Pomology, Fac. Agric., Kyoto University, Kitashirakawa Oiwake-cho, Sakyo-ku Kyoto 606-8502, Japan. Phone: (81)757536053, Fax: (81)757536497, E-mail: rtao@kais.kyoto-u.ac.jp or Hideki Murayama, Faculty of Agriculture, Yamagata University, 1-23 Wakabamachi Tsuruoka, Yamagata 997-8555, Japan. Phone: (81)235282887, Fax: (81)235282812, E-mail: mhideki@tds1.tr.yamagata-u.ac.jp Web: <http://cherry2017.jshs.jp>

- June 18-22, 2017, Warsaw (Poland): **XII International Controlled and Modified Atmosphere Research Conference - CaMa2017**. Info: Prof. Dr. Franciszek Adamicki, Research Institute of Horticulture, Konstytucji 3 Maja 13 Str., 96-100 Skierniewice, Poland. Phone: (48)46 833 34 34, Fax: (48)46 833 31 86, E-mail: franciszek.adamicki@inhort.pl

- June 19-23, 2017, Palermo (Italy): **International Symposium on Flowering, Fruit Set and Alternate Bearing**. Info: Prof. Francesco Marra, L.go Villaura, 27, 90142 Palermo, Italy. Phone: (39)09123861236, Fax: (39)09123861211, E-mail: francescopaolo.marra@unipa.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. Dr. Sisir Kumar Mitra, B-12/48, Kalyani, Nadia, West Bengal 741235, India. Phone: (91)3325823017, Fax: (91)3325828460, E-mail: sisirm@vsnl.net

- June 20-23, 2017, Hoce (Slovenia): **VII South-Eastern Europe Symposium on Vegetables and Potatoes**. Info: Prof. Dr. Martina Bavec, Univerza V Mariboru, Slomkov Trg. 15, 2000 Maribor, Slovenia. E-mail: martina.bavec@um.si E-mail symposium: 7sees.vp@gmail.com

- July 2-6, 2017, Bucharest (Romania): **IX International Peach Symposium**. Info: Prof. Dr. Florin Stanica, University of Agronomic Sciences, Faculty of Horticulture, B-dul Marasti, 59, Sector 1, 011464, Bucuresti, Romania. Phone: (40)722641795, Fax: (40)213182888, E-mail: flstanica@yahoo.co.uk

- July 2-7, 2017, Angers (France): **VII International Symposium on Rose Research and Cultivation**. Info: Dr. Fabrice Foucher, UMR IRHS, Centre INRA, BP 60057, 49071 Beaucouze, France. E-mail: fabrice.foucher@angers.inra.fr E-mail symposium: secretariat.irhs@angers.inra.fr

- August 15-19, 2017, Atakum, Samsun (Turkey): **IX International Congress on Hazelnut**. Info: Prof. Dr. Celal Tuncer, Ondokuz Mayıs University, Faculty of Agriculture, Department of Plant Protection, 55139 Atakum, Samsun, Turkey. Phone: (90)3623121919, Fax: (90)3624576034, E-mail: celalt@omu.edu.tr

- August 20-24, 2017, Beijing (China): **Greensys 2017 - International Symposium on High Technology for Environment Engineering, Energy-Saving and Crop Management in Greenhouse Systems**. Info: Prof. Dr. Qichang Yang, 211, IEDA, CAAS, 12#, Zhongguancun

South Street, Haidian District, Beijing City, 100081, China. Phone: (86)010-82105983, Fax: (86)010-82106021, E-mail: yangqichang@caas.cn

- August 27-30, 2017, Chiba (Japan): **XIII International Symposium on Plant Bioregulators in Fruit Production**. Info: Prof. Dr. Satoru Kondo, Graduate School of Horticulture, Chiba University, Matsudo, Chiba, 271-8510, Japan. Phone: (81)-47-308-8800, Fax: (81)-47-308-8800, E-mail: s-kondo@faculty.chiba-u.jp Web: <http://www.pgr-fruit2017.org/>

- September 17-22, 2017, Elche, Valencia (Spain): **IV International Symposium on Pomegranate and Minor Mediterranean Fruits**. Info: Dr. Julian Bartual, Estación Experimental Agraria, Ctra Dolores Km.1, 03290 Elche, Alicante, Spain. Phone: (34)965455952, E-mail: bartual_jul@gva.es

- September 18-20, 2017, Muscat (Oman): **X International Symposium on Temperate Fruits in the Tropics and Subtropics**. Info: Dr. Rashid Al-Yahyai, Dept. of Crop Sciences, CAMS, Sultan Qaboos University, P.O. Box 34, Al-Khoud 123, Oman. Phone: (968) 24411201, Fax: (968) 24413418, E-mail: alyahyai@squ.edu.om

- October 2-6, 2017, Banja Luka (Bosnia and Herzegovina): **II International Symposium on Fruit Culture along Silk Road Countries**. Info: Prof. Dr. Gordana Djuric, University of Banjaluka, Genetic Resources Institute, Bulevar vojvode Petra Bojovica 1A, 78000 Banjaluka, Bosnia and Herzegovina. Phone: (387)51461392, Fax: (387)51463024, E-mail: gordana.djuric@griunibl.rs.ba

- November 5-9, 2017, Adelaide (Australia): **VII International Symposium on Pistachios and Almonds**. Info: Dr. Michelle Wirthensohn, Discipline of Wine and Horticulture, Waite Campus, University of Adelaide, PMB 1 Glen Osmond SA 5064, Australia. Phone: (61)883136653, E-mail: michelle.wirthensohn@adelaide.edu.au

Year 2018

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

- October 15-17, 2018, Plovdiv (Bulgaria): **III International Symposium on Wild Relatives of Subtropical and Temperate Fruit and Nut Crops**. Info: Assist. Prof. Stefan Gandev, Fruit Growing Institute, Ostromila 12, 4004 Plovdiv, Bulgaria. Phone: (359)32 69 23 49, E-mail: s.gandev@abv.bg

Year 2019

- June 16-20, 2019, Angers (France): **Greensys 2019**. Info: Prof. Dr. Pierre-Emmanuel Bournet, Agrocampus Ouest, 2, rue Le Nôtre, 49045 Angers, France. Phone: (33) 2 41 22 55 04, Fax: (33) 2 41 22 55 53, E-mail: pierre-emmanuel.bournet@agrocampus-ouest.fr or Mr. Hicham Fatnassi, 400 Route des Chappes, Sophia Antipolis, France. Phone: (33)492386400, E-mail: fatnassi@sophia.inra.fr or Eric Brajeul, Centre CTIFL de Carquefou, ZI Belle Etoile Antarès, 35 Allée des Sapins, 44483 Carquefou Cedex, France. Phone: (33)240508165, Fax: (33)240509809, E-mail: brajeul@ctifl.fr

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