Chronica Horticulturae

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Horticultural Highlights

Economic, Environmental and Well-Being Benefits of Lifestyle Horticulture • The Origin of Horticulture in Australia: The Early European Colony in Sydney 1788-1850 • Status of Citrus in Indonesia: Production, Research, and Development • The Pear Industry in South Africa

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ISHS

CHRONICA HORTICULTURAE

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Cover photograph: Rooftop ornamental horticulture.

A publication of the International Society for Horticultural Science, a society of individuals, organizations, and governmental agencies devoted to horticultural research, education, industry, and human well-being.

ISHS

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Sailing Route to Safe Harbour

António Monteiro, President of ISHS

António Monteiro

The Society is in a stable financial situation. The balance sheet is positive and we have reached our goal of having one year's budget in reserve. The ISHS is sponsoring a record number of symposia per year and the number of pages and articles published in *Acta Horticulturae* continues to increase. The last International Horticultural Congress in Lisbon was a success with a high attendance of participants from all over the world. Some would say it is time to relax, to enjoy the benefits of the comfortable financial situation and to continue sailing at cruise speed pushed by the favourable winds of success.

Such a lazy attitude will ruin the Society in a very short time. The scientific world is changing dramatically with new publications popping-up every day, and better means of communication and diversified options in the organisation of scientific meetings constantly evolving. It is not only a time to shield the Society from external threats but also to seize opportunities offered by new technologies and methods for scientific communication.

Even an optimist like me can see the glimmer of problems for ISHS on the horizon. Some conveners find it difficult to break even financially in the organisation of symposia because of a reduced number of participants; *Acta Horticulturae* is threatened by scientific journals for the publication of the best manuscripts; an increasing number of meetings is being challenged by strong cuts in travel budgets in many universities and research institutions.

Let's anticipate changes and prepare the ISHS for more challenging situations by making timely investments in strategic activities and tools. Prevention is recommended, particularly when we have time for informed decision-making and money for investment. The first step is to establish priorities so that we can focus the limited human and financial resources of the ISHS most efficiently. The new Board has created a justified hierarchy of strategic goals. Emerging priorities will be carefully assessed and discussed among the relevant bodies of the Society before implementation.

In February 2011, the Board held a strategic meeting with the objectives of prioritizing actions for the current term ending in 2014, and defining the amount of finances needed to put these actions in place. Agreement was unanimously reached and it is now time to share the outcomes with ISHS members. Some priorities are too complex to be addressed in this editorial and they will be presented in detail subsequently. Here I present a summary of the Board's priorities and comments on their fitness in relation to the ideal we understand to exist for the ISHS.

Information Technologies (IT) and Social Media are fundamental tools for ISHS to accomplish its mission. The rapidly advancing technological evolution and the need to update our current systems require a significant investment to access the communication and income generating possibilities of these new technologies. We are presently looking at the webpage, *Acta* manuscript handling and publication procedure, and social-networking. The new IT can open wide perspectives for improving communication and information exchange inside and outside the Society. We feel that we have to move forward and enter into this incredible new world, but we need to do this carefully and with professional advice. Potential benefits are high, but there are also risks associated with uncertainty and competition from other players.

Building industry partnerships to broaden and deepen industry relationships and to give industry an active role in the life of the Society. There is much unexploited potential in industry to further the aims of the Society and horticulture as a whole, as well as providing benefits to individual and organisational members from the private sector. Industry is already present in our activity but we have to give it more visibility. Errol Hewett, the Board member in charge of Innovation, Industry and Insight, has formed an Industry Committee to help us understand what the Society can offer stakeholders and industry-related individual members.

The private sector could be an ISHS competitor in the organisation of events and in the publication of books and periodicals. However, there are opportunities to change apparently competitive activities into mutual cooperation. We have to be better known, to advertise ourselves, but also to listen to the industry. For instance, it is not difficult to increase the number of industry personnel invited to be members of our Organising and Scientific Committees as well as speakers in our symposia.

Building and developing existing and new non-industry partnerships is the response to the opportunity to broaden and deepen the ISHS current relationships with other scientific societies, international organizations, key NGO's, and organisations that represent emerging sciences. The ISHS has a long list of partnerships that requires screening to focus our attention on those partners with whom there is greatest potential for mutual benefits. As an example, the ISHS could exploit synergies with other scientific societies, especially in new fields of science such as nanotechnology. Overall, this issue requires a lengthy discussion, but I cannot resist highlighting the advantages of giving the floor more often to scientists from other disciplinary areas of science in our meetings.

The theme of the IHC2010 was "Science and Horticulture for People" and many wondered why simply "Science," and not "Horticultural Science". This was because Science is universal and any good science can be applied to horticulture and contribute to technological development and innovation. Nowadays much relevant science that underpins horticultural innovation is produced outside the traditional departments of horticulture in different institutions all over the world. It is our obligation to attract these scientists to our meetings and make them part of a holistic approach focused on horticultural crops or technologies. Cooperation with other scientific societies would be especially fruitful if we could provide their members an opportunity to be knowledge providers interacting with knowledge users. In addition, the stronger the presence of industry people in our meetings, the more attracted and influenced they will become to the scientific community in its broadest sense.

Representation and equity in the activity and structure of the Society is of concern in an international organisation such as ours. The Board has already identified imbalances in regional, language and gender representation, and will propose corrective measures as appropriate. I like to compare the ISHS membership diversity with the diversity of horticultural crops and services. We all promote an all-inclusive concept of horticulture. Let's apply this concept to people and select some unfamiliar persons, as we do when exploring alternatives to the most common fruits and vegetables in order to find a unique and delicious product. In the future we wish to see a wider range of individuals putting their names forward for Chairs of Working Groups, Sections and Commissions,

Council, the Board and members of Symposia Organising and Scientific Committees.

Journal publishing and *Acta Horticulturae* is the last priority to be mentioned, but it is surely the most important. The decision on whether ISHS should engage in publication of a scientific journal has been debated for several years. We have an agreement with *The Journal of Horticultural Science & Biotechnology*, which is a valuable option to our members to publish in a prestigious scientific journal. However, some feel the absence of a recognized journal owned by the Society limits the prestige of the ISHS and reduces the options of those who deliver good papers at Symposia and who feel that they should publish in high-impact journals.

We all know that *Acta Horticulturae* is critically important for the financial health of the ISHS and it should be kept in mind that the services provided to the members of our Society are being substantially financed out of our publication revenue, predominantly *Acta.*

Therefore, the Board will endeavour to ensure that *Acta* remains a competitive publication without losing any of its strengths, as a characteristic and permanent record of our Symposia proceedings. Yves Desjardins, the Board member responsible for publications, will soon present this topic in more detail. We have already taken action to improve the timeliness of *Acta* publications but further innovations will come in relation to the use of IT tools. However, the high cost associated with implementing updated IT is currently a bottleneck to modernising ISHS publications. This issue needs thorough and strategic examination if part of the financial reserves are to be used for improving the publication base of ISHS.

Some may ask why we did not rank horticulture for development at the top of our priorities. The French would say "Ça va sans dire", which means that it is already integrated within the ISHS and it is part of our regular activity. We do recognise that the ISHS can serve horticulturists around the world, and especially in developing countries, only if the Society is a successful organisation in providing good meetings, publications and services to the members, which are included already among our top priorities.

I would like to go on presenting new ideas and discussing numerous interesting activities that could involve the ISHS but it is time to stop. As I said at the beginning, we must limit our dreams and focus on a few key reachable goals. I believe we can reach these goals because the President and the Board are not alone in their commitment to the Society and in their enthusiasm to make the ISHS a better and bigger organisation. We are lucky to have many highly qualified and dedicated members voluntarily serving in various capacities. The valuable contribution of Council and Executive Committee members is already well recognised, but I want to highlight the commitment of symposium conveners, *Acta* editors, working group chairs, and members of sections and commissions that are the cement of the international network that generates our symposia and the resultant *Actas*, and contributes to the development of horticultural science and technology worldwide.

I finish by using this opportunity to convey my best Seasons Greetings to all ISHS members and their families, and to wish them a New Year in peace and full of joy.

Postcard

Before sms and e-mail messages entered into our daily life, postcards were used to communicate the atmosphere of the moment or to say hello to friends on special occasions. It is a short message, written in plain text, used just to say 'here I am.'

Our Editor kindly provided me a few lines to write postcards in *Chronica*. I promise to be concise and to use this micro-column for short comments or for signalling topics for discussion. Here comes the first one.

Some time ago, when going through the emigration control at Vancouver airport, the officer asked my profession. When I replied that I was professor of horticulture, I immediately saw a big question mark on his face. "What do you teach?" he said. After my explanation, which took me quite a while, I became highly regarded by him because I was working with charming and delicious produce such as fruits, vegetables and flowers. "I like flowers and gardens very much," he said and with a big smile welcomed me to Canada.

Then I thought I needed a short but fully inclusive sentence that everybody could understand to explain what horticulture is all about and to describe the diversity of products and services, chain management, science and innovation, and much more. I spent some time meditating on my definition of horticulture while watching the luggage belt, but I gave up even before my suitcase had arrived. Horticultural products are highly regarded by the people, they are part of our daily life, but very few know where they come from or understand the importance of the science and technology involved. I open it up to the membership to suggest a 30 second elevator promotional pitch defining horticulture…

António Monteiro, President of ISHS

Economic, Environmental and Well-Being Benefits of Lifestyle Horticulture

Charles R. Hall and Alan W. Hodges

Lifestyle Horticulture is known around the world by different names. In the United States, it is casually referred to as the *green industry* and more formally as the *environmental horticulture industry*. Lifestyle horticulture is a rapidly growing and very visible component of the world economy, but interestingly there is little information available at the national and international level.

The lifestyle horticulture industry is comprised of wholesale nursery, greenhouse, and turfgrass sod growers; landscape service firms such as architects, designers/builders, contractors, and maintenance firms; retail firms such as garden centers, home centers and mass merchandisers with lawn and garden departments, and marketing intermediaries such as brokers and horticultural distribution centers (re-wholesalers). There is also a substantial allied trade industry that supplies various production inputs to the industry.

The lifestyle horticulture industry must do more to promote itself by educating the public regarding the numerous economic, environmental, and social benefits it provides to society. After all, lifestyle horticulture is, in essence, a true *green* industry, but most people do not consider this fact. The plethora of benefits provided by flowers, shrubs, and trees is not common knowledge. People often have difficulty in even seeing flowers or plants in their own environment, much less connecting plants to tangible benefits. For most people, flowers and other plants are a part of the subconscious sector of mental life, perceived as the backdrop, not the main actors in the playing out of our everyday lives.

The lifestyle horticulture industry is large, complex and dynamic, and represents a vital part of the U.S. and world economies. As many countries in the world become increasingly industrialized and urbanized, lifestyle horticulture will have an increasingly important role to play. Hence, the demand for lifestyle horticulture amenities will grow in the years to come as economies develop and more people move up to the "middle class" and expect a better quality of life. But there is another dimension to these demographic trends that should not be underestimated. As global populations grow, pressures on resources such as land, water and energy will become even more acute. Lifestyle horticulture is only one among many industries competing for these scarce resources. Increasingly local, regional and national governments are weighing the use of these resources in terms of their benefits and costs.

One obvious and critical measure is economic. For each unit of scarce resource used, how much is returned to society in terms of economic gain via income, employment, value added and taxes paid? Unfortunately, the economic contribution of lifestyle horticulture is not adequately documented in most countries and, if it is, the analyses are usually incomplete. Industries that have rigorously established their economic contribution will be in a stronger position to preserve the use of these scarce resources. Recent research in the literature, however, has pointed to specific economic, environmental, and social benefits of lifestyle horticulture and these will be discussed in the remainder of this article.

ECONOMIC BENEFITS

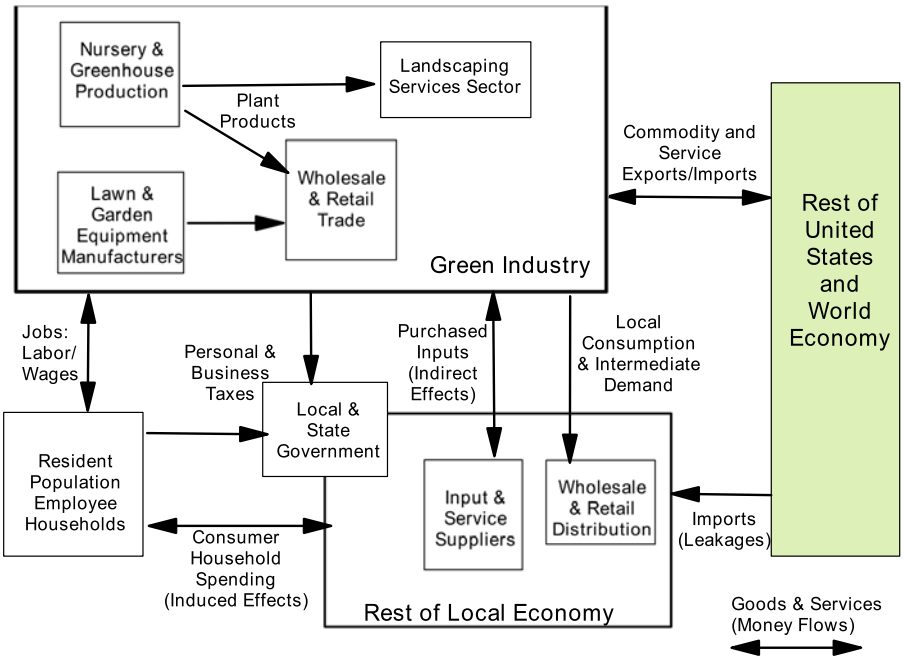
The lifestyle horticulture industry has extensive linkages to other sectors of regional and national economies, generating earnings, employment, and tax revenues to local governments, as illustrated in Fig. 1. Estimates of the economic contributions of the U.S. lifestyle horticulture industry were recently updated using data for 2007-08 (Hodges et al., 2011). Total sales revenues for all sectors were $176.11 billion, direct output was $117.40 billion, and total output impacts, including indirect and induced regional economic multiplier effects, were $175.26 billion, as summarized in Table 1. Total industry payroll was $35.88 billion and the total labor earnings impact, with multiplier effects, was $53.16 billion. The total value added impact was $107.16 billion, including

Table 1. Summary of total economic contributions of the U.S. green industry by industry group and sector in 2007-08.

Industry group / sector (NAICS[x])	Direct output	Total output impact[y]	Total earnings impact[y]	Total value added impact[y]	Direct employment	Total employment impact[y]
	Million dollars				Full-time and part-time jobs	
Production and manufacturing	**35,386**	**52,572**	**13,145**	**32,128**	**277,736**	**468,692**
Nursery and greenhouse production (1114)	27,139	40,941	11,986	27,099	262,941	436,462
Lawn and garden equipment manufacturing (333112)	8,247	11,632	1,160	5,028	14,795	32,230
Horticultural services	**58,276**	**92,830**	**30,151**	**54,521**	**631,511**	**1,123,428**
Landscaping services (56173)	53,910	86,661	27,809	50,283	596,896	1,075,343
Landscape architectural services (54132)	4,365	6,169	2,342	4,238	34,615	48,085
Wholesale and retail trade[z]	**23,740**	**29,856**	**9,866**	**20,511**	**292,962**	**357,515**
Total all industries	**117,402**	**175,258**	**53,162**	**107,160**	**1,202,210**	**1,949,635**

[z] Values for wholesale and retail trade sectors reflect share of sales, employment and payroll for horticulture product lines, and gross margin on sales for output.
[y] Total impact estimates include regional economic multiplier effects.
[x] North American Industry Classification System.

Figure 1. Structure of the lifestyle horticulture industry.



employee compensation, proprietor (business owner) income, other property income and indirect business taxes paid to state/local and federal governments. The industry had direct employment of 1.2 million full-time and part-time jobs, and total employment impacts of 1.95 million jobs in the broader economy. The total value added contributions represented 0.76% of the U.S. Gross Domestic Product.

So what do all these numbers mean and why are they important? In today's economic climate, businesses are seeking new methods to effectively maintain their customer base. What few businesses realize is that the simple addition of landscaping to a storefront can make a significant difference in how a customer perceives the store. The positive environment created by aesthetically pleasing landscaping not only welcomes customers inside, but also enhances their perception of the level of quality of products and services offered by that store. Consumers are willing to pay higher prices, travel further to, and shop longer in a store that they perceive to be a quality establishment. In addition, ornamental plants are an effective way to revitalize a stale business, bring in additional customers, and improve the overall environment of the store. Furthermore, the presence of ornamental plants reduces shopping-related stress and makes customers feel more at ease in a store, which is a key factor in increasing the total amount of time they spend shopping.

Figure 2. Lifestyle horticulture provides tremendous economic benefit to residential and municipal properties, increasing perceived property values by 9 percent, on average.

Landscape amenities represent an effective tool to boost the occupancy rate of apartments and other commercial buildings. People enjoy aesthetically-pleasing areas and are much more likely to choose to live and work in buildings with attractive landscapes, so there is a high correlation between nice landscaping and high occupancy rates of buildings. It therefore becomes more economically feasible to invest money in landscaping, because the return in the number of tenants and rents received far exceeds the cost of installing ornamental plants.

Parks and botanical gardens have been shown to be effective tourist attractions in both large and small cities, and consequently, are a strategic source for generating tourism revenue. Tourist expenditures on food, transportation, lodging, etc. represent additional sources of revenue for local businesses that provide these services. Moreover, new revenue from outside the region adds to the overall economic base of a local economy. Admissions and ancillary dollars from botanical parks also augment municipal revenue through the community's attendance at special events held on park premises. This revenue gets filtered back into the economy and adds to the financial prosperity of the community.

Home improvements can add significant value to a property, and landscaping yields, on average, a 109% return on every dollar spent. This is much higher than other home improvements (Fig. 2). Homebuyers respond positively to homes with professionally landscaped and manicured lawns, and consequently perceive a higher property value. With landscaping, it is possible to increase its value to potential buyers and receive a significant positive monetary return on this external home improvement investment. Landscape improvements are also an important strategy for increasing property sales during economically depressed times.

Planting trees along paved roads reduces temperatures on the ground and helps increase the longevity of the paving materials. When asphalt is continually exposed to the sun, it tends to break down faster, requiring more frequent maintenance that can cost a great deal of money, and be a source of inconvenience for residents. The installation of shade trees greatly reduces the temperature of the ground and lengthens the asphalt's life span. This ensures that streets stay usable for longer periods of time, saving the city on maintenance costs, and providing residents with shade over pedestrian walkways.

ENVIRONMENTAL (ECOSYSTEMS SERVICES) BENEFITS

Trees and other ornamental plants are crucial to the sequestration of carbon from the earth's atmosphere and play an important role in reducing the carbon footprint (Brethour et al., 2007; Hall and Dickson, 2011). Research has shown that large trees can absorb significant amounts of carbon dioxide, particulate matter and other pollutants from the atmosphere each year and release oxygen through photosynthesis. As such, trees and other landscape plants serve as an important tool in improving air quality in cities and mitigating potential health effects on human inhabitants (Fig. 3).

Cultivating urban green spaces is an effective way to host wildlife populations in otherwise inhospitable areas. Providing animals with habitats and refuges within populated areas increases their survival and success. Sheltering animal populations in the city is part of maintaining urban biodiversity, an important aspect of keeping a city environmentally friendly.

Planting trees and other ornamental plants around a building can significantly reduce the extreme temperatures in the ambient environment, thus lowering the energy cost of heating and cooling, and in turn, reducing its environmental burden (Bowler et al., 2010). Thus, planting trees around buildings is not only a positive step towards reducing energy consumption, but it also has a significant financial benefit as well. Trees also help protect buildings against deterioration of building materials and

Figure 3. Lifestyle horticulture provides many environmental amenities (ecosystems services) to the communities in which we live.

coatings, thereby reducing long-term maintenance costs.

Furthermore, the inclusion of green spaces in an urban landscape can offset the urban heat islands by absorbing heat and sunlight, thereby creating a much more enjoyable and inviting urban environment.

Trees and urban green spaces can reduce noise and light pollution that can disrupt human and animal activity patterns and cause physiological stress. Landscaped areas absorb high volume sound waves, improving the quality of life for both human and wildlife populations in a community.

Planting trees and cultivating landscaped areas is an effective way to reduce soil erosion. Plant roots create a network structure below the surface that helps anchor the soil in place during heavy rain events and holds twenty times more soil than traditional tilled soil. Above the surface, plant foliage and surface cover also help to reduce wind erosion of topsoil and decrease dust in the air.

By absorbing water, trees and plants reduce the amount of runoff that the city has to deal with, pump out, or purify after significant rainfall events. This reduces the cost of storm water treatment plants and saves the city money. Landscaping absorbs some of the pollutants in the water, meaning that there is less pollution in the water that the city has to purify. Plants and trees improve water quality by ensuring that current purification methods can effectively treat reasonable amounts of runoff (Criley, 2008).

Urban glare is the excessive reflection of sunlight from surfaces such as windows and buildings. Green spaces reduce urban glare in cities by absorbing light, and strategically placed landscaping becomes an important tool for city planners to capture and deflect light so that it is less unpleasant for residents and drivers, improving the quality of life in the community.

Lifestyle horticulture spaces can reduce the harmful effects of wind in cities by slowing and diminishing its strength, helping to preserve delicate natural environments that could be harmed by high winds. Minimizing wind strength also reduces soil erosion due to wind gusts and reduces the need for heating and cooling in buildings by moderating the effects on temperature.

WELL-BEING BENEFITS

The calming influence of natural environments is conducive to human labor productivity by increasing a person's ability to concentrate on the task at hand. Work performed under the natural influence of ornamental plants is normally of higher quality and completed with a higher accuracy rate than work done in environments devoid of nature. The influence of plants can increase memory retention up to twenty percent, stimulating the senses and improving mental cognition and performance (Ulrich, 2003).

Keeping plants in a child's learning environment enhances learning capabilities by helping them to focus and concentrate. This improves their ability to learn new things and makes it easier for them to absorb and retain information. Specifically for children with problems paying attention, adding plants to the classroom can have a dramatic positive effect on the way they learn. For example, for children with Attention Deficit Disorder, learning in a natural environment can help them to engage more in the classroom, improving their focus and concentration on the task at hand. The soothing effects of natural aesthetic beauty help to minimize the distractions that would otherwise occupy their minds.

Botanical gardens and other entities utilizing natural green spaces often create educational programs for children and adults in order to teach them the value of being environmentally-conscious and conserving natural resources. Parks and gardens foster an appreciation for nature that often instills in residents a sense of responsibility to care for and protect the environment (Hull and Ulrich, 1992).

Keeping flowers and plants in and around the home and workplace is an excellent way to lower stress levels and anxiety. Research shows that people who keep flowers in their home feel happier and more relaxed. As a result of the positive energy they derive from plants, the chances of suffering from stress-related depression are decreased as well.

Active participation in gardening and landscaping activities is also an effective way to reduce stress levels. Studies have shown that people who nurture plants and garden have less mental distress than others. Gardening provides people with a positive way to channel their stress and frustration into something beautiful that provides them with comfort and joy. Part of the effects of gardening comes from the satisfaction people get from nurturing a living thing to grow. Plants and gardening soothe people because they help them turn their stressful feelings into something positive which gives them pleasure and provides an excellent coping mechanism for their daily frustrations. This often translates into reduced urban crime in cities with enhanced green spaces (Gorham et al., 2009).

Parks and urban green spaces impact people's health by providing them with an inexpensive (often free) setting for recreation. There is a positive correlation between the presence of a park in a neighborhood and the level of physical activity of the residents: people are much more likely to exercise when there is a convenient, no-cost, aesthetically pleasing area or facility for them to use. As a result, residents of neighborhoods with beautiful parks are less susceptible to physical ailments and more resilient against minor illnesses, and therefore do not spend as much on health care and medical treatment. Healthy people are generally happier people; residents who exercise regularly have better overall health and a more positive mental outlook (Zampini, 1992).

Plants and ornamental shrubs and flowers have a practical application in hospitals: the presence of plants in patient recovery rooms has been shown to reduce the time necessary to heal. The soothing effects of ornamental flowers and plants are so great that simply having daily views of flowers and other ornamental plants in landscaped areas outside patient recovery rooms can also significantly speed up recovery times. Another technique to decrease recovery time is horticulture therapy, where patients care for and nurture plants themselves. Many patients who physically interact with plants experience a significantly reduced recovery time after medical procedures.

Gardening can have therapeutic effects on people who have undergone either mental or physical trauma. The act of nurturing a plant can provide victims with a way to work through difficult issues and heal their wounds. Gardening is a therapeutic tool that can be used to help put people in a better psychological state during recovery and help them to work past the mental barriers that could impede their healing (Dunnett and Qasim, 2000).

Ornamental plants affect the level of compassion that people feel towards others. Studies have shown that people who spend more time around plants are much more likely to help others, and often have more advanced social relationships. People who care for nature are more likely to care for others, reaching out to their peers and forming shared bonds resulting from their common interests. Extended exposure to nature and wildlife increases people's compassion for each other just as it increases people's compassion for the environment in which they live. In short, being around plants improves relationships between people and increases their

Figure 4. Today's lifestyle gardener is more concerned with the benefits or outcomes of gardening and not necessarily the work of gardening. In their minds, decorating equals gardening.

concern and empathy toward others (Younis et al., 2008).

Spending time in nature gives people an increased feeling of vitality, increasing their energy levels and making them feel more animated. In turn, their performance levels are enhanced by this improved state of mind. Natural environments induce a positive outlook on life, making people feel more alive and active. Plants can help people at work and at home by increasing their perceived vitality and feelings of added energy (Fig. 4). People who spend more time outside in nature have a significantly more positive outlook on life than people who spend a great deal of time indoors (Evers et al., 2000).

Beautifying traffic medians not only improves the aesthetics of the roadways, it also affects driver attitudes. Studies show that drivers are more at ease on roadways with natural landscaping, and are much more inclined to think positively about the community that they are driving through if the roadways are beautiful. Furthermore, adding trees to roadways creates a sort of natural obstruction that could reduce the likelihood of cars crossing medians into oncoming traffic lanes, thereby improving driver safety and making the community a safer place for everyone to live.

How does one place an economic value on such nebulous but vital amenities that enhance the quality of life so dramatically? Measuring these less tangible benefits represents an additional challenge that must be undertaken by researchers of the lifestyle horticulture industry. In the meantime, lifestyle horticulture needs to do more to promote its contributions to society at large in order to affirm its value and relevancy in the lives of citizens worldwide.

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The Origin of Horticulture in Australia: The Early European Colony in Sydney 1788-1850

David E. Aldous, Catherine A. Offord and John P. Silk

With the loss of the North American colonies following the American War of Independence (1775-1783), the British Government needed new lands to banish its so-called 'undesirables'. One prominent English navigator, Lieutenant (later Captain) James Cook (1728-1779), who had been sent on a voyage of scientific and economic discovery, had recently discovered the east coast of New Holland in 1770, later to be called Australia. Famed botanist Joseph (later Sir) Banks (1743-1820) (Fig. 1) and American loyalist James Matra (1746-1806), who had both accompanied Cook on this first voyage (1768-1771), strongly supported Botany Bay in New South Wales as a site for the new penal colony. And so it was, that between January 18th-20th 1788, the First Fleet of 11 ships, with 1,487 people that included 778 convicts (192 women and 586 men), landed at Botany Bay. However the colony's first Captain-General and Governor in Chief of the Territory of New South Wales, Captain (later Vice-Admiral) Arthur Phillip (1738-1814) (Fig. 2), found the site unfavourable, and sailed on to establish the settlement on Farm Cove, Port Jackson (latitude 33.94°S, longitude 151.18°E) in Sydney Harbour on the 26th of January, 1788. These first few years were to prove a struggle for the new settlement. It was to be established as a penal colony, and neither the convicts nor the military officers were particularly willing or interested in farming the land to provide the supplies needed to sustain everyone.

Figure 1. Sir Joseph Banks, who accompanied James Cook on his voyage of discovery to Australia, recommended plants for establishment of the first European settlement at Botany Bay.

Figure 2. Governor Arthur Phillip oversaw the establishment of the first European settlement in Australia. This memorial is located in the Royal Botanic Gardens, Sydney, in the vicinity of the first garden in Australia.

Fortunately, Sir Joseph Banks had advised Captain Arthur Phillip on the appropriateness of seeds, plant material and livestock to establish the penal colony. These materials, along with local food supplies, livestock and grain were collected en route at Tenerife, in the Canary Islands, Rio de Janeiro and Cape Town, and were to be the staples of establishment. Records from the HMS Sirius, one of the three supply transport ships of the First Fleet, listed amongst its provisions horticultural plant materials such as banana (*Musa* spp.), cocoa (*Theobroma cacao*), coffee (*Coffea arabica*), cotton (*Gossypium hirsutum*), eugenia (*Eugenia* spp.), guava (*Psidium guinense*), ipecacuanha (*Cephaelis ipecacuanha*), lemon (*Citrus* × *limon*), orange (*Citrus* × *sinensis*), prickly pear (*Opuntia* spp.), Spanish reed (*Arundo donax*), tamarind (*Tamarindus indica*), fig (*Ficus carica*), bamboo (*Phyllostachys* spp.), sugar cane (*Saccharum* spp.), quince (*Cydonia oblonga*), apple (*Malus* spp.), pear (*Pyrus* spp.), strawberries (*Fragaria* spp.), oak (*Quercus* spp.) and myrtle (*Myrtus communis*) trees, India seed corn (*Zea mays*), 12 baskets of associated garden vegetable seeds (First Fleet Fellowship, 2006), as well as 15,448 m^2 of Crown Grass (*Paspalum quadrifolium*) for pastoral purposes (Hope, 1996). During Captain Cook's earlier voyage to New Zealand in 1769, Joseph Banks had recognized the value of Warrigal greens (*Tetragonia tetragonioides*), as did Captain Cook, with citrus and sauerkraut (pickled cabbage), as a means of saving his crew from the ravages of scurvy (Laws, 2010).

BIRTH OF AUSTRALIA'S HORTICULTURE

As soon as Governor Phillip pitched his tent in Sydney Cove he established a garden, known as the Governor's Farm on Farm Cove in the grounds of what is now Sydney's Royal Botanic Gardens (Lucas, 1928; Gilbert, 1986) (Figs. 3 and 4). Within days of settlement, 3.6 hectares of the Governor's Farm had been planted to wheat and corn, managed principally by Phillip's personal servant, Henry Edward Dodd (1748-1791), who had acquired some limited farming skills when working as a labourer on Phillip's former Lyndhurst property in Hampshire, England.

These garden beds were to prove essential in the early colony's survival. However, these early crops of wheat and corn ultimately failed due to the poor climate and soil conditions at Farm Cove. Lieutenant (later Marine Captain) Watkin Tench (1758-1833), a member of the First Fleet, explains it this way through Flannery's (1996) reference; *'the cultivation of the land was still in*

Figure 3. Early map of the colony showing the location of the first garden and the nearby first farm at 'Farm Cove', now part of the Royal Botanic Gardens, Sydney (Photo courtesy National Library of Australia).

Figure 4. Farm Cove – Woggan-ma-gule. The area overlooking Farm Cove has double significance to the people of Australia. It was an important meeting and ceremonial ground for the traditional owners, the Cadigal people. It is also the site of the first farm in Australia and has been in continuous cultivation since 1788. It is now the site of Australia's oldest scientific institution, the Royal Botanic Gardens.

its infancy. We had hitherto tried only the country contiguous to Sydney. Here the governor had established a government farm, at the head of which a competent person of his household was placed, with convicts to work under him. Almost the whole of the officers likewise accepted small tracts of ground for the purpose of raising grain and vegetables, but experience proved to us that the soil would produce neither without manure and.... most of the farms (among the one belonging to the government) were successfully abandoned'. However, the role of the Government Farm was to change in later years, not only as a botanic garden, but as a site to acclimatise new horticultural species coming into the colony. In doing so, the Royal Botanic Gardens became Australia's first scientific organisation.

"In no other part of the world can we point to a spot and say - here is the site of the beginning of horticulture and agriculture of a continent."

Joseph Maiden (1859-1925),
Director, Royal Botanic Gardens

Within 5 weeks of settlement, Governor Phillip had sent Lieutenant (later Governor) Philip Gidley King (1758-1808) to establish a second settlement at Norfolk Island (latitude 29.03°S, longitude 167.97°E). King reported back that the *'soil proves admirably adapted to produce all kinds of grain and European vegetables... as well as New Zealand flax* (Phormium tenax)', a plant previously reported by Banks on an earlier voyage. Flax was one of the earliest crops of economic interest for the penal colony as a replacement for hemp (*Cannabis sativa*), as was the bread-fruit (*Artocarpus altilis*), which was written into horticultural history when the crew of the ship HMS Bounty, carrying the cargo to the West Indies, mutinied against its Captain (later Governor and Vice Admiral) William Bligh (1754-1817) in 1789.

Suffering was continuous in the early years of the penal settlement. Stocks from the First Fleet had been depleted and the Second Fleet that came in 1790, failed to bring sufficient supplies and arrived with most of its convicts malnourished. The early farms had failed to provide sufficient food for the burgeoning colony, and other measures had to be taken. One of these was that Governor Phillip had turned to James Ruse (1760-1837), one of the few convicts who came on the First Fleet with a farming background. Ruse established successful farming practices at Rose Hill, some 12 miles north of Farm Cove, and was to receive the first land grant in the colony. Ruse's farming practices, as reported by Lieutenant Watkin Tench involved *'hooeing (the soil) to fine I would sow it with turnip seed which will mellow and prepare it for next year. My straw I meant to bury in pits and throw in it everything which I think will rot and turn to manure. The soil on the farm is middling; neither good nor bad. I will be bound to make it do with the aid of manure but without cattle it will fail'*.

Tench continues to report that by 1791 *'many other fruits were still in their infancy, but oranges, lemons and figs... in a few years will become plentiful... apples and the fruits of colder climes also promise to gratify expectation... (and) the banana-tree (which had) been introduced from Norfolk Island, grows spontaneously'*, and he even makes mention of some native plantings at the Rose Hill site of *'the native sarsaparilla* (Smilax glyciphylla) *or sweet tea, and the inner part of the Cabbage tree palm* (Livistona australis) *which formed the principal support of (feed for) our hogs'*.

A First Fleet seaman from the HMS Sirius, who made good, was Owen Cavanough (1762-1841). Cavanough was discharged from service and settled on Norfolk Island, before later becoming a successful 'small-vegetable' grower on a tributary of the Hawkesbury River in the Windsor district just northwest of the colony. Fowell (1790) reported that in this district *'vegetables grow very fine, Cabbages grow to a large Size, for on the Kings Birth Day 1789 A Cabbage was Cut & Sent to the Govonor which weighed 27 Lbs Several have been cut Weighing from 15 to 20 Lbs, but it is a general opinion Potatoes Degenerate very much. Melons & Pumkins thrive astonishingly'*.

TOWARDS A SELF-SUSTAINING COLONY

By 1790 the situation had stabilised, the colony's population was approaching about 2,000 inhabitants, and fresh food sources from vegetable gardens, orchards and vineyards were becoming sustainable. By 1791 some 8,000 vines, which had originally come via the Cape of Good Hope, had been planted at the Governor's house in Sydney. Even some of the early founding fathers such as John Macarthur (1767-1837), 'Father of the Australian Wool Industry', and explorers William Wentworth (1790-1872) and Gregory Blaxland (1778-1853), two of the three pioneers who crossed the Blue Mountains in 1813, were producing wine from their vineyards. Other vines collected from around Europe and from the botanical gardens in Montpellier, France, were planted on the Camden farm of James Busby (1801-1871) around 1830 (Fig. 5). Similarly, the first crop of apples was recorded in 1791 – *'six (apple) fruits produced on a tree that came to the colony from the Cape of Good Hope'* (Cramond, 2005) planted at Rose Hill. Tasmania's apple industry commenced with the planting of three apple seedlings and several pips on Bruny Island (latitude 43.4378°S, longitude 147.246°E) in 1788 by Captain William Bligh (1754-1817).

However by December 1792, Governor Phillip, weakened by illness, sought a return to England and left the new incoming Governors of John Hunter (1795-1800), Philip Gidley King (1800-06), and William Bligh under the influence of military Lieutenant-Governors for the next 4 years. These proved to be turbulent times when some of these early governors compromised their authority with officers of the army, or other well-connected individuals in the early colony. One was John Macarthur (1766-1834), who was able to secure 'Elizabeth Farm' in 1793 from one of the Lieutenant-Governors, Major Francis Grose (1758?-1814). Macarthur's wife Elizabeth (1766-1850) described their property as *'four to five hundred Acres, (and) is bounded on three sides by water…… We have at this time, about one hundred and twenty Acres in Wheat, all in a promising state. Our Gardens, with Fruit and Vegetables are extensive and produce abundantly It is now spring & the Eye is delighted with a most beautiful variegated Landscape. Almonds, Apricots, Pear and Apple Trees are in full bloom'* (Anon., 2007). The youngest son of John and Elizabeth Macarthur, Sir William Macarthur (1800-1882) was to go on to make an impact on gardening, horticulture and viticulture in colonial Australia, sending large numbers of vine cuttings to the younger colonies in Western Australia, Victoria and South Australia. *Erythrina* 'Blakeii' (*E. herbaceae* x *E. crista-galli*), a sterile hybrid shrub, was one of the first horticultural plants bred in the new colony in the early 1840s and is still extant at Camden Park Estate, New South Wales, the home of Sir William Macarthur

Figure 5. *Vitis vinifera* L. 'Pinot Gris' (Pomona Brittanica via Hortus Camdenesis). This is one of many cultivars introduced into Australia by James Busby, many of which were established at the Royal Botanic Gardens before wider distribution throughout the colony.

(Fig. 6) who was one of the most active and influential horticulturists in Australia.

AUSTRALIA GAINS ITS IDENTITY

The disorderly conduct of the militant Lieutenant-Governors came to an end with the appointment of Governor Lachlan Macquarie (1762-1824), who in 1810 disbanded the army and incidentally was the first to use the word Australia in official documents. Macquarie came from a military background whereas all earlier Governors and Lieutenant-Governors had a navel background. Macquarie came at a time when New South Wales was transiting from a penal colony to a free settlement. The numbers of free settlers and merchants had steadily grown, as had the number of native born people and convicts who had served their time and were now free citizens or emancipists. Among Macquarie's early accomplishments as the 'Father of the Nation' was opening up the Hawkesbury-Nepean River from Jamison town, now a suburb of Penrith, to Windsor, for agricultural and horticultural production, and settling large tracts of Crown land for pastoral purposes. Primitive huts, once occupied by squatters, or people who occupied large tracts of Crown land in order to graze livestock, were being replaced by more substantial homesteads and extensive gardens in the 'classical' style. Names such as the Macarthurs of Camden Park, the Macleays of Elizabeth Bay, and the Rouses of Rouse Hill, built what are now historic gardens using both imported and native plants in their extensive landscaped gardens. The years during Governor Macquarie's governorship and into the 1830s were referred to as 'the golden decade' in New South Wales. John Dunmore Lang (1799-1878), a noted clergyman and politician of the times, on his departure from Australia in 1833 wrote that *'some ground having been near his Excellency's house on the east side, the plants from Rio de Janeiro and the Cape of Good Hope were safety brought on shore in a few days; and we soon had the satisfaction of seeing the grape, the fig, the orange, the pear, and the apple, the delicious fruits of the Old, taking root and establishing themselves in our New World'* (Lang, 1837).

SEEDS OF CHANGE: DEVELOPING SPECIES FOR ANTIPODEAN HORTICULTURE

Many of the early colony's botanists, naturalists and landscape artists, not only came with the First Fleet, but on earlier and later voyages, and played an important part in identifying new and unique horticultural plant species for commerce. Botanists such as Daniel Solander (1733-1782) and Joseph Banks accompanied Captain James Cook when he landed and named Botany Bay in April 1770. Similarly the French expedition, commanded by navigator Jean-Francois de Galaup, comte de Laperouse (1741-88?), who incidentally put into Botany Bay just a few days after the First Fleet arrived, had among his

Figure 6. *Erythrina* 'Blakeii' (*E. herbaceae* x *E. crista-galli*), a sterile hybrid shrub and one of the first horticultural plants bred in the new colony still extant at Camden Park, home of William Macarthur (Photos courtesy of C. Offord).

Figure 7. *Banksia coccinea* named by Robert Brown and illustrated by Ferdinand Bauer (Plate 3 from *Illustrations Florae Novae Hollandiae*). This is one of many species described by early botanists in Australia that are now widely cultivated for their spectacular blooms.

114-man crew the botanist Bossieu de la Martinière (1758-1788?) as well as ten other scientists. The botanist on Matthew Flinder's (1774-1814) voyage of circumnavigation (1801-1805) around Australia was Robert Brown (1773-1858) and he was accompanied by the Austrian artist Ferdinand Bauer (1773-1858). Brown botanically described many Australian plants, collecting around 3500 specimens from 1801 to 1805, naming more than 1200 species in Western Australia (Fig. 7). In 1816, Alan Cunningham (1791-1839) arrived in the colony and was appointed the King's Botanist at the Sydney Botanic Gardens, and travelled widely in the colony to collect plants. In 1817 Charles Fraser (1788-1831) became the Colonial Botanist and was responsible for creating the 'botanic garden', that reflected the importance of acclimatisation and cultivation in colonial times (Figs. 8 and 9).

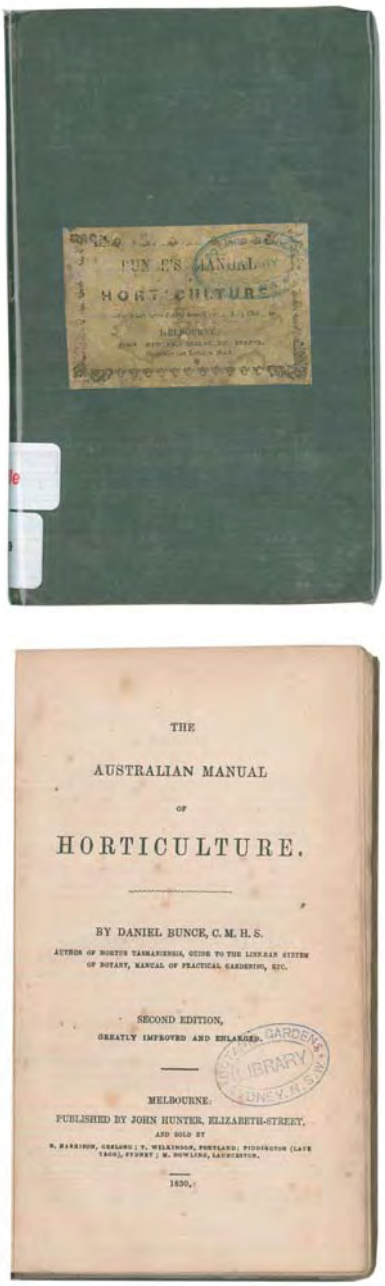
Although horticultural plants and produce continued to be an important food source for the early colony, there were also opportunities that involved horticulture for recreation purposes. For example, cricket was first played on grass, albeit the local native grasses, between the officers and crew of the 54-gun fourth rate HMS Calcutta, in today's Hyde Park, Sydney, as early as January 8th, 1803 (Cricket Fans' Forum, 2007). Horseracing was established near the township of Richmond in 1806, with match races commencing at Parramatta in April 1810 (Cashman, 2008). Records show that golf was first played at Ratho, Bothwell, Tasmania in 1822 (Geary, 2009) and lawn bowls at Sandy Bay, Tasmania, as early as 1826 (Gerty, 1996).

Large public gardens were established quite early in the new colony, such as the Royal Botanic Gardens within the Domain in Sydney in 1816, the Royal Tasmanian Botanical Gardens in 1818 and the Royal Botanical Gardens, Melbourne, Adelaide and Brisbane established in 1845, 1854 and 1855 respectively. All have vast areas of lawn, which in the early days was largely maintained by sheep or laboriously maintained by scythe, sickle or a pair of shears. In 1828, the original squared beds and gravel walks of Sydney's Government House garden were replaced by large areas of lawn. With the closure of 1850 we see names emerging such as leading nursery and seedsmen John Pascoe Fawkner (1792-1869) and Daniel Bunce (1813-1872) (Fig. 10), orchardist John Bateman (1801-1839), and the curator of Melbourne's Royal Botanic Gardens, John Arthur (1804-1849), all ready to play their part in the next era of horticultural history in Australia.

Figure 8. A flower show in the Royal Botanic Gardens, Sydney, possibly staged by the Australasian Botanic and Horticultural Society 1853 (Gilbert, 1986) (Image courtesy of W.G. Mason, National Library of Australia).

Figure 9. Botanic Gardens are a feature of all Australian capital cities reflecting the importance of plant acclimatization and cultivation in colonial times. This image shows later development of paths and beds at Royal Botanic Gardens, Sydney.

Figure 10. The cover page of Daniel Bunce's (1813-1872) first seed and nursery catalogue.



CONCLUSION

In just over 200 years, Australia has developed significant horticultural expertise and enterprise since the early colonial days. The scale and diversity of modern horticulture in this country had its origins in the struggle of the early colonists having to adapt northern hemisphere species to a land of vastly different soils and climates. From humble beginnings, where horticultural foodstuffs were one of survival, Australia has now advanced its fruit, vegetable, ornamental and environmental horticulture industries to where they play a significant part in Australia's social, environmental and economic fabric.

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Status of Citrus in Indonesia: Production, Research, and Development

Hardiyanto and Nirmala Friyanti Devy

Indonesia is a country in Southeast Asia that encompasses 17,508 islands. The Indonesia archipelago is located directly on the equator and is thus distinctly a tropical country. Yet, despite its agroecological situation, almost all horticultural crops including subtropical crops (fruits, vegetables and ornamentals) can be grown and exploited commercially. One of the national priorities is the expansion of the fruit crops industry and, in particular, that of citrus. Many citrus species such as *Citrus reticulata* Blanco (mandarin), *Citrus sinensis* L. (orange), *Citrus maxima* Merr. (pummelo), *Citrus suhuiensis* hort. Ex Tanaka (siam), *Citrus* x *hystrix* (Kieffer lime) and *Citrus* x *limon* L. Burn F. (lemon) are commercially grown in Indonesia.

Due to its tropical location, Indonesian citrus growers are facing many challenges and have to deal especially with phytosanitary problems, such as citrus greening, that have not yet been solved. Research on this disease has been conducted and is ongoing. Technologies developed by Indonesian research institutes are of paramount importance to improve the national citrus production and phytosanitary quality if the country is to compete with imported fruits as well as sustain a profitable national citrus agribusiness.

CITRUS PRODUCTION IN INDONESIA

Production of citrus has been increasing steadily from 2005 to 2009. In 2009, total production attained about 2,100,000 tons, grown on 72,306 ha. Despite its importance for the country, the productivity of citrus orchards is still low, reaching about 28.6 ton/ha (Table 1). Five provinces of the country's 33 contribute the majority of the national production; North Sumatera, East Java, West Kalimantan, Bali, and West Sulawesi. Citrus production in these provinces ranges from 157,484 up to 728,796 tons; therefore, these provinces are categorized as the main citrus growing center in Indonesia (see Fig. 1, Table 2). Meanwhile, the production of the remaining producing areas is less than 100,000 tons (Table 3).

DISTRIBUTION OF COMMERCIAL CITRUS CULTIVARS

To date, more than 25 national citrus cultivars from many species have been commercially developed either for low or high altitudes, such as 'Keprok Batu 55', 'SoE', 'Garut', 'Tejakula', 'Terigas' (Mandarin group), 'Siam Pontianak', 'Madu', 'Gunung Omeh' (Siam group), 'Nambangan', 'Sri Nyonya', 'Raja', 'Kudus' (Pummelo group), and 'Manis Pacitan' (Orange group) (Figs. 2-5). However, almost 80% of the commercial citrus production is dominated by the Siam group. This has a negative impact on price owing to over production during certain periods. Consequently, the Indonesian government has implemented a policy to reduce the proportion of siam production from 80% to 50% by establishing more mandarins in several citrus producing areas.

CITRUS RESEARCH AND DEVELOPMENT

The main national research institute conducting research on citrus is the Indonesian Citrus and Subtropical Fruits Research Institute (ICSFRI). This institute is located in Batu (900 m above sea level), East Java, and it belongs to a

Table 1. Status of the citrus harvested areas, production, and yield in Indonesia (2005-2009).

NATIONAL					
Indicator	2005	2006	2007	2008	2009
Harvested areas (ha)	37,120	35,367	47,824	56,290	72,306
Production (tons)	644,052	691,433	968,132	1,441,680	2,102,562
Yield (tons/ha)	17.35	19.55	20.24	25.61	28.64

Source: Horticulture production. 2010. Indonesian Centre for Data and Agriculture Information System, Ministry of Agriculture.

Table 2. The main citrus producing provinces in Indonesia (2009).

Provinces	Production (tons)
North Sumatera	728,796
East Java	378,462
West Kalimantan	170,201
Bali	162,916
West Sulawesi	157,484

Source: Provinces based horticulture production. 2010. Indonesian Centre for Data and Agriculture Information System, Ministry of Agriculture.

Table 3. Other citrus producing areas in Indonesia (2009).

Provinces	Production (tons)
South Kalimantan	88,061
South Sumatera	77,316
Jambi	39,073
East Nusa Tenggara	36,918
South Sulawesi	35,816
Center of Java	30,341
West Java	27,453
South East Sulawesi	26,275
West Sumatera	24,891
Riau	19,221
Nanggroe Aceh Darussalam	19,037
Papua	18,406
Center of Sulawesi	14,156
East Kalimantan	11,754
Lampung	11,006
Center of Kalimantan	8,601
Bengkulu	8,516
West Nusa Tenggara	6,931
Bangka Belitung	5,966
Maluku	3,882
DI Yogyakarta	2,062
North Sulawesi	1,903
Gorontalo	1,594
Banten	1,563
North Maluku	1,452
Kepulauan Riau	556
West Papua	341
DKI Jakarta	18

Source: Provinces based horticulture production. 2010. Indonesian Centre for Data and Agriculture Information System, Ministry of Agriculture.

Figure 1. The main citrus growing centers in Indonesia.

Figure 2. Distribution of citrus cultivars in Indonesia.

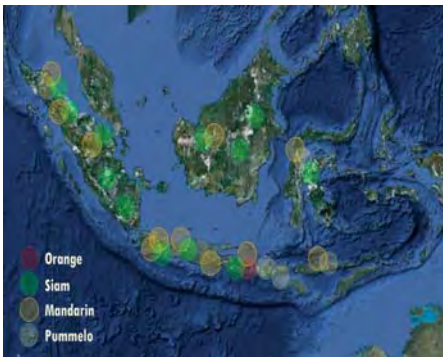

Figure 3. Commercial mandarin cultivars: A. 'Keprok Batu 55' from East Java, B. 'SoE' from East Nusa Tenggara, C. 'Garut' from West Java, D. 'Tejakula' from Bali, E. 'Terigas' from West Kalimantan.

Figure 4. Commercial *Citrus suhuiensis* siam cultivars: A. 'Madu' from North Sumatera, B. 'Gunung Omeh' from West Sumatera, C. 'Siam Pontianak' from West Kalimantan.

Figure 5. Commercial *Citrus maxima* Merr. pummelo cultivars: A. 'Sri Nyonya' from East Java, B. 'Raja' from West Sumatera, C. 'Kudus' from Center of Java.

Figure 6. ICSFRI office.

network of institutes under the aegis of the Indonesian Centre for Horticultural Research and Development from the Indonesian Agency for Agricultural Research and Development of the Ministry of Agriculture (Fig. 6). ICSFRI has a mandate to carry out research on citrus and subtropical fruits such as apple, grape, longan, and strawberry. This institute hosts 26 scientists with several specializations such as plant breeding, physiology, tissue culture, phytopathology, virology, entomology and soil science; 34 technicians and 36 administration staff. The main facilities established by ICSFRI include laboratories for plant breeding, tissue culture, somatic embryogenesis, phytopathology, virology and entomology (Fig. 7), 8 experimental gardens, and 23 screenhouses and greenhouses.

With respect to citrus, the research and development program in the institute comprises a number of priorities:

1. Production of virus-free plant material.
2. Enhancement and improvement of citrus quality through selection and breeding.
3. Mass production of citrus rootstock through somatic embryogenesis.
4. Conservation and utilization of citrus genetic resources.
5. Dissemination and transfer of citrus innovative technologies to the growers.

PRODUCTION OF VIRUS-FREE PLANT MATERIAL

The main phytosanitary problem encountered in citrus orchards is citrus greening disease or Huang Long Bing (HLB), one of the most destructive diseases of citrus. HLB is endemic in large parts of Asia, including Indonesia. This

Figure 7. Integrated laboratory at ICSFRI: A. Plant breeding, B. Tissue culture, C. Somatic embryogenesis, D. Integrated laboratory, E. Phytopathology, F. Virology, G. Entomology.

Figure 8. Healthy citrus tree production conducted in tissue culture laboratory at ICSFRI.

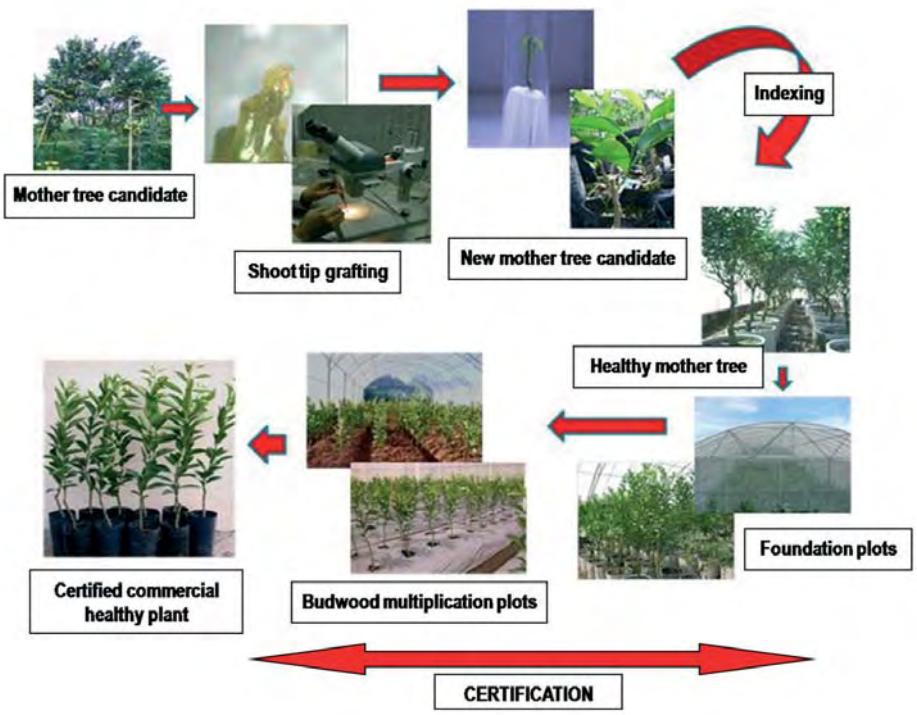

Figure 9. New seedless cultivars of 'SoE' mandarin and 'Nambangan' pummelo through mutation breeding: A. Seedless cultivars of 'SoE' mandarin derived from mutation breeding, B. 'SoE' mandarin, C. 'Nambangan' pummelo.

disease, caused by a bacterium (*Candidatus Liberibacter asiaticus*), is transmitted by an hemiptera (*Diaphorina citri*). In Indonesia, this disease has destroyed almost all citrus trees since 1970. In this context, ICSFRI together with FAO started a project in 1986 entitled "Citrus Rehabilitation in Indonesia". The priority of the program was to produce virus free plant materials. ICSFRI has thus developed a platform and the know-how to produce healthy citrus plants using shoot tip grafting techniques. As a spin-off of this program, 15 provinces have established citrus "foundation" plots and 19 provinces have installed citrus budwood multiplication plots. All healthy mother plants from each province were initially collected, propagated and distributed by the ICSFRI in its central location of Batu. An illustration of the steps involved in the production of healthy citrus trees at the institute is presented in Figure 8.

ENHANCEMENT AND IMPROVEMENT OF CITRUS PRODUCTIVITY AND QUALITY THROUGH SELECTION AND BREEDING

The overall quality of Indonesian citrus production does not yet compete with imported fruit from other countries because of poor skin color and presence of seeds in the fruits. Therefore, breeders are now creating new superior cultivars using biotechnological approaches based on mutation breeding, embryo rescue and protoplast fusion, but also using conventional methods and selection to produce colorful, seedless fruits displaying tolerance to biotic and abiotic stresses. This program has been in place since 2003, and has been successful in introducing new cultivars of seedless mandarin and pummelo (Fig. 9). This program remains a priority of ICSFRI.

Figure 10. Mass production of citrus rootstock ('Japanshe' citrus) through somatic embryogenesis using bioreactor: A. Embryo multiplication through immersion system by using bioreactor, B. New plantlets from bioreactor, C. Acclimatization of seedlings, D. Citrus rootstock seedlings produced from somatic embryogenesis.

Figure 11. Citrus germplasm collection and conservation in the field and greenhouse.

MASS PRODUCTION OF CITRUS ROOTSTOCK THROUGH SOMATIC EMBRYOGENESIS

Indonesian citrus growers usually use 'Japanshe' citrus (JC) as a citrus rootstock because it is more compatible to many cultivars and species compared to other rootstocks. Interestingly, this rootstock is tolerant to both drought conditions and humid, swampy areas where citrus trees are predominantly planted. Access to this citrus rootstock in Indonesia is still limited, a factor hampering large-scale commercial production. To overcome this problem, new technologies have been developed to rapidly provide the desired rootstock to the farmers using mass propagation. One of the technologies developed by the ICSFRI is a bioreactor-based somatic embryogenesis technology. This technology is also used for rapid callus multiplication derived from nucellus seeds, embryos and plantlets through bioreactor-based immersion system. This technology can potentially produce 150,000 plantlets from about three grams of embryo tissue from one bioreactor in one year. To date, the institute has developed protocols for the induction of somatic embryos and their conversion into true-to-type, virus-free plantlets (Fig. 10). This year, 500,000 plantlets will be produced, and it is expected that mass production of JC rootstock seedlings derived from somatic embryogenesis will be commercialized in 2013.

CONSERVATION AND UTILIZATION OF CITRUS GENETIC RESOURCES

To date, the largest citrus germplasm collection in Indonesia is located at ICSFRI and is officially recognized by the Indonesian Museum Record as such. This citrus collection consists of 211 citrus accessions from both introductions from abroad and endemic species and clones obtained through exploration in different regions of the country. This germplasm is collected and conserved either in a greenhouse or in the field. Many superior and promising citrus cultivars derived from selections have been obtained from this citrus germplasm bank (Fig. 11). The institute is also actively seeking new accessions and launching explorations for specimen displaying suitable traits. It is involved in rigorous evaluation of new accessions, updating the bank database on a continuous basis. It also organizes contests recognizing the best fruits produced by growers (Fig. 12).

DISSEMINATION ACCELERATION OF CITRUS TECHNOLOGICAL INNOVATIVE TRANSFER TO THE GROWERS

It is essential for Indonesia that the technologies developed at ICSFRI be transferred to the farmers and benefit the population as a whole.

Figure 12. National fruit contests at ICSFRI: A. Mandarin contest, B. Pummelo contest, C. Mandarin, siam, and pummelo contest.

Figure 13. Several activities of dissemination conducted by ICSFRI: A. Leaflets distributed to farmers, B. Training to farmers on cultural practices in the experimental garden, C. Training to farmers on pest and disease control in the phytopathology laboratory, D. Pruning demonstration by technician in the farmer's field, E. Tour visit to harvest fruits in visitor plot at ICSFRI, F. Participation in national horticulture expose, G. National fruit seminar activity.

Therefore, extensive dissemination programs have been implemented to bring innovative technologies to the field and bridge the gap between researchers, growers and the different stakeholders. For instance, ICSFRI distributes leaflets, brochures, posters and catalogs to farmers, describing recent findings of the Institute. It also establishes demonstration plots and organizes field days in several centers of citrus production. The institute also provides expertise and technical assistance to farmers and provides information through interactive communication streams such as websites, SMS, and faxsheets. It is actively involved in training of growers, farmers and stakeholders and regularly organizes tours and workshops in its facility (Fig. 13).

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The Pear Industry in South Africa

Karen Theron

HISTORY OF PEAR PRODUCTION

According to Stander (1983), the pear tree in the Company Gardens in Cape Town is the oldest living deciduous fruit tree in South Africa, descending from trees planted during the reign of Simon van der Stel (1639-1712), second Commander of the Dutch settlement at the Cape (1691-1699). From 1929, when export data became available per fruit type, pears were the major deciduous fruit export from South Africa until 1937. In 1939, the ca. 10,000 tonnes of pears exported made up more than 40% of total deciduous fruit exports. By 1930, one million "packages" of pears were exported. This figure was again reached after the war only in 1950. After the Second World War, pears became relatively less important due to a large increase in apple exports. The 3 million cartons mark was reached in 1981. 'Williams Bon Chretien' was the major exported pear in the 1930s, after which it was overtaken by 'Packham's Triumph', introduced in the Ceres area in 1922. In these earlier years, other exported cultivars included 'Beurré Bosc' (3rd), 'Beurré Hardy' (4th), 'Winter Nellis', 'Clapp's Favourite' and 'Doyenné du Comice' (Stander, 1983).

PRODUCTION AREAS AND INDUSTRY STATISTICS

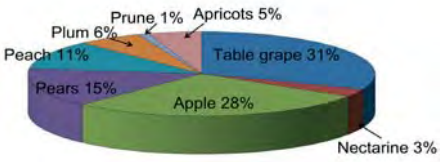
Pear production is limited to the Western Cape Province and the small, western part of the Eastern Cape (Fig. 1). The main production area is the Warm Bokkeveld situated around the town of Ceres (S33°22'; E19°19') with 4287 ha. In the Langkloof East around Joubertina (S33°49'30"; E23°51'18") another 1466 ha can be found. Wolseley (S33°25'; E19°12') and Tulbagh (S33°17'; E19°08'25") form the centres of the third largest production area with 1437 ha, while the Elgin area has another 1418 ha (Table 1). According to the 2010 tree census, 15% of deciduous fruit hectares were planted to pears (Fig. 2). This is a total of 11435 ha. From 1980 when the total pear hectares were 7011, a steady increase occurred until 2002 when 12911 ha were planted, thereafter a slow decrease in hectares occurred. Also, the percentage of deciduous orchards planted to pears decreased from 17% in 2001/2002 to the current 15% (Fig. 3).

Figure 1. Distribution of deciduous fruit production regions in South Africa (www.hortgro.co.za).

Table 1. Pear production districts in South Africa (www.hortgro.co.za).

District	Hectares	Percentage of total plantings
Ceres (Warm Bokkeveld)	4287	37.8
Langkloof East	1466	12.9
Eolseley/Tulbach	1437	12.7
Elgin (Groenland)	1418	12.5
Villiersdorp/Vyeboom	958	8.5
Klein Karoo	778	6.9
Other	989	8.7
Total	11332	100

Figure 2. Percentage hectares planted to different deciduous fruit types (Adapted from www.hortgro.co.za).



The current cultivar mix is dominated by 'Packham's Triumph', 'Forelle', 'Williams Bon Chretien' (WBC) and 'Early Bon Chretien' (EBC) (Fig. 4). EBC is an earlier maturing mutation

Figure 4. Distribution of different pear cultivars planted in South Africa in 2010 (Adapted from www.hortgro.co.za).

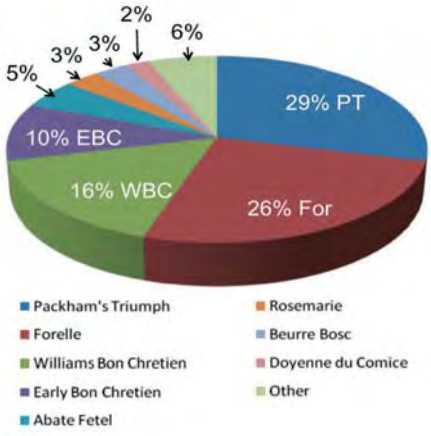


Figure 3. Percentage of deciduous fruit orchards planted to pears (Adapted from www.hortgro.co.za).

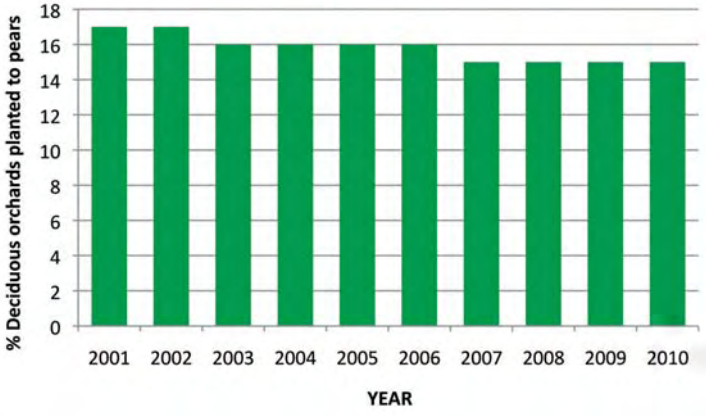
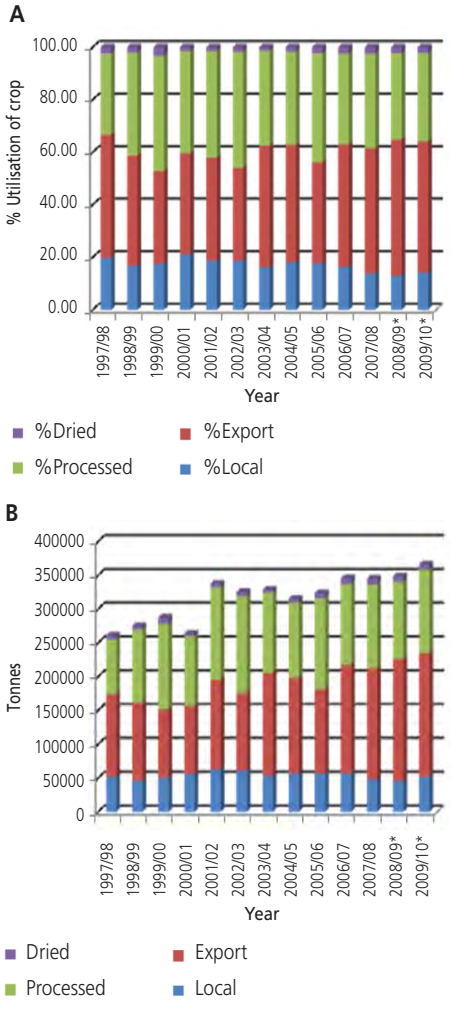


Table 2. Changes in hectares planted to different cultivars over the last five years (Adapted from www.hortgro.co.za).

Cultivar	2006	2007	2008	2009	2010
Packhams' Triumph	3301	3258	3278	3294	3249
Forelle	2539	2686	2801	2895	2963
Williams Bon Chretien	2326	2147	2062	1951	1775
Early Bon Chretien	1068	1084	1031	1092	1097
Abate Fetel	384	444	493	540	589
Rosemarie	428	394	384	384	365
Beurré Bosc	412	392	365	353	340
Doyenne du Comice	294	276	268	245	236
Other	795	722	743	679	718
Total (ha)	11547	11403	11425	11435	11332
% change		-1.2%	+0.2%	+0.1%	-0.9%

of WBC that probably also has a lower winter chilling requirement. From Table 2 it is clear that some changes are occurring in the cultivar mix, with 'Forelle' steadily increasing in area planted, 'WBC' showing a definite decrease in plantings, 'Packham's Triumph' and EBC stable in area, but 'Rosemarie' showing a definite decrease in hectares planted (Table 2). South Africa has been the leading country in planting bi-colour or blushed pears, firstly with 'Forelle', but also with two locally bred cultivars 'Rosemarie' and 'Flamingo'. The latter have however become relatively marginal due to problems with colour loss during periods of hot weather prior to harvest ('Rosemarie'), small fruit size and peel sensitive to scuffing (both) and internal browning ('Flamingo').

Figure 5. (A) The percentage utilisation of the pear crop in South Africa split between export, local consumption, processing and drying and (B) the utilisation in tonnes dried, processed, exported and sold locally (Adapted from www.hortgro.co.za).



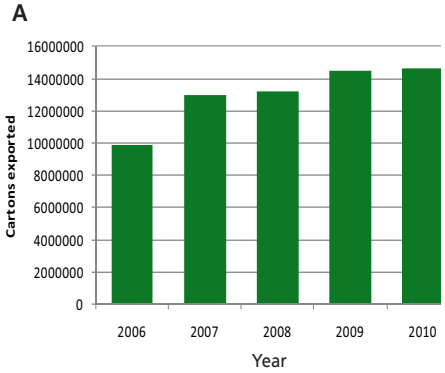
Of the total crop, just over 60% is consumed fresh; of which about 10% is being consumed locally while the rest is exported (Fig. 5). Even though total area planted to pears has decreased slightly over the last few years as mentioned earlier, the export volumes have increased owing to the fact that fruit quality has improved (Fig. 6a). The main destination for South African exports is still mainland Europe and Russia with 60%, and the United Kingdom with 15% (Fig. 6b). Since deregulation of the South African deciduous fruit industry in 1997, exports to the Middle East, Far East and Asia have increased to 19%.

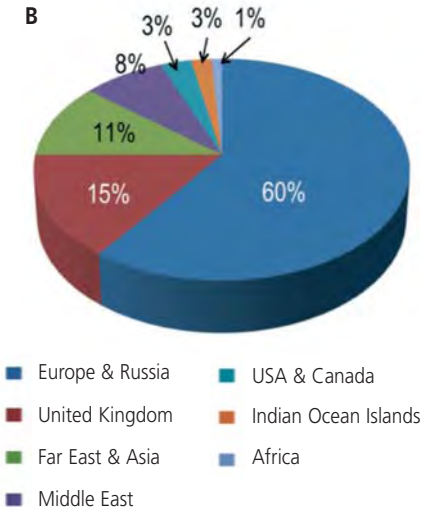
CLIMATIC CONDITIONS

The areas where pears are grown in South Africa can be classified as having a Mediterranean-type climate with mild, rainy winters and long, hot, windy summers. Rainfall varies from 250 to 1000 mm per annum, while winter chilling units accumulated over the four months of May to August range from 250 to 1000 hours below 7.2°C. Another aspect that makes the climate marginal for pear production is the high night temperatures in late summer and autumn (Strydom and Cook, 2005).

Another limiting aspect is the relative poor soils found in most of the production areas. The reasons for poor soils are varying, starting with the limited potential of the parent rock that it develops from resulting in limited and unbalanced soils. Soils generally have low cation exchange capacity (1-6 meq/100 g), low water holding

Figure 6. (A) Increase in 12.5 kg equivalent export cartons of South African pears over the last five years and (B) main export destination of pears from South Africa in 2010 (Adapted from www.hortgro.co.za).





capacity (50-230 mm/m), and generally low pH of the virgin soil (4-5 (KCl)). In addition, physical limitations such as depth, wetness, compaction and rock occur. Soils can also vary widely over short distances. To aggravate matters, better soils are reserved for apple and stone fruit plantings, while shallower, wetter soils are used for pear orchards (Strydom and Cook, 2005).

ORCHARD DESIGN, PLANTING SYSTEM AND ROOTSTOCKS

Depending on orchard age, the type of planting system and orchard design will vary. Prior to 1950, orchards were planted 6 x 6 m on seedling rootstock and were trained as large multi-leader trees (Fig. 7a). Between 1950 and 1980, a closed vase system with 3 to 4 leaders was used at spacings of 5 x 3 m (Strydom and Cook, 2005). During this time the *Pyrus communis* L. clonal rootstocks, BP1 and BP3, became popular. These rootstocks are nearly as vigorous as seedlings, with BP1 about 80% and BP3 about 90% of the vigour of seedling rootstocks. About 50% of current 'Packham's

Figure 7. Planting systems: (A) old, productive 'Packham's Triumph' orchard and (B) example of more typical resent pear planting of 'Early Bon Chretien'.

Table 3. Yield parameters for selected pear cultivars (From Strydom and Jacobs, 2011).

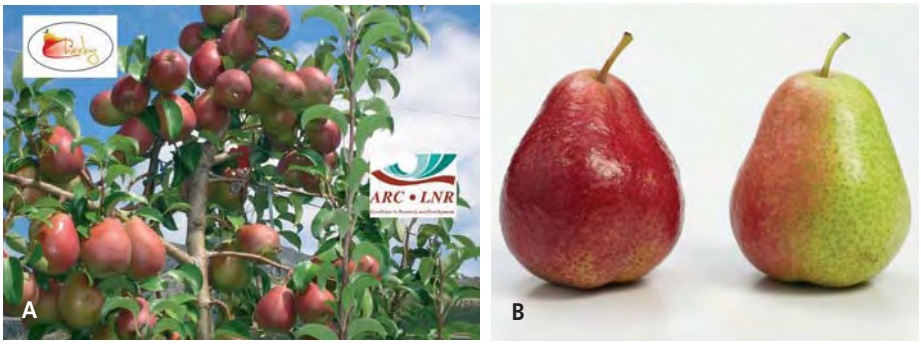
Cultivar	Yield parameter					
	t/ha*	g/fruit	Trees/ha**	Fruit/tree	Branches/tree	Fruit/branch
Packhams' Triumph	80	190	1666	253	25	10
Forelle	45	170	1666	159	20	8
Golden Russet Bosc	60	190	1666	190	25	8
Doyenné du Comice	50	200	1666	150	20	8
Abate Fetel	50	230	1666	131	23	7

* Yield is based on cultivar, soil potential and climatic suitability
** 4 x 1.5 m spacing

Table 4. Cropping pattern for selected pear cultivars in ton/ha (From Strydom and Jacobs, 2011).

Years after planting	Year 3	Year 4	Year 5	Year 6	Year 7
Packhams' Triumph	10	20	40	60	80
Forelle	8	20	35	40	45
Golden Russet Bosc	8	20	35	45	60
Doyenné du Comice	8	20	35	45	50
Abate Fetel	8	20	35	45	50

Figure 8. (A) 'Cheeky', a new bi-colour pear bred by the Agricultural Research Council and released in 2009 (Photograph courtesy of Taaibos Human, ARC Infruitec-Nietvoorbij) **and (B) 'Flare', a redder mutation of 'Forelle' next to the standard 'Forelle'** (Photograph courtesy of HDPFruit).



Triumph' orchards are older than 25 years and were therefore still planted at these wide spacings (Key Deciduous Fruit Statistics, 2010). Plantings from the era 1980-1995 were mostly spaced closer, around 4.5 x 2.5 or 4 x 1.5 m and trained as central leader trees (Fig. 7b). Currently most new plantings will be established at 4 x 1.5 m developing a central leader tree and using either BP1 or BP3 as rootstock or also more recently the quince rootstock BA29 at more favourable sites.

Orchards currently being established are designed to develop and yield as proposed in Tables 3 and 4. The aim is therefore to establish a tree consisting of a single trunk, 3.2 m tall with ca. 20 branches. Different techniques, e.g. rest breaking chemicals, scoring and notching, are used to achieve this. The branches should be comparable in vigour and not compete with the trunk, while the overall vigour of branches is reduced by bending (80° from vertical) and this also induces comparable vigour of laterals over the entire length of the branch. Complex, well branched fruiting units are formed and maintained by correct light management and reducing alternate bearing by fruit thinning and girdling or scoring (Strydom and Jacobs, 2011).

PROBLEMS ENCOUNTERED AND INNOVATIVE SOLUTIONS

Probably the most important problem encountered in South African pear production areas is warm temperatures in autumn and the lack of adequate winter chilling. In the case of new orchards that are established, trees are kept in cold storage at 4°C for 12 weeks. Subsequently the lack of winter chilling is addressed by the application of restbreaking chemicals. Hydrogen cyanamide in combination with oil is usually used at around bud swell, but the rate depends on the amount of chilling accumulated during the previous winter as well as the chilling requirement of the cultivar.

A loss of red colour of bi-coloured or blushed fruit is a huge problem especially in 'Rosemarie'. This cultivar, more so than 'Flamingo' or 'Forelle', suffers from red colour loss close to harvest when exposed to high ambient temperatures (Steyn et al., 2004). A possible solution is to plant new cultivars with higher initial red pigmentation, e.g. 'Cheeky' or a new mutation of 'Forelle', 'Flare' (Fig. 8). Sunburn damage to fruit results in approximately a 5% loss of the yield, which is not as high as in apples, and is mostly controlled through using the correct pruning and training system and optimal irrigation scheduling.

Due to the fact that the rootstocks used are quite vigorous, vegetative growth control is important. Prohexadione-Ca is not used extensively. Although very effective on 'Rosemarie', it is less effective on other cultivars and especially on 'Forelle' where very high rates are required to reduce growth (Smit et al., 2005). Growers use

Figure 9. (A) Vigorous 'Packham's Triumph' tree being girdled with the back of the chain of a chain saw and (B) the scoring pliers.

girdling two weeks after full bloom (w.a.f.b.) to reduce vigour (Fig. 9a). Girdling or scoring with special scoring pliers (Fig. 9b) is also used to increase fruit set, fruit size (2 w.a.f.b.) and return bloom (5-6 w.a.f.b.). Fruit set is also improved by applying gibberellin during bloom.

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About the Author

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ISHS Meets the European Plant Science Organisation

Jozef Van Asche, Executive Director of the International Society for Horticultural Science (ISHS), and Karin Metzlaff, Executive Director of the European Plant Science Organisation (EPSO), met at the EPSO office in Brussels on 19 October to get to know the two societies and discuss how to best collaborate.

Olaf van Kooten, member of the ISHS Executive Committee, participated in the EPSO Workshop on Plant Pigments and Human Health in May 2011 (http://epsoweb.org/workshop-plant-pigments-and-human-health) and recommended such collaboration. Similarly Uli Schurr from EPSO worked together with Jozef on several occasions.

Jozef and Karin agreed to propose to their Boards to collaborate in the future, starting with the Fascination of Plants Day (www.plantday12.eu) to which ISHS already gives full support. Additional support could be for meetings (workshops, conferences), publications and policy work, similar to the collaboration between EPSO and EUCARPIA.

Jozef, Olaf and Karin will meet again in the coming months to follow up on the decisions of their Boards, this time at the ISHS office near Leuven (Belgium).

EPSO, the European Plant Science Organisation (www.epsoweb.org), is an independent academic organisation that represents more than 227 leading academic research institutes, universities and departments from 30 countries. Together they represent over 28000 plant researchers and staff. In addition, EPSO has over 3000 personal members.

The mission of EPSO is to promote plant science and plant scientists, to represent plant scientists in discussions about future plant science programme priorities across Europe, to provide an authoritative source of independent information on plant science, and to promote training of plant scientists to meet 21st Century challenges in breeding, agriculture, horticulture, forestry, plant ecology and sectors related to plant science.

To achieve its mission, EPSO advises policy and decision makers at national and European level on science policy – such as Horizon 2020 (the successor of the 7th European Framework Programme for research) and the European Bioeconomy strategy - as an independent body and as member of the Initiative for Science in Europe (ISE), the European Technology Platform 'Plants for the Future' and the Global Plant Council. EPSO supports plant scientists via the EPSO conferences including support grants for junior and eastern European scientists (www.epsoweb.org/events/conferences), workshops (www.epsoweb.org/events/workshops), working groups (www.epsoweb.org/epso-working-groups-0) and as information broker via EPSO News and its website.

Since its creation in 2000, the organisation has become a strong advocate of plant research in Europe and an important voice articulating the contributions and needs of plant scientists at national and European levels and beyond.

EPSO's institutional membership is open to universities and research institutions conducting research in the field of plant science worldwide, while its personal membership is targeted at individuals interested in plant science, regardless of their nationality, profession, seniority or age. EPSO is looking forward to welcoming you as a member.

Contact

Karin Metzlaff (EPSO, epso@epsomail.org) or Jozef Van Asche (ISHS, info@ishs.org)

New Books, Websites

BOOK REVIEWS

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

STOLO, volume 3, Spain (in German). Uwe Schneider and Gert Gröning. 2011. Wernersche Verlagsgesellschaft, Worms am Rhein, Germany. 368p. ISBN 978-3-88462-301-5. € 29.80. www.wernersche.com

It is the worldwide largest directory for Spanish garden culture. Some 3.000 titles of professional articles and monographs, as well as garden culturally-meaningful pieces of evidence are listed in chapter IV. Numerous further pieces of evidence in general and special bibliographies, as well as a large number of pieces of evidence for libraries and other institutions which are meaningful for history and theory in garden culture, make this volume a much more comprehensive instrument for research than the usual bibliographies.

Some 4.000 titles have been referenced in bibliographies and book directories of garden cultural meaning. Some 2.500 titles are listed in bibliographies of neighboring disciplines, the Spanish-related percentage being considerably lower. More titles are listed in general bibliographies and regional and local bibliographies.

Additionally, the monographs and singular articles contain far reaching lists of special literature and archival sources and other sources which are commented upon as a rule. In total, the corpus proper of this bibliography, part IV "Handbücher und Überblickswerke zur Gartenkultur sowie Beiträge zu speziellen Fragen und Themen" (Manuals and survey works about garden culture as well as contributions to special topics and themes) lists close to 3.000 works. To the majority of these works we added a comment.

Also, the volume contains a list of significant libraries and further public and private institutions which are meaningful for garden culture and open space development. Besides printed works the volume also pays attention to internet sources.

As in the preceding volumes for Italy (2009) and Switzerland (2010), the bibliography is arranged according to 54 special descriptors. In chapter IV for example, you can find descriptors for Botanic Gardens, Zoological Gardens, Castle Gardens, etc. When descriptors show no entry this points to a deficit or a lack of research interest in certain areas. This enables identification of areas that require further research.

Authors' comments

NEW TITLES

Sanches Stuchi, Eduardo and Girardi, Eduardo Augusto. 2010. Use of Horticultural Practices in Citriculture to Survive *Huanglongbing*. Published by Embrapa Cassava & Fruits, Cruz das Almas, Bahia, Brazil. 68p. http://www.cnpmf.embrapa.br/publicacoes/documentos/documentos_189i.pdf

Yahia, E. (ed.). 2011. Postharvest Biology and Technology of Tropical and Subtropical Fruits. Volume 1: Fundamental Issues. Woodhead Publishing Series in Food Science, Technology and Nutrition No. 206. Woodhead Publishing Limited, Cambridge, UK. 584p. ISBN 978 1 84569 733 4 (hardback). £165.00 / US$280.00 / €200.00. www.woodheadpublishing.com

Yahia, E. (ed.). 2011. Postharvest Biology and Technology of Tropical and Subtropical Fruits. Volume 2: Açai to Citrus. Woodhead Publishing Series in Food Science, Technology and Nutrition No. 207. Woodhead Publishing Limited, Cambridge, UK. 584p. ISBN 978 1 84569 734 1 (hardback). £165.00 / US$280.00 / €200.00. www.woodheadpublishing.com

Yahia, E. (ed.). 2011. Postharvest Biology and Technology of Tropical and Subtropical Fruits. Volume 3: Cocona to Mango. Woodhead Publishing Series in Food Science, Technology and Nutrition No. 208. Woodhead Publishing Limited, Cambridge, UK. 624p. ISBN 978 1 84569 735 8 (hardback). £165.00 / US$280.00 / €200.00. www.woodheadpublishing.com

Yahia, E. (ed.). 2011. Postharvest Biology and Technology of Tropical and Subtropical Fruits. Volume 4: Mangosteen to White Sapote. Woodhead Publishing Series in Food Science, Technology and Nutrition No. 209. Woodhead Publishing Limited, Cambridge, UK. 568p. ISBN 978 0 85709 090 4 (hardback). £165.00 / US$280.00 / €200.00. www.woodheadpublishing.com

Courses and Meetings

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

Train-the-Trainer Workshop "Horticultural Business Management", 22 February 2012, Bangkok, Thailand. Train-the-Trainer workshops are designed to add value in assisting Symposium Conveners with their scientific program. Horticultural business management introduces participants to a variety of business management techniques. Info: Drs. David Aldous and Peter P. Oppenheim, Email: dealdous@gmail.com and peter.oppenheim@ymail.com

International Postgraduate Course Plant Breeding, January 2012 – October 2013, Wageningen, The Netherlands. Info: Janine Luten, Wageningen Business School, Wageningen University & Research Centre, Wageningen, The Netherlands, Phone: +31(0)317-483223, Fax: +31(0)317426547, Email: janine.luten@wur.nl, web: http://www.wbs.wur.nl/UK/Postacademic+education/International+postgraduate+course+Plant+Breeding/

14th International Peat Congress, 3-8 June 2012, Stockholm, Sweden. Info: Marie Kofod-Hansen, Congress Secretariat, Email: marie.kofod-hansen@torvforsk.se, Web: www.ipc2012.se

XII International Citrus Congress, 18-23 November 2012, Valencia, Spain. Info: Prof. Luis Navarro, President of the International Society of Citriculture and Chairman of the Congress, Email: lnavarro@ivia.es, and Technical Secretariat Citrus Congress 2012, Viajes El Corte Inglés S.A., División de Congresos, Convenciones e Incentivos, Gran Vía Fernando el Católico, no. 3 bajo, 46008 Valencia, Spain, Phone: +34.963.107.189, Fax: +34.963.411.046, Email: citruscongress2012@viajeseci.es, Web: www.citruscongress2012.org

Section Nuts and Mediterranean Climate Fruits

Second Balkan Symposium on Fruit Growing

Participants of the Symposium at Ramada Conference Centre, Pitesti.

The Second Balkan Symposium on Fruit Growing, "Fruit Quality, Health and Environment", represented an opportunity for scientists to exchange their research results obtained in national, bilateral and international programs, to debate the latest advances, and to create the premises for further common projects, aiming to achieve high quality horticultural crops, with more influence on human health and well-being.

More than 188 scientists, technicians, growers, students, advisors, nurserymen, post harvest specialists and politicians participated in the event. All are involved in temperate pome, stone and small fruit production, from Romania, Estonia, Latvia, France, Italy, Slovakia, Hungary, Bulgaria, Serbia, Macedonia, Moldavia, Cyprus, Greece, Turkey and Iran.

The Symposium program was presented over three days (September 5-7) at Ramada Conference Centre, Pitesti, and at the Research Institute for Fruit Growing (RIFG), Pitesti, Romania, and had the scientific endorsements of the Academy of Agriculture and Forestry Sciences "Gheorghe Ionescu Şişeşti", Romanian Academy, and the Romanian Horticulturists Society from Bucharest and the direct support of National Authority for Scientific Research, National Society of Fruit Growers, Arges County Council and Pitesti City Hall.

The meeting had a pronounced interdisciplinary character, all 176 scientific papers (32 oral, 144 poster) being organized into six topics:

- *Genetic resources, breeding and biotechnology* - moderated by Prof. Silviero Sansavini from University of Bologna, Dipartimento di Colture Arboree, Bologna, Italy – 45 papers;

For his merits and remarkable contribution to the progress of fruit growing science in the world, within a solemn ceremony, the Academy of Agriculture and Forestry Sciences "Gheorghe Ionescu Sisesti" from Bucharest, awarded Professor Emeritus Silviero Sansavini the title *Doctor Honoris Causa*.

Closure ceremony of the II Balkan Symposium on Fruit Growing (BSFG). From left to right: Drs. Damiano Avanzato, Mihail Coman - Convener of II BSFG and Dragan Milatovic - Convener of next III BSFG.

- *Fruit growing technologies: traditional, modern and organic* - moderated by Prof. Florin Stanica from the Horticulture Faculty of University of Agronomic Science and Veterinary Medicine, Bucharest, Romania – 40 papers;
- *Propagation and nursery management* - moderated by Prof. Karoly Hrotko from the Faculty of Horticultural Science of Corvinus University, Budapest, Hungary – 24 papers;
- *Diseases and pest management; virology* - moderated by Prof. Damiano Avanzato from

Apple and plum cvs. exhibition.

RIFG Pitesti apple field trial.

the Fruit Tree Research Centre (CRA-FRU), Rome, Italy – 21 papers;

- *Fruit quality, crop physiology and postharvest* - moderated by Francois Laurens from GenHort INRA Angers, France - 31 papers;
- *Other subjects* - moderated by Prof. Damiano Avanzato from the Fruit Tree Research Centre (CRA-FRU), Rome, Italy – 15 papers.

The Symposium program included an exhibition of new fruit cultivars with perspectives for extension into commercial fruit growing. At the end the participants took part in a technical tour in the fields and laboratories of RIFG Pitesti, to see the latest achievements and in a short visit to the Cultural Center "Bratianu" and the Viticulture and Fruit Growing Museum from Golesti.

The Symposium was a place for interesting debates on common issues, priorities, the role of the national and Balkanic fruit sector in the frame of European horticulture and for the assessment of collaboration opportunities in common projects.

University of Belgrade, Serbia, was elected to hold the next Balkan Symposium on Fruit Growing in 2015 with Mr. Dragan Milatovic as Convener.

Mihail Coman

Contact

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Join the Fascination of Plants Day, 18 May 2012

The first international "Fascination of Plants Day" will be launched under the umbrella of the European Plant Science Organisation (EPSO). The goal of this activity is to get as many people as possible around the world fascinated by plants and enthused about the importance of plant science for agriculture, in sustainably producing food, as well as for horticulture, forestry, and all of the non-food products such as paper, timber, chemicals, energy, and pharmaceuticals. The role of plants in environmental conservation will also be a key message.

Everybody is welcome to join this initiative! We invite you to organize for the 18th of May 2012 a fascinating activity related to plants attracting and interacting with the public. Just contact your National Coordinator (click on "countries" at www.plantday12.eu) or Jan Kellmann, the EPSO Coordinator (jkellmann@ice.mpg.de) to discuss and get access and guidelines for using the Fascination of Plants Day corporate design. We invite many others to join, ranging from schools to horticulture and anyone who feels to have a suited contribution to this initiative. Many plant science institutions, universities, botanical gardens, and museums, together with farmers and companies, have already announced that they will open their doors, with a variety of plant-based events for all the family. Also, the media are invited to join in, and scientists, farmers, politicians and industrialists will discuss with them and present the latest state-of-the-art research and breakthroughs in the plant science world and explore all of the new potential applications plant science can offer.

The Fascination of Plants Day will be backed up by a range of events in public spaces, theatres, cafes, central city squares and parks designed to get everyone thinking about plants.

Plants are fascinating. From one little seed, planted into soil, many green lives can arise - from small herbs up to big trees, or from ornamental

flowers to substantial crops, which all animals and mankind need to survive on this planet. Plant biologists estimate the total number of plant species roughly to be about 250,000. With this coordinated activity we hope to plant many virtual and constantly germinating seeds in the collective mind of the European and World Public that plant science is of critical significance to the social and environmental landscape now and into the future.

Contact

Jan Kellmann (coordinator FoPD, jkellmann@ice.mpg.de) or Karin Metzlaff (EPSO Executive Director, epso@epsomail.org)

Seventh Int'l Congress on Cactus Pear and Cochineal and Seventh General Meeting of the FAO-ICARDA Int'l Technical Cooperation Network on Cactus Pear and Cochineal

Group photo of the Congress participants.

The VIIth International Congress on Cactus Pear and Cochineal and the VIIth General Meeting of the FAO-ICARDA International Technical Cooperation Network on Cactus Pear and Cochineal were held in Agadir, Morocco, October 17-22, 2010.

The Congress was opened by the Director General INRA Morocco on behalf of the Minister of Agriculture and Fisheries. The opening session included a contribution from Moroccan authorities highlighting the importance of cactus crop to rural development and income generation and its contribution to poor rural livelihoods in marginal areas. Recent development of cactus crop in Morocco could not have been achieved without the strong decision maker support at local and national levels and this support is illustrated by the on-going creation of a "Cactopole" gathering all cactus "filière" from production to marketing. During the opening session, special recognition was expressed to Dr. Enrique Arias, former FAO/AGPC senior Officer in charge of the cactus network, for his tireless support during the last 15 years.

Visit to the INRA Experimental Station in Agadir where an excellent cactus collection station has been recently established with the help of the FAO-ICARDA cactus network.

Preparing sample for analysis (left) and fruits sorting and packaging (right).

The Congress was attended by 160 participants from 27 countries with significant participation from Latin America (Argentina, Chile, Brazil, Mexico), South Africa, Italy, and North Africa (Morocco, Tunisia). The Congress included 6 sessions, one field day, and the general meeting of the International Committee of the Cactusnet. Scientific sessions covered the following topics: Genetic Resources, Biology and Biotechnology; Fruit Production; Medicinal Uses; Post-harvest and Agro-industries; Animal Feeding; Cochineal; and Pests and Diseases. A keynote paper highlighting major recent findings introduced each session.

122 contributions were presented and gathered in a "book of abstracts" including invited keynote papers, 45 oral presentations and 70 posters. Exciting recent findings, especially in the fields of better knowledge of cactus physiology and carbon sequestration, active molecules for medicinal uses, and livestock feeding, were thoroughly discussed.

A field day and a two-day post congress tour were organized and supported by local organizers. The field day tour included a visit to the Province of "Guelmim", South Agadir. The Moroccan Agency of the South Development with the support of UNDP and national partners, launched an ambitious program with a budget of around US$4 million in 2008 aiming to promote cactus crop and its uses. The program created a cooperative in the oasis of 'Tighmert' with six young rural women with university degrees, for which a building was conceived, constructed and equipped to produce jam, nopalitos, cosmetic seed oil and juice. The nopalitos and the oil have been certified "organic". This successful initiative is being upscaled to create other similar cooperatives in the region.

During the Congress, the FAO-ICARDA Cactus Network International Committee held its meeting on October 20 and 21 chaired by Dr. Alison Hodder, AGPC/AFO senior officer, and Dr. Ali Nefzaoui, Network General Coordinator. During this meeting the committee discussed the following items: (i) review the activities and achievements of each regional grouping and the network technical working groups; (ii) review the coordination responsibilities with the view to filling gaps and re-energizing groups that have been less active; (iii) review the general coordination responsibility; (iv) exchange ideas and build agreements on future work plans for the respective regional groups and technical working groups; (v) examine needs and options for raising resources to strengthen the work of the network prospects and consider proposals for hosting the VIIIth International Congress on Cactus Pear and Cochineal.

Major outcomes are (i) the appointment of the new International Committee members: Ali Nefzaoui (General Coordinator), Liberato Portillo (Deputy General Coordinator and Coordinator of Cochineal Working Group), Candelario Mondragon (Coordinator of Genetic Resources Working Group), Monica Nazareno (Coordinator of Medicinal and Cosmetic Uses Working Group), Carmen Saenz (Coordinator of Post-Harvest and Agro-industries Working Group), Jesus Fuentes (Coordinator North America Region), Innocenza Chessa (Coordinator of Mediterranean Basin Region), P.R. Megwal (Coordinator of South East Asia Region), Jose Dubeux (Coordinator of South America Region), Hichem Ben Salem (Coordinator of Forage, Rangeland and Environmental Protection Working Group), Judith Ochoa (Coordinator of Fruit Production Working Group), Herman Fouché (Coordinator of Sub-Saharan Africa Region); (ii) Election of Prof. Innocenza Chessa as the new Chair of the ISHS Working Group on Cactus Pear and Cochineal; (iii) the VIII International Congress on Cactus Pear and Cochineal will be held in Palermo, Italy, in 2013 to coincide with and mark the 20th anniversary of CactusNet (Conveners: Drs Paolo Inglese and Innocenza Chessa).

Ali Nefzaoui

Some participants posing in front of exterior poster session.

Contact

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First Int'l Workshop on Floral Biology and S-Incompatibility in Fruit Species

Participants of the Workshop.

The First International Workshop on Floral Biology and Self-Incompatibility in Fruit Species was held in San Michele all'Adige and Bologna, Italy, on June 22-25, 2011. Seventy participants from 11 countries attended the workshop that was organised under the patronage of the International Society for Horticultural Science (ISHS). The main conference location, the Foundation E. Mach at San Michele all'Adige, is located close to the beautiful Alps. The second location was the Department of Fruit Trees and Woody Plant Science Experimental Farm of Bologna University, where a technical visit to the field plots was organised. The two Conveners, Prof. Silviero Sansavini (Department of Fruit Trees and Woody Plant Science of Bologna) and Prof. Francesco Salamini (Istituto San Michele All'Adige, IASMA) designed the scientific program with the help of Luca Dondini (scientific secretariat) and Alessandro Gretter (workshop secretariat). Two sessions were planned: a) the first one focused on the molecular basis of phase transition and flower development; b) the second one discussed the update achievements on S-locus structures and relative determinants in pome, stone and other fruit tree species.

The Workshop opening lecture by Riccardo Velasco evidenced the importance of genomics as a tool for genetics and breeding in fruit tree species. This talk clarified how genomics can support research aimed at characterising specific chromosome regions and structure of loci.

The first Workshop session was dedicated to phase transition and flower development and it was coordinated by Prof. Angelo Ramina of Padua University. The first talk by Fabio Fornara (University of Milan, Italy) reported on controlling flowering time using day length in the model species *Arabidopsis*. Then Henryk Flachowsky (Pillnitz Dresden Institute for Genetic and Breeding, Germany) reported the importance of genetic engineering applied to early flowering in apple breeding. Paul Boss (CSIRO, Australia) discussed dwarfing and floral induction in *Vitis vinifera* and Alessandro Botton (University of Padua, Italy) presented the "Comparative genomics for identifying flower organ identity genes in peach and olive". The first session was closed by Moshe Flaishman (The Volcani Center, Israel) who analysed the effects of global warming on flower development and fruit set in deciduous fruit tree species. This talk also highlighted the importance of tools as the GM early flowering plants for breeding.

The second session addressed "Self-Incompatibility" and was introduced by Prof. Silviero Sansavini who presented the main topics of the session. Luca Dondini (University of Bologna, Italy) introduced the key-points of gametophytic incompatibility in pome and stone fruits with particular attention to the genes controlling S-locus function (S determinants, mutations internal or external to the S-locus). After this overview, Martin Goldway (MIGAL, Galilee Technological Center, Israel) analysed several aspects of the self-incompatibility fertilization system in *Rosaceae*, merging the perspectives of horticulture and genetics. Gianni Barcaccia (University of Padua, Italy) analysed more in depth the olive model system introducing a new hypothesis on the S-locus genes controlling pollen-pistil interaction. The session continued with a detailed explanation of the S-locus structure in apple (by Hidenori Sassa, Graduate School of Horticulture, Chiba University, Japan) and its structural and functional conservation among the *Pyrinae* species (by Paolo De Franceschi, University of Bologna, Italy). The *Prunus* S-locus structure was very well dissected by Ryutaro Tao (Kyoto University, Japan) who described S-locus mutations linked with self-compatibility in stone fruits. Attila Hegedus (Corvinus University of Budapest, Hungary) highlighted the importance of S-genotyping on stone fruits and proposed the re-numbering of the apricot S-alleles analogously to pear to create order in the public databases for these genes. The first Workshop day was closed by Rafael Socias i Company (CITA, Zaragoza, Spain) who described the double expression of *Sf* allele in almond and the presence of an active and an inactive form of this haplotype. At the end of this session a poster session was planned presenting five very interesting research approaches: a) "Transcript levels of genes involved in floral transition in apple trees and its relation with biennial bearing" by Baptiste Guitton (INRA Montpellier, France); b) "Genetic basis of fruitlet abscission in apple" by Sergi Ferrero (University of Milan, Italy); c) "Isolation of a pollen-expressed actin homologous protein as a possible interacter with S-RNase in *Prunus avium*" by Daiki Matsumoto and Ryutaro Tao (Kyoto University, Japan); d) "The study of self-(in)compatibility in CEBAS-CSIC almond breeding programme" by Encarnación Ortega et al. (CEBAS-CSIC, Murcia, Spain); e) "Syrian pear (*Pyrus syriaca*) as a pollinator for European pear (*Pyrus communis*) cultivars" by Annat Zisovich (MIGAL, Galilee Technological Center, Israel).

The second session was coordinated by Martin Goldway. The first speaker, Marco Caruso (University of Catania, Italy) presented new insights into the molecular basis of self-incompatibility in *Citrus*. The second and third speakers of this session, Donatella Serafini Fracassini and Stefano Del Duca (University of Bologna, Italy) presented their results on post-trans-

lational modification by transglutaminase of proteins involved in incompatibility and the role of pollen cytoskeleton in self-incompatibility. This research work was conducted in collaboration with Giampiero Cai (University of Siena, Italy). The session was closed by Mark Davey (Catholic University of Leuven, Belgium) who presented the possibilities offered by genetic engineering in self-incompatibility breakdown by the gene silencing approach. This presentation once again highlighted the importance of GM approaches for breeding and integrated well with reports by Henryk Flachowsky and Moshe Flaishman.

After the two sessions a General Assembly chaired by Silviero Sansavini was planned in which two main topics were discussed: a) the constitution of a new Working Group within ISHS, a proposal that was approved by all the attendants, and b) the organisation of the Second International Workshop on Floral Biology and S-Incompatibility in Fruit Species. Silviero Sansavini is in charge of the constitution of the new ISHS Working Group and the second edition of the Workshop will be organised by Viola Hanke (Convener) and Henryk Flachowsky in Dresden, Germany (in the summer of 2015). All workshop attendants had the opportunity to visit the genomic and the metabolomic platforms by IASMA in San Michele.

On the last Workshop day the attendants moved to Bologna for a technical visit of the Bologna University Experimental Farm. Afterwards everyone spent a couple of hours on a tourist visit of Bologna.

In conclusion, this Workshop represented a first forum for discussion and exchange of ideas between younger generations of researchers and more experienced and established scientists about floral biology and self-incompatibility in fruit tree species. The results obtained by different institutions were merged and new strategies for breeding were defined, aimed at releasing new self-compatible genotypes to producers. The workshop proceedings will be published as a special *Acta Horticulturae* volume.

Group of Workshop participants at the Bologna University experimental farm during the technical visit.

Luca Dondini and Paolo De Franceschi

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Section Tropical and Subtropical Fruits

Global Conference on Augmenting Production and Utilization of Mango: Biotic and Abiotic Stresses

Mango (*Mangifera indica* L.), grown in India for more than four thousand years, has been a source of inspiration across the globe and is currently grown in over 90 countries. In the last two decades, accelerated demand for mango fruit and its products has occurred. The fruit's delicious taste, flavor, nutritive and nutraceutical values have led to its commercialization globally. In the process of commercialization, different constraints of biotic and abiotic stresses have been experienced and, therefore, there was a need for a global dialogue to share knowledge and establish partnerships. Accordingly, a four-day Global Conference on "Augmenting Production and Utilization of Mango: Biotic and Abiotic Stresses" was organized by the Society for Development of Subtropical Horticulture, Central Institute for Subtropical Horticulture, Lucknow, and Confederation of Horticulture Association of India, New Delhi, in partnership with the International Society for Horticultural Science (ISHS) from 21-24th June, 2011 at Lucknow, India. The theme of the conference was "Mango for Health Care and Livelihood". Over 350 persons representing scientists, farmers, policy planners and students from India and abroad attended the conference. The conference had the representation of many countries including Thailand, Indonesia, Australia, Kenya, USA, South Africa, Oman, Egypt, Spain and Germany. During the conference, a 'Mango Diversity Show' was also organized, in which 800 varieties/clones and hybrids from across the country, including farmers' varieties, were displayed. An exhibition, showcasing the inputs and technological innovations, was also organized. The technical deliberations of the conference were organized in nine sessions, including the inaugural and valedictory sessions as per the following details:

- **Inaugural Session; Mango Diversity Show; Technology/Inputs Exhibition**

  Plenary Lecture: Mango variability, conservation and utilization in peninsular India - Dr. S.B. Dandin, India

Dr. H. Ravishankar, Organizing Secretary of the Global Conference, delivering welcome address.

- **Session I: Genetic Diversity and its Utilization**

  Plenary Lectures:

  1. Mango reproductive physiology challenges and opportunities - Dr. Thomas L. Davenport, USA
  2. Mango, historical perspectives and future prospects - Dr. H.P. Singh, India
  3. Current situation and future prospects of worldwide mango production and markets - Dr. Víctor Galán Saúco, Spain
- **Session II: Genomics and Biotechnological Tools: Breeding for Biotic and Abiotic Stresses and Qualities**
- **Session III: Dynamics of Production Technologies and Quality Planting Materials**
- **Session IV: Plant Health Management**
- **Session V: Post-harvest Management System including Supply Chain Management**
- **Session VI: Open Session (trade, policy, institutional support, etc.)**
- **Session VII: Valedictory Session (presentation of recommendations of different sessions, discussion, Chairman's remarks)**
- **Field Visit (visit to Central Institute for Subtropical Horticulture, Lucknow and field of mango growers nearby) and interaction with growers**

RECOMMENDATIONS OF THE GLOBAL CONFERENCE

1. The group recognized that mango is an important fruit, with India contributing more than 49% to the world production and playing a very significant role in developing strategies to address many of the constraints that are identified in production and utilization.
2. There is a need to work in partnership mode to achieve the maximum outputs from the investments in research.
3. As mango provides livelihood to millions of people across the globe and is important with respect to nutrition and nutraceutical values, concerted efforts are necessary to create awareness of mango. Thus profiling the different nutraceutical values including its impact on human health needs to be carried out.
4. Since seedlings have been the major contributors to the current varieties, core collections and conservation of existing diversity require priority attention for effective utilization. Work being done under the GEF-UNEP project on tropical fruits like mango should be integrated effectively to institutional mechanisms for achieving goals.
5. Characterization of germplasm, understanding resilience under different agro climatic situations and development of a database are essential to address the challenges posed by climate variables.
6. Breeding programmes should be more targeted to understanding the donor sources of desirable traits, and chief transfer mechanisms should be intensified by production of large seedling populations for further selection. Biotechnological tools are to be effectively used for speedier outputs from conventional breeding programmes.
7. Since mango is the most important fruit crop of India, the need to employ genomics, both structural and functional, to understand the variations is essential. Regeneration protocols need further research so that the transgenic approach can become a reality.
8. Understanding of reproductive biology resulting from work done in India and elsewhere needs to be prioritized and customized for adoption by farmers. This information may include the understanding of hormonal, nutritional and water relations to effectively regulate flowering and fruiting.
9. Leaf nutrient standards have been developed but they have not been refined to target maximum yields. The standards developed must be refined to enhance nutrient productivity. Water relations of mango in reference to climate and varieties are less understood and assume critical significance to produce mango with less water.
10. Differential management of nutrients at vegetative and reproductive phases, and during fruit development and fruit maturity, is essential to produce more with fewer nutrients. Research on these lines requires

Display of more than 800 mango varieties and clones in All India Mango Diversity Show and Exhibition during four-day Global Conference.

major emphasis on the balanced use of nutrients as per phenological needs of the crop.

11. Mango production systems provide centre space, both initially and later following rejuvenation/top working, and its effective utilization enhances returns. Understanding of available light at different growth phases is essential to utilize the space for designed crops.
12. Mango-based farming systems that ensure a better income for the farmers as well as reducing risks, needs research emphasis.
13. Rejuvenation technologies have both successes and failures. Therefore, the technology needs to be revisited for refinement to achieve the targeted goals.
14. Abiotic stresses, especially salinity and fluctuating temperatures and humidity, need to be better understood for developing technologies to make mango more productive.

Dr. H.P. Singh, Deputy Director General (Horticulture), Chairman, International Organizing Committee, addressing the Global Conference (left); Dr. Víctor Galán Saúco, Chair ISHS Mango Working Group, Spain delivering Plenary Lecture on "Current Situation and Future Prospects of Worldwide Mango Production and Market" during Technical Session II (right).

Field visit to Central Institute for Subtropical Horticulture, Rehmankhera, Lucknow, by participating delegates of the Global Conference.

15. Technologies for biotic stress management that have been developed from time to time, need refinement to suit current needs, especially to produce safe fruits with minimum use of inputs like pesticides. This may require development of forecasting models, diagnostic approaches for the decision support system to target effective plant health management.
16. The post-harvest management system has to be visualized together with the pre-harvest management system. Traditional knowledge, such as harvesting fruits before dawn, must be matched with new and novel techniques to enhance shelf life, uniformity in ripening and maintenance of the flavor of fruits.
17. Maturity standards developed for different varieties need to be revisited in the scenario of climate changes to get better fruit quality.
18. Storage studies and use of CA storage and high-pressure technology need to be explored and further standardized. The need for diversification of mango products to meet the needs of the consumer segment is necessary.
19. Market information systems utilizing developments in the area of Information Technology need further strengthening and integration to improve trade and reduce the gap between farm gate price and consumer price.
20. In addition to mango fruits, work is required on the utilization of different non-timber parts of the mango tree to bring more income from mango orchards to the farmer.
21. Environmental services provided by the mango crop need critical appraisal in order to harness the benefits of carbon credits.

H.P. Singh and H. Ravishankar

View of delegates participating in the Global Conference.

Contact

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Seventh Int'l Pineapple Symposium

The 7th International Pineapple Symposium was held from July 13 to 15, 2010 at the beautiful Persada Johor International Convention Center, Johor, Malaysia, near the heart of Malaysia's pineapple growing area. The Symposium was supported by Malaysian Agricultural Research and Development Institute (MARDI), Malaysian Pineapple Industrial Board, Department of Agriculture Malaysia, Federal Agricultural Marketing Authority, The International Tropical Fruits Network and Tourism Malaysia and was held under the auspices of the International Society for Horticultural Science. The theme of the symposium was "Global Pineapple Industry – The Way Forward." There were 421 registered participants from 22 countries, certainly making it one of the largest pineapple symposiums held to date.

There were 32 oral presentations and 115 posters and the papers were organized into six topics, namely (abstract numbers in parentheses); Industry and Trade (4), Biotechnology and Breeding (15), Plant Physiology and Cultural Practices (32), Pest and Disease Management (18), Postharvest Handling and Product Development (40) and Consumer and Marketing (6). The last session of the symposium was a panel discussion led by Ying Kwok (YK) Chan on the subject "Global pineapple industry: The way forward".

After the opening ceremonies, which included

Participants attending the 7th International Pineapple Symposium in the Johor Convention Center (MARDI photo).

a welcome from the Director General of MARDI and an official opening by the Minister of Agriculture, speakers at the first session provided overviews of the pineapple industries of Malaysia, Philippines, Chinese Taipei, Thailand and North East India. The oral presentations were supplemented by poster presentations on the pineapple industry in China and in the Commonwealth of the Northern Mariana Islands. The presenters highlighted interesting contrasts between the smaller-scale operations in the foregoing countries and the very large and highly integrated operations in Mindanao, Philippines and Sumatra, Indonesia. Growers in the Philippines produce for the fresh and processed market, while production in Indonesia is destined primarily for processing. In Thailand, most of the fruit is produced by literally thousands of smallholders who supply about 30 canneries and 95% of the country's production is processed. Presenters from Indonesia and Malaysia indicated their governments were trying to help small-scale farmers obtain an increased share of the market, an issue that was explored in more detail at a panel discussion at the end of the symposium (see below). There was general optimism about the potential for growing the industry in most countries but the prospects and problems varied with the country. Small holder production in North East India is unique because the fruit is produced entirely by small holders and production techniques are entirely organic, which it was believed offered good opportunities in the high-value organic niche.

With 15 papers included in the Biotechnology and Breeding section, the breadth of coverage in the oral and poster sessions ranged from the molecular (screening pineapple bacterial endophytes for cytokinin-like compounds; differential expression of microRNAs during fruit ripening) to the whole plant (pineapple with landscaping potential; a new pineapple cultivar) and everything in between. Brazilian researchers continue to explore the genetic diversity of their large germplasm collection, while work in Thailand produced a new hybrid with herbicide resistance based on a genetically transformed parent. If the amount of work being done to engineer cultivars resistant to important diseases was disappointing, so is the public acceptance of such cultivars. Permanent solutions to the major pest and disease problems of pineapple and their respective reductions in cost to human health, the environment and to producers, remain relatively unexplored because the public has been deceived about the risks involved.

Topic coverage by the 32 papers in the Plant Physiology and Cultural Practices section was broad but generally quite site specific. Among those that bring a new approach to old problems was new research from Reunion that indicates it is possible to use a heat unit model to help manage pineapple crops in diverse environments. While the model appears to be more relevant to cooler subtropical environments, it could speed the development of cultural practices tailored to new cultivars and add needed sophistication to the management of small holder pineapple farms in the cooler regions of the tropics. The wide-spread adoption of the 'MD-2' cultivar brought with it the problem of managing natural flowering. Until a genetically engineered solution becomes acceptable, three papers reported on the continued development

Malaysian hosts M.M. Selamat (1st row, 2nd from left), T.M. Tengku Ab Malik (1st row, 6th from left), M.N. Latifah (1st row, 2nd from right) and H. Abdullah (2nd row, 5th from left). Discussion panel members include D.P. Bartholomew (1st row, 5th from left), D.H. Reinhardt, Chair, Pineapple Working Group (1st row, 6th from right), A.P. de Matos, and G. Sanewski, co-host, 8th International Pineapple Symposium (1st row, 3rd from right) with some of the local and international participants at the 7th International Pineapple Symposium, Johor, Malaysia (DPB photo).

and success of aviglycine in controlling this important problem. While a costly solution, cost-benefit analyses show that when used successfully, the benefits in both mother plant crop and ratoon exceed the costs.

The keynote presentation in the Pest and Disease Management section highlighted integrated pest management as the best and most economical solution to the myriad of problems confronting pineapple growers. However, the session was dominated, nine of 18, by papers dealing with various aspects of mealybug wilt. The etiology of this complex disease, typically ranked first or second in importance in areas where pineapple is grown, is still being worked out. With more scientists bringing new tools to bear on the detection of the viruses involved in disease development, it seems likely that all of the characteristics of the disease will soon be known. The next problem will be to develop cost-effective solutions for its control as the array of pesticides available to control it continues to dwindle. Perhaps the "way forward" for this problem will be via a biotechnology approach.

A highlight of the meeting for those interested in what happens to pineapple once it is harvested was the rich coverage of such issues in the Postharvest Handling and Product Development section. The papers highlighted the wide-ranging expertise of Malaysian scientists in this area, evident from the fact that 37 of 40 papers were by Malaysian authors. Of particular note was the broad focus on product development with products ranging from vacuum fried pineapple chips to utilization of waste products recovered during fruit processing in high fiber products such as juice and cookies and in the production of organic dyes.

The country reports mentioned above indicated plans were to continue the expansion of pineapple plantings for fresh fruit production in tropical Asian countries. In contrast to such optimism, the lead paper in the Consumer and Marketing section raised concerns about the decreasing quality and decreasing prices of 'MD-2' fruits in the European market. But perhaps the Asian market is not yet saturated with high quality pineapple fruits. Related to fruit quality, one of the four papers in the section dealt with assessing consumer preferences for fresh pineapple. It was reported that consumers prefer 'MD-2' fruits over other cultivars currently being grown in Malaysia and the authors recommended that the 'MD-2' cultivar be used as the benchmark when selecting hybrids in a pineapple fresh fruit breeding program.

The last session of the meeting was a panel discussion that focused on the theme of the symposium, 'The Global Pineapple Industry - The Way Forward'. Panel members were: Y.K. Chan (Facilitator), D.P. Bartholomew, D.H. Reinhardt, A.P. de Matos, G. Sanewski, H. Abdullah and Y. Ahmad. Dr. Chan provided the following summary of the discussion.

The Global Pineapple Industry provides equal opportunities for all countries/players to grow, market and trade in fresh pineapple on an international level playing field. Is this realistic or plain idealism based on naivety?

Equipment suitable for mechanizing operations on mineral soil on Malaysian pineapple farms of 40 ha and larger: A. Tractor-mounted two-row transplanting machine with two operator stations and the planting material bin, B. Inter-row cultivator-cum-fertilizer applicator, C. 12-m boom sprayer for general field spraying of herbicides, insecticides and hormones for forced induction of flowering, D. 12-m boom harvester with removable fruit bin to facilitate harvesting of fruit from the farm road side (MARDI photos).

Tengku Ab. Malik Bin Tengku Maamun, Convener of the IPS2010 gives special gift to Prof. Duane Bartholomew during the Gala dinner (MARDI photo).

This certainly is not happening now as multinational giants like Dole, Del Monte and Chiquita dominate the global pineapple industry. Likened to a poker game with the big players having a mountain of chips, where and how would a new player with a couple of chips break in?

The situation is made worse by some of the pressing issues faced by the fresh produce industry today:

1. GAP (Good Agricultural Practices) certification for traceability on food safety, environmental protection and sustainability and worker's well-being. This is all good, but it marginalizes the small producers who can ill-afford such expensive certification.
2. Sanitary and Phytosanitary (SPS) restrictions imposed by many importing countries are sometimes viewed as trade barriers that have the effect of precluding the small growers from exporting their fruits because SPS treatments are done with expensive equipment that require specialized technical expertise to operate.
3. Food Miles/Carbon Footprints are yet another constraint for growers to export their fresh produce. Big players have invested huge sums to develop technology for export by sea reefers that have reduced carbon footprint, but the average producer does not have the technology, equipment or volume to go by this means.
4. In the past, germplasm accessions were freely exchanged, but today they are severely restricted by Intellectual Property (IP), Variety Protection, Breeders' Rights, patents and Access and Benefits Sharing (ABS) agreements. In the days to come, small growers will have no opportunity to benefit from new cultivars developed by research organizations without paying hefty royalties.
5. The advent of 'MD-2' dramatically changed the fresh fruit pineapple market, a market currently dominated by multinationals that grow the hybrid in low-cost countries like Costa Rica and the Philippines. To obtain

market share, the smaller players are rapidly changing over to this cultivar. The result is a concern not only of a glut of 'MD-2', but more importantly, continuous monoclonal culture will lead to loss of diversity resulting in genetic vulnerability.

In 'Going Forward', it is unrealistic to expect the global pineapple industry to change very much in the coming years. It will continue to be dominated by the multinational giants. The role of small growers can be increased but they need the help of the bigger "boys" in fulfilling their corporate social responsibility. There is some evidence of this already happening when contract farmers are roped in to produce for the multinationals such as Dole in the Philippines. There is also evidence that the government can help in integration of the small farms into economically viable and competitive enterprises. The Farm Consortiums reported in Indonesia and the Technology Management initiatives in NE India are cases in point.

On the last day of the meeting, the organizers recognized and presented small gifts to the speakers. Prof. Reinhardt, Chair, ISHS Pineapple Working Group announced that Australia would host the next, the 8th, International Pineapple Symposium in 2014. At the gala dinner held in the evening, Prof. Duane Bartholomew was recognized for his contributions to the world pineapple community and was presented with a special gift by Convener Tengku Ab. Malik Bin Tengku Maamun.

The meeting closed with a one-day field trip to Johor Tropical Products (JCorp) packaging center and to the Malaysian Pineapple Industry Board Pineapple Technology Development Center. Featured at JCorp was the packing plant operation and right-sized equipment for the smaller farms typical of areas of mineral soils in Malaysia where pineapple is grown.

Next was a visit to the Malaysian Pineapple Industry Board (MPIB) experimental farm, which is located in Alor Bukit, Pontian, Johor. Malaysia is the only country in the world with large-scale pineapple cultivation on peat soil. The farm covers approximately 40 hectares and has samples of most of the pineapple cultivars found in the country. Visitors had a chance to see and taste the pineapple accessions 'Josapine', 'Maspine', 'Moris', and 'N36' and were given a brief synopsis of each commercial cultivar developed by MARDI. For many foreign visitors it was the first time they had a chance to see well-grown pineapple on peat soil.

The last stop of the day was at MARDI's Technology Development Center. This government run and operated facility was established to create and develop new products and uses for pineapple. This facility has the capabilities to produce juice concentrate, dehydrated slices, candied pine pieces, pineapple chips, sauces and salsas. Newly developed technologies are later turned over to private companies for large scale productions.

D.P. Bartholomew, T.M. Tengku Ab Malik, H. Abdullah, Y.K. Chan and M.N. Latifah

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Second Int'l Symposium on Underutilised Plant Species (CFF SYMPOSIUM 2011)

Section Tropical and Subtropical Fruits – Commission Plant Genetic Resources

The 2nd International Symposium on Underutilised Plant Species entitled 'Crops for the Future – Beyond Food Security' was held on 27 June – 1 July 2011 in Kuala Lumpur, Malaysia. The Symposium was organised by the University of Nottingham Malaysia Campus under the auspices of the International Society for Horticultural Science (ISHS) with support from the ISHS Working Group on Underutilized Plant Genetic Resources, the ISHS Commission on Plant Genetic Resources and the ISHS Section on Tropical and Subtropical Fruits. The event was co-convened and supported by Crops for the Future, Bioversity International, the Malaysian Agricultural Research and Development Institute (MARDI), Boustead Holdings Berhad, Food and Agriculture Organisation of the United Nations, Kirkhouse Trust, British Council and Forum for Agricultural Research in Africa.

Over 240 participants from over 45 countries attended the four-day event held in Kuala Lumpur to mark the hosting by Malaysia of the world `Crops for the Future' (CFF) organisation with a global mandate to investigate promising underutilised food and non-food crops. Yang Amat Berhormat Dato' Sri Mohd Najib Bin Tun Haji Abdul Razak, the Prime Minister of Malaysia, officiated the opening ceremony of this symposium as well as the official launching of the Crops for the Future Research Centre (CFFRC). CFFRC is a joint venture between the Government of Malaysia and the University of Nottingham Malaysia Campus, and from its global base in Malaysia, CFFRC will establish world-class research on promising underutilised crops.

Delegates including high level keynote speakers contributed to oral presentations, posters and technical tours. Their deliberations culminated in the identification of priorities for the future development of underutilised plant species and for building the critical mass of researchers and end-users across food and non-food crops.

SYMPOSIUM OPENING

On day one, the first morning session was chaired by Professor Ian Pashby, Provost and CEO, University of Nottingham Malaysia Campus, who expressed a cordial welcome to all the delegates. The welcome remarks from the chair were followed by brief welcome

Yang Amat Berhormat Dato' Sri Mohd Najib Bin Tun Haji Abdul Razak, the Prime Minister of Malaysia, extending a warm welcome to symposium participants during the official opening ceremony. He also officially launched Crops for the Future Research Centre.

Symposium participants outside the main symposium hall at the Royale Chulan, Kuala Lumpur, Malaysia.

remarks by Dr. Festo Massawe, Symposium Convener, and Dr. Hannah Jaenicke, Chair of ISHS Commission on Plant Genetic Resources. Professor Sayed Azam-Ali, Vice-Provost for Research & Knowledge Transfer, University of Nottingham Malaysia Campus (now CEO, CFFRC), chaired the second session, which included three exciting keynote addresses. Dr. Hannah Jaenicke (Consultant in Project Management and Evaluation: Agrobiodiversity, Marketing and Rural Development; also Chair ISHS Commission Plant Genetic Resources) presented an interesting paper on research and development of underutilised plant species: crops for the future - beyond food security. In her paper she pointed out a number of key ingredients necessary for research and development of underutilised plant species. Having convened the 1st International Symposium on Underutilised Plant Species held in Arusha, Tanzania in 2008, Dr. Jaenicke was well placed to provide the link between the two symposia. The second paper was presented by Dr. Mohd Norowi bin Hamid on behalf of Datuk Dr. Shukor Abd Rahman, Director General of MARDI. In his paper Datuk Dr. Shukor highlighted the current and future strategies and practices in the conservation and sustainable utilisation of underutilised fruit genetic resources in Malaysia. The final paper of the morning session was expertly delivered by Professor Felix Dakora (South African Research Chair in Agrochemurgy and Plant Symbioses). In his paper Professor Dakora addressed the overall contribution of underutilised leguminous species to human and environmental health and, in particular, the contribution of these species to biological nitrogen fixation.

The afternoon of day one saw the official opening address and the launching of CFFRC by Yang Amat Berhormat Dato' Sri Mohd Najib Bin Tun Haji Abdul Razak, the Prime Minister of Malaysia, attended by over 400 delegates and invited guests. The many distinguished speakers at this flagship meeting included a World Food Prize laureate, Professor M.S. Swaminathan, Chairman of the M.S. Swaminathan Research Foundation, who shared the platform with Prime Minister Najib. In his address Prime Minster Najib extended a very warm welcome to all the guests and participants. He then talked about progress made with Millennium Development Goals and especially the need for strong government leadership, effective policies and institutional capacities to address issues related to Food Security.

Following the grand official opening were five further keynote addresses, chaired by Professor Jeremy Roberts, Head of the School of Biosciences, University of Nottingham, and expertly presented by Professor M.S. Swaminathan (World Food Prize laureate, Chairman of the M.S. Swaminathan Research Foundation), Dr. Kwesi Atta-Krah (Deputy Director General, Bioversity International), Dr. Michael Hermann (Global Coordinator, Crops for the Future), Dr. Jacqueline d'Arros Hughes (Deputy Director General, The World Vegetable Centre), and Professor Peter J. Gregory (Chief Executive, East Malling Research and Professor of Global Food Security, University of Reading). Professor Swaminathan talked about green revolution in underutilised crops: pathway to sustainable food security in an era of climate change, while Dr. Kwesi Atta-Krah addressed the issue of agricultural biodiversity for nutrition and livelihoods. This was followed by a paper by Dr. Michael Hermann on agricultural diversification and the role of collaborative action. Dr. Jacqueline d'Arros Hughes spoke passionately about the role of minor and underutilised vegetables in assuring food and nutritional security. The last paper of the first day was presented by Professor Gregory on the challenge of sustainable crop production. Despite a long day of presentations and discussions, participants were still able to find time to glance through the posters on display.

SCIENTIFIC PROGRAMME

The presentations followed five thematic areas.

1. Nutritional, processing and end-user values
2. Economic and marketing potential – building value chains
3. Physiology, agronomy and agro-ecological potential
4. Biotechnology, breeding and seed systems
5. Strategic approaches for research and development

Nutritional, Processing and End-User Values

This session discussed the role of underutilised plant species in contributing to global food security and nutrition. Most papers emphasised

the importance of documenting indigenous and scientific knowledge on the nutritional and processing value of species. A number of papers also discussed issues related to product development and approaches for developing novel products and uses. Post-harvest and processing issues also featured in this theme. R&D in post-harvest was considered critical to preserve the species produce before processing or before they reach the market for fresh consumption, as most of the species are perishable. Processing and product development of underutilised plant species should consider the effects of the processes on the nutritional elements. It was stressed therefore that the retention of nutrient content is important, as it was evident that processing influenced or decreased the level of nutrients such as vitamin A, certain minerals and antioxidant compounds.

In theme 1 it was clear that initiatives from local agencies are needed to establish connection, facilitate capacity building, as well as R&D for product commercialisation. Local and international linkage has been initiated by several agencies including CFF. In the near future, CFFRC will add to the effort by organising local, regional and international collaborations.

Some members of the secretariat committee soon after the symposium dinner hosted by Boustead Holdings Berhad at the Royale Chulan, Kuala Lumpur, Malaysia.

Economic and Marketing Potential - Building Value Chains

Underutilised plant species have local or regional importance but generally lack international recognition. Papers in this theme presented a diverse view on issues and covered different commodities including fruits, vegetables, roots and tubers, grains/grasses, and palms. Several studies on developing/strengthening markets to provide additional income opportunities, as well as problems to (further) commercialisation, featured in presentations. Overall, the issues raised by theme 2 presentations included lack of data on markets and marketing potential of underutilised plant species. It was felt that involvement of local and national governments to influence markets would be key to successful marketing of any underutilised plant species.

Physiology, Agronomy and Agro-Ecological Potential

A number of presenters talked about agronomic potential of specific crops, as well as environmental constraints to their wider cultivation. Papers in this session explored the role of underutilised plant species as buffers against climate change, looking at physiological mechanisms that enable a species to perform in hostile environments such as adaptation to drought conditions. Drought affects many parts of the tropics. Specific presentations shared results of research work that has shown lines of baobab, taro and cucurbits with drought tolerance. A variety of drought response mechanisms in some underutilised species were also reported.

Papers were presented and discussions also touched on tree domestication techniques. It was clear that strategies for wider application of these techniques throughout the tropics and sub-tropics exist for high-value underutilised tree species and are ready for dissemination. It was also made clear that some of the techniques are readily transferable with minimum modification for different socio-economic/geographic/agro-ecological locations. Domestication of tree species can contribute to the development of multi-functional agriculture and generate income to purchase a variety of services.

Prime Minister Najib sharing a light moment with Professor M.S. Swaminathan and other symposium participants and members of the media.

Biotechnology, Breeding and Seed Systems

Advances in biological sciences have brought about a number of biotechnological tools that can be useful in research and development of underutilised plant species. These tools offer alternative opportunities to make rapid progress in the improvement of the germplasm. Papers in this session discussed practical applications of biotechnology in research and development of underutilised plant species. Discussions raised a number of issues including lack of common approaches and protocols, which makes it difficult to compare between species and learn general lessons. It was also noted that it is still difficult to make useful links between con-

servation of germplasm resources and active breeding. The group also expressed concerns that different molecular markers give different genetic distances and seldom correlate well with morphological analysis.

It was concluded that focused use of cross-species tools and knowledge is needed to exploit investment already made in major crops for use in underutilised plant species. Sequence-based approaches potentially allow a focused approach to working on complexes of related species and gene complexes, rather than isolated species, reducing 'in species' costs. A service-based molecular marker system for underutilised plant species, for example, would avoid the need for the development of complex techniques by individual groups and ensure large-scale compatibility of datasets.

In most of the underutilised crop species knowledge is still needed on breeding systems and germplasm, as this determines genetic improvement methods possible and could identify short-cuts. Use of indigenous knowledge potentially allows the most promising species to be identified for specific traits, allowing a focused approach to trait-based germplasm selection. Development of geographical/ethnic distribution and use of species would be a valuable guide to practical enhanced use of underutilised plant species.

Strategic Approaches for Research and Development

Following the four thematic sessions was the final plenary session to discuss issues related to strategic approaches. A key message here was that resources available for research are limited and therefore investment of resources on any underutilised plant species calls for a common methodology that can be applied across a range of underutilised plant species. Papers in this session examined strategic approaches that can be used in research for development across many underutilised plant species, and where these can also be used to provide a basis for comparison with major crop species. Presenters looked at regional frameworks as conditions and challenges were considered common within regions. Thinking regionally and acting locally would mean that regional analysis and priority setting is crucial for research and development of underutilised plant species. Strong political and governmental support was considered invaluable (e.g. Conference of Ministers; Committee on World Food Security; G8 statement). National government support is crucial as seen with Malaysian government support for the establishment of CFFRC. It was also stressed in most presentations that advocacy is an important component, and linking underutilised plant species to the development challenges, as part of the solution, is crucial.

Presentations and discussions also touched on Holistic Approach to research and development of underutilised plant species. Delegates stressed the link between Conservation to Use and to Market, as well as Value chain or Market chain approach. An understanding of local underutilised plant species diversity and identifying potential or priority species was stressed along with value adding research and other interventions such as reducing drudgery, increasing productivity and participatory selection.

Theme 5 also dealt with capacity development including knowledge and information systems as well as information and informatics. Presentations covered formal databases and repositories such as the PROTA experience, botanical profiling and characterisation strategies. A Web Platform for information and communication was also presented – the CFF Platform tool – a tool for information sharing. There was a lot of enthusiasm amongst researchers, for example food plants database collection stressing that underutilised species presented the great wealth 'out there'. It was also stressed that underutilised species could be profitable but need further improvement (both technological as well as genetic).

SIDE EVENTS

In addition to the presentations, a number of side events were organised. These included a demonstration of an e-Learning Course on Pre-breeding for effective use of plant genetic resources led by Dr. Chikelu Mba of the Food and Agriculture Organisation of the United Nations (FAO). The course, developed by The Global Partnership Initiative for Plant Breeding Capacity Building (GIPB), aims at strengthening capacities at the interface between germplasm conservation and its use in plant breeding. Dr. Michael Hermann (Crops for the Future) and Dr. Per Rudebjer (Bioversity International) also led a very successful roundtable discussion on Capacity Development – meeting the demand for research and development of underutilised plant species. Another side event was a programme for underutilised plant species led by Dr. Mary Taylor, Chair of the ISHS Working Group on Underutilized Plant Genetic Resources. In this event a possible location for the 3rd International Symposium on Underutilised Crops, which was suggested to be held in 2015, was discussed. Suggested locations included India, Ghana, Sri Lanka and Latin America.

CONCLUDING REMARKS

Symposium delegates discussed the potential role of underutilised plant species to contribute to global food security and nutrition, provide buffer against the consequences of climate change and the need to enhance agricultural biodiversity. One objective of this meeting was to encourage participants to share strategies that aim to maximise knowledge acquisition, minimise duplication of efforts and identify priority areas for further research and development. Throughout presentations and discussions calls were made to encourage active collaborations and exchange of ideas and skills needed for research and development of underutilised plant species.

Overall the symposium offered a wide range of topics, from nutritional biochemistry and agronomy to biotechnology, breeding and seed systems. The proceedings of the symposium will be published as a volume of *Acta Horticulturae*.

Festo Massawe

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Tenth Int'l Rubus and Ribes Symposium

Participants of the Symposium.

Scientists and industry representatives from all corners of the world gathered in Zlatibor, Serbia on June 22-26 for the X International *Rubus* and *Ribes* Symposium with an optional technical tour from 18 to 21 June. The Symposium was co-organized by the Faculty of Agriculture, University of Belgrade and the Institute of Pesticides and Environmental Protection, Belgrade, supported by the Ministry of Education and Science of the Republic of Serbia, and sponsored by the *Rubus* and *Ribes* industry.

The Symposium was attended by 179 people representing 35 countries from 5 continents. In addition to the representatives of the Faculty of Agriculture and the Institute of Pesticides and Environmental Protection, we were welcomed by Dr. Adam Dale, Chair of the Rubus and Ribes Species Working Group, ISHS. During the opening ceremony, the Chair of the ISHS Section Vine and Berry Fruits, Dr. Bernadine Strik, gave an excellent overview of the pre-symposium technical tour and officially opened the meeting. Thanks to the Scientific Committee members and many other people and institutions, the Symposium achieved all of its objectives and was a complete success.

Scientists gave 123 oral and poster presentations within five sessions: Genetics I – Genetic Resources and Biotechnology; Genetics II – Breeding, Cultivar Development and Performance; Weed and Pest Management; Fruit Production Systems, Physiology and Protected Culture; and Fruit Quality, Economics and Marketing. Four invited speakers from four countries (Canada, the United States of America, Poland, and Serbia) gave excellent summaries of up-to-date scientific achievements on *Rubus* and *Ribes* worldwide. The Symposium atmosphere was wonderful with high quality presentations, good discussions,

Opening ceremony. From left to right: Drs. Bernadine Strik, Adam Dale, Brankica Tanović, Mihailo Nikolić and Mr. Rade Ljubojević.

and a broad diversity of subjects. In addition, the setting in the landscape of Zlatibor Mountain (1000 m a.s.l.) and excellent weather were awesome.

Two official meetings and one ceremony were conducted during the Symposium. At the business meeting, held on June 23, Dr. Pedro Oliveira was elected as the new Chair of the ISHS Rubus and Ribes Species Working Group, while the Scientific Committee members in the meeting held on June 25 chose Dr. Brankica Tanović to be the editor of the Symposium proceedings. A gala dinner, complete with traditional music and dancing, was a perfect opportunity for Dr. Yves Desjardins to deliver the medals and special award certificates to the Conveners of the Symposium, Drs. Brankica Tanović and Mihailo Nikolić.

In meetings like this, while the quality and quantity of scientific work presented are important, of equal or greater importance is the opportunity to meet colleagues, technicians, researchers, growers and industry representatives to share experiences and ideas related to research programs or production problems and find solutions or new perspectives. In this aspect, the Symposium was a unique opportunity. All participants and accompanying persons enjoyed several themed evenings with a variety of wonderful Serbian food and traditional music and dances that created a relaxing atmosphere for personal relationships to develop or renew. Especially interesting for the participants was a visit to the village Sirogojno and the dinner served among the forest trees.

During the Symposium, the attendees were hosted by the Municipality of Ivanjica and Sirogojno Co., where various activities were conducted. All the participants were impressed by the production systems being used by the numerous small raspberry farms in the Ivanjica region, while a demonstration of four types of machines for raspberry harvesting triggered fruitful discussions.

The three-day Pre-symposium Tour of the Serbian *Rubus* and *Ribes* industry was informative and enjoyable. The tour included visits to raspberry, blackberry, and red currant plantations and cold storage facilities in different production areas of Serbia. During the first morning, the participants visited a raspberry field in Djurdjevo where they had a chance to see primocane-fruiting raspberries. Afterwards, they were hosted by the Experiment Station of the Faculty of Agriculture, University of Novi Sad in Sremski Karlovci, where they had traditional Vojvodina lunch. The second day was reserved for visits to currant and blackberry fields in Topola and the Fruit Research Institute in Čačak. Dr. Svertana Paunović, the director of the Institute, gave an excellent presentation of scientific achievements of the Institute in terms of released cultivars and new promising selections. The last pre-symposium tour day was organized as a balance of technical visits of raspberry and blackberry fields and impressive tourist attractions of the Bajna Bašta region. The participants had a chance to see Tara National Park and to enjoy their lunch while traveling on the famous Šargan steam engine train. A cocktail dinner for all Symposium participants, organized in the Hotel Mona in Zlatibor, marked the end of the tour and the beginning of the scientific portion of the Symposium. The many fruit brandies for which the Serbians are famous, especially Slivovitz (plum brandy), were served at a number of stops and were a wonderful cultural experience for the tour participants.

Prof. Yves Desjardins handing out the ISHS medal and certificate to Conveners Drs. Brankica Tanović and Mihailo Nikolić.

Participants enjoyed the Symposium and their short stay in Serbia. They said that the Symposium was extremely successful and well organized. The quality of the berry farms and processing plants that they visited was impressive and the hospitality of the Serbian people was tremendous.

Finally, we would like to thank all the people who put their confidence in us, as well as everyone, including the institutions and sponsors, for their interest, time and efforts that helped make this Symposium a success and an extraordinary event. We would like to especially thank the graduate students from our programs who worked so hard to help everyone during the Symposium.

We would like to remind all the ISHS members that the XI International Rubus and Ribes Symposium will take place in June/July, 2015 in Charlotte, NC, USA. See you there!

Mihailo Nikolić and Brankica Tanović

Dr. Bernadine Strik in a raspberry field.

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Int'l Symposium on Advanced Technologies and Management towards Sustainable Greenhouse Ecosystems (GreenSys 2011)

The Conference participants.

The University of Thessaly and the Centre for Research and Technology, Thessaly, co-organised the International Symposium on "Advanced technologies and management towards sustainable greenhouse ecosystems-GreenSys2011" under the auspices of the ISHS. The Symposium was held at Halkidiki peninsula, Greece, from 5 to 10 June 2011, in Porto Carras Grand Resort, located inside a paradise in Northern Greece on the western coast of Sithonia Halkidiki's central peninsula. In total 240 participants from 30 different countries attended the meeting.

The scientific sessions of the Symposium covered: greenhouse design, microclimate, energy, water, covering materials, climate control, Computational Fluid Dynamics (CFD), environmental friendly technologies, sensors automation and robots, growing media and hydroponics, plant protection, product quality, crop management and cultural practices. There were 116 oral and 105 poster presentations. Innovative and efficient systems and technologies were highlighted and explored. The symposium showed how high and innovative technologies and optimal management come together to create a sustainable greenhouse ecosystem for a better world. Greensys2011 highlighted possible avenues for cooperation between different research teams and also came up with beneficial, cutting-edge resolutions, which can positively impact the greenhouse sector.

The Conference Conveners: Prof. C. Kittas (left), Dr. T. Bartzanas (center), Assist. Prof. N. Katsoulas (right).

Three keynote lectures were given during the plenary sessions, specifically: "Efficient use of natural resources in greenhouses" by Dr. Arend-Jan Both of the Rutgers State University of New Jersey; "Automation and robotics in greenhouses" by Prof. Dr. Ir. Eldert Van Henten of Wageningen University, The Netherlands; and "Good agricultural practices in greenhouse production" by Dr. Muien Muhamad Qaryouti of the National Centre for Agricultural Research and Extension, Jordan.

Besides the plenary sessions, there were three parallel oral sessions, as well as three poster sessions per day. Four special meetings took place during the conference: the meeting of the Commission of Protected Cultivation, the CFD meeting, the meeting of the Commission of Good Agricultural Practices in Greenhouses and the meeting of the Commission of Horticultural Engineering.

During the oral sessions, targeted keynote lectures were given by distinguished speakers such as Dr. Meir Teitel on "Greenhouse design concept and trends", Dr. Thierry Boulard on "Greenhouse microclimate", Dr. Silke Hemming on "Covering materials", Prof. In-Bok Lee on "CFD", Prof. Stefania de Pascale on "Crop management and cultural practices" and Prof. Chieri Kubota on "Product quality".

The Symposium began on the 5th of June with a workshop for Greek farmers and professionals in the field of greenhouse technologies, with more than 100 participants and presentations on modern trends in design, equipment and management of greenhouses. Greensys2011 became an opportunity for Greek farmers to learn recent advances in this field. Although progress exists, there is still a gap in the transfer of scientific research into the production sector and between international collaborations.

The Symposium also included a Scientific Tour to a nursery greenhouse, an agricultural bee keeping co-operative, and an organic winery,

Prof. S. Sase (left) and Prof. N. Castilla (right) at the closing ceremony.

as well as two cultural tours to Mount Athos and Vergina.

During the closing ceremony the Conveners decided to give a special award to Dr. Thiery Boulard from INRA France. He is a distinguished researcher in the field of greenhouse cultivations, who will retire soon, and who has contributed a lot to advance our knowledge in the past 20 years with his ideas, methods and papers.

Constantinos Kittas, Nikolaos Katsoulas and Thomas Bartzanas

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Second Int'l Symposium on Genetically Modified Organisms in Horticulture (GMO2011)

Attendants to the II GMO2011 Symposium.

The ISHS Second International Symposium on Genetically Modified Organisms in Horticulture (GMO2011) was hosted at the picturesque town of White River, Mpumalanga Province, South Africa, from 11-15 September 2011. The theme of the event, "Paving the Way for a Sustainable Future", aimed at bringing together scientists, industries and regulators involved in the development of genetically engineered horticultural crops. The symposium aimed at providing a platform for sharing of research results, gaining knowledge from fellow scientists, investigating applications of the research in industry, and investigating decision making and regulatory processes worldwide. The symposium was attended by 80 participants from 21 countries all over the world, including South and North America, Africa, Europe, Asia, Australia, New Zealand and Russia. The internationally-renowned keynote speakers, Muffy Koch (Canada), Bart Panis (Belgium), Melané Vivier (RSA), Leena Tripathi (Kenya), Marc Gislain (Kenya) and Frans Krens (The Netherlands), addressed the participants on topics relevant to progress in the development of genetically modified horticultural crops, as well as experiences with different regulatory systems. Several invited speakers added to the bouquet of information updating participants on the different crops that are being developed and, in the case of some, have been commercialised. A total of 34 talks and 21 posters were presented. Information was shared that comprised detailed scientific data covering developmental strategies and regulatory hurdles to commercialisation on 16 different crops, including vegetables (e.g. sweet potatoes, potato and cassava), fruits (e.g. bananas, plum, apples and grapes), flowers (e.g. *Ornithogalum*, roses, *Chrysanthemum* and *Gladiolus*) and other plants (e.g. trees and cereals). The sympo-

Participants at the welcoming function: Margaretha Welander, Bart Panis (ISHS representative), Frans Krens and Giovanni Broggini.

Visit to the Kruger National Park.

sium sessions specifically addressed biosafety regulatory systems, legislation and intellectual property, progress and exploitation of genetic modification in fruits and vegetables, plant and pest diseases, reducing the environmental footprint, GMOs in developing countries, and progress in genetic modification of flowers. The informal atmosphere of the symposium contributed to the vast amount of ideas and suggestions that were shared with regard to resistance strategies, product development and approaches to address regulatory requirements for commercialisation of products.

The symposium, however, did not only provide knowledge and information, but allowed for fun and enjoyable activities. These included a drive into the world-famous Kruger National Park on open vehicles to allow game viewing, and a barbeque dinner in the open bush veld under bright African stars for which South Africa is famous. The symposium's gala dinner was also hosted at a special site – a game farm where game viewing preceded a five star dinner at the top of a hill. The symposium was concluded with a scientific excursion to a Clivia flower producer (Clivia's are bulbous flowers from the *Amaryllidaceae* family native to southern Africa and are favoured due to their flamboyant, colourful flowers) and the Nelspruit Botanical Garden. This symposium was made possible by the sponsorships of 17 companies, with ABSA and Department of Science and Technology the major sponsors.

Lynelle van Emmenes, Gurling Bothma and Adri Veale

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Commission Molecular Biology and In Vitro Culture
Seventh Int'l Symposium on In Vitro Culture and Horticultural Breeding (IVCHB2011)

The 7th IVCHB meeting was held in Gent (Belgium), home ground of Prof. Em. Pierre Debergh, who was one of the co-founders of the micropropagation industry in Belgium. Plant tissue culture is a key component of many breeding programs and of plant propagation methods. Hence, the technology is widespread in the ornamental and horticulture industries. Despite its relevance for agriculture we are experiencing a gradual decline in investments in tissue culture research in the public sector and as a consequence fewer students are attracted to start a career in plant tissue culture technology development. At least this is the case in well-funded research institutes and academic laboratories in Europe. The IVCHB2011 symposium was therefore a timely event for the promotion of plant tissue culture research.

The symposium was very well attended with over 270 participants from 54 countries. During 4 days (18-22 September) 14 keynote speakers gave state-of-the-art presentations on diverse topics, which were divided into 8 sessions (in vitro breeding, in vitro stress physiology, rationalization of plant breeding, micropropagation and regeneration, modern transformation technologies, chemical genetics, in vitro preservation of germplasm and cryopreservation, and new developments in tissue culture technology). There were 148 posters, some of which can be viewed via the e-poster link at the website ivchb2011.ugent.be.

The title of the 7th edition was "Biotechnological Advances in In Vitro Horticultural Breeding" and covered a range of topics that are relevant for the development of novel strategies to make progress in what is often viewed as an art. Tissue culture involves serendipity and the implementation of a lot of technical skill. However, the symposium demonstrated that a deeper understanding of plant physiology and molecular biology is equally important to make

Group photo of IVCHB2011 participants after the morning lectures.

further progress in advancing the development of tissue culture and horticultural practices.

In the in vitro breeding session, Jude Grosser showed how protoplast fusion, embryo rescue and interploidy crosses are implemented to generate a novel variety for the citrus industry in Florida. Marc De Block from Bayer CropScience introduced epigenetics and how this phenomenon has become a relevant component in the breeding of a large crop like canola. The role of epigenetic effects on the plant phenotype contrasted nicely with the work presented by Rob Dirks who explained how reverse breeding is implemented to produce chromosome substitution lines or even libraries, and how this is effective for mapping relevant traits. Pascal Montoro gave an overview of many years of improvements to propagate elite *Hevea brasiliensis* trees. Breeding of trees is truly a life-long learning process. A remarkable presentation was given by Renate Muller, who started a breeding program with *Kalanchoe* plants that were transformed by unmodified *Agrobacterium rhizogenes* strains. The Danish government apparently does not consider these plants to be GMO and provisionally would allow the marketing of the transgenic derivatives. The reasoning is that a transformation event that is also possible in nature should not be considered as a GMO. In the chemical genetics session, a novel approach to improve plant tissue culture processes was presented. The screening of small chemicals is a well-established technique to discover cancer drugs but the approach has been implemented in plant research only during the last decade. Interestingly, it has found its way into tissue

Technical tour visit of the pot plant company Rudy Raes. The machine shown in the picture automates the replacement of drop-out plants.

Tuesday night boat trip through the heart of the center of Ghent. The captains were excellent guides showing us picturesque views mixed with funny anecdotes of the history of the city.

culture research and unpublished results related to somatic embryogenesis, meristem growth promotion and adventitious rooting were presented at the meeting. Joachim Keller presented the cumulative efforts to preserve potato, garlic and mint germplasm, and how cryopreservation can be the technology of choice for long term storage of rarely used material. Finally, Kevin Folta gave an enchanting talk on strawberry and how physiological and molecular research on a crop generates new insight into plant growth behavior, which can be quite different from a model like *Arabidopsis*.

In addition to science we had a great deal of fun. On Tuesday evening we went on a boat trip through the center of Ghent to look at the city from a fish's viewpoint and discover some of its history and picturesque spots. We travelled in groups of 40-50 people per boat and, at least in the boat where I was, we were entertained with plenty of anecdotes by the multilingual guide and captain. On Wednesday evening it was time to relax and we had the opportunity to taste known and less well-known Belgian beers mixed with tango.

On the 23rd of September we went on a technical tour and visited two companies, one specialized in tissue culture based plant propagation (Microflor) and one specialized in the production and breeding of pot plants (Rudy Raes). In the afternoon we visited the Plant Sciences unit of the Institute for Agriculture and Fisheries Research (ILVO).

The IVCHB2011 team who made this symposium a memorable event.

The Convener wishes to express his thanks to the staff and students of the plant production team who generously helped to run the symposium, the Organizing and Scientific Committees for their kind help with selecting speakers and abstract submissions, and the sponsors, Ugent and FWO for financial support.

Danny Geelen

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Commission Plant Substrates and Soilless Culture

Int'l Symposium on Responsible Peatland Management and Growing Media Production

The symposium aimed at allowing people from both the International Peat Society and the International Society for Horticultural Science to exchange and share views on the future management and use of peatlands. The event went well and attracted a total of 225 participants for the symposium itself and additional people who attended structured workshops organized before or after the symposium. The meeting was held on June 13-17, 2011 at the Concorde Hotel, downtown Québec City, Québec, Canada, where posters and oral papers were given over two days.

Papers dealt with responsible peatland management and growing media production. They showed that knowledge and applications from scientists and from the peat industry have evolved in North America and across the world with respect to three main aspects.

1. It has moved towards a responsible use of peat resources and peatlands, because of a common public and industry consensus to make wise use of peat bogs with increasing awareness of the goods and services provided by this type of wetlands. Latest results stemming from joint investments of industry and government were presented, specifically on fen restoration, restoration and rehabilitation of bog peatlands, peatland management in the energy sector, rewetting of peatlands, the cultivation of *Sphagnum* and biomass production, the production of berries in bogs, and investigation on carbon and climate change.
2. Recent years have witnessed an increased proportion of composted by-products and other biomass being used in substrates, which changes are partly based on growing environmental concerns regarding waste management, and also on wills and interests to include more compost within substrates. Papers have also indicated resistance to do so because of toxins, pathogens, weeds, nitrogen immobilization, stability, and avail-

Dr. Line Rochefort (center) receiving the 2011 International Peat Society Award of Excellence from IPS president Donal Clarke (right) and secretary general Jaakko Silpola (left).

Symposium participants visiting a research project about different approaches to block former drainage system in peatlands.

Dr. Jean Caron welcoming the participants.

ability of by-product and compost resources at large scale and with uniform quality. Specific sessions were organized on the future of regulations and certification of growing media, compost and alternative substrates, and properties for organic soils and growing media.

3. Papers also reported results on the increased proportion of substrates containing biological agents, as a result of nutrient solution recycling in crop production systems and because of increasing evidences of beneficial microbial activity (vesicular arbuscular mycorrhizae, *Bacillus subtilis, Trichoderma* sp.). Sessions on the future of regulation and certification, compost and alternative substrates, and technology of innovation in peat harvesting and substrate production touched base with these issues.

Dr. Michael Raviv (Vice Chair of ISHS Commission Plant Substrates and Soilless Culture, Chair of ISHS Working Group on Composting for Horticultural Applications, and one of the guest speakers) talking to Sophie Rochefort from the Quebec Institute of Development of Horticultural Crop.

At the end of the meeting, 2-hour round-table discussions were conducted for each different session simultaneously, including those of researchers working on all the different aspects of Responsible Peatland Management and Growing Media Production.

The first part of the discussions dealt with what was learned during this meeting by the scientists. The second part of the discussion dealt with the next steps to move forward and identification of knowledge gaps, applications, education or lobbying. A summary report of each session was presented before the full discussion took place. Sessions dealing with regulations, certifications and growing media shared knowledge between disciplines; information was gathered on research and growing media certification processes, as well as systems for efficiently composting biomass to be used as a substrate component (e.g. double entrance systems). Based on carbon budget and on a growing desire of society to diminish its footprint, people rapidly agreed on the rationale of reducing the use of peat within substrates with respect to peatland use in growing media production. The symposium also revealed results of researchers from different countries to find alternatives to peat. There was also a common agreement to seek more uniformity in guidelines for regulations and certification of growing media, as well as to guide substrate manufacturing. There was consensus about the need for regional consideration for these guidelines.

With respect to the next steps forward, accurate tools should be derived with respect to compost maturity and its potential use, also for norms regarding health issues and substrate manufacturing (e.g. gas diffusivity, saturated hydraulic conductivity). According to results presented, composts appear a sound alternative to peat within growing media, in volumetric ratio anywhere between 30 to 100%, depending on their origin, composition, and maturity. There should be an effort to recognize worldwide the value of specific biomass as peat alternatives. With respect to alternatives, again there was a consensus that coco fibres may partly fulfill this role. However, as the overall peat demand is growing in the market, and as the volume needed to fully replace peat by far exceeds the expected availability of coco resources, other alternatives may need to be found. Raw *Sphagnum* fibres appear to be a promising sound alternative to decomposed peat to reduce pressure on existing peatlands, as raw *Sphagnum* fibres were shown comparable to decomposed peat in some studies. A second by-product that appears very promising because of its stability is biochar, with many studies indicating its potential value. Additional work should be conducted on this material. Finally, lifecycle studies should be performed on different peat and peat free substrates to better assess their footprint with respect to carbon budget and other environmentally-related issues resulting from different growing substrate manufacturing. There should be an additional criterion guiding the substrate manufacturing process to drive a more holistic approach to the research in this area.

Following the symposium, site visits were conducted to different restoration, peat extraction, and growing substrate manufacturing sites in Québec and New Brunswick. Workshops were also organized and attended.

Jean Caron and Line Rochefort

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New ISHS Members

ISHS is pleased to welcome the following new members:

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In Memoriam

PIERS TREHANE

(9 November 1950 - 20 March 2011)

On 20 March 2011 Piers Trehane passed away. Piers was a good friend of the International Society for Horticultural Science. In his capacity as Chair of the ISHS Commission Nomenclature and Cultivar Registration he served the ISHS for the period 2001-2003. For a long time he maintained the web pages for International Cultivar Registration Authorities (ICRAs).

As rapporteur of the Commission for the first edition of the International Code of Nomenclature for Cultivated Plants, Piers assisted in the creation of a work of reference for many generations of taxonomists to come.

Calendar of ISHS Events

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YEAR 2011

- December 9-12, 2011, Madurai (India): **I International Symposium on Cashew Nut.** Info: Dr. Ravindran Chandran, Assistant Professor, KVK, AC & RI, Tamil Nadu Agricultural University, Madurai, 625104 (Tamil Nadu), India. Phone: (91)452-2422955, Fax: (91)452-2422785, E-mail: ravi_hort@yahoo.com Web: http://www.iscn2011.com/

NEW

- New date: December 15-18, 2011, Chiang Mai (Thailand): **International Symposium on Medicinal and Aromatic Plants - Royal Flora 2011.** Info: Peyanoot Naka, Horticulture Research Institute, Department of Agriculture, Chatuchak, Bangkok 10900, Thailand. Phone: (66)819076821, Fax: (66)25614667, E-mail: peyanoot@hotmail.com or Dr. Somchai Charnnarongkul, Department of Agriculture, Phahonyothin Rd., Chatuchak, Bangkok 10900, Thailand. Phone: (66)25799636, Fax: (66)29405412, E-mail: tosomchai@yahoo.com E-mail symposium: royalflorasymposium2011@yahoo.com Web: http://www.royalflora2011.com/index_eng.html

NEW

- Because of the current political instability in Egypt the Convener decided to Postpone the symposium December 19-22, 2011, Giza (Egypt): **V International Symposium on Vegetable Nutrition and Fertilization: Vegetable Farms Management Strategies for Eco-Sustainable Development.** Info: Dr. Ahmed Glala, Hoticultural Crops Technology Department, Agriculture Resarch Division, National Research center, Dokky, 12622 Giza (El-Bhoos Street), Egypt. Phone: (20)122963894, Fax: (20)237601877, E-mail: aaa_glala@yahoo.com Web: http://www.udvsq-nrc.com/ishs-2011

NEW

- New date: December 19-22, 2011, Chiang Mai (Thailand): **International Symposium on Tropical and Subtropical Fruits - Royal Flora 2011.** Info: Peyanoot Naka, Horticulture Research Institute, Department of Agriculture, Chatuchak, Bangkok 10900, Thailand. Phone: (66)819076821, Fax: (66)25614667, E-mail: peyanoot@hotmail.com or Dr. Somchai Charnnarongkul, Department of Agriculture, Phahonyothin Rd., Chatuchak, Bangkok 10900, Thailand. Phone: (66)25799636, Fax: (66)29405412, E-mail: tosomchai@yahoo.com E-mail symposium: royalflorasymposium2011@yahoo.com Web: http://www.royalflora2011.com/index_eng.html

NEW

- New date: December 19-22, 2011, Chiang Mai (Thailand): **III International Symposium on Papaya - Royal Flora 2011.** Info: Dr. Jirakorn Kosaisawe, Director General, Department of Agriculture, Chatuchak, Bangkok 10900, Thailand. Phone: (66)25799636, Fax: (66)29405412, E-mail: jirakorn_k@yahoo.com E-mail symposium: royalflorasymposium2011@yahoo.com Web: http://www.royalflora2011.com/index_eng.html

YEAR 2012

- January 9-13, 2012, Chiang Mai (Thailand): **International Symposium on Orchids and Ornamental Plants - Royal Flora 2011.** Info: Peyanoot Ms. Naka, Horticulture Research Institute, Department of Agriculture, Chatuchak, Bangkok 10900, Thailand. Phone: (66)819076821, Fax: (66)25614667, E-mail: peyanoot@hotmail.com or Dr. Somchai Charnnarongkul, Department of Agriculture, Phahonyothin Rd., Chatuchak, Bangkok 10900, Thailand. Phone: (66)25799636, Fax: (66)29405412, E-mail: tosomchai@yahoo.com E-mail symposium: royalflorasymposium2011@yahoo.com Web: http://www.royalflora2011.com/index_eng.html
- January 15-20, 2012, Skukuza, Kruger National Park (South Africa): **II All Africa Horticultural Congress.** Info: Ms. Karin Hannweg, ARC-ITSC, Private Bag X11208, Nelspruit Mpumalanga 1200, South Africa. E-mail: karin@arc.agric.za Web: http://www.aahc.co.za/
- January 23-26, 2012, Chiang Mai (Thailand): **International Symposium on Banana - Royal Flora 2011.** Info: Peyanoot Naka, Horticulture Research Institute, Department of Agriculture,

Chatuchak, Bangkok 10900, Thailand. Phone: (66)819076821, Fax: (66)25614667, E-mail: peyanoot@hotmail.com E-mail symposium: royalflorasymposium2011@yahoo.com

- February 14-17, 2012, Zürich (Switzerland): **I International Workshop on Bacterial Diseases of Stone Fruits and Nuts.** Info: Dr. Brion Duffy, Agroscope Faw, Schloss, Postfach 185, 8820 Waedenswil, Switzerland. Phone: (41)447836111, Fax: (41)447836305, E-mail: duffy@acw.admin.ch
- February 18-22, 2012, Beijing (China): **VII International Strawberry Symposium.** Info: Dr. Zhang Yun-tao, Forestry & Pomology Institute of Beijing, Rui Wang Fen, Xiang-Shan, Hai Dian District, Beijing 100093, China. Phone: (86)1082592157, Fax: (86)1062598744, E-mail: ytaozhang@gmail.com E-mail symposium: strawberry2012@163.com Web: http://www.iss2012bjchina.org.cn/
- NEW New date: February 21-24, 2012, Bangkok (Thailand): **International Conference on Quality Management in Supply Chains of Ornamentals (QMSCO 2011).** Info: Dr. Sirichai Kanlayanarat, King Mongkut's University of Technology, Thonburi, Division of Postharvest Technology, Thungkhru, Bangkok 10140, Thailand. Phone: (66)2 470 7720, Fax: (66)2 452 3750, E-mail: sirichai.kan@kmutt.ac.th E-mail symposium: qmsco@kmutt.ac.th Web: http://www.kmutt.ac.th/QMSCO2011/
- NEW New date: February 21-24, 2012, Bangkok (Thailand): **Southeast Asia Symposium on Quality Management in Postharvest Systems (SEAsia2011).** Info: Dr. Sirichai Kanlayanarat, King Mongkut's University of Technology, Thonburi, Division of Postharvest Technology, Thungkhru, Bangkok 10140, Thailand. Phone: (66)2 470 7720, Fax: (66)2 452 3750, E-mail: sirichai.kan@kmutt.ac.th Web: http://www.kmutt.ac.th/SEAsia2011
- NEW New date: February 21-24, 2012, Bangkok (Thailand): **I International Symposium on Postharvest Pest and Disease Management in Exporting Horticultural Crops - PPMD2011.** Info: Pongphen Jitareerat, King Mongkut's Univ. of Technology Thonburi, Div. Postharv. Techn. School of Biores.& Techn., 83 Moo 8, Tientalay rd., 10150 BKK -Bangkhuntien, Thakham, Thailand. E-mail: pongphen.jit@kmutt.ac.th E-mail symposium: ppmd2011@kmutt.ac.th Web: http://www.kmutt.ac.th/ppdm2011/
- NEW New date: February 21-24, 2012, Bangkok (Thailand): **Asia Pacific Symposium on Postharvest Quality Management of Root and Tuber Crops.** Info: Dr. Sirichai Kanlayanarat, King Mongkut's University of Technology, Thonburi, Division of Postharvest Technology, Thungkhru, Bangkok 10140, Thailand. Phone: (66)2 470 7720, Fax: (66)2 452 3750, E-mail: sirichai.kan@kmutt.ac.th E-mail symposium: APS2011@kmutt.ac.th Web: http://www.kmutt.ac.th/APS2011/
- March 19-22, 2012, Temuco City (Chile): **VIII International Congress on Hazelnut.** Info: Dr. Pablo Grau Beretta, INIA, Avda. Vicente Mendez 515, Chillan, Chile. Phone: (56)42 209707, Fax: (56)42 209720, E-mail: pgrau@inia.cl or Miguel Ellena Dellinguer, INIA, Instituto De Investigaciones Agropeciarias, Km 10, Camino Cajon Vilcun, Temuco, Chile. Phone: (56)45 215 706, Fax: (56)45 216 112, E-mail: fellena@inia.cl Web: http://www.hazelnut2012.cl
- March 22-24, 2012, Djerba (Tunisia): **IV International Symposium on Medicinal and Aromatic Plants SIPAM2012.** Info: Dr. Houcine Khatteli, Institut des Régions Arides, Route de Djouf, Km 22,5, 4119 Médenine, Tunisia. Phone: (216)75633121, Fax: (216)75633006, E-mail: h.khatteli@ira.rnrt.tn or Dr. Mohamed Neffati, Institut des Regions Arides (IRA), Route de Djorf Km 22,5, 4119 Medenine, Tunisia. Phone: (216)75633839, Fax: (216)75633006, E-mail: neffati.mohamed@ira.rnrt.tn E-mail symposium: sipam@ira.rnrt.tn Web: http://www.sipam.ira.rnrt.tn/
- March 26-30, 2012, Nelson (New Zealand): **II International Symposium on Biotechnology of Fruit Species.** Info: Roger Hellens, Plant & Food Research, 120 Mt Albert Road, Auckland, New Zealand. Phone: (64)98154200, E-mail: roger.hellens@plantandfood.co.nz or Dr. Susan Elizabeth Gardiner, Plant & Food Research, Tennant Drive Private Bag 11030, Palmerston North, New Zealand. E-mail: sue.gardiner@plantandfood.co.nz E-mail symposium: yvonne.mcdiarmid@plantandfood.co.nz Web: http://www.plantandfood.co.nz/conferences/biotechfruit-2012/
- As a result of the March 11, 2011 earthquake and tsunami the AHC2012 organizing committee decided to Cancel the AHC2012 March 27-30, 2012, Tsukuba (Japan): **II Asian Horticultural Congress AHC 2012.** Info: Prof. Dr. Yoshinori Kanayama, Graduate Sch. of Agric., Tohoku Univ., 1-1 Tsutsumidori, Amamiyamachi, Aoba-ku, Sendai 981-8555, Japan. Phone: (81)227178642, Fax: (81)227178878, E-mail: kanayama@bios.tohoku.ac.jp E-mail symposium: info@ahc2012.com Web: http://www.ahc2012.com
- March 28 - April 1, 2012, Antalya (Turkey): **XI International Symposium on Flower Bulbs and Herbaceous Perennials.** Info: Prof. Dr. Ibrahim Baktir, Akdeniz University, Faculty of Agriculture, Department of Horticulture, Campus, 07058 Antalya, Turkey. Phone: (90)2423102468, Fax: (90)2422274564, E-mail: ibrahim.baktir@gmail.com E-mail symposium: flowerbulbs2012@gmail.com Web: http://flowerbulbs2012.org/
- April 2-3, 2012, Lake Alfred, FL (United States of America): **International Symposium on Mechanical Harvesting and Handling Systems of Fruits and Nuts.** Info: Prof. Dr. Jim Syvertsen, University of Florida, IFAS, CREC, 700 Exp. Stn. Rd., Lake Alfred FL, 33850, United States of America. Phone: (1)8639561151, Fax: (1)8639564631, E-mail: jmsn@ufl.edu
- April 10-13, 2012, Viterbo (Italy): **VIII International Symposium on Artichoke, Cardoon and their Wild Relatives.** Info: Prof. Mario-Augusto Pagnotta, Dipt. di AgroBiologia e AgroChimica, Universita' della Tuscia, Via S.C. de Lellis, 01100 Viterbo, Italy. Phone: (39)0761357242, Fax: (39)0761357423, E-mail: pagnotta@unitus.it or Prof. Dr. Francesco Saccardo, Dip.di Produzione Vegetale, University of Tuscia, Via S. Camillo de Lellis, 01100 Viterbo VT, Italy. Phone: (39)0761357554, Fax: (39)0761357558, E-mail: saccardo@unitus.it Web: http://www.symposium2012.cynares.com/
- Because of a low number of registrations the organizing committee decided to cancel this symposium. Contact conveners for further details. April 18-22, 2012, Antalya (Turkey): **IV International Symposium on Improving the Performance of Supply Chains in the Transitional Economies.** Info: Prof. Dr. Burhan Ozkan, Department of Agricultural Economics, Faculty of Agriculture, University of Akdeniz, 07070 Antalya, Turkey. Phone: (90)2423102475, Fax: (90)2422274564, E-mail: bozkan@akdeniz.edu.tr or Dr. Peter J. Batt, Horticulture, Curtin University of Technology, GPO box U1987, Perth, WA 6845, Australia. Phone: (61)8 9266 7596, Fax: (61)8 9266 3063, E-mail: p.batt@curtin.edu.au Web: http://www.supplychains2012.org/
- NEW April 23-25, 2012, Petrolina, Pernambuco (Brazil): **III International Symposium on Guava and other Myrtaceae.** Info: Dr. Natoniel Franklin de Melo, EMBRAPA-CPATSA, Cx.Postal 23, Lab. de Biotecnologia, CEP 56302-970 Petrolina -PE, Brazil. or Dr. Carlos Antonio Fernandes Santos, EMBRAPA CPATSA, Km 152, Zona Rural, Caixa Postal 23, 56302-970 Petrolina, Brazil. Phone: (55)08738621711, Fax: (55)08738621744, E-mail: casantos@cpatsa.embrapa.br E-mail symposium: 3rdsygom@cpatsa.embrapa.br Web: http://www.cpatsa.embrapa.br/sygom/
- NEW April 23-26, 2012, Santiago (Chile): **XI International Protea Research Symposium.** Info: Mr. Eduardo Olate, P. Universidad Catolica De Chile, Avenida Vicuna Mackenna 4860, Fac.de Agronomia, Santiago RM, Chile. Phone: (56)23544112, Fax: (56)25520780, E-mail: eolate@uc.cl or Mrs. Flavia Schiappacasse, Universidad de Talca, Facultad de Ciencias Agrarias, Casilla 747, Talca, Chile. Phone: (56)71200214, Fax: (56)71200212, E-mail: fschiap@utalca.cl E-mail symposium: robyn.mcconchie@sydney.edu.au Web: http://www.proteas2012.cl/

- April 29 - May 2, 2012, Antalya (Turkey): **International Symposium on Biotechnology and other Omics in Vegetable Science.** 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 Web: http://www.biotech-omics.org/web/

- May 15-17, 2012, Tel Aviv (Israel): **The International CIPA Conference 2012: Plasticulture for a Green Planet.** Info: Mr. Itzhak Esquira, Ministry of Agriculture, 34 Burla Street, Apt. 2, 69364 Tel Aviv, Israel. E-mail: esquirai@gmail.com E-mail symposium: Pzilberman@kenes.com Web: http://www2.kenes.com/agritech2012/conference/Pages/Conference.aspx

- May 19-25, 2012, Chanthaburi (Thailand): **VII International Symposium on Mineral Nutrition of Fruit Crops.** Info: Dr. Sumitra Poovarodom, King Mongkut's Inst. of Tech., Landkrabang, Faculty of Agric. Technology, 10520 Bangkok, Thailand. Phone: (66)262341001, Fax: (66)232641001, E-mail: kpsumitr@kmitl.ac.th E-mail symposium: mnutrition7@kmitl.ac.th Web: http://www.mnutrition7.kmitl.ac.th/

- May 20-26, 2012, Davis, CA (United States of America): **X International Symposium on Plum and Prune Genetics, Breeding and Technology.** Info: Prof. Ted M. DeJong, University of California, Department of Plant Sciences, Wickson Hall, One Shields Ave, Davis, CA 95616-8683, United States of America. Phone: (1)530-752-1843, Fax: (1)530-752-8502, E-mail: tmdejong@ucdavis.edu or Carolyn DeBuse, University of California Cooperative Extension, 501 Texas Street, Fairfield, CA 94533, United States of America. Phone: (1)707-784-1320, E-mail: cjdebuse@ucdavis.edu

- May 21-24, 2012, Fukuoka (Japan): **VI International Symposium on Edible Alliaceae.** Info: Prof. Dr. Masayoshi Shigyo, Faculty of Agriculture, Yamaguchi University, Yoshida 1677-1, Yamaguchi 753-8515, Japan. Phone: (81)839335842, Fax: (81)839335842, E-mail: shigyo@yamaguchi-u.ac.jp E-mail symposium: isea2011@convention.co.jp Web: http://www2.convention.co.jp/isea2011/

- NEW May 22-25, 2012, Shanghai (China): **International Symposium on Soilless Cultivation.** Info: Mr. Weimin Zhu, Hort.Inst. of Shanghai Academy of Agr. Sci., Beidi Road 2901, Shanghai Shanghai 201106, China. Phone: (86)21-62206683, E-mail: wmzhu69@hotmail.com E-mail symposium: wtzp05@163.com Web: http://www.icesc-2012.com/

- NEW June 9-11, 2012, Beijing (China): **XII International Symposium on the Processing Tomato - X World Congress on Processing Tomato.** Info: Dr. Guitong Li, China Agricultural University, CAU, West Road of Yuanmingyuan, Beijing, China. Phone: (86)1062732963, Fax: (86)1062733596, E-mail: lgtong@cau.edu.cn 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 Web: http://www.worldtomatocongress.com/

- June 14-17, 2012, (Turkey): **I International Mulberry Symposium.** Info: Prof. Dr. Sezai Ercisli, Ataturk University Agricultural Faculty, Department of Horticulture, 25240 Erzurum, Turkey. Phone: (90) 442-2312599, Fax: (90) 442 2360958, E-mail: sercisli@atauni.edu.tr E-mail symposium: sercisli@hotmail.com

- June 17-22, 2012, Maastricht (Netherlands): **X International Symposium on Vaccinium and Other Superfruits.** Info: Prof. Dr. Fred Brouns, Maastricht University, NUTRIM, PO Box 616, 6200 MD Maastricht, Netherlands. Phone: (31)433881466, Fax: (31)433670976, E-mail: fred.brouns@maastrichtuniversity.nl E-mail symposium: i.vermeeren@pauwelspco.nl Web: http://www.vaccinium2012.com/

- NEW June 18-22, 2012, Guangzhou (China): **V International Symposium on Tropical and Subtropical Fruits.** Info: Prof. Dr. Jiang Zongyong, Guangdong Academy of Agric. Sci., Guangzhou, Guangdong, 610640, China. Phone: (86)2087596262, Fax: (86)2087503358, E-mail: jiangz38@hotmail.com or Prof. Dr. Ganjun Yi, Fruit Tree Research Institute, Guangdong Academy of Agricultural Sciences, Wushan, Guangzhou Guangdong 510640, China. Phone: (86)2038765869 or 13302200898, Fax: (86)2038765626, E-mail: yiganjun@vip.163.com Web: http://www.istsf2012.com/

- NEW June 18-21, 2012, Leavenworth, WA (United States of America): **II International Organic Fruit Symposium.** Info: David Granatstein, Sustainable Agriculture Specialist, Ctr. for Sust. Agric. & Natural Res., WSU, 1100 N. Western Ave., Wenatchee, WA 98801, United States of America. Phone: (1)509-663-8181x.222, Fax: (1)509-662-8714, E-mail: granats@wsu.edu or Prof. Dr. Preston K. Andrews, Department of Horticulture, Landscape Architecture, Washington State University, Pulmann, WA 99164-6414, United States of America. Phone: (1)509-335-3603, Fax: (1)509-335-8690, E-mail: andrewsp@wsu.edu Web: http://www.tfrec.wsu.edu/pages/organicfruit2012/

- June 24-29, 2012, Ski and Grimstad (Norway): **XIII International Symposium on Virus Diseases of Ornamental Plants - ISVDOP13.** Info: Dr. Dag-Ragnar Blystad, The Norwegian Crop Research Institute, Plant Protection Center, Høgskoleveien 7, N-1432 Aas, Norway. Phone: (47)6494 9261, Fax: (47)6494 9226, E-mail: dag-ragnar.blystad@bioforsk.no E-mail symposium: isvdop13@bioforsk.no Web: http://www.bioforsk.no/ISVDOP13

- June 25-29, 2012, Kuala Lumpur (Malaysia): **VII International Postharvest Symposium.** Info: Mr. Abdullah Bin Hassan, Horticulture Research Centre, MARDI, GPO Box 12301, 50774 Kuala Lumpur, Malaysia. Phone: (60)389437810, Fax: (60)389422906, E-mail: abhassan@mardi.gov.my

- June 27-29, 2012, Piacenza (Italy): **I International Workshop on Vineyard Mechanization and Grape and Wine Quality.** Info: Prof. Stefano Poni, Director Istituto di Frutti-Viticoltura, Università Cattolica del Sacro Cuore Piacenza, via Emilia Parmense 84, Piacenza, Italy. Phone: (39)0523599271, Fax: (39)0523599268, E-mail: stefano.poni@unicatt.it Web: http://meetings.unicatt.it/ishs/

- NEW July 1-5, 2012, Angers (France): **II International Symposium on Horticulture in Europe - SHE2012.** Info: Prof. Jean-Claude Mauget, AGROCAMPUS OUEST - Centre d'Angers (INHP), Dept. STPH, 2, rue Le Nôtre, 49045 Angers, France. Phone: (33)241225428, Fax: (33)241225515, E-mail: jean-claude.mauget@agrocampus-ouest.fr Web: https://colloque.inra.fr/she2012

- July 1-5, 2012, Brasilia (Brazil): **VI International Symposium on Seed, Transplant and Stand Establishment - SEST2012.** Info: Dr. Warley Marcos Nascimento, EMBRAPA - Vegetables, C. Postal 218, Brasilia - DF 70359-970, Brazil. Phone: (55)6133859125, Fax: (55)6135565744, E-mail: wmn@cnph.embrapa.br

- July 1-4, 2012, Ghent (Belgium): **II International Symposium on Woody Ornamentals of the Temperate Zone.** Info: Dr. Johan Van Huylenbroeck, ILVIO- Plant Unit, Applied genetics & breeding, Caritasstraat 21, 9090 Melle, Belgium. Phone: (32) 9-2722862, Fax: (32) 9-2722901, E-mail: johan.vanhuylenbroeck@ilvo.vlaanderen.be E-mail symposium: woodyornamentals@ilvo.vlaanderen.be Web: http://www.ilvo.vlaanderen.be/woodyornamentals2012

- NEW July 4-7, 2012, Cebu (Philippines): **V International Symposium on Improving the Performance of Supply Chains in the Transitional Economies.** Info: Dr. Peter J. Batt, Horticulture, Curtin University of Technology, GPO box U1987, Perth, WA 6845, Australia. Phone: (61)8 9266 7596, Fax: (61)8 9266 3063, E-mail: p.batt@curtin.edu.au or Dr. Sylvia B. Concepcion, University of the Philippines, Mindanao, Davao City, Mindanao, Philippines. Fax: (6382) 2270750, E-mail: sbconcepcion@yahoo.com Web: http://www.business.curtin.edu.au/business/ISHSsymposium

- July 9-12, 2012, Valencia (Spain): **I International Symposium on Computational Fluid Dynamics (CFD) Applications in Agriculture.** Info: Dr. Florentino Juste, IVIA, Ctra. Moncada-Náquera, Km. 4, Moncada, 46113 Valencia, Spain. Phone: (34)963424000, Fax:

(34)963424001, E-mail: juste_flo@gva.es or Dr. Ricardo Suay Cortés, Ctra Moncada-Náquera, Km 4,5, Centro de Agroingenieria - IVIA, 46113 Valencia Moncada, Spain. Phone: (34) 96 3424000, Fax: (34) 96 3424001, E-mail: rsuay@ivia.es Web: http://cigr.ageng2012.org/

- July 16-20, 2012, Beijing (China): **International Conference on Germplasm of Ornamentals.** Info: Prof. Qi Xiang Zhang, College of Landscape Architecture, Beijing Forestry University, No.35, Qinghua East Road-Haidian Dist., Beijing 100083, China. Phone: (86)1062338005, Fax: (86)1062336126, E-mail: zqx@bjfu.edu.cn or Dr. Guijun Yan, School of Plant Biology MO84, The University of Western Australia, 35 Stirling Hwy, Crawley WA 6009, Australia. Phone: (61) 8 6488 1240, Fax: (61) 8 6488 1108, E-mail: guijun.yan@uwa.edu.au
- July 16-20, 2012, Geisenheim (Germany): **VII International Symposium on Irrigation of Horticultural Crops.** Info: Prof. Dr. Peter Braun, Research Centre Geisenheim, Dept. of Pomology, Von Lade Str. 1, D-65366 Geisenheim, Germany. Phone: (49)6722502566, Fax: (49)6722502561, E-mail: braun@fa-gm.de Web: http://www.irrigation2012.de
- September 2-5, 2012, Warsaw (Poland): **XXIV Eucarpia Symposium on Ornamentals - Ornamental Breeding Worldwide.** Info: Dr. Teresa Orlikowska, Research Institute of Horticulture, Konstytucji 3 Maja 1/3, 96-100 Skierniewice, Poland. Phone: (48)468332041, Fax: (48)468333228, E-mail: teresa.orlikowska@insad.pl E-mail symposium: dariusz.sochacki@insad.pl Web: http://www.ornamentalbreeding2012.pl/
- September 6-8, 2012, Venlo (Netherlands): **XI International People Plant Symposium.** Info: Ms. Annette Beerens, Oude Graafseweg 50, 6543 PS Nijmegen, Netherlands. Phone: (31)615647097, E-mail: hozhq.foundation@gmail.com
- September 9-14, 2012, Zatec (Czech Republic): **III International Humulus Symposium.** Info: Dr. Josef Patzak, Hop Research Institute Co, Ltd., Kadanska 2525, Zatec, 434 46, Czech Republic. E-mail: j.patzak@telecom.cz or Dr. Anthony Koutoulis, he University of Tasmania, Private Bag 55, Hobart TAS, 7001, Australia. E-mail: anthony.koutoulis@utas.edu.au Web: http://www.chizatec.cz/ishs.htm
- September 18-20, 2012, Bogor (Indonesia): **II Asia Pacific Symposium on Postharvest Research Education and Extension: APS2012.** Info: Prof. Dr. Hadi K. Purwadaria, Faculty of Agricultural Engineering, Bogor Agricultural University, PO Box 220, 16002 Bogor, Indonesia. Phone: (62)8129579098, Fax: (62)2518623026, E-mail: tpphp@indo.net.id

For updates logon to www.ishs.org/calendar

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